

## Response to Reader 2 (Anonymous)'s Comments

Thank you very much for your careful review of our paper. We appreciate your constructive and thoughtful feedback. Below we describe in detail our responses to your comments. We are happy to revise the paper along the lines you propose and as described in the responses below.

### Specific comments:

1. *The identification of the island border effect depends on the correct specification of the transport cost function:*

- a) *It is not clear why the Island border effect leads to higher fixed trade costs while the variable costs are the same for air, land or sea transport. The authors might be able to give more specific (anecdotal) evidence for the higher fixed transportation costs. It would be interesting to interact the island dummy with the distance measure in the transportation costs equation (8) to allow for different variable costs. Actually the Blinder-Oaxaca decomposition would suggest this as the "Coefficients term C" for distance is very high. This should considerably improve the results of the gravity estimation.*

**Authors' response:** It is important to clarify that most trade with Islands is carried out by maritime transport (as can be seen from Figure 2) and that the Blinder-Oaxaca decomposition picks up this difference without relying on the restrictiveness of the dummy approach (by interacting the island dummy with distance). Intermodal transport has high island-specific costs while road-only has high iceberg costs. So, over short distances trade costs are higher for intermodal transport while over longer distances the cost is higher for road-only transport. Moreover, intermodal transport presents higher time costs (Janic, 2007; Wichser et al, 2007). Consequently, intermodal transport represents a relatively lower disadvantage in long-distance trade (i.e international), compared to interregional trade. Therefore, intermodal transport is not competitive with road transport on similar routes, but island regions have no choice given the low substitutability of the two transport modes. Hummels (2007) and related literature discuss this issue.

Nevertheless, the island-specific trade cost term represents the additional trade cost incurred by islands due to the use of intermodal or air transport. This cost is due to the existence of a sea border between two trading regions and only affects islands. We have added a detailed discussion on this to the revised version of the paper to improve its motivation (see the introduction and section 3).

- b) *Omitted variables, such as the (time varying) industry structure of the regions might bias (or even drive) the results. For robustness variables such as size of the service and agricultural sector could be included. As well as historical ties of regions, e.g. Balearic Islands and Cataluña.*

**Authors' response:** The reader's concern seems to be that the industry structure may cause distortions in the estimations. In addition to previous controls, we have also estimated the baseline model with the share of tourism in GDP and the results are

qualitatively the same. Moreover, when we introduce origin-time and destination-time dummies we also obtain higher distance coefficients for island regions. That is, the structure of the economy doesn't seem to affect our results.

Regarding historical ties it seems the reader is concerned with the role of networks in interregional trade, as has been analyzed in previous research. In this regard, we have performed some robustness checks not shown for space reasons. Empirically, to control for historical ties we added a dummy variable that takes value one for trade among the Balearic Islands, Catalonia and the Valencian Community, regions where various forms of Catalan are spoken, zero otherwise. The dummy is strongly correlated with the sea distance of the Balearic Islands and hence it captures part of the distance frictions with those regions: the Catalan dummy is significant only for exports from islands and distance coefficients are reduced when it is introduced, although they remain significant. In general, given that the two variables are time-invariant it is not possible to disentangle the respective contribution of each of them. To see whether the distance coefficient loses explanatory power when we control for historical ties with dummies, we have created artificial historical ties between regions and in doing so we observed that the distance effect was much lower as well.

A better way to control for the possible presence of networks, not just among Catalan-speaking regions but between each pair of regions in the data, would be to use a time-varying variable such as the number of residents originating in the partner region present in the reporter region. Unfortunately such variable would be correlated with the error term and an IV estimation would have to be carried out. However, the trade networks literature suggests that the strength of trade networks is negatively correlated with distance but positively correlated with trade flows. This would reinforce our results as the consideration of networks would widen the trade gap between Island and Mainland regions and the varying strength of networks is itself a result of distance. Hence this is an additional channel of impact of distance on the trade gap between Island and Mainland regions. This potential channel although interesting is beyond the scope of our research.

