

---

# **Trade effects of policy uncertainty: Evidence from the Brexit referendum**

by



Ellinor Olsson Kaalhus

Bachelor's thesis

Lund University  
11 January 2021

Department of Economics  
Supervisor: Maria Persson

---

## **Abstract**

This paper examines the trade effects of increased trade policy uncertainty following the Brexit referendum by viewing the referendum's influence on UK exports of goods to EU27 during the time period 2012-2019. This is done to give insight of how trade policy uncertainty can impact real economic behaviour, even when no classical trade barriers are changed. Methodologically, this is approached by employing a modified gravity model with fixed effects estimating the counterfactual of what UK exports would have been like, without the treatment effect of the referendum, and exploring how this correlates with an uncertainty level index. The estimator used is Ordinary Least Squares in a panel framework outlining monthly exports of goods from UK to EU27 at a 2-digit HS product level. The results indicate that the Brexit referendum has reduced UK exports to EU27 from 2012-2019 by approximately 2,7% from what they otherwise would have been, *ceteris paribus*. The decrease is interpreted as being a probable result of increased trade policy uncertainty due to the Brexit referendum by deferring UK firms to enter the EU exporting market or choosing to exit and lowering their competitiveness on the EU market.

***Keywords:*** *trade policy uncertainty, Brexit, international trade, gravity model*

# Table of Contents

<b>1. Introduction.....</b>	<b>4</b>
<b>2. What are the short-term effects of the Brexit referendum? .....</b>	<b>5</b>
2.1 Overview of the Brexit debate .....	5
2.2 Short term-effects of the referendum: Increased uncertainty.....	9
<b>3. The theoretical link between uncertainty and trade.....</b>	<b>13</b>
3.1 Central theory.....	13
3.2 Contemporary theory.....	16
<b>4. Previous research .....</b>	<b>17</b>
4.1 Trade policy uncertainty and its effect on trade.....	18
4.2 Brexit and trade policy uncertainty .....	20
<b>5. Empirical strategy.....</b>	<b>22</b>
5.1 Empirical model .....	22
5.2 Estimations issues .....	25
<b>6. Empirical results .....</b>	<b>27</b>
6.1 Baseline results.....	27
6.2 Robustness analysis.....	30
<b>7. Summary and conclusion .....</b>	<b>35</b>
<b>References.....</b>	<b>39</b>

# 1. Introduction

Uncertainty over the future trade policy is a constant element to international trade but much is still unknown of how it can affect economic outcome. The future of the UK-EU trading relationship took a pivotal turn on 23 June 2016 when the British voted to leave the EU in a national referendum, a result many were taken aback by. This shifted the UK-EU relationship substantially, going from being two deeply economically integrated entities to entering a renegotiation phase of their current trade agreements. This is likely to have augmented trade policy uncertainty levels and in turn affected trading activity between the UK and EU due to economic agents adjusting their behaviour according to their beliefs regarding future trade policy. Thus, this paper will examine the effects of the Brexit referendum on UK exports to the EU27 and reviewing if the effects correlate with uncertainty levels. Therefore, this paper aims at answering the research question:

- i) *Has the Brexit referendum's uncertainty effects affected the volume of exported goods from the UK to EU27?*

The purpose of this paper is to provide evidence in order to get a deeper understanding of how trade policy uncertainty can affect trade outcomes, even when no tariffs or other non-tariff trade barriers have changed. Therefore, an event such as the Brexit referendum is valuable to future research within the trade policy uncertainty area since it is an example of likely higher trade policy uncertainty without changes in classical trade barriers. Hence, the evidence from this paper has policy relevance since it could be utilized to examine to what quantitative extent uncertainty hinders trade outcomes viewing export volumes and point to the benefits of trade agreement commitments. Moreover, this is relevant for policy makers to comprehend what factors that can induce uncertainty shocks and how renegotiation periods of trade agreements affect trading relations. This in turn can be useful to obtain knowledge of how national occurrences affects international trade and examine the importance of lowering the chances of future uncertainty shocks.

Methodologically, the research question will be answered by employing a gravity model approach accounting for fixed effects with an error component model. The model will be adjusted by adding a variable for the referendum representing uncertainty and viewing the treatment effect of said variable. Further, an uncertainty index will be incorporated in the model to determine the correlation between trade effects of the referendum and policy uncertainty

level. The thesis of this paper is that the Brexit referendum depressed Britain's exports to EU27 from what they otherwise would have been, due to higher policy uncertainty. The rationale behind this is that the referendum induced an uncertainty shock leading to higher trade policy uncertainty amongst British firms over how future exporting conditions to the EU would transpire. The uncertainty then led to some UK firms deferring from entering the EU exporting market due to the option value of waiting, while others choose to exit. Thus, having a negative impact on the extensive margin of trade, that is volume of exported goods.

The disposition of the paper is as follows. Firstly, a historic background of the Brexit debate is presented followed by empirical measurements on uncertainty to view the short-term effects of the Brexit referendum. Thereafter, the theoretical framework for this paper is presented and subsequently a literature review of previous research divided in to two sections: general trade policy uncertainty research and specific Brexit uncertainty. Following that, our empirical strategy of the gravity model approach is presented explaining the empirical model, estimation issues and the data collected. Thereafter, the paper's results of the empirical strategy are presented and discussed. Lastly, a summary of the paper is presented, and conclusions are drawn from the empirical results, answering the research question.

## **2. What are the short-term effects of the Brexit referendum?**

### **2.1 Overview of the Brexit debate**

The Brexit referendum, the events leading up to it and not the least the aftermath is somewhat of a thorny matter since it has taken many turns since its occurrence. Therefore, this paper will provide a chronological overview of the main events to establish an outline to build off further in the study.

Since the UK accession and enlargement in the European Union in 1972 and 1973 respectively, both pro- and anti-EU views have had majority support at different times (Mortimore, Roger, 2019). In 1975, the UK held a national referendum on whether the UK should remain in the European Economic Community. It resulted in two-thirds of British voters, 67,2%, favouring continued EC membership (House of Commons, 2015, p. 1). However, over the decades of UK-EU membership, Euroscepticism existed on both the left and right of British politics. Adding to that, The UK Independence Party, a Eurosceptic political

party, was formed in 1993 and achieved third place in the UK during the 2004 European elections, second place in the 2009 European elections and first place in the 2014 European elections, with 27.5% of the total vote (The Guardian, 2014). This was in a sense a testament of the UK's growing Euroscepticism and is documented as the strongest correlate of the support for the Leave campaign in the 2016 referendum (Becker & Fetzer, 2016, p. 10). By trying to garner support among euro-sceptics within his own party, the British Prime Minister David Cameron promised on January 23, 2013, a referendum on Britain's membership to the EU if the Conservative party is elected in the next general election. On May 7, 2015, British voters elected a majority Conservative government. Cameron then confirmed in his victory speech that there would be an 'in/out referendum' on European Union membership (The Associated Press, 2017). Thereafter, Cameron announced a deal that he had negotiated with the EU, which would give Britain "special status", campaigning for Britain to remain in the union (The Associated Press, 2017). Hence, two camps of campaigns were set up, one vouching for Britain to remain in the EU, Remain, and the other to exit, Brexit. With the camps being so close in size, polls having different results and undecided voters holding the balance merely days before the referendum, it was difficult to foresee what the outcome would be (University of Birmingham, 2016).

In the referendum held on 23 June 2016, the majority of those who voted, namely 52%, chose to leave the European Union (House of Commons, 2020, p. 7). This result led the current prime minister David Cameron to announce his resignation the following day. Many European leaders announced their shock and dismay regarding the referendum's results (BBC, 2016). The succeeding month Theresa May accepted the Queen's invitation to form a government and on 29 March 2017, the new UK Government formally notified the EU of the country's intention to withdraw, beginning the Brexit process (House of Commons, 2020, p. 7). The withdrawal itself was based on Article 50 of the Treaty on European Union, which gives each member state the right to request withdrawal. According to the article, this takes place two years later by the termination of all EU treaties for that country, or at a time and in a manner agreed in an agreement between the EU and the country in question. Therefore, the withdrawal was originally scheduled for 29 March 2019, but was then delayed by a deadlock in the UK Parliament. This was due to the June 2017 general election that had resulted in an unexpected hung parliament after the Conservatives lost their small overall majority but remained the largest party, which would later lead to three subsequent extensions of the Article 50 process (House of Commons, 2020, p. 17). Meanwhile, Brexit negotiations commenced in June of 2017 and in July 2018, a UK white paper on the future relationship between the UK and the EU,

known as the Chequers agreement, was finalised. In matters of days after the white paper was finalised, both the Secretary of State for Exiting the European Union, David Davis, and the foreign secretary, Boris Johnson, resigned. In September 2018, the EU rejected the white paper (House of Commons, 2020, p. 33).

The succeeding month, in November 2018, The Brexit Withdrawal Agreement was published and gained the endorsement of the 27 other EU member states. However, the UK House of Commons voted against ratifying it three times in the beginning of 2019. The agreement meant in practice that the UK would leave the EU customs union as well as the single market which the Labour Party opposed since they wanted to remain in the customs union. Further, many Conservatives opposed the agreement's financial settlement, as well as the "Irish backstop" designed to prevent border controls between Northern Ireland and the Republic of Ireland and other parties, The Liberal Democrats, Scottish National Party (SNP), wanted to reverse Brexit altogether via a new referendum. May, therefore, requested to extend the Article 50 period, to June and later October 2019 which the EU granted on the premise that the UK would hold European Parliament elections in May 2019, or it would leave on 1 June 2019 (House of Commons, 2020, p. 43). The UK held elections to the European Parliament which resulted, on the one hand, the Brexit Party led by Nigel Farage being the largest party winning 29 seats and, on the other hand, parties advocating a new referendum securing 37 seats and obtaining 55.5% of the vote. The largest of these was the strongly anti-Brexit Liberal Democrats led by Vince Cable coming second with 16 seats, ahead of the more ambiguous Labour Party on 10. The Conservatives fell to 4 seats on 8.8 percent, the biggest ever defeat of a governing party in a UK-wide election. Subsequently, May announced that she would resign as Conservative Party leader due to being unable to get her Brexit plans through parliament and several votes of no-confidence (House of Commons, 2020, p. 61).

On the 24th of May 2019, Boris Johnson accepted the Queen's invitation to form a government and became Prime Minister of the United Kingdom, the third since the referendum. Johnson sought to replace parts of the agreement and vowed to leave the EU by the new deadline (House of Commons, 2020, p. 63). On 17 October 2019, the UK Government and the EU agreed on a revised withdrawal agreement, with new arrangements for Northern Ireland. The parliament approved the agreement for further scrutiny but rejected passing it into law before the 31 October deadline, and bound the government to ask for a third Brexit delay through what is commonly known as the "Benn Act" (House of Commons, 2020, p. 63). An early general election was then held on 12 December after several attempts from Johnson to enforce it. The Conservatives won a large majority in the election, with Johnson declaring that

the UK would leave the EU in early 2020. The withdrawal agreement was ratified by the UK on 23 January and by the EU on 30 January; it came into force on 31 January 2020 (House of Commons, 2020, p. 64). Hence, on 31 January 2020, the UK left the European Union and entered a transition period that ran out December 31, 2020, starting a brand new economic and political relationship with the EU (House of Commons, 2020, p. 64). A chronological outline of the most important events since the Brexit referendum is provided below.

