Understanding Post-Brexit Trade –
A Gravity Model Perspective

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Introduction

The United Kingdom (UK) leaving the European Union (EU), commonly referred to as Brexit, has greatly altered the trade dynamics between the UK and its largest trading partner, the EU. The UK's departure from the EU in early 2021 introduced a range of non-tariff barriers which have transformed its long-standing trading relationships. These include new custom procedures and the requirement of new intricate coordination, all of which have increased the overall cost and complexity in trade. (Dhingra et al., 2017).

This case study focuses on evaluating the trade relationship between the EU and the UK after Brexit, with attention to how this transition has affected the trade flows. The EU has historically amounted to nearly half of UK's trade (Ward & Webb, 2024) and Brexit has created a scenario where deep-rooted economic partnerships are being reversed. This shift is relevant to international trade theories like the Gravity Model of Trade, which states that distance between two countries and their GDPs greatly influences the amount of trade which takes place between them. Considering that the UK and EU are geographically close and have noticeably large GDPs, this allows the Gravity Model of Trade to be applied in real world conditions.

The objective of this case study is to analyze how geographic proximity, economic size, and trade barriers influences trade flow between UK-EU since Brexit, using the Gravity model . It also aims to assess how this current relationship may evolve during the next years as firms, institutions and governments will adapt to this new trade environment.

Theoretical Framework

The Gravity Model of Trade is a theory which is widely used in international economics and was introduced by Jan Tinbergen in 1962 (Tinbergen, 1962). He took inspiration from Newton's law of gravity and applied it on international trade, stating that trade flows between two countries are based on their economic size and geographic distance (Krugman, Obstfeld, & Melitz, 2022).

$$\mathrm{Tij} = \frac{\mathrm{A} \times \mathrm{Yi} \times \mathrm{Yj}}{Dij}$$

Above is the formula for this model where A is a constant term, Y_i and Y_j are the GDPs of country i and j. D_{ij} is the distance between both the countries and T_{ij} is the value of trade between them. (Krugman, Obstfeld, & Melitz, 2022). Tinbergen's model assumes that, ceteris paribus, trade between countries increases alongside the size of their economies while decreases due to rising distance between the two countries.

The theory helps us understand and predict patterns of trade when comparing countries over time or when there is major change in policy. This theory is relevant in analyzing how trade between the UK and EU has changed after Brexit. The UK and EU had strong trade ties and were part of a single market but due to Brexit non-tariff barriers have been introduced. These include custom checks and new paperwork which acts as red tape which lead to increases in transaction costs and longer processing times. By using the Gravity model, we can understand how these new trade cost has affected the existing trade flows and the decline in trade.

