

**BREXIT: TRADE DIVERSION DUE
TO TRADE POLICY UNCERTAINTY**

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Abstract

During the long process of negotiation after the 2016 Brexit referendum there was a high uncertainty about the final shape of bilateral trade relations between the European Union (EU) and the United Kingdom (UK), especially for particular sectors and firms. Given this context, the paper explores whether a fraction of Spanish trade with the UK was diverted to other markets after the referendum as a function of Spanish firms' exposition to the British market. The paper shows that firms more exposed to that particular market (above 10% of foreign sales and purchases) were able to almost fully divert the shock in their sales and purchases, mostly to other European countries. Instead, there was an heterogeneous responses of Spanish firms with a low share of British bilateral flows over total trade. Given a particular share, trade diversion appears to be more limited for imports relative to exports and for big companies.

Keywords: policy uncertainty, Brexit, trade diversion.

JEL classification: F02, F13, F14, F15, F61, F68.

Resumen

El período de negociación posterior al referéndum sobre el *brexit* de 2016 se caracterizó por una elevada incertidumbre en relación con el nuevo marco de las relaciones bilaterales entre la Unión Europea y el Reino Unido, especialmente en el caso de ciertos sectores y empresas muy expuestos al mercado británico. En este contexto, el presente documento explora si una parte del comercio español con el Reino Unido fue desviada a mercados alternativos tras el referéndum. Según los resultados, aquellas empresas con una exposición elevada al mercado británico (más del 10 % de las compras y ventas exteriores) pudieron compensar casi plenamente las caídas de compras y ventas experimentadas en ese mercado principalmente por el acceso a otros países europeos. Sin embargo, la respuesta del resto de las empresas habría sido heterogénea. La sustitución de mercados resultó más limitada en las importaciones que en las exportaciones, así como en empresas de mayor tamaño.

Palabras clave: incertidumbre política, Brexit, sustitución de mercados.

Códigos JEL: F02, F13, F14, F15, F61, F68.

1 Introduction

After the unexpected vote of the United Kingdom (UK) electorate to leave the European Union (EU) in June 2016 and during bilateral negotiations, there was a great deal of uncertainty surrounding the final shape of potential trade barriers between the UK and the EU. Although the two regions have finally reached an agreement on December 2020 whereby no bilateral tariffs have been established, the uncertainty surrounding the long process of negotiations was very high. In response to this uncertainty, EU policymakers implemented contingency plans considering alternative scenarios.¹ Simultaneously, those firms highly exposed to this particular trade risk reacted by initiating a search of alternative exporting and importing markets.² However, very little is known regarding the quantitative importance of this channel. Indeed, despite numerous studies have quantified the impact of Brexit on the world economy (see, for example, Steinberg (2019) and Berthou et al. (2019)), fewer have analyzed the firms' capacity to substitute international markets. This paper fills this gap using monthly trade flows for the universe of Spanish firms that traded with the UK before the referendum.

In order to do so, first, the paper implements a difference in difference strategy to estimate the Spanish exporter/importer response to potential trade losses in a context of increased uncertainty due to future trade policy changes by using the Brexit vote as a quasi-natural experiment. The empirical strategy, which follows a two stage procedure as in Almunia et al. (2021), allows exploring trade diversion patterns as a reaction to increasing uncertainty.³

As a measure of potential losses of Spanish firms trading with the UK related to the final trade relationship between the EU and Britain, the paper uses (1) Most Favored Nation (MFN) tariffs at the sector level, which would prevail in absence of a trade deal, and (2) the share of trade with the UK at the firm level. Lawless and Morgenroth (2019) estimate that, given the exported products structure and the MFN tariffs, Spanish exports to the UK would have decreased by around 40% if a hard Brexit had materialized. However, within a particular sector, different firms might be impacted differently depending on the structure of their international markets. In particular, Bloom et al. (2019) find that British firms with higher trade exposure to the EU experienced significantly higher levels of uncertainty after the Brexit vote. This argument could be also applied for European firms with high exposition to the British market. Availability of monthly flows between 2015 and 2018 allows incorporating this mechanism into the analysis.

As preliminary evidence, Figure 1 shows a reduction in the share of British exports and imports over total flows for those Spanish firms that traded with that market within the period 2015-2018. Additionally, using monthly information between 2015 and 2018, Table 1 reports the change in firms' bilateral trade with UK since the Brexit referendum. The results point to a decline of trade flows:

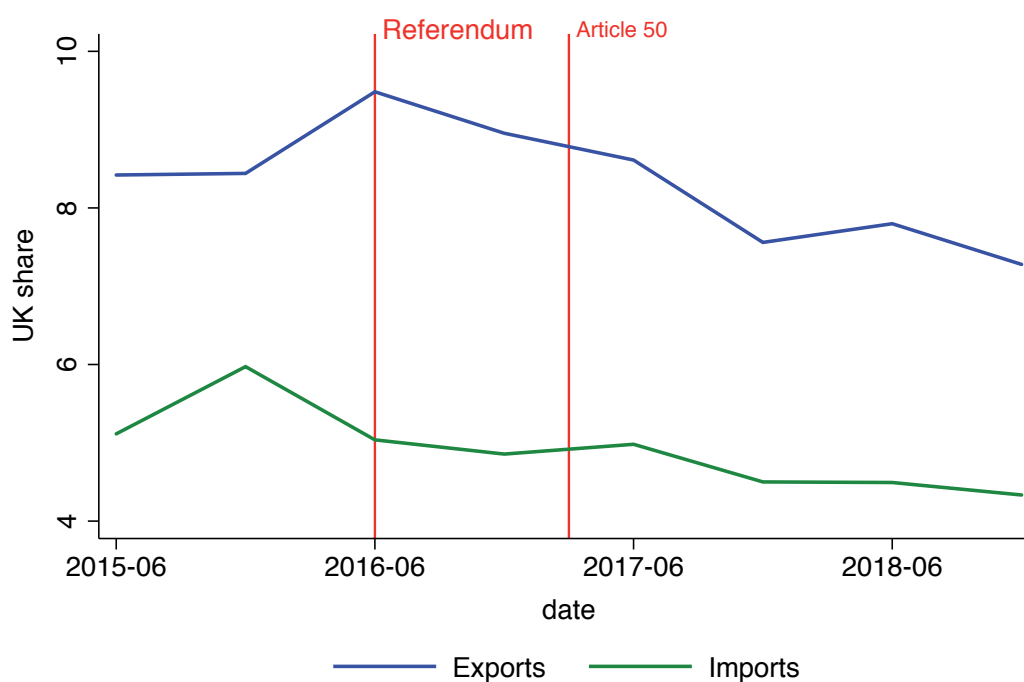
¹One example could be the European Commission Contingency Plan of November 2018, which announced unilateral measures to limit the damage and mitigate the most severe consequences of a no-deal Brexit.

²In the case of Spanish companies, according to a survey conducted by KPMG at the end of 2019 to 1,899 business managers, 39% of companies with an export relationship with the UK and 27% of importers reported having drawn up a contingency plan.

³This paper does not explore the effect of uncertainty on the extensive margin of trade.

exports growth rates declined by 9 pp. while in the case of imports the reduction was of lower magnitude (approximately 5 pp.). These reductions are robust once additional controls of firms' idiosyncratic shocks through labour productivity and total turnover changes are included. Notice in any case that the regressions do not include as explanatory variables time dummies or bilateral exchange rates, so it is not possible to isolate at this stage the impact of sterling pound depreciation on bilateral exports, something that will be more carefully treated in the empirical strategy section.

FIGURE 1
UK SHARE IN SPANISH TRADE



Notes: This figure shows the semestral evolution of the share of the UK in total exports and imports for firms exposed to the UK in 2015-2018.

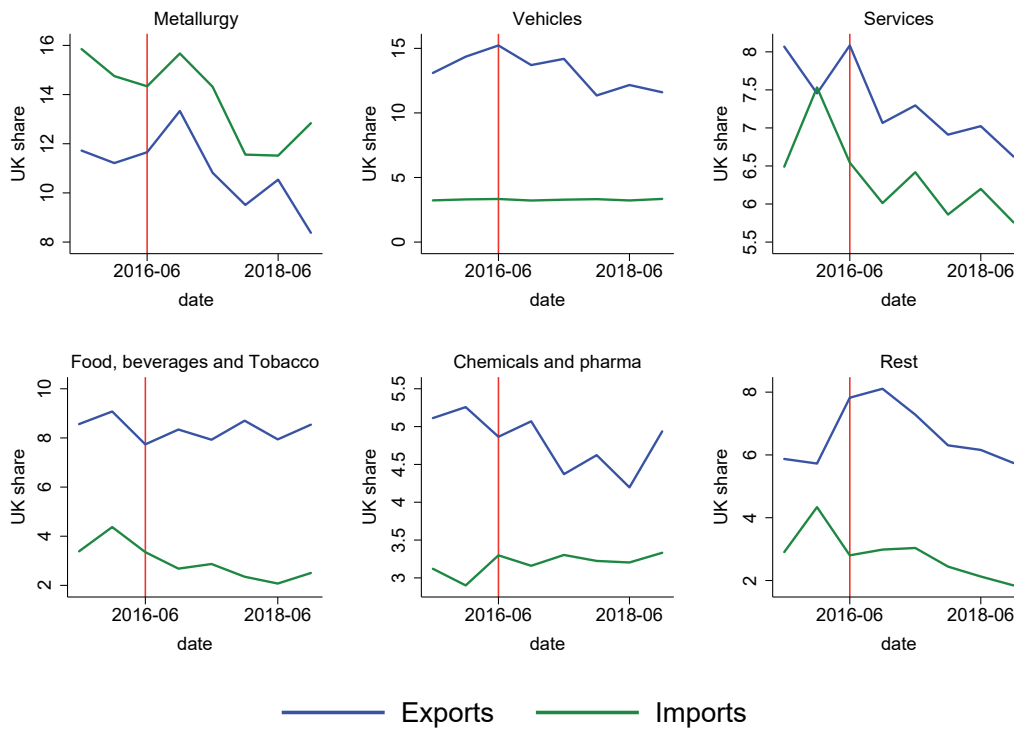
In any case, it is expected a great deal of heterogeneity in all these developments depending on the sector and the characteristics of the firms. According to the Chartered Institute of Procurement and Supply, 14% of European firms with UK suppliers had already started the process of moving their offices or storage facilities out of the UK and to reorganize their value chains during the transition period. This phenomenon is remarkable in some industries, particularly the automobile or services like transport of equipment, due to the relevance of logistics in their production process. The departure of many companies from the British market in a climate of high uncertainty about the future relationship between the UK and the rest of Europe reflects the disruption both for the EU and for the UK provoked by Brexit. Specifically, taking advantage of the size of the dataset, one can observe differences in the intensity of the change in the share of exports and imports across sectors. For instance, the decrease of the share of UK exports has been especially remarkable in

