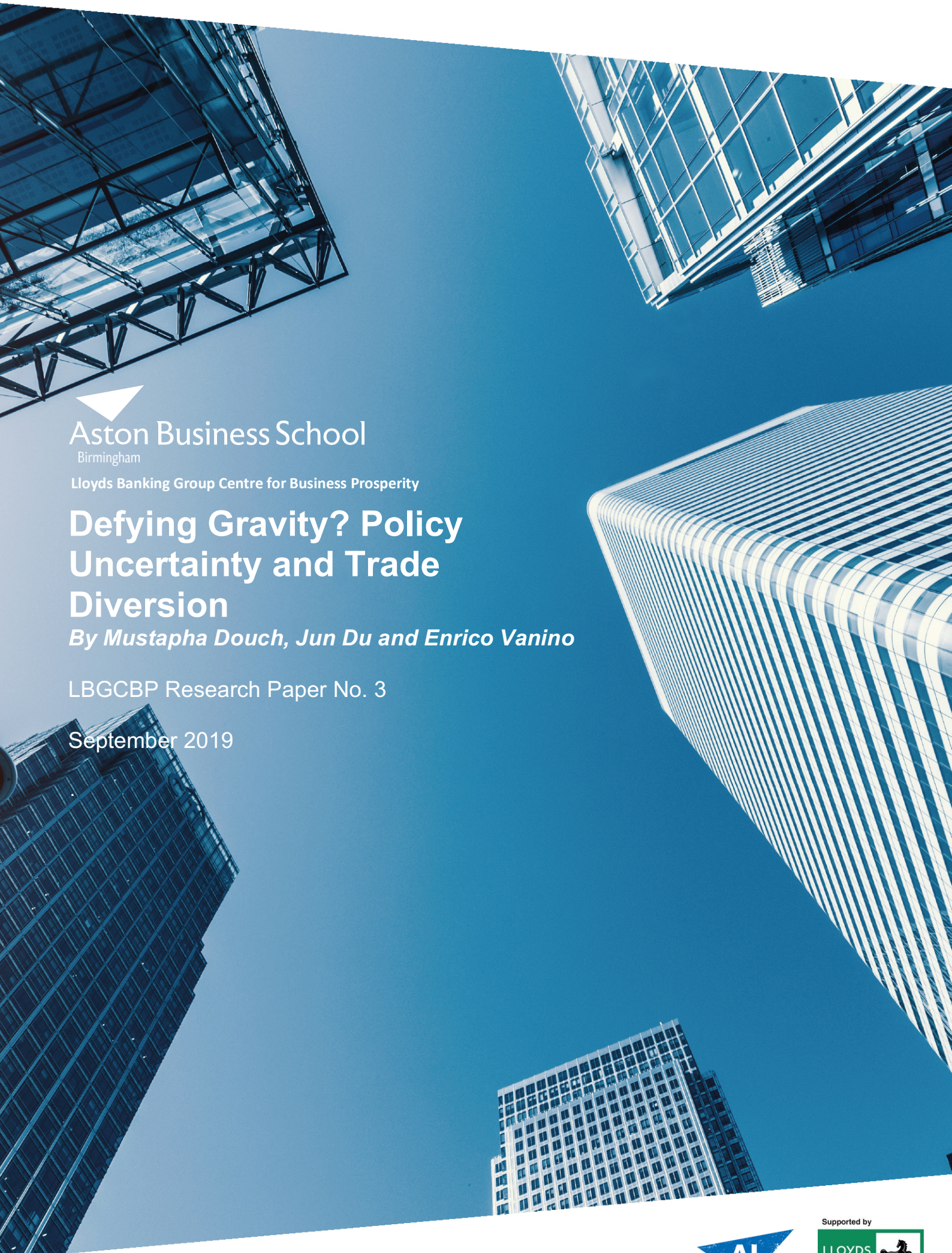


Aston Business School
Birmingham

Lloyds Banking Group Centre for Business Prosperity

Defying Gravity? Policy Uncertainty and Trade Diversion

By Mustapha Douch, Jun Du and Enrico Vanino

LBGCBP Research Paper No. 3

September 2019

Supported by
LLOYDS BANKING GROUP

Defying Gravity?
Policy Uncertainty and Trade Diversion

Mustapha Douch* Jun Du* Enrico Vanino†

Abstract

The reduction of uncertainty over future tariff schedules and customs arrangements is a key factor in boosting firms' investment and participation in international markets. This paper investigates the effects of trade policy uncertainty on firms' export margins and on trade diversion, exploiting the Brexit process as a natural experiment and using transaction-level trade data for UK firms. Comparing the growth in UK trade flows to the EU and extra-EU countries throughout the Brexit process (to the time of writing), and comparing the variations across product-specific tariff threats and destination markets, our results show a diversion of UK trade flows away from EU markets towards extra-EU countries, as trade policy uncertainty increased during the Brexit negotiation. In particular, small and medium-sized firms, more exposed to uncertainty and potential tariffs, show greater trade diversion towards more distant extra-EU countries, mainly towards rapidly growing emerging markets and Commonwealth member states.

JEL Codes: F02, F13, F14, F15, F61, F68

Keywords: policy uncertainty; Brexit; trade diversion; trade margins.

*Aston University, Lloyds Banking Group Centre for Business Prosperity, ABS, UK. Contacting author: Jun Du, Email: j.du@aston.ac.uk.

†London School of Economics, Department of Geography and Environment, UK

Disclaimer: This work contains statistical data from HMRC which is Crown Copyright. The research datasets used may not exactly reproduce HMRC aggregates. The use of HMRC statistical data in this work does not imply the endorsement of HMRC in relation to the interpretation or analysis of the information.

Acknowledgement: The financial support of Lloyds Banking Group for this research is gratefully acknowledged. The views expressed in this paper are the authors and do not necessarily reflect those of the Lloyds Banking Group. The authors also wish to thank the Enterprise Research Centre (ERC) for its support for this research. The authors are grateful to comments by participants in seminars at Aston University, Jiao Tong University, ETSG conference 2019, the Regional Science Association International British and Irish Section Conference and ERC-HMRC-OGD Business Growth Analysis Group.

1 Introduction

Trade flows are highly dependent on the certainty of trade policies and the possibility of predicting future trade regimes, due to the high level of long-term investment required to plan future international transactions. In this regard, economic and trade policy uncertainties surrounding future trade relationships with other countries could dampen export flows and the international activities of firms. Thus the reduction of uncertainty over future tariff schedules and customs arrangements is a key factor in boosting firms' investment and participation in international markets (Handley & Limao 2015). This is even more important for small exporter firms, which on average are less capable of quickly adjusting their production in response to international shocks. These firms are also more exposed to trade risks given their higher participation in geographically and culturally proximate markets (Shoag & Veuger 2016).

A growing body of literature has analysed the interaction between macro shocks and the related uncertainty with respect to economic growth, showing evidence that economic uncertainty could lead to reduced or delayed investment (Bloom 2009, 2014), damaged consumer confidence in businesses (Dominguez & Shapiro 2013, Baker et al. 2016) and the reduction of trade participation and performance (Limão & Maggi 2015, Handley & Limão 2017, Pierce & Schott 2016). In particular, recent studies have tried to disentangle the impact of policy uncertainty on international trade, with primarily empirical evidence on aggregate trade flows (Graziano et al. 2018, Carballo et al. 2018), and on firms' export participation (Crowley et al. 2018). The evidence remains limited, due largely to the difficulties of identifying and measuring policy uncertainty, and the lack of granular micro-level data.

In this study we seek to understand the effects of trade policy uncertainties on firms' export behaviour. In particular, we are interested in understanding whether uncertainties about future trade barriers can hold firms back from exporting to existing markets

and divert their flows to other more distant markets previously considered riskier. To do so, we exploit the Brexit process as a natural experiment to assess whether the uncertainty about future trade dislocation between the UK and EU has led UK firms to divert their international trade flows away from the EU and towards more distant countries. Using the UK HM Revenue Customs (HMRC) quarterly trade transaction level data for the population of UK exporters during the 2012-2017 period, we test if UK firms have diverted their exports from EU destinations to elsewhere, especially for small and medium enterprises (SMEs), which are more exposed to policy uncertainty and the potential threat of tariff increases under a "no-deal" scenario.[1]

Our study is novel in several ways. By using Brexit as a natural experiment, we are able to study firms' adjustments in their export strategies in relation to anticipated future trade barriers, by comparing firm-level export flows to EU and extra-EU destinations. In particular, we disentangle the effect of uncertainty across different firms' margins of trade, considering both extensive (products and markets) and intensive margins (export values). This very granular analysis gives us the possibility of investigating two novel dimensions. First, we identify the heterogeneous effect across different product categories, based on the product-specific potential tariff-threat under a no-deal scenario. Secondly, we are able to analyse the effect across market destinations, understanding whether uncertainty regarding the future of EU-UK trade policy has pushed firms to divert their trade flows against the traditional predictions of trade gravity models, leading them towards more distant and riskier markets. In addition, we account for the dynamic evolution of policy uncertainty, considering Brexit as a process rather than an event, and taking into account the change in the perceived policy uncertainty from the time of the referendum announcement till the triggering of the formal

[1]In a no-deal scenario, the UK would immediately leave the European Union with no agreement about the divorce process and the future trade arrangements. In this case, the UK would leave the single market and customs union. Under a no-deal Brexit, there would be no time to bring in a UK-EU trade deal and trade would initially have to be on terms set by the World Trade Organization. If this happens, tariffs will apply to most goods and border checks for goods could be applied.

Article 50 notice of withdrawal. Finally, we analyse the heterogeneous effects of policy uncertainty across exporters of different sizes, providing insights on how increased instability could have affected differently firms with different resources and capabilities of reacting to external shocks.

After testing the robustness of our analysis through several checks and falsification exercises, our results show that the uncertainty related to the Brexit process has pushed UK firms to divert their exports flows from EU to extra-EU markets. This effect is not only self-contained in relation to the referendum event, but consists of an anticipatory effect pre-referendum, which grows in magnitude after the surge in uncertainty following the triggering of Article 50 in March 2017 and the following snap general election. The effect of Brexit policy uncertainty is most pronounced upon the products that would face an increase in tariffs under a no-deal scenario, moving from a zero tariff to a most-favoured nation (MFN) duty. In this regard, policy uncertainty has particularly affected micro and small exporter firms, who are significantly more exposed to the potential tariff threat. Interestingly, trade diversion to extra-EU markets has not been homogeneous across destinations, but has been more prominently directed towards emerging economies, such as the BRICS (Brazil, Russia, India, China and South Africa) countries and the Commonwealth nations, presumably because of their rapid economic growth, market potential and previous colonial and institutional ties.

Our study is related mainly to three different strands of literature: the links between trade policies and trade diversion, the effects of policy uncertainty, and finally the growing body of literature focusing on the effects of Brexit. A first strand of the literature has investigated how trade policies can give rise to trade diversion, where trade flows diverge from the equilibrium of relative prices and quantities of varieties exported to different markets, due to the imposition of new trade policies (Frankel 1997). Trade diversion occurs when the implementation of a trade policy causes trade to be diverted

from one (second) country to another third country, despite the fact that were these countries treated equally, the original trade partner would be the low cost source of import or the preferred export destination, following comparative advantage or gravity models predictions (Clausing 2001). Most of the studies in this literature have mainly focused on the trade diversion effects of two different kinds of trade policies, preferential trade agreements (PTAs) (Clausing (2001); Romalis (2007), among others) or trade defence instruments, such as anti-dumping and anti-subsidies measures (Prusa 2001, Konings et al. 2001, Bown & Crowley 2007, Vandenbussche & Zanardi 2010, Egger & Nelson 2011, Cohen-Meidan 2013, Besedeš & Prusa 2013). Overall, these studies show how trade policies could lead to imperfect substitution across trade flows, increasing prices from equilibrium levels, and imposing significant externalities on the trade flows not directly targeted by trade policies.

Secondly, several recent papers have highlighted the role played by less directly observable factors related to trade policies, such as expectations, anticipation and uncertainty. Freund & McLaren (1999) They provide evidence that trade flows adjust in anticipation of trade agreements, as lately theoretically formalised by Handley & Limão (2017), distinguishing between the effect of anticipation and that of policy uncertainty. Regarding policy uncertainty, a recent study by Osnago et al. (2015) finds that the effect of trade policy uncertainty could be equivalent to a tariff increase, while other authors have also claimed that trade agreements play a major role in reducing policy uncertainties (Handley & Limao 2015, Carballo et al. 2018). However, we still know little about the specific impact of trade policy uncertainty on trade flows diversion.

