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HOW BREXIT AFFECTS THE TRADE FLOWS BETWEEN UNITED KINGDOM AND EUROPEAN UNION

Dissertation submitted

by

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Abstract

This   study uses data from 2013 to 2022 to investigate how Brexit will affect trade flows between the UK and the EU. The purpose of the study is to determine how the UK's exit from the EU has affected trade dynamics by analysing bilateral exports and imports. Using a strong econometric model, the study presents important results, such as a notable 19.83% decline in UK exports to the EU following Brexit, while EU imports were constant. The analysis extends to non-EU countries and reveals a less obvious impact on trade flows, suggesting that a new trade deal could have mitigated the negative consequences. The study emphasizes the importance of GDP in influencing trade and the need for strategic measures to advance trends. The resilience findings provide useful evaluation of the economic effects of Brexit, as well as helpful suggestions for future trade agreements and policies.

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1.Introduction

On June 23,2016, the United Kingdom held a referendum to determine whether or not to remain in the European Union. Polls showed that the election would be close, but betting markets were sure that voters would keep things the same. The movement to leave the EU had an unexpected victory when it got more than 50% of the vote. The Leave vote caused the UK stock market and the value of the pound to drop sharply. It also caused David Cameron, the Conservative Prime Minister, to quit.

The Brexit process in the UK was ignited by the referendum, which also made it difficult to forecast future relations between the UK and the EU. When, for instance, does the UK intend to exit the EU? What kind of relationship will the UK and the EU have going forward? Will the UK enter a customs union with the EU or remain in the single market? Are you prepared for a no-deal Brexit for the UK? These are the matters that were not addressed in the vote.

The discussion on the specific format of Brexit was the main focus of UK government for the next four years. The EU was open to maintaining a strong partnership but which the rights of the single mark, including as frictionless trade in goods and services, were interconnected with permitting free movement of people.

Faced with this situation, the UK government, led by newly appointed Prime Minister Theresa May, focused on managing immigration, withdrawing from the authority of the European Court of Justice, and striving to uphold a strong commercial partnership. Following a sudden election defeat in June 2017, may did not have enough support from Parliament for her Brexit plan.

Parliament rejected the divorce agreement reached by May with the EU three times in early 2019, causing the Brexit date of 29 March 2019 to be delayed and resulting in May's resignation.

Boris Johnson replaced May as the Conservative party leader and Prime Minister. Unlike May, Johnson had backed the Leave campaign. Johnson revised the separation deal and subsequently declared and won an election in December 2019 on the slogan "Get Brexit Done. "Johnson's achievement enabled him to secure approval for the updated exit deal, leading to the UK's departure from the EU on 31 January 2020, more than three years after the referendum.

The departure agreement encompassed a monetary agreement, safeguards for UK nationals residing in the EU and vice versa, and measures aimed at ensuring peace in Northern Ireland. Yet, it did not establish the terms of the post-Brexit trading relationship between the UK and the EU. The agreement provided for a transition period that would allow the UK to remain in the customs union and single market until the end of 2020 while negotiations were ongoing for a future relationship. Early in 2020, the Covid-19 epidemic affected Europe, but the transition period was not prolonged.

The UK government aimed to establish a new relationship with the EU that maximized access to EU markets while preserving its autonomy in setting policies regarding immigration, trade, and economic regulation (HM Government, 2020). These aims necessitated exiting the single market and customs union, while yet allowing for the possibility of a free trade pact. The European Union proposed a zero-tariff, zero-quota, zero-dumping trade agreement, provided that both sides committed to level-playing-field regulations to avoid unfair competition based on labour or environmental standards.

The future relationship negotiations' result was uncertain in 2020. If the transition period had concluded without an agreement, UK-EU trade would have returned to World Trade Organization (WTO) conditions, resulting in goods commerce being subject to most-favoured nation (MFN) tariffs. On Christmas Eve 2020, an agreement was reached, and eight days later, at the start of 2021, it became provisional.

The Trade and Cooperation deal (TCA) is a free trade deal that eliminates all tariffs and quotas on trade between the UK and the EU. It does not, however, significantly improve integration by lowering non-tariff barriers (NTBs) or guaranteeing market access for services in contrast to EU membership. Under the Trade and Cooperation Agreement (TCA), the United Kingdom is not part of the European Union's single market and customs union. As a result, the free movement of persons has stopped, and a customs and regulatory border has been established between the UK and the EU, leading to the emergence of numerous new non-tariff barriers. Separate legal compliance obligations between the EU and the UK, restrictions on quick business trips, and a reduction in service providers' access to the market, including the cancellation of financial services companies' passporting privileges. Comprehensive customs check on imports from the EU were initially postponed by the UK, but they will now be implemented throughout 2022.

Under the TCA, goods are eligible for tariff-free, quota-free access if they comply with the rules of origin. The percentage of a product's value that must originate in the UK or the EU in order to be qualified to use the TCA is usually indicated by the requirements. Certain commodities do not fit the requirements, and occasionally the expenses of achieving compliance outweigh the tariff savings from observing to rules of origin. Trade may not always be completely tariff-free under the TCA. In the first seven months of 2021, around

30% of UK exports to the EU were subject to tariffs even though they qualified for preferred zero tariff entry under the TCA.

Our study provides us with a distinctive advantage in analysing the impact of Brexit on trade between the UK and the EU countries, particularly in terms of how it affected trade flows between the two entities.

This study focuses on the examination of the effect of Brexit on the trade flows of the United Kingdom, that is, how and if they were affected, their exports and imports with their trading partners were affected. Furthermore, to strengthen the examination of the impact of Brexit on trade flows, it is important to include non-EU (ROW) countries in our model, in particular countries that are important trading partners with the UK. This will let us to check in more detail the trade flows in the EU countries and also in the rest of the world.

