Responses to Reviewer 2's Report on EEREV-D-23-00148 "The negative impact of disintegration on trade: the case of Brexit"

We would like to thank you for the thoughtful and detailed report on our manuscript. All your comments were very well received and we have tried to address them as best as we could in preparing a revised version of the manuscript.

We organize our responses in the same order as your comments appeared. Furthermore, for your convenience, we repeat your comments in italics before describing how we addressed each of them.

Before beginning with the detailed report, we must mention that the revised version of the paper uses a data set that covers the entire 2022. In the original version of the paper, we only covered the first half of 2022. Furthermore, all empirical analyses use a quarterly frequency. In the previous version, we used a quarterly frequency for the intensive margin analyses and a half-year frequency for the extensive margin analyses. Finally, analyses on the extensive margin of trade now include the firm-destination-product dimension.

1. Main comments

1. Broad remarks

(a) At various points throughout the paper (e.g. last paragraph on page 2) the authors refer to the new trade arrangement between the UK and Spain (and EU) post-Brexit as shallow. This is not entirely just. As the paper details, UK-EU tariffs are still zero under the TCA, and what primarily changed was the implementation of NTBs. One could argue that the new relationship is akin to a NAFTA-like FTA depth, which is still the deepest trade agreement outside of the EU itself.

Following your recommendation, we no longer denote TCA as a shallow trade agreement. Instead, in the new version of the paper, we argue that the level of integration under the TCA is lower than that achieved when the UK was a member of the EU's single market and customs union.

(b) It was not clear to me why the paper focused only on SPS and RoO, as other NTBs (such as TBT) are likely to be equally important hindrances to Spanish-UK trade.

In the original version of the paper, we argued that technical barriers to trade (TBT) had not diverged between the UK and the EU during the TCA period covered by our data set. Therefore, we did not expect that TCA would have a stronger negative effect on products subjected to a large number of TBT than on those subjected to a low number of TBT. However, there was a limitation in our argument.

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The EU follows two strategies to ensure that product standards do not introduce unjustified barriers to trade between member countries. In some products, EU members use the same standards; that is, standards are harmonized. In the remaining products, the EU relies on mutual recognition: if it is legal to sell a product in a member state, then it is also legal to sell that product in another member state. The TCA does not include a mutual recognition clause. Therefore, the argument about the absence of divergence in TBT between the UK and the EU defended in the original version of the paper may be valid for products whose standards were harmonized. However, it might not be valid for products that were under the mutual recognition scheme. After the TCA, a Spanish firm should abide by the technical standards of the UK if it wants to continue selling its products to that country. Similarly, a British firm should abide by the Spanish technical standards if it wants to continue selling its products in Spain. The adoption of the partner's technical standards introduces a new cost that can have a negative impact on the EU-UK trade.

In the new version of the paper, we explore whether the negative impact of the TCA on trade was stronger on products that were under the mutual recognition scheme than on products that were already harmonized prior to the TCA. We use European Commission's (2017) which in Annex Table 8.2 classifies manufacturing industries as harmonized or non-harmonized.[1] We expand Equation (1) by multiplying each Brexit stage by a dummy variable that turns one if the product was not harmonized prior to the TCA.

Table 1 presents the estimates. The negative impact of the TCA on Spanish exports to the UK was stronger for non-harmonized than harmonized manufactures (column 1). However, the negative impact of the TCA on Spanish imports from the UK was similar for non-harmonized and harmonized manufactures (column 2). The decrease in entry into the UK after the TCA was stronger for non-harmonized than harmonized manufactures both in exports and imports (columns 3 and 4). The probability of stopping exporting or importing a product to the UK after the TCA was also stronger for non-harmonized than harmonized manufacturers (columns 5 and 6). To sum up, the results indicate that manufactures whose technical standards had not been harmonized before the withdrawal of the UK from the EU's single market experienced, in most cases, a larger decrease in the intensive and extensive margins of trade after the TCA than manufactures whose technical standards had already been harmonized.

The analysis on the heterogeneous effects of the TCA on harmonized and non-harmonized manufactures is introduced at the end of the product heterogeneity subsection on page 24 of the revised version of the paper.

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[1]Products in European Commission (2017) are defined using the 4-digit NACE classification. We use a crosswalk obtained from Eurostat Ramon to match this classification with the HS classification used by Spanish Customs.

Table 1: Product heterogeneity: Harmonized vs. Non-harmonized

	Value		Entry		Exit	
	(1)	(2)	(3)	(4)	(5)	(6)
	Exports	Imports	Exports	Imports	Exports	Imports
Post-referendum$_{ct}$	-0.022^b	-0.072^a	-0.008^a	-0.003	0.004	-0.018^a
	(0.009)	(0.016)	(0.002)	(0.006)	(0.003)	(0.006)
Post-referendum$_{ct}$ x Non-Harmonized$_k$	0.023^b	0.054^a	0.012^a	-0.011	-0.015^a	0.003
	(0.010)	(0.012)	(0.003)	(0.007)	(0.004)	(0.007)
Official$_{ct}$	-0.029^b	-0.053	0.018^a	0.023^b	0.001	-0.039^a
	(0.013)	(0.033)	(0.003)	(0.010)	(0.004)	(0.008)
Official$_{ct}$ x Non-Harmonized$_k$	0.076^a	-0.014	0.034^a	-0.019	-0.044^a	-0.060^a
	(0.023)	(0.020)	(0.004)	(0.012)	(0.009)	(0.017)
TCA$_{ct}$	-0.206^a	-0.320^a	-0.107^a	-0.286^a	0.121^a	0.243^a
	(0.014)	(0.034)	(0.010)	(0.021)	(0.004)	(0.010)
TCA$_{ct}$ x Non-Harmonized$_k$	-0.238^a	0.060	-0.059^a	-0.054^a	0.081^a	0.155^a
	(0.029)	(0.045)	(0.005)	(0.011)	(0.005)	(0.020)
Observations	6771283	7555494	6070680	1891456	2796305	905227
Adj.-R2	0.789	0.751	0.121	0.011	0.265	0.057
Firms	47069	71893	16266	17034	16447	17316
Countries	61	61	61	61	61	61
Products	7161	7488	6097	6289	6100	6302