Finally, since the Brexit referendum delivered a somewhat unexpected outcome favouring Britain leaving the EU (Breinlich et al. 2017), a growing literature has started analysing its effect on the UK economy. A first group of studies have modelled *ex-ante* the Brexit economic effect and its macroeconomic cost, predicting a reduction in trade

and GDP growth in multiple scenarios (Born et al. 2017*a*, Dhingra et al. 2017, Sampson 2017). Secondly, several papers have analysed the first effects of the Brexit referendum, finding evidence of a reduction in UK living standards as a consequence of the related significant exchange rate pass-through (Kren 2017, Breinlich et al. 2017), of negative reactions to stock market fluctuations in certain industrial sectors (Ramiah et al. 2016), and showing the impact on firms financing decisions (Berg et al. 2017).

More focused on the effect of Brexit on trade, Douch et al. (2018*a*)we test the policy uncertainty effects of the Brexit announcement on UK exports and imports of goods. Then we look at the announcement effect on the aggregate imports and exports (trade creation) and on the direction of imports and exports (trade diversion), finding that UK aggregate exports have been lower than predicted for both the UK-EU and the extra-EU trade flows. Similarly, Graziano et al. (2018)we model how the increased probability of UK exit from the EU reduces bilateral export values and trade participation, finding heterogeneous effects of trade policy uncertainty across products and the asymmetric shocks between the UK and EU exporters. Closely related to our paper, Crowley et al. (2018) study the effect of renegotiating a trade agreement on firms' entry/exit decisions in export markets, using Brexit as a natural experiment. They find evidence that the export entry (exit) rate in 2016 would have been 5.1% higher (3.0% lower) if the UK firms exporting to the EU had not faced increased trade regulation uncertainties after June 2016. Previous studies have shown that the high uncertainties brought about by the Brexit process have affected investment and other business decisions, prompting firms to alter their exporting plans and strategies. However, these adjustments may occur in changing export decisions, reconsidering the introduction of new products or in the exploration of new markets, thus leading not only to changes in export participation and total export volume, but also changes in products exported and the destination markets for exports. The aim of this paper is to investigate in greater detail these phenomena.

The rest of the paper is structured as follows. In the next section we summarise the Brexit process and present the context regarding our study. In Section 3 we present the data used and outline our methodological approach. Section 4 discusses the empirical results and presents tests to verify the validity of our analysis. Section 5 concludes by suggesting related policy implications.

2 Brexit: A Trade Policy Uncertainty Case Study

This section outlines the Brexit process up to mid-2019. The purpose of this account is to demonstrate the unpredictable nature of the Brexit referendum outcome and the fact that the consequences of Brexit for future trade relationships still remained largely uncertain post-referendum. The withdrawal process of the United Kingdom from the European Union, commonly known as Brexit, can be tracked back to the 2015 UK General Election campaign when the Conservative Prime Minister (PM) David Cameron announced an in-or-out referendum on EU membership, based on a renegotiated package of concessions,to take place before 2017. After winning the election in 2015 with a working majority, the Conservative government introduced the European Union Referendum Act to enable a referendum to be held in 2016, and started a negotiation process with the EU in order to reform the UK's EU membership, specifically regarding the protection of single market access for non-Eurozone countries, the reduction of "red tape" regulations, the exemption of Britain from aspirations to "ever-closer union", and the restriction of immigration to the UK from the rest of the EU.

After the outcome of the renegotiations was announced in February 2016, the Prime Minister announced the date for the referendum, the 23rd of June 2016, supporting as positive the outcome of the negotiations with the EU, and indicating his intention to campaign in favour of remaining in a reformed EU. This started a tense political campaign, "Remain" versus "Leave", open to every possible outcome, which led to

a growing uncertainty regarding the referendum outcome, the government's strategy vis-a-vis EU membership and the country's position in the customs union. There were substantial variations in the opinion polls in the months immediately preceding the referendum, with large swings in the polls particularly around key events (Graziano et al. 2018), although the "Remain" side had maintained a relative margin ahead of the "Leave" campaign up to the day immediately before the referendum. On the 23rd of June 2016, the referendum delivered an outcome of 51.9% of British voters in favour of the UK leaving the European Union, against the predictions of opinion polls and experts. Arguably, the outcome was widely regarded as a surprise.[2]

Although legally the referendum was non-binding, the government of that time had promised to implement the result. The Prime Minister (PM) David Cameron having campaigned to remain, resigned after the result, adding to the already mounting policy uncertainty. Following a leadership contest, the newly elected PM Theresa May constructed a new government and started the discussions to begin the process for the UK's withdrawal from the EU. Subsequently, the government initiated the official EU withdrawal process by triggering Article 50 of the EU Lisbon Treaty on the 29th of March 2017, meaning that the UK was due to leave the EU within two years unless this was extended. The purpose of the triggering was also to notify the European Council of the decision to "negotiate and conclude an agreement with the leaving State, setting out the arrangements for its withdrawal, taking account of the framework for its future relationship with the Union".[3] This however has not been a linear process, given the polarised opinions between "Leave" and "Remain" supporters within the UK gov-

[2]Anecdotal evidence about the mismatch between expectations and actual results in the UK and elsewhere can be found in several newspaper articles published in the days following the Brexit referendum such as in the New York Times (https://www.nytimes.com/2016/06/25/upshot/why-the-surprise-over-brexit-dont-blame-the-polls.html), on BBC News (https://www.bbc.co.uk/news/world-europe-46892422) or in the Economist (https://www.economist.com/graphic-detail/2016/06/24/who-said-brexit-was-a-surprise).

[3]Consolidated version of the Treaty on European Union, Title VI - FINAL PROVISIONS, Article 50, OJ C 326, 26.10.2012: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12012M050.

ernment, and the constitutional disputes about the procedure to be followed between Parliament and Government. Businesses and the rest of the country were in a state of increasing confusion and uncertainty about the future relationship with the EU for almost 9 months after the Brexit referendum.

Further, the negotiations with the EU did not start until 19 June 2017, primarily because of the decision by the PM Theresa May in April to announce a snap general election to take place on the 8th of June, confident of securing a fresh and stronger mandate for a new government with a larger majority to negotiate with the EU. However, the result of the election was the loss of a majority for the Conservative Party in the House of Commons, leading to a minority government, supported by the Democratic Unionist Party of Northern Ireland, which was pushing for a harder version of Brexit. The following political turmoil has provoked more uncertainties regarding the future relationship with the EU bloc. Even though the UK Parliament approved a Withdrawal Act in June 2018 and a draft Withdrawal deal was agreed by the May government and the EU in November 2018, this deal had not been passed by the UK Parliament by the deadline of the 29th of March 2019, with the likely exit date further extended to the 31st of October 2019.

This brief summary explains how throughout the period since the Brexit referendum, firms had to face a high degree of uncertainty around future trade policies between the UK and the EU in the post-Brexit era. As the media often claims, while anything is possible, nothing seems likely. Hence, the unpredictable nature of the Brexit process provides an excellent opportunity to study the effects of policy uncertainty on trade diversion.

3 Data

The empirical analysis is mainly based on the HMRC Overseas Trade Statistics (OTS) database containing the universe of international trade transactions carried out by UK firms. The HMRC OTS database reports all import and export transactions monthly between the UK and the rest of the world, including information about the value and quantity of transactions, the HS 8-digit classification and the country origin of imports or destination of exports. The dataset includes monthly records for all UK firms trading with a value of more than £250,000 in a given year with other EU countries, and all transactions with extra-EU countries.[4] For the purposes of our analysis, we focus on export transactions during the period of January 2012 to December 2017, aggregated at the quarterly level in our baseline analysis to avoid the high and frequent fluctuations.[5]

To analyse the effect of policy uncertainty on the diversion of trade flows following the Brexit referendum, we differentiate between export flows towards intra-EU and extra-EU countries, calculating for each firm and quarter both measures of intensive and extensive margins of trade towards these two destinations. First, we measure the intensive trade margin as the total value of exports towards intra and extra-EU markets. Secondly, we build several measures of extensive trade margins, particularly focusing on the overall number of transactions (product-destination combination), the numbers of products exported and countries served, the number of new transactions, new products shipped and new destinations accessed both within and outside the EU.[6] Overall, we

[4]Comparisons with official statistics indicate that the £250,000 threshold captures up to 98% of the total value of UK exports to the EU. As a robustness test, we have also limited the extra-EU transactions to be only for firms trading with a value of more than £250,000 in a year with extra-EU countries. Results are robust and available upon request.

[5]In order to carry out our analysis and to compare intra- and extra-EU export flows, we have performed several data management tasks. First, we have harmonized all the extra-EU trade flows to a unique trade term, the *Ex Works* (EXW) term, in order to make it comparable with the flows internal to the Customs Union. Secondly, we have aggregated the export flows at the firm, destination and HS 6-digit level, since the 6-digit codes are the most detailed definitions that are used as common standards across all countries. We also test the robustness of the key findings when observation frequencies are at monthly and semester level. See more details in the Robustness Checks Section.

[6]We define a transaction, product or destination as "new" if it appears in a firm's records for the

have detailed information about 339,493 quarterly export transactions carried on by more than 26,000 UK exporters during the period between 2012 and 2017.

[Table 1 about here]

Table 1 compares the summary statistics of different margins of trade flows to intra- and extra-EU destinations before and after the Brexit referendum. Most calculated trade margins in the broad intra-EU and extra-EU markets have increased in the post-Brexit referendum period, including the quarterly number of trade transactions, the number of products, the number of destinations both for existing products and new products. However, the total quarterly exports have decreased in intra-EU markets noticeably, while the extra-EU ones kept growing. This is early evidence of a subtle shift from the existing major EU trade destinations to extra-EU markets.

To detect trade diversion in export flows from intra-EU towards extra-EU markets over time, we build double-difference measures $\Delta ln(y_{iq})$ for all the trade margins y considered, where we compared the change in the growth of export flows to EU and to $extra-EU$ markets (first difference) in respect to the same quarter one year earlier $q-4$ (second difference) for each firm i and quarter q:

$$\Delta ln(y_{iq}) = \Delta ln(y_{iq}^{EU}) - \Delta ln(y_{iq}^{extra\text{-}EU}) \tag{1}$$

where in the above equation the two terms $\Delta ln(y_{iq}^{EU})$ and $\Delta ln(y_{iq}^{extra\text{-}EU})$ represent the logarithm of four-quarter difference for intra-EU and extra-EU export flows of firm i at quarter q. This design allows us to compare the post-referendum trade patterns with those in the same period a year earlier, by comparing the yearly growth in export flows for each quarter between flows affected or not affected by the Brexit-related trade policy uncertainty:

first time since 1997, when the HMRC OTS database started.

$$\Delta ln(y_{iq}^{EU}) = ln(y_{iq}^{EU}) - ln(y_{iq-4}^{EU}) \tag{2}$$

$$\Delta ln(y_{iq}^{extra\text{-}EU}) = ln(y_{iq}^{extra\text{-}EU}) - ln(y_{iq-4}^{extra\text{-}EU}) \tag{3}$$

Figure 1 considers the dynamic evolution of these double-differences, firstly reporting separately in the left-hand side diagram the average yearly growth in intra-EU and extra-EU export values for UK firms between quarters 2012-Q1 and 2017-Q4. The trends highlighted from Table 1 are corroborated in this analysis as well. In particular, since the beginning of the period examined, there has been a parallel downward trend in the growth of both intra and extra-EU exports by value between 2012-Q1 and 2015-Q4. However, after a sharp growth in both flows in Q1 2016 compared to one year earlier, the two trade flows have followed divergent paths from Q3 2016 onward, after the Brexit referendum decision in June 2016. This trend is even more evident when focusing on the net double-difference between the two growth trends over the same time period depicted in the diagram on the right-hand side. We can clearly observe that up to Q2 2016 intra-EU quarterly exports were decreasing less rapidly than the extra-EU flows, hence the positive slope of the curve up to that point. However, the trend has sharply reversed after the Brexit referendum, when extra-EU exports have kept on growing while intra-EU flows have decreased significantly.