*Table 1. Outline of major Brexit-related events*

<b>23 June 2016</b>	<b>A national referendum takes place and the majority of those who voted chose to leave the European Union.</b>
<b>29 March 2017</b>	The Prime Minister triggered Article 50 and began the two-year countdown to the UK formally leaving the EU.
<b>14 March 2019</b>	House of Commons voted for the Government to seek permission from the EU to extend Article 50 and agree a later Brexit date.
<b>20 March 2019</b>	The Prime Minister wrote to European Council, asking to extend Article 50 until 30 June 2019.
<b>2 April 2019</b>	The Prime Minister announced she will seek a further extension to the Article 50 process.
<b>10 April 2019</b>	The UK and EU27 agreed to extend Article 50 until 31 October 2019.
<b>19 October 2019</b>	The Prime Minister's new Brexit deal was lost on amendment in the Commons. In accordance with the European Union (Withdrawal) (No. 2) Act 2019), the Prime Minister wrote to European Council to request an extension to the Brexit process.
<b>28 October 2019</b>	EU Ambassadors agreed on a further Brexit extension to 31 January 2020.
<b>12 December 2019</b>	Boris Johnson won a majority in the UK General Election and reaffirmed his commitment to 'get Brexit done' by 31 January 2020.
<b>23 January 2020</b>	The European Union (Withdrawal Agreement) Act 2020 received Royal Assent. This is the legislation that will implement the withdrawal agreement negotiated by the UK and the EU.
<b>31 January 2020</b>	The UK left the European Union and entered a transition period due to run until 31 December 2020.

Source: House of Commons Library, Brexit timeline: events leading to the UK's exit from the European Union, 2020



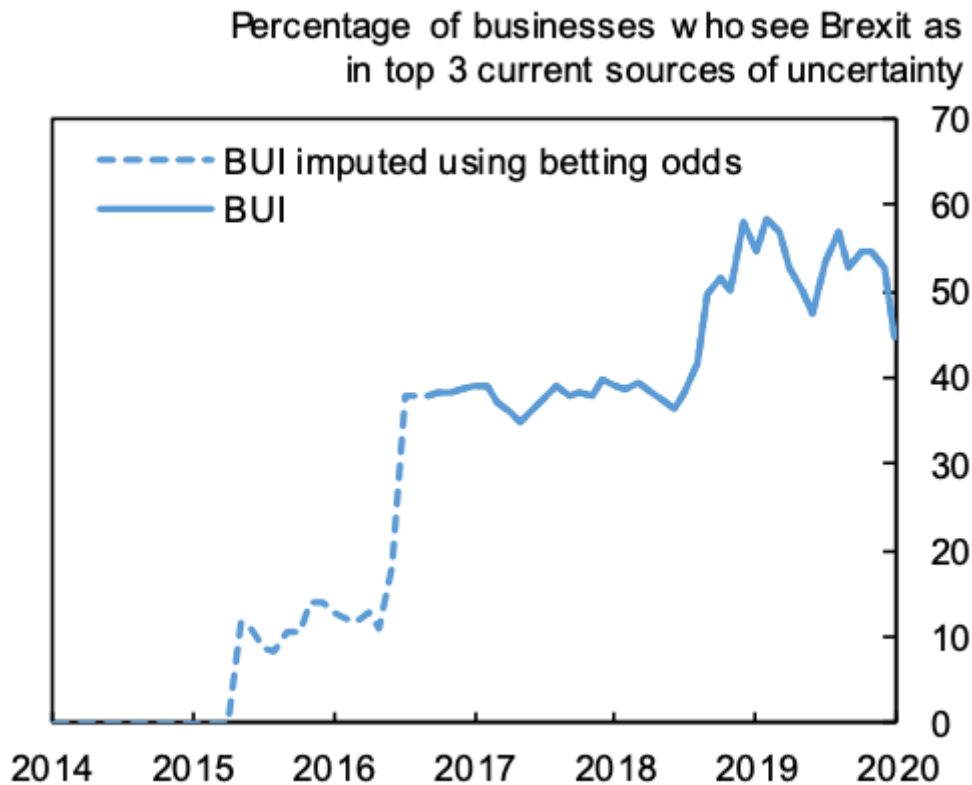
To sum up, Britain's relationship with the EU has gone through a time period that has drastically changed the way the future UK-EU trade relationship is thought to look like. From the growing Euroscepticism in the UK, to the Brexit camp gaining majority in the referendum and all its rigorous aftermath. The Brexit referendum will likely have unforeseeable consequences in the long run, which might affect how consumers and producers in the UK and abroad decide to act in the present time. What is clear is that the Brexit referendum's result came as a great shock for many which is relevant for this study since it likely inflicted trade policy uncertainty and in turn affected UK-EU trade. Further, what can be taken from this timeline is that the Brexit negotiations have taken many turns even after the referendum, and feasibly made agents on the economic market even less certain about its outcome.

## **2.2 Short term-effects of the referendum: Increased uncertainty**

In Section 2.1, we have established that it is likely that the Brexit referendum has induced higher trade policy uncertainty between 2016 and present time than what we would have experienced without it. The next challenge is to find measurements that can provide some empirical evidence and background as to if this statement is in fact true. Uncertainty is a difficult concept to measure due to its inherently elusive nature. However, there are a few different approaches to measure uncertainty in order to understand if the Brexit referendum has increased uncertainty and in turn has affected trade. An empirical measurement called the Decision Maker Panel (DMP) was launched in August 2016 by the Bank of England together with Stanford University and the University of Nottingham (Bloom et al. 2018, p. 1). This survey technique helps scholars to better understand the uncertainties created by Brexit and how they have affected UK businesses. The measurement entails a large and representative business survey which collects information on many different aspects of uncertainty. These include: (i) self-reported views about the importance of Brexit as a source of uncertainty; (ii) uncertainty about the eventual impact on the sales and costs; (iii) uncertainty about year-ahead sales growth; and (iv) uncertainty about the timing of Brexit after any transition period (Bloom et al. 2018, p. 1). In the Monetary Policy Report (2019) by The Bank of England the DMP provided rigorous empirical evidence suggesting how the referendum has affected uncertainty levels and the UK economy, looking at different sources from business investment, household consumption and sales from firms. In the report it is concluded that Brexit has raised indicators of uncertainty and this has been evident since the referendum. At least 30% of firms have cited

Brexit in their top three sources of uncertainty in the Bank’s Decision Maker Panel (DMP) Survey since it began in 2016 and that this number has risen to around 55% of firms in more recent surveys, as seen below.

*Figure 1. DMP Survey of Brexit uncertainty amongst firms*

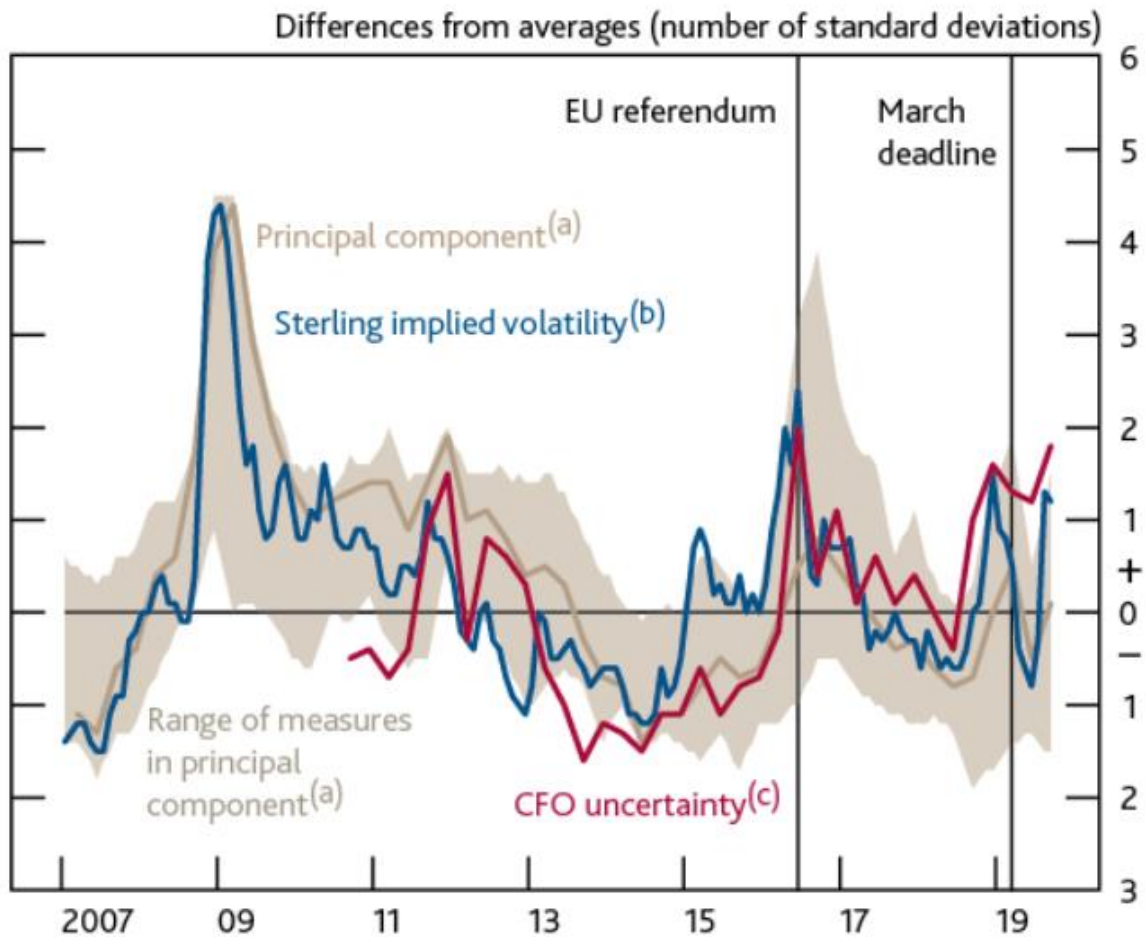


Source: Bank of England, *Monetary Policy Report*, 2019.

Further, they provide evidence that the ‘Brexit uncertainty’ has been widespread, including for UK firms which are not reliant on exports to the EU. In addition to the DMP measurement, some indicators capturing general uncertainty have been recorded to have risen too. For instance, an above-average proportion of respondents to the Deloitte CFO Survey, in fact more than half, have reported high uncertainty in 2019. Moreover, the implied volatility from sterling options, which captures perceived uncertainty around the exchange rate, was measured to have been elevated which is likely to capture both business cycle as well as political uncertainty. Therefore, the report argues, is it befitting to distinguish UK-specific shocks such as Brexit, since it reflects beliefs about relative economic prospects. In continuation, in the run-up to the Article 50 deadline in March 2019, sterling implied volatility, uncertainty among CFOs and

the proportion of firms which place Brexit in their top three sources of uncertainty rose substantially, as can be seen in graph below. These measures suggested that uncertainty 2019 was close to post-crisis highs, according to the report.

