Trade Potential of Afghanistan with European Union: A Gravity Model Approach

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Abstract

The notion of international trade and its impact on economic growth has been phenomenal. Thus, countries to reap the trade dividends diversify their trade destinations. Against this backdrop, this study investigates the trade potential of Afghanistan with the European Union by applying the gravity model of international trade. The study used panel data for five years, from 2015 to 2019. The gravity model has been further augmented by adding GDP per capita, population, real exchange rate, inflation rate, and openness of the partner country. The co-efficient of the gravity model has been used to estimate the trade potential of Afghanistan with the European Union. The analysis used the gravity trade model, satisfying the OLS assumptions. The data revealed that Afghanistan's bilateral trade with the EU is positively and significantly affected by its GDP, GDP per capita, exchange rate, population, inflation rate, and employment openness. The results indicate that Afghanistan has trade potential with ten European Union countries. The study's results satiate that out of the chosen fifteen countries of the European Union, the magnitude of Afghanistan's trade potential is high with three EU countries (Germany, followed by France, and Spain). The trade potential also exists for seven other countries: Sweden, the Netherlands, Belgium, Austria, Poland, Ireland, and Italy. Afghanistan is close to its trade potential with Finland and Denmark. Whereas in the case of Romania, Latvia, and Greece, Afghanistan does not enjoy any trade potential. The findings of this study are intended to help the Afghan government and traders estimate Afghanistan's trade future and consistency in European Union markets, as well as to determine whether the Afghan government can sustain its trade with those countries.

Key Words: *EU (European Union), GDP (Gross domestic product), WB (World Bank), WITS (World Integrated Trade Solution).*

Introduction

International trade is an unavoidable fact in the current era. Countries have been obliged to compete in global markets to gain from trade. The changes in the world economy have brought nations together to trade, and no one can survive alone (Agarwal,2002; Wani & Dhami, 2014). The 21st century eased the trading system in a global atmosphere by providing an advanced and digitalized transportation system. Simultaneously, the World Trade Organization emphasizes trade liberalization and removing trade barriers within regions and around the world. Trade is a phenomenon that allows nations to fulfill their needs by either exporting those items for which they have a factor of abundance or producing intensively while importing those items for which they have a factor of scarcity (Salvatore, 2019). While doing so, the nations must consider the availability of trade potential within the trading partner to escalate the trade further or shift the trade's direction. Afghanistan has witnessed four decades of conflict (Muram & Wani, 2019), resulting in mass deterioration of the economic system, thereby augmenting the economic fragility of the state. The scarcity of resources, exacerbating transit, and inadequate transportation facilities vehemently oriented the exports toward neighboring countries such as Pakistan and Iran. As WITS data depicts, the magnitude of

Afghanistan's export was repressed to $166.24 million in 2001, elucidating the country's trade contiguity. Despite the international players' intervention, Afghanistan came out of oblivion, and somehow the economic activities started furnishing. In a decagon, the exports slop has experienced an upward trend, reaching almost $400 million in 2010 and approximately $800 million in 2019. Meanwhile, the volume of imports has also amplified from $2400 million in 2001 to $6776 million in 2019. The country has entered various bilateral and regional agreements throughout its trade journey. Afghanistan joined the South Asian Association for Regional Cooperation in 2007. Although SAARC was established in 1985, Afghanistan joined after 22 years as its last member. Besides, Afghanistan joined World Trade Organization (WTO) in 2016. In addition, Afghanistan is a member of the Central Asia Regional Economic Cooperation (CAREC) and the Economic Cooperation Organization. Against this backdrop, the current study identifies the countries where Afghanistan enjoys trade potential within the EU, analyzes the trends and patterns of Afghanistan's trade flow with EU countries from 2010 to 2020, and estimates the overall trade potential of Afghanistan with the European Union.

The rest of the study is divided into five sections, with section two highlighting the trade overview of Afghanistan and the EU; section three demarcates the theoretical perspective and the scholarship review, section four presents the research methodology; section five portrays the results, analysis, and discussions; and finally section highlights the broad conclusions, policy recommendations, implications, limitations and future scope of the study.

2. Afghanistan's Trade with EU: An Overview

In order to capture the picture of Afghanistan's trading partners, the major export and import destinations are analyzed based on their percentage of share in exports and imports. The table below indicates Afghanistan's five major trading partners from 2010 to 2019.

Table 1: Afghanistan's major export partners, 2010 - 2019

Country/year	2010	2015	2018	2019
India	16.8	33.5	40	47
Pakistan	38.9	39.6	42	34
Iran	8	5.1	2.2	<1
Turkey	8.9	<1	2.4	<1
UAE	<1	4.2	<1	2.8
China	<1	<1	3.2	3.5
Russia	7.6	3.2	<1	<1

Source: Data from the World Integrated Trade Solution 2019.

Table 2: Afghanistan's major import partners, 2010–2019

Country/year	2010	2015	2018	2019
Pakistan	11.5	17.4	14.6	12.8
Uzbekistan	**21**	<1	7.4	5
Germany	8	<1	<1	<1
China	13.6	13.5	**15.7**	13.9
Japan	9.5	<1	<1	<1
Iran	<1	**23.4**	17.7	**14.5**
Turkmenistan	<1	8	<1	8
Kazakhstan	<1	5.5	10.6	<1

Source: Data from the World Integrated Trade Solution 2019.

