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IMPACT OF GROSS DOMESTIC PRODUCT PER CAPITA AND POPULATION ON UNITED ARAB EMIRATES TRADE VOLUME

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ABSTRACT

The United Arab Emirates (UAE) has become a significant global trade hub. Understanding the factors influencing trade flows is crucial for developing effective strategies to promote trade activities and sustain economic growth. This study examines the impact of Gross Domestic Product (GDP) per capita and population size on trade flows in UAE with major trading partners, including China, Germany, Iraq, India, Japan, and Saudi Arabia, by utilizing a fixed-effects gravity model and panel data from 2000 to 2020. A positive relationship was found between the GDP of UAE and trading partners and bilateral trade, and a negative relationship was found between GDP per capita, the population of UAE, and bilateral trade flows. The distance between the capital city of UAE and its trading partners also has a negative effect on bilateral trade flows. This study suggests that trading partners should improve their GDP per capita. The negative impact of the increasing population size of the UAE on bilateral trade flows indicates that the UAE should improve labor quality and skills that may enhance trade growth and economic development and that trade policies between UAE and its trading partners need to address trade barriers and initiate efforts for their eradication to improve bilateral trade. The policy implication is that trade opportunities should be expanded by exploring trade agreements and fostering diversification of export goods to mitigate domestic competition and open new markets.

Keywords: *Trade Flow, United Arab Emirates, GDP Per Capita, Population, Fixed-Effects Model, Panel Data Analysis*

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Introduction

The United Arab Emirates (UAE) has emerged as a significant global trade hub, attracting partners from around the world. This rapid growth in international trade has played a pivotal role in a country's economic development and diversification. As the UAE continues to strengthen its position as a trade powerhouse, it has become increasingly crucial to understand the factors influencing trade flows within the nation (Dadakas *et al.*, 2020). Two key economic factors garnered attention in the literature are a country's Gross Domestic Product (GDP) per capita and population size. These variables are often considered determinants of a nation's trade patterns, reflecting economic prosperity, market size, and potential demand. However, the specific impact of GDP per capita and population size on trade flows within the UAE remains an area that requires further investigation. Understanding these relationships can provide valuable insights for policymakers and businesses seeking to foster an environment conducive to trade and economic growth.

The gravity model, a widely used framework in international trade research, has been extensively employed to analyze trade flows between countries. This model draws an analogy to Newtonian gravity, suggesting that trade volume between two nations is positively related to their economic size (measured by GDP) and negatively related to the distance separating them (Capoani, 2023). Studies have highlighted a positive association between a country's economic development, as measured by GDP per capita, and its attractiveness to trading partners (Boulhol et al., 2008). Countries with a higher GDP per capita tend to engage in more trade due to increased purchasing power and a larger domestic market (Lambrechts et al., 2012). literature presents a multifaceted perspective regarding population size. While larger populations represent a greater potential market size, they also translate to increased competition among businesses within the region, potentially leading to decreased trade volume per entity (Kichko, 2018). While previous studies have examined the role of economic factors in trade patterns, there is a gap in understanding how GDP per capita and population size specifically impact trade flows within the UAE. Previous studies have focused on broader regional or global contexts, leaving room for country-specific analyses tailored to the UAE's unique characteristics and economic landscapes.

Using the fixed-effects gravity model and panel data spanning 2000 to 2020, this study contributes to the existing literature by providing empirical evidence on the impact of GDP per capita and population size on trade flows within the UAE. The findings shed light on the relative importance of these factors and their implications for UAE trade policies and strategies. Furthermore, this study addresses the potential collinearity issues that may arise when including distance variables in the gravity model, which could lead to biased estimates. By focusing on the economic factors of GDP per capita and population size, this study provides a more robust and accurate assessment of their impact on trade flows within the UAE by formulating a research question, namely, how does GDP per capita influence trade flow within UAE?, what is the relationship between population size and trade flow within UAE?, and to what extent do the impacts of GDP per capita and population size vary across trading partners or regions within UAE?. The research objectives include investigating the effect of GDP per capita on trade flows within the UAE using a fixed-effects gravity model and panel data. To examine the effect of population size on trade flows within the UAE, accounting for potential competition and market-size factors. To explore the potential heterogeneities in the effects of GDP per capita and population size on trade flows across different trading partners or regions within the UAE. To provide empirical evidence and insights that can inform policymakers and businesses in developing strategies to foster an environment conducive to increased trade

activity and economic growth in the UAE. The existing literature on bilateral trade flows has extensively utilized the gravity model to analyze trade relationships between various countries and regions (Dadakas *et al.*, 2020). These studies have examined trade patterns involving the G7 countries, Indonesia, India, the Gulf Cooperation Council (GCC) countries, ASEAN nations, and South Asian countries, among others (Khayat, 2022).