TABLE 1
BREXIT EFFECT ON TRADE

| | Exports | | Imports | |
|---------------------|-----------|-----------|-----------|-----------|
| | (1) | (2) | (3) | (4) |
| Post | -0.084*** | -0.092*** | -0.047*** | -0.048*** |
| (s.e.) | (0.017) | (0.015) | (0.016) | (0.015) |
| $\Delta \ln Prod_f$ | | 0.108*** | | 0.064*** |
| (s.e.) | | (0.019) | | (0.019) |
| $\Delta \ln GVA_s$ | | 1.017*** | | 1.036*** |
| (s.e.) | | (0.331) | | (0.368) |
| # obs | 130,858 | 130,858 | 115,047 | 115,047 |
| R2 | 0.095 | 0.096 | 0.086 | 0.086 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No |

Notes: Dependent variable: Growth of trade with the UK. *Post* is a dummy variable which takes a value of 1 after the Brexit vote. $Prod_f$ refers to productivity and GVA_s is the sectoral gross value added.

FIGURE 2
UK SHARE IN SPANISH TRADE BY SECTOR



Notes: This figure shows the semestral evolution of the share of the UK in total exports and imports for firms exposed to the UK in 2015-2018 by sector of activity.

sectors where their share was initially high such as metallurgy, vehicles and services while it has remained relatively stable in food or chemicals (see Figure 2). Regarding imports, again the drop in the British share was higher for sectors in which the UK was relatively more important (metallurgy and services), being lower for the rest.

The rest of the article is structured as follows. Section 2 revises the literature on the link between uncertainty and trade. Section 3 details the firm level datasets used in the analysis. Section 4 presents the empirical strategy. Sections 5 and 6 show the main findings exploring the heterogeneity by replacement market and size. Lastly, sections 7 and 8 contain robustness checks and the conclusion.

2 Related literature

This paper is part of a growing literature linking uncertainty with trade destruction, and is also related to a strand of the literature that analyzes within firm trade diversion patterns in response to policy changes, which eventually affect aggregate geographical trade structure. Lastly, this paper contributes to the research exploring the specific impact of Brexit on trade.

With respect to the effect of uncertainty on exports to the affected market, Crowley et al. (2018a) analyze the impact of trade uncertainty on Chinese firms exports and show that the threat of a tariff hike reduces the probability of entry by 5.2% for manufacturers and 10% for trading firms.⁴ On the other hand, Handley and Limão (2015) develop a dynamic model of firm entry into export markets under trade policy uncertainty and apply their model to Portugal's accession to the European Community in 1986, finding that lower uncertainty increased sales to this market by 20 log points. Crucially, there is some debate regarding the quantitative importance of the uncertainty channel compared to variations in trade after changing tariffs de facto. In particular, these authors report that if the accession of Portugal to the European Community had only involved reduced applied tariffs, and not trade policy uncertainty, less than 30% of the increase in trade would have materialized. Similarly, Handley and Limão (2017) explore the effect of lower trade policy uncertainty for Sino-US relationship after the accession of China to the World Trade Organization. Reduced uncertainty in this case explains around one-third of the observed growth in Chinese exports to the US.

Evidence on the effect of uncertainty on trade diversion is rather limited, but several papers have explored trade substitution in response to actual policy changes. In this sense, Hoai et al. (2017) analyze the impact of anti-dumping measures imposed by the EU on Vietnam in 2006 on exports to the EU and the US, and find that, due to the protectionist measures, exports to the EU decreased around 50-65%, but this market was replaced by American firms. Similarly, Bown and Crowley (2007) assess the effect of US import restrictions on Japanese exports and find that an anti-dumping duty increases exports of the affected product to the non-US market by around 6%. With respect to the US-China trade war initiated in 2018, Bekkers and Schroeter (2020) argue that around 60% of

⁴They estimate a linear probability model of firm entry into foreign markets in which uncertainty is captured by increases in tariffs in another country in which the firm is operating.

the reduction in American imports from the Asian country was acquired from alternative markets. Alternatively, Susanto et al. (2007) argue that the NAFTA agreement increased US imports of agricultural products from Mexico but not in detriment of acquisitions from the rest of the world.

Concerning the specific case of Brexit, the effect of Brexit uncertainty on the extensive and the intensive margins of trade has been largely analyzed. Also, evidence on the drivers of Brexit uncertainty and trade diversion patterns after the referendum has been gathered. With respect to the probability of exporting, Crowley et al. (2018b) exploit Brexit as a quasi-experiment to estimate the effect of higher uncertainty on exporters decisions. They find that a 1 pp. increase in the threat point tariff decreases the growth rate of entry by 1.1 pp. Additionally, Graziano et al. (2021) show that uncertainty, measured with Brexit probability and industry specific exposure to this possible outcome, reduced UK-EU trade value by 11-20 log points. Crucially, the authors explain that, using the average MFN tariff in the EU of 4.5% and the trade elasticities from the literature that range from 4 to 7 (see, for example, Bajzik et al. (2020)), a permanent actual increase in tariffs would imply a reduction of trade of 18-32 log points. Thus, in this case, uncertainty would also be more relevant than the actual materialization of the risk.

As for the drivers of Brexit uncertainty, Breinlich et al. (2018) analyze the stock market reactions of 350 firms to the referendum and to Theresa May's speeches. They find that after the referendum abnormal returns were driven mostly by the exchange rate and fears of a cyclical downturn, but after May speeches returns were driven by the potential imposition of tariff and non-tariff barriers. The uncertainty indicator in this paper exploits both potential tariff barriers and firm level dependence on the UK in 2015. With respect to the latter, Bloom et al. (2019) exploit a survey of 5,900 British firms and show that their trade dependence on the EU is a key indicator of firm level uncertainty together with the share of EU workers, the share of sales covered by EU regulation and ownership links with the EU. Then, it is expected that firms' vulnerability to a hard Brexit rises with UK trade share within the firm as well as applied MFN tariffs for the products they trade.

Lastly, evidence on trade diversion due to Brexit uncertainty is scarce and points to a much lower effect compared with previous studies analyzing the effect of actual trade policy changes. To be more concrete, Douch et al. (2020) have explored the effect of uncertainty on trade with unaffected markets. They point that Brexit uncertainty has encouraged British firms to decrease their exports towards EU countries by 9% in comparison with sales to other regions. However, their paper does not exploit firm level heterogeneity in terms of uncertainty perceived and results can't be directly attributed to trade replacement effects. This paper fills this gap by providing a direct estimate of trade growth in the non-UK market in response to changes in firms' relationship with the UK after the Brexit referendum.

3 Data

For the purposes of this paper, three different sources of information are employed. First, a monthly dataset provided by INE according to an agreement with the Customs Agency including most Spanish

firms that traded goods with the UK between 2015 and 2018. It provides firm level information on exports and imports of goods with the UK, the EU and the rest of the world. If a firm trades simultaneously in these three areas, there is a value for trade flows in each separate market. On the other hand, if the firm does not export/import with the UK but instead maintains trading flows with other markets, there is a 0 for the UK and a value for the corresponding trading partner. Finally, if the firm does not trade in any market, the dataset reports 0 for the three variables. It includes information about 35,656 exporters and 40,394 importers, which account for around 90% of exports and 85% of imports with the UK.

Second, to control for the sector of activity and productivity shocks that might impact sales at the firm level, an annual firm level dataset for the period 2015-2018 regarding the universe of firms from INE's Central Business Register is used. The dataset provides information on the sector of activity, turnover and number of employees as a firm size proxy. The sector classification is a mixture of NACE-2, 3 and 4 digit level with more details on particular sectors that have large trading flows. Information is available for 75 sectors (see appendix A).