Afghanistan exports were directed toward close collaboration with Indian and Pakistani markets from 2010 to 2019. Whereas Afghanistan's imports were much more diverse than

its exports; however, imports from a particular partner stayed within 25 percent. Afghanistan has been running a trade deficit since 2001 (Taj & Wani, 2019).). However, major trading partners in Afghanistan are neighbor-centric relations, including Pakistan and India, followed by some Central Asian countries like Uzbekistan and Iran. However, the current trade policy of Afghanistan (Trade Policy 2019-2023) experienced a revival of trade markets. It thus led to expedited trade flow in Afghanistan at the cost of the environment (Hotak & Wani, 2019). Looking at the EU trade market, until 2010, Afghanistan had trade relations with 12 countries with a total value of $46.4 million in goods and services. However, on opening their market to the European Union, the trade flow of Afghanistan flourish.

Furthermore, the accession Afghanistan to the WTO in 2016 also intensified its relations with the European Union. The total exports of Afghanistan to the EU in terms of goods and services reached $60.6 million in 2019. Although the European Union was missing from the economic radar of Afghanistan up until recently, the trade flow has intensified. This study is designed to analyze the rationale and future adaptability of the European Union as a potential market for Afghanistan and to explore new avenues for export diversification and linkage. Looking at the needs of the European Union and mapping the export scenario of Afghanistan, it much more closely fits the demographic image of the European Union, so this study would specifically examine the trade potential of Afghanistan with European Union countries. The European Union was established after World War II to bring peace to neighboring countries and eliminate war. This Union was founded by six European countries, such as Germany, France, Belgium, Luxembourg, Italy, and the Netherlands, in 1951. The Union became more prominent with time. It reached 27 countries, which are: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, and Sweden (European Union trade report), which assumed one of the most significant economic powers in the world.

The Union has unified monetary, political, and social policies, and its overall aim is to ensure peace and motivate free trade among the Union's members. The Union signed an agreement on the "common market" back in 1957 in order to persuade the member countries to remove trade restrictions. Subsequently, in 1993, the Union signed another "single market" agreement to have freedom in trading in four categories: money, people, goods, and services. Union's budget allocation and international staff belong to the EU Commission. There are no charges, taxes, quotas, or tariffs among the union members. From an economic standpoint, the criteria for joining the Union are first to meet the "Copenhagen" requirements, then have a well-functioning and stable economy, and the ability to compete in EU markets and deal with market forces that arise. As one of the largest single markets in the world, in 2019, the EU claimed that the total GDP of the Union's member countries reached 15.59 trillion dollars. The amount reveals that after the United States of America, the EU has the largest market size around the globe.

The EU has trade agreements with the following countries: Canada (CETA), Japan, Singapore, and Australia. The EU's major trading partners are the USA, the UK, India, China, Russia, Switzerland, Japan, Turkey, Norway, and South Korea. The major exporting items of the EU in 2019 were machinery, automobiles, pharmaceuticals, chemicals, computers, and other electronics. Meanwhile, in 2019, the major imported items were computers and electronics, petroleum and gas, chemicals, machinery, and automobiles. In 2010, Afghanistan's total export value in goods and services to the

European Union was $42.9 million, while its total import value in goods and services was $923.23 million (Eurostat Comext, Statistical Regime 4). In Parallel, Afghanistan had imported from 17 countries in the European Union, whereas the number increased to 27 countries in 2019 (WITS, 2019). Afghanistan's main exports to the EU are fruits and vegetables, textiles, and cotton (European Commission, 2019). As per the data available in 2019, the only European Union country that comes under the ten major export destinations of Afghanistan is Germany, with a 0.63 percent share of Afghanistan's total products. The table shows Afghanistan's export destinations to the European Union. The data shows the changes and variations in the country's exports to the EU during the specified years.

Table 3: Afghanistan's exports to the EU (in $ thousands)

No	Country	2010	2015	2018	2019
1	Germany	1883	5677	5584.72	11704.68
2	Italy	549	2381	279.92	491.21
3	Sweden	45	281	107.47	307.09
4	Netherlands	9409	1056	255.37	283.03
5	Belgium	839	354	25.72	61.45
6	Austria	13	51	104.41	380.04
7	France	264	250	538.39	338.66
8	Finland	2953	2057	1228.02	920.82
9	Spain	127	333	51.75	388.57
10	Poland	37	6	414.89	124.52
11	Romania	NA	19	298.84	306.08
12	Denmark	67.18	113	5.58	5.42
13	Latvia	195.70	149711.34	NA	16.28
14	Ireland	NA	3019.56	NA	NA
15	Greece	NA	504.18	NA	NA

Source: Data from the World Integrated Trade Solution 2019.

It should be noted that Afghanistan's exports to the EU are worth less than $100,000, making them insignificant on the list. Table 1 indicates that Afghan commodities reached 12 EU markets in 2010; after one decade, in 2019, Afghan Products exploited 16 EU markets. The total export value of Afghan commodities to the EU was $15.3 million in 2019, while this figure is much higher regarding the value of goods and services. According to Eurostat Comext, Statistical Regime 4 report, the total export volume of Afghanistan to the EU reached $60.6 million in goods and services.