**Figure 2. DMP Survey of Brexit uncertainty amongst CFOs**

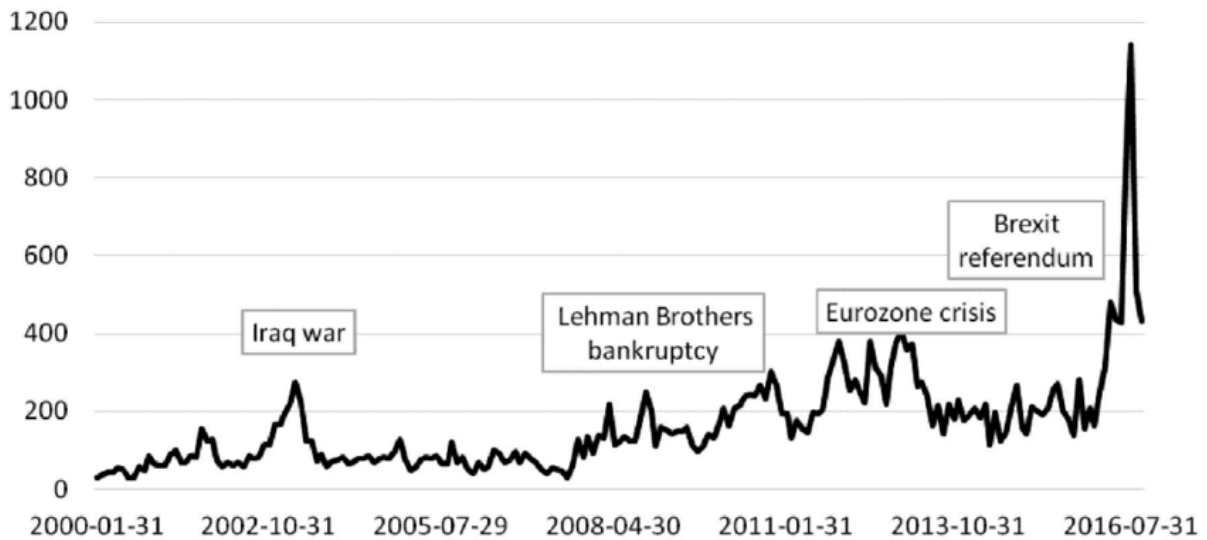


Source: Bank of England, *Monetary Policy Report*, 2019.

A different approach in order to measure Brexit uncertainty is to look at media publications and the language used in order to establish a greater understanding about uncertainty. This is exactly what the Economic Policy Uncertainty did when constructing an index based on newspaper articles regarding policy uncertainty. They included 11 UK newspapers: The FT, The Times and Sunday Times, The Telegraph, The Daily Mail, The Daily Express, The Guardian, The Mirror, The Northern Echo, The Evening Standard, and The Sun. Thereafter, they utilized the number of news articles containing the terms uncertain or uncertainty, economic or economy, as well as policy relevant terms, creating a useful dataset

for measuring uncertainty. In *Figure 3*, the data from the monthly UK EPU index from the Economic Policy Uncertainty is presented from January 2000 to July 2016.

**Figure 3. Economic Policy Uncertainty index of Brexit uncertainty**



Source: Czech & Wielechowski, 2016. *Brexit Related Uncertainty for United Kingdom Economy*.

The graph helps us create a view of how UK uncertainty spiked in 2016 to unprecedented levels, based on media's reporting, pointing to the Brexit referendum as a key factor. However, even if the graph is quite clear in the development of UK uncertainty, it is crucial to realize that this does not provide the exact reality that is UK uncertainty. Therefore, one must take into consideration other factors playing in on this uncertainty measurement, such as newspapers' motives and the correlation between newspapers and actual economic beliefs. Nonetheless, it is a valuable supplement to other measurements of the uncertainty bolstered by the Brexit referendum and is the measurement for uncertainty that will be incorporated in our empirical model.

Further, according to a paper by the Federal Reserve (2020), there was a sharp slowdown in UK business investment growth that occurred during a period when investment growth accelerated in peer economies. Additionally, UK investment outperformed investment in other G7 countries in the period preceding the referendum, but as UK business investment has stalled while investment growth has picked up in other G7 economies. This, according to the paper, strengthens the case that this is due to UK-specific factors, meaning Brexit-related uncertainty. The Federal Reserve strengthens its case that the Brexit referendum has increased uncertainty building off theory from Bloom (2014) establishing that greater uncertainty tends

to decrease consumers' desire to spend and firms' willingness to hire and invest. The paper provides evidence that the UK-experience since the referendum has been consistent with this prediction. Firstly, they point to quarterly business investment growth since the referendum has been running about 5.4 percentage points lower on average than in the three years prior to the referendum. Secondly, it is stated that since the fall in investment growth was large, it has contributed substantially to the overall GDP growth slowdown. Lastly, they point to a much smaller but still occurring decline in private consumption growth at 1.2 percentage points. Thus, their conclusion is that these macroeconomic effects all are likely to be UK-specific and due to higher policy uncertainty following the Brexit referendum.

In conclusion, there is a substantial amount of evidence pointing to an increase in uncertainty succeeding the Brexit referendum and it being characterized as an uncertainty shock. This view seems to be the prevailing consensus in literature and is motivated by business surveys, newspaper analysis and macroeconomic indicators. This conclusion is very relevant for this study since it declares that the Brexit referendum has had an uncertainty inducing effect and could therefore be an important driver of changes in export volumes from UK to EU27. Understanding the different aspects of the uncertainty is crucial to be able to assess how firms and consumers might respond and what the implications for the traded volume might be. Thus, the Brexit referendum is likely to have affected British volume of exports to the EU27 by increasing the trade policy uncertainty.

### **3. The theoretical link between uncertainty and trade**

#### **3.1 Central theory**

Having now a more solid background to build off in order to answer our research question, a theoretical base is necessary to understand the link between uncertainty and trade. In this section, a theoretical foundation will be provided based on three key arguments: firms' real options, risk aversion and premiums and precautionary savings.

Firstly, we will go through the link between trade and uncertainty from the idea of firms' real options. It builds off when market entry costs are sunk, policy uncertainty creates a real option value of waiting to enter foreign markets until conditions improve or uncertainty is resolved (Bloom 2014, p. 11). Hence, investment and entry into export markets is reduced when trade policy is uncertain since firms may be inclined to wait for more information to

surface when faced with an uncertainty shock (Bloom 2014, p. 11). In the context of the Brexit referendum, that would mean that Britain would experience a reduction of firms entering the exporting market due to the increased uncertainty. Since there is growing evidence that firms must incur substantial fixed costs before exporting, this affects the exporting market substantially. The argument of real options is reliant on a few key assumptions, the three most important ones being firms having the ability to wait, that firms are selling into imperfectly competitive markets and/or operating with decreasing returns to scale technology and that decisions cannot be easily reversed (Bloom 2014, p. 13). The real-options literature depends on firms having the ability to wait since there are instances where a delay would be extremely costly, so the option to wait would not be valuable, breaking the negative real-options effect of uncertainty on investment. This can for example be the case when firms are racing to be the first to launch a new product or a new idea (Bloom 2014, p. 13). Moreover, the real-options argument rely on imperfect competition and/or decreasing returns to scale since if firms were producing with constant returns to scale and selling into a perfectly competitive market, the choice of investment this period would have no impact on the profitability of investment next period. This would therefore lead to no option value from waiting (Bloom 2014, p. 11). The last key assumption is perhaps the most intuitive one, if decisions could easily be reversed, actions would not lead to the loss of an option. Hence, uncertainty would not make a firm choose the option to wait and therefore would not have an impact on firms' decisions (Bloom 2014, p. 13). All these assumptions are applicable to the Brexit referendum's effects since it is most likely that most firms are not constantly launching new products or selling into a perfectly competitive market. Therefore, the argument is appropriate to apply in this context.

Secondly, another argument on how the theoretical link between uncertainty and trade correlates stems from risk aversion and risk premiums. Higher uncertainty increases the risks linked to investment projects, since the pay-off required to make the project profitable is less certain (Bloom 2014, p. 14). This suggests that the financial backers of the investment will demand a higher default premium and compensation for bearing the higher risk. Consequently, this raises costs for borrowing for firms and can cause a great deal of influence, especially for financially constrained firms. This in turn will induce firms to increase their mark-ups and their willingness to engage in international trade depends on their assessment of the long-term prospects for profit in that activity (Bloom 2014, p. 14). Such an assessment considers firms' inability to predict with certainty the domestic value of their foreign sales. In general, there will be variations in profits caused by unforeseen changes and an increase in the variance of profits will reduce the volume of trade if exporters are risk averse (Bloom 2014, p. 14). This is relevant

when examining Britain's exports following the Brexit referendum since it could explain why British firms not only are less likely to enter the exporting market, but also make them less attractive for foreign EU consumers due to higher prices. An additional, related reasoning is the so-called *confidence effect* which relates to consumers' behaviour under uncertainty. This boils down to consumers trying to adjust their decisions to best fit when faced with uncertainty but when there are many different outcomes (Bloom 2014, p. 14). Therefore, instead of logically agreeing that there is a range of possible outcomes, they will act as if the worst outcomes will occur. Hence, when the range of possible outcomes increases, that is uncertainty increases, consumers and other agents will become more pessimistic (Bloom 2014, p. 14). This would entail British consumption to go down primarily, but could affect EU consumption as well, reducing UK exports.

Thirdly, a further argument on the theory between trade and uncertainty builds off when consumers are being affected by uncertainty, they will increase their precautionary saving in order to compensate for the greater uncertainty. Individuals will not be able to insure themselves against some bad state of the economy in the future that may be an effect due to the uncertainty (Bloom 2014, p. 14). Thus, they anticipate that if this bad state is realized, they will be negatively affected. Hence, to avoid adverse effects of future income fluctuations, they set aside a precautionary reserve, by consuming less in the current period, and resort to it in case the bad state is realized in the future. This would in turn reduce consumer demand (Bloom 2014, p. 15). The effect of this could potentially in an open economy spill over into other economies, causing a further reduction in demand globally. Hence, this could decrease the volume of international trade since the 'spill-over effect' will shift the demand not only for domestic but foreign consumers (Nguyen Ba 2019, p. 1). This is where the consumption effect becomes most relevant for this study, since it would mean that not only would Britain's consumption go down, but also their trading partners' consumption. Hence, indicating a reduction of British exports to the EU market.

Conclusively, all these arguments significantly affect firm level investment and entry decisions in the context of international trade, thus reducing the volume of traded export goods. Uncertainty is damaging for short-run and long-run, reducing output, investment, hiring, consumption and most importantly trade. This can be theoretically motivated by firms choosing to stand by for current conditions to be sufficiently good or until uncertainty about future conditions is sufficiently low before investing. Further motivation is that uncertainty raises real costs for firms since for instance when given a loan they will face higher risk premiums since banks will have to bear a higher risk. Moreover, consumers and other agents when faced with

uncertainty will turn toward precautionary savings, reducing consumer demand, potentially affecting trading partners' consumer demand. The role of future conditions is particularly paramount when firms make decisions on investments that are pricey and irreversible such as entering an exporting market. Each one of these theoretical arguments convey that increased uncertainty is likely to reduce volume of internationally traded goods. Thus, according to this theoretical framework, it is reasonable to presume that the increased trade policy uncertainty effect of the Brexit referendum has reduced British exports to EU27 by creating an option value for firms to delay export entry, raising British firms' costs and shrinking EU consumer demand for British goods.