Lastly, to compute the potential tariff in a hard Brexit scenario, the paper exploits information on tariffs at the product level from the World Trade Organization (WTO) at HS2 level disaggregation. In particular, it employs information on external tariffs applied by the EU to third countries trade as registered by the WTO, when there is no trade agreement in place. In the event of a hard Brexit, these third country tariffs would have been applied by default for trade between the EU and the UK. These data are matched sector by sector to the previous datasets using a crosswalk that requires information of products sold by firms belonging to particular sectors. In particular, sector specific tariffs are constructed with products information coming from the Bank of Spain's balance of payments database.⁵ As an example, exports in the textile intermediaries sector would suffer an estimated tariff of 9.5% that is obtained from a weighted average of tariffs by products: 62% of exports within this sector are footwear which support a tariff of 10%, followed by not knitted clothing (10%) with tariffs around 11% and knitted clothing (10%) with tariffs around 11%. The remaining textile products account for around 18% of exports and support a 5% tariff. Crucially, according to Handley and Limão (2015), most of the tariffs variability occurs between industries.

The vulnerability to Brexit of companies trading with the UK will depend, among other things, on their exposure to the UK. For those firms trading at all with the UK, this market represents around 12% of total exports and 17% of total imports on average. However, as it can be seen through exporters and importers distribution by UK share (Table 2), there is a significant heterogeneity across firms. This heterogeneity is a consequence of the concentration of bilateral trade with the UK in a relatively small percentage of firms, in line with international empirical evidence. To be more concrete, in around half of firm-year combinations of UK-Spain bilateral trade, the British market represents less than 4% of total trade and only 30% have a relative exposure to this market above 10%.

⁵Until 2012 the Bank of Spain had data on exports and imports at the firm-product-year level, which allows us to learn about the products traded in each sector.

TABLE 2
UK SHARE IN FIRM LEVEL TRADE

| Panel A: Exporters | | | | | | | | |
|---------------------------|-------|------|------|------|------|------|------|------|
| | N | mean | sd | p10 | p25 | p50 | p75 | p90 |
| Total | 35656 | 0.12 | 0.21 | 0.00 | 0.01 | 0.04 | 0.13 | 0.35 |
| By Size | | | | | | | | |
| Small | 22271 | 0.14 | 0.23 | 0.00 | 0.01 | 0.05 | 0.15 | 0.42 |
| Medium | 10268 | 0.09 | 0.16 | 0.00 | 0.01 | 0.03 | 0.10 | 0.25 |
| Large | 3117 | 0.10 | 0.17 | 0.00 | 0.01 | 0.04 | 0.11 | 0.27 |
| By Sector | | | | | | | | |
| Metallurgy | 614 | 0.11 | 0.16 | 0.00 | 0.01 | 0.05 | 0.12 | 0.31 |
| Vehicles | 916 | 0.13 | 0.17 | 0.00 | 0.01 | 0.05 | 0.17 | 0.35 |
| Food | 4215 | 0.11 | 0.17 | 0.00 | 0.01 | 0.04 | 0.13 | 0.30 |
| Services | 15219 | 0.15 | 0.25 | 0.00 | 0.01 | 0.05 | 0.17 | 0.49 |
| Chemicals | 1804 | 0.07 | 0.13 | 0.00 | 0.01 | 0.03 | 0.07 | 0.16 |
| Rest | 12888 | 0.10 | 0.17 | 0.00 | 0.01 | 0.04 | 0.11 | 0.26 |
| Panel B: Importers | | | | | | | | |
| | N | mean | sd | p10 | p25 | p50 | p75 | p90 |
| Total | 40394 | 0.17 | 0.27 | 0.00 | 0.01 | 0.04 | 0.18 | 0.60 |
| By Size | | | | | | | | |
| Small | 25428 | 0.21 | 0.30 | 0.00 | 0.01 | 0.06 | 0.26 | 0.78 |
| Medium | 10308 | 0.10 | 0.20 | 0.00 | 0.00 | 0.02 | 0.09 | 0.30 |
| Big | 4658 | 0.10 | 0.19 | 0.00 | 0.00 | 0.02 | 0.10 | 0.32 |
| By Sector | | | | | | | | |
| Metallurgy | 517 | 0.13 | 0.21 | 0.00 | 0.01 | 0.03 | 0.16 | 0.42 |
| Vehicles | 814 | 0.05 | 0.11 | 0.00 | 0.00 | 0.01 | 0.05 | 0.14 |
| Food | 2031 | 0.09 | 0.17 | 0.00 | 0.00 | 0.02 | 0.08 | 0.24 |
| Services | 26167 | 0.21 | 0.30 | 0.00 | 0.01 | 0.06 | 0.26 | 0.80 |
| Chemicals | 1979 | 0.07 | 0.13 | 0.00 | 0.01 | 0.02 | 0.07 | 0.18 |
| Rest | 8886 | 0.10 | 0.18 | 0.00 | 0.01 | 0.02 | 0.09 | 0.30 |

Notes: This table shows the distribution of the share of external annual sales/acquisitions with the British market for firms exposed to the UK in 2015-2018. Small firms are firms with less than 50 employees, medium firms have between 50 and 249 employees and big firms have 250 employees or more.

Small firms present a higher dependence on the British market. These companies are less likely to be established in foreign markets, so that the proportion of companies for which the UK market is the most relevant, or even the only one, is higher than among large companies. Indeed, UK share is higher in small enterprises both in exports and imports (14% and 21%, respectively). For medium

TABLE 3
DESCRIPTIVES. EXPORTERS EXPOSED TO THE UK

| | N | mean | sd | p10 | p50 | p90 |
|--|-------|---------|----------|--------|--------|---------|
| Imports from the UK (thousand €) | 13684 | 2013.5 | 21179.7 | 4.0 | 79.1 | 1633.2 |
| Imports from the EU-28 (thousand €) | 25386 | 11386.9 | 100058.9 | 44.7 | 1097.5 | 13833.1 |
| Imports from the RoW (thousand €) | 23269 | 12457.4 | 192295.4 | 11.5 | 542.6 | 10594.5 |
| Exports to the UK (thousand €) | 35656 | 1920.3 | 23929.1 | 5.0 | 106.2 | 2090.7 |
| Exports to the EU-28 (thousand €) | 35656 | 14257.7 | 126515.4 | 252.8 | 1888.4 | 19504.6 |
| Exports to the RoW (thousand €/worker) | 31073 | 7357.9 | 57892.5 | 33.1 | 660.1 | 9543.9 |
| Age | 35656 | 18.2 | 7.6 | 6.0 | 22.0 | 26.0 |
| Number of workers | 35656 | 139.7 | 1131.9 | 4.0 | 33.0 | 224.0 |
| Turnover (thousand €) | 35656 | 60146.8 | 458669.1 | 1600.6 | 9117.4 | 75370.0 |
| Productivity (thousand €/worker) | 35039 | 874,3 | 20007,8 | 99,8 | 260,4 | 1164,6 |

Notes: Exporters exposed to the UK in 2015-2018.

TABLE 4
DESCRIPTIVES. IMPORTERS EXPOSED TO THE UK

| | N | mean | sd | p10 | p50 | p90 |
|-------------------------------------|-------|---------|----------|--------|--------|---------|
| Imports from the UK (thousand €) | 40394 | 981.5 | 12764.0 | 2.8 | 49.8 | 898.0 |
| Imports from the EU-28 (thousand €) | 40394 | 9581.3 | 82430.9 | 77.8 | 1054.7 | 12407.5 |
| Imports from the RoW (thousand €) | 29391 | 10543.3 | 172152.0 | 9.6 | 350.1 | 8716.9 |
| Exports to the UK (thousand €) | 13684 | 3799.2 | 37088.1 | 5.7 | 174.8 | 3997.0 |
| Exports to the EU-28 (thousand €) | 23758 | 17606.8 | 152460.7 | 50.3 | 1551.3 | 22936.2 |
| Exports to the RoW (thousand €) | 26608 | 7782.4 | 64088.0 | 7.8 | 320.7 | 9304.8 |
| Age | 40394 | 18.0 | 7.6 | 6.0 | 21.0 | 26.0 |
| Number of workers | 40394 | 221.5 | 1728.7 | 3.0 | 28.0 | 293.0 |
| Turnover (thousand €) | 40394 | 71942.4 | 518351.8 | 1027.3 | 8329.6 | 89808.3 |
| Productivity (thousand €/worker) | 39703 | 890.9 | 20384.6 | 99.2 | 281.0 | 1005.3 |

Notes: Importers exposed to the UK in 2015-2018.

and big firms the UK's relative weight is broadly similar (around 10% in exports and imports). There is a significant heterogeneity across sectors. Services depicts the highest relative weight both in exports and imports, followed by vehicles in the case of sales to the UK and metallurgy in the purchases from the UK. On the contrary, chemicals (exports and imports) and cars (imports) are the sectors in which the UK share is lowest.

In addition, those 35,656 exporters to the UK identified in this dataset have an average annual export value to that market of 1.9 million euros (Table 3). On average, the number of employees of exporters to the UK is close to 140, while the age of these firms is 18 years. The dispersion of these characteristics is relatively high, in particular of exports to the UK market, since the median

(106 thousand euros) is far away from the average. The distribution of labour productivity also shows a high sample dispersion, with a small fraction of exporters with very high productivity. More than a third of these firms also import goods from the UK. The average value of these purchases is moderately higher than the average value of exports. On the other hand, most of the exporters to the UK are also present in non-EU markets (near 90%).⁶

On the imports side (Table 4), the average value imported of the 40,394 importing firms is lower than that observed for exporters (about 1 million euros). Their size and apparent labor productivity are similar to exporters, especially below the median (Table 4). A third of these firms also export goods to the UK. The average value of these sales is higher than the average value of imports (about 4 million euros). A lower percentage with respect to that observed in the case of exporters also import from other regions outside the EU (72%).

