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# **A methodological contribution for measuring trade competition**

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**Abstract:** The traditional approach to evaluate trade competition considers the competition between two countries in a given destination market and quantifies it through a measure of structural similarity such as the Krugman index. We explore this topic further through the discussion of six distinct perspectives. For each of them, adequate measures are proposed.

**Keywords:** trade competition, globalization, structural similarity, index.

**JEL Codes:** F10, F14.

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## **I. Introduction**

Trade openness, internationalization, and globalization are critical trends of the last decades (Head and Mayer, 2013), with trade growing faster than GDP since 1980 (Berthelon and Freund, 2008). In an increasingly interdependent world, trade competition emerges as a fundamental topic, requiring further research concerning theory, measurement, and empirical analysis. This study contributes to the second dimension – the measurement of trade competition between countries.

The empirical study of trade competition is usually grounded on the concepts of competition threat (Jenkins, 2008) and structural similarity (Crespo and Fontoura, 2007; Palan and Schmiedeberg, 2010), the last one being the dominant approach. Among the indexes of structural similarity used to evaluate the degree of trade competition, the Krugman index is the most standard option (Palan, 2013). The underlying assumption is that greater similarity implies stronger competition. Recently, Crespo and Simoes (2012) argue that a more comprehensive understanding of the trade competition between two countries requires a multidimensional index that incorporates not only the similarity in sectoral shares, as in the Krugman index, but also the degree of intra- and inter-sectoral similarity.

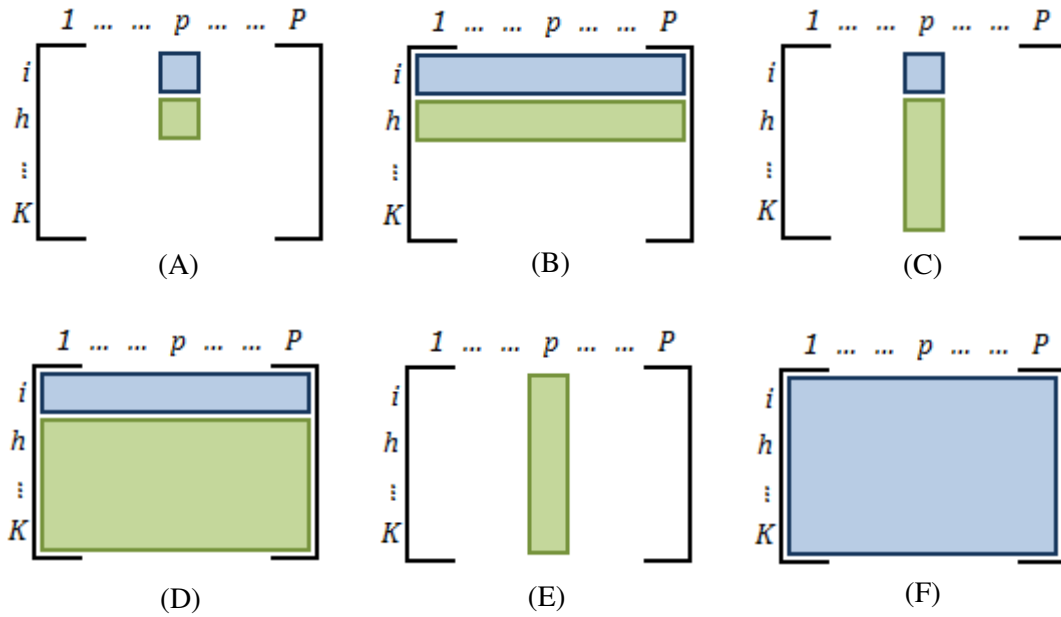
We contribute to this line of research by providing a broader framework for the study of trade competition. We argue that the standard perspective that exclusively evaluates trade competition between two countries in a given destination market is just one of several perspectives that we could adopt to investigate this complex empirical phenomenon. Therefore, we discuss six alternative optics of analysis that can be usefully applied in the empirical exercises. Each of them addresses a specific question that emerges in the empirical analysis of trade flows and, especially, of trade competition.

The remainder of the paper is organized as follows. Section II provides an overall picture of the conceptual framework and Section III presents in a formal way the measures proposed. Section IV concludes.

## II. A Preliminary View of the Measurement of Trade Competition

The usual perspective on the measurement of trade competition assumes the exports of two countries ( $i, h$ ) for a given destination market ( $p$ ), as shown in panel (A) of Fig. 1.