[Figure 1 about here]

4 Methodology

In order to identify the causal effect of trade policy uncertainty on the diversion of export flows, we start by estimating a benchmark specification employing a difference-in-difference strategy by regressing the difference in the growth of trade margins to the

intra- and extra-EU markets before and after the Brexit referendum:[7]

$$\Delta ln(y_{iq}) = \beta_0 + \beta_1 Brexit + \beta_2 ln(Size_{it-1}) + \beta_3 ln(y_{iq-4}) + \beta_4 \Delta(Ex.Rate_{iq}) + \gamma_i + \gamma q + \gamma_{ht} + \varepsilon_{it} \tag{4}$$

where $\Delta ln(y_{iq})$ represents the double-difference between the change in the growth of export margins to EU and to $extra-EU$ markets with respect to the same quarter one year earlier, considering both intensive and extensive margins of trade. The variable $Brexit$ is a dummy taking the value equal to 1 from Q3 2016 onward and 0 otherwise. $ln(Size_{it-1})$ is the log value of firm i's total exports in the previous year $t-1$, included to proxy the overall size and productivity of the firm. The size effect is controlled for, assuming that large exporters usually tend to be highly productive multi-product firms (Mayer & Ottaviano 2008). In addition, we control for firm i exposure to exchange rate fluctuations $\Delta(Ex.Rate_{iq})$. In fact, it is possible that the Brexit referendum might have affected trade diversion not only through an increase in trade policy uncertainty, but also by stimulating sharp fluctuations in exchange rates between the GBP and other major foreign currencies. As a matter of fact, the immediate impact of the referendum was a depreciation in the value of sterling which fell by 15% against a trade weighted basket of currencies, and in particular vis-a-vis the Euro. This depreciation made foreign imported products more expensive, affecting inflation and living standards in the UK as demonstrated by Breinlich et al. (2017), but it might have boosted UK exporters' performance in international markets by reducing the cost of their goods for foreign buyers. To disentangle the effect of policy uncertainty from other sources of impacts, we create a firm-level measure of exposure to exchange rate fluctuations given by the difference in the export share weighted average exchange rate between sterling and all the foreign currencies included in the exporter's basket of goods exported in the previous year, i.e. between quarters q and $q-4$:

[7] Tables in this paper report the results estimated with an OLS model, since the dependent variables are the double-log-difference of several trade margins. As a robustness test, we have replicated the results for the extensive margins specifications, using Poisson maximum likelihood (PPML) and Negative Binomials models for counting double-differences. Results are robust and available upon request.

$$\Delta(Ex.Rate_{iq}) = log\left(\frac{\sum_c w_{icq} ex_{cq}}{N_{iq}}\right) - log\left(\frac{\sum_c w_{icq-4} ex_{cq-4}}{N_{iq-4}}\right) \quad (5)$$

where ex_{cq} is the average exchange rate between British Sterling and currency c denominated in each trade transaction, derived from the IMF monthly Exchange Rate Archives. Furthermore, w_{icq} is the share of export flows denominated in currency c over the total exports of firm i in quarter q, while N_{iq} is the number of export transactions denominated in different currencies for firm i at time q.[8] Finally, we include firm γ_i, quarter γ_q, and product-year γ_{ht} fixed-effects in order to eliminate any residual firm-specific time-invariant unobservable variability, quarter-specific macro shocks, and any product-specific time trends which could bias our estimation.[9]

Starting from this initial benchmark model, we develop more advanced specifications in order to further disentangle the impact of Brexit-related policy uncertainty on trade flows, analysing its heterogeneous effects across different products and exporters, and in order to identify the direction of the trade diversion. First, we try to estimate the effect of trade policy uncertainty on trade diversion at a very granular observational level, modelling the Brexit-induced uncertainty as a dynamic process rather than a single event. As discussed in Section 2, the referendum result increased the likelihood of a change in trade regime, but the specific changes in policy and their timing remained uncertain. We argue that the perception of uncertainty about future trade relations between the UK and the EU has not been homogeneous during the two periods before and after the referendum, but has dynamically evolved following the political decisions and strategies made by the UK Government at different points in time. For instance, Graziano et al. (2018) have modelled how the increase in the probability of UK exit

[8]From the HMRC OTS database we know the denominated currency for all the extra-EU transactions. For the intra-EU transactions, we assume that the currency used is the Euro for Eurozone countries and the destination country local currency for all other non-Eurozone EU countries.

[9]For each firm we build a product dummy corresponding to the HS 2-digit category accounting for the largest share of its annual total exports.

from the EU has reduced bilateral export values and trade participation, using data about daily-frequency variations in the average price of contracts predicting the referendum outcome. Therefore, we model Brexit as a dynamic process hinged on three main events which have significantly increased the likelihood of the UK leaving the EU: first, the announcement of the date of the referendum made by the PM in the first quarter of 2016 after the end of the re-negotiations with the EU; secondly, the Brexit referendum taking place at the end of the second quarter in 2016; and finally the triggering of Article 50 made at the end of the first quarter of 2017, marking the beginning of the formal process of exiting the EU. In this way, we would be able to better track the impact of an increasing trade policy uncertainty on the diversion of British exporters' trade flows.

Secondly, we investigate the heterogeneous effect of trade policy uncertainty across the distribution of British exporters, differentiating exporters by size. The increased instability could have affected differentially firms with different resources and capabilities to react to external shocks. This is particularly true for micro and small firms, which are usually constrained in adjusting their production in response to international shocks, and are heavily reliant on fewer and smaller trade flows to geographically and culturally proximate markets (Shoag & Veuger 2016). Thus we categorize firms into micro, small, medium and large based on their proportion of exports in the distribution of all exporters. The firm's relative position in the overall distribution was used to provide a proxy for the overall size and productivity of the firm, assuming that more productive firms are more likely to export, and that large exporters are usually larger and more productive multi-product firms (Mayer & Ottaviano 2008).

Third, we identify the heterogeneous effect across different product categories, based on the potential product-specific tariff-threat under a no-deal scenario. In fact, not all products might be affected homogeneously by trade policy uncertainty, since for many products very little would change between the current EU customs union regime and

a future different trade agreement. In order to model this, we follow the methodology proposed by Crowley et al. (2018) and measure the level of trade policy uncertainty faced by firms as the weighted average difference between the zero-tariff faced by products exported under the EU customs union regime and the tariff UK products would face if exported under WTO rules applying the EU Most-Favoured Nation (MFN) tariff. Using data on MFN tariffs at the HS 8-digit level applied by the EU from the WB TRAINS database, we differentiate between 4 different categories of products, based on the 4 quartiles of the tariff threats distribution: products with a low potential tariff-threat, medium-low, medium-high and a high threat.

[Figure 2 about here]

Figure 2 clearly illustrates that the exposure of UK exports to EU potential tariff threats is unevenly distributed across industries. The graph on the left hand side shows that UK products would be potentially exposed to particularly high tariff threats from the EU in the agriculture and food industries, chemicals, minerals and metals industries, and as well as the textile and footwear sectors. Also around 30% of the products in the transport equipment manufacturing industry would face a very high risk of potential tariff threats. In addition, the diagram on the right-hand side shows that the potential tariff threat is not evenly distributed across UK exporters, but would particularly affect micro and small exporters, who are significantly more exposed to the potential tariff threat. There are at least two facts that help explain the vulnerability of smaller exporters facing trade policy uncertainties. First, micro and small exporters usually rely on very few export transactions and would not be able to diversify this risk as large multi-product firms would be able to do. Second, small and less productive exporters dominate in mature manufacturing sectors, which are more prone to potential tariff threats. Thus, moving from a zero-tariff regime to a MFN trade regime would have disproportionate effects on exporters of different sizes, and therefore should be expected to push micro and small exporters to divert towards alternative trade destinations.

Finally, we further investigate the direction of trade diversion by attempting to find regularities in the diversion among extra-EU destinations. In particular, we follow the key principles identified in trade gravity models (Anderson & Van Wincoop 2003, Head & Mayer 2002, Head et al. 2010), considering geographic euclidean distance from the UK, destinations, population size and average income per-capita, obtained from the CEPII Gravity database. In addition, we distinguish between export flows towards 3 main groups of extra-EU destinations: countries who are members of the Commonwealth, with whom the UK maintains a privileged relation as the former colonizer[10], the BRICS group of emerging economies (Brazil, Russia, India, China and South Africa), and the group of rich extra-EU countries part of the OECD[11]. In this way, we will be able to understand where UK exporters are diverting their export flows to, and in doing so, if exporters are defying the predictions of the traditional trade gravity models that bilateral trade flows are determined by economic size and geographic distance between two countries (Anderson & Van Wincoop 2003).

In addition, to test the validity of our main results, we have performed several robustness tests and additional estimations, as reported in Tables A.1-A.9 in the Appendix. First, we have performed our analysis using different data frequencies, initially exploiting as much as possible the granularity of the data at the monthly-level and then testing the noise of high-frequency data when collapsing the analysis to the semester level. Second, we have tested the validity of our results by taking into account longer lags to calculate the growth rate in trade flows, considering up to 2 years' growth. Third, we have taken into consideration additional gravity measures to better identify

[10]The Commonwealth includes 53 extra-EU members across 4 continents: Botswana, Cameroon, Gambia, Ghana, Kenya, Kingdom of Swatini, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Seychelles, Sierra Leone, South Africa, Uganda, Tanzania, Zambia, Bangladesh, Brunei, India, Malaysia, Pakistan, Singapore, Sri Lanka, Antigua, Bahamas, Barbados, Belize, Canada, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, St Kitts and Nevis, St Vincent and The Grenadines, Trinidad and Tobago, Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

[11]This group includes the following extra-EU countries: Canada, Chile, Iceland, Israel, Japan, Korea, Mexico, New Zealand, Norway and the United States.

the direction of the trade diversion, looking at countries with similar legal system or language, countries with whom the EU has an FTA in force, alternative measures of distance weighted by economic size of the main cities, or taking into account specific countries singly for their importance as trading partners with the UK. Finally, to check that our results are not picking up a more general trend taking place during the same period but completely unrelated to the Brexit process, we perform several falsification exercises in which we fictionally and randomly assign the different Brexit treatments at different points in time between 2012 and the beginning of the Brexit process in 2016.

5 Results

5.1 Baseline Specification

Table 2 reports the results of our benchmark model specified in eq(4). We use a fixed effect model with time, exporter and product-trend fixed effects to control for unobserved heterogeneity. Specifically, a number of model specifications of alternative trade margins are reported, with $\Delta ln(y_{it})$ being the growth of firms' total exports value, total number of products exported and total number of destinations served on a quarterly basis in columns (1)-(3), or the growth in the overall numbers of new products introduced and new destinations in columns (4)-(5).

[Table 2 about here]

Overall, the results show that the Brexit referendum has negatively affected UK exporters' intensive and extensive margins of trade at the transaction level. This provides new evidence of the negative impact of Brexit on UK exports, beyond the typical ways of identifying the entry-exit probability for UK firms in relation to exporting, as highlighted in previous studies (Crowley et al. 2018). Furthermore, our results show

consistent trade diversion effects towards extra-EU markets. This result holds robust with the inclusion of several control variables, including the lag of exporter size defined by its annual exports value, the lagged level of the dependent variable, a weighted average exchange rate fluctuation exposure, and a battery of fixed effects to eliminate any unobserved effects. More specifically, the Brexit referendum dummy variable highlights that on average UK traders have diverted about 9% of their export values from EU countries towards non-EU countries in the post-Brexit referendum period. In comparison, about 2.54% and 2.86% of the total number of products and destinations have been diverted to extra-EU markets. Further, around 1.15% and 0.9% of new products exported and new export destinations were diverted by an average UK trader each quarter, from EU markets to extra-EU ones.[12]

These results identify UK firms' responses to the perceived potential threat of future trade barriers between the UK and the EU. Indeed, through several indicators of firm's trading patterns, the evidence shows a clear picture of trade diversion from EU markets that are perceived as riskier than before, to extra-EU markets with more stable trade regimes, and thus less volatility and risk. However, this can also be interpreted as a strategy of UK exporters to diversify their risk by exploring new opportunities outside the traditional EU markets. Put differently, the motivation of the trade diversion patterns we observe could be risk-minimising or forward-looking investment. Overall, these results support the predictions of previous theoretical studies on the effects of policy uncertainties on trade relationships at the transaction-level, highlighting the impact on different margins of trade (Limão & Maggi 2015, Handley & Limão 2017).

Testing the effect of Brexit-induced uncertainties as a dynamic process rather than a single event, we consider as an alternative some sequential events related to Brexit. The results above consider only the exogenous Brexit referendum shock as the main

[12]The results for the overall number of transactions, as well as for the number of new transactions, are in line with these figures and are available from the authors upon request.

variable of interest. However, the perception of uncertainty about future trade relations between the UK and the EU has not been homogeneous within the two periods before and after the referendum. Instead, it has dynamically evolved with the political decisions and strategies made by the UK Government at different points in time. For this reason, we model Brexit as a dynamic process, hinged on three main events which have significantly increased the likelihood of the UK leaving the EU: first, the announcement of the date of the referendum made by the Prime Minister in the first quarter of 2016 after the end of the re-negotiations with the EU; secondly, the Brexit referendum taking place at the end of the second quarter in 2016; and finally the triggering of Article 50 at the end of the first quarter of 2017, marking the formal process of exiting the EU (Handley & Limão 2017). Figure 3 reports the impact of these major events in the Brexit process on the different trade margin variables.