4 Empirical model

The empirical analysis aims to estimate the exporters/importers response to potential trade losses in a context of increased uncertainty due to future trade policy changes by using the Brexit vote as a quasi-natural experiment. The preferred empirical model used to estimate the impact of uncertainty on trade follows a two stage procedure as in Almunia et al. (2021). This approach allows identifying whether uncertainty in one market has consequences on trade diversion patterns to alternative markets. Other approaches, like the one of Douch et al. (2020), only account for the relative growth rate of different markets, but do not identify trade diversion effects. First, the paper estimates the annual growth rate of trade with the UK that happened in a particular month of a corresponding year at the firm level before and after the referendum as a function of an uncertain future potential trade loss indicator as in equation 1.

$$\Delta \ln t_{fym,UK} = \beta \ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}} + \eta \Delta \ln Prod_{fy} + \omega_f + \gamma_{ym} + v_{fym} \quad (1)$$

where $t_{fym,UK}$ refers to exports or imports of firm f in year y and month m with the UK, t_{fym} captures total exports and imports by firm f , T_s is the sectoral tariff applicable in a hard Brexit scenario and only takes positive values after the referendum, $Prod_{fy}$ refers to productivity in year y . Lastly, ω_f and γ_{ym} are firm and period fixed effects.

Firm level uncertainty is measured as the interaction between its relative trade exposure to the UK in the past and potential sectoral tariffs after Brexit which may affect the firm.⁷ A negative response to potential tariffs of trade flows is expected, especially in those firms where sales or purchases were initially more concentrated in the affected market. If $\beta=-1$, a firm which sells 40% of its exports to

⁶According to the available evidence, Spanish exporting firms to the UK are more geographically diversified than those selling their products to the main economies of the euro area (Gutiérrez and Martín Machuca, 2018).

⁷The robustness section describes different specifications of the instrument using separately either the relative trade exposure to the UK in the past or the potential sectoral tariffs.

the UK, will respond to a 1 pp. tariff potential rise by reducing exports to this market by 0.4 pp ($0.4 \cdot -1$).

The inclusion of firm fixed effects implies that the identification derives from comparing within firm trade growth before and after the referendum as a function of the uncertainty measure. Time fixed effects (γ_{ym}) control for transitory specific macro shock that could bias the estimations, such as exchange rates changes and economic growth. It is possible that exports (imports) to the UK diminished (augmented) in response to the depreciation of the sterling after the referendum. This depreciation made exports to the UK more expensive and imports cheaper, thus affecting inflation and economic growth in the UK.⁸ The estimations also include the change in firm level productivity to control for time varying factors at the firm level that might affect the capacity of firms to export.

In a second stage, the paper quantifies trade diversion patterns using the predictions of the first stage above ($\Delta \ln \widehat{t_{fym,UK}}$). On the one hand, those firms which would face higher tariffs in case of hard Brexit, measured through their main sectoral activity, might have reduced their trade with the UK more intensely and replaced, at least partially, the British market with other alternative destinations. Additionally, a higher firm relative exposure to the UK will increase the risks associated with Brexit, and could lead in turn to a higher trade diversion. So, the regressions estimated in the second stage use the estimates obtained in the first stage as follows:

$$\Delta \ln t_{fym} = \alpha \Delta \ln \widehat{t_{fym,UK}} + \eta \Delta \ln Prod_{fy} + \omega_f + \gamma_{ym} + v_{fym} \quad (2)$$

where t_{fym} refers to non-UK exports (imports) of firm f in year y and month m . The other variables are equivalent to those used in the first stage, in order to control for idiosyncratic firm shocks and to catch potential bias by omitted variables with FE. The interaction of potential tariffs and UK firm level dependence instruments export/import growth with the UK ($\Delta \ln \widehat{t_{fym,UK}}$). In order to grasp the magnitude of the effects, the share of the UK in firm level external trade has to be taken into account. For example, if $\alpha = -0.5$, a firm which sells 40% of its exports to the UK, will respond to a 100 euros reduction of sales to the UK by increasing exports to alternative markets by 75 euros ($\frac{1-0.4}{0.4} \cdot 100 \cdot -0.5$).

The next section describes the results of this two-stage estimation for firms that present a high share of trade flows with the UK (in particular 10% of total international flows that will be close to the top quartile of exports and imports shares). Focusing the analysis to this group of firms has the advantage of concentrating in those firms whose exports might be severely hit. Section 6 explores the heterogeneity of these effects in terms of the size of the firm. Section 7 in the paper shows the estimates for those firms whose share is below the top quartile and checks the validity of results to alternative specifications of the instrument.⁹

⁸In principle, exchange rates might affect differently to different sectors but not necessarily in a way that is correlated with the potential tariff and within sector.

⁹Appendix B shows results with a 20% threshold as well as estimates for the whole sample.

5 Results of the baseline specification

5.1 Uncertainty and Trade with the UK

In this section the paper describes the results for the estimation of equation 1. The paper calls “All” to a sample with all firms and “Trade diversion sample” to a sample composed by firms whose dependence on the UK is above 10% for the flow that is being analyzed (exports or imports, in each case), which will be the focus of the paper hereafter.

Table 5 reports the impact of firm level uncertainty due to brexit on firms’ exports to the UK. The first explanatory variable catches the effect of the interaction between UK trade share and potential tariffs within firms. Firms and sectoral idiosyncratic shocks are captured through firm productivity changes and GVA in the UK by sector. Note that columns 1 and 2 do not account for transitory shocks such as exchange rates or capital flows, and the results could be biased by the omission of these factors. In this sense, the estimate could be biased upwards as the reduction in exports might have been caused not only by higher uncertainty but also by sterling depreciation. In column 2, controlling for firm productivity changes and GVA in the UK by sector, a 1 pp. tariff increase leads to a 8.8 pp. lower growth of exports to the UK for those firms fully dependent on the British market. In columns 3 and 4, time specific shocks are controlled for together with firm fixed effects. Comparing columns 2 and 4, as expected, the estimate that does not control for macroeconomic dynamics is biased upwards. To be more concrete a 1 pp. potential tariff for a firm only selling to the UK leads to a 8.2 pp. decrease in exports growth to the UK. As it is computed in the last row of Table 5 and given the average export share to the UK of 12% of foreign sales, the average exporter reduces exports growth by 1 pp. in response to a 1% potential tariff.

In the case of exporters highly exposed to the UK and operating in alternative markets (column 5), which are the ones in which this market is replaced by alternative countries, the elasticity remains broadly unchanged. Since for these firms the British market represents 37%, the last row estimates that a 1% potential tariff involves a 2.6 pp. exports growth reduction in this case. Several recent papers in the literature have shown elasticities to applied tariff raises of around 4 (see Simonovska and Waugh (2014) and Bajzik et al. (2020)).

On the imports side, a similar pattern is observed, although the magnitude of the coefficient would be of lesser magnitude (Table 6). Specifically, the coefficient obtained is 5.5. However, since the average share for importers is higher than that for exporters, the average importer responds to a 1 pp. potential tariff by reducing its imports growth by 0.9 pp., very similar elasticity to that in Table 5. The response of firms highly exposed to the UK and importing from alternative markets is substantially higher (column 5). Specifically, a 1% potential tariff involves a reduction in the growth of imports from the UK around 3.6 pp. for these firms.¹⁰ As mentioned above, it should be noted that the depreciation of the pound may have at least partially cushioned the impact of this uncertainty on the decisions of importing firms during the period analyzed in the paper.

¹⁰Section 7.1 explores how the response of firms differ with different expositions to the British market.

TABLE 5
UNCERTAINTY AND EXPORTS TO THE UK

| | All | | | | Trade diversion sample |
|---|-----------|-----------|-----------|-----------|------------------------|
| | (1) | (2) | (3) | (4) | (5) |
| $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$ | -8.810*** | -8.825*** | -8.243*** | -8.202*** | -7.472*** |
| (s.e.) | (1.266) | (1.327) | (1.405) | (1.405) | (1.521) |
| $\Delta \ln Prod_f$ | | 0.103*** | | 0.101*** | 0.120*** |
| (s.e.) | | (0.020) | | (0.020) | (0.020) |
| $\Delta \ln GVA_s$ | | 0.711** | | | |
| (s.e.) | | (0.298) | | | |
| # obs | 128,801 | 128,801 | 128,801 | 128,801 | 48,865 |
| R2 | 0.094 | 0.095 | 0.097 | 0.097 | 0.132 |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | Yes | Yes | Yes |
| Elasticity Avg. Firm | 1.095 | 1.097 | 1.025 | 1.019 | 2.581 |