Note: In column 1 (2) the dependent variable is the log value of exports (imports). In column 3 (4) the dependent variable turns one if firm f that did not export (import) product k to destination c at year-quarter $t-1$ began exporting (importing) product k to destination c at t. In column 5 (6) the dependent variable turns one if firm f exported (imported) product k to destination c at $t-1$ ceased to export (import) product k to destination c at t. Estimations in columns 1 and 2 include firm×country×product and firm×product×quarter fixed effects, and a constant. Estimations in columns 3 to 6 include country×product and firm×product×quarter fixed effects, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

2. Mechanisms

(a) The paper could benefit from a more through discussion of mechanisms which might drive the results. Overall, I think this could be done by framing the analysis after the baseline results as an exploration of what is behind the drop in Spain-UK trade. For example, there could be a more developed discussion of why different products or firms might have a different Brexit exposure.

We agree with the reviewer. In the new version of the paper, we introduce the heterogeneity analysis as an exploration of the mechanisms that could explain the large decrease in the Spain-UK trade after the TCA. In addition, we expand the discussion on why a product or a firm characteristic may magnify the negative effect of the TCA on trade.

(b) Related to the above, the paper could benefit from a deeper discussion on why one might expect Brexit to raise trade costs in products more affected by SPS & RoO.

Following your recommendation, the new version of the paper provides a more in-depth discussion on why the negative effect of TCA on trade is magnified for products that require SPS certifications or are subject to more stringent rules of origin.

3. Dataset

(a) The paper states that data on quarterly real GDP & bilateral real exchange rates are only available for 44 export destinations/import origins. This vastly reduces the sample, and, as outlined on page 5, excludes 25% of Spanish exports and 31% of Spanish imports. While the OECD data set should cover OECD countries, the IMF IFS data set covers many more countries (including at the quarterly level). This should be addressed.

Following the recommendation of the reviewer, we have increased the number of countries included in the sample. We have taken the following steps. First, following the reviewer's suggestion, we have selected all countries that have quarterly-level data in the IMF IFS data set. Second, we have added Greece and Canada to that set. These countries are included in the OECD data set, but not in the IMF IFS data set. Finally, we have added Taiwan using data from the St. Louis Federal Reserve data set. The number of countries included in the sample increases from 44 to 61. After all data cleaning steps, the new sample represents 78% and 71% of Spanish exports and imports, respectively, in 2014 (the first year of our analysis period).

(b) Transactions with a value of 10,000 euros or below have been dropped to "reduce noise in the data" (p. 7). However, this value seems arbitrary and I worry that this will also have implications for the extensive margin analysis results. Dropping these small trade transactions might be systematic across certain (small) destinations, time periods, etc. Further, the paper lacks a discussion of how this affects overall summary stats (e.g. what share of total trade is this, etc.).

Our data set contains a large number of export and import transactions that have a very low value. We feared that these small-value transactions could distort the estimates. We selected the 10,000 euro threshold because it eliminated a large number of small-value transactions (43% and 42% of export and import transactions, respectively), while keeping most of the total value of exports and imports (99%).

Following the advice of the reviewer, we test whether our extensive margin estimates are affected by the 10,000 euro threshold. We have re-estimated all the baseline extensive margin specifications using a 1,500 euro instead of a 10,000 euro threshold.[2] Table 2 presents the results. The point values of the TCA_{ct} coefficients are qualitatively and quantitatively similar to those obtained with the 10,000 euro threshold (Table 3 in the revised version of the paper).

The new version of the paper includes this robustness analysis as Table 2 in the online Appendix. Furthermore, we explain how the 10,000 euro threshold affects the number of transactions and the total value of exports and imports in the main body of the paper.

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[2] 1,500 euro was the transaction value threshold used by Customs when providing us with this database.

Table 2: 1,500 euro threshold. Impact of Brexit on Spanish firms' entry and exit in the UK

	Entry				Exit			
	Firm-destination		Firm-destination-product		Firm-destination		Firm-destination-product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Post-referendum$_{ct}$	-0.001	-0.005	0.001	-0.002	0.002	0.007^b	0.000	-0.002
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.004)
Official$_{ct}$	0.024^a	0.002	0.030^a	0.020^a	0.020^a	0.004	-0.009^b	-0.034^a
	(0.003)	(0.005)	(0.003)	(0.007)	(0.003)	(0.005)	(0.004)	(0.009)
TCA$_{ct}$	-0.030^a	-0.116^a	-0.125^a	-0.297^a	0.058^a	0.177^a	0.135^a	0.268^a
	(0.005)	(0.006)	(0.009)	(0.022)	(0.003)	(0.006)	(0.004)	(0.010)
ln Real GDP$_{ct}$	0.044^a	0.077^b	0.049^a	0.126^b	-0.075^a	-0.057^c	-0.109^a	-0.119^a
	(0.013)	(0.029)	(0.015)	(0.049)	(0.018)	(0.032)	(0.023)	(0.042)
ln Real exchange rate$_{ct}$	0.046^a	-0.011	0.041^a	-0.015	-0.038^a	0.017	-0.038^b	0.042
	(0.009)	(0.019)	(0.009)	(0.019)	(0.012)	(0.012)	(0.015)	(0.026)
Observations	5208303	3097756	10181762	3351765	2680005	1494193	4691422	1539041
Adj.-R2	0.051	0.019	0.126	0.021	0.117	0.039	0.270	0.078
Firms	17216	22053	17141	21853	17320	22277	17276	22198
Countries	61	61	61	61	61	61	61	61
Products			6361	6830			6378	6862