What emerges from these results is that the Brexit referendum announcement did not cause trade diversion. On the contrary, it is possible to notice that immediately after the referendum announcement, UK exporters experienced a sharp increase in exports to EU markets relative to extra-EU markets in the same quarter a year before, even after we account for exchange rate exposure. This is mainly significant in terms of the value of exports to the EU, increasing almost 10% faster than to extra-EU markets. We consider this as an anticipation effect by UK exporters and their EU trading partners: anticipating their orders for existing trade flows before the potential increase in uncertainty following the referendum decision. Next, reflecting the results discussed above in Table 2, the Brexit referendum led to a larger deviation towards the extra-EU especially in terms of total number of products and the number of destinations served. It is also the case when looking at the introduction of new products, but not for number of destinations of the new product introduction. Furthermore, when we turn to examine the effect of the triggering of Article 50 at the end of the first quarter in 2017, an even stronger trade diversion effect to extra-EU countries is noticeable. In fact, across all specifications these effects are consistent and seem stronger than the effects

observed from the Brexit referendum. More specifically, the number of overall products and new products exported shows a clear deviation towards extra-EU markets. This evidence is in line with theoretical predictions from the previous trade policy uncertainty literature. In fact, while immediately after the referendum it was not clear if the UK Government would be following the indication of the referendum, and when the actual negotiations with the EU were to start, the triggering of Article 50 confirmed that the UK would have to renegotiate its trade relationship with the rest of the EU bloc, fixing the departure date for 29 March 2019. This increased likelihood of exiting the EU and uncertainties about the future trade regime with the EU have pushed UK exporters to divert their trade flows away from EU destinations, taking this opportunity to explore new extra-EU markets.

[Figure 3 about here]

5.2 Heterogeneous Analysis

Thus far we have presented the overall estimate of the trade diversion effect assuming it is homogeneous across firms, products and destinations. In this section we analyse the potential heterogeneous effect along different dimensions in order to understand more deeply the impact of trade policy uncertainty on trade diversion.

5.2.1 Exporters size distribution

In Table 3, we show that the Brexit referendum has varied effects across the four quartiles of the size distribution of UK exporters measured in terms of annual exports.

[Table 3 about here]

What becomes clear is that the exporter's size matters. Table 3 shows in particular

that micro and small exporters have seen the largest deviation for all trade margins in favour of non-EU markets. About 45% and 19% of total export values for micro and small firms have experienced a diversion, while medium exporters have experienced a similar pattern but at a lower magnitude. This is the case also when looking at other trade margins. In fact, both for number of products and destinations, micro, small and medium sized exporters have been most affected by Brexit-related uncertainty. Nevertheless, although large exporters have also deviated towards extra-EU markets, this has happened to a lesser extent. In particular, export values towards EU markets have mostly increased for large exporters in relation to extra-EU destinations, probably by their taking up smaller firms' EU export shares; but instead the number of products exported and the number of destinations served have increased at a much faster pace towards extra-EU markets.

Trade policy uncertainty effects might be disproportionately larger for micro and small exporters because these firms are often financially constrained, and do not have the capability of quickly adjusting their production to economic shocks, relying heavily on fewer and smaller trade flows to geographically and culturally proximate markets (Shoag & Veuger 2016). This finding has important policy implications. It sheds light on the type of exporters who are potentially more likely to be affected by trade policy uncertainties and hence might benefit more from public support. Nevertheless, it also highlights that small businesses might seek more secure markets for exports. Thus future trade policies should target mainly small-medium exporters, to help them overcome trade uncertainties which could hinder their export performance, especially towards their traditional export markets.

5.2.2 Potential Tariff Threat

Brexit-related trade uncertainty has not only affected UK exporters differentially by reference to their size, but also across different product categories, especially given the product-specific potential threat of tariff impositions under a no-deal scenario. Therefore, we test if the uncertainty for exporters varies based on the specific products they export, according to differences between the current EU Customs Union zero-tariff regime and the arrangements under a future trade agreement or a WTO-terms deal, as previously shown in the across-industries variation in Figure 2. Using data on MFN tariffs, Figure 4 reports the estimates by quartile of the trade diversion for firms exporting products facing different levels of potential tariff threats, ranging from low to high, in the distribution of potential tariff increases .[13]

[Figure 4 about here]

The results highlight a large and statistically significant deviation, mostly in the middle-upper end of the distribution. This suggests that the trade diversion effects we have observed so far are concentrated mostly on products with a potentially higher risk of facing higher EU tariffs in the future. This effect is pronounced in terms of both the intensive margins, the export value, and the extensive margins, where the number of products exported and the number of destinations served have increased at a much higher rate in relation to extra-EU markets for those products at the top-end of the potential tariffs threat distribution.[14]

Furthermore, when we combine this analysis with the previous dimension of heterogeneity, it also becomes evident that micro and small exporters are mostly affected

[13] In order to build a firm-level measure of exposure to potential tariff-threats, we have calculated the weighted average potential tariff by weighting the potential tariff increase for each product by its share in the firm's total export value.

[14] Results for new transactions show a similar pattern and are available in Table B.3 in the Appendix.

not only because of their size but also because of the kind of products they export. As shown in Figure 2, the exposure to potential tariff threats is not evenly distributed across UK exporters, but is particularly severe for micro and small exporters, who usually rely on very few export transactions, mostly directed towards proximate and easily accessible traditional EU markets, and tend to export mostly mature manufacturing goods which are more exposed to potential tariff threats by the EU, such as agri-food products, textiles and footwear, chemicals and metal products. This is the evidence of a compounding effect of trade policy uncertainty on smaller firms, an effect operating both in respect of size and product mechanisms.

5.2.3 Imports Diversion

Another consideration is whether there is symmetry in trade diversion between exports and imports between the UK and the EU: in other words, whether trade policy uncertainty is also affecting import flows, or if this uncertainty is confined only to UK exports. In particular, we might expect an analogous response by UK importers due to the uncertainty surrounding future trade relations. To investigate this phenomenon, we analyse the impact of Brexit-induced uncertainty on the population of UK importers. What emerges from Table A.8 in the Appendix is that also in the case of total imports there is a clear diversion pattern towards extra-EU origins, with intra-EU imports decreasing by 6.5% after the Brexit referendum. This is similar to the result concerning total exports, although of a smaller magnitude, and similar patterns can be seen across other trade margins, such as the number of products imported, countries of origins and new import transactions.

For instance, the results in Table A.8 highlight that among importers there has been on average a 1.7% deviation in the number of products from extra-EU markets per quarter since the referendum result, but no significant effect in terms of country of

origin. This suggest that the trade policy uncertainty has also affected import inflows, but on a relatively smaller scale than in respect of exports. Furthermore, breaking down these effects by firm size in Table A.9, we show that, even in the case of imports, micro and small firms are those mostly affected by trade policy uncertainty. Indeed, across different model specifications these groups face the highest deviation toward extra-EU markets. This suggests that both exporting and importing firms, in particular micro-to-medium size firms, are facing mounting uncertainties about post-Brexit activity, leading to deviations both in their exports and in import flows, towards far-away countries.

5.2.4 Trade Diversion Direction

What previous results establish is that UK firms have diverted their trade flows away from EU-markets toward extra-EU markets as a consequence of the Brexit-related trade policy uncertainty. Clearly, the diversion from the proximate, bigger, and richer EU markets towards more distant, often smaller and less rich extra-EU markets is an intriguing pattern. This seems to contradict the theoretical predictions of the traditional trade gravity models, which argue for the role of distance and economic mass in shaping the direction of trade and the volume of trade flows (Anderson & Van Wincoop 2003, Head & Mayer 2002, Head et al. 2010). In this section, we further investigate the direction of trade diversion and seek to understand whether the Brexit shock has shaken the traditional features of trade gravity models for UK traders.

We start in Figure 5 by looking at the effect of trade policy uncertainty on the diversion of trade flows in relation to the quartile distribution of extra-EU markets' euclidean distance from the UK, reporting the elasticity by size of exporter. What emerges from these results is that the increase in trade policy uncertainty has led to diversion both in the intensive and the extensive margins and in almost all quartiles of the distance distribution, especially for micro, small and medium size exporters. In particular, mi-

cro and small firms have experienced larger diversion, especially towards further away extra-EU markets, that is those in the third and fourth quartile of distance distribution. The diversion is not statistically significant for countries immediately outside the EU, except in the case of micro exporters, while as noticed before, large exporters keep exporting more to the EU than to extra-EU destinations, probably due to the fact that they have better resources to manage the increased trade policy uncertainty. The pattern is extremely similar in terms of the extensive margins of trade, both for the number of products exported and for destinations served, clearly highlighting a large diversion towards far away non-EU markets.[15]

[Figure 5 about here]

Figure 6 reports the effect of policy uncertainty across the quartile distribution of the extra-EU countries' GDP per capita distribution. It is notable that across all quartiles, and for both the intensive and extensive margins of trade, we find evidence again that mostly micro and small exporters have been largely diverting towards extra-EU countries, in particular towards countries in the third quartile of the distribution, that is upper-middle income countries. Indeed, this effect is consistent both for intensive margins, export value, and transaction extensive margins, both in terms of overall number of products exported as well as the number of destinations.[16] Considering these together, the trend emerging from the gravity analysis shows that trade diversion has occurred mostly towards slightly more distant extra-EU countries, but at the same time towards relatively less risky extra-EU markets, characterized by upper-middle incomes per capita. Thus, following overall the gravity model predictions.

[Figure 6 about here]

[15]The results for number of transactions and new products, destinations and transactions are very similar and reported in Table B.1 in the Appendix.

[16]We report in Table B.2 in the Appendix the corresponding effect on firms' new transactions, and the results are consistent.

Finally, following the previous results of the gravity distribution analysis, in Figure 7 we distinguish between export flows towards three main groups of extra-EU destinations, reflecting the patterns outlined above: Commonwealth countries, the BRICS group of emerging economies, and the group of extra-EU rich countries, part of the OECD club. This exercise allows us to identify more precisely the ways in which diversion occurs. In addition, we test as well whether UK exporters are anticipating potential future trade agreements following the UK's departure from the EU, along with the announcement made by the UK Government about new trade negotiations with distant rich partners, dynamic emerging economies and former colonies.[17]

[Figure 7 about here]

Figure 7 shows heterogeneous results across the distribution of UK exporters, by size. In terms of the intensive margin, micro and small exporters have mainly diverted their exports towards Commonwealth and BRICS countries, and to a lesser extent to other extra-EU OECD countries. On the other hand, large exporters have increased export values most rapidly towards EU markets, as shown before. Nevertheless, when looking at the extensive margins of trade, all categories of firm show clear evidence of diversion towards extra-EU markets, although micro and small exporters remain the main driving force of this diversion. Again, uncertainty-led diversion seems to affect mainly diversion towards Commonwealth and BRICS countries, as shown by previous macro-economic evidence (Douch et al. 2018*a*). This evidence may suggest that UK exporters prefer to direct their trade flows towards former colony countries where the UK may still have historical linkages, or towards emerging economies where the future market access potential could offset some of the current costs of trading. This may

[17]For an overview of the future trade relationships envisaged by the UK Government after leaving the EU, refer to the House of Commons International Trade Committee report (https://publications.parliament.uk/pa/cm201719/cmselect/cmintrade/667/667.pdf), the Department for International Trade strategy (https://www.gov.uk/government/speeches/britains-place-in-the-global-trading-system), or some recent references in the academic debate (Hearne et al. 2019).

also reflect policies and campaigns promoted by the UK Government intended to promote and incentivise exporters to explore new rapidly growing extra-EU markets, as discussed above.

5.3 Robustness checks

We carried out a number of robustness checks and additional tests to validate our findings. First, we checked the robustness of our results against different observational frequencies of our data. To do so, we replicated our benchmark analysis using monthly and semesterly export transaction data. The results in both tables are consistent and statistically significant, reported in Table A.1 and A.3 in the Appendix. The magnitude of the effect of Brexit shock is much larger, suggesting that on a monthly basis deviation might be stronger, and similarly results hold when looking at semester data based regression.

Secondly, following Handley & Limão (2017), suggesting that the period of uncertainty may have started well before the actual Brexit referendum, we replicated our benchmark specification comparing the post-Brexit period with the previous 8 quarters (24 months in the case of monthly analyses) rather than 4 quarters (12 months). Table A.4 in the Appendix reports the results of this alternative specification in line with the findings previously discussed.

Furthermore, we have taken into consideration additional gravity measures to better identify the direction of trade diversion, looking at countries with similar legal system or language, countries with whom the EU has a FTA in force, alternative measures of distance weighted by economic size of the main cities, or taking into account specific countries singularly for their importance as trading partners with the UK. For an additional robustness test, we look at other aggregate groups of destinations - e.g. by

population size, trade agreements or other gravity model variables - as well as at specific individual countries. Results are consistent and available from the authors upon request.

We further consider only a sub-sample of the population of exporters who export both to EU and extra-EU markets, in order to take into account the different thresholds used by HMRC to include exporters to EU and extra-EU markets. This exercise would also eliminate the potential selection bias of very small exporters exporting only to extra-EU markets. Results by using this alternative specification are quantitatively and statistically similar and are available upon request.