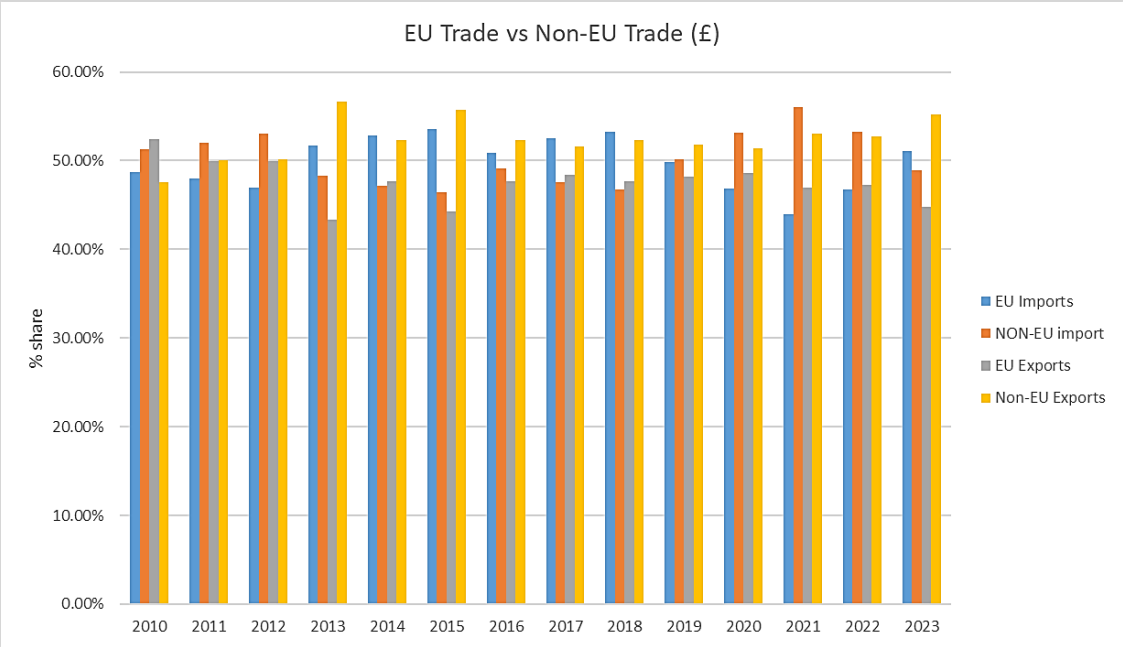
Overall, the Gravity model is a strong fit for this case study as it considers the effect of economic size and geographic proximity on trade which are central to post Brexit trade analysis. The model allows us to assess how much of the decrease in trade is due to Brexit and its implication rather than changes in GDPs or the distance between two countries as it helps in isolating the changes in change in economic size and geographic proximity.

Analysis:

The effects of "Brexit" after its initiation in 2016 were expected to be strong regarding trade. Almost all major analyses of the consequences of the United Kingdom leaving the European Union pointed towards a potentially substantial decline in economic activity particularly trade between the UK and Europe post-Brexit (Oberhofer & Pfaffermayr, 2021).

The following analysis pursues the impact of Brexit on trade, exploring the changes in trade between the UK and Europe, as well as the UK with the rest of the world before Brexit and after. This study also aimed to apply the gravity model to estimate trade and determine the applicability of it to trade in the United Kingdom. Before conducting our analysis, we hypothesized a sizeable decline in trade of the UK with European countries, as well as a steady incline in trade with non-EU countries to fill the void left behind.

EU VS Non-EU Trade:

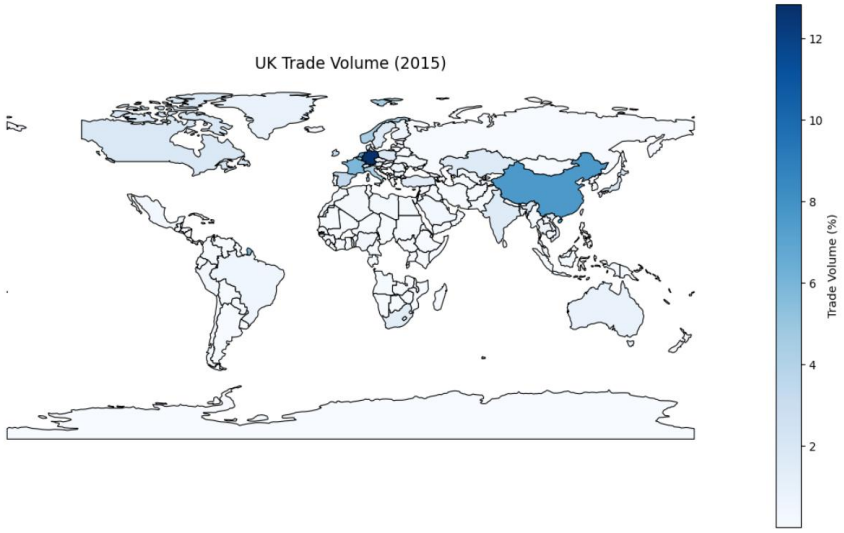


Source: UK Trade Info (HMRC)

The above graph shows the trade share of UK with EU countries in comparison to UK and non-EU countries through 2010 to 2023. It is to be noted that the referendum for Brexit occurred in 2016 while the official initiation of Brexit with the European Union took place in early 2017. The graph shows that before Brexit, the trade with EU and non-EU countries was roughly equal and following the same path of a steady increase. Pre-Brexit non-EU countries gained a higher share of UK's exports which continues till now. Similarly, EU has been the main import destination for the UK with imports mostly rising from the EU except for 2021, when Brexit actually concluded.