This research builds on the established gravity model framework to focus specifically on the trade flows between the United Arab Emirates (UAE) and its major trading partners, including China, Germany, Iraq, India, Japan, and Saudi Arabia, from 2000 to 2020. By employing a fixed-effects gravity model for panel regression analysis, the study provides valuable insights into the impact of key economic factors, such as GDP, GDP per capita, and population size, on shaping bilateral trade patterns.

The findings from this research offer policymakers and businesses a deeper understanding of the dynamics influencing trade flows within the UAE context. These insights can inform the development of effective strategies to bolster trade activity, enhance economic growth, and promote national competitiveness. Additionally, the study contributes to the existing knowledge on applying the gravity model in analyzing bilateral trade relationships.

Literature Review

The existing literature on bilateral trade flows has extensively utilized the gravity model to analyze trade relationships between various countries and regions. These studies have examined trade patterns involving the G7 countries, Indonesia, India, the Gulf Cooperation Council (GCC) countries, ASEAN nations, and South Asian countries (Tang et al., 2023), among others (Abidin & Haseeb, 2018). However, most of these previous studies have focused on broader regional or global trade dynamics rather than delving deeper into the specific trade flows of individual economies within these regions (Dadakas et al., 2020).

Unlike many of the studies mentioned in the literature, this research examines explicitly the trade flows of the United Arab Emirates (UAE) with its major trading partners, including China, Germany, Iraq, India, Japan, and Saudi Arabia, over the period from 2000 to 2020. This study uses more recent data (2000-2020) compared to some previous studies, such as Alam and Ahmed (2018), which covered 2001-2015, or Munir and Sultan (2015), which analyzed data from 2001 to 2013. Also, they have used data panels from 2000- to 2023

While previous studies have examined various factors influencing trade (Khayat, 2022), this study specifically focuses on the combined impact of GDP per capita and population size on UAE's trade flows, which was not the primary focus of the studies mentioned in the literature review. The study employs a fixed-effects gravity model, which is noted to control for unobserved time-invariant factors specific to UAE. This specific methodological approach was not highlighted in the descriptions of the other studies in the literature review. The literature review points out that while previous studies have examined economic factors in trade patterns, there is a gap in understanding how GDP per capita and population size specifically impact trade flows within the UAE. This study aims to fill this gap by providing valuable insights into the dynamics influencing UAE's bilateral trade patterns.

By focusing on UAE's trade with specific major global trading partners, this research offers policymakers and businesses a deeper understanding of the factors shaping the country's trade flows. These insights can inform the development of effective strategies to bolster trade activity, enhance economic growth, and promote competitiveness in the UAE.

Additionally, the study contributes to the existing body of knowledge on applying the gravity model in the analysis of bilateral trade relationships (Subhan et al., 2021), with a specific focus on an individual economy's trade dynamics.

Study Hypotheses

There is a positive relationship between the Gross Domestic Product per capita of United Arab Emirates and its trade volume. As GDP per capita increases, the trade volumes of the United Arab Emirates are expected to increase tremendously. A higher GDP per capita indicates a more affluent population with greater purchasing power, which can lead to increased demand for goods and services. This, in turn, can drive up trade volumes as the country imports more goods and services to meet this demand. Higher GDP per capita attracts more foreign investment, leading to increased exports and overall trade activity in the exporting country.

There is a positive relationship between the population of the United Arab Emirates and their trade volume. As the population grows annually, the demand for goods and services in the United Arab Emirates increases, leading to higher trade volumes. A larger population in UAE means that the country requires a larger market for its goods and services, which increases imports and exports, respectively. It can also lead to increased economic activity, including investment in infrastructure and industry, which can further boost trade volumes.