In addition, we also consider the possibility that the trade diversion effects may be mainly driven by firms' entry into and exit from the export markets and thus do not reflect the continuing exporters' dynamics. To this end, we test against this hypothesis by examining if the same trade diversion effects remain statistically significant among the firms that always exported over the whole examined period. Using the balanced panel built around these firms, Table A.5 reports results for the almost 18,000 UK traders who, once they started exporting, always traded over the whole remaining period. This alternative specification shows consistent results, identifying that also this sub-sample experienced a trade diversion from EU to extra-EU markets.

Moreover, to check whether our results depend on the number of countries that are within the EU relative to extra-EU countries, we weight the number of destinations and of new destinations served by the total number of available destinations within and outside the EU.[18] The rationale behind this is to correct for the total number of available countries in the two alternative markets, hence correcting our results for potential bias due to the differences in the number of countries available. Nevertheless, Table A.7

[18]In other words, in deriving the Diff-in-Diff in the EU and extra-EU we weight by 27 and 243 as the available destination in each market respectively, before calculating our net Diff-in-Diff ($\Delta ln(y_{it})$).

in the Appendix shows that this specification is also consistent with previous results in Table 3, where micro to medium size exporters experience the highest deviation towards extra-EU markets.

Finally, we check that our results are not picking up a more general trend taking place during the same period but completely unrelated to the Brexit process. For instance, Acemoglu et al. (2016) highlights the requirement of a falsification test when considering a treated group and a control group in a difference-in-difference framework. In order to do so, we perform several falsification exercises in which we fictionally and randomly assign the different Brexit treatments at different points in time between 2012 and the beginning of the Brexit process in 2016. In Table A.6 in the Appendix we report the results of one of these placebo tests, showing that we do not find any significant trade diversion towards extra-EU markets when setting Brexit decisions in 2014, corroborating the validity of our main findings.[19]

6 Conclusions

Building on the current literature on the consequences of trade policy uncertainty (Limão 2016, Handley & Limão 2017, Crowley et al. 2018, Douch et al. 2018*a*,*b*, Born et al. 2017*b*), this study finds strong and robust evidence about the significant impact of trade policy uncertainties induced by Brexit on UK firms' exports. The anticipation of potential future trade barriers has had a significant impact on firms' exporting decisions, even before the final implementation of Brexit. One of our main contributions is to provide detailed granular evidence of the impacts on trade diversion of the threats of sharp reversals of existing trade agreements. Specifically, we show that even the possi-

[19] We have randomly assigned the Brexit shock to various points in time before Q1-2012 and Q1-2016, always estimating insignificant effects. Results of these additional tests are available from the authors upon request.

bilities of the UK-EU trade regime shifts have caused firm's' exports and imports to be diverted away from EU markets to extra-EU markets. The evidence also suggests that the trade diversion effects persisted over the time of the Brexit process and intensified as the risk of a no-deal Brexit grew.

Further, we provide new evidence of the mechanisms through which trade diversion occurs, enriching previous analysis studying firms' entry-exit export patterns. Brexit-induced trade policy uncertainties have had a negative effect on both the intensive and extensive margins of trade, characterised by a decline in UK-EU exports and a rise in the UK-ROW (rest of the world) trade. In particular, trade diversion effects are more pronounced for new products and new market entries. Furthermore, while the overall results are common to all firms, firm heterogeneity plays a relevant role, since smaller traders have been the most heavily influenced by trade policy uncertainties, due to their constrained resources and the reliance on their exporting to closer EU markets of fewer products with a higher threat of potential future tariffs.

The implications of these findings have considerable economic significance. The uncertainties induced by Brexit have proved to have a forceful impact on exporters in a number of ways. The evidence presented in this study suggests that UK firms have been diverting from nearby, larger and similar trading partners to further away, distant and poorer markets. This phenomenon implies that, ceteris paribus, UK firms are likely to face higher costs of exports with increased trading distance - both due to the sunk costs of pursuing new markets and to higher transport costs; reduced profits when dealing with less mature consumer markets; and potentially to experience less learning-by-exporting in relation to less developed markets. This would weaken firms' competitiveness in a highly competitive international market. In the longer term, diverting from advanced supply chain networks linked in in the EU single market would have a severe and long-lasting effect on UK firms, affecting in turn jobs and the pros-

perity of the whole economy.

However, we might interpret UK firms' trade diversion as an opportunity, where firms respond to the shock by exploring alternative markets, such as in emerging economies. In this case, it would become crucial for firms to carefully identify appropriate alternative markets outside the EU, fully understand the risks involved in diverting trade and learn to face the obstacles in reaching new trade destinations. This has important implications for public policies and creates an argument for transitional public support, especially for smaller firms. More specifically, the government and trade-promoting agencies could help firms by providing information and guidance about reaching new trade destinations, but also by easing export administrative processes and by reducing the uncertainties regarding future international trade relationships.

References

Acemoglu, D., Johnson, S., Kermani, A., Kwak, J. & Mitton, T. (2016), 'The value of connections in turbulent times: Evidence from the United States', *Journal of Financial Economics* **121**(2), 368–391.

Anderson, J. E. & Van Wincoop, E. (2003), 'Gravity with gravitas: a solution to the border puzzle', *American economic review* **93**(1), 170–192.

Baker, S. R., Bloom, N. & Davis, S. J. (2016), 'Measuring Economic Policy Uncertainty*', *The Quarterly Journal of Economics* **131**(4), 1593–1636.
URL: *https://doi.org/10.1093/qje/qjw024*

Besedeš, T. & Prusa, T. J. (2013), Antidumping and the death of trade, Working Paper 19555, National Bureau of Economic Research.

Bloom, N. (2009), 'The impact of uncertainty shocks', *Econometrica* **77**(3), 623–685.

Bloom, N. (2014), 'Fluctuations in uncertainty', *Journal of Economic Perspectives* **28**(2), 153–76.

Born, B., Müller, G., Schularick, M. & Sedlacek, P. (2017*a*), 'The economic consequences of the Brexit vote'.

Born, B., Müller, G., Schularick, M. & Sedlacek, P. (2017*b*), '300 million a week: The output cost of the brexit vote', *VOX discussion paper* .

Bown, C. & Crowley, M. (2007), 'Trade deflection and trade depression', *Journal of International Economics* **72**(1), 176–201.

Breinlich, H., Leromain, E., Novy, D. & Sampson, T. (2017), 'The brexit vote, inflation and uk living standards', *CEP Working paper* pp. 1–17.

Carballo, J., Handley, K. & Limão, N. (2018), Economic and policy uncertainty: Export dynamics and the value of agreements, Technical report, National Bureau of Economic Research.

Clausing, K. (2001), 'Trade creation and trade diversion in the canada - united states free trade agreement', *Canadian Journal of Economics* **34**(3), 677–696.

Cohen-Meidan, M. (2013), 'The heterogeneous effects of trade protection: A study of us antidumping duties on portland cement', *Review of Industrial Organization* **42**(4), 369–394.

Crowley, M., Exton, O. & Han, L. (2018), 'Renegotiation of trade agreements and firm exporting decisions: Evidence from the impact of Brexit on UK exports', *Society of International Economic Law (SIEL), Sixth Biennial Global Conference* .

Dhingra, S., Huang, H., Ottaviano, G., Paulo Pessoa, J., Sampson, T. & Van Reenen, J. (2017), 'The costs and benefits of leaving the eu: trade effects', *Economic Policy* **32**(92), 651–705.

Dominguez, K. M. E. & Shapiro, M. D. (2013), 'Forecasting the recovery from the great recession: Is this time different?', *American Economic Review* **103**(3), 147–52.

Douch, M., Edwards, T. & Soegaard, C. (2018*a*), 'The trade effects of the Brexit announcement shock', *Warwick Economics Research Paper Series* **1176**.

Douch, M., Edwards, T. & Soegaard, C. (2018*b*), 'UK services exports in the aftermath of the brexit announcement shock', *Warwick Economics Research Paper Series* **1182**.

Egger, P. & Nelson, D. (2011), 'How bad is antidumping? evidence from panel data', *The Review of Economics and Statistics* **93**(4), 1374–1390.

Frankel, J. (1997), *Regional Trading Blocs in the World Economic System*, Peterson Institute for International Economics.

Freund, C. & McLaren, J. (1999), 'On the dynamics of trade diversion: Evidence from four trade blocs'.

Graziano, A., Handley, K. & Limão, N. (2018), Brexit uncertainty and trade disintegration, Technical report, National Bureau of Economic Research.

Handley, K. & Limao, N. (2015), 'Trade and investment under policy uncertainty: theory and firm evidence', *American Economic Journal: Economic Policy* **7**(4), 189–222.

Handley, K. & Limăo, N. (2017), 'Policy Uncertainty, Trade, and Welfare: Theory and Evidence for China and the United States', *American Economic Review* **107**(9), 2731–2783.

Head, K. & Mayer, T. (2002), *Illusory border effects: Distance mismeasurement inflates estimates of home bias in trade*, Vol. 1, Citeseer.

Head, K., Mayer, T. & Ries, J. (2010), 'The erosion of colonial trade linkages after independence', *Journal of international Economics* **81**(1), 1–14.

Hearne, D., Ruyter, A. D. & Davies, H. (2019), 'The commonwealth: a panacea for the uks post-brexit trade ills?', *Contemporary Social Science* **14**(2), 341–360.

Konings, J., Vandenbussche, H. & Springael, L. (2001), 'Import diversion under european antidumping policy', *Journal of Industry, Competition and Trade* **1**(3), 283–299.

Kren, J. (2017), 'Exchange rates and trade prices after the Brexit referendum', *working paper* .

Limão, N. (2016), Preferential trade agreements, *in* 'Handbook of Commercial Policy', Vol. 1, Elsevier, pp. 279–367.

Limão, N. & Maggi, G. (2015), 'Uncertainty and trade agreements', *American Economic Journal: Microeconomics* **7**(4), 1–42.

Mayer, T. & Ottaviano, G. I. (2008), 'The happy few: The internationalisation of european firms', *Intereconomics* **43**(3), 135–148.

Osnago, A., Piermartini, R. & Rocha, N. (2015), Trade policy uncertainty as barrier to trade, Technical report, WTO Staff Working Paper.

Pierce, J. R. & Schott, P. K. (2016), 'The surprisingly swift decline of us manufacturing employment', *American Economic Review* **106**(7), 1632–62.

Prusa, T. (2001), 'On the spread and impact of anti-dumping', *Canadian Journal of Economics* **34**(3), 591–611.

Romalis, J. (2007), 'Nafta's and cusfta's impact on international trade', *The Review of Economics and Statistics* **89**(3), 416–435.

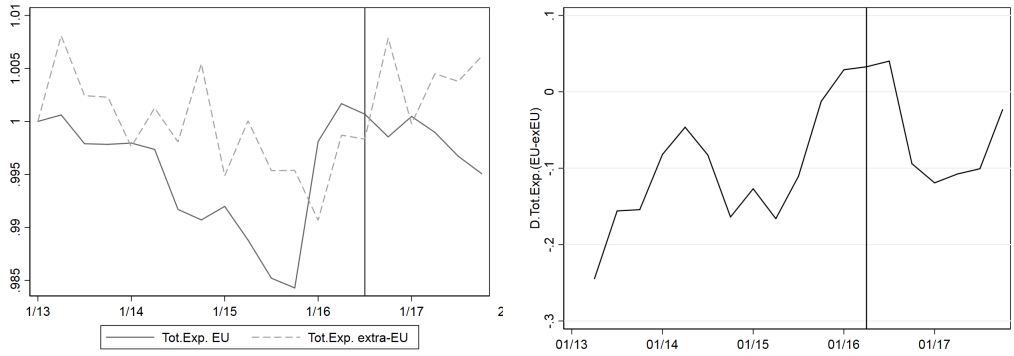
Sampson, T. (2017), 'Brexit: the economics of international disintegration', *Journal of Economic perspectives* **31**(4), 163–84.

Shoag, D. & Veuger, S. (2016), 'Uncertainty and the geography of the great recession', *Journal of Monetary Economics* **84**(C), 84–93.

Vandenbussche, H. & Zanardi, M. (2010), 'The chilling trade effects of antidumping proliferation', *European Economic Review* **54**(6), 760–777.