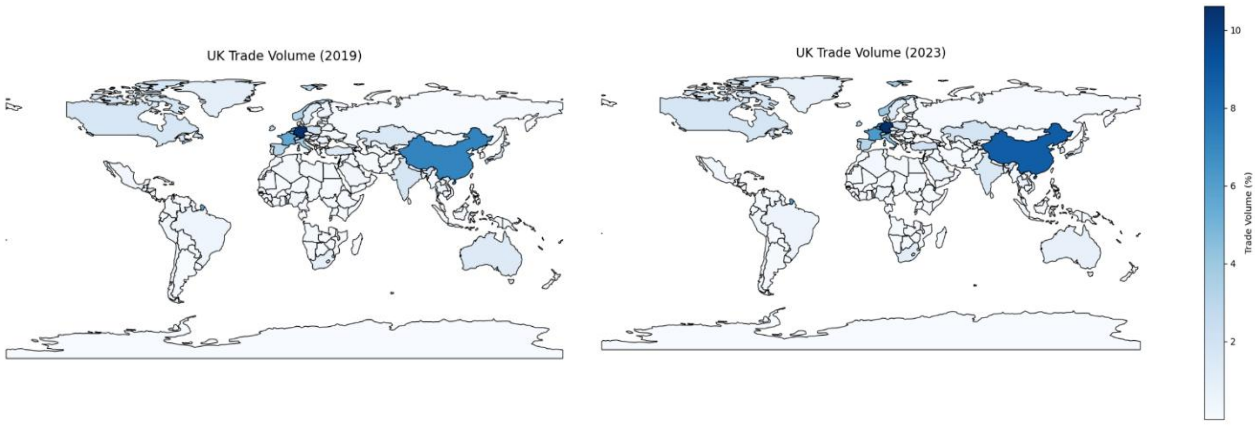
It is pertinent to mention that an exogenous event, the COVID-19 pandemic occurred in 2020 and while the pandemic had hit both EU and non-EU countries, it did play a major role in propelling the downturn of trade between the UK and EU post Brexit (Minenna, 2020). While the gap has since closed, it is evident that trade relations between the UK and EU relative to the world have deteriorated.

Trade Density:



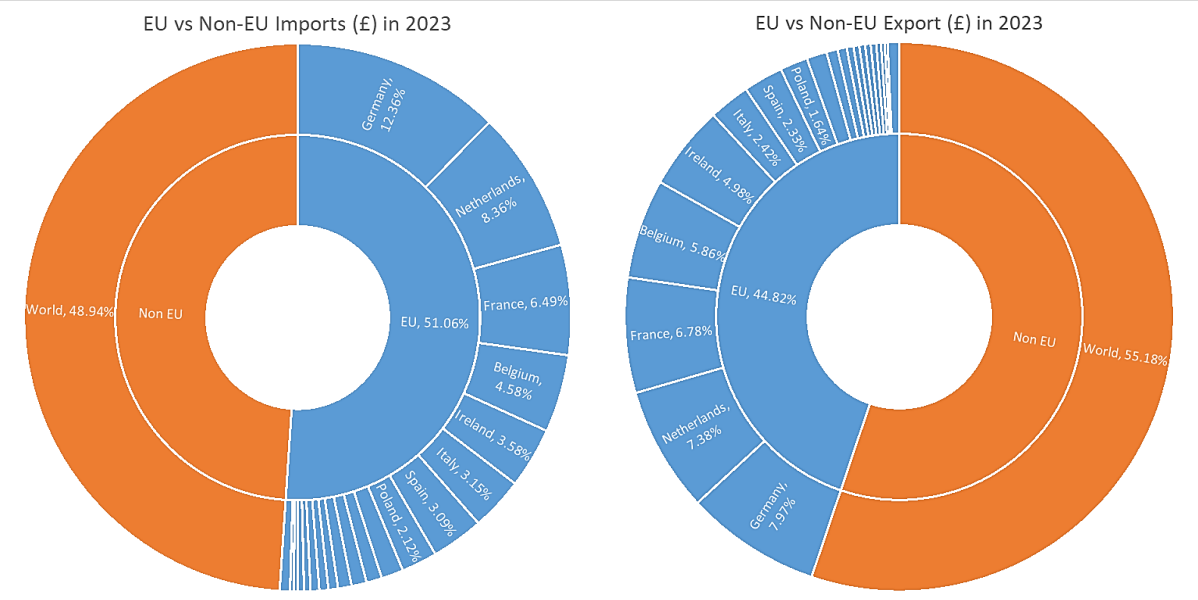
In 2015, majority of UK's trade was concentrated with its neighboring European countries with Germany being the largest trade partner. Furthermore, a high trade volume with China can be seen, despite significantly larger distance between the two. This can likely be attributed to the sheer size of China's GDP and its manufacturing sector.