2.Literature Review

Following three years of departure negotiations since the referendum, the United Kingdom legally ceased to be a member of the European Union as of January 31, 2020. Subsequently, often referred to as the "divorce bill," the first phase of negotiations for a withdrawal agreement was completed in October 2019. A preliminary version of the withdrawal agreement, which was mutually supported by the United Kingdom and the European Union in November 2018, experienced three defeats in the UK House of Commons. The road to a withdrawal agreement was difficult.

A stoppage or transition period was decided upon to enable the second step of the process following the conclusion of the withdrawal stage of discussions. Establishing a future partnership between the UK and the EU was the goal of this process. Because the United Kingdom remained a member of the European Union during this time, it was able to keep its

economic access. A deadline of December 31, 2020, was established prior to the conclusion of the transition period and the departure of the UK from the EU Single Market and Customs Union. The Trade and Cooperation Agreement (TCA) was completed just a few days prior to the deadline.

During the trade negotiation process in 2020, there was substantial discussion about the hazards associated with the possibility of not reaching an agreement, which was referred to as a "Hard" Brexit. If such a scenario occurs, trade between the UK and EU would be subject to "third country" duties, resulting in significant cost hikes for trading, especially for food products.

The TCA mitigated this danger by establishing a trade agreement that allows for tariff-free and quota-free trade between the UK and EU.

Nevertheless, while the agreement successfully avoided the potential expenses associated with tariffs, it had a restricted scope in terms of addressing non-tariff barriers. Non-tariff barriers refer to a diverse range of governmental measures, excluding tariffs, that impede international trade. Non-tariff obstacles on goods trade encompass technical requirements such as licensing, labelling, standards, and sanitary and Phyto-sanitary norms, which are intended to safeguard health and food safety. These requirements establish the criteria that a product must meet in order to be eligible for sale in a market.

While trade between the European Union (EU) and the United Kingdom (UK) continues to be exempt from tariffs, certain modifications have been implemented regarding documentation and inspections. Currently, there is an imbalance in the customs requirements between the EU and the UK. The EU has introduced these requirements immediately, while the UK has chosen to gradually implement new regulatory and customs inspections. These

checks implemented in January 2022 and July 2022, as outlined in the Border Operating Model.

The research of (Crowley et al. ,2018) examines the impact of the UK-EU trade relationship renegotiation on UK firms' export choices to the EU. It measures trade policy uncertainty across all CN8 products sold from the UK to the EU, based on threat point tariffs. Increased tariffs reduce the number of companies entering the EU export market and increase the number of firms withdrawing from exporting to the EU. Exposure to extreme and high tariffs leads to a decline in growth rate of entrants into exporting compared to products facing zero tariffs. According to a partial equilibrium aggregation exercise, in 2016 there would have been a 5.1% increase in the number of UK firms entering the EU export market and a 4.3% drop in the number of firms leaving the market if trade policy uncertainty did not become more prevalent for exporting businesses to the EU. The study highlights the importance of the large margin in stimulating overall export expansion.

The Brexit referendum in 2016 had significant economic consequences on trade, with UK export demand declining below expectations. The study of (Douch and Edwards, 2022) found deficient performance in EU and non-EU nations, with exports to EU countries experiencing a deficit of 20%-25%. Imports from the EU and non-EU nations also showed poor performance, possibly due to Brexit campaign strengthening pro-Commonwealth attitudes among Leave supporters. Policy uncertainty has already had quantifiable impacts on trade before concrete policy changes are implemented. However, there is scant indication of countries outside Europe shifting towards British exports.

The economic effects of Brexit are examined in a study by Dhingra et al. (2017), with an emphasis on trade and fiscal transfers between the UK and the EU. The analysis projects that living standards in the UK would fall by 1.3% in the event of an optimistic soft Brexit

using a quantitative trade model. However, under a pessimistic hard Brexit scenario, the economic loss increases to 2.7%. The study also suggests that static estimates of Brexit's costs may be understated due to the dynamic impact of trade on productivity and foreign direct investment. If the UK were to leave the EU and join EFTA, income per person would decrease from 6.3% to 9.4%. The study also finds that the UK economy will incur higher costs from reduced trade resulting from decreased integration with EU members, compared to the benefits derived from lower contributions to the EU budget. The study suggests that both the UK and the EU have a significant interest in the evolution of UK-EU relations following Brexit.

(Hantzsche et al., 2019) examines the economic impact of the UK's proposed Brexit deal on its economic ties with the EU. It reveals that trade and migration barriers negatively affect long-term GDP levels. A scenario where the UK trades with the EU on WTO terms results in a more significant economic impact. Increased obstacles to exporting and importing services discourage trade and investment, leading to less productivity for UK workers. The estimates are uncertain due to the absence of previous instances of exiting a significant trade group.

The paper of (Oberhofer & Pfaffermayr, 2021) explores the welfare effects of Brexit on trade in manufacturing goods using an estimation approach and multilateral resistances system. The study considers uncertainties surrounding Brexit discussions and provides a range of prospective trade implications for the UK, the EU, and the rest of the world. The panel structure in the data allows for the assessment of short-term and medium-term impacts on trade resulting from Brexit. The study combines the panel data structural gravity estimator with the complete endowment general equilibrium model to evaluate the welfare consequences caused by Brexit on industrial trade. The results indicate that the most significant negative impacts on trade and welfare are likely to occur in the event of a hard

Brexit, where the UK would engage in trade only under the rules of the World Trade Organization (WTO). The implementation of free trade agreements with other countries and negotiation of similar agreements with the EU may mitigate these adverse consequences. The welfare impacts indicate that the UK's real income (real GDP) is expected to decline by 0.3% to 5.7% due to Brexit.