### **3.2 Contemporary theory**

The previously accounted arguments are based on the central theory in international trade context and are very much prevalent in present day literature. However, a more recent body of works have surfaced, adding additional theoretical arguments to the link between uncertainty and international trade. These arguments will be presented adjacently.

An explanation as to why international trade specifically is so volatile in response to economic shocks is offered by Dennis Novy and Alan M. Taylor (2014). Their theory points to firms, when faced with an uncertainty shock, optimally adjust their inventory policy of intermediate goods by cutting their orders of foreign intermediates disproportionately strongly compared to domestic goods. Thus, the response leads to a bigger reduction in international trade flows than in domestic economic activity. Therefore, uncertainty shocks magnify the response of international trade (Novy & Taylor, 2014, p. 45). This is especially relevant for this study since it means that the UK would experience a bigger effect on international trade than on domestic trade, reducing volume of exports further. Moreover, this theoretical argument could especially be helpful in order to understand the outcomes of trade policy uncertainty with an increasingly fragmented international market.

Furthermore, the role of trade agreements as a determinant for international trade volumes and their effects on trade policy uncertainty can be derived by continuing the mechanism of higher uncertainty reducing investment through the increase of the option value of waiting in standard sunk models (Handley & Limão, 2012, p. 1). The argument conveys that trade agreements decreases trade policy uncertainty and in turn spur export investments and trade integration (Handley & Limão, 2012, p. 1). Preferential trade agreements are therefore valuable to exporters, even if applied trade barriers are currently low or zero since they lower,



in practice, the cost of exporting by lowering the uncertainty (Handley & Limão, 2012, p. 43). Thus, theoretically, due to the negotiations of the preferential trade agreement between Britain and the EU, British exporters could lose the benefits of the trade agreement even before its dissolution. Furthermore, policy uncertainty can be mitigated by trade agreements, which are particularly beneficial when there is increasing demand volatility. However, these uncertainty reducing effects generated by policy commitment may decline if the trading partners have more secure market access (Handley & Limão, 2012, p. 43). If this is the case, the benefit of multilateral over regional agreements may be even greater (Handley & Limão, 2012, p. 45). This makes the case for the Brexit referendum's effect on British exports a bit more nuanced since if one would assess the market between Britain and the EU as very secure, they might not experience the same benefits from a PTA as they would if their economic relationship were very precarious. However, if Britain and/or the EU, being less trade integrated, would experience increased uncertainty in the future, this could reduce trade disproportionately despite a secure market access (Handley & Limão, 2012, p. 45).

Finally, it may be concluded that the more recent theoretical framework builds off the classical theoretical arguments presented in Section 3.1 but two additional dimensions of the linkage between uncertainty and trade. The first dimension being that international trade is specifically volatile to increasing uncertainty due to firms cutting their orders of foreign intermediates disproportionately strongly. The second dimension argues that the renegotiation of a preferential trade agreement decreases export investments and in turn export volumes due to beliefs of policy reversal. Both theoretical arguments are significant for this study since they could explain the potential trade effects of the uncertainty effects from the Brexit referendum. To summarise, the first argument regarding foreign intermediates being cut disproportionately is thought to have a reducing effect on Britain's exports after the increased uncertainty following the Brexit referendum, relatively shortly after. The second argument is a bit more elusive to determine if it will influence short run British trade but is likely to reduce Britain's exports to the EU at some point in the future.

## **4. Previous research**

Now that we have a more lucid idea of the theoretical linkage between policy uncertainty and trade is formatted, we will present a review of previous research conducted regarding the matter. Section 4.1 presents a literature review of academia examining trade policy uncertainty

and its effects on trade in general. Section 4.2 presents a review of the research specifically examining Brexit outcome, uncertainty and how these correlates.

## **4.1 Trade policy uncertainty and its effect on trade**

In a paper by Osnago et al. (2015), on behalf of WTO, the research question is if trade policy uncertainty influences export volumes. Their method consists of measuring trade policy uncertainty as the gap between binding tariff commitments under trade agreements and applied tariffs. This gap is known as tariff's water. Thereafter they implement a gravity model approach to review the impact on export volumes. The report establishes that uncertainty is a distinguished and substantial barrier to export since, according to their estimates, eliminating tariff's water increases the probability to export by 12 percent on average. Further, it is concluded that one percent decrease of water, increases export volumes by one percent and trade policy uncertainty is on average equivalent to a level of tariffs between 1.7 and 8.7 percentage points. Thus, the report concludes that there is substantial evidence on the importance of trade commitments since trade uncertainty has a negative impact both on the probability to export and on export volumes. The study relates to this study in the sense that it views trade policy uncertainty as a barrier to export. However, the trade policy uncertainty examined in this paper does not stem from tariff's water but the Brexit referendum, separating the two studies.

The paper by Handley (2014) sets out to empirically examine the impact of tariff binding commitments on export volumes. This is done in a model of trade with heterogeneous firms that examine Australian import and policy disaggregated product level data for all WTO members in a deterministic multi-period framework for 1991, 1993, and 1996–2001. The model considers a single importer and incorporates a stochastic process for tariffs and extends it to binding tariff commitments. The study shows that uncertainty over future conditions delay the firm entry in a foreign market, aligning with the real-options argument. This displays that uncertainty of trade policy has real economic effects, altering economic behaviour. The study concludes that multilateral policy commitments at the WTO help to reduce this uncertainty and increase product entry, thus indicating that commitments are important to exporters. This is relevant in the context of the Brexit referendum since it not only concludes that policy uncertainty lowers firms' export entry but also points to the importance of commitment in international trade agreements. Our paper differs from the study's modelling approach but does

examine a somewhat similar issue. Further, the Handley (2014) study explores Australia's imports without shocks but from exporters with or without trade agreements and this study in a sense is examining the opposite, that is a 'homogenous' set of importers and the effects of a Brexit referendum shock.

Moreover, in a paper by Handley and Limão (2012) the two research questions are what are the first order effects of current policy and uncertainty on firm entry into exporting and do trade agreements reduce uncertainty? They answer these by deriving a structural equation that predicts how firm entry responds to changes in applied tariffs and a theory-based measure of policy uncertainty. This approach allows them to estimate the impact of policy uncertainty and quantify its aggregate implications by exploiting observable trade policies. This framework is applied to Portugal's accession in the EU and it is concluded that Portuguese exports significantly increased upon the EU accession. This even entailed sectors where applied tariffs did not change. Handley and Limão then interpret this as evidence that Portugal's accession to the EU eliminated the pre-accession risk that tariffs faced by Portuguese exporters may increase to the level of EU external tariffs. This relates to our study since it regards commitment to trade agreements reducing uncertainty and a no-change in tariffs having an impact on traded volumes due to agents' beliefs of future policy. The Brexit referendum's potential effect on Britain's exports is just that, a response of an uncertainty shock influencing today's decisions based on tomorrow's outcome.

Furthermore, in another paper by Handley and Limão (2017) they assess the impact of trade policy uncertainty in a simulation of a tractable general equilibrium framework with heterogeneous firms. This framework is applied to China's WTO accession and is used to quantify the impacts of the trade policy uncertainty-reduction, faced by Chinese exporters, when the United States ended its annual threat to revert to higher tariffs. This provides results that show that if the MFN status were revoked, the typical Chinese exporter would have faced an average tariff of 31 percent and that the removal of this threat had large effects on Chinese export entry, about 60 log points, and export growth, 32 log points. Their findings point to a broader role of trade agreements reducing trade policy uncertainty and that renegotiating agreements can undermine PTAs' values even if they lead to no applied policy change. The study relates to the Brexit referendum because it puts forward evidence that renegotiating trade agreements can be a source of uncertainty and in turn reduce traded volumes. The study takes on a simulation approach, meaning that it differs substantially from our methodological approach but is relevant in context of the research on trade effects of policy uncertainty.

To summarise, the previous research on trade policy uncertainty and its effects on trade is unanimously pointing to that uncertainty decreases trade volumes, as predicted by theory. The research also points to exporters gaining significant benefits from trade agreements, even without actual tariff changes. This is relevant for our study since the Brexit referendum is characterized by the notion of detaching from a trade agreement. However, this study differs from several others since it is examining an uncertainty shock induced by political factors and ambiguity regarding the future rather than actual changes in applied tariffs. Further, it complements the existing literature by examining the effects of trade disintegration rather than the more prevalent research field of trade integration. Nonetheless, the empirical evidence from the previous research provides important insight as to how exporters respond to changes in trade conditions, future or present. Based on the above, trade policy uncertainty acts as a barrier to trade causing exporters to reduce export investment and volume of trade which points to the importance of commitment to trade agreements. Thus, these conclusions support this study's hypothesis of higher uncertainty levels stemming from the Brexit referendum, decreasing volume of British exported goods.

## **4.2 Brexit and trade policy uncertainty**

The research paper by Graziano et al. (2018), sets out to answer how changes in beliefs about policy reversals impact trade in the context of Brexit. In a broader sense, their goal is to estimate the uncertainty effects of preferential trade disagreements. Their methodology applied in the paper measures the responsiveness of trade to increases in the likelihood of Brexit in order to model the counterfactual effect on trade flows of large political uncertainty shocks. Their sample consists of bilateral monthly trade data at a 6-digit product level of the Harmonized System between the UK and the EU from August 2015 to June 2016. The results establish that shocks to the probability of Brexit, reduce trade flows and trade participation. The effects are largest where the reversion to MFN tariffs under WTO rather than PTA rules are highest. Further, they find larger negative effects of Brexit uncertainty on EU exports relative to UK exports, in industries with high sunk costs, and at the product entry margin. The study is therefore complementary to our study but differs methodologically since they examine different outcomes' likelihood regarding Brexit and our study focuses on already occurred potential differences in export behaviour succeeding the referendum specifically. Nonetheless,

their findings are telling for our study since they portray the Brexit referendum as a source of uncertainty, reducing trade flows.

Furthermore, in Crowley et al. (2018), they set out to estimate the impact of uncertainty associated with trade agreement renegotiation by empirically measuring trade policy uncertainty facing firms exporting from the UK to the EU after June 2016. Using the universe of UK export transactions at firm-and product level, they can then estimate exporting firm entry after Brexit compared to if firms would have not faced increased trade policy uncertainty after June 2016. In the study it is concluded that entry in 2016 would have been 5.0% higher and exit would have been 6.1% lower if firms exporting from the UK to the EU had not faced increased trade policy uncertainty after June 2016. This suggests that uncertainty over future trade policy brought about by the renegotiation of a trade agreement can reduce current export activity by an overall decline in number of exporting firms. The findings of the study are very telling for this study since it describes how firm participation in foreign markets changes under the renegotiation of an existing trade agreement. Our study is heavily related to this study, examining the Brexit referendum in a similar manner. However, it differs from Crowley et al. (2018) by being less disaggregated on product level and exploring solely exported trade volumes, thus complementing their previous conclusions.