In 2019, and then even more in 2023, we see a visible increase in the trade volume (%) with China, as effects of Brexit and Covid-19 are starting to take place. While most of the UK's highest trading volume still appears to be with EU countries, the China's share seems to have taken a particularly large increase.



Source: UK Trade Info (HMRC)

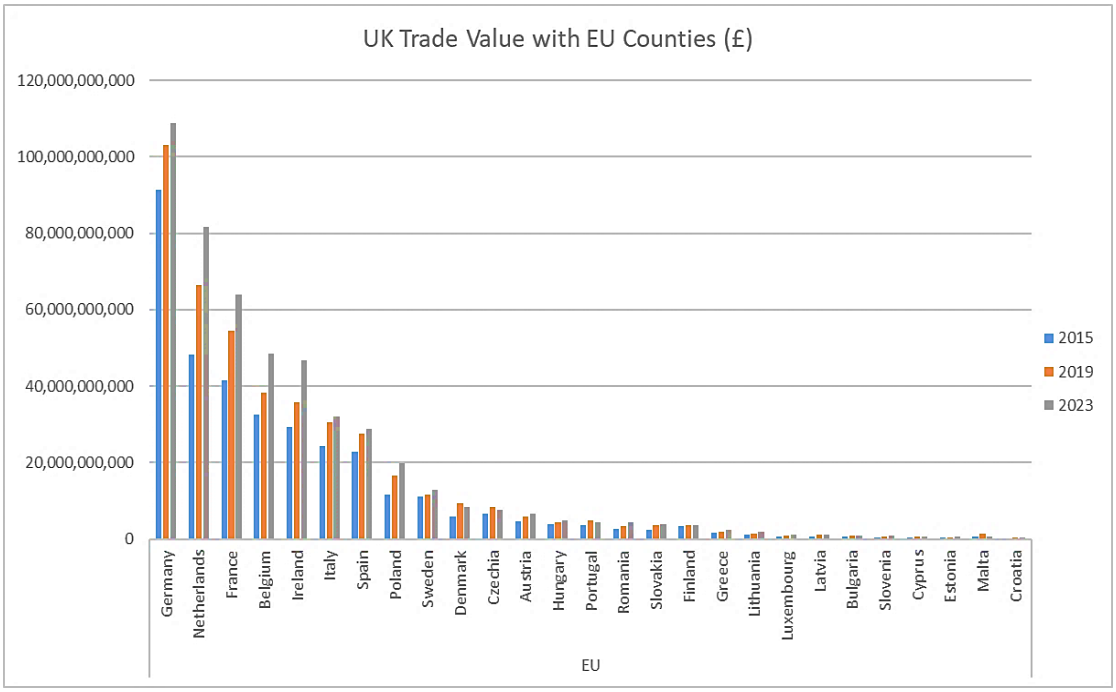
EU VS Non-EU Share in Trade:



Source: UK Trade Info (HMRC)