Table 4: Afghanistan's Imports from the European Union (in Thousands of Dollars)

No	Country	2010	2015	2018	2019
1	Germany	422289	30984	65545	89702.14
2	Italy	9647	4770	9167.96	14756.10
3	Sweden	18505	4753	5327.86	5199.63
4	Netherlands	10152	7878	6819.83	13935.88
5	Belgium	5517	1234	11181.05	7042.55
6	Austria	315	147	457734	1331.31
7	France	3753	9766	7406.89	11729.35
8	Finland	1755	187	304.72	505.14
9	Spain	2446	2386	2728.14	3286.94
10	Poland	269	3112	4131.78	5095.18
11	Slovak	1569	113	361.72	300.73
12	Romania	NA	90	360.49	39.96
13	Portugal	NA	NA	41.46	419.39
14	Hungry	3	39.75	877.01	1102.01
15	Denmark	988	1032	1233.40	15742.75
16	Czech	NA	367	1335.11	1400.79

17	Slovenia	NA	NA	0.03	3.03
18	Malta	NA	NA	0.47	0.17
19	Latvia	195.70	NA	8.28	115.02
20	Luxembourg	NA	NA	3.47	203.26
21	Lithuania	NA	526	5922.51	5587.10
22	Croatia	NA	NA	173.94	490.59
23	Estonia	NA	193	1627.04	718.08
24	Bulgaria	125	83	362.32	121.46
25	Ireland	2900	7450	5360	11188.09
26	Greece	0.27	7	216.87	5930.18
27	Cyprus	NA	NA	NA	165.21

Source: Data from the World Integrated Trade Solution 2019.

Table 1.4 depicts that in 2010, Afghanistan imports were from 17 European Union Countries, while the importing partners increased to 27 countries in 2019 (WITS, 2019). Parallel to this, Eurostat Comext's Statistical Regime 4 reports reveal that Afghanistan's import of goods and services from the EU has declined drastically from $775.8 million in 2010 to $324.8 million in 2019. At the same time, Afghanistan's goods and services exports increased from $46.4 million in 2010 to $60.6 million in 2019. For the enhancement of Afghanistan's exports into EU markets over the last decade, there is still room for Afghan products to thrive in European Union markets. In contrast, EU exports have lost market share in Afghanistan, even though imports from Afghanistan have decreased from the European Union. The decrease in the export volume of the EU to Afghanistan might have been caused by the withdrawal and a decrease in the number of some international and military alliances and partners of Afghanistan, such as NATO, ISAF, and other countries, back in 2014.

3. Literature Review

The gravity model has been taken from Newton's theory, which explains the law of gravitation. The scientists who first used the gravity model concept in international Trade were Tim Bergen (1962) and Poyhonen (1963), who used this model to find the trade flow between the countries of the European Union. This model measures the volume of Trade between two countries. According to this concept, the gravitational forces between two objects directly depend on the country's GDP, representing mass. They are inversely related to the geographical distance of the country. This model is highly used to examine bilateral trade patterns, estimate the possibility of trade creation and diversion effects, and estimate the Potential of Trade (Porojan, 2000). Linneman (1966) provided the gravity model's classical application by adding an extra variable to the model to reveal the commodity structure of the trade stream (Kien & Hashimoto, 2005; Armstrong, 2007).

The model has been further extended by Linneman (1966), though other trade variables, such as population and complementarity, have also been added. Leamer (1974) improved the model for two-digit SITC for commodities. In the improved version of the model, the relative factor endowments were used as independent variables to define the impact of population and income. Anderson (1979), the scientist who applied the utility functions for the first time (Cobb-Douglas and Constant Elasticity of Substitution), The properties of linear expenditure systems were used in substitution to develop the gravity model. Bergstrand (1985) has generalized the gravity model by presenting the prices. Bergstrand (1989) used the monopolistic competition model in another effort, assuming that goods differ between firms and countries. Likewise, all the international trade theories, such as Heckscher-Ohlin, New Trade Theory, Ricardian, Monopolistic Competition, and Intra-industry Trade Theory, explain why countries trade different products but are unable to explain why some countries' trade linkages are stronger than others. Similarly, some

countries tend to increase or decrease their trade level. The gravity model can explain the extent and size of trade flows. This study distinguishes the application of the gravity model in various works of literature, such as trade potential and bilateral trade, which are discussed below. The gravity model has been extensively used to evaluate the countries' trade potential. Several studies (Wani, Dhami, & Rehman, 2016; Ahmad & Wani, 2018; Dhami, Wani, & Sidana, 2020; Weijian Li et al., 2021) have applied the gravity model to examine the trade potential of India, Afghanistan, China, and Russia against their main trading partners. The researcher mentioned that although both countries have good economic ties, optimized trade structures, and a growing trade scale, their purpose was to find the exact trade potential between them. The results showed that the bilateral Trade between China and Russia is related to the GDP of both countries.