Data and Research Methods

This study analyses trade flows within the United Arab Emirates (UAE) and its trading partners–China, Germany, Iraq, India, Japan, and Saudi Arabia–using a quantitative research approach. UAE is a federation of seven Emirate nations located on the Arabian Peninsula and serves as the primary geographic location of interest for this study. The study selected these countries due to their heavy reliance on the oil sector, which contributes significantly to the sectors in terms of their GDP and market exchange rates. These secondary data were sourced from the International Monetary Fund's, WTO, and FAO databases as panel data from 2000 to 2020. They employed a panel regression analysis as an econometric data analysis technique using STATA version 17 software (Midamba et al. 2025). This study employed the Fixed-Effects Gravity Model in the context of panel regression anal ysis. This model accounts for unobserved factors specific to each country (UAE) that might influence trade flows. These factors include political stability, cultural norms, and geographical location. By fixing these effects, the model isolates the impact of variables of interest (GDP per capita and population size). In addition, the model allows us to see how changes in GDP per capita and population size within the UAE over time (2000-2020) affect trade flows. This is particularly relevant for this study, as we are interested in how UAE's economic development and population growth impact its trade activities. The disadvantage of the fixed-effects gravety model is that the results may not directly apply to other countries because of its fixed-effects nature, which focuses on variations within a single entity (UAE).

Furthermore, the model does not account for external factors that may change over time and influence all countries, such as global economic trends and trade policies. A fixed effects gravity model is a strong choice for this study because we primarily want to understand how internal factors within the UAE (GDP per capita and population size) affect trade flows over a specific period (2000-2020). By controlling for unobserved country effects, we obtain a clearer picture of the relationship between these internal factors and trade activity. The other alternative model could be a Random-Effects Gravity Model that allows some generalizability

to other countries. However, it would not account for unobserved country effects specific to UAE. This could have led to biased results in our case, while the Pooled OLS Regression also controls for unobserved country effects or time-invariant variables, potentially leading to misleading conclusions. Overall, the fixed-effects gravity model offers the best balance for this study by isolating the impact of the chosen variables within the context of UAE development. (common effects), fixed effects, and random effects. It is essential to conduct Chow and Hausman tests to determine the most effective model for explanation. The gravity model was used in this study, which was first introduced by Sir Isaac Newton in 1978 as part of his Law of Universal Gravitation. This gravitational law states that the attraction between two objects is proportional to their mass and inversely proportional to the square distance between their centres. According to the established gravity principle, the allure exerted between two objects i and j is represented by:

$$F_{ij} = G\frac{M_I M_J}{D_{IJ}} Eqn. \quad (1)$$

Where F_{ij} is the total volume of international trade, M_i and M_j denote the country's economic scale, which is represented by its GDP in countries i and j. D_{ij}, is the geographical distance between two trading countries i and j and G is a gravitational constant of the trade equation.

In bilateral trade, the gravity model suggests that trade intensity between countries positively relates to national income and inversely to the distance between the original and destination country. Economists have used this gravity model to explain bilateral trade flows, and they have found that it has a strong relationship with the measures of interaction between two trading countries in the world. The Gravity Model has been widely used in international trade studies. In this study, the natural logarithm of the original and destination countries' GDP per capita, the natural logarithm of both the original and destination country's population, and the natural logarithm of the distance between the two countries have been utilized as essential variables. The variables used (GDP, GDP per capita, population, and distance) are standard in gravity models of trade. The equation is specified by:

$$Indrade_{ij} = \beta_0 + \beta_1 Ingdppc_1 + \beta_2 Ingdppc_j + \beta_2 Inpop_i + \beta_4 Inpop_j + \beta_5 Indist + \varepsilon_{ij} Eqn. \quad (2)$$