While trade share of EU countries has decreased relative to non-EU countries, the share of trade as a total of the UK's trade is still fairly even. Although post Brexit we saw a visible change in trend earlier, with trade with EU countries no longer at par with non-EU countries, and a divergence of path evident, as of 2023 non-EU countries have a share of 51.42% of UK's trade while EU countries at roughly 48.58%. This indicates that despite worsening trade relations, and the separation of the UK from the EU trade bloc, the importance of EU countries in trade is still high. This is likely attributed to the ease of trade with EU countries due to the significantly smaller distance, evidenced by the higher share of UK imports being made up of EU counties. Countries like Germany, Netherlands, France, Belgium and Ireland are all still essential trade partners with the UK and carry significant share in the total trade volume of the UK.

UK Trade with EU countries:



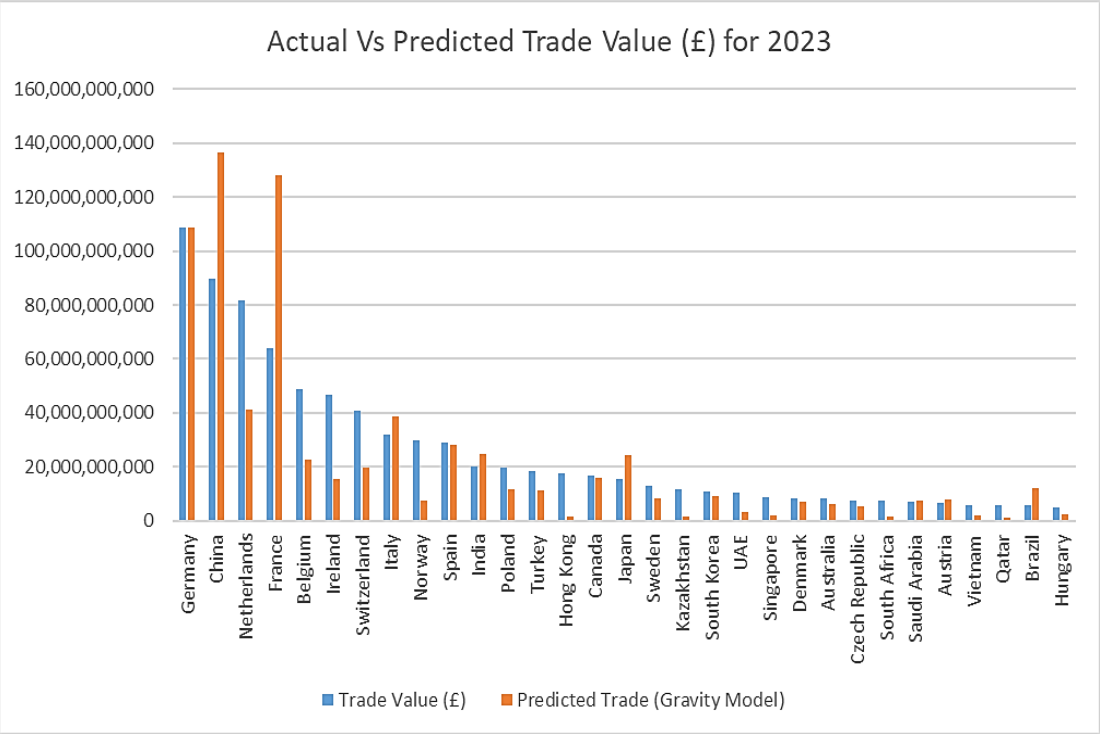
Source: UK Trade Info (HMRC)

Despite Brexit, and even the Covid-19 pandemic, the trade between UK and EU countries has continued to grow, particularly with the largest countries by trade value (Germany, Netherlands, France, Belgium and Ireland). The anticipated impact of Brexit to trade relations between UK and EU countries does not seem to have been enough to offset the growth of trade value of the UK with EU, and trade appears to still be growing, though some hints of stagnation in the growth do appear visible especially with lesser important EU countries in terms of trade such as Denmark, Czechia and Portugal. This indicates that the importance of trade of the UK with EU countries is still vital and growing.