Notes: Dependent variable: Growth of exports to the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE 6
UNCERTAINTY AND IMPORTS FROM THE UK

| | All | | | | Trade diversion sample |
|---|-----------|-----------|----------|----------|------------------------|
| | (1) | (2) | (3) | (4) | (5) |
| $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$ | -5.496*** | -5.436*** | -5.529** | -5.540** | -8.227** |
| (s.e.) | (2.016) | (2.022) | (2.249) | (2.244) | (3.117) |
| $\Delta \ln Prod_f$ | | 0.073*** | | 0.073*** | 0.110*** |
| (s.e.) | | (0.017) | | (0.017) | (0.022) |
| $\Delta \ln GVA_s$ | | 0.938*** | | | |
| (s.e.) | | (0.348) | | | |
| # obs | 112,573 | 112,573 | 112,573 | 112,573 | 44,399 |
| R2 | 0.085 | 0.085 | 0.087 | 0.087 | 0.116 |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | Yes | Yes | Yes |
| Elasticity Avg. Firm | 0.922 | 0.912 | 0.927 | 0.929 | 3.642 |

Notes: Dependent variable: Growth of imports from the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

5.2 Uncertainty and Trade Diversion

In this section the paper presents estimates for equation 2. It analyzes trade diversion due to the effect of Brexit-related uncertainty on bilateral trade flows between Spain and the UK. First stage regressions allow obtaining estimates of Brexit uncertainty impact, which are used as instruments in the second stage in order to obtain an estimation for trade diversion resulting from Brexit referendum for those firms with high dependence on the British market. An instrument will be valid when it is exogenous and statistically significant. As shown in Table 7, firm level uncertainty, measured as the interaction between potential tariffs and UK weight in total trade has a strong explanatory power

for bilateral trade growth. So, estimated coefficients for the uncertainty indicator are negative and statistically significant (columns 2 and 4). In the same vein, F-statistic suggests that instruments are statistically significant but only strong for exports. The strength of the instrument comes from the firm level share as it is shown in the robustness section 7.2 and using it alone one obtains similar results with much higher F-statistics.

Once instrumented with the estimated impact of Brexit through increased uncertainty, the magnitude of the contribution of trade diversion attributable to this potential risk is reversed compared to a direct estimate of the effect of trade with the UK on trade with other markets, as inferred from the comparison between columns 1 and 3 (4 and 6) for exports (imports). This means that there is a positive correlation between trade reductions among markets, as expected, given that the ex-ante productivity level of firms determines simultaneously the level of sales in each market (Melitz 2003). However, when an exogenous variation of a particular market is isolated, a negative and statistically significant effect of trade growth in the UK on trade growth in the rest of the world arises. In terms of the quantitative relevance of these results, according to the computations in Almunia et al. (2021), for the average firm in the sample with an initial export share to the UK of 35%, a drop of 100 euros in their British sales would lead to an increase in exports between 92 and 151 euros elsewhere. This means a close to full diversion of exports.

In terms of imports, the diversion appears to be slightly more limited. In particular, for every 100 euros lost in British purchases, the average firm in the sample with a British import share of 44% would be able to divert between 64 and 100 euros. Summarizing, it appears that uncertainty would have partially reduced imports.¹¹

Once it has been established that uncertainty causes a partial trade diversion of former trade with the UK, it is of interest to analyze which markets benefit most from this diversion. In table 8, it can be seen that the results obtained indicate that the area that has benefited most is the EU. EU is Spain's main market (it accounted for around 60% of total goods exports in 2019, according to Customs data), a significant percentage of firms has stable trade relationships with the EU and it has a similar level of development and demand preferences as the UK. In the case of new trade relationships, they face lower costs of entry than in non-EU countries, since Spain is a member of EU, which reduces fixed costs involved in a new trade relationship. So, the costs of redirecting trade from the UK to the EU are probably lower than for other areas, also due to a lower distance and transport costs. In addition, it is likely that a large number of exporters to the UK were previously present in the EU, since this area is, by far, the main exports destination of the Spanish economy, with established exports relationships. All this makes trade diversion into this area less costly than into other areas.

¹¹The robustness section 7.1 explores how this pattern of trade diversion differs when using different thresholds by quartiles. In a nutshell, those firms with a very small share do not divert at all, while between the median (4%) and the third quartile (13% and 18% for exports and imports respectively) there is a huge heterogeneity of diversion. Finally, in line with these results, for those with a share above the third quartile the capacity to divert appears to be very high, in particular for exports.

TABLE 7
UNCERTAINTY AND TRADE DIVERSION

| | Exports | | | Imports | | |
|---|-----------------------|----------------------|----------------------|-----------------------|----------------------|----------------------|
| | (1) (OLS) | (2) (FS) | (3) (IV) | (4) (OLS) | (5) (FS) | (6) (IV) |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$ (s.e.) | | -7.472*** (1.521) | | | -8.227** (3.117) | |
| $\Delta \ln t_{fym,UK}$ (s.e.) | 0.0557*** (0.0126) | | -0.640*** (0.079) | 0.0861*** (0.0107) | | -0.657*** (0.077) |
| $\Delta \ln Prod_f$ (s.e.) | 0.149*** (0.0278) | 0.120*** (0.0205) | 0.234*** (0.0334) | 0.119*** (0.0300) | 0.110*** (0.0224) | 0.201*** (0.0406) |
| # obs | 48,865 | 48,865 | 48,865 | 44,399 | 44,399 | 44,399 |
| R2 | 0.148 | 0.132 | | 0.103 | 0.116 | |
| F-statistic | | 24.12 | | | 6.97 | |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Diverted per 100 euros | | | 92-151 | | | 64-102 |

Notes: The dependent variable is the growth of trade with the UK ($\Delta \ln t_{fym,UK}$) in columns 2 and 5, which report the first stage estimates for columns 3 and 6. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. The dependent variable is the growth of non-UK trade in columns 1, 3, 4 and 6. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE 8
UNCERTAINTY AND TRADE DIVERSION BY MARKET

| | Exports | | | Imports | | |
|-----------------------------------|----------------------|-----------------------|----------------------|----------------------|-----------------------|----------------------|
| | (1) (Total) | (2) (EU) | (3) (RoW) | (4) (Total) | (5) (EU) | (6) (RoW) |
| $\Delta \ln t_{fym,UK}$ (s.e.) | -0.640*** (0.079) | -0.454*** (0.0814) | -0.0835 (0.135) | -0.657*** (0.077) | -0.481*** (0.0782) | -0.409*** (0.148) |
| $\Delta \ln Prod_f$ (s.e.) | 0.234*** (0.0334) | 0.166*** (0.0254) | 0.138*** (0.0408) | 0.201*** (0.0406) | 0.165*** (0.0381) | 0.180*** (0.0604) |
| # obs | 48,865 | 47,721 | 33,219 | 44,399 | 43,007 | 20,500 |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Diverted per 100 euros | 92-151 | 40-84 | -16-8 | 64-102 | 31-61 | 3-19 |

Notes: The dependent variable is the growth of non-UK exports/imports in columns 1/4, exports/imports with the EU in columns 2/5 and exports/imports to the RoW in columns 3/6. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

6 Results by firms' size

The results indicate that the relative exposure to the UK is a factor conditioning the response of companies to the uncertainty generated by Brexit. It is worth asking whether other firm characteristics, such as size, also influence the evolution of bilateral trade at the firm level and whether it

also explains, at least partially, trade diversions to other markets.¹² A priori, it is more difficult for a big firm to have a high British concentration of either exports or imports. As a consequence, a high concentration in a particular market of a big firm might be a signal of low substitutability. In addition, these firms could have a higher internal capacity to replace affected products domestically or even wait until uncertainty is resolved. On the other hand, a bigger firm is more likely to start exporting or importing with alternative markets. In order to test empirically the behaviour of firms with different sizes, the paper quantifies whether the vulnerability faced by companies exposed to Brexit extends to all firm size categories, exploiting the sample information on company size and foreign trade for those firms with a relative exposure with the UK above 10%. Firms are splitted into small (less than 50 workers), medium (50-249) and large firms (+249). Trade flows with the British market changed significantly after the referendum and the impact appears to be positively correlated with company size, so that larger exporters would have reacted more dramatically, reducing their sales to the UK more sharply. To be more concrete, for the average large exporter, a 1 % tariff involves a 3.2 pp. reduction in exports to the UK while it involves a 2.5 pp. reduction in exports for small and medium firms (Table 9).

TABLE 9
UNCERTAINTY AND EXPORTS TO THE UK BY SIZE

| | (1) | (2) | (3) | (4) |
|---|-----------|-----------|-----------|-----------|
| | Total | Small | Medium | Large |
| $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$ | -7.472*** | -6.854*** | -8.741*** | -10.95*** |
| (s.e.) | (1.521) | (1.050) | (2.500) | (3.405) |
| $\Delta \ln Prod_f$ | 0.120*** | 0.116*** | 0.212*** | 0.155 |
| (s.e.) | (0.020) | (0.040) | (0.063) | (0.272) |
| # obs | 48,865 | 27,093 | 15,933 | 5,772 |
| R2 | 0.132 | 0.137 | 0.158 | 0.176 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Elasticity Avg. Firm | 2.581 | 2.536 | 2.548 | 3.249 |

Notes: Dependent variable: Growth of exports to the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

In the case of imports, large firms have also reduced more intensely their purchases of UK goods in response to uncertainty (Table 10). In particular, for the average large exporter, a 1 % tariff involves a 4 pp. reduction in imports from the UK while it involves a 2.2 pp. reduction in imports for small firms.

¹²This section contains the results for the subsample of firms whose dependence on the UK is above 10%. Results for the entire sample can be found in Tables B.4, B.5, B.6 and B.7.