To conclude, there is substantial literature regarding the Brexit referendum's trade effects that this study aims to complement. Previous research conducted on Brexit uncertainty exhibits that the higher the uncertainty is, the more export participation will be reduced. Furthermore, renegotiation of trade agreements is uncertainty creating due to the risk of policy reversal and, in the case of Brexit, has reduced export entry and induced export exit, of firms. Specifically influenced firms are in industries with high sunk costs and at the product entry margin. This is highly relevant for this study since it aims at exploring UK exports in terms of value of exports traded within the EU, where firm entry and exit on the export market is fundamental factors for the volume of exported goods. Our study most tangibly differentiates methodologically from previous research conducted but is relatively close in research question. Thus, previous research establishes that there has been an overall decline in British exporting firms to the EU succeeding the Brexit referendum and that this was due to higher trade policy uncertainty. Further, this is estimated to have had a bigger impact if the uncertainty levels would have been even higher. We bring this with us when embarking on the empirical portion of our paper estimating the matter with our gravity model approach.

## 5. Empirical strategy

This paper takes on a gravity model approach in order to meet the research questions satisfactorily. This is a relatively commonly used and robust model in an economic integration research context, first presented in its traditional form by Isard and J. Peck (1954), predicting bilateral trade flows based on the economic sizes and distance between two economies. Our gravity model is modelled somewhat differently, with adjustments presented in this episode. The intuition behind the model is that it constructs a hypothetical counterfactual world where the treatment, in this case the Brexit referendum, never took place and examines those hypothetical trade flows. This allows for a comparison with the counterfactual and the actual occurred trade flows in order to determine the difference in effect of the referendum. Methodically, this will be accounted for by including a dummy variable in the regression for the trade disintegration referendum, thus enabling the possibility to separate its effects. Followingly, if the coefficient appurtenant to the referendum dummy variable is positive or negative and significant, the interpretation is that the Brexit referendum has increased respectively decreased the value of trade, above or below, what it otherwise would have been. More specifically, this study will attempt to examine the trade effects on disaggregated export goods on a product level of the Brexit referendum from the UK to EU27 by employing a gravity model framework with exports as its dependent variable and a Brexit uncertainty dummy variable. The trade policy uncertainty perspective will be implemented by constructing an explanatory variable from the Economic Policy Uncertainty index and examining if the potential trade effects following the referendum is correlated with uncertainty level.

### 5.1 Empirical model

Drawing on econometric specification with modifications of the traditional gravity model, the following gravity model is specified to estimate the variable of interest  $REFERENDUM_t$  for exports from the UK to EU27:

$$X_{ijct} = \exp(\beta_1) (GDP_{it})^{\beta_2} (GDP_{jt})^{\beta_3} (POP_{it})^{\beta_4} (POP_{jt})^{\beta_5} \exp(\beta_6(REFERENDUM_t)) + \alpha_{ci} + \vartheta_t + \eta_{ijct}$$

This will then be converted to a log-log model by taking the natural logarithm of both the left and right side of the equation in order to perform more accessible econometric analysis, resulting in:

$$\ln X_{ijct} = \beta_1 + \beta_2 \ln(GDP_{it}) + \beta_3 \ln(GDP_{jt}) + \beta_4 \ln(POP_{it}) + \beta_5 \ln(POP_{jt}) + \beta_6 (REFERENDUM_t) + \alpha_{ci} + \vartheta_t + \varepsilon_{ijct}$$

The dependent variable  $X_{ijct}$  is exports from country  $i$  to country  $j$ , for commodity  $c$  and time period  $t$ , which in this case corresponds to a month's exports for a commodity in the UK to an EU27 member.  $GDP_{it}$  is the real gross domestic product of country  $i$  and correspondingly,  $GDP_{jt}$  is the real gross domestic product of country  $j$ , for time period  $t$ . These variables capture the size of the economies, level of economic development and the productive capacity of the exporting country as well as the purchasing power of the importing country (UNCTAD & WTO 2012, p. 107). Hence, the hypothesis for these variables' coefficients is that they are expected to be positive since the larger the economy, the larger volume of trade. Further,  $POP_{it}$  is the population of country  $i$  and equivalently,  $POP_{jt}$  is the population of country  $j$ , at time period  $t$ . These variables capture the income effects over time in the two countries, importer and exporter (UNCTAD & WTO 2012, p. 52). The coefficients of the population variables are expected to be positive. For the exporting country, this is due to larger countries' greater ability to experience economies of scale and thus develop a comparative advantage in their export goods than the smaller countries. For the importing country, the reasoning is that a higher level of income within the population will lead to greater imports and larger population being associated with openness (UNCTAD & WTO 2012, p. 40).

The  $REFERENDUM_t$  variable is a dummy variable that equals zero before the month of the Brexit referendum, June 2016, and the value of unity starting from June 2016 and forward. This explanatory variable is intended to measure the trade policy uncertainty effects by capturing the referendum's trade effect on UK exports to EU27. The variable's coefficient is hypothesised to be negative since literature points to an increase of trade policy uncertainty succeeding the referendum. Thus, since uncertainty is predicted by theory to reduce trade volumes by reducing firm export participation, the effect of the referendum is believed to have reduced UK exports from what they otherwise would have been. This is would also mirror previous research on Brexit uncertainty, pointing to an overall decrease in number of exporting British firms to the EU and decrease in value of goods exported. The percentual effect of the

dummy variable's beta coefficient will be calculated via  $\Delta \% = (e^{\beta} - 1) * 100$ . Furthermore, the Economic Policy Uncertainty index will be introduced in the model as a logged explanatory variable,  $UNCERTAINTY_t$ . This is in order to review this index influence on UK exports to EU27 and comparing it to the effect of the dummy variable,  $REFERENDUM_t$ . If the variables seem to measure the same occurrence, it will strengthen the case that the  $REFERENDUM_t$  variable is measuring uncertainty. These variables will be estimated separately since they are believed to measure the same effect, that is uncertainty reducing trade volumes.

Our gravity model is specified with the individual and period fixed effects  $\alpha_{ci}$  and  $\theta_t$ .  $\alpha_{ci}$  is the fixed effect for the individual, time-invariant qualities of the observations depending on commodity and importer and  $\theta_t$  is the time specific fixed effect depending on month. This approach is modelled via an error component model approach by implementing dummy variables for the fixed cross-sectional effect for the individual effect  $\alpha_{ci}$  and fixed period effect for the time-specific, monthly effect  $\theta_t$ . This means that the cross-sectional dummies will be different for each pair of importer and commodity and the period dummies will be different for each month of the study period. For instance, the individual effect for UK exports of one commodity to Belgium will not be equal to another commodity to Belgium and January 2012 will have a different effect than January 2013. This fixed effect approach is crucial to our analysis since allows us to control for unobserved heterogeneity in our sample by considering time invariant and time specific characteristics that determine export volumes. Therefore, the model does not include the time-invariant characteristic distance as an explanatory variable since this is accounted for by the individual fixed effects.

In summation, the empirical model applied to this paper in order to obtain answers to our research question will be the gravity model. Our gravity model is modelled with an error component model where we account for distance and other time invariant qualities by implementing dummy variables for the fixed, individual effect. This approach is also implemented for the time-specific, monthly effect. To measure the export effects of the Brexit referendum, the dummy variable  $REFERENDUM_t$  will be included taking the value of unity from the month of the referendum, June 2016, and otherwise 0. This variable is predicted to showcase that the referendum decreased UK exports from what they otherwise would have been. Further, the model will attempt to establish if the potential decrease in trade is correlated with a higher uncertainty level. This will be taken account by implementing the Economic Policy Uncertainty index and reviewing if it seems to measure the same effect as the  $REFERENDUM_t$  dummy.



## 5.2 Estimations issues

The estimator used in this study is the ordinary least squares estimator, the OLS estimator. The rationale behind this choice of estimator is that OLS can estimate the gravity model in a distinctive and accessible manner. This will be beneficial when analysing its results since the interpretations of the OLS estimations are relatively straightforward compared to other econometric estimators. Another estimator that could have been applied is the Poisson estimator but the choice of implementing the OLS-estimator is a way of prioritizing accessibility and simplicity over perfect accuracy. Our OLS estimation will be modelled by implementing an error component model, presenting baseline results of two-way, one-way and no fixed effect specifications. This is done to account for unobserved heterogeneity in the sample, both for individual specific effects and time-specific effects, mitigating the bias generated by heterogeneity across importers (UNCTAD & WTO 2012, p. 108). It is most likely that the appropriate model to estimate the data is with fixed effects since it would otherwise assume that there are no individual differences for different importers and volume of UK exports, such as distance. Which model is appropriate for the estimation can be tested via the Hausman test (UNCTAD & WTO 2012, p. 108). Another approach to account for fixed effects is to run within-group regressions in order to demean the dependent and independent variables before estimating the regression. The reasoning of choosing the error component model stems from the two approaches being different but essentially mathematically interchangeable (Maddala 1971, p. 350).

However, there are potential estimation issues that need to be addressed. Firstly, we have the issue of potential heteroscedasticity and autocorrelation. OLS will only be efficient if the error terms are homoscedastic and not autocorrelated. A remedy for mitigating these issues is the introduction of robust standard errors (Wooldridge 2009, p. 102). This is the remedy applied in this paper by implementing White diagonal standard errors & covariance with d. f. correction in the estimations. Secondly, there is the issue of high multicollinearity since our explanatory variables of GDP and population are likely of having a high degree of correlation causing coefficient estimates to be unstable and difficult to interpret. The remedy implemented for this issue is to omit one of the variables with the highest degree of correlation. However, this remedy causes issues in of itself since the estimation will lose information and result in biased coefficient estimates for the remaining explanatory variables that are correlated with the dropped variable (Wooldridge 2009, p. 92). Lastly, the gravest of the estimation issues that our

regression model can face is the issue of endogeneity. This is an issue when the Gauss-Markov exogeneity assumption fails and an explanatory variable is correlated with the error term causing the OLS coefficient estimates to become biased and inconsistent. Since our model is controlling for the unobserved heterogeneity in our sample using the error component model, it can help remedy the issue of endogeneity due to the omitted variable bias, but time-varying omitted variables remain an issue (UNCTAD & WTO 2012, p. 118).

To conclude, the estimator used to study our gravity model is the OLS estimator. To account for the individual and time-specific effects, an error component model is implemented in the approach. Two-way, one-way and no fixed effect specifications will be presented in our baseline results. The no fixed effect estimator is unlikely to be the appropriate model to estimate the data since it does not control for individual or time-specific effects but is included to view how our results differ for different specifications. The fixed effect approach will to some extent lower the probability of endogeneity in the model by accounting for the omitted variable bias, but not solve the issue completely due to remaining time-specific omitted variable bias. Heteroskedasticity and autocorrelation issues will be remedied by implementing White diagonal standard errors & covariance with d. f. correction. As for the issue of high multicollinearity, the variable with the highest degree of correlation to another will be omitted from the estimation but is likely to cause remaining correlated variables' coefficient estimates to be biased.