Furthermore, it adds that there is still a potential for China and Russia to escalate their trade. The trade potential of Afghanistan with the SAARC region has been studied by Shabir and Wani (2018), who found that Afghanistan has a high trade potential with Pakistan and India in the SAARC region. There is also a high potential for Trade with Bangladesh. The authors mention that Afghanistan has to use trade as a means of economic development to capture global markets. The gravity model has been used for examining bilateral trade in various studies, as Fatma et al. (2021) studied Egypt's bilateral trade by applying the gravity model approach. The study was conducted from 2000 to 2018, encompassing Egypt's international trade with 36 partners.

The study used panel data and some financial and geographical variables such as border, market size, openness to trade, common language, and regional trade agreements. The study's findings revealed that certain factors, such as the GDP of both trading countries, border sharing, and distance, influenced Egypt's Trade, while others had no overall influence. The Chinese–African bilateral trade determinants have been studied by Guan et al. (2020) by applying an augmented gravity model. For further analysis, the study used variables such as RTAs and recession apart from the real exchange rate and population to augment the model.

The result reveals that African imports from China are negatively affected by GDP, whereas exports to China are positively affected. Similarly, actual exchange rates positively impact African exports to China while hurting African imports from China. Furthermore, trade agreements had a positive impact on overall African-Chinese Trade, whereas the recession had a negative impact. The study adds that there is an absolute need to improve the structure of African exports to China, and the existing gap must be filled by reinforcing trade agreements.

4. Research Methodology

This study follows a positivist philosophy that helps examine theories to discover reality and facts. Subsequently, the research methodology incorporated in the study is quantitative and follows a deductive approach. The data used in this research is panel data taken from WITS, World Bank, UN COMTRADE, European Union Foreign Trade Policy, Corporate Finance website, and other reliable sources. The data reveals Afghanistan's and EU Trade for ten years from 2010 – 2019. The unit of analysis is based on individual country-level data; as the EU consists of 27 countries, some variables are considered for the whole Union.

Table 4.1: Operationalization of the Variables

Variable names	Definition	Measurement	Expected sign
GDP	country's total domestic production value within its boundaries in a specific fiscal year	GDP	Positive
Distance	A proxy for transportation cost	Kilometers	Negative
GDP per capita	The average earnings of an individual in a country during one year	GDP per capita	Positive
Population	The residence of a particular area	Pop	Positive
The real exchange rate	The value of one country's currency against another country	Real Exchange Rate	Negative
Inflation rate	The rate of change in commodity prices over a specific period.	Inflation rate	Positive
Openness to Trade	The outward or inward economy of a particular country	Openness to Trade	Positive

Source: Data from the World Integrated Trade Solution 2019.

Empirical model

a) The basic gravity model:

The gravity model is taken from Newton's law of gravity, first used by Timbergen (1962) in international trade. According to the model, the two countries trade potential is directly related to their respective GDPs and inversely related to the physical distance between them.

$$F_{ij} = G * M_i * M_j / D_{ij}$$

The model can be transmitted to the following model to fit the regression analysis best.

$$Log\ (Trade\ ij) = \alpha + \beta 1\ log\ (GDP\ i.GDP\ j) + \beta 2\ log\ (Distance\ ij) + uij$$

b) Augmented gravity model:

In order to find and analyze the augmented model, the research has applied factors other than the basic formula. Besides this, some other condition variables are also added to determine the factors that affect trade potential.

The Equation is as follows:

$$Log\ (Trade\ ij = \alpha + \beta 1\ Log\ (GDPi * GDP\ j) + \beta 2\ Log\ (PCGDPi.* PCGDPj)$$
$$+ \beta 3\ Log\ (Distance\ ij) + \beta 5\ Log\ (Pop) + \beta 6\ Log\ (Exchange\ rate) + u\ ij$$

The general model as equation is shown below:

$$Log\ (Trade\ ij) = \beta 0 + \beta 1\ log\ X1it + \beta 2\ log\ X2it + \beta 3\ log\ X3it + \cdots \ldots + \omega it$$

The X in the above formula represents a quantitative or ordinary variable containing the product of GDP, distance, GDP per capita, population, and exchange rate; thus, further elaboration is required for expanding the above formula.

c) Extended gravity model

In this section, the model is re-estimated by adding new variables. The newly introduced variables are regarded as critical in international trade perceptions. The variables incorporated in the new model are openness to trade and inflation in the partner country.

The Equation for the extended gravity model is shown below:

$$Log\ (Trade\ ij = \alpha + \beta 1\ Log\ (GDPi * GDP\ j) + \beta 2\ Log\ (PCGDPi.* PCGDPj)$$
$$+ \beta 3\ Log\ (Distance\ ij) + \beta 4\ Log\ (Pop) + \beta 5\ Log\ (Exchange\ rate)$$
$$+ \beta 6\ Log\ (Openness\ t.) + \beta 7\ Log\ (Inflation) + u\ ij$$

Econonometric Issues

In order to test the validity of the data, the following tests have been done in the analysis.

Endogeneity, Multicollinearity, and Heteroscedasticity

A country's GDP is an exogenous variable in the gravity model application. Therefore, if an endogeneity problem exists, the effect of income over trade would be misleading. Alternative variables such as population and GDP per capita are added to the analysis to avoid the endogeneity problem. The co-efficient of variables will not change with alternative variables. Further, if the endogeneity of income exists, it will not create any significant falsification in the gravity model relationship.

