Responses to Reviewer 1'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 is based on 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.

Major comments

The rules of origin index and the impact it has on the response to Brexit is a very interesting contribution in terms of what drives trade costs in the absence of tariffs. As such, I would suggest that it be highlighted more than it is at the moment in the paper. In particular, I would like to see some summary statistics on the index, the number of products affected, their share of total values over time and so on. This would provide greater context to this section of the paper and place greater focus on this aspect of the findings.

Following the advice of the reviewer, in the new version of the paper, we devote more space to explain the rules of origin stringency index that we developed for this study. Furthermore, as suggested by the reviewer, we include summary statistics, make reference to the number of products affected by rules of origin, and the share of each rules-of-origin category in total Spanish trade with the UK over time.

The new paragraph on page 23 of the revised version of the paper reads as follows: "Using the information in the TCA, we built a product-level measure of RoO stringency. The TCA uses ten different RoO categories.[1] First, we identify the RoO applied to each 6-digit HS product. Second, following a methodology similar to Estevadeordal (2000), we

[1]See Online Appendix B for a detailed description of each RoO category, the construction of the index, and some additional statistics.

rank the stringency of the RoO categories from bottom to top. Third, we define the RoO stringency of a product as the ranking of the RoO category applied to that product.[2]

The RoO stringency index ranges from 0 to 8.5. The median stringency level is 4. There are 219 products of 5,393 whose RoO index is zero, that is, they are not subject to RoO. 37% of total Spanish exports to the UK in 2019 corresponds to products that had a stringency index above the median in 2019. This percentage decreased to 35% in 2021. 25% of total Spanish imports from the UK corresponds to products that had a stringency index above the median in 2019. This percentage decreased to 23% in 2021."

I had expected that the granularity of the data would be exploited a bit more. The extensive margin examined is that of whether the firm continues to export/import with the UK or not but does not consider if those that do not exit entirely reduce their number of products. A number of papers on multiproduct firms have suggested that this product number margin is of considerable importance if trade costs increase (e.g. Eckel and Neary 2010 "Multi-Product Firms and Flexible Manufacturing in the Global Economy" Review of Economic Studies 77, 188-217).

Following your comment, we have analyzed whether the TCA had a negative impact on the number of products exported and imported by Spanish firms to the UK. We selected firms that traded more than one product with a country (multiproduct firms) in each of the pre-Brexit years (2014 and 2015) and continued trading, at least one product, with that country during the entire post-Brexit period. We estimate the following regression equation:

$$nprod_{fct} = exp[\beta_1(UK_c \times PostReferendum_t) + \beta_2(UK_c \times Official_t) + \beta_3(UK_c \times TCA_t) + \alpha_1 \ln RER_{ct} + \alpha_2 \ln RGDP_{ct} + \gamma_{fc} + \gamma_{ft}]\epsilon_{fct} \quad (1)$$

where $nprod_{fct}$ is the number of products exported (imported) by firm f to country c in year-quarter t. Since the dependent variable is a count variable, we estimate the regression using a Poisson pseudomaximum likelihood estimator (Santos-Silva and Tenreyro, 2010).[3] Furthermore, this model enables the inclusion of quarterly observations in which the number of products traded with a country is zero. We cluster standard errors at the country level.

Table 1 presents the estimations. The TCA led to a reduction in the number of products traded by Spanish firms with the UK. In particular, the number of exported

[2]Interested readers can download a Stata file with the RoO stringency index for each HS 6-digit product from https://paginaspersonales.deusto.es/aminondo/Research.htm.

[3]We use Stata's ppmlhdfe command developed by Correia et al. (2020).

and imported products with the UK decreased by 12% and 31%, respectively, after the TCA. Interestingly, there was an increase in the number of exported products during the Post-referendum and Official periods, but a decrease in the number of imported products during the Official period.

Table 1: Impact of Brexit on the number of products traded by Spanish firms with the UK

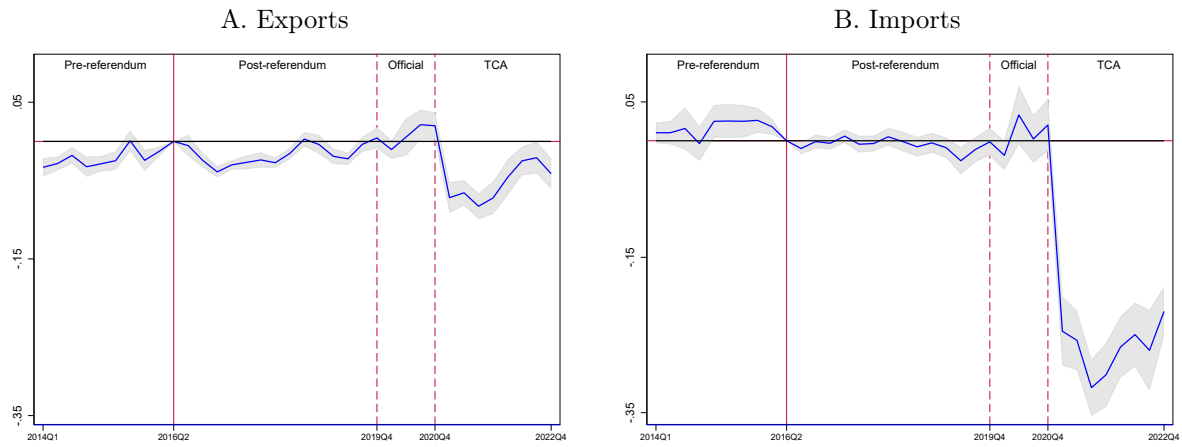
	(1) Exports	(2) Imports
Post-referendum$_{ct}$	0.025^{a}	-0.019
	(0.004)	(0.014)
Official$_{ct}$	0.044^{a}	-0.037^{b}
	(0.014)	(0.018)
TCA$_{ct}$	-0.124^{a}	-0.369^{a}
	(0.013)	(0.019)
ln Real GDP$_{ct}$	0.150	0.472^{a}
	(0.112)	(0.088)
ln Real exchange rate$_{ct}$	0.180^{a}	-0.117^{c}
	(0.039)	(0.065)
Observations	1013904	1047852
Pseudo-R2	0.601	0.652
Firms	8982	14409
Countries	139	108