Using the gravity model, the study of (Stack & Bliss, 2020) investigates the trade effects of EU economic integration accords and their evolution over time. It shows that whereas regional Economic Partnership Agreements (EPAs) have a detrimental effect on trade, EU membership and Free Trade Agreements (FTAs) have a favourable effect. The study also finds that the positive impact of EU and FTA membership decreases over time, suggesting that countries that joined the European Integration Agreements (EIAs) earlier experienced greater trade benefits. However, the projected term indicates a recovery in the trade benefits of EU membership. The study predicts that the UK's trade with all three country groups would decrease significantly, while global trade would increase by over 50%. The global Britain plan would mitigate these declines, but the decision ultimately depends on the extent to which Britain aligns with the EU.

Brexit poses significant economic challenges to the UK economy, with potential GDP declines ranging from 1.6% to 7.8% for a hard Brexit and 0.8% to 3.8% for a soft Brexit. The impact of Brexit on trade, migration, FDI, uncertainty, and financial variables depends on the model used. Factors influencing trade include data on exports, imports, domestic shares, whether the model incorporates intermediates, and the magnitude of trade elasticities. The impact on the UK's labour supply is complex, with EU immigrants accounting for 12.9% of total sales and foreign multinationals accounting for 37.4%. Alternative trade policy options, such as the complete removal of tariffs and further regulation reduction, are also considered. (Latorre et al. 2020)

The study of (Du et al., 2022) reveals that the Trade and Cooperation Agreement (TCA) has a significant and worsening effect on UK exports, highlighting ongoing difficulties faced by UK companies. Imports have been diminishing, but the escalating costs associated with imports may counterbalance this recovery. The UK has also experienced a significant decline in product variations and a focus on a smaller number of exportable products, raising concerns about its future exporting and productivity.

The United Kingdom's exit from the European Union has had a notable effect on its commerce with the EU in relation to other nations. The period between the June 2016 Brexit referendum and the January 2021 start of the new UK-EU Trade and Cooperation Agreement is examined in the study by (Freeman et al. ,2022). It found that trade flows were not significantly impacted by anticipated trade barriers resulting from Brexit. However, the transition to the Trade and Cooperation Agreement (TCA) resulted in significant imbalances between exports and imports. The TCA did not have a lasting detrimental impact on export values, but it did decrease the volume of exports to the EU compared to other regions. The introduction of the TCA led to a significant decrease in imports from the EU, with a decrease of approximately 25% in UK imports from the EU compared to UK imports from other countries in 2021. The study advises against making hasty judgments regarding the long-term trade impacts of Brexit and suggests revising conclusions as more data becomes accessible. (Freeman et al. 2022)

The study of (Kren and Lawless, 2022) examines the changes in trade between the European Union (EU) and the United Kingdom (UK) following Brexit, focusing on the initial year following the move. The study uses extensive data on monthly trade between the EU and other countries and employs a comprehensive set of fixed effects to isolate the specific impact of Brexit on trade patterns. Preliminary calculations show a significant decrease in commerce between the UK and the EU, while the impact on trade from the EU to the UK is

modest. However, the study also finds that the contradictory outcomes cannot be attributed to small variations in specifications. The study also explores possible causes for the discrepancy, including the use of different data sources and changes in data gathering techniques. To provide the most accurate estimation of the consequences of Brexit, a hybrid dataset is constructed, combining EU trade data with UK bilateral trade statistics. The study estimates that Brexit resulted in a 16% decline in trade from the UK to the EU and a 24% decline in trade from the EU to the UK. The study suggests that future investigation may explore whether Brexit can be linked to slower UK export growth to other countries and faster import growth, potentially through changes in supply networks

A Computable General Equilibrium (CGE) model is used in the article by (Valverde & Latorre, 2020) to analyse how Brexit affects many macro and microeconomic parameters in the US, China, UK, EU, and other countries. The results show that if a hard or "no deal" Brexit is implemented, the UK would see a decline in GDP by 1.14%, a loss in welfare by 1.94%, and a reduction in capital rents by 4.77%. The impact on wages would range from -4.26% to -4.60%, with greater losses observed among skilled individuals. If the UK removes all tariffs in relation to its trading partners, its GDP remains almost unchanged. The immigration problem has been a significant factor in pre-referendum discussions, with the Withdrawal Agreement simplifying the process for EU migrants to stay in the UK.

The dissolution of the European Union (EU) could have worse consequences for EU countries than a hard Brexit. This is because each EU country engages more trade with other EU member states than with the UK. The welfare impact of a full EU collapse is unevenly distributed among EU27 countries, with Germany, France, Italy, and Spain being most protected. Middle-income and developed nations would benefit from trade diversion. Aggregate trade policy analysis shows that certain products, such as medical supplies and vehicle production, may experience greater influence. (Jackson & Shepotylo , 2021)

The article of (Campos & Timini, 2019) aims to quantify the impact of Brexit on both commerce and migration. In order to accomplish this, we employ a structural gravity model. The quantitative research demonstrates strong adverse impacts on both trade and migration flows for the UK as a result of Brexit. The findings of our study are consistent with the existing literature in terms of both direction and magnitude. When analysing the EU-27, the adverse impacts on overall trade volumes are far smaller. The negative effects on trade could be considerably reduced by a Free Trade Agreement (FTA) between the EU and the UK that excludes the free movement of labour. It is not expected to have a significant effect on migration, though. We cannot rule out the possibility that trade for specific products could be considerably impacted by a particular increase in tariffs or divergence in non-tariff measures, as this research is based on aggregate data.