**Fig. 1.** A conceptual framework for the measurement of trade competition



Nevertheless, other useful perspectives of analysis can also be employed:

(B) Competition between two countries in all the markets, i.e., what is the degree of competition between  $i$  and  $h$  in all the markets? For example, what is the competition between France and Germany in overall terms?

(C) Competition that a country faces in a specific destination market, i.e., what is the degree of competition that country  $i$  faces in market  $p$  from other countries? For example, what is the competition faced by France in the Spanish market?

(D) Competition that a country faces in all markets, i.e., what is the degree of competition that country  $i$  faces in all markets from all other countries? For example, what is the competition faced by France in overall terms?

(E) Competition in a given market among all the countries, i.e., what is the degree of competition in market  $p$  among all the countries exporting to that country? For example, what is the competition in the Spanish market?

(F) Global competition, i.e., what is the degree of competition between all countries in all markets?

The goal of this paper is to discuss how to complement the traditional measurement approach in order to obtain quantitative answers to all these questions. To that end, the starting point is the consideration of a trade competition index. Following the dominant perspective, we consider a modified version of the standard Krugman index expressed as:

$$E_{ihp} = 1 - \frac{1}{2} \sum_{j=1}^J |v_{jip} - v_{jhp}| \quad (1)$$

where  $v_{jip}$  and  $v_{jhp}$  are, respectively, the shares of sector  $j$  in the exports of  $i$  and  $h$  to  $p$ .  $E_{ihp}$  ranges between 0 and 1. A higher value for  $E_{ihp}$  indicates a stronger structural similarity, suggesting more intense trade competition between  $i$  and  $h$ . Hereinafter we will designate the trade competition index as  $TCI$  in order to make it clear that it may correspond to alternative indicators, including the multidimensional measures proposed by Crespo and Simoes (2012).

### III. Obtaining the Trade Competition Indexes

The first perspective on trade competition is the traditional one and can be empirically evaluated through a trade competition index ( $TCI$ ) between countries  $i$  and  $h$  in a given market  $p$ , which we will designate as  $TCI_{ihp}$ . Let us concentrate now on the remaining five perspectives.

The second approach – Panel (B) in Fig. 1 – captures, as does the first, the competition between two countries but now in overall terms, i.e. in all markets for which they export. It is therefore a bilateral perspective of trade competition, like the first, but now measured at the global scale. To obtain such a measure we calculate the weighted average of the trade competition indexes between  $i$  and  $h$  in each specific destination market  $p$ :

$$TCI_{ih} = \sum_{p=1}^P TCI_{ihp} \gamma_{ihp} \quad (2)$$

$P$  is the total number of destination markets.  $\gamma_{ihp}$  is the simple average of the share of market  $p$  in the exports of  $i$  and  $h$ :

$$\gamma_{ihp} = \frac{1}{2} \left[ \frac{x_{ip}}{x_i} + \frac{x_{hp}}{x_h} \right] \quad (3)$$

in which  $x_{ip}$  and  $x_{hp}$  correspond, respectively, to the exports of  $i$  and  $h$  for  $p$  and  $x_i$  and  $x_h$  are the total exports of  $i$  and  $h$ .

When a country exports to a given destination market it faces the competition not only from another specific country but from all of the countries that export to that destination. This leads us to the third perspective of analysis – Panel (C) in Fig. 1 – in which we measure the degree of trade competition that a country  $i$  faces in a market  $p$  from all the remaining countries that also export to  $p$ . In order to obtain an index corresponding to this perspective of analysis, we follow a strategy very similar to that used in the second approach. The main difference regards the weights considered. They now correspond to the share of each origin country  $h$  in the total of exports that arrive at  $p$  excluded from the exports from  $i$  to  $p$ :

$$\mu_{ihp} = \frac{x_{hp}}{\sum_{\substack{h=1 \\ h \neq i}}^K x_{hp}} \quad (4)$$