Table 1: Description of Bilateral Trade Variables Used in Gravity Model Analysis

Variable	Description & Units of Measurement	References	Source	Expected Sign
$Intrade_{ij}$	Trade between the UAE and trading partners (currency) in natural logarithm form	(Abidin dan Haseeb 2018; Alam dan Ahmed 2018; Khayat 2019)	The International Monetary Fund (IMF), WTO	
$Ingdppc_i$	GDP per capita of UAE (AED) in natural logarithm form	(Lambrechts et al. 2012; Khayat 2022)	IMF	+
$Ingdppc_j$	GDP per capita of trading partners (USD) in natural logarithm form	(Khayat 2019; Khayat 2022; Kumar et al. 2024)	IMF	+
$Inpop_i$	Population of UAE (million) in natural logarithm form	(Kumar & Ahmed, 2015; Subhan et al. 2021; Khayat 2022; Kumar et al. 2024)	IMF, WTO	-
$Inpop_j$	Population of training partners (million) in natural logarithm form	(Kumar 2015; Khayat 2022; Kumar et al. 2024)	IMF, WTO	-
Indist	Distance between the capital city of UAE and trading partners' capital city(km) in natural logarithm form	(Munir dan Sultan 2015; Subhan et al. 2021; Kumar et al. 2024)	Distance Calculator	-

Data includes the categories, period of analysis, and sources of data. Meanwhile, the research method describes in detail the design, population, sample and sampling technique, the workings of the study, the observed parameters, and technical analysis. The method is written in narrative form to convey the important way the research is conducted.

Finding and Discussion

Table 2 presents the summary statistics of the bilateral trade flow data between the UAE and its trading partners from 2000 to 2020. The mean value of trade during this period was AED 14.64 billion, with a standard deviation of 13.5 billion. The UAE's population averaged 6.96 million, while the population of its trading partners averaged 1.29 billion. The mean GDP of the UAE was AED 286.9 billion, and the mean GDP of its trading partners was AED 3.16 trillion. The average GDP per capita of the UAE was AED 39,988, and its trading partners' average GDP per capita was AED 17,751. The average distance between the UAE and its trading partners was 3,808 kilometers.

Table 2: Descriptive Statistics of Trade Variables Used in The Gravity Model

Variable	Mean	Std. Dev.	Min	Max
TRADE	1.46E+10	1.35E+10	1.13E+08	5.29E+10
LESTRADE	22.92	1.13	18.54	24.69
POPi	6.96E+06	2.31E+06	3.28E+06	9.29E+06
LNPOPi	15.83	0.3	15.15	16.04
POPj	1.29E+09	9.27E+09	2.15E+07	1.04E+11
LNPOPj	18.92	1.67	16.89	25.37
GDPPCi	39,988	5,748	29,909	46,866
LNGDPPCi	10.59	0.15	10.31	10.76
GDPPCj	17,752	16,895	442	49,145
LNGDPPCj	9.03	1.44	6.09	10.8
DIS	3,808	2,465	972	8,090
LNDIS	7.996	0.75	6.88	8.998

* LESTRADE, LNPOPi, LNPOPj, LNGDPPCi, LNGDPPCj, and LNDIS are natural logarithms of the respective variables.

Table 3 presents the correlation coefficient matrix of bilateral trade variables used in the Gravity model. The dependent variable shows a positive and negative relationship with the explanatory variables. The results of the estimation from the regression of random effect RE (GLS) and OLS estimations for bilateral trade flows between UAE and trading partners are presented in Table 4.

Table 3: Correlation Coefficient Matrix of Trade Variables

Correlation	Lntrade	Lngdppci	Lngdppcj	Lnpopi	Lnpopj	Lndist
Lntrade	1	0.58	0.16	0.22	0.42	-0.29
Lngdppci	0.58	1	0.21	0.12	0	0
Lngdppcj	0.16	0.21	1	0.12	-0.5	0.34
Lnpopi	0.22	0.12	0.12	1	-0.03	-0.04
Lnpopj	0.42	0	-0.5	-0.03	1	0.46
Lndist	-0.29	0	0.34	-0.04	0.46	1

Table 4: Gravity Equation Estimates Bilateral Trade Between UAE and Trading Partners

Variable	RE(GLS)		OLS	
	Coef.	Std. Err.	Coef.	Std. Err.
$lngdppc_i$	2.421***	0.425	1.683	0.4130
$lngdppc_j$	0.957***	0.134	1.363***	0.1456
$lnpop_i$	-0.019	0.174	-0.325**	0.169
$lnpop_j$	0.439***	0.114	0.168	0.121
lndist	-0.640	0.392	-0.311***	0.107
Constant	-14.236***	5.998	-14.221**	5.653
No. observation	126		126	
No. groups	5		5	
F-test			(5,114) =74.62	
Wald chi2(7)	22O.24***			
R2(within)	0.6889		0.7201	
R2(between)	0.00146		0.0003	
R2(overall)	0.2892		0.1831	