Note: In column 1 (2) the dependent variable turns one if firm f that did not export (import) to destination c at year-quarter $t-1$ began exporting (importing) at t. In column 3 (4) the dependent variable turns one if firm f that did not export (import) product k to destination c at $t-1$ began exporting (importing) product k at t. In column 5 (6) the dependent variable turns one if firm f that exported (imported) at $t-1$ ceased to export (import) to destination c at t. In column 7 (8) the dependent variable turns one if firm f that exported (imported) product k to destination c at $t-1$ ceased to export (import) product k at t. Estimations at the firm-destination level include firm×time and country fixed effects, and a constant. Estimations at the firm-destination-product level include country×product and firm×product×quarter fixed effects, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

(c) P. 25: The paper should provide a more comprehensive description of how TFP is computed beyond simply citing Levinsohn and Petrin (2003). More broadly, there are various approaches to measuring TFP (see e.g. ACF 2015 and GNR 2020) which provide improvements in properly identifying revenue TFP.

Following your recommendation, we provide a more comprehensive description on how TFP is computed. The new text, included on page 30 of the revised version of the paper, reads as follows:

"We estimate TFP using the Levinsohn and Petrin's (2003) approach. It employs a Cobb-Douglas gross output production function that uses intermediate inputs as a proxy to control the correlation between input levels and unobserved firm-specific productivity.[3] Variables to estimate the production function (revenue, employment, tangible assets, and intermediate inputs) are obtained from the Bureau van Dick SABI database. The nominal values are deflated using the industrial price index obtained from the Spanish National Statistics (2010=100). We eliminate observations with negative output or a revenue smaller than the value of intermediate inputs. The data set covers all manufacturing firms with complete data for at least 4 years over the period 2010-2019. The production function is estimated separately for each four-digit NACE manufacturing industry."

Following your suggestion, we also calculated productivity measures using the methodologies developed by Ackerberg et al. (2015) and Gandhi et al. (2020).[4] Table 3 presents the results using the Ackerberg et al.'s (2015) productivity measure. The results are qualitatively similar to those using the Levinsohn and Petrin's (2003) TFP measure, which are reported in Table 9 of the revised version of the paper. Table 4 presents the results using the Gandhi et al.'s (2020) productivity measure. There are some differences with respect to the estimates using Levinsohn and Petrin's (2003) TFP measure. First, we find that the negative impact of the TCA on import value is now stronger for large importers. Second, the negative impact of the TCA on entry is not stronger for high-productivity exporters. Finally, the impact of the TCA on exit is similar for low-productivity and high-productivity importers.

We comment on these robustness analyses on page 30 of the revised version of the paper. Furthermore, Tables 3 and 4 of this report are included as Tables A.13 and A.14 of the online Appendix.

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[3] The production function is estimated using Stata's prodest module.

[4] We use Stata's prodest module to estimate Ackerberg et al.'s (2015) TFP and R's gnrprod package to estimate Gandhi et al.'s (2020) total productivity.

Table 3: Robustness. Impact of Brexit on low and high-productive manufacturing firms based on Ackerberg et al. (2015) productivity measure

	Value		Entry		Exit	
	(1)	(2)	(3)	(4)	(5)	(6)
	Exports	Imports	Exports	Imports	Exports	Imports
Post-referendum$_{ct}$	-0.023^b	-0.028	-0.005^c	0.008^c	-0.003	-0.005
	(0.010)	(0.022)	(0.003)	(0.004)	(0.004)	(0.007)
Post-referendum$_{ct}$ x High-TFP$_f$	-0.022^a	-0.063^a	0.009^a	-0.015^a	0.015^a	0.037^a
	(0.008)	(0.020)	(0.002)	(0.005)	(0.005)	(0.006)
Official$_{ct}$	-0.112^a	-0.024	0.014^a	0.016^a	0.012^c	0.004
	(0.013)	(0.040)	(0.004)	(0.005)	(0.007)	(0.009)
Official$_{ct}$ x High-TFP$_f$	0.043^a	-0.089^b	-0.008^b	-0.026^a	0.035^a	0.029^a
	(0.011)	(0.037)	(0.004)	(0.005)	(0.008)	(0.010)
TCA$_{ct}$	-0.172^a	-0.216^a	-0.027^a	-0.099^a	0.031^a	0.145^a
	(0.014)	(0.057)	(0.005)	(0.005)	(0.005)	(0.009)
TCA$_{ct}$ x High-TFP$_f$	-0.036^a	-0.055	-0.010^a	0.004	0.025^a	0.017^b
	(0.011)	(0.037)	(0.004)	(0.004)	(0.005)	(0.008)
Observations	2918426	2173944	1876411	720358	969583	363629
Adj.-R2	0.791	0.758	0.032	0.002	0.104	0.007
Firms	7355	6677	5007	3852	5010	3856
Countries	61	61	61	61	61	61
Products	6587	7210				