### **5.3 Data**

The data being used in this study for the dependent variable  $X_{ijct}$  is total monthly trade of goods data on imports from EU27 as reporters with the UK as partner and value in euros. The data used is from Eurostat Database at the 2-digit product level of the Harmonized System (HS), ranging from the study period January 2012 to December 2019. The reasoning for using import data rather than export data with the UK as a reporter and EU27 as partner is due to import data tending to be of higher quality and accuracy than export data. The sample chosen contains the UK and the EU27 countries, namely Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden. This is sample of importers is chosen since this study will be examining the effects on UK exports to the EU27 specifically. The choice of using 2-digit

product level of the Harmonized System it to get a larger variety in the data set, and therefore more data for the regressions to estimate the effect of the  $REFERNDUM_t$  dummy. A similar reasoning is applied when choosing to measure the effect on monthly trade on goods, rather than annual, since we can obtain more variation with more detailed data. The choice of the study period 2012-2019 is motivated by aspiring to study a homogenous time period, that is not choosing a too long of a period so that the effect could be likely to depend on something else.

Information on real gross domestic product is from *World Development Indicators* by the World Bank, measured annually from 2012-2019 adjusted for PPP by current international dollar. Information on population is from *World Development Indicators* by the World Bank as well. This is measured annually as total population. These variables will therefore differ for importers and exporters at an annual rate. Furthermore, the data regarding the  $UNCERTAINTY_t$  variable is employed from the *UK Monthly EPU Index* by Economic Policy Uncertainty. This index is measured monthly and will therefore take on different values regarding each month, but not differ for importers or exporter.

## 6. Empirical results

### 6.1 Baseline results

In *Table 2* and *3*, our baseline results are presented. The results estimate determinants of monthly UK-exports from 2012-2019 to EU27 at a disaggregated HS-2-digit product level using an OLS estimator with an error component model. The coefficients are presented in three columns with three different fixed effect specifications: two-way (cross-section and period) fixed effect, one-way (cross-section) fixed effect and no fixed effects.

*Table 2. Baseline results of OLS on UK exports with REFERENDUM<sub>t</sub>*

Model:	OLS		
	Two-way FE	One-way FE	No FE
ln GDP <sub>it</sub>	0.55752*** ( $p=0$ )	0.51008*** ( $p=0$ )	1.889001*** ( $p=0$ )
ln GDP <sub>jt</sub>	0.181274 ( $p=0.9773$ )	-4.46963*** ( $p=0$ )	-6.430597*** ( $p=0$ )
ln POP <sub>it</sub>	-2.039526*** ( $p=0$ )	-2.01985*** ( $p=0$ )	-0.858811*** ( $p=0$ )

<b>ln POP<sub>jt</sub></b>	(Omitted)	29.422*** ( <i>p</i> =0)	30.23639*** ( <i>p</i> =0)
<b>REFERENDUM<sub>t</sub></b>	0.026114 ( <i>p</i> =0.9653)	-0.02025*** ( <i>p</i> =0.0089)	-0.050353*** ( <i>p</i> =0)
<b>Const.</b>	24.94053 ( <i>p</i> =0.8915)	-370.189*** ( <i>p</i> =0)	-383.4420** ( <i>p</i> =0.0159)
<b>R-squared</b>	0.892013	0.891283	0.248684
<b>Observations</b>	236092	236092	236092

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

Table 2 provides estimates of our model for UK exports with the variable of interest *REFERENDUM<sub>t</sub>* being active from June 2016, and onwards. We find that for the two-way fixed effects estimates, the referendum has had a positive effect on exports of circa 2,65%. This effect is on the other hand highly insignificant. This could be a result of the omission of *POP<sub>jt</sub>* due to high multicollinearity causing estimates to be biased. It could also be a case of overspecification in the model due to the time-specific effect cancelling out the dummy variable's effect. In contrast, we find that for the one-way fixed effects estimates, the referendum has had a negative effect on exports of circa -2%. This effect is highly statistically significant and aligns with the hypothesis and theory presented in this paper. As for the no fixed effects model, the referendum is estimated to have had a negative effect on UK exports of -4,91%, and is highly statistically significant. However, the R-squared for the no fixed effects specification is notably smaller than for the fixed effects models, 0,24 contra 0,89. This, as predicted, strengthens the case for fixed effects as the more appropriate model due to the higher R-squared being interpreted as higher explanatory power and is mirrored when performing the Hausman Test.

As for the other explanatory variables of the estimation, some of the variables did not match the hypothesis of being positive by taking on negative values. This is the case for *POP<sub>it</sub>* for all the specifications, as well for *GDP<sub>jt</sub>* for the one-way fixed effects model and no fixed effects model. This is somewhat worrying since it points to probable estimation issues of the model, such as endogeneity issues. It could also be plausible that it is depicting a true estimation of the data set and rather showing an example where the gravity model's hypothesis is not showing through. This argument is strengthened by the relatively high R-squared value

the estimation takes on for the fixed effects models. Yet, this argument is not established and lowers the reliability of the inference from the coefficient estimates.

**Table 3. Baseline results of OLS on UK exports with  $UNCERTAINTY_t$**

Model:	OLS		
	Two-way FE	One-way FE	No FE
<b>ln GDP<sub>it</sub></b>	0.557519*** ( <i>p=0</i> )	0.494398*** ( <i>p=0</i> )	1.888354*** ( <i>p=0</i> )
<b>ln GDP<sub>jt</sub></b>	0.173571 ( <i>p=0.9793</i> )	-4.720701*** ( <i>p=0</i> )	-6.784763*** ( <i>p=0</i> )
<b>ln POP<sub>it</sub></b>	-2.039527*** ( <i>p=0</i> )	-2.008661*** ( <i>p=0</i> )	-0.858168*** ( <i>p=0</i> )
<b>ln POP<sub>jt</sub></b>	(Omitted)	30.6641*** ( <i>p=0</i> )	31.18822*** ( <i>p=0</i> )
<b>ln <math>UNCERTAINTY_t</math></b>	-0.037614 ( <i>p=0.9791</i> )	-0.015927*** ( <i>p=0.0039</i> )	-0.016318 ( <i>p=0.2698</i> )
<b>Const.</b>	25.36066 ( <i>p=0.8963</i> )	-385.0335*** ( <i>p=0</i> )	-390.3491*** ( <i>p=0.0001</i> )
<b>R-squared</b>	0.892013	0.891284	0.248670
<b>Observations</b>	236092	236092	236092

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

Table 3 provides estimates of our model for UK exports, including  $UNCERTAINTY_t$  as an explanatory variable. We find that for the two-way fixed effects model, the uncertainty index correlated negatively with UK exports at circa -0,038%. For the no fixed effect specification, the results convey that the uncertainty has had a negative relationship with the dependent variable of circa -0,0163%. However, none of these effects are statistically significant. In contrast, for the one-way fixed effects model, the uncertainty index correlated negatively with UK exports at circa -0,016% and is highly statistically significant. This means that a 1% increase in the index lowered expected value of exports by 0,016. Thus, the findings align with the hypothesis and theory for the variable. Further, the results of when examining the  $UNCERTAINTY_t$  variable and the  $REFERENDUM_t$  variable did not create that vast of a difference on the other explanatory variables, indicating that the two variables could be measuring the same effect. The estimates are viewed as reliable based off both corresponding estimates being highly statistically significant and the relatively high R-squared of the

estimations. This is relevant to this paper since it strengthens the case that the referendum's negative effect on UK exports is due to higher uncertainty.

To conclude for the baseline results, the analysis points to that the Brexit referendum has had a reducing effect on Britain's exports to EU27 between the period of 2012-2019. Further, this reducing effect seems to be correlated with uncertainty and that the referendum dummy is estimating trade effects of uncertainty since  $UNCERTAINTY_t$  and  $REFERENDUM_t$  seem to measure the same effect. Further estimations of this claim must be done in order to view if this is robust, especially since the model seems to suffer from some level of estimation issues. Depending on which specification one follows, the reducing effect on exports of the referendum for the significant values of the results are between -2% to -4.91%. Although, it should be emphasised that the -4.91% effect is estimated with no fixed effects, treating all cross-section and period differences the same, which is highly unlikely. Thus, the more reliable effect is from the more appropriate fixed effects model at a -2%. In conclusion, our results showcase some evidence that the Brexit referendum has reduced exports from the UK to EU27 succeeding the Brexit referendum of what they otherwise would have been, and that this is correlated with higher uncertainty levels. This coincides with uncertainty theory and mirrors previous research within the field.

## 6.2 Robustness analysis

In *Tables 4-7*, the robustness analysis of our baseline estimations is presented. First, we analyse the difference in results for both the variables of interest by solving the issue of trade values being zero. This is an issue since the logarithm of zero is undefined, lowering the observations able to perform in the estimation and decreasing the variation in data. The remedy applied entails substituting the zero values by the small constant 2, so that the double-log model can be estimated. Examples in the literature that followed this approach are Linnemann (1966) and Van Bergeijk & Oldersma (1990). It should be stressed that there is no guarantee that the substitution reflects the underlying expected values, thus yielding inconsistent estimates, and the implementation is therefore a matter of judgement (UNCTAD & WTO 2012, p. 112). The prediction for solving the zero-trade issue is that the estimates will become more amplified than the baseline estimates, due to the larger variance in the data. Thereafter, we examine the difference in introducing the  $REFERENDUM_t$  variable at different times in the model, namely in June 2015 and June 2017. The prediction is that the dummy should not have a significant

effect when implemented in 2015 since the reducing effect of the uncertainty created by the referendum is believed to be correlated to the time the referendum occurred. Hence, an effect before the referendum would lower the robustness of the baseline results. The hypothesis for the dummy implemented in 2017 is that the effect for the reducing effect of the referendum should be somewhat smaller since the uncertainty level index peaked following the referendum. Should the  $REFERENDUM_t$  variable follow this pattern, it would strengthen the case that the trade reducing effect of the referendum is correlated with higher uncertainty.

**Table 4. Results with no zero trade of OLS on UK exports for  $REFERENDUM_t$**

Model:	OLS		
	Two-way FE	One-way FE	No FE
<b>ln GDP<sub>it</sub></b>	0.5252*** ( <i>p=0</i> )	0.427175*** ( <i>p=0</i> )	2.487048*** ( <i>p=0</i> )
<b>ln GDP<sub>jt</sub></b>	-0.731066 (0.9274)	-3.206161*** ( <i>p=0</i> )	-5.666171*** ( <i>p=0.0005</i> )
<b>ln POP<sub>it</sub></b>	-2.481475*** ( <i>p=0</i> )	-2.439136*** ( <i>p=0</i> )	-1.123589*** ( <i>p=0</i> )
<b>ln POP<sub>jt</sub></b>	(Omitted)	23.9221*** ( <i>p=0</i> )	24.41168*** ( <i>p=0.0096</i> )
<b>REFERENDUM<sub>t</sub></b>	-0.003474 ( <i>p=0.9987</i> )	-0.033622*** ( <i>p=0.0033</i> )	-0.091862*** ( <i>p=0.0008</i> )
<b>Const.</b>	58.14552 ( <i>p=0.8007</i> )	-299.4335*** ( <i>p=0</i> )	-312.7170** ( <i>p=0.0114</i> )
<b>R-squared</b>	0.862978	0.862365	0.244490
<b>Observations</b>	251424	251424	251424

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

In *Table 4*, our robustness analysis attempts to solve the zero-trade issue. We find that in our two-way fixed effects model, the referendum and UK exports have had a negative correlation of circa -0,347%. This differs from the result of the corresponding estimate in *Table 2* that suggested a positive relationship. However, the estimate is still not statistically significant. Due to the big difference and insignificance in the results, the reliability of the two-way model estimates is severely weakened. We find for the one-way fixed effects model that the referendum has had a negative impact on UK exports of -3,306% at a high significance level. This effect is bigger than the corresponding effect result in *Table 2*, when comparing -3,306%

to -2%, coinciding with predictions. Thus, the robustness of the results from the one-way fixed effect model is strengthened. We find for the no fixed effect estimator that the referendum has had a negative correlation with exports of -8,777%, a greater effect compared to the no fixed effects result in *Table 2* of -4,91%. The effect is highly statistically significant and coincides with the more amplified answers in the more varied data set.