3)Empirical Analyses

3.1) Data Analyses

Bilateral exports and imports of good are provides from the US dollars. We have yearly data from 2013 to 2022 covering 50 countries. The countries considered in the study are the European Union Countries and 21 non-European Countries for the rest of the world(row). The appendix 1 shows all the countries that study regarded. The data for independent variables Population(millions), GDP (millions)selected from World Bank.

3.2) Descriptive analysis

GRAPH 1
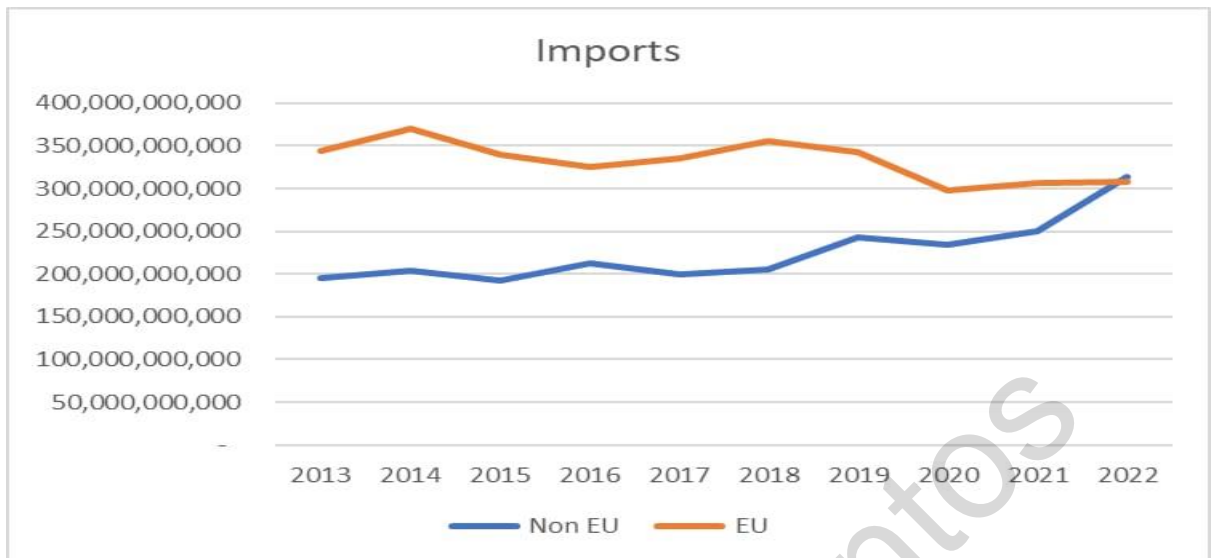
This graph shows data on imports from 2013 to 2022, differentiating between imports from European Union (EU) nations and imports from non-EU countries. The vertical axis shows the value of imports in US dollars. The x-axis represents the time period spanning from 2013 to 2022.

EU Imports: The orange line shows the amount of goods brought into a country from countries within the European Union. The quantity begins at slightly less than 300 billion units in 2013, rises to approximately 350 billion units by 2017, and maintains almost steady level until 2021 with minor variations. By 2022, there is a significant decrease to approximately 300 billion units, reaching levels similar to those in 2013.

Non-EU Imports: The blue line shows the imports originating from nations outside the European Union. The data indicates that the line commences at approximately 150 billion units in 2013 and exhibits a consistent and continuous increasing trajectory. By 2022, the production of roughly 300 billion units will greatly lessen the difference from the higher imports from EU nations at the beginning of the decade.

Initially, the volume of imports from EU countries was around double that of imports from non-EU countries. EU imports have maintained a rather constant trend over the

15

years, whilst non-EU imports have continuously shown an upward trajectory. By 2022, there has been a substantial reduction in the disparity between imports from the European Union (EU) and imports from countries outside the EU.