*Denotes statistical significance at the 10% level, ** at 5% and *** at 1%. Source: Author's computation

Table 4 highlights the gravity estimates for bilateral trade, as expected in the model; the coefficient of GDP in UAE and the trading partners in RE and OLS estimations positively and significantly influenced bilateral trade at a 1% significance level. The result means that both the UAE and its trading partners have a higher GDP, making them produce more goods, services and export more. In addition, the higher level of GDP in trading partner countries results in a higher export value from UAE. This implies that the rich and highly populated countries tend to trade more with each other and contribute to trade integration for economic benefits. The results found are consistent with the findings of Bakhsh et al. (2016), Kumar et al. (2024), and Jayasooriya (2021).

The positive and significant coefficients of GDP for UAE and its trading partners indicate that as economic output and production increase in these countries, their ability to trade with each other also rises. A higher GDP reflects greater economic activity, production capabilities, and purchasing power, facilitating more bilateral trade flows.

The negative coefficient for GDP per capita of trading partners suggests that as these countries become wealthier, their demand for imports from UAE may decrease. Higher income levels can lead to increased domestic consumption of locally produced goods, reducing reliance on imports and lowering bilateral trade volumes with the UAE.

The negative coefficient for the UAE's population implies that a larger domestic market does not necessarily translate into higher trade volumes. A potential reason could be increased competition among domestic firms in the UAE, causing them to focus more on the local market than expanding export operations.

The negative effect of distance aligns with the gravity model's prediction that greater geographical separation hinders trade flows. Longer distances increase transportation costs, time delays, and other logistical barriers, making it more challenging for the UAE to engage in international trade with farther partners.

Overall, these results highlight the complex interplay between economic factors and trade patterns, with GDP, income levels, market size, and geographic proximity all playing significant roles in shaping bilateral trade flows for the UAE.

In addition, UAE's coefficient of GDP per capita in the RE estimation negatively and significantly influenced the bilateral trade at a 1% significance level. This negative value indicates that an increase in GDP per capita reduces the bilateral trade flows between UAE and its trading partners due to the higher transportation costs, increased competition, increased demand for domestic products, and differentiated product categories in UAE's trading partner countries. For instance, higher GDP per capita in trading countries could lead to higher transportation costs due to increased demand for goods and services, negatively influencing bilateral trade flows. In addition, higher GDP per capita in the importer country can also lead to increased competition in the international market, making it more difficult for the UAE to penetrate the market and potentially reducing trade flows. This detrimental influence arises due to its corresponding expense in terms of trade and transport, which affects international trade compared to the expense of production, confirmed by Abdullahi et al. (2021), Khayat (2019) and Patuelli et al. (2016).

The coefficients for the home country's total population and trading partners in RE and OLS estimations had a negative effect on bilateral trade flows at a 1% significance level. This means the UAE has a large population, enabling them to import more products but export less. The result also reveals an inverse relationship between the population size and trade flow per entity. While a larger population signifies a potentially larger market, it can intensify domestic business competition. This competition might lead to a decrease in the average trade volume per individual entity in the UAE. This finding is consistent with the concept of market size in international trade. While a larger population offers a vast market, it can also increase competition among domestic firms for a fixed pool of resources (Dadakas et al., 2020). This can lead firms to focus on domestic competition rather than expanding their operations internationally. Alam and Ahmed (2018) found that India's total population size negatively affected bilateral trade with Gulf Cooperation Council Countries.

As expected in the model, the coefficients of distance between the home country (UAE) and destination countries (trading countries) in the RE and OLS estimations negatively and significantly affected bilateral trade at a 1% significance level. The results prove that the distance between UAE and the trading partners is negative due to the higher distance between UAE and trading partners decreasing international trade by increasing transportation costs, administrative procedures, and trade-related barriers. The greater the distance between the exporting country (UAE) to importing countries (trading partners), the more it will cause a decrease in export volume. The farther the distance between bilateral trade countries, the greater the trade costs incurred, causing the volume of exports to be reduced drastically. The result is in line with the findings of Fevriera et al. (2021), Santosa et al. (2021), Jayasooriya (2021), and Ristanović et al. (2020).