Note: The dependent variable is the (log) value of exports and imports in columns 1 and 2, respectively. In column 3 (column 4) the dependent variable turns one if firm f that did not export (import) at $t-1$ began exporting (importing) at t. In column 5 (column 6) the dependent variable turns one if firm f that exported (imported) at $t-1$ ceased to export (import) at t. All estimations include a log real GDP and a log real bilateral exchange rate variable. In columns 1 and 2 estimations include a firm×country×product fixed effect, a firm×time fixed effect, and a constant. In columns 3 to 6, estimations include a firm×time fixed effect, a country fixed effect, and a constant. Standard errors clustered at country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

Table 4: Robustness. Impact of Brexit on low- and high-productive manufacturing firms based on Gandhi et al. (2020) productivity measure

	Value		Entry		Exit	
	(1)	(2)	(3)	(4)	(5)	(6)
	Exports	Imports	Exports	Imports	Exports	Imports
Post-referendum$_{ct}$	-0.044^a	-0.017	-0.005^c	-0.006	-0.010^b	0.017^a
	(0.007)	(0.024)	(0.003)	(0.004)	(0.004)	(0.006)
Post-referendum$_{ct}$ x High-Productivity$_f$	0.015^b	-0.067^a	0.009^a	0.010^a	0.027^a	-0.007
	(0.007)	(0.023)	(0.002)	(0.004)	(0.005)	(0.005)
Official$_{ct}$	-0.097^a	0.007	-0.003	-0.008	0.020^a	0.034^a
	(0.010)	(0.047)	(0.004)	(0.006)	(0.006)	(0.010)
Official$_{ct}$ x High-Productivity$_f$	0.015	-0.118^a	0.025^a	0.017^a	0.019^a	-0.025^b
	(0.010)	(0.044)	(0.004)	(0.005)	(0.006)	(0.011)
TCA$_{ct}$	-0.160^a	-0.151^a	-0.035^a	-0.099^a	0.017^a	0.146^a
	(0.017)	(0.050)	(0.004)	(0.006)	(0.005)	(0.009)
TCA$_{ct}$ x High-Productivity$_f$	-0.056^a	-0.152^a	0.004	0.005	0.053^a	0.014
	(0.010)	(0.044)	(0.005)	(0.005)	(0.005)	(0.009)
Observations	2918426	2173944	1876411	720358	969583	363629
Adj.-R2	0.791	0.758	0.032	0.002	0.104	0.007
Firms	7355	6677	5007	3852	5010	3856
Countries	61	61	61	61	61	61
Products	6587	7210				

Note: The dependent variable is the (log) value of exports and imports in columns 1 and 2, respectively. In column 3 (column 4) the dependent variable turns one if firm f that did not export (import) at $t-1$ began exporting (importing) at t. In column 5 (column 6) the dependent variable turns one if firm f that exported (imported) at $t-1$ ceased to export (import) at t. All estimations include a log real GDP and a log real bilateral exchange rate variable. In columns 1 and 2 estimations include a firm×country×product fixed effect, a firm×time fixed effect, and a constant. In columns 3 to 6, estimations include a firm×time fixed effect, a country fixed effect, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

(d) For the TFP analysis, it is not clear why the focus is only on the manufacturing sector, presuming that SABI does contain balance sheet information for firms in other sectors as well.

(e) Merge with SABI: Why is it that the authors only select firms with 10 or more employees? This seems an arbitrary number and reduces the sample vastly (and - alongside the manufacturing sector restriction - cuts trade by basically half). Further, this large reduction in trade does not seem to square with the statement on page 18 that "manufacturing is the activity that accounts for the bulk of Spanish trade in goods".

Your comments (d) and (e) are correct, since SABI does contain balance sheet information for firms in all industries, and the choice of 10 or more employees reduces the sample vastly. In the previous version of the paper, we did not explain why we restricted the analysis of firm productivity heterogeneity to only manufacturing firms with more than 10 employees.

Although we can use all the firms included in SABI to calculate TFP, we can only merge firms in Customs with a subsample of firms in SABI. Due to statistical secrecy, we are only authorized to use the information of firms included in the Directorio de Empresas Exportadoras e Importadoras, a database elaborated by Cámara de Comercio de España (Spanish Chamber of Commerce). The Directorio is a good representation of exporting and importing firms with 10 or more employees operating in the manufacturing sector.

Table 5 shows the number of trading firms and the value of trade flows in 2015 for different samples of firms. The reference sample is the Customs database, which captures all Spanish traders and trade transactions. In 2015 there were 147,334 exporters and 257,880 importers. The customs database provided by the Spanish Trade Chamber only includes transactions over 1,500 euros. The number of exporters is reduced by 45% (82,041 exporters), but the value of exports is reduced by only 1.7%. The number of importers is reduced by 69% (81,818 importers), but the value of imports is reduced by only 2.4%. The sample of firms used in the paper imposes a threshold value of 10,000 euros. Although the number of exporters and importers falls to 51,214 and 54,126, respectively, the value of exports and imports only falls marginally. When we analyze the role of firm productivity in the impact of TCA on Spain-UK trade flows, we restrict the sample to firms included in the Directorio. Most of these firms operate in the manufacturing sectors. The sample of manufacturing firms contains 11,804 exporters and 10,204 importers, representing 63% of total exports and 47% of total imports. Finally, the sample is restricted to firms with 10 or more workers and with information to estimate the TFP; the sample contains 8,240 exporters and 7,168 importers, representing 57% and 43% of Spanish exports and imports, respectively.

Table 5: Number of trading firms and value of trade flows in Spanish Customs database in 2015, for different samples of firms.