TABLE 10
UNCERTAINTY AND IMPORTS FROM THE UK BY SIZE

| | (1) | (2) | (3) | (4) |
|---|----------|----------|----------|-----------|
| | Total | Small | Medium | Large |
| $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$ | -8.227** | -6.903** | -10.75** | -16.24*** |
| (s.e.) | (3.117) | (2.708) | (4.199) | (5.672) |
| $\Delta \ln Prod_f$ | 0.110*** | 0.122*** | 0.222** | 0.062 |
| (s.e.) | (0.022) | (0.028) | (0.103) | (0.040) |
| # obs | 44,399 | 28,727 | 10,273 | 5,356 |
| R2 | 0.116 | 0.108 | 0.142 | 0.145 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Elasticity Avg. Firm | 3.642 | 2.222 | 3.236 | 4.051 |

Notes: Dependent variable: Growth of imports from the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

It is important to explore in more detail whether part of the previous fall was compensated by trade diversion. This is done again by exploiting the sample information on company size and firms foreign trade excluding the UK for those firms in which the UK represents over 10% of total exports/imports.

Starting with exports, the results suggest that trade diversion has been more pronounced in SMEs (Table 11),¹³ while in aggregate terms the effect is not statistically significant for large ones. This

TABLE 11
UNCERTAINTY AND EXPORTS DIVERSION BY SIZE

| | (1) | (2) | (3) | (4) |
|-------------------------|-----------|-----------|-----------|---------|
| | Total | Small | Medium | Large |
| $\Delta \ln t_{fym,UK}$ | -0.640*** | -0.885*** | -0.365*** | -0.151 |
| (s.e.) | (0.079) | (0.129) | (0.131) | (0.166) |
| $\Delta \ln Prod_f$ | 0.234*** | 0.244*** | 0.369*** | 0.0453 |
| (s.e.) | (0.0334) | (0.0521) | (0.110) | (0.133) |
| # obs | 48,865 | 27,093 | 15,933 | 5,772 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Diverted per 100 euros | 92-151 | 108-194 | 26-151 | -41-113 |

Notes: The dependent variable is the growth of non-UK exports. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

¹³In spite of the favorable Brexit resolution, logistical problems associated with the implementation of customs formalities were encountered at the beginning of 2021, especially in the case of small firms. In addition, over time, bilateral trade flows may be negatively affected by the increase of non-tariff barriers, particularly in the case of SMEs.

result is consistent with the idea that big firms with high UK shares might be trading products that are very market specific. These findings are also consistent with those of Douch et al. (2020), who argue that for UK exporters trade diversion towards non-EU markets has been concentrated on SMEs.

When attention is shifted to imports, the same pattern is observed as for exports. High degree of trade diversion which is more intense in SMEs, although in this case small firms replacement of this market is lower than for exporters (Table 12). In consequence, these results point that although small firms have been less capable of reducing their sales and acquisitions with the UK in response to increased uncertainty, their degree of substitution with alternative markets has been higher. SMEs are characterized by being more dependent on the EU, where, as shown in Table 8, trade diversion was higher.

TABLE 12
UNCERTAINTY AND IMPORTS DIVERSION BY SIZE

| | (1) | (2) | (3) | (4) |
|-------------------------|-----------|-----------|-----------|----------|
| | Total | Small | Medium | Large |
| $\Delta \ln t_{fym,UK}$ | -0.657*** | -0.712*** | -0.796*** | -0.361 |
| (s.e.) | (0.077) | (0.112) | (0.290) | (0.245) |
| $\Delta \ln Prod_f$ | 0.201*** | 0.265*** | 0.364** | 0.0895* |
| (s.e.) | (0.0406) | (0.0459) | (0.171) | (0.0499) |
| # obs | 44,399 | 28,727 | 10,273 | 5,356 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Diverted per 100 euros | 64-102 | 55-103 | 41-243 | -22-158 |

Notes: The dependent variable is the growth of non-UK imports. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

7 Robustness

This section checks the validity of previous results and contrasts the findings with alternative samples. First, as the previous sections were based on firms in the top quartile in terms of share of the UK in trade, section 7.1 shows that those firms whose UK share in total trade is below the median (4%) do not react at all to Brexit, while the reaction is very heterogeneous for the group of firms between the median and the percentile 75 of the share distribution. Section 7.2 checks the validity of results to alternative specifications of the instrument. The baseline model uses the interaction between the firm's relative trade exposure to the UK in the past and potential sectoral tariffs after Brexit, and in this section results are presented using separately the different factors of the interaction. Estimates are broadly consistent but only the share of the UK appears to be a strong instrument. Lastly, the

robustness section 7.3 follows an exercise similar to Douch et al. (2020), comparing growth rates in different markets and obtaining similar results.

7.1 Specification with all firms and interaction by quartile of the share

Table 13 presents the results of a regression by quartiles of the UK share, both in exports and imports. The results show that in companies located in quartiles 1 and 2 (i.e. those in which the UK accounts for less than 4% of sales), there is no statistically significant impact of the referendum result on bilateral trade flows with the UK market. Likewise, there is also no indication that trade diversion is relevant. For companies in quartile 3 (with a relative exposure between 4% and 12/18% for exports/imports), there are some signs of declining bilateral trade with the UK, although low (elasticities of -1.4 and -1.3 respectively for exports and imports). The second stage presents some signs of trade diversion, but the results are very imprecise, reflecting large heterogeneity, which means that firms might follow different strategies given their own circumstances. Specially interesting is the very high diversion for imports that might indicate an increase in costs while finding new markets.

TABLE 13
UNCERTAINTY AND TRADE DIVERSION BY QUARTILE

| | Exports | | | Imports | | |
|---|--------------|-------------|-------------|--------------|-------------|-------------|
| | (1) (OLS) | (2) (FS) | (3) (IV) | (4) (OLS) | (5) (FS) | (6) (IV) |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}} pt1 - 2$ | | 16.92** | | | -5.052 | |
| (s.e.) | | (7.160) | | | (10.65) | |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}} pt3$ | | -19.16*** | | | -14.59* | |
| (s.e.) | | (4.232) | | | (8.232) | |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}} pt4$ | | -9.126*** | | | -8.002*** | |
| (s.e.) | | (1.693) | | | (3.329) | |
| $\Delta \ln t_{fym,UK} pt1-2$ | 0.0166** | | 0.236 | 0.0234*** | | -0.0420 |
| (s.e.) | (0.0071) | | (0.155) | (0.0043) | | (0.138) |
| $\Delta \ln t_{fym,UK} pt3$ | 0.0540*** | | -0.173** | 0.0638*** | | -0.729*** |
| (s.e.) | (0.0078) | | (0.0757) | (0.0078) | | (0.247) |
| $\Delta \ln t_{fym,UK} pt4$ | 0.0434*** | | -0.564*** | 0.0706*** | | -0.632*** |
| (s.e.) | (0.0153) | | (0.0610) | (0.0118) | | (0.148) |
| $\Delta \ln Prod_f$ | 0.145*** | 0.101*** | 0.189*** | 0.107*** | 0.0624*** | 0.149*** |
| (s.e.) | (0.0164) | (0.0167) | (0.0184) | (0.0251) | (0.0171) | (0.0323) |
| # obs | 125,680 | 125,680 | 125,680 | 105,444 | 105,444 | 105,444 |
| R2 | 0.142 | 0.098 | | 0.110 | 0.088 | |
| F-statistic | | 25.28 | | | 5.345 | |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Diverted per 100 euros, pt3 | | | 30-391 | | | 244-1209 |
| Diverted per 100 euros, pt4 | | | 69-106 | | | 27-74 |

Notes: The dependent variable is the growth of trade with the UK ($\Delta \ln t_{fym,UK}$) in columns 2 and 5, which report the first stage estimates for columns 3 and 6. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. The dependent variable is the growth of non-UK trade in columns 1, 3, 4 and 6. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Finally, in the last quartile (12% or higher share in the case of exports and over 18% for imports) there is a statistically significant drop in bilateral transactions that is much higher than what was observed for quantiles below. As far as trade diversion is concerned, there is also a significant effect, especially on the foreign sales side, where such diversion is practically complete, while this substitution is somehow less intense in imports.

7.2 Specification with different instruments

Table 14 reports the impact of firm level uncertainty due to brexit on firms' exports to the UK using as a measure of uncertainty the interaction of tariffs and share of the UK in firm level trade, as well as these variables separated. These results correspond to the first stage estimations used to analyze trade diversion due to uncertainty generated by the Brexit referendum. This first stage allows obtaining estimates of Brexit uncertainty impact, which will be used as instruments in the second stage in order to obtain an estimation for trade diversion resulting from Brexit referendum. Then, this section corroborates whether results hold using as instruments of uncertainty potential tariffs and the share of the UK in firm level trade.

An instrument will be valid when it is exogenous and statistically significant. As shown in section 5, firm level uncertainty, measured as the interaction between potential tariffs and UK weight in total trade has a strong explanatory power for bilateral exports growth. This result holds using tariffs and the dependence on the UK separately. On the other hand, the F-statistic suggests that instruments are strong when using UK share (columns 3 and 6), while it is very low when uncertainty is instrumented with tariffs.