Table 5: Estimation Results of Gravity Model Analysis

Test	Test statistic	p-value	Selected Model
F-test	19.40	0.0000	Fixed Effects Model
Hausman Test	33.25	0.0000	Fixed Effects Model
Breusch-Pagan LM Test	6.23	0.0125	Random Effects Model

The F-test results indicate that the fixed-effects model is more appropriate than the pooled OLS model, suggesting significant individual-specific effects. However, the Hausman test also favors the fixed-effects model, indicating that the individual-specific effects are correlated with the explanatory variables. The Breusch-Pagan LM test, on the other hand, suggests the presence of heteroskedasticity, which can be addressed using robust standard errors.

Given the conflicting results from the Hausman and Breusch-Pagan tests, a more in-depth analysis may be necessary to determine the most appropriate model definitively. This could involve considering additional diagnostic tests, sensitivity analyses, or alternative estimation techniques, such as generalized least squares (GLS), to account for heteroskedasticity.

Conclusion

The empirical results, presented in Table 5, indicate a significant positive relationship between the GDP of the UAE and its trading partners and bilateral trade flows. Additionally, the GDP per capita of trading partners, the population of the UAE, and distance were found to have a significant negative impact on bilateral trade.

The positive relationship between the GDP of the UAE and its trading partners suggests that economic growth in both countries can stimulate bilateral trade. This could be attributed to increased demand for goods and services and increased investment flows.

The negative relationship between the GDP per capita of trading partners and bilateral trade is counterintuitive and may be due to several factors. One possible explanation is that higher-income countries may have a higher propensity to import goods and services from other high-income countries rather than lower-income countries like the UAE.

The negative impact of the UAE's population size on bilateral trade may be due to factors such as labor market competition, increased demand for imported goods and services, and infrastructure congestion.

Limitations and Future Research

While this study provides valuable insights into the determinants of bilateral trade flows between the UAE and its trading partners, it is important to acknowledge its limitations.

First, the study's focus on the UAE and its trading partners limits the generalizability of the findings to other countries or regions. Future research could expand the analysis to include more diverse countries to provide a broader understanding of the factors influencing bilateral trade.

Second, the analysis was limited to the 2000-2020 period. Incorporating more recent data could offer additional insights as trade patterns and the influence of economic factors may have evolved.

Third, the study did not consider the impact of other potentially relevant factors, such as trade agreements, infrastructure development, and export diversification, which could also influence trade patterns. Incorporating these variables in future research could provide a more comprehensive understanding of the determinants of bilateral trade flows.

Finally, the study employed a fixed-effects gravity model and OLS, which may not fully address potential endogeneity issues, such as reverse causality or omitted variable bias. Utilizing alternative econometric techniques, such as instrumental variables or panel data methods, could help to address these concerns and strengthen the causal inferences.

Policy Implications

The findings of this study have several implications for policymakers in the UAE and its trading partners:

Economic Growth: Continued economic growth in the UAE and its trading partners is crucial for fostering bilateral trade.

Trade Diversification: The UAE should explore opportunities to diversify its export markets and reduce reliance on a few key trading partners.

Infrastructure Development: Investments in infrastructure can improve trade logistics and reduce trade costs.

Trade Policy Reforms: The UAE should continue to pursue trade liberalization policies and negotiate bilateral and multilateral trade agreements.

Labor Market Reforms: To mitigate the negative impact of population growth on trade, the UAE should focus on improving labor quality and skills through education and training programs.

Conflict of Interest

The authors attest to the absence of competing interests that might impair the impartiality of their results**.**

Availability of Data and Materials

Data and material research can be provided upon request.

Authors' Contribution

Conceptualization was carried out by EH; Methodology and Data Analysis; Validation was done by AR & RN. Writing and Editing were handled by EH & JAA. AR & RN took charge of reviewing and editing, while AR & RN provided supervision. All authors have reviewed and consented to the publication of the manuscript.

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