Sample	Exports		Imports	
	Firms	Value	Firms	Value
Spanish Customs	147334	249794	257880	274772
Spanish Trade Chamber	82041	245750	81818	268267
Baseline sample	51214	242612	54126	245750
Manufacturing sample	11804	157405	10204	129941
TFP sample	8240	143817	7168	118672

Note: Values are in millions of euros. Source: authors' own calculations based on Datacomex and the Spanish Customs' database.

4. Empirical Specifications

(a) Controls: Given the discussion of uncertainty, it seems an important control for cross-product heterogeneity in exposure to Brexit-related trade policy uncertainty–namely MFN tariffs–is missing. This is an important control insofar as it would measure the barriers that Spanish trade could have faced without a new TCA-like trade deal. Beyond this uncertainty control, I think the authors should be controlling for bilateral tariffs with all trade partners.

Following your recommendation, we analyze the impact of trade policy uncertainty on Spain-UK trade flows. It is important to stress that trade policy uncertainty only affects the Post-Referendum and Official periods. It does not affect the TCA period, because uncertainty on trade policy disappears once the new trade agreement between the EU and the UK is signed.

Trade policy uncertainty, TPU_{ckt}, is measured by EU's most-favored nation tariff for product k if partner c is the UK and t is between 2016Q3 and 2020Q4, the Post-Referendum and Official periods. In all the remaining cases, TPU_{ckt} takes the value of zero. We expand Equation (1) with a new variable $\ln(1 + (TPU_{ckt}/100))$.

Table 6 presents the estimations for the intensive margin of trade. The first column reports the estimates for the benchmark case, which does not include trade policy uncertainty as a regressor. Column 2 reports the results for the specification that includes trade policy uncertainty as an independent variable. The trade policy uncertainty coefficient is positive and statistically significant. Specifically, a 1% increase in the EU most-favored tariff leads to 1.4% increase in Spanish exports to the UK. This result is contrary to expectations. We expected exports of products that would have a large tariff in a hard-Brexit scenario to decrease more, or at minimum the same, than of those that would have a small tariff in a hard-Brexit scenario. Since trade policy uncertainty does not affect the TCA period, the sign and value of the TCA_{ct} coefficient, the key coefficient in our analysis, are not affected by the inclusion of the trade policy uncertainty variable.

Columns 5 and 6 present the results for imports. As before, contrary to our expectations, we find that trade policy uncertainty *increases* the value of Spanish firms imports from the UK.

We made some additional estimations to test the robustness of these awkward results. In column 3 (7), we select a subsample that only includes Spanish exports (imports) to the UK between 2014 and 2020. We exclude the period in which the TCA is in force because we want to focus on the periods in which trade policy uncertainty could have an impact on trade flows: Post-Referendum and Official.

We estimate the following specification:

Table 6: Trade policy uncertainty. Intensive margin

	Exports				Imports			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-referendum$_{ct}$	-0.017^c	-0.091^a			-0.058^a	-0.083^a		
	(0.009)	(0.010)			(0.016)	(0.018)		
Official$_{ct}$	-0.006	-0.080^a			-0.061^c	-0.085^b		
	(0.012)	(0.012)			(0.033)	(0.033)		
TCA$_{ct}$	-0.275^a	-0.277^a			-0.319^a	-0.321^a		
	(0.018)	(0.019)			(0.030)	(0.030)		
ln Real GDP$_{ct}$	0.428^a	0.428^a			0.567^a	0.568^a		
	(0.088)	(0.088)			(0.118)	(0.118)		
ln Real exchange rate$_{ct}$	0.180^a	0.180^a			-0.135	-0.136		
	(0.058)	(0.058)			(0.118)	(0.118)		
ln (1+(TPU$_{ckt}$/100))		1.377^a	0.404^a	0.198^c		0.717^a	0.343^a	0.303^b
		(0.181)	(0.085)	(0.110)		(0.233)	(0.099)	(0.140)
Observations	5043116	5043116	247131	61754	2923630	2923630	242407	53734
Adjusted R^2	0.784	0.784	0.759	0.001	0.752	0.752	0.741	0.002

Note: The dependent variable is the (log) value of exports in columns 1 to 3 and the (log) value of imports in columns 5 to 7. The dependent variable is the year-to-year percentage change in exports in column 4 and the year-to-year percentage change in imports in column 8. Estimations in columns 1, 2, 5, and 6 include firm×country×product and firm×product×quarter fixed effects, and a constant. Estimations in columns 3 and 7 include firm×product and quarter fixed effects, and a constant. Estimations in columns 4 and 8, include product and quarter fixed effects, and a constant. Standard errors, in parentheses, are clustered at the country level in columns 1, 2, 5, and 6. Standard errors are heterokedasticy robust in columns 3, 4, 7, and 8. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

$$\ln y_{fkt} = \beta \ln(1 + (TPU_{kt}/100)) + \gamma_{fk} + \gamma_t + \epsilon_{fkt} \qquad (1)$$

where y_{fkt} is Spanish firm f exports (imports) of product k to the UK in year-quarter t. Note that in this equation we have removed the $Post-Referendum_t$, $Official_t$, $\ln GDP_t$, and $\ln RER_t$ variables, because they are collinear with the t fixed effect. The trade policy uncertainty coefficient, although with a lower point value, remains positive and statistically significant both for exports and imports.