The consistent rise in imports from non-European Union (EU) nations may indicate a shift towards expanding trade relationships with different partners or alterations in trade regulations. The significant decline in EU imports in 2022 could be attributed to economic causes such as trade agreements after the Brexit that impact imports from these nations.
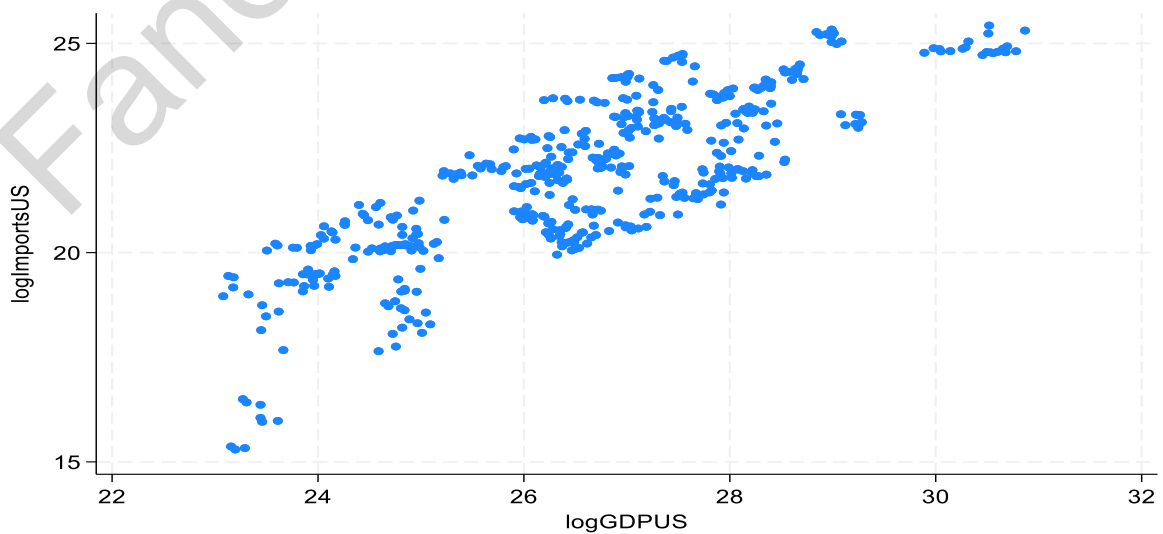
SCATTER PLOT 1:
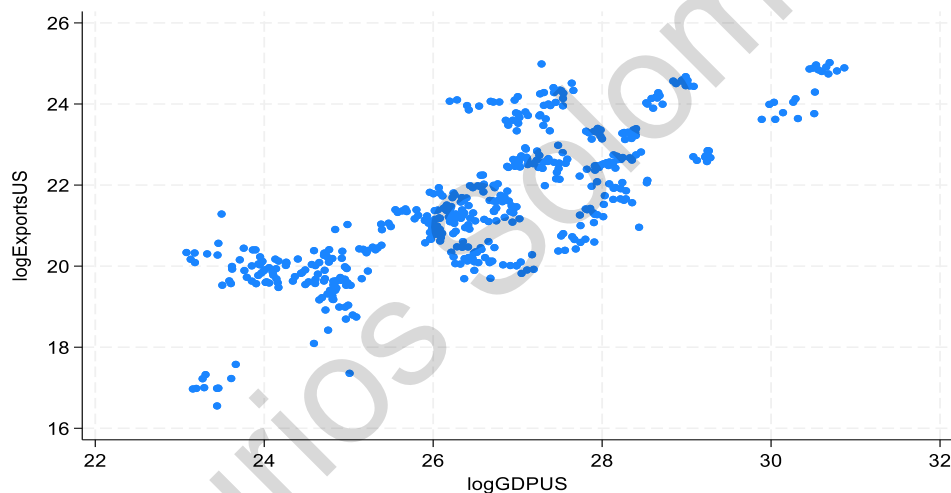
The above Scatter Plots is a diagram that shows the Total exports of good from UK to its trading partners from EU countries on the vertical axis, while the horizontal shows GDPUS. The conclusion drawn from the chart concerns a strong positive relationship that the two variables have, that is, the higher GDP of the trading partner of UK have, bigger increase of exports from the UK to its trading partner exist.

SCATTER PLOT 2:
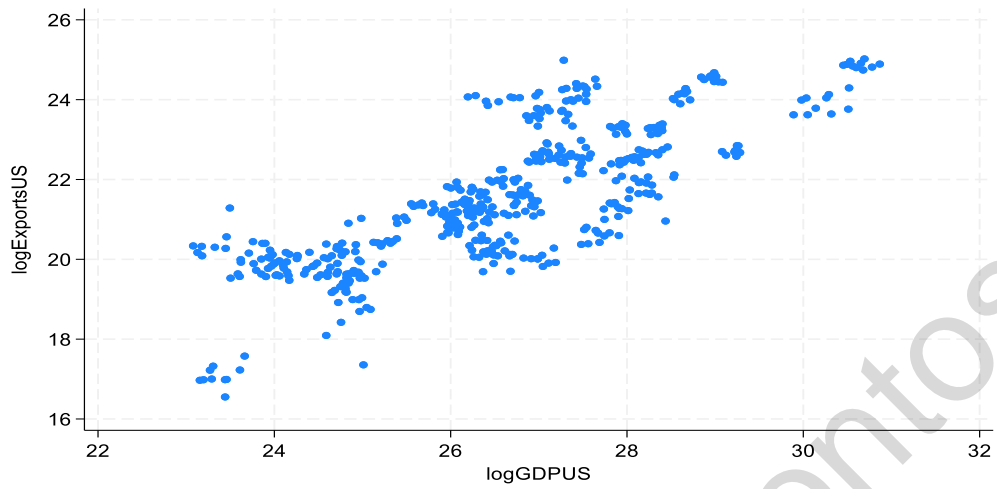
The above Scatter Plots is a diagram that shows the Total exports of good from UK to its trading partners from non-EU countries on the vertical axis, while the horizontal shows GDPUS. The conclusion drawn from the chart concerns a strong positive relationship that the two variables have, that is, the higher GDP of the trading partner of UK have, bigger increase of imports from the UK to its trading partner exist.

SCATTER PLOT 3:

The above Scatter Plots is a diagram that shows the Total imports of good from EU trading partners of UK on the vertical axis, while the horizontal shows GDPUS. The conclusion drawn from the chart concerns a strong positive relationship that the two variables have, that is, the higher GDP of the trading partner of UK have, bigger increase of imports from the UK to its trading partner exist.
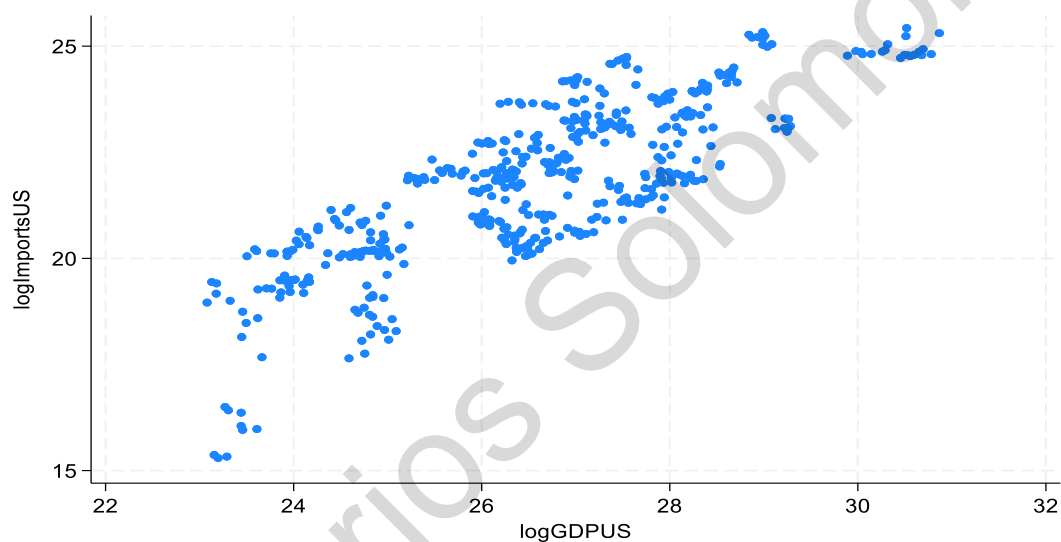
SCATTER PLOT 4:

The above Scatter Plots is a diagram that shows the Total imports of good from non-EU trading partners of UK on the vertical axis, while the horizontal shows GDPUS. The conclusion drawn from the chart concerns a strong positive relationship that the two variables have, that is, the higher GDP of the trading partner of UK have, bigger increase of imports from the UK to its trading partner exist.

3.3 Regression Analysis:

Econometric model:

The present research will be based on OLS method, and the regression model in the form $Y = b_0 + \beta_1 X_1 + \beta_2 D + ... + \beta_p X_p + u$, where Y will be the dependent variable for the 1st regression, (ExportsUS(ijt): is the total exports of good from UK(i) to other Country (j) at time (t) and the number of individuals who left a country). In the 2nd regression the Y will be the dependent variable and specifically is the ImportsUSijt, (is the total imports of good from UK(i) to other Country (j) at time (t)). The other variables of the regression model are exactly the same X1, X2 etc. all independent variables, and U errors. There are 3 dummy variables, specifically are periods1, periods2, periods3.The period1 which take the years before the Brexit referendum we will have been as a base line period to compare it with other 2 periods. Furthermore, to be more accurate in our results we will do the first regression with Exports two times. First time with EU countries and the second time with non-EU countries. The same procedure we will do for the second regression which has the Imports as a dependent variable. So, we will have 4 tables of result when we will do the regressions. In detail the regression models that emerged is as follows:

1st Regression model:

1)log(ExportsUSijt) =β_0+$\beta_1$log(GDPi)+$\beta_2$log(GDPj) +$\beta_3$log(Populationioni)+β_4 log(Populationj) +$\delta_1$period2+$\delta_2$period3

TABLE 1: SHOWS THE VARIABLES AND THE EXPLANATION OF THE 1st REGRESSION MODEL

Variables	Explanation of Variables
logExports(ijt): Dependent Variable	the logarithm of total exports of good from UK(i) to other Country (j) at time (t) in US dollars
logPopulationUK(i)	the logarithm of the populations of the UK in millions
LogPopulation(j)	the logarithm of the population of UK trading partner in millions
logGDPUS(j)	the logarithm of the Gross Domestic Product of the UK in US dollars
logGDPUK(i)	the logarithm of the Gross Domestic Product of the trading partner of UK in US dollars
period 1	is a dummy variable that takes the years for the periods before the referendum (2013-2015)
period 2	is a dummy variable that takes the years for the periods when the referendum of Brexit was made (2016-2019)
period 3	is a dummy variable that takes years for the periods after the Brexit (2020-2022)

2st Regression model:

2) $\log(\text{ImportsUS}_{ijt}) = \beta_0 + \beta_1 \log(\text{GDP}_i) + \beta_2 \log(\text{GDP}_j) + \beta_3 \log(\text{Population}_i) + \beta_4 \log(\text{Population}_j) + + \delta_1 \text{period2} + \delta_2 \text{Period3}$

TABLE 2: SHOWS THE VARIABLES AND THE EXPLANATION OF THE 2nd REGRESSION MODEL

Variables	Explanation of Variables
logImports(ijt): Dependent Variable	the logarithm of total imports of good from other Country (j)to UK(i) at time (t)
logPopulationUK(i)	the logarithm of the populations of the UK
LogPopulation(j)	the logarithm of the population of UK trading partner
logGDPUS(j)	the logarithm of the Gross Domestic Product of the UK
logGDPUK(i)	the logarithm of the Gross Domestic Product of the trading partner of UK

period 1	is a dummy variable that takes the years for the periods before the referendum (2013-2015)
period 2	is a dummy variable that takes the years for the periods when the referendum of Brexit was made (2016-2019)
period 3	is a dummy variable that takes the years for the periods after the Brexit (2020-2022)

Assessing the independent variables, it was observed that variables such Imports, Exports, Population, PopulationUK, GDPUS, GDPUK that would not be easy to process in the form they were in, and so it was decided to make them in a logarithmic form, where their values are more convenient to use.

Fixed/Random Effects:

The next step was to decide whether to use fixed or random effects, as our samples consist of panels. The test's zero assumption, that the model effects are random, was rejected, leading to the use of fixed effects, which were determined using the Hausman Test.

Heteroskedasticity:

A stage that is equally crucial is heteroskedasticity analysis. There is variability when it comes to panel data, according to the research. To avoid errors, we employed the White test to uncover heterogeneity by rejecting the homogeneity-claiming zero hypothesis. Thus, the optimal choice for the model is to use robust standard errors instead of typical standard errors.