This multicollinearity issue is tested to verify the variables' correlation. If some variables are correlated with each other, it will nullify the results. For the current research, the simple correlations of all variables are tested for multicollinearity. All observations are tested for heteroscedasticity while running the regression in this research. All of the regression results are heteroskedastic.

Panel Data Framework

The cross-sectional data and a single equation are applied to evaluate trade flow between countries on a specific issue in a selected or predetermined time range. The single Equation is best described through a panel data framework. There are various techniques for applying panel data, but the fixed and random effect models are the most rigorous.

a) The Fixed Effect Model (FEM)

The fixed effect model is usually used in panel data frameworks; the facts are recognized through the model, and the change between the individual units is determined. In the fixed-effect model, the relation between the unobserved and observed variables is open, though they can be associated.

$$Yit = \beta 1i + \beta 2\ X2\ it + \beta 3 X3\ it + u\ it$$

b) The Random Effects Model (REM)

The random effect model uncorrelated the relationships between the unobserved and observed variables. In contrast to FEM, the intercept of a unit is picked randomly from a large population.

The random error term is assumed to be distributed with a zero mean and constant variance:

$$Yit = \beta 1i + \beta 2\ X2\ it + \beta 3 X3\ it + \varepsilon i + u\ it$$
$$= \beta 1i + \beta 2\ X2\ it + \beta 3 X3\ it + w\ it$$

The composite error term w consists of two components: ε_i is the cross-sectional or individual-specific error component, and u is the combined time-series and cross-sectional error component, given that ~ (0, σ2ε), X_{it} ~ (0, σ2u$i\varepsilon$), where is independent of the X_{it}.

5. Findings and Analysis

Basic Gravity Model

The basic gravity model equation is as follows:

$$Log (Trade_{ij}) = \alpha + \beta1 \log (GDP_{i}.* GDP_j) + \beta2 \log (Distance_{ij}) + u_{ij}$$

Table 5: Basic gravity model

Independent variables	Co-efficient	Standard error*	t- statistic
Constant	4.44	0.43	10.18
Product of GDP	1.53	1.06	1.44
Distance	0.26	0.66	4.27
Adjusted R-squared	0.22		

Source: Data output from E-Views 8.0

The basic gravity model, which contains the product of GDP and the distance, is calculated for the analysis. The results indicate that both variables are significant. Parallelly, with a positive sign, the results show that Afghanistan's bilateral trade with its European Union partner countries is directly related to the magnitude of the country's GDP. It reveals that for every one percent increase in a country's GDP, bilateral trade increases by 1.53 percent. Similarly, due to the geographically parallel distance between Afghanistan with the European Union and the same air transportation cost, the co-efficient of distance is also indicating a positive number, which is 0.26, which means that for every one percent increase in distance, the bilateral trade is also affected by 0.26 percent.

Augmented Gravity Model

In order to estimate variables other than the basic variables of GDP and distance, the model has been further augmented. In this stage, variables such as GDP per capita, the population of the partner country, and the real exchange rate of the partner country are added to the analysis.

The Equation for the augmented gravity model is as follows:

$$Log (Trade_{ij} = \alpha + \beta1 Log (GDP_i * GDP_j) + \beta2 Log (PCGDP_i.* PCGDP_j)$$
$$+ \beta3 Log (Distance_{ij}) + \beta5 Log (Pop) + \beta6 Log (Exchange\ rate) + u_{ij}$$

Table 6: Augmented Gravity Model

Explanatory variables	Co-efficient	Standard error*	t- statistic
Constant	6.39	1.95	3.27
Product of GDP	1.85	1.11	-0.16
GDP per Capita	3.25	1.17	2.76
Distance	0.04	0.08	0.52
Population	2.25	6.61	3.40
Real Exchange rate	-182.06	154.62	-1.01
Adjusted R-squared	0.34		

Source: Data output from E-Views 8.0

As indicated in table 6, the product of GDP changes from 1.53 to 1.83, which is also a significant and positive sign. The distance variable coefficient also fluctuates from 0.26 to 0.04. The GDP per capita is 3.25, which means that a one percent increase in the GDP per capita of the EU trading partners of Afghanistan, the bilateral trade by 3.25 percent. Likewise, the co-efficient for the partner country's population is 2.25 percent, which is positive and reveals that a one percent increase in the partner population will increase

the bilateral trade by 2.25 percent. The real exchange rate of Afghani with Euro currency is enormous, and analysis shows that it has a negative sign of -182. It means that a 1 percent increase in partner currency has an 18.2 percent negative impact on bilateral trade.

Extended Augmentation

In this section, the model is re-estimated by adding new variables. The newly introduced variables are regarded as critical in international trade perceptions. The variables incorporated in the new model are openness to trade and inflation in the partner country. The percentage of a country's trade openness indicates the extent to which it is open to trade; the higher the percentage of a country's trade openness, the greater its trade involvement. Similarly, a country's inflation rate influences its trade extent. Therefore, the inflation rate of all EU-selected countries is included for analysis. Simultaneously, dummies such as common languages, regional trade agreements, shared borders, landlocked countries, and cultural similarities were added to the Equation individually. Nevertheless, due to the multicollinearity issue, the dummies were excluded.