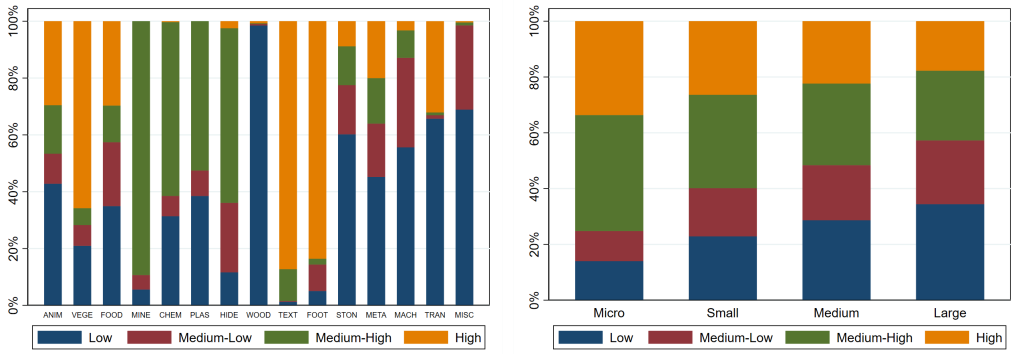
Tables and Figures

Figure 1: Quarterly growth in UK total exports towards EU and extra-EU markets



Note: Elaboration at the quarter-level based on the HMRC OTS database. The diagram on the left-hand side compares the average yearly growth in intra-EU and extra-EU exports flows for UK firms for each quarter between 2012-Q1 and 2017-Q4. The diagram on the right-hand side shows the difference between the two growth trends over the same time period.

Figure 2: Tariff exposure across product categories and exporters size.



Note: Elaboration at the quarter-level based on the HMRC OTS database for the year 2015. Data on MFN tariff schedule for the EU obtained from the WB TRAINS database. Potential tariff threat measured as the difference between the zero-tariff faced by products exported under the EU custom union regime and the tariff UK products would face if exported under WTO rules applying the EU Most-Favoured Nation (MFN) tariff. Low potential tariff-threat, medium-low, medium-high and high threat categories based on the 4 quartiles of the tariff threats distribution. Exporter size categories based on the quartile distribution of firms annual total exports.

Table 1: UK firms export margins to intra and extra-EU destinations before and after the Brexit referendum.

	Pre-Brexit		Post-Brexit	
	mean	sd	mean	sd
Intra EU Exports				
Tot. Exports (£m)	31.110	2,186	24.050	2,344
No. Transactions	105.5	1,684	115.5	1,611
No. Products	13.71	69.91	14.95	71.51
No. Destinations	7.803	6.376	8.027	6.611
New Transactions	3.999	22.68	4.729	27.83
New Products	0.719	3.611	0.899	4.239
New Destinations	0.154	0.506	0.131	0.472
Extra EU Exports				
Tot. Exports (£m)	1.313	26.500	1.351	24.340
No. Transactions	20.87	147.6	21.83	150.5
No. Products	6.729	30.00	6.987	30.43
No. Destinations	6.281	8.124	6.259	8.072
New Transactions	4.030	18.66	4.246	17.97
New Products	1.915	2.142	2.005	2.910
New Destinations	1.226	0.606	1.210	0.581
Annual Tot. Exports EU&extraEU (£m)	121.6	6,830	103	6,630
Annual Tot. Exports extraEU (£m)	5.142	101	5.191	91.310
Annual Tot. Exports EU (£m)	116.5	6,826	97.8	6,627

Note: Statistics at the quarter-level based on the HMRC OTS database for the period 2012-Q1 to 2017-Q4. Variables reported in levels. Total exports expressed in million of pounds. Pre-Brexit considers the period between 2012-Q1 and 2016-Q2, pots-Brexit referendum between 2016-Q3 and 2017-Q4.

Table 2: Effect of Brexit dynamic process policy uncertainity on the trade margins of UK Exporters

Quarterly	(1)	(2)	(3)	(4)	(5)
	Tot. Exports	No. Products	No. Destinat.	New Products	New Destinat.
Brexit Referndum	-0.0873***	-0.0254***	-0.0286***	-0.0115**	-0.00855***
	(0.0218)	(0.00392)	(0.00431)	(0.00473)	(0.00314)
L.Dep.Variable	-0.936***	-0.896***	-0.919***	-1.008***	-1.038***
	(0.00843)	(0.00540)	(0.00617)	(0.00300)	(0.00180)
L.Exporter Size	-0.0802***	-0.00409***	-0.00230**	-0.00893***	-0.00717***
	(0.0163)	(0.00152)	(0.00109)	(0.00189)	(0.000757)
Ex. Rate Exposure	-0.0593**	0.00727*	0.00939*	-0.0281***	-0.00534
	(0.0285)	(0.00393)	(0.00493)	(0.00377)	(0.00427)
Observations	339,493	339,493	339,493	339,493	339,493
R-squared	0.503	0.569	0.536	0.516	0.551
No. Exporters	26,051	26,051	26,051	26,051	26,051
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y

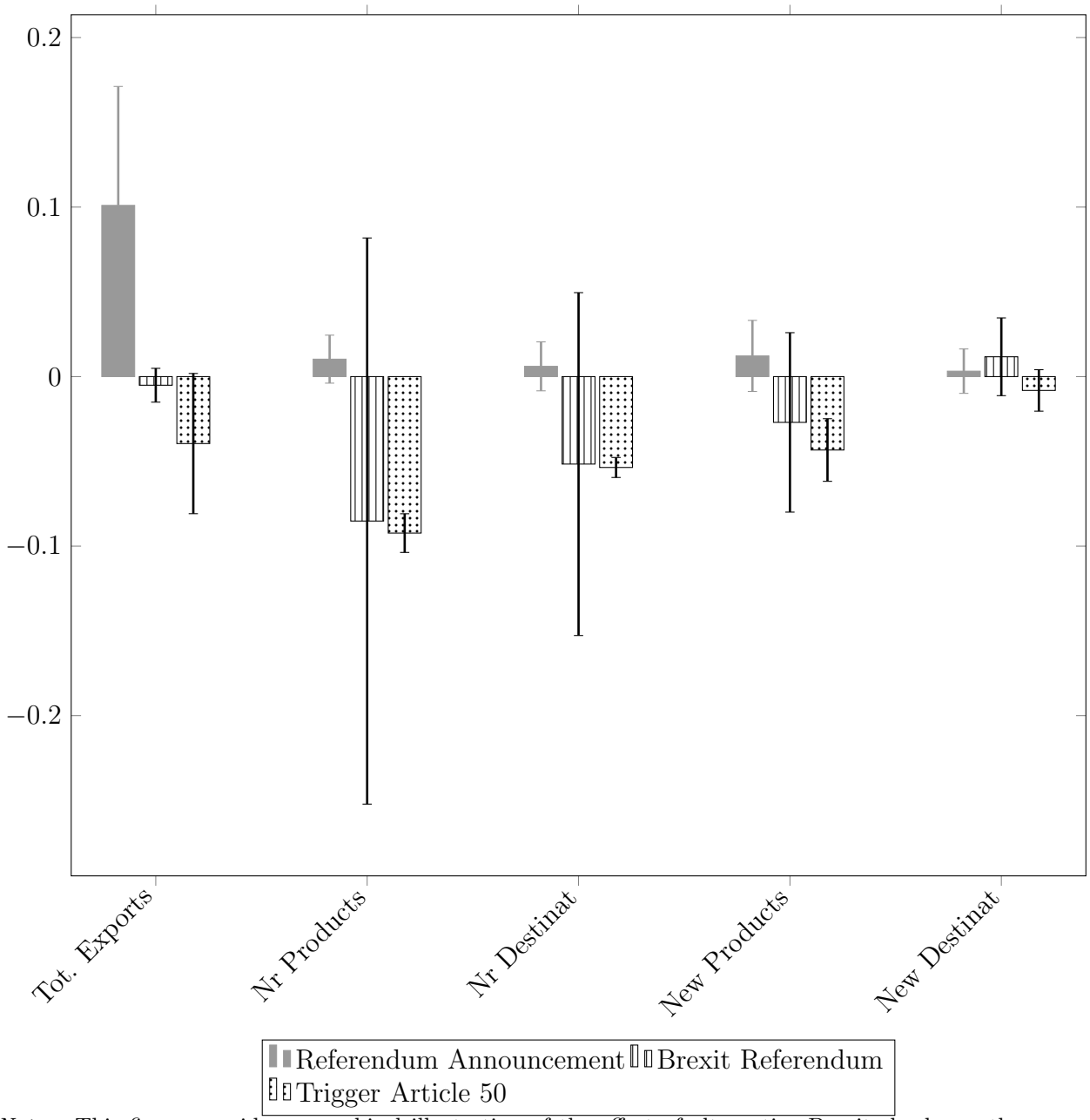
Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. We include a number of fixed effects to control for unobserved characteristics.

Table 3: Heterogeneous effect of Brexit related uncertainty on trade margins across UK exporters' size distribution

Quarterly	(1)	(2)	(3)	(4)	(5)
	Tot. Exports	No. Products	No. Destinat.	New Products	New Destinat.
Micro Exporters	-0.457***	-0.0356***	-0.0454***	-0.0552***	-0.0321***
	(0.0543)	(0.00658)	(0.00569)	(0.00781)	(0.00350)
Small Exporters	-0.189***	-0.0266***	-0.0261***	-0.0517***	-0.0313***
	(0.0341)	(0.00597)	(0.00444)	(0.00926)	(0.00376)
Medium Exporters	-0.0730***	-0.0238***	-0.0291***	-0.0505***	-0.0244***
	(0.0275)	(0.00493)	(0.00427)	(0.00564)	(0.00431)
Large Exporters	0.261***	-0.0184***	-0.0184***	-0.0393***	-0.00855*
	(0.0432)	(0.00556)	(0.00671)	(0.00875)	(0.00479)
Observations	339,493	339,493	339,493	339,493	339,493
R-squared	0.504	0.569	0.536	0.516	0.551
No. Exporters	26,051	26,051	26,051	26,051	26,051
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y

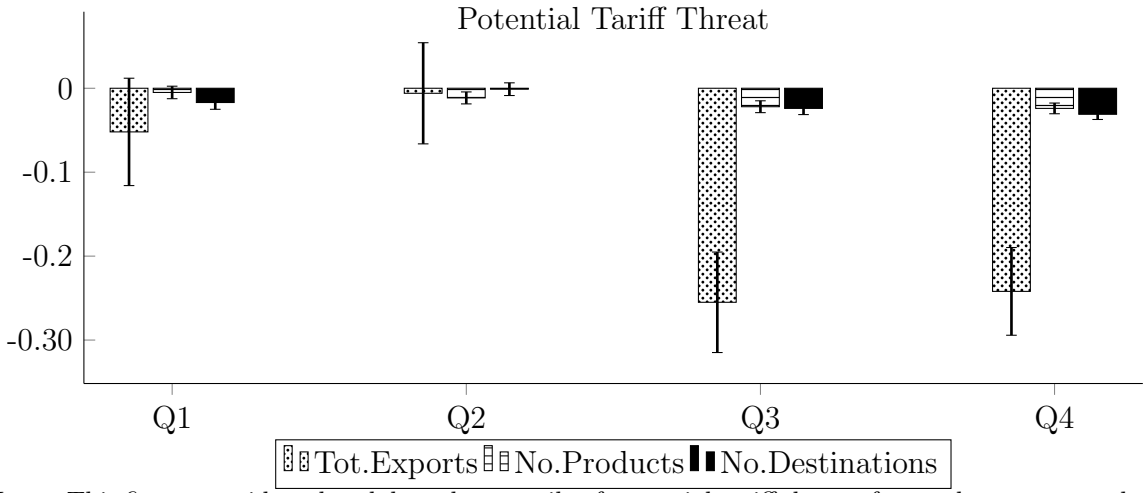
Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. We include a number of fixed effects to control for unobserved characteristics. Furthermore, we break down this effect by firm size (annual export values category).