*2. The motivation to use distance and quadratic distance should be described in more detail, especially as the effects in the gravity estimation are not clear. The authors find that distance has a U-shape effect on trade for islands and an inverse U-shape effect for the mainland. At which distance is the turning point for these effects? If I use  $\log(km)$  with the coefficients of the gravity equation in Table B1, I find that exports and imports for Island regions are strictly decreasing for reasonable values of distance ( $<4,000km$ ), while imports and exports for mainland regions increase for reasonable values of distance ( $<4,000km$ ).*

**Authors' response:** The reader's point is well taken. We now motivate in greater detail the introduction of non-linear distance effects, which we now introduce in section 4 using distance ranges, and confirm their existence in section 5 with a quadratic polynomial (subsection 5.2).

The empirical literature shows that most economic interactions take place in proximity. This is a plausible explanation of why distance coefficients are found to change with distance ranges (e.g. the magnitude of distance coefficients increases with the distance to trading partners). Our approach is aimed at capturing this feature of the data in a flexible way using a quadratic distance term.

Our current results show that the relationship between distance and trade is different for island and for mainland regions, and that this fact can be explained by the existence of different trade costs, but the results could be contaminated by the way distance is treated. We have checked whether our results are sensitive to this by inserting distance into the gravity equation in two different ways. First, we have used our distance variable without logs entering as a second order polynomial, as in the baseline model of the Discussion Paper version. In both imports and exports equations now the distance linear term is highly significant with a negative sign, and the quadratic term is positive and significant. Interestingly, now the adjacency variable turns out insignificant, as presumed. So, we conclude that it is better not to log. Second, we have split the distance variable in ten equally frequent intervals (i.e. decile ranges) instead of treating it as a continuous variable. This increases the flexibility of our approach and allows us to capture a richer pattern of transport costs across several distance ranges. In all the ranges, distance coefficients are negative and highly significant and the adjacency variable is no longer significant. These results show more clearly that for each distance range coefficients are larger for island regions. The Oaxaca decomposition shows again that most of the trade gap among regions is due to the additional transportation costs that island regions suffer.

Although in both checks we find that distance affects trade following a U-shaped pattern, by estimating distance coefficients we find that the quadratic specification only approximates the actual shape and that the range-by-range does a better job in estimating the non-linearities found in the data. Therefore, the latter estimation is now our baseline model and quadratic distance is discussed as a robustness check in subsection 5.2. of the revised version.

Importantly, our main message remains valid after this change in the specification: the distance coefficients for island regions are larger than the coefficients of mainland regions. Hence, an important part of the trade gap is still explained by differences in coefficients and not by physical distance.

*3. The Alchian-Allen effect might be an explanation for the lower trade of islands due to higher fixed transportation costs. The corresponding literature should be mentioned.*

**Authors' response:** Indeed distance could impact either positively or negatively on exports due to two conflicting effects. On one hand, transport costs increase with distance, therefore higher distance would force up prices and thus drive down exports. If this price effect predominates, distance would impact negatively on exports. On the other hand, quality increases with distance as firms facing higher transport costs have an incentive to offset these higher costs by upgrading the quality of their exports. This is known as the "Washington apples" effect (Alchian and Allen, 1964), supported empirically by Hummels and Skiba (2004) and Feenstra and Romalis (2014), whereby firms export their higher quality products and the quality level of exports increases with distance. In this case, if quality upgrading is high enough, the quality-adjusted price of exports may actually decrease with distance. If this effect is strong enough, and the importer's preference for quality is high enough, exports could actually increase with distance. However, formally testing for product quality cannot be done at the level of aggregation we use and in any case it would be beyond the scope of the paper.

4. It would be interesting to link the inter-regional findings for Spain to international trade. Do we find a similar effect for islands, such as Cyprus, Ireland, or Sri Lanka?

**Authors' response:** Yes, we agree that providing a comparison between our results and other findings for country-islands will improve the scope of the paper and we now provide further references. The conclusions now incorporate the extension of our analysis to other islands (in Europe or outside) as an idea for future research, since our methodology can be applied to any sample of island and non-island regions.

## References

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