4.Results of Empirical Analysis

4.1. Regressions 1a&1b with dependent variable Exports

TABLE OF REGRESSION 1a) (EU)			
Variables	Coefficient	Standard Error	P>|t|
period 2	-0.065	0.060	0.281
period 3	-0.198	0.100	0.048**
logPopulationUK	-0.617	2.091	0.768
logpopulation	0.187	0.268	0.485
logGDPUS	0.676	0.199	0.001***
logGDPUK	-0.0203	0.329	0.951
R- Squared	Within:0.1357	Between:0.8110	Overall:0.8025
Number of observations	270		

4.1.1. Interpretation of Results of regression 1a

period 2: By holding all other variables constant level, the exports from UK to its EU trading partner during the referendum period is 6.56 % lower than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.281, which is higher than the conventional threshold for statistical significance. Thus, the effect of period 2 on exports is not statistically significant, showing that there is not strong evidence to conclude that exports in period 2 differ from the baseline period.

period 3: By holding all other variables constant level, the exports from UK to its EU trading partner after the Brexit is 19.83 % lower than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.048,

which is statistically significant at 5% threshold for statistical significance. This shows that there is a statistically significant decreases in exports in period 3 compared to the baseline.

logPopulationUK : : By holding all other variables constant level ,for each 1% increases in PopulationUK,, Exports decrease by 0.618 on average. The p- value for this coefficient is 0.768, which is very higher than the conventional threshold for statistical significance. This indicate that is not statistically significant at any level.

logpopulation: By holding all other variables constant level, for each 1% increases in Population, Exports increases by 0,187 on average. The p- value for this coefficient is 0.485, which is higher than the conventional threshold for statistical significance. This shows that is not statistically significant at any level.

logGDPUS : By holding all other variables constant level, for each 1% increases in GDPUS, Exports increases by 0.676 on average. The p- value for this coefficient is 0.001, which shows that is statistically significant at the 1% than the conventional threshold for statistical significance.

logGDPUK: By holding all other variables constant level, for each 1% increases in GDPUK, Exports decreases by 0.203 % on average. The p- value for this coefficient is 0,951 which very higher shows than the conventional threshold for statistical significance. This relationship is not statistically significant at any level.

R- Squared: The independent variables used in this model, explain 80.25 % of the UK exports of goods to EU trading partners variation.

TABLE OF REGRESSION 1b) (non-EU)			
Variables	Coefficient	Standard Error	P>|t|
period 2	-0.083	0.130	0.530
period 3	-0.146	0.136	0.292
logPopulationUK	-1.709	5.521	0.760
logpopulation	0.620	1.34	0.648
logGDPUS	0.444	0.131	0.003 ***
logGDPUK	-0.072	0.736	0.922
R- Squared	Within:0.0646	Between:0.4773	Overall:0.4661
Number of observations	220		

4.1.2. Interpretation of Results of regression 1b

period 2: By holding all other variables constant level, the exports from UK to its EU trading partner during the referendum period is – 8.34 % lower than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.530, which is higher than the conventional threshold for statistical significance. Thus, the effect of period 2 on exports is not statistically significant, showing that there is not strong evidence to conclude that exports in period 2 differ from the baseline period.

period 3: By holding all other variables constant level, the exports from UK to its EU trading partner after the Brexit is 14.68 % lower than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.292, which is not statistically significant at any level.

logPopulationUK: By holding all other variables constant level, for each 1% increases in PopulationUK, Exports decrease by 1.709 on average. The p- value for this coefficient is 0.760, which is very higher than the conventional threshold for statistical significance. This indicate that is not statistically significant at any level.

logpopulation: By holding all other variables constant level, for each 1% increases in Population, Exports increases by 0.620 on average. The p- value for this coefficient is 0.648, which is higher than the conventional threshold for statistical significance. This shows that is not statistically significant at any level.

logGDPUS: By holding all other variables constant level, for each 1% increases in GDPUS, Exports increases by 0.444 on average. The p- value for this coefficient is 0.003, which shows that is statistically significant at the 1% level.

logGDPUK: By holding all other variables constant level, for each 1% increases in GDPUK, Exports decreases   by 0.072 on average. The p- value for this coefficient is 0,951 which very higher shows than the conventional threshold for statistical significance. This relationship is not statistically significant at any level.

 R- Squared: The independent variables used in this model, explain. 44.61 % of the UK exports of goods to non-EU to trading partners variation.

4.2. Regressions 2a&2b with dependent variables imports

TABLE OF REGRESSION 2a) (EU)			
Variables	Coefficient	Standard Error	P>|t|
period 2	0. 047	0.052	0.377
period 3	0.001	0.075	0.986
logPopulationUK	-0.614	1.713	0.723
logpopulation	-3.290	0.513	0.000***
logGDPUS	0.349	0.113	0.005***
logGDPUK	0.726	0.289	0.019 **
R- Squared	Within: 0.2903	Between: 0.6519	Overall: 0.6432
Number of observations		270	

4.2.1. Interpretation of Results of regression 2a

period 2: By holding all other variables constant level, the exports from UK to its EU trading partner during the referendum period is 4.7% higher than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.377, which is higher than the conventional threshold for statistical significance. Thus, the effect of period 2 on exports is not statistically significant, showing that there is not strong evidence to conclude that exports in period 2 differ from the baseline period.

period 3: By holding all other variables constant level, the exports from UK to its EU trading partner after the Brexit is 0.13% higher than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.986, which is not statistically significant at any level.

logPopulationUK: By holding all other variables constant level, for each 1% increases in PopulationUK, Exports decrease by 0.614 on average. The p- value for this coefficient is, which is very higher 0.723 than the conventional threshold for statistical significance. This indicate that is not statistically significant at any level.

logpopulation: By holding all other variables constant level, for each 1% increases in Population, Exports decreases by 3.290 on average. The p- value for this coefficient is 0.000, which is which shows that is statistically significant at the 1% level.

logGDPUS : By holding all other variables constant level, for each 1% increases in GDPUS, Exports increases by 0.349 on average. The p- value for this coefficient is 0.005, which shows that is statistically significant at the 1% level.

logGDPUK: By holding all other variables constant level, for each 1% increases in GDPUK, Exports increases   by 0.726 on average. The p- value for this coefficient is 0.019 which shows that is statistically significant at the 1% level.