**Table 5. Results with no zero trade of OLS on UK exports for *UNCERTAINTY<sub>t</sub>***

<b>OLS</b>			
<b>Model:</b>	<b>Two-way FE</b>	<b>One-way FE</b>	<b>No FE</b>
<b>ln GDP<sub>it</sub></b>	0.525201*** <i>(p=0)</i>	0.401232*** <i>(p=0)</i>	2.485963*** <i>(p=0)</i>
<b>ln GDP<sub>jt</sub></b>	-0.699212 <i>(p=0.932)</i>	-3.576917*** <i>(p=0)</i>	-6.148558*** <i>(p=0.0002)</i>
<b>ln POP<sub>it</sub></b>	-2.481477*** <i>(p=0)</i>	-2.420484*** <i>(p=0)</i>	-1.122518*** <i>(p=0)</i>
<b>ln POP<sub>jt</sub></b>	(Omitted)	25.70465*** <i>(p=0)</i>	25.21684*** <i>(p=0.0087)</i>
<b>ln <i>UNCERTAINTY<sub>t</sub></i></b>	0.093334 <i>(p=0.9854)</i>	-0.025752*** <i>(p=0.0014)</i>	-0.032525* <i>(p=0.0915)</i>
<b>Const.</b>	56.76485 <i>(p=0.8143)</i>	-320.3781*** <i>(p=0)</i>	-313.2422** <i>(p=0.0128)</i>
<b>R-squared</b>	0.862978	0.862366	0.244465
<b>Observations</b>	251424	251424	251424

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

*Table 5* provides estimates of our model of UK exports with no zero trade and the variable of interest being *UNCERTAINTY<sub>t</sub>*. We find that for the two-way fixed effects model, the uncertainty index and UK exports has had a positive relationship at an effect of circa 0,093%. This differs from corresponding result in *Table 3* which found a negative relationship of -0,038%. Still the estimate was statistically insignificant and the reliability of the estimates from the two-way fixed effects model is further weakened. In contrast, we find for the one-way fixed effects model that the uncertainty index has had a negative correlation with UK exports of -0,026%. When comparing this result to the corresponding in *Table 3* which was -0,016%, we



find a more amplified negative effect, as predicted. Both results are highly statistically significant and thus, strengthens the robustness of the estimates. For the no fixed effects model, the estimates suggest that the uncertainty index and UK exports has had a negative correlation of circa -0.0325% compared to corresponding results in *Table 3* of -0,0163%. This result is statistically significant at a 10% significance level, unlike the statistically insignificant result in *Table 3*, and aligns with predictions of solving the zero-trade issue.

**Table 6. Results of OLS on UK exports with referendum effect in 2015**

<b>OLS</b>			
Model:	Two-way FE	One-way FE	No FE
<b>ln GDP<sub>it</sub></b>	0.557521*** <i>(p=0)</i>	0.494866*** <i>(p=0)</i>	1.888383*** <i>(p=0)</i>
<b>ln GDP<sub>jt</sub></b>	0.172138 <i>(p=0.9785)</i>	-4.154677*** <i>(p=0)</i>	-6.112814*** <i>(p=0)</i>
<b>ln POP<sub>it</sub></b>	-2.039528*** <i>(p=0)</i>	-2.007517*** <i>(p=0)</i>	-0.858196*** <i>(p=0)</i>
<b>ln POP<sub>jt</sub></b>	(Omitted)	26.83654*** <i>(p=0)</i>	26.64125*** <i>(p=0.0015)</i>
<b>REFERENDUM<sub>t</sub></b>	-0.056806 <i>(p=0.9589)</i>	0.012216 <i>(p=0.1804)</i>	0.016063 <i>(p=0.5119)</i>
<b>Const.</b>	25.24656 <i>(p=0.8905)</i>	-332.5038*** <i>(p=0)</i>	-327.8849*** <i>(p=0)</i>
<b>R-squared</b>	0.892013	0.891282	0.248667
<b>Observations</b>	236092	236092	236092

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

*Table 6* provides us with a robust analysis of the estimates of the gravity model when implementing the *REFERENDUM<sub>t</sub>* dummy variable in June 2015. We find that for no of the estimates of the *REFERENDUM<sub>t</sub>* invoked in June 2015, are the coefficients statistically significant, aligning with our hypothesis. This is specifically telling for our analysis as to whether the trade reducing effects of the referendum provided in our baseline estimates, are caused by higher uncertainty. The estimation provided here strengthens this case due to not showing a significant effect before the referendum, indicating the trade reducing effect to be

due to higher uncertainty. Thus, the robustness of the baseline results is strengthened and the correlation between the referendum reducing trade effects and higher uncertainty level is fortified.

**Table 7. Results of OLS on UK exports with referendum effect in 2017**

<b>OLS</b>			
<b>Model:</b>	<b>Two-way FE</b>	<b>One-way FE</b>	<b>One-way FE</b>
<b>ln GDP<sub>it</sub></b>	0.55752*** <i>(p=0)</i>	0.491786*** <i>(p=0)</i>	1.889296*** <i>(p=0)</i>
<b>ln GDP<sub>jt</sub></b>	0.219376 <i>(p=0.9721)</i>	-4.47185*** <i>(p=0)</i>	-6.115669*** <i>(p=0)</i>
<b>ln POP<sub>it</sub></b>	-2.039529*** <i>(p=0)</i>	-2.00668*** <i>(p=0)</i>	-0.859097*** <i>(p=0)</i>
<b>ln POP<sub>jt</sub></b>	(Omitted)	29.00873*** <i>(p=0)</i>	28.18184*** <i>(p=0)</i>
<b>REFERENDUM<sub>t</sub></b>	-0.050718 <i>(p=0.968)</i>	0.000788 <i>(p=0.9113)</i>	-0.048164** <i>(p=0.0106)</i>
<b>Const.</b>	23.87601 <i>(p=0.8943)</i>	-362.423*** <i>(p=0)</i>	-355.5105 <i>(p=0.0002)</i>
<b>R-squared</b>	0.892013	0.891281	0.248686
<b>Observations</b>	236092	236092	236092

Notes: \*\*\*, \*\*, and \* indicates that the estimated parameter is statistically different from zero at the 1%, 5% and 10% level. The values presented in parenthesis are the p-values. All values are estimated with White diagonal standard errors & covariance with d. f. correction.

Table 7 presents estimates from our robust analysis when invoking the *REFERENDUM<sub>t</sub>* dummy in June 2017, rather than June 2016. Due to its shortcomings in previous estimations, the two-way fixed effects relatively high estimate is presumed to give a skewed result. Further, as for the one-way fixed effect estimate, the effect is relatively small and very statistically insignificant. This makes it difficult to infer any conclusions of the robustness of the estimate. In contrast, for the no fixed effects specification, the estimate suggests that the dummy has had a reducing effect on exports since June 2017 of circa -4,7%. This estimate is statistically significant at a significance level of 5%. In comparison to the corresponding effect of the no fixed effects model in our baseline results with *REFERNDUM<sub>t</sub>* invoked in June 2016, the effect of -4,7% is smaller than -4,91%. Even being a marginal difference, the results coincides with

the prediction of the variable since it still has a reducing effect on exports, whilst being somewhat smaller further from the referendum took place. The marginal difference could be explained by uncertainty still being present in our model in 2017 and therefore still having a reducing effect on UK exports. Yet, this strengthens the robustness of our results and provides an insight that the referendum had a larger reducing effect on exports following the Brexit referendum, than a year later, indicating higher uncertainty to be the cause.

Conclusively, our robust analysis strengthens the case that our baseline results are reliable. This means that the conclusions from 6.1 holds, that the Brexit referendum has had a reducing effect on Britain's exports to EU27 between the period of 2012-2019. Further, the case for the referendum being an uncertainty induced shock and in turn reducing exports is strengthened by the effect not being significant in 2015 and being slightly lower in 2017. When solving the zero-trade issue, the most appropriate one-way fixed effect model estimated that UK exports have been 3,306% lower than what they would have been without the referendum during the study period. Thus, our study puts forward quite substantial evidence that the Brexit referendum due to an uncertainty shock, decreased exports from the UK to EU27 from what it otherwise would have been. This conclusion aligns with theory of uncertainty reducing firm export investment, raising costs for firms and lowering the number of firms able to participate in the export market and reducing consumer demand and in turn reducing volume of exports. Further, this mirrors the conclusions of previous research establishing that uncertainty is trade reducing and the number of British firms on the exporting market has decreased due to higher uncertainty. Thus, the average trade effect on British exports to EU27 from the uncertainty effects of the Brexit referendum is calculated by taking the mean of our most appropriate one-way fixed model estimates from the baseline estimate and no zero trade-estimate. This results in UK exports to EU27 being approximately 2,7% lower than what they would have been without the referendum induced uncertainty.

## **7. Summary and conclusion**

The Brexit referendum was a pivotal point for UK-EU trade relations. Growing Euroscepticism in the UK, the Brexit camp gaining majority in the referendum and all its rigorous aftermath, drastically changed beliefs of future trade policy regarding UK-EU trade. Not the least since the result of the referendum came as a great shock for many and negotiations taking many turns, making it difficult to foresee future trade policy. Viewing empirical evidence of

uncertainty levels through business surveys, newspaper analysis and macroeconomic indicators, it distinctly points to an increase in uncertainty succeeding the Brexit referendum and it being characterized as an uncertainty shock. Theory tell us that such heightened uncertainty levels most likely reduces volume of trade. This is explained by uncertainty creating an option-value of entering foreign markets and uncertainty raising real costs for firms due to higher risk premiums from banks that will have to bear a higher risk, pushing mark-ups higher and lowering domestic firms' competitiveness and profit value on a foreign market. Previous research between the linkage of uncertainty and trade unanimously points to uncertainty decreasing trade volumes, as predicted by theory. The research also points to exporters facing significant benefits from trade agreements, even without actual tariff change and that these benefits can be diminished with uncertainty inducing renegotiations, reducing trade volumes. Brexit research establishes that there has been an overall decline in British exporting firms to the EU succeeding the Brexit referendum and that this was due to higher trade policy uncertainty. Thus, this paper examines the trade effects of the Brexit referendum on UK volume of exports to the EU27 and reviewing if the effects correlate with uncertainty levels.