TABLE 14
UNCERTAINTY AND TRADE WITH THE UK. ALTERNATIVE INSTRUMENTS

| | Exports | | | Imports | | |
|---|----------------------|--------------------|----------------------|---------------------|----------------------|-----------------------|
| | (1) (Baseline) | (2) (Tariffs) | (3) (UK share) | (4) (Baseline) | (5) (Tariffs) | (6) (UK share) |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$ (s.e.) | -9.172*** (1.646) | | | -7.875** (3.223) | | |
| $\ln(1 + T_s)$ (s.e.) | | -1.108* (0.603) | | | -1.620*** (0.581) | |
| $\frac{t_{f2015m,UK}}{t_{f2015m}}$ (s.e.) | | | -0.526*** (0.052) | | | -0.482*** (0.0324) |
| # obs | 125,680 | 127,391 | 125,680 | 105,444 | 107,251 | 105,444 |
| R2 | 0.097 | 0.098 | 0.098 | 0.088 | 0.089 | 0.089 |
| F-statistic | 31.05 | 3.377 | 103.7 | 5.97 | 7.76 | 221.3 |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the growth of exports to the UK in columns 1-3 and the growth of imports in columns 4-6. $\ln(1 + T_s)$ corresponds to potential sectoral tariffs after Brexit and $\frac{t_{f2015m,UK}}{t_{f2015m}}$ is the firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Then, Table 15 confirms that there is a shift in trade flows to alternative destinations when using the share of the UK as an instrument. As a matter of fact, columns 3 and 6 show that results hold broadly unchanged.

TABLE 15
UNCERTAINTY AND TRADE DIVERSION. ALTERNATIVE INSTRUMENTS

| | Exports | | | Imports | | |
|-------------------------|-------------------|------------------|-------------------|-------------------|------------------|-------------------|
| | (1) (Baseline) | (2) (Tariffs) | (3) (UK share) | (4) (Baseline) | (5) (Tariffs) | (6) (UK share) |
| $\Delta \ln t_{fym,UK}$ | -0.454*** | 0.986* | -0.507*** | -0.636*** | 0.477*** | -0.710*** |
| (s.e.) | (0.0470) | (0.530) | (0.0497) | (0.0646) | (0.164) | (0.076) |
| $\Delta \ln Prod_f$ | 0.196*** | 0.047 | 0.201*** | 0.151*** | 0.083*** | 0.155*** |
| (s.e.) | (0.0182) | (0.0595) | (0.0177) | (0.0328) | (0.023) | (0.0340) |
| # obs | 125,680 | 127,391 | 125,680 | 105,444 | 107,251 | 105,444 |
| F-statistic | 31.05 | 3.377 | 103.7 | 5.97 | 7.76 | 221.3 |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the growth of non-UK exports in columns 1-3 and the growth of non-UK imports in columns 4-6. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1+T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

7.3 Specification with differences in growth of trade flows by market

Additionally, the paper checks the results robustness by a direct estimation of the impact of the measure of uncertainty (approximated by the interaction of the UK share in the company's international transactions and the potential tariff in the case of a hard Brexit) on the difference between the growth rate of firm exports (imports) to alternative markets and their sales (acquisitions) to the UK.

As shown in table 16, a potential raise in tariffs increases statistically significantly the substitution with the rest of the markets. This result remains once controlling for time fixed effects, together with productivity changes and firm fixed effects, to avoid biases by omitted variables. The magnitude of the impact of uncertainty on trade diversion patterns would be much higher than those reported in the baseline specification, in line with the results obtained in the first stage of the baseline procedure.

Lastly, the exercise is repeated comparing growth rates of trade with the RoW and with the UK before and after the referendum by including a dummy that takes a value of 1 after the referendum, in line with Douch et al. (2020), who find that British exporters have replaced 9% of sales to the EU with the RoW. Table 17 reflects a partial substitution of around 5% of exports, while no effect is found in the case of importers. However, this result might be partially explained by time-varying factors (i.e. exchange rates) and can't be directly attributed to markets replacement.

TABLE 16
UNCERTAINTY AND TRADE DIVERSION

| | Exports | | Imports | |
|---|----------|----------|---------|---------|
| | (1) | (2) | (3) | (4) |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$ | 12.41*** | 13.33*** | 11.41** | 12.89** |
| (s.e.) | (2.383) | (2.489) | (4.461) | (5.227) |
| $\Delta \ln Prod_f$ | 0.048** | 0.048** | 0.049** | 0.049** |
| (s.e.) | (0.023) | (0.023) | (0.023) | (0.023) |
| $\Delta \ln GVA_s$ | 0.392 | | -0.195 | |
| (s.e.) | (0.267) | | (0.406) | |
| # obs | 125,680 | 125,680 | 105,444 | 105,444 |
| R2 | 0.097 | 0.098 | 0.087 | 0.088 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | No | Yes | No | Yes |

Notes: Dependent variable: Export growth to the world excluding the UK minus export growth to the UK in columns 1-2 and import growth from the world excluding the UK minus import growth from the UK in columns 3-4. Uncertainty is proxied with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE 17
TRADE DIVERSION DUE TO BREXIT

| | Exports | | Imports | |
|---------------------|-----------|-----------|----------|----------|
| | (1) | (2) | (3) | (4) |
| Post | 0.0488*** | 0.0461*** | 0.0169 | 0.0173 |
| (s.e.) | (0.0145) | (0.0143) | (0.0152) | (0.0152) |
| $\Delta \ln Prod_f$ | | 0.044** | | 0.055*** |
| (s.e.) | | (0.022) | | (0.020) |
| $\Delta \ln GVA_s$ | | 0.350 | | -0.330 |
| (s.e.) | | (0.257) | | (0.368) |
| # obs | 127,391 | 127,391 | 107,251 | 107,251 |
| R2 | 0.097 | 0.097 | 0.088 | 0.088 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No |

Notes: Dependent variable: Export growth to the world excluding the UK minus export growth to the UK in columns 1-2 and import growth from the world excluding the UK minus import growth from the UK in columns 3-4. *Post* is a dummy variable which takes a value of 1 after the Brexit vote. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

8 Concluding remarks

The result of the Brexit referendum generated an immediate concern about the trade repercussions between EU countries, including Spain, and the UK, both in the short and, above all, in the long term. Depending on the final outcome of the negotiations between the EU and British institutions, trade barriers could be significant, with potential high losses in the case of hard Brexit, which would have implied bilateral tariffs. The uncertainty about the final shape of the trade relationship between the UK and the EU as well as the long negotiation process meant that the effects of Brexit on bilateral trade flows between Spain and the UK may have become apparent before the actual exit of the British economy from the EU, through the direct impact of potential losses due to tariff barriers and second round effects linked to trade diversion towards other markets. However, this impact will likely be softened as a result of the final agreement in which there will not be tariff barriers. Indeed, during the long negotiation period, there was a high uncertainty about the final shape of the trade relationship between the UK and the EU.

This paper explores how Spanish firms' participation in the British market has been hindered by the aforementioned uncertain future potential losses, as well as their effect on trade with other countries. The baseline specification is consistent with a reduction of trade with the UK market and a replacement with alternative countries of those firms highly exposed to the British market. Trade diversion is higher for exports and more intense towards EU markets, where exporters and importers maintain stable trade relationships. By size, this trade diversion effect is more pronounced in SMEs, more vulnerable to a hypothetical increase of transactions costs. These results are robust to alternative approaches. In turn, the differences in magnitude between two-stage (through instrumental variables) and direct estimation approaches underline the adequacy of carrying out estimation strategies to consistently isolate the impact of potential losses associated with exposure to the UK market in the face of an eventual hard Brexit. Future advances in this line of research could contemplate extending the analysis to a sectoral scale with the aim of analyzing differences in substitutability degrees across products.

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Appendix A List of sectors available

This section lists the 75 sectors that could be identified in the sample.