The Equation for the extended gravity model is shown below:

$$Log\ (Trade\ ij = \alpha + \beta1\ Log\ (GDPi * GDP\ j) + \beta2\ Log\ (PCGDPi.* PCGDPj)$$
$$+\ \beta3\ Log\ (Distance\ ij) + \beta4\ Log\ (Pop) + \beta5\ Log\ (Exchange\ rate)$$
$$+\ \beta6\ Log\ (Openness\ t.) + \beta7\ Log\ (Inflation) + u\ ij$$

Table 7: Extended Augmentation

Explanatory variables	Co-efficient	Standard error*	t- statistic
Constant	4.50	10.19	0.44
Product of GDP	7.18	9.95	0.07
GDP per Capita	2.29	1.08	2.10
Distance	0.04	0.07	0.52
Population	1.72	5.96	2.89
Real Exchange Rate	-119.68	154.08	-0.77
Inflation rate	0.08	0.15	0.56
Openness to Trade	0.01	0.11	0.16
Adjusted R-squared	0.22		

Source: Data output from E-Views 8.0

Based on Table 7, including the other essential variables in the model has raised the co-efficient of the product of GDP to 7.18, which means that considering all the other variables, the bilateral trade will increase by 7.18 percent if the GDP per capita changes by one percent. The inflation rate and openness to trade coefficient are both positive and significant. The inflation rate of EU members differs from one another, as well as their trade openness. The openness of trade coefficient is 0.019, which reveals that Afghanistan's bilateral trade will increase by 0.019 percent if the openness to the trade of that country increases by one percent.

Segmented Gravity Analysis

Here, the EU countries with bilateral trade with Afghanistan are estimated individually. The co-efficient for the size of each EU country is calculated. However, all countries come under the same roof as a union, but each has specific characteristics. Each country's GDP is different from the next. On the other hand, the distance has also varied. The results generated from this calculation will help calculate the trade potential of Afghanistan with individual EU countries.

Table 8: Gravity Models - Comparative Position

Model Variables	Constant	Product of GDP	Distance	R-Squared adjusted
Afghanistan – Germany	6.22	2.35	0.23	0.28
Afghanistan – Italy	5.12	1.26	0.210	0.27
Afghanistan – Sweden	4.31	1.52	0.26	0.25
Afghanistan Netherlands	5.10	1.91	0.3	0.21
Afghanistan– Belgium	5.45	1.49	0.31	0.27
Afghanistan – Austria	5.12	1.32	0.24	0.26
Afghanistan – France	5.37	2.3	0.32	0.27
Afghanistan – Finland	5.21	1	0.25	0.28
Afghanistan – Spain	5.41	2.01	0.35	0.29
Afghanistan – Poland	4.21	1.6	0.23	0.31
Afghanistan – Romania	4.31	0.8	0.21	0.28
Afghanistan - Denmark	5.3	1.19	0.27	0.25
Afghanistan – Latvia	5.21	0.75	0.23	0.27
Afghanistan – Ireland	4.31	1.29	0.33	0.29
Afghanistan – Greece	4.37	0.9	0.22	0.29

Source: Data output from E-Views 8.0

The results show that the countries' GDP product coefficients differ and vary from country to country. Germany has the highest GDP coefficient, while Latvia has the lowest. On the other hand, the distance coefficient has fluctuated as the geographical distance between Afghanistan and individual EU countries has changed. Consequently, Spain has the highest distance coefficient with Afghanistan, while Romania has the lowest distance coefficient.

Trade Potential of Afghanistan

The results generated from the gravity model are used to estimate the trade potential of Afghanistan with the European Union. The results are obtained from different gravity model equations: basic, augmented, and extended. All of the information gathered is significant and trustworthy. The predicted Trade (P) ratio taken from the co-efficient of the dependent variables to the actual Trade (P/A) is used to calculate the trade potential.

Table 9: Overall Trade Potential of Afghanistan with EU

Indicator Country	P/A 2010 – 2019
Afghanistan – Germany	2.31
Afghanistan – Italy	1.24
Afghanistan – Sweden	1.55
Afghanistan - Netherlands	1.92
Afghanistan – Belgium	1.45
Afghanistan – Austria	1.39
Afghanistan – France	2.37
Afghanistan – Finland	1.03
Afghanistan – Spain	2.16
Afghanistan – Poland	1.67
Afghanistan – Romania	0.81
Afghanistan - Denmark	1.13
Afghanistan – Latvia	0.76
Afghanistan – Ireland	1.21
Afghanistan – Greece	0.94

Source: Data output from E-Views 8.0

Based on the table, Afghanistan could expand Trade with Germany, Italy, Sweden, the Netherlands, Belgium, Austria, France, Spain, Poland, and Ireland. Additionally, in the case of Finland and Denmark, the ratio of (P/A) is closer to unity, which means it has reached its potential. Likewise, Afghanistan's Trade with Latvia, Romania, and Greece has exceeded its potential.