Our results show that the Brexit referendum decreased export volumes to the EU27 by approximately 2,7% from what they otherwise would have been, *ceteris paribus*. These are estimations from our modified gravity model with a one-way fixed effect error component model and a dummy variable representing the occurrence of the Brexit referendum. The estimations were performed on data of monthly UK-exports from 2012-2019 to EU27 at a disaggregated HS-2-digit product level, using OLS as estimator. The trade effect is highly statistically significant but relatively small when reviewing findings of previous research. The results indicate that the trade reducing effect of the referendum is correlated with higher uncertainty levels when incorporating the Economic Policy Uncertainty index as an explanatory variable, since the referendum dummy and the uncertainty index seem to be measuring the same effect. This notion is further strengthened by the referendum dummy not having significant impact a year before the referendum and having a slightly smaller impact the year after. This suggests that the export reducing effect coincide simultaneously as the referendum, bolstering the argument that the effect is due to Brexit uncertainty.

These results coincide with theory of heightened uncertainty levels reducing volume of trade and can be explained by British firms waiting for beliefs about the future to become more lucid, and thereafter deciding to participate on the EU27 export market. It could also be the effect of fewer British firms being able to participate on the EU27 export market since

uncertainty raises costs due to higher risk premiums, making British exports less attractive on the European market due to likely higher product prices than competitors within EU27. This is feasible to have had an effect due to firms raising mark-ups is often viewed as occurring in the short run, but this effect could be more prominent in the long run as well. Further, the export reduction could be a result of British consumer demand being reduced due to precautionary saving and spilling over into the EU27 market. This argument has somewhat of a lower explanatory power since the trade policy uncertainty regarding Brexit is most tangible in the UK. However, the referendum is still possible to have lowered EU27 consumer demand and thus reducing the imports of British goods. Our results mirror previous research establishing that uncertainty decreases trade volumes by working as a barrier to trade and an overall decline in British exporting firms to the EU succeeding the Brexit referendum due to higher trade policy uncertainty, indicating that there likely had been an overall decline in British export goods as well.

However, this model did suffer from some estimation issues, such as probable endogeneity. This must be considered when reviewing the results since it could result in skewed inference. Hence, this paper fails at receiving perfectly accurate estimates but does provide quite substantial evidence that the uncertainty effects succeeding the Brexit referendum depressed UK exports. Yet, our conclusion leaves a lot of potential future research regarding the Brexit referendum's effect on trade and uncertainty effects on trade in general. Firstly, this paper reviews the effects on trade from UK to EU specifically, but another extension would be to review the potential trade effects of the Brexit referendum on other trading partners. Secondly, another key in understanding how uncertainty and trade affects one and other is to control these trade reducing effects with other effects that may have caused them to be reduced, such as exchange rates or global trends. Lastly, it would be very beneficial to study the differences in outcome on different goods, that is on a product, sector or firm level. This could help us understand which products and firms are most exposed to the uncertainty effects which is of very high policy relevance. Possible approaches could be to study effects on intermediate goods or the difference between homogenous and differentiated products.

Conclusively, this paper has attempted to answer the question as to whether the Brexit referendum's uncertainty effects has affected the volume of UK export goods from the UK to EU27 from 2012-2019. The results show us that the referendum has reduced UK exports to EU27 from 2012-2019 by approximately 2,7% from what they otherwise would have been, *ceteris paribus*. The results are relevant for policy makers since the trade reducing effect of the Brexit referendum emphasises the importance of lowering uncertainty regarding future

uncertainty shocks. This is further of policy relevance since it establishes the benefits of trade commitments for exporters and how trade policy uncertainty can impact real economic behaviour, even when no classical trade barriers are changed. The result is explained by theory of uncertainty reducing trade by creating an option-value for British firms to wait for beliefs about future policy to become more lucid, and thereafter deciding to participate on the EU27 export market. It could also be the effect of fewer British firms being able to participate on the EU27 export market since uncertainty raises costs due to higher risk premiums, making British exports less attractive on the European market due to likely higher product prices than competitors within EU27. Our results coincide with previous research establishing that uncertainty reduces trade and fewer UK firms being active on the EU market due to higher uncertainty. What is clear is that the trade effects of Brexit at large are not yet determined and are likely to continue to influence trade relations between UK and EU ahead.

## References

- Bank of England. 2019. In focus - Uncertainty and Brexit. *Monetary Policy Report*. <https://www.bankofengland.co.uk/monetary-policy-report/2019/november-2019/in-focus-uncertainty-and-brexit> (Retrieved 2 December 2020)
- BBC. 2016. Brexit: Europe stunned by UK Leave vote. 24 June 2016. <https://www.bbc.com/news/uk-politics-eu-referendum-36616018> (Retrieved 4 December 2020)
- Becker, Sascha O. & Fetzer, Thiemo. 2017. Does Migration Cause Extreme Voting? *CAGE Online Working Paper* (306). [https://warwick.ac.uk/fac/soc/economics/research/centres/cage/manage/publications/306-2016\\_becker\\_fetzer.pdf](https://warwick.ac.uk/fac/soc/economics/research/centres/cage/manage/publications/306-2016_becker_fetzer.pdf)
- Bloom, Nicholas. 2014. Fluctuations in Uncertainty. *National Bureau of Economic Research*. NBER Working Paper No. 19714. <http://www.nber.org/papers/w19714>
- Bloom, Nicholas, Philip Bunn, Scarlet Chen, Paul Mizen, Pawel Smietanka, Greg Thwaites, Garry Young. 2018. Brexit and Uncertainty: Insights from the Decision Maker Panel. *Bank of England, Institute for Fiscal Studies*. 39 (4): 555–580. <https://doi.org/10.1111/1475-5890.12179>
- Crowley, M. A. & Exton, O. & Han, L. 2018. Renegotiation of Trade Agreements and Firm Exporting Decisions: Evidence from the Impact of Brexit on UK Exports. *Cambridge Working Papers in Economics 1839, Faculty of Economics, University of Cambridge*. No: 2018/10.
- Czech, Katarzyna & Wielechowski, Michał. 2016. Brexit Related Uncertainty for United Kingdom Economy. *Acta Scientiarum Polonorum – Oeconomia*. 15(4):171-181.
- Economic Policy Uncertainty. 2020. *UK Monthly EPU Index*. <https://www.policyuncertainty.com/index.html> (Retrieved 13 December 2020)
- Eurostat. 2020. *International trade in goods EU trade since 1988 by HS2-HS4 (DS-016894)*. <https://ec.europa.eu/eurostat/web/international-trade-in-goods/data/database> (Retrieved 13 December 2020)
- Graziano, Alejandro & Handley, Kyle & Limão, Nuno. 2018. Brexit Uncertainty and Trade Disintegration. *National Bureau of Economic Research*. NBER Working Paper No. 25334. <http://www.nber.org/papers/w25334>

Handley, Kyle. 2014. Exporting under trade policy uncertainty: Theory and evidence. *Journal of International Economics*, 94(1), p.50 - 66. <https://doi.org/10.1016/j.jinteco.2014.05.005>

Handley, Kyle & Limão, Nuno. 2012. Trade and Investment under Policy Uncertainty: Theory and Firm Evidence. *National Bureau of Economic Research*. NBER Working Paper No. 17790 <http://www.nber.org/papers/w17790>

Handley, Kyle & Limão, Nuno. 2017. Policy Uncertainty, Trade, and Welfare: Theory and Evidence for China and the United States. *American Economic Review*, 107(9): 2731–2783 <https://doi.org/10.1257/aer.20141419>

House of Commons Library. 2015. The 1974–1975 UK Renegotiation of EEC Membership and Referendum. *Briefing Paper* nr. 7253. <https://commonslibrary.parliament.uk/research-briefings/cbp-7253/> (Retrieved 10 December 2020)

House of Commons Library. 2020. Brexit timeline: events leading to the UK's exit from the European Union. *Briefing Paper* nr. 7960. <https://commonslibrary.parliament.uk/research-briefings/cbp-7960/> (Retrieved 10 December 2020)

Isard, Walter & J. Peck, Merton. 1954. Location Theory and International and Interregional Trade Theory. *The Quarterly Journal of Economics* 68(1): 97-114. <http://hdl.handle.net/10.2307/1881920>

Linnemann, H. 1966. An Econometric Study of International Trade Flows, *The Economic Journal* 77 (306): 366–368. <https://doi.org/10.2307/2229319>

Maddala, G. S. 1971. The Use of Variance Components Models in Pooling Cross Section and Time Series Data. *Econometrica*. 39 (2) :341-358 <http://www.jstor.org/stable/1913349>

Mortimore, Roger. 2016. "Polling history: 40 years of British views on "in or out" of Europe". *The Conversation*. June 21. <https://theconversation.com/polling-history-40-years-of-british-views-on-in-or-out-of-europe-61250> (Retrieved 20 December 2020)

Nguyen Ba, Trung. 2019. The spillover effects of US economic policy uncertainty on the global economy: A global VAR approach *The North American Journal of Economics and Finance*, 48, 90 - 110. <https://doi.org/10.1016/j.najef.2019.01.017>

Novy, Dennis & M. Taylor, Alan. 2014. Trade and Uncertainty. *National Bureau of Economic Research*. NBER Working Paper No. 19941 <http://www.nber.org/papers/w19941>

Osnago, Alberto & Piermartini, Roberta & Rocha, Nadia. 2015. Trade policy uncertainty as barrier to trade. *WTO Staff Working Papers ERSD-2015-05*. World Trade Organization. Economic Research and Statistics Division. <https://doi.org/10.30875/6c9ef04c-en>



The Associated Press. 2017. Timeline of events leading up to Brexit. March 29.  
<https://apnews.com/article/f1325c8657674c7e9266923861b50f84> (Retrieved 10 December 2020)

The Federal Reserve. 2020. Real Effects of Uncertainty: Evidence from Brexit.  
<https://www.federalreserve.gov/econres/notes/feds-notes/real-effects-of-uncertainty-evidence-from-brexit-20200511.htm> (Retrieved 15 December 2020)

The Guardian. 2014. 10 key lessons from the European election results. 26 May 2014.  
<https://www.theguardian.com/politics/2014/may/26/10-key-lessons-european-election-result>  
(Retrieved 28 December 2020)

The World Bank. 2020. World Development Indicators. *Population, total*.  
<https://databank.worldbank.org/source/world-development-indicators> (Retrieved 13 December 2020)

The World Bank. 2020. World Development Indicators. *GDP, PPP (current international \$)*  
<https://databank.worldbank.org/source/world-development-indicators> (Retrieved 13 December 2020)

UNCTAD & WTO. 2012. A Practical Guide to Trade Policy Analysis.  
[https://www.wto.org/english/res\\_e/publications\\_e/wto\\_unctad12\\_e.pdf](https://www.wto.org/english/res_e/publications_e/wto_unctad12_e.pdf) (Retrieved 28 December 2020)

University of Birmingham. 2016. Brexit Poll of Polls: Undecided voters hold the balance. The Birmingham Brief. 02 June.  
<https://www.birmingham.ac.uk/news/thebirminghambrief/items/2016/06/Brexit-Poll-of-Polls-Undecided-voters-hold-the-balance..aspx> (Retrieved 20 December 2020)

Van Bergeijk, Peter .A.G. & Oldersma, Harry. 1990. Détente, Market-Oriented Reform and German Unification: Potential Consequences for the World Trade System. *Kyklos*. 43 (4): 599–609. <https://doi.org/10.1111/j.1467-6435.1990.tb02239.x>

Wooldridge, Jeffrey M. 2009. *Introductory Econometrics: A Modern Approach*. 5<sup>th</sup> edition. Mason: Cengage Learning.

---