Finally, similar to Fernandes and Winters (2021), in addition to the pre-Brexit period, we only include one year of the post-Referendum period (2016Q3-2017Q2) in the sample and estimate a regression equation in first differences:

$$\Delta \ln y_{fkt} = \Delta \ln(1 + (TPU_{kt}/100)) + \gamma_k + \gamma_t + \epsilon_{fkt} \qquad (2)$$

where $\Delta \ln y_{fkt} = \ln y_{fkt} - \ln y_{fkt-1}$ and $\Delta \ln(1+(TPU_{kt}/100)) = \ln(1+(TPU_{kt}/100)) - \ln(1 + (TPU_{kt-1}/100))$. Note that $\Delta \ln(1 + (TPU_{kt}/100))$ is zero if t and $t-1$ are before the Brexit referendum and equal to $\ln(1 + (TPU_{kt}/100))$ if t is after the referendum. As in the previous estimation, the UK is the only partner included in the sample. The trade

policy uncertainty coefficient remains positive and statistically significant. Therefore, our awkward result is robust to using different samples and specifications.

In the new version of the paper, we analyze the impact of the TCA on entry and exit at the firm-destination-product level. At this level, we can also explore whether the impact of Brexit on the extensive margin was different on products that had a large trade policy uncertainty. Tables 7 and 8 present the estimates for entry and exit, respectively. The first column in each trade flow reports the results for the benchmark case, the second column introduces the trade policy uncertainty variable, and the third column restricts the sample to the UK and the 2014-2020 period. Similarly to intensive margin analyses, the sign of the trade policy uncertainty variable is contrary to expectations: Spanish firms had a higher probability to enter the UK market and a lower probability to exit the UK market if they exported a product with large policy uncertainty. The results are similar for imports.

Table 7: Trade policy uncertainty. Entry

	Exports			Imports		
	(1)	(2)	(3)	(4)	(5)	(6)
Post-referendum$_{ct}$	0.004	-0.016^a		-0.014^a	-0.032^a	
	(0.003)	(0.002)		(0.005)	(0.006)	
Official$_{ct}$	0.023^a	0.004		0.001	-0.017^b	
	(0.004)	(0.004)		(0.008)	(0.008)	
TCA$_{ct}$	-0.144^a	-0.144^a		-0.347^a	-0.348^a	
	(0.010)	(0.010)		(0.027)	(0.027)	
ln Real GDP$_{ct}$	0.057^a	0.057^a		0.155^b	0.155^b	
	(0.019)	(0.019)		(0.058)	(0.058)	
ln Real exchange rate$_{ct}$	0.047^a	0.047^a		-0.028	-0.028	
	(0.012)	(0.012)		(0.026)	(0.026)	
ln $(1+(\text{TPU}_{ckt}/100))$		0.389^a	0.235^a		0.475^a	0.063
		(0.028)	(0.042)		(0.067)	(0.061)
Observations	5886687	5886687	221883	1799709	1799709	183273
Adjusted R^2	0.235	0.235	0.223	0.115	0.115	0.267

Note: In columns 1 to 3 (columns 4 to 6) the dependent variable turns one if firm f that did not export (import) product k to destination c at $t-1$ began exporting (importing) product k at t. Estimations in columns 1, 2, 4, and 5 include country×product and firm×product×quarter fixed effects, and a constant. Estimations in columns 3 and 6 include firm×product and quarter fixed effects, and a constant. Standard errors, in parentheses, are clustered at the country level in columns 1, 2, 4, and 5. Standard errors are heterokedasticy robust in columns 3 and 6. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

Our results on the impact of trade policy uncertainty on the intensive and extensive margins of trade are difficult to reconcile with the existing literature and require further exploration. Considering that (i) trade policy uncertainty disappears once the TCA enters into force; (ii) the goal of this paper is to analyze the impact of the TCA on Spanish trade with the UK; and (iii) the impact of trade policy uncertainty at the product level during the Post-referendum and Official stages requires a thorough analysis which is beyond the scope of our study, we decided not to incorporate the product-level trade policy uncertainty analysis to the revised version of the paper.

Table 8: Trade policy uncertainty. Exit

	Exports			Imports		
	(1)	(2)	(3)	(4)	(5)	(6)
Post-referendum$_{ct}$	0.000	0.018^a		0.009^c	0.031^a	
	(0.004)	(0.003)		(0.004)	(0.005)	
Official$_{ct}$	-0.018^a	-0.001		-0.018	0.004	
	(0.006)	(0.005)		(0.014)	(0.012)	
TCA$_{ct}$	0.174^a	0.175^a		0.396^a	0.397^a	
	(0.006)	(0.006)		(0.013)	(0.013)	
ln Real GDP$_{ct}$	-0.134^a	-0.134^a		-0.200^a	-0.201^a	
	(0.033)	(0.033)		(0.057)	(0.057)	
ln Real exchange rate$_{ct}$	-0.058^a	-0.058^a		0.049^c	0.049^c	
	(0.017)	(0.017)		(0.028)	(0.029)	
ln $(1+(\text{TPU}_{ckt}/100))$		-0.324^a	-0.244^a		-0.653^a	-0.109
		(0.043)	(0.057)		(0.115)	(0.088)
Observations	2472456	2472456	140168	608332	608332	97673
Adjusted R^2	0.383	0.383	0.380	0.211	0.211	0.430

Note: In columns 1 to 3 (columns 4 to 6) the dependent variable turns one if firm f exported (imported) product k to destination c at $t-1$ ceased to export (import) product k at t. Estimations in columns 1, 2, 4, and 5 include country×product and firm×product×quarter fixed effects, and a constant. Estimations in columns 3 and 6 include firm×product and quarter fixed effects, and a constant. Standard errors, in parentheses, are clustered at the country level in columns 1, 2, 4, and 5. Standard errors are heterokedasticy robust in columns 3 and 6. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

Beyond this uncertainty control, I think the authors should be controlling for bilateral tariffs with all trade partners.