R- Squared: The independent variables used in this model, explain. 64.32 % of the UK exports of goods to non-EU to trading partners variation.

TABLE OF REGRESSION 2b) (non-EU)			
Variables	Coefficient	Standard Error	P>|t|
period 2	0 .032	0.081	0.690
period 3	0.158	0.093	0.105
logPopulationUK	0 .724	3.780	0.850
logpopulation	-1.752	1.361	0.212
logGDPUS	0.648	0.241	0.014 **
logGDPUK	0.443	0.448	0.333
R- Squared	Within: 0.1375	Between: 0.1851	Overall: 0.1773
Number of observations	220		

4.2.2. Interpretation of Results of regression 2b

period 2: By holding all other variables constant level, the exports from UK to its EU trading partner during the referendum period is 3.2% higher than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.690 which is higher than the conventional threshold for statistical significance. Thus, the effect of period 2 on exports is not statistically significant, showing that there is not strong evidence to conclude that exports in period 2 differ from the baseline period.

period 3: By holding all other variables constant level, the exports from UK to its EU trading partner after the Brexit is 15.87% higher than in the baseline period (period 1 which is the period before the Brexit referendum). However, the p- value for this coefficient is 0.105, which is not statistically significant at any level.

logPopulationUK: By holding all other variables constant level, for each 1% increases in PopulationUK, Exports increases by 0.724 on average. The p- value for this coefficient is, which is very higher 0.850 than the conventional threshold for statistical significance. This indicate that is not statistically significant at any level.

logpopulation: By holding all other variables constant level, for each 1% increases in Population, Exports decreases by 1.752 on average. The p- value for this coefficient is 0.212 %, which is higher than the conventional threshold for statistical significance. This indicate that is not statistically significant at any level.

logGDPUS: By holding all other variables constant level, for each 1% increases in GDPUS, Exports increases by 0.648 on average. The p- value for this coefficient is 0.014 which shows that is statistically significant at the 5% level.

logGDPUK: By holding all other variables constant level, for each 1% increases in GDPUK, Exports increases by 0.443 on average. The p- value for this coefficient is 0.333 which is not statistically significant at any level.

R- Squared: The independent variables used in this model, explain. 64.32 % of the UK exports of goods to non-EU to trading partners variation 17.73.

Note that a (***) that exists in the tables above means that $p \leq 0.01 = 1\%$ (**) that $0.01 \leq p \geq 0.05 = 5\%$ and (*) $0.05 \leq P \leq 0.1 = 10\%$, if there are no stars in any of the variables in the above table means that it is not statistically significant.

5. Conclusion

According to our analysis, the impact of Brexit on trade flows between the UK and the EU reveals significant changes in the economic relationship between them. Our study uses extensive data from 2013 to 2022, which covers all the important stages until Brexit and after, and applies strict econometric methods to understand these changes.

One of the main conclusions of our study is that the UK's exports to the EU have significantly decreased as a result of Brexit. The most significant finding of our analysis was a decrease of roughly 19.83% in the time after Brexit as compared to the time before the referendum. This statistically significant decline illustrates the difficulties UK exporters have adjusting to the new trade restrictions and regulatory demands brought about by Brexit.

On the other hand, imports from EU countries have been resilient, with no obvious drop following Brexit. This resilience may have arisen from the UK's delayed introduction of regulatory requirements and customs procedures, which gave businesses time to adapt. However, the significant decline in exports has had a negative impact on the trade balance overall.

The broader impact of Brexit is also obvious in non-EU trade patterns. Exports to non-EU nations have decreased, but the impact is not statistically significant, indicating that the UK's attempts to create new trade deals and improve relations with non-EU trading partners have at least partially reduced the negative consequences of Brexit on its global trade.

Our regression analysis shows how important GDP is in affecting trade flows. Increased trade is correlated with higher GDP levels among trading partners, demonstrating the continued importance of economic stability in sustaining strong trade partnerships. The

UK trade with both EU and non-EU countries indicate a strong positive relationship with the trading partners.

Our analysis identifies a number of measures that could be taken to mitigate the adverse effects of Brexit on trade deals with both non-EU and EU nations. In addition, lowering non-tariff barriers and strengthening regulatory coordination with the EU could decrease the impact of Brexit on trade.

In conclusion, Brexit has had an important effect on trade between the UK and the EU, resulting in a notable decline in UK exports to the EU while keeping import levels mostly unchanged. The results highlight the necessity of implementing strategic policy actions to improve trade resilience and leverage new trade prospects beyond the European Union. Future research should concentrate on long-term trade trends and how suitable future trade agreements are in order to mitigate the negative effects of Brexit.

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7.Appendix

Appendix 1: List of Countries Considered in this Study

Albania	Chile*	France	Japan*	Poland	Switzerland*
Argentina*	China*	Germany	Latvia	Portugal	Thailand
Australia*	Colombia*	Greece	Lithuania	Romania	Turkey*
Austria	Croatia	Hungary	Luxembourg	Russian Federation*	United Kingdom
Belarus*	Cyprus	Iceland*	Malta	Saudi Arabia*	USA*
Belgium	Czechia	Indonesia*	Mexico	Slovakia	
Brazil*	Denmark	Ireland	Netherlands	Slovenia	
Bulgaria	Estonia	Israel	New Zealand*	Spain	
Canada*	Finland	Italy	Philippines*	Sweden	