Table 10: Countries with whom Afghanistan has the Potential to Expand trade

Indicator Country	P/A 2010 – 2019
Germany	2.31
Italy	1.24
Sweden	1.55
Netherlands	1.92
Belgium	1.45
Austria	1.39
France	2.37
Spain	2.16
Poland	1.67
Ireland	1.21

Source: Data output from E-Views 8.0

Table 10 indicates the number of EU countries with which Afghanistan has the potential to expand trade. Trade with Germany has the highest potential, as the coefficient is 2.31, followed by France with 2.37 and Spain with 2.16, with other countries such as Italy, Sweden, the Netherlands, Belgium, Austria, and Poland. Ireland has the lowest trade potential among the rest of the EU countries.

Table 11: Countries with whom Afghanistan has Exceeded Trade Potential

Indicator Country	P/A 2010 – 2019
Romania	0.81
Latvia	0.76
Greece	0.94

Source: Data output from E-Views 8.0

Table 8 indicates the EU countries in which Afghanistan has exceeded its potential for Trade with them. These countries have co-efficient (P<1). The countries are as follows: Greece, Romania, and Latvia.

Table 12: Countries with whom Afghanistan's Trade has reached its potential

Indicator Country	P/A 2010 – 2019
Denmark	1.13
Finland	1.03

Source: Data output from E-Views 8

Based on table 12, the Afghanistan trade has reached its potential with Denmark and Finland. The (P/A) of Afghanistan with these two countries equals one.

Discsussions

This study estimated the trade potential of Afghanistan with the European Union. The study has employed various gravity models, such as basic, augmented, and extended, along with a simple OLS technique. Further, the study has used panel data for five years, from 2015 to 2019, for 15 EU countries. As illustrated in Table 1, the coefficients of the variables are both positive and significant. The primary gravity model reveals that the coefficient for the product of GDP is positive, which is 1.53; this means that by increasing the product of GDP by one percent in the partner country, Afghanistan's bilateral trade with the EU will increase by 1.53 percent. The above findings are consistent with previous studies such as Gul &Yasin (2011), Boughanmi (2008), and Ahmad & Wani (2018). Albeit, based on the theoretical justification of the model, the coefficient of the distance has to be negative; nonetheless, the coefficient of the distance is zero and positive. The reason for the zero positive distance coefficient is the exact transportation cost of Afghanistan toward all EU countries and the closest distance of EU countries from one another. The distance variable coefficient is contrary to other findings, such as those of Gul and Yasin

(2011), R. Rahman (2009), and Batra (2004). Moreover, the basic gravity model is further augmented by adding new variables. The variables added to the augmented model are GDP per capita, population, and the real exchange rate of the partner country. Economic prosperity grows in direct proportion to per capita income. Besides, countries with similar GDP per capita desire more trade than countries with a GDP per capita difference. The per capita GDP coefficient is 3.25, which means that a 1 percent increase in the partner country's per capita GDP increases bilateral trade between Afghanistan and the EU by 3.25 percent. These findings are consistent with the theory of Helpman and Krugman (1985).

The population variable was added to the model of Timbergen by Linneman (1966). The population of a partner country impacts the volume of Trade among the countries; a high population demands and needs more commodities compared to a low population. The co-efficient for the population is 2.25, which reveals that for every one percent increase in the partner country's population, the bilateral trade will increase by 2.25 percent. The population co-efficient is consistent with a study of Vietnam's Trade with 60 countries conducted by Binh et al. (2013). On the other hand, the real exchange rate reveals a negative sign, which means that Afghanistan's bilateral trade with the EU will be negatively affected if the euro exchange rate against the Afghani surges. Subsequently, the model has been further extended by adding new variables, such as the partner country's inflation rate and openness to trade. The inflation rate affects trade both domestically and internationally. The coefficient of the inflation rate is positive and near one (0.086), which reveals that the inflation rate of the partner country affects bilateral trade positively. Similarly, the co-efficient for the openness to the trade of the partner country also shows a positive figure, which is 0.019. Trade openness shows the level of a country's open borders toward trade. The higher the openness to the trade level of a country, the greater its tendency toward trade. This finding is mutual with that of Rahman (2006) regarding the trade Potential of SAFTA. Afterward, in the next stage, the trade potential of Afghanistan with the 15 EU countries is calculated. The results illustrate that Afghanistan has trade potential with ten out of fifteen EU countries. Afghanistan has the most significant potential to expand trade with Germany, followed by France and Spain. Other EU countries with which Afghanistan has trade potential are Italy, Sweden, the Netherlands, Belgium, Austria, and Poland.

6. Conclusion and Recommendations

This study's essential purpose was to evaluate Afghanistan's trade potential with the European Union. The research has been conducted using the essential, augmented, and extended gravity models of international trade and the simple OLS estimation technique. Moreover, this study's dependent and independent variables have been theoretically justified and tested for econometric issues. The research used panel data for five years, from 2015 to 2019, for 15 countries in the European Union. Similarly, EU countries with less than $100,000 in Trade with Afghanistan in a given year were excluded from the analysis. The data reveals that Afghanistan has the most significant trade potential with Germany, followed by France and Spain.