Figure 3: Effect of Brexit dynamic process policy uncertainity on the trade margins of UK Exporters



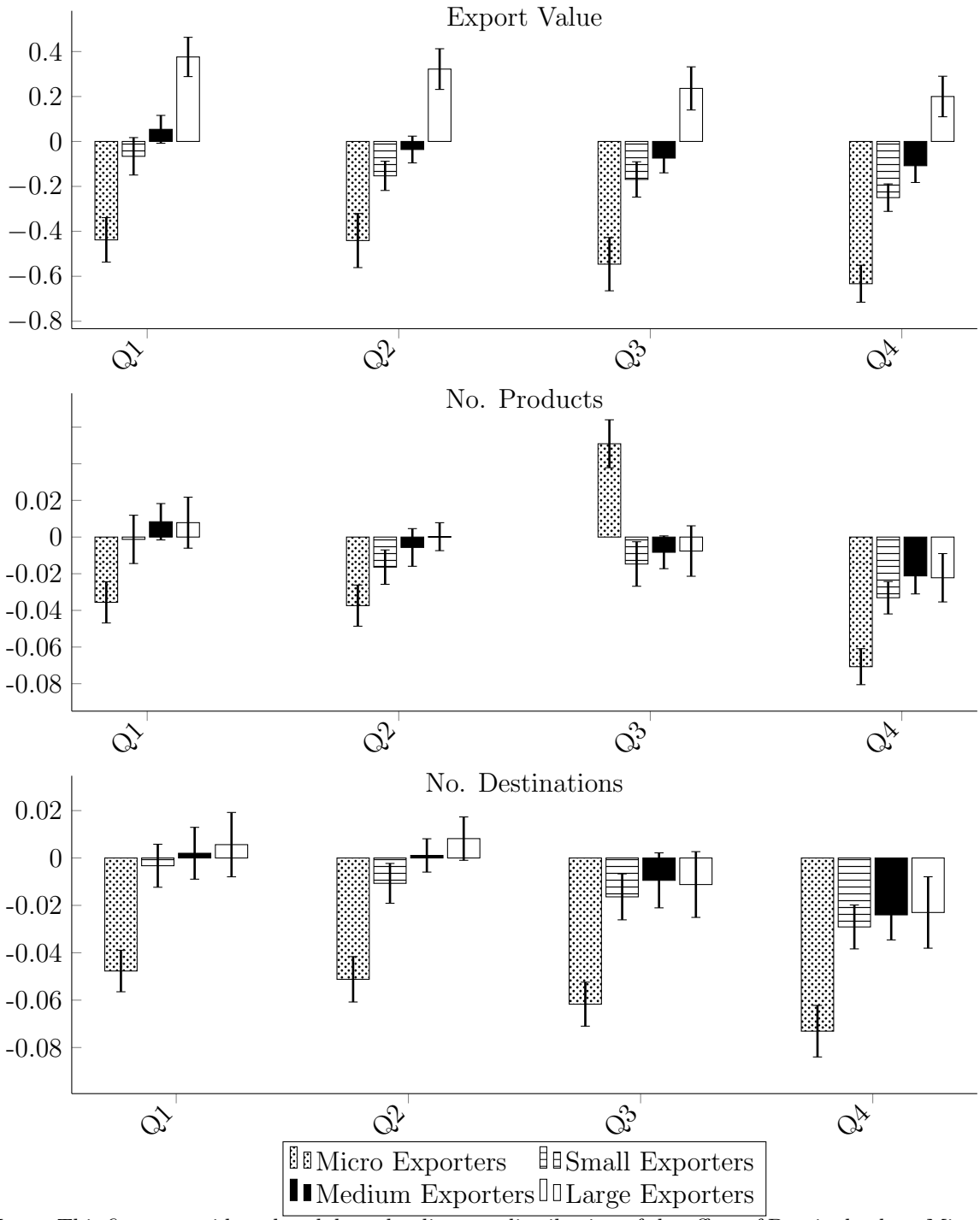
Notes: This figure provides a graphical illustration of the effect of alternative Brexit shocks on the population of the UK exporters. In particular, it shows the effects on total export values, number of products, number of destinations, total new products and total new destinations served. A 95% confidence interval is reported for all exporters types.

Figure 4: Effect by quartile of Potential Tariff Threat



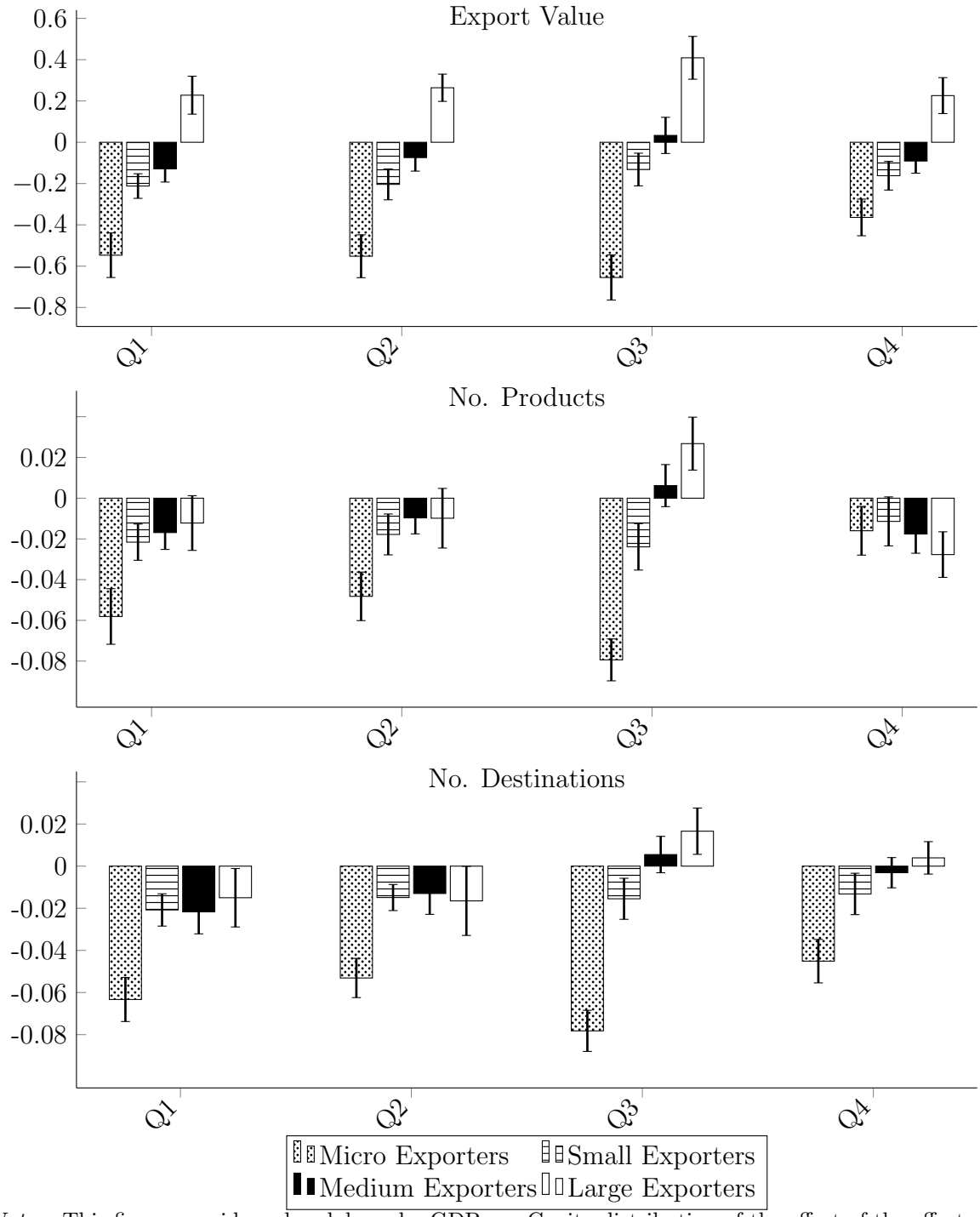
Notes: This figure provides a breakdown by quartile of potential tariff threats for total exports, number of products and number of destinations. A 95% confidence interval is reported for each destination market.

Figure 5: Gravity: Distance effect on Exporters



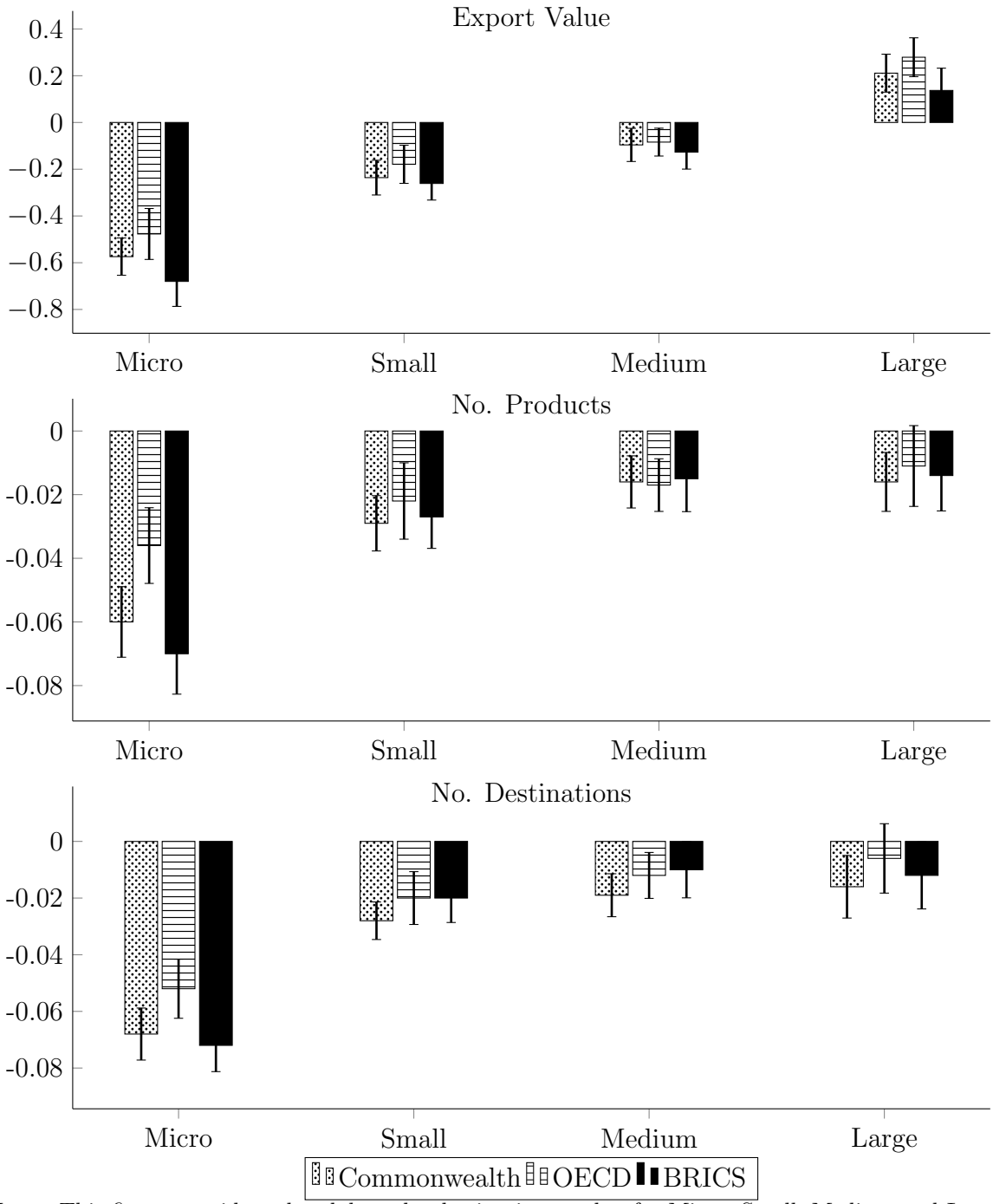
Notes: This figure provides a breakdown by distance distribution of the effect of Brexit shock on Micro, Small, Medium and Large exporters. A 95% confidence interval is reported for all exporters types.

Figure 6: Gravity: GDP per Capita effect on Exporters



Notes: This figure provides a breakdown by GDP per Capita distribution of the effect of the effect of Brexit shock on Micro, Small, Medium and Large exporters. It highlights a trade diversion towards extra-EU markets in all specifications. A 95% confidence interval is reported for all exporters types.

Figure 7: Gravity: Diversion by Export Market



Notes: This figure provides a breakdown by destination market for Micro, Small, Medium and Large exporters. A 95% confidence interval is reported for each destination market.

A Appendix A

Table A.1: The Effect of Brexit Shock on the Population of Exporters, Monthly Diff-in-Diff

Monthly	(1)	(2)	(3)	(4)	(5)
	Tot. Exports	No. Products	No. Destinat.	New Products	New Destinat.
Brexit Referendum	-0.632***	-0.0566***	-0.107***	-0.0510***	-0.0234***
	(0.0350)	(0.00586)	(0.00510)	(0.00501)	(0.00266)
Observations	938,260	938,260	938,260	938,260	938,260
R-squared	0.482	0.441	0.462	0.510	0.563
No. Exporters	25,590	25,590	25,590	25,590	25,590
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. Here we consider our dependent variable, $\Delta ln(y_{it})$, on a monthly basis by using monthly transaction rather than quarterly aggregates. The results highlight trade diversion towards extra-EU markets.

Table A.2: UK firms export margins to intra and extra-EU destinations before and after the Brexit referendum, Semester transactions.