Following your recommendation, we have included bilateral tariffs with all trade partners as an additional control. We use the applied tariffs from WITS. The applied tariff is the minimum between the preferential rate (if any) and the most-favored nation (MFN) rate. At the time of writing this report, the WITS data on tariffs ended in 2021. Therefore, we had to exclude observations from 2022 from the sample. Table 9 reports the results of the intensive margin of trade.

Table 9: Tariffs. Intensive margin of trade

	Exports		Imports	
	(1)	(2)	(3)	(4)
Post-referendum$_{ct}$	-0.021^c	-0.021^c	-0.063^a	-0.063^a
	(0.011)	(0.011)	(0.014)	(0.014)
Official$_{ct}$	-0.011	-0.011	-0.076^b	-0.076^b
	(0.013)	(0.013)	(0.031)	(0.031)
TCA$_{ct}$	-0.261^a	-0.261^a	-0.337^a	-0.337^a
	(0.020)	(0.020)	(0.032)	(0.032)
ln Real GDP$_{ct}$	0.468^a	0.469^a	0.467^a	0.465^a
	(0.096)	(0.097)	(0.116)	(0.121)
ln Real exchange rate$_{ct}$	0.175^b	0.176^b	-0.136	-0.137
	(0.078)	(0.078)	(0.100)	(0.100)
ln $(1+(\text{tariff}_{ckt}/100))$		0.274		-0.069
		(0.503)		(0.271)
Observations	4130201	4130201	2428894	2428894
Adjusted R^2	0.794	0.794	0.759	0.759

Note: The dependent variable is the (log) value of exports in columns 1 and 2 and the (log) value of imports in columns 3 and 4. All estimations include a country×product fixed effect, a firm×product×quarter fixed effect, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

The tariff coefficient is statistically insignificant for both exports and imports. To explain this result, we must remember that our regression specification includes a firm×product ×country fixed effect. Therefore, the identification of the effect of tariffs on trade flows comes from the variation within the country-product dyad. As tariffs have not varied substantially at that level during the period analyzed in our paper, it is unsurprising to find an insignificant effect of tariffs on trade flows.

Table 10 presents the estimates for the extensive margin of trade. The tariff coefficient

is positive and significant in column 2. This result is surprising, since it implies that Spanish firms are more likely to begin exporting a product to a given destination if the tariff level of that product at that destination is large. In the remaining estimations, the tariff coefficient is statistically insignificant.

Table 10: Tariffs. Extensive margin of trade

	Entry				Exit			
	(1) Exports	(2) Exports	(3) Imports	(4) Imports	(5) Exports	(6) Exports	(7) Imports	(8) Imports
Post-referendum$_{ct}$	-0.010^a	-0.010^a	-0.023^a	-0.023^a	0.006^c	0.006^c	-0.009	-0.009
	(0.003)	(0.003)	(0.008)	(0.008)	(0.003)	(0.003)	(0.007)	(0.007)
Official$_{ct}$	0.011^b	0.011^b	-0.003	-0.003	-0.009^b	-0.009^b	-0.039^a	-0.039^a
	(0.004)	(0.004)	(0.012)	(0.012)	(0.004)	(0.004)	(0.010)	(0.010)
TCA$_{ct}$	-0.159^a	-0.159^a	-0.361^a	-0.361^a	0.246^a	0.246^a	0.452^a	0.451^a
	(0.008)	(0.008)	(0.026)	(0.026)	(0.005)	(0.005)	(0.013)	(0.013)
ln Real GDP$_{ct}$	0.055^a	0.055^a	0.227^a	0.227^a	-0.128^a	-0.128^a	-0.130^b	-0.131^b
	(0.013)	(0.013)	(0.070)	(0.070)	(0.035)	(0.035)	(0.051)	(0.052)
ln Real exchange rate$_{ct}$	0.025^c	0.025^c	-0.037	-0.037	-0.037^b	-0.037^b	0.050^b	0.050^b
	(0.015)	(0.015)	(0.023)	(0.023)	(0.016)	(0.016)	(0.025)	(0.025)
ln (1+(tariff$_{ckt}$/100))		0.054^a		0.054		-0.012		-0.060
		(0.019)		(0.098)		(0.047)		(0.091)
Observations	4133730	4133730	1311262	1311262	1764065	1764065	489918	489918
Adjusted R^2	0.142	0.142	0.016	0.016	0.290	0.290	0.070	0.070

Note: In column 1 and 2 (3 and 4) the dependent variable turns one if firm f that did not export (import) product k to destination c at $t-1$ began exporting (importing) product k at t. In columns 5 and 6 (7 and 8) the dependent variable turns one if firm f that exported (imported) product k to destination c at $t-1$ ceased to export (import) product k at t. Estimations include firm×product×quarter and country×product fixed effects, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

Since in most cases tariffs have an insignificant effect on the intensive or extensive margin of trade, the value and sign of the remaining coefficients are not altered by including tariffs in the regression, and adding tariffs obliges us to exclude the 2022 data, we decided not to incorporate tariffs in the regression equations.

(b) EM analysis: The paper would benefit from this analysis being performed at the quarterly (rather than half-yearly) frequency. Further, it was not clear to me why this analysis was done at the firm-destination level while all other specifications are carried out at the firm-product-destination level? (This should be motivated – as I imagine many firms are multi-product exporters/importers with a given destination).