The same potential exists for seven other countries, such as Sweden, the Netherlands, Belgium, Austria, Poland, Ireland, and Italy. Based on the data, Afghanistan has the potential to trade two times more than it does with Germany, France, and Spain, where the remaining countries are between one and two. The data revealed that Afghanistan's bilateral trade with the EU is positively and significantly affected by its GDP, GDP per

capita, exchange rate, population, inflation rate, and openness to trade. The magnitude of this effect is high in the product of GDP, whereas it is low in openness to trade. In reverse, bilateral trade is negatively affected by the real exchange rate. Subsequently, according to the model, trade is negatively affected by the geographical distance between the trading partners.

Nonetheless, because Afghanistan does not share a border with the European Union and the European countries are geographically closer to one another, the distance coefficient is positive but close to zero, at 0.04678, revealing the exact transportation cost from Afghanistan to the European Union. Subsequently, Afghanistan has exceeded its trade potential with countries such as Romania, Latvia, and Greece, where the (P<1). Following that, Afghanistan's trade potential was realized with countries such as Finland and Denmark, where the P/A is one. The dummy variables are also added to the extended gravity model; nonetheless, due to the multicollinearity issue, the dummy variables were excluded from the analysis. It is understood by common sense that countries that share a border, have common languages, regional trade agreements, and cultural similarities are more willing to trade with each other than other countries. Correspondingly, the political ties between the two countries are also affecting their bilateral trade. The dummies listed above are rare between Afghanistan and the European Union.

Policy Recommendations

The study has policy suggestions to develop further economic and trade ties with the European Union.

- There is no single trade agreement between Afghanistan and the EU. In order to ease the trade relations between the two, Afghanistan and the EU have to sign a preferential trade agreement.

- In order to maximize the trade volume between Afghanistan and the EU, Afghanistan has to reduce tariffs on EU exports to the country.

- Based on the European Asylum Support Office, most Afghan refugees in the EU live in Germany, followed by France, Austria, and Sweden. Correspondingly, Afghanistan has maximum trade potential with Germany, followed by France; though, it is understood that Afghanistan has more trade potential where the Afghan diaspora lives. Therefore, the Afghan government has to focus on exporting those domestic products used by most of the Afghan diaspora in EU countries.

- According to data, Afghanistan can expand trade with ten EU countries, while trade with two countries surpasses its potential with three others. As a result, Afghanistan must channel its exports from the five countries where it has exceeded or reached trade potential toward the ten countries in the European Union where trade potential exists.

- Afghanistan must improve its products' quality, packaging, and labeling to compete in international markets, particularly the European Union. This policy will help Afghanistan flourish in its existing markets and explore new ones.

- The Afghan government must provide financing and subsidies to domestic businesses in order for them to develop and upgrade by international standards. This policy helps the country in two dimensions: first, the country grows economically, and second, exports boom.

Implications (Academic implications & Practical implications)

The gravity model has been used in international Trade since Timbergen and Poyhonen (1963). After that, scholars applied the model to find the countries' trade potential. There is a large amount of academic research in this regard, but there has yet to be a previous study regarding Afghanistan's trade potential with the European Union. The gravity model used in this research is newly applied to identifying Afghanistan's trade potential with the European Union. The research literature will help potential researchers who want to expand their research on Afghanistan's trade potential with the EU or other trading partners. Furthermore, it will add to the knowledge of those who want to know about Afghanistan's trade volume with the European Union from 2010 to 2019.

The findings of this study are intended to help the Afghan government and Afghan business people better understand Afghanistan's trade future and consistency in European Union markets, as well as to determine whether the Afghan government can sustain its trade with those countries. As this research is the first attempt in the Afghanistan context where the country's trade potential is evaluated through the application of the gravity model, it will therefore help Afghan policymakers develop policies as well as strategies in order to shape the Afghan trade direction toward the European Union markets in such a way that Afghanistan can optimize its exports and gain the utmost advantage from the trade.

Limitations and Future Scope of the Study

This study has some limitations, like the updated data. The Afghan government collapsed on August 15, 2021. Since then, with the new regime, the overall system in the country has changed. Therefore, the new government needed to update the data regarding Afghanistan's Trade on the United Nations or World Bank websites. However, the data used in this study is up to 2019. This study only employed the merchandise trade data regarding products and commodities without considering services. Even some scholars argue that the gravity model only considers one-sided trade, not mutual trade. This study only investigates the Afghanistan trade potential with the European Union; moreover, the EU trade potential needs to be reflected.

Future researchers interested in trade relations between Afghanistan and the European Union can use the updated data for analysis. In addition, this study only considers the merchandise data regarding products and commodities traded between Afghanistan and the European Union. The trade relations of Afghanistan with the European Union could be further explored by considering services and commodities. However, the data used in this study is taken from a globally authentic source, WITS; nevertheless, future researchers could use the UN COMTRADE data on HS 12 classification. Subsequently, future researchers can examine the trade potential of the European Union with Afghanistan and vice versa to understand the complete trade scenario in terms of explaining the trade feasibility and potential.

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Authors Contributions

The authors confirm their contribution to the paper as follows: study conception, data collection, model evaluation, analysis and design: HK; interpretation of results and draft manuscript preparation: FA. All authors reviewed the results and approved the final version of the manuscript.

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