Using these weights allows us to give greater representation to the trade competition indicators that correspond to countries with a higher share of the exports to  $p$ . The index that captures this third optic of analysis can be represented as follows:

$$TCI_{ip} = \sum_{\substack{h=1 \\ h \neq i}}^K TCI_{ihp} \mu_{ihp} \quad (5)$$

This index measures the competition faced by  $i$  in market  $p$ . Another interesting question is the level of competition faced by  $i$  in the full range of destination markets – Panel (D) in Fig. 1. Constructing an index adequate to quantify this aspect is our task in the fourth perspective. We start from Equation (5) and calculate the weighted average of the values obtained for all destination markets in which the corresponding weight is the share of  $p$  in the total exports of  $i$ :

$$TCI_i = \sum_{p=1}^P TCI_{ip} \delta_{ip} \quad (6)$$

and

$$\delta_{ip} = \frac{x_{ip}}{x_i} \quad (7)$$

While the previous perspectives focus on the exporting markets, the last two concentrate on the level of trade competition in the destination markets. The fifth perspective – panel (E) in Fig. 1 – focuses on the competition in a given market  $p$ . In this case, however, we are considering the competition among all countries that export to  $p$ . For calculating this, we can adopt two different approaches. The first considers the indexes obtained in the first perspective ( $TCI_{ihp}$ ) and is calculated as:

$$TCI_p = \sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K TCI_{ihp} \tau_{ihp} \quad (8)$$

In this case, we use as weights the relative importance of each country-pair in total exports to  $p$ :

$$\tau_{ihp} = \frac{x_{ip} + x_{hp}}{\sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K (x_{ip} + x_{hp})}. \quad (9)$$

The second approach uses the indexes obtained in the third perspective ( $TCI_{ip}$ ):

$$TCI'_p = \sum_{i=1}^K TCI_{ip} \tau'_{ip} \quad (10)$$

The share of exports from  $i$  to  $p$  in the total exports to  $p$  is assumed as weight:

$$\tau'_{ip} = \frac{x_{ip}}{X_p} \quad (11)$$

Once more we are giving more importance to the countries that represent a larger fraction of exports to  $p$  since they account for a more important part of trade competition in this specific market.

The last perspective that we should consider seeks an index that captures trade competition in the global space under consideration – Panel (F) in Fig. 1. This is a more complex task because it can be obtained in four different ways. We next discuss each of them briefly.



The first possibility implies the consideration as starting point of the measures derived from our first perspective:

$$TCI = \sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K \sum_{p=1}^P TCI_{ihp} \sigma_{ihp} \quad (12)$$

Thus, the weights are given by the share of the sum of exports from  $i$  and  $h$  to  $p$  in total trade, i.e., the exports from all countries to all destination markets. Of course, each country-pair receives a weight according to its level of exports:

$$\sigma_{ihp} = \frac{x_{ip} + x_{hp}}{\sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K \sum_{p=1}^P (x_{ip} + x_{hp})} \quad (13)$$

A second and third way of obtaining an index for this last perspective can be grounded on two measures that result from the fifth perspective ( $TCI_p$  and  $TCI'_p$ ). The new indexes are calculated as follows:

$$TCI' = \sum_{p=1}^P TCI_p \sigma'_p \quad (14)$$

and

$$TCI'' = \sum_{p=1}^P TCI'_p \sigma'_p \quad (15)$$

Independently of the index chosen, the weights correspond to the weighted average of the shares of exports to  $p$  in total exports:

$$\sigma'_p = \frac{x_p}{\sum_{p=1}^P x_p} \quad (16)$$

Finally, we can also adopt as reference the indicators obtained in the second perspective ( $TCI_{ih}$ ):

$$TCI''' = \sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K TCI_{ih} \sigma_{ih}'' \quad (17)$$

In this last case, we assume as weights the share of the sum of exports from  $i$  and  $h$  in total exports:

$$\sigma_{ih}'' = \frac{x_i + x_h}{\sum_{i=1}^K \sum_{\substack{h=1 \\ h>i}}^K (x_i + x_h)} \quad (17)$$

#### IV. Conclusion

The main goal of this study was the proposal of a (simple) method to empirically evaluate the phenomenon of trade competition. While the common approach to this issue considers the competition between two countries in a given destination market, we propose the consideration of five other perspectives of analysis. This allows to address important alternative questions that arise in the study of international trade competition and that are impossible to consider in their full extension exclusively through the standard measure commonly applied.

A remarkable advantage of this methodological contribution is the fact that it is flexible enough to allow for the consideration of alternative trade competition indexes (i.e., others than the standard Krugman index). We believe that the joint consideration of these six perspectives on the trade competition phenomenon offer a deeper and broader understanding of this complex and rapidly changing reality.

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