The Gravity Model:

By applying the gravity model to the UK, we are able to see the actual trade of the UK with the world, relative to the potential or predicted trade based on the Gravity model. The Gravity model showed good overall predictability of trade, as the regression showed 82% predictive value (R squared). This indicates that the size of countries economy (GDP) and the distance between the UK and the given country were strong indicators of the trade between the two countries, allowing us to deem the Gravity model strongly applicable to trade.

The Gravity model showed that trade with countries like China (non-EU) and France (EU) still have much greater trade potential due to the size, and in Frances' case, small distance between the two countries. Countries like Ireland, Netherlands, Belgium, Switzerland and Norway (all EU countries) had much higher trade than predicted, indicating strong trade relations and dependence despite the UK exiting the EU.



Winners and Losers of Brexit trade changes:

Brexit led to increasing trade costs between the UK and the EU owing to trade barriers such as custom checks and border delays, which raised prices and reduced trade efficiency. The EU still accounts for 52% of the UK's imports in 2023, indicating that UK businesses still rely on EU suppliers.

According to Dhingra et al., (2017), EU countries lost income after Brexit. The overall GDP fall in the UK in 2016 was estimated around £26 billion to £55 billion, about twice as big as the £12 billion to £28 billion income loss in the rest of the EU combined. Non-EU countries experience some smaller income gains.

Predictions for Future UK-EU Trade:

Trade between the UK and the EU is likely to remain stable as businesses adapt overtime, although it will take time to reach pre-Brexit levels if at all. The UK will look to increase trade ties with non-EU countries, but distance will be an obstacle. Although exports in goods declined, services exports have done well for the UK post-Brexit and post-covid, indicating potentially stable exports in the future.

Policy Implications:

The current Trade and Cooperation Agreement (TCA) (European Union & United Kingdom, 2020) could be further expanded to include mutual recognition of standards which would help business' avoid duplication of product standards rules and duplication of testing, significantly reducing compliance costs. It would make trade conditions between UK and EU like pre-Brexit, significantly helping industries such as pharmaceuticals and automotive industry due to their heavy reliance on regulatory compliance and international trade. Depending on how integrated the two entities wish to be, there could also be mutual recognition of professional qualifications facilitating labor mobility.

Maximizing participation in Horizon Europe (European Commission, 2021) could significantly help gain mutual technological advancement due to pooled resources for research and innovation. This could help UK and EU gain comparative advantages in trade, boosting innovation driven growth. Awareness of this program should be spread with reassurances regarding fundings due to the uncertainties caused by Brexit.

Digitalization of customs systems and tasks such as documentation of declarations and taxes could be done to avoid congestion at high traffic ports. This facility could be integrated with already existing schemes such as Authorized Economic Operator (AEO) (World Customs Organization, 2005) which would help trustworthy businesses to avoid hassles caused by post-Brexit changes regarding customs, keeping costs minimal.

Conclusion:

Thus, the study highlighted the remarkable shifts in trade patterns of the UK following Brexit, making the impact on trade with both EU and non-EU countries significant. The findings suggest that EU remain vital traded partners despite the decline in UK's trade with EU relative to non-EU countries. It was also underscored that some of the gaps left by Brexit were filled by China, which could be seen in terms of trade expansion. Furthermore, the UK-EU trade has shown resilience, despite increased trade barriers. However, some signs of stagnation in trade growth were present.

Gravity model, which was applied in this study, has proven to be a reliable estimator of UK trade flows reiterating the significance of geographical proximity and economic size in formation of trade relationships. Thus, the model suggests that despite Brexit, EU continues to be a viable trading partner for the UK as well as other large non-EU economies like China. Findings also indicate that trade barriers induced by Brexit have raised costs, leading to economic losses for both the EU and the UK, whereas some non-EU countries have benefited. The policy implications suggest that the future UK and EU trade policies should target the reduction of trade frictions through regulatory alignment, digitalization and relax custom processes, and fostering new trade agreements.

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