Note: The dependent variable is the number of products exported and imported in columns 1 and 2, respectively. All estimations include a firm×country fixed effect, a firm×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.

Panels A and B of Figure 1 present the evolution of the quarterly coefficients for the number of exported and imported products, respectively.

We include the new analysis on the impact of the TCA on the number of products traded with the UK at the end of the section dedicated to the extensive margin, between page 17 and 19 of the revised version of the paper.

Figure 1: Number of products traded with the UK, relative to other countries, along the Brexit stages



Note: The figures report the point estimate and the 95% confidence interval of the quarter coefficients estimated with an equation similar to Equation (2). The excluded category is 2016-Q2.

More minor issues:

I would like to see some robustness test applied to the cut-off threshold of €10,000 applied by the authors particularly to the extensive margin. How many observations does this affect and could it bias the analysis of firm size and entry / exit if marginal exporters have been dropped by this data cleaning decision?

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 threshold.[4] The use of the 1,500 euro threshold, instead of the 10,000 euro threshold, increases the number of export and import transactions by 75% and 72%, respectively. However, the total value of export and import covered by the data set only increases by 1%.

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). Note that Table 2 already includes the entry and exit estimates at the firm-destination-product level mentioned at the beginning of this report.

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.

[4] 1,500 euro was the transaction value threshold used by Customs when providing us with this database.

Table 2: Robustness analysis. Impact of Brexit on Spanish firms' entry and exit in the UK. Value threshold set at 1,500 euro instead of 10,000 euro

	Entry				Exit			
	Firm-destination		Firm-destination-product		Firm-destination		Firm-destination-product	
	(1) Exports	(2) Imports	(3) Exports	(4) Imports	(5) Exports	(6) Imports	(7) Exports	(8) 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 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 exporting (importing) at $t-1$ ceased to export (import) at t. Estimations at the firm-destination level include firm×time and destination fixed effects, and a constant. Estimations at the firm-destination-product level 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.

The test by firm size distinguishes firms as large traders if they are "above the median" – I take it this means above the median for UK trade? This should be clarified. It is not clear that this is the best way to categorise size in this context or, at least, some alternatives could be considered. If a firm has the UK as its sole market or one of a small number of major markets, it may be above the UK median while not being a particularly large exporter overall. This may make it more sensitive to changes in trade costs with the UK. Conversely, a very large diversified international exporter may not be as sensitive to a trade cost change with one of its smaller markets. I would therefore suggest that the division into large and small exporters be done on the basis of their total activity rather than their UK-specific flows to examine if the results are consistent with the current definition.

In line with the reviewer's suggestion, in the original version of the paper, the division between large and small traders was defined using total exports or imports. In the new version of the paper, we clarify that total exports (imports) is the variable used to define small and large exporters (importers).

The paper switches between quarterly and half-yearly frequencies. This should be either on a consistent basis or have some comparison on whether this change matters to the baseline results.

Following your suggestion and as mentioned at the beginning of the report, in the revised version of the paper all empirical analyses are performed using a quarterly frequency.

The paper makes several references to "permanent" changes in terms of its estimation findings. I would suggest this be caveated somewhat given the recency of the event being discussed means that some transition adjustments are perhaps still under way.

Following the recommendation of the reviewer, we refrain from using the term "permanent" when referring to the impact of the TCA on Spanish-UK trade flows.

There are a number of rather clunky sentences and grammatical errors throughout the paper: for example on page 4 "However, this effect dwarfs compared.." should be "this effect is dwarfed by...".

We apologize for these errors. We have rewritten the sentence mentioned by the reviewer and thoroughly revised the text to remove grammatical errors.

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

References

Correia, S., Guimarães, P., and Zylkin, T. (2020). Fast Poisson estimation with high-dimensional fixed effects. *The Stata Journal*, 20(1):95–115.

Estevadeordal, A. (2000). Negotiating preferential market access: The case of the North American Free Trade Agreement. *Journal of World Trade*, 34(1):141–166.

Santos-Silva, J. and Tenreyro, S. (2010). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2):220 – 222.