Following your suggestion, and as explained at the beginning of this report, all intensive and extensive margin analyses are now performed using quarterly data. Furthermore, and also following your suggestion, we expand the extensive margin analysis estimating the effect of the TCA on entry and exit at the firm-destination-product level. As shown in Table 11, the negative effect of the TCA on entry and exit is magnified when the analysis is performed at the firm-destination-product level.

Table 11: Impact of Brexit on Spanish firms' entry and exit in the UK

	Entry				Exit			
	Firm-destination		Firm-destination-product		Firm-destination		Firm-destination-product	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Post-referendum$_{ct}$	0.001	-0.008^b	-0.000	-0.004	0.006^b	0.010^b	-0.000	-0.014^b
	(0.002)	(0.004)	(0.002)	(0.005)	(0.002)	(0.005)	(0.003)	(0.005)
Official$_{ct}$	0.019^a	0.002	0.028^a	0.022^b	0.020^a	0.006	-0.014^a	-0.050^a
	(0.003)	(0.004)	(0.003)	(0.008)	(0.004)	(0.006)	(0.004)	(0.010)
TCA$_{ct}$	-0.042^a	-0.136^a	-0.123^a	-0.300^a	0.070^a	0.205^a	0.142^a	0.277^a
	(0.004)	(0.007)	(0.009)	(0.023)	(0.004)	(0.010)	(0.004)	(0.012)
ln Real GDP$_{ct}$	0.050^a	0.084^a	0.055^a	0.147^a	-0.069^a	-0.055^c	-0.107^a	-0.096^b
	(0.014)	(0.027)	(0.017)	(0.049)	(0.018)	(0.028)	(0.030)	(0.043)
ln Real exchange rate$_{ct}$	0.041^a	-0.019	0.042^a	-0.024	-0.040^a	0.016	-0.040^b	0.032
	(0.011)	(0.022)	(0.010)	(0.023)	(0.015)	(0.012)	(0.016)	(0.027)
Observations	3959471	2137146	6070680	1891456	1860158	1035145	2796305	905227
Adj.-R2	0.045	0.000	0.129	0.014	0.121	0.009	0.278	0.062
Firms	16740	19296	16305	17073	16882	19531	16486	17358
Countries	61	61	61	61	61	61	61	61
Products			6099	6292			6108	6314

Note: In columns 1 and 3 (columns 2 and 4) the dependent variable turns one if firm f that did not export (import) at $t-1$ began exporting (importing) at t. In column 5 and 7 (columns 6 and 8) the dependent variable turns one if firm f exported (imported) at $t-1$ ceased to export (import) at t. Estimations at the firm level include firm×time and country fixed effects, and a constant. Estimations at the firm-product level include country×product and firm×product×quarter fixed effects, and a constant. Standard errors clustered at the country level are in parentheses. a, b, and c: statistically significant at 1%, 5%, and 10%, respectively.

5. Presentation of results

(a) I found Table 1 challenging to read in the absence of the surrounding text which contextualizes it. The table should say that the values are for the median firm. Further, the row which refers to the number of markets is hard to understand without the accompanying text. Lastly, in Row 1 I do not understand why the columns for non-UK and Total are left empty.

We agree with the reviewer that Table 1 could be simplified and made easier to read. The new table and text on page 6 of the new version of the paper are as follows:

"There were 6,846 exporters to the UK and 6,117 importers from the UK in 2015, the year before the Brexit referendum. Table 12 presents some descriptive statistics on the median Spanish firm that traded with the UK in 2015. The median exporter to the UK exported 224 thousand euros to this country. The median importer from the UK imported 149 thousand euros from this country. The median exporter sold one product in the UK and the median importer purchased one product from the UK. The median exporter to the UK had 14 export destinations, and the median importer had eight supplier countries. The UK represented 9% of total exports for the median exporter. For the median importer, 10% of all its imports originated in the UK. In addition, for almost 20% of firms exporting to the UK, this market represented their main destination. For importers from the UK, this market was the main supplier for 25% of the firms."

Table 12: Descriptive statistics on the median Spanish firm trading with the UK, 2015

	Exporters	Importers
Value of flow with the UK (thousand euros)	224	149
Number of products traded with the UK	1	1
Number of foreign markets	14	8
Share of the UK in firm's total flow (%)	9	10

Note: Values correspond to the median trader. Source: authors' own calculations based on the Spanish Customs' database.

(b) In all regression tables, the left-most column which states variable names should include the relevant subscripts, such that readers can follow the level of identifying variation at which the variables vary.

Following your recommendation, we have added subscripts to all the variables reported in the regression tables.

2. Smaller points

1. The description of equation (1) on page 8 should clarify that x_{fkct} can be either exports or imports depending on the trade flow being examined.

Following your recommendation, in the new version of the paper, we explain that after substituting the dependent variable for $\ln m_{fkct}$, we also use Equation (1) to analyze the impact of the TCA on Spanish imports from the UK.

Page 12: I believe the authors mean to say "persistent negative effect on UK's imports from the EU" (not to the EU).

The reviewer is right. We apologize for this error and amend it in the new version of the paper.

The description of results seems sensationalist in places and could be rephrased. E.g. p. 13 "massive drop"; p. 15 "increased massively".

Following your recommendation, we substitute the term "massive" by less sensationalist terms, such as "great" or "large".

I would like to see an appendix table that explains what chapters 1-16 of the HS classification, i.e. those sectors which get the SPS dummy, are.

Following your recommendation, we have included a new table A.12 in Online Appendix A that lists the chapters that are subject to SPS measures.

We thank you again for your comments and hope that you find the revision satisfactory.

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