TABLE A.1
AVAILABLE NACE CODES

| Section | Code | Title |
|---------|------|--|
| B | B | Mining and quarrying |
| C | 101 | Processing and preserving of meat and production of meat products |
| C | 102 | Processing and preserving of fish, crustaceans and molluscs |
| C | 103 | Processing and preserving of fruit and vegetables |
| C | 104 | Manufacture of vegetable and animal oils and fats |
| C | 105 | Manufacture of dairy products |
| C | 106 | Manufacture of grain mill products, starches and starch products |
| C | 107 | Manufacture of bakery and farinaceous products |
| C | 108 | Manufacture of other food products |
| C | 109 | Manufacture of prepared animal feeds |
| C | 1101 | Distilling, rectifying and blending of spirits |
| C | 1102 | Manufacture of wine from grape |
| C | 1103 | Manufacture of cider and other fruit wines |
| C | 1104 | Manufacture of other non-distilled fermented beverages |
| C | 1105 | Manufacture of beer |
| C | 1106 | Manufacture of malt |
| C | 1107 | Manufacture of soft drinks; production of mineral waters and other bottled waters |
| C | 12 | Manufacture of tobacco products |
| C | 13 | Manufacture of textiles |
| C | 14 | Manufacture of wearing apparel |
| C | 15 | Manufacture of leather and related products |
| C | 16 | Manufacture of wood and of products of wood and cork, except furniture |
| C | 17 | Manufacture of paper and paper products |
| C | 18 | Printing and reproduction of recorded media |
| C | 19 | Manufacture of coke and refined petroleum products |
| C | 20 | Manufacture of chemicals and chemical products |
| C | 21 | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| C | 22 | Manufacture of rubber and plastic products |
| C | 23 | Manufacture of other non-metallic mineral products |
| C | 24 | Manufacture of basic metals |
| C | 25 | Manufacture of fabricated metal products, except machinery and equipment |
| C | 26 | Manufacture of computer, electronic and optical products |
| C | 27 | Manufacture of electrical equipment |
| C | 28 | Manufacture of machinery and equipment n. |
| C | 291 | Manufacture of motor vehicles |
| C | 292 | Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers |
| C | 293 | Manufacture of parts and accessories for motor vehicles |
| C | 30 | Manufacture of other transport equipment |
| C | 31 | Manufacture of furniture |
| C | 32 | Other manufacturing |
| C | 33 | Repair and installation of machinery and equipment |
| D | D | Electricity, gas, steam and air conditioning supply |
| E | E | Water supply; sewerage; waste management and remediation activities |
| F | F | Construction |
| G | 45 | Wholesale and retail trade and repair of motor vehicles and motorcycles |
| G | 4611 | Agents involved in the sale of agric. materials, live animals, textile materials and semi-finished goods |
| G | 4612 | Agents involved in the sale of fuels, ores, metals and industrial chemicals |
| G | 4613 | Agents involved in the sale of timber and building materials |
| G | 4614 | Agents involved in the sale of machinery, industrial equipment, ships and aircraft |
| G | 4615 | Agents involved in the sale of furniture, household goods, hardware and ironmongery |
| G | 4616 | Agents involved in the sale of textiles, clothing, fur, footwear and leather goods |
| G | 4617 | Agents involved in the sale of food, beverages and tobacco |
| G | 4618 | Agents specialised in the sale of other particular products |
| G | 4619 | Agents involved in the sale of a variety of goods |
| G | 462 | Wholesale of agricultural raw materials and live animals |
| G | 463 | Wholesale of food, beverages and tobacco |
| G | 464 | Wholesale of household goods |
| G | 465 | Wholesale of information and communication equipment |
| G | 466 | Wholesale of other machinery, equipment and supplies |
| G | 467 | Other specialised wholesale |
| G | 469 | Non-specialised wholesale trade |
| G | 47 | Retail trade, except of motor vehicles and motorcycles |
| H | H | Transporting and storage |
| I | I | Accommodation and food service activities |
| J | J | Information and communication |
| K | K | Financial and insurance activities |
| L | L | Real estate activities |
| M | M | Professional, scientific and technical activities |
| N | N | Administrative and support service activities |
| O | O | Public administration and defence; compulsory social security |
| P | P | Education |
| Q | Q | Human health and social work activities |
| R | R | Arts, entertainment and recreation |
| S | S | Other services activities |
| U | U | Activities of extraterritorial organisations and bodies |

Notes. The sector classification is a mixture of NACE 2, 3 and 4 digit level.

Appendix B Additional tables

TABLE B.2
UNCERTAINTY AND TRADE DIVERSION BY UK SHARE

| | Exports | | Imports | |
|---|----------------------|-----------------------|-----------------------|-----------------------|
| | (1) (10%) | (2) (20%) | (3) (10%) | (4) (20%) |
| $\Delta \ln t_{fym,UK}$ (below threshold) (s.e.) | -0.164 (0.100) | -0.177*** (0.0448) | -0.0830 (0.108) | -0.308*** (0.066) |
| $\Delta \ln t_{fym,UK}$ (over threshold) (s.e.) | -0.544*** (0.052) | -0.639*** (0.0807) | -0.786*** (0.0838) | -0.862*** (0.0988) |
| $\Delta \ln Prod_f$ (s.e.) | 0.187*** (0.0185) | 0.185*** (0.0173) | 0.149*** (0.0321) | 0.149*** (0.0328) |
| # obs | 125,680 | 125,680 | 105,444 | 105,444 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Diverted over threshold | 84-122 | 49-82 | 78-120 | 48-76 |

Notes: The dependent variable is the growth of non-UK exports in columns 1-2 and the growth of non-UK imports in columns 3-4. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE B.3
UNCERTAINTY AND TRADE DIVERSION. ENTIRE SAMPLE

| | Exports | | | Imports | | |
|---|-----------------------|----------------------|-----------------------|-----------------------|----------------------|-----------------------|
| | (1) (OLS) | (2) (FS) | (3) (IV) | (4) (OLS) | (5) (FS) | (6) (IV) |
| $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$ (s.e.) | | -9.172*** (1.646) | | | -7.875** (3.223) | |
| $\Delta \ln t_{fym,UK}$ (s.e.) | 0.0328*** (0.0089) | | -0.454*** (0.0470) | 0.0468*** (0.0049) | | -0.636*** (0.0646) |
| $\Delta \ln Prod_f$ (s.e.) | 0.146*** (0.0163) | 0.101*** (0.0167) | 0.196*** (0.0182) | 0.108*** (0.0254) | 0.062*** (0.0171) | 0.151*** (0.0328) |
| # obs | 125,680 | 125,680 | 125,680 | 105,444 | 105,444 | 105,444 |
| R2 | 0.141 | 0.097 | | 0.109 | 0.088 | |
| F-statistic | | 31.05 | | | 5.97 | |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Diverted per 100 euros | | | 255-385 | | | 253-379 |

Notes: The dependent variable is the growth of trade with the UK ($\Delta \ln t_{fym,UK}$) in columns 2 and 5, which report the first stage estimates for columns 3 and 6. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{t_{f2015m,UK}}{t_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. The dependent variable is the growth of non-UK trade in columns 1, 3, 4 and 6. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE B.4
UNCERTAINTY AND EXPORTS TO THE UK BY SIZE. ENTIRE SAMPLE

| | (1) | (2) | (3) | (4) |
|---|-----------|-----------|-----------|-----------|
| | Total | Small | Medium | Large |
| $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$ | -8.202*** | -7.204*** | -10.98*** | -13.07*** |
| (s.e.) | (1.405) | (1.050) | (2.500) | (4.499) |
| $\Delta \ln Prod_f$ | 0.101*** | 0.134*** | 0.137*** | 0.252* |
| (s.e.) | (0.020) | (0.030) | (0.030) | (0.146) |
| # obs | 128,801 | 63,269 | 48,229 | 17,303 |
| R2 | 0.097 | 0.104 | 0.109 | 0.107 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Elasticity Avg. Firm | 1.019 | 1.019 | 1.030 | 1.348 |

Notes: The dependent variable is the growth of exports to the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE B.5
UNCERTAINTY AND IMPORTS FROM THE UK BY SIZE. ENTIRE SAMPLE

| | (1) | (2) | (3) | (4) |
|---|----------|-----------|----------|---------|
| | Total | Small | Medium | Large |
| $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$ | -5.540** | -4.691*** | -9.004** | -11.66* |
| (s.e.) | (2.244) | (1.699) | (3.569) | (6.846) |
| $\Delta \ln Prod_f$ | 0.073*** | 0.095*** | 0.151** | 0.056 |
| (s.e.) | (0.017) | (0.016) | (0.064) | (0.034) |
| # obs | 112,573 | 62,179 | 30,644 | 19,750 |
| R2 | 0.087 | 0.089 | 0.103 | 0.091 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Elasticity Avg. Firm | 0.929 | 0.967 | 0.924 | 1.185 |

Notes: The dependent variable is the growth of imports from the UK. Uncertainty is proxied with $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE B.6

UNCERTAINTY AND EXPORTS DIVERSION BY SIZE. ENTIRE SAMPLE

| | (1) | (2) | (3) | (4) |
|-------------------------|-----------|-----------|-----------|----------|
| | Total | Small | Medium | Large |
| $\Delta \ln t_{fym,UK}$ | -0.454*** | -0.609*** | -0.286*** | -0.122 |
| (s.e.) | (0.0470) | (0.0803) | (0.0788) | (0.0979) |
| $\Delta \ln Prod_f$ | 0.196*** | 0.228*** | 0.324*** | 0.174* |
| (s.e.) | (0.0182) | (0.0272) | (0.0514) | (0.097) |
| # obs | 125,680 | 60,651 | 47,813 | 17,151 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the growth of non-UK exports. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{X_{f2015m,UK}}{X_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

TABLE B.7

UNCERTAINTY AND IMPORTS DIVERSION BY SIZE. ENTIRE SAMPLE

| | (1) | (2) | (3) | (4) |
|-------------------------|-----------|-----------|-----------|----------|
| | Total | Small | Medium | Large |
| $\Delta \ln t_{fym,UK}$ | -0.636*** | -0.696*** | -0.620*** | -0.464** |
| (s.e.) | (0.0646) | (0.105) | (0.176) | (0.204) |
| $\Delta \ln Prod_f$ | 0.151*** | 0.203*** | 0.240** | -0.083* |
| (s.e.) | (0.0328) | (0.045) | (0.112) | (0.043) |
| # obs | 105,444 | 56,009 | 29,927 | 19,447 |
| Firm FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the growth of non-UK imports. $\Delta \ln t_{fym,UK}$ is instrumented with $\ln(1 + T_s) \frac{M_{f2015m,UK}}{M_{f2015m}}$, which denotes the interaction between potential sectoral tariffs after Brexit and firms' relative trade exposure to the UK in 2015. Small firms have less than 50 employees, Medium 50-249, and large 250 or more. Standard errors are clustered at the sectoral level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

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