Semester	Pre-Brexit		Post-Brexit	
	mean	sd	mean	sd
Intra EU Exports				
Tot. Exports (£m)	59.670	4,016	46.040	3,246
No. Transactions	202.8	3,290	221.9	3,146
No. Products	15.63	72.89	17.09	75.36
No. Destinations	8.651	6.829	8.885	7.062
New Transactions	7.795	41.07	9.215	49.53
New Products	1.415	6.118	1.772	7.441
New Destinations	0.308	0.780	0.266	0.737
Extra EU Exports				
Tot. Exports (£m)	2.586	50.710	2.666	46.950
No. Transactions	8.077	5.789	8.223	5.876
No. Products	4.112	3.287	4.149	3.33
No. Destinations	4.055	3.186	4.051	3.177
New Transactions	2.98	3.07	3.046	3.161
New Products	1.902	2.177	1.956	2.241
New Destinations	1.284	1.548	1.264	1.526

Note: Statistics at the semester-level based on the HMRC OTS database for the period 2012-Q1 to 2017-Q4. Variables reported in levels. Total exports expressed in million of pounds. Pre-Brexit considers the period between 2012-s1 and 2016-s1, post-Brexit referendum between 2016-s2 and 2017-s2

Table A.3: The Effect of Brexit Shock on the Population of Exporters, Semesterly Diff-in-Diff

Semesterly	(1)	(2)	(3)	(4)	(5)
	Tot. Exports	No. Products	No. Destinat.	New Products	New Destinat.
Brexit Referndum	-0.131***	-0.0300***	-0.0296***	-0.0600***	-0.0398***
	(0.0232)	(0.00357)	(0.00367)	(0.00672)	(0.00415)
Observations	177,903	177,903	177,903	177,903	177,903
R-squared	0.521	0.611	0.579	0.550	0.563
No. Exporters	26,387	26,387	26,387	26,387	26,387
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. Here we consider our dependent variable, $\Delta ln(y_{it})$, on a semester basis by aggregating transaction level information. The results highlight trade diversion towards extra-EU markets.

Table A.4: The Effect of Brexit Shock on the Population of Exporters, 2 years Diff-in-Diff

Quarterly	(1) Tot. Exports	(2) No. Products	(3) No. Destinat.	(4) New Products	(5) New Destinat.
Brexit Referndum	-0.103***	-0.0259***	-0.0324***	-0.0108**	-0.0192***
	(0.0285)	(0.00511)	(0.00473)	(0.00474)	(0.00429)
Observations	248,903	248,903	248,903	248,903	248,903
R-squared	0.550	0.641	0.599	0.534	0.566
No. Exporters	21,597	21,597	21,597	21,597	21,597
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. Furthermore, these variable consider 8 quarters lag in the dependent variable. That is, when constructing our dependent variable, $\Delta ln(y_{it})$, we account for a longer control period. The results highlight trade diversion towards extra-EU markets.

Table A.5: Effect of Brexit dynamic process policy uncertainity on the trade margins of UK Exporters: Always Exporters

Quarterly	(1) Tot. Exports	(2) No. Products	(3) No. Destinat.	(4) New Products	(5) New Destinat.
Brexit Referndum	0.000447	-0.000155**	-0.000270***	-0.00131***	-0.000393***
	(0.000439)	(6.44e-05)	(0.000101)	(0.000182)	(0.000108)
Observations	270,823	270,823	270,823	270,823	270,823
R-squared	0.615	0.514	0.480	0.515	0.551
No. Exporters	17,282	17,282	17,282	17,282	17,282
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. In particular we investigate the effect of policy uncertainty restricting our sample to firms who when they enter export activity do not exit. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. We include a number of fixed effects to control for unobserved characteristics.

Table A.6: The Effect of Brexit Shock: Placebo in time

Quarterly	(1) Tot. Exports	(2) No. Products	(3) No. Destinat.	(4) New Products	(5) New Destinat.
Brexit Referndum	-0.458	0.0297	0.113	-0.0705	-0.0179
	(0.762)	(0.122)	(0.104)	(0.130)	(0.100)
Observations	202,542	202,542	202,542	202,542	202,542
R-squared	0.552	0.670	0.609	0.542	0.558
No. Exporters	22,529	22,529	22,529	22,529	22,529
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations served, new products and new destinations. We consider Brexit shock to have occurred in 2014 rather than in 2016. This placebo in time show no statistical significance of trade diversion. Indeed, none of the results support this conclusion.

Table A.7: Heterogeneous effect of Brexit related uncertainty on trade margins across UK exporters' size distribution, weighted scale

Quarterly	(1) Tot. Exports	(2) No. Products	(3) No. Destinat.	(4) New Products	(5) New Destinat.
Micro Exporters	-0.0227***	-0.00204***	-0.00221***	-0.00233***	-0.000756***
	(0.00116)	(0.000143)	(0.000156)	(0.000157)	(0.000109)
Small Exporters	-0.00294***	-0.000212	-0.000129	-0.00145***	-0.000679***
	(0.000582)	(0.000133)	(0.000136)	(0.000187)	(9.74e-05)
Medium Exporters	0.00524***	0.000575***	0.000460***	-0.000926***	-0.000544***
	(0.000570)	(9.70e-05)	(0.000135)	(0.000177)	(0.000102)
Large Exporters	0.0165***	0.000703***	0.000309*	-0.000441	-0.000437***
	(0.00114)	(0.000153)	(0.000157)	(0.000310)	(0.000108)
Observations	339,493	339,493	339,493	339,493	339,493
R-squared	0.607	0.513	0.484	0.525	0.576
No. Importers	26,051	26,051	26,051	26,051	26,051
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of exporter variables. That is, we investigate the effect on total export value, total number of products, total number of destinations, new products and new destinations. We include a number of fixed effects to control for unobserved characteristics. Furthermore, we break down this effect by firm size (annual import values category). Here we weight our EU diff-in-diff variable by 27 countries and extra-EU by 243 countries, before we calculate a net Diff-in-Diff between the two.

Table A.8: The Effect of Brexit Shock on the Population of Importers

Quarterly	(1)	(2)	(3)	(4)	(5)
	Tot. Imports	No. Products	No. Destinat.	New Products	New Destinat.
Brexit Referendum	-0.0646*	-0.0164***	-0.00532	-0.0480***	-0.00703*
	(0.0345)	(0.00525)	(0.00486)	(0.00689)	(0.00422)
Observations	234,041	234,041	234,041	234,041	234,041
R-squared	0.503	0.518	0.525	0.516	0.542
No. Importers	19,501	19,501	19,501	19,501	19,501
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Importer FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of importer variables. That is, we investigate the effect on total import value, total number of products, total number of destinations of origins, as well as new products and new destinations. Here we consider our dependent variable, $\Delta ln(y_{it})$, on a quarterly basis by using quarterly transactions. The results highlight trade diversion towards extra-EU markets.

Table A.9: Heterogeneous effect of Brexit related uncertainty on trade margins across UK importers size distribution

Quarterly	(1)	(2)	(3)	(4)	(5)
	Tot. Imports	No. Products	No. Destinat.	New Products	New Destinat.
Micro Exporters	-0.773***	-0.0747***	-0.0317***	-0.0988***	-0.0124**
	(0.0932)	(0.00939)	(0.00823)	(0.00975)	(0.00494)
Small Exporters	-0.234***	-0.0163**	-0.00989*	-0.0623***	-0.00697*
	(0.0394)	(0.00728)	(0.00522)	(0.0129)	(0.00414)
Medium Exporters	-0.0504	-0.00308	0.00505	-0.0354***	-0.00861
	(0.0368)	(0.00646)	(0.00660)	(0.00702)	(0.00523)
Large Exporters	0.619***	0.0149	0.00890	-0.00818	-0.00145
	(0.0814)	(0.00982)	(0.00641)	(0.0119)	(0.00511)
Observations	234,041	234,041	234,041	234,041	234,041
R-squared	0.506	0.519	0.525	0.517	0.542
No. Importers	19,501	19,501	19,501	19,501	19,501
Control Variables	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y

Notes: This table reports the overall effect of Brexit referendum shock on a number of importer variables. That is, we investigate the effect on total import value, total number of products, total number of destinations (origin), new products and new destinations. We include a number of fixed effects to control for unobserved characteristics. Furthermore, we break down this effect by firm size (annual import values category).

B Appendix B

Table B.1: Gravity: Effect of Distance on Firm's New Activity

Quarterly - Distance	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	New Products				New Destinations			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Micro Exporters	-0.0545***	-0.0563***	-0.0628***	-0.0754***	-0.0210***	-0.0209***	-0.0246***	-0.0251***
	(0.00768)	(0.00496)	(0.00498)	(0.00479)	(0.00405)	(0.00287)	(0.00354)	(0.00317)
Small Exporters	-0.0362***	-0.0409***	-0.0400***	-0.0531***	-0.0184***	-0.0205***	-0.0219***	-0.0241***
	(0.00858)	(0.00670)	(0.00586)	(0.00558)	(0.00348)	(0.00312)	(0.00304)	(0.00318)
Medium Exporters	-0.0206***	-0.0347***	-0.0296***	-0.0423***	-0.0146***	-0.0164***	-0.0167***	-0.0190***
	(0.00649)	(0.00606)	(0.00493)	(0.00425)	(0.00344)	(0.00351)	(0.00323)	(0.00313)
Large Exporters	-0.0134	-0.0186**	-0.0217**	-0.0305***	-0.00718*	-0.00797*	-0.0135***	-0.0151***
	(0.0107)	(0.00767)	(0.00873)	(0.00764)	(0.00366)	(0.00428)	(0.00379)	(0.00329)
Observations	339,493	339,493	339,493	339,493	339,493	339,493	339,493	339,493
R-squared	0.518	0.514	0.519	0.518	0.565	0.567	0.563	0.565
No. Exporters	26,051	26,051	26,051	26,051	26,051	26,051	26,051	26,051
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y	Y	Y	Y

Notes: This Table provides a breakdown by distance distribution of the effect of Brexit shock on Micro, Small, Medium and Large exporters. In particular we consider exporter new activity, e.g. total new products introduced and total new destinations served. The results show also in this alternative specification trade diversion towards extra-EU markets. A 95% confidence interval is reported for all exporter types.

Table B.2: Gravity: Effect of GDP per Capita on Firm's New Activity

Quarterly - GDP per Capita	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	New Products				New Destinations			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Micro Exporters	-0.0686***	-0.0620***	-0.0841***	-0.0379***	-0.0266***	-0.0260***	-0.0195***	-0.0201***
	(0.00506)	(0.00546)	(0.00477)	(0.00653)	(0.00329)	(0.00355)	(0.00281)	(0.00313)
Small Exporters	-0.0441***	-0.0410***	-0.0515***	-0.0363***	-0.0256***	-0.0231***	-0.0171***	-0.0176***
	(0.00548)	(0.00693)	(0.00616)	(0.00826)	(0.00320)	(0.00347)	(0.00257)	(0.00286)
Medium Exporters	-0.0340***	-0.0307***	-0.0301***	-0.0362***	-0.0177***	-0.0193***	-0.0145***	-0.0146***
	(0.00473)	(0.00522)	(0.00596)	(0.00489)	(0.00399)	(0.00344)	(0.00266)	(0.00283)
Large Exporters	-0.0236**	-0.0213**	0.00511	-0.0452***	-0.00907**	-0.0125***	-0.0115***	-0.0116***
	(0.00989)	(0.00892)	(0.00969)	(0.00861)	(0.00436)	(0.00345)	(0.00272)	(0.00304)
Observations	339,493	339,493	339,493	339,493	339,493	339,493	339,493	339,493
R-squared	0.518	0.519	0.520	0.505	0.557	0.563	0.575	0.575
No. Exporters	26,051	26,051	26,051	26,051	26,051	26,051	26,051	26,051
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y	Y	Y	Y
Product-Trend	Y	Y	Y	Y	Y	Y	Y	Y

Notes: This Table provides a breakdown by GDP per Capita distribution of the effect of Brexit shock on Micro, Small, Medium and Large exporters. In particular we consider exporter new activity, e.g. total new products introduced and total new destinations served. The results show also in this alternative specification trade diversion towards extra-EU markets. A 95% confidence interval is reported for all exporters types.

Table B.3: Effect of Potential Tariffs threat on Firm's New Activity

Quarterly - Potential Tariffs Threat	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	New Products				New Destinations			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Brexit Referndum	-0.0111	-0.00180	-0.00656***	-0.00653***	-0.00104	-0.000353	-0.000413	0.000894
	(0.00210)	(0.00201)	(0.00204)	(0.00185)	(0.00123)	(0.000976)	(0.000942)	(0.000834)
Observations	339,493	339,493	339,493	339,493	339,493	339,493	339,493	339,493
R-squared	0.510	0.510	0.511	0.511	0.548	0.551	0.547	0.548
No. Exporters	26,051	26,051	26,051	26,051	26,051	26,051	26,051	26,051
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y	Y	Y	Y
Product FE	Y	Y	Y	Y	Y	Y	Y	Y

Notes: This Table provides a breakdown by tariffs threat distribution of the effect of Brexit shock on Micro, Small, Medium and Large exporters. In particular we consider exporter new activity, e.g. total new products introduced and total new destinations served. The results show also in this alternative specification trade diversion towards extra-EU markets. A 95% confidence interval is reported for all exporters types.

Aston Business School
Birmingham

Aston University, Aston St, Birmingham B4 7ET
www.lbpresearch.ac.uk