

Is the World Flat or Not (Yet)?

Trade Globalization and Digitalization

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ABSTRACT

This chapter adds to the understanding of trade globalization by accounting for the complexity and multi-dimensionality of the phenomenon at hand. This approach captures different aspects of the phenomenon, such as the interconnectedness of countries, geographical distance, and sectoral trade relationships over a period of 50 years. Thereby both the commonalities and differences in the long-term trends for the individual dimensions of trade globalization are highlighted. Results indicate that regarding the number of positive bilateral trade flows, globalization was almost completed by 2016. Also, distance diminished significantly in importance for trade relationships. Yet, data shows that the degree of globalization was significantly different for high-tech sectors compared to low-tech sectors even though the latter could catch up over time. During recent years, protectionism tendencies have led to the discussion about a new age of slowbalization to be on the way while digitalization processes can integrate countries even further into global production and trade networks.

INTRODUCTION

Along the last decades, globalization has been a hot topic both in academic literature and policy debate regarding not only its current characterization but also its effects and, although to a lower extent, the sustainability of the phenomenon (see for instance Figge, 2017; Beumer, Figge, & Elliott, 2018). Between 1990 and 2010, trade volume measured as a portion of world GDP has constantly risen, with China's integration into the world trade network playing a major role in this development. Additionally, the success of GATT and WTO rule settling lead to the abolishment of quota regimes and the decline in tariffs, making the establishment of global value chains more advantageous (OECD, 2005). Moreover, advances in information and communication technologies as well as automation and digitalization processes reduced trade costs even further, making it ever more easily to trade between faraway places. Especially since the early 1990s, globalization has dramatically gained momentum regarding size, scope and speed; this is why this phase is sometimes also referred to as the golden era of globalization or as hyper-globalization (Subramanian & Kessler, 2014). With the Great Recession in 2009, the trend of growth in world trade and trade integration, however, had come to a pause. Protectionist policies and trade tensions between US and China lead to an increase in tariffs on Chinese imports as well as global tariffs on steel and a European tariff on automobiles. The Economist referred

--to this new situation as slowbalization. Bordo (2017) and The Economist (2019) identified several additional factors for the decrease of the growth rate at which trade volume (that is used as a proxy for globalization) had evolved. First, as trade costs had already declined by a large fraction, there is hardly any further room for additional cost cutting when goods have to be shipped from one country to another. Second, many advanced economies have moved on towards service economies. As such, services are still far less traded compared to goods and trade in services and data are still less captured in traditional trade data, thus underestimating trade volume. Third, China has become more self-reliant in the production of medium-tech to high-tech as well as high-skill products, making China less dependent on imports and thus having a dampening effect on world trade volume. Fourth, global supply chains and completely integrated global firms become more ineffective since the Great Recession in 2009 as with lower income, less consumption and lower volumes of trade, splitting tasks of production over a set of countries has run into diseconomies of scale. However, digitalization also made the coordination of global value chains easier and more cost-effective, which should be able to boost trade globalization and the number of sectors that countries trade with in the long run.

In this chapter, the authors aim to address three critical topics related to the broad phenomenon of economic globalization. First, the authors provide a broad conceptual discussion on the definition of trade globalization and show that this concept has to be captured in a multi-dimensional way and cannot be satisfactorily analysed by the interpretation of world trade volume alone. This builds the foundation to clarify the differences between the concept of globalization and other connected research topics, such as internationalization or regionalization of trade. Second, the authors focus on identifying key dimensions of trade globalization and aim to shed more light onto these important components. In more detail, the authors study trade volume as well as distance, the number of trade flows, and sectoral components. Based on that discussion, the authors present evidence on the evolution of trade globalization along a period of 50 years. Describing the multi-faceted process for that time period, the authors can catch important developments and show a differentiated picture of the evolution of trade globalization. Third, the authors discuss how major trends in contemporary world economy – such as digitalization – affect globalization and how distance has become less relevant for global value chains, leading to a higher degree of interdependence of countries worldwide.

BACKGROUND

The current section deals with two main topics: (1) the various definitions of globalization (and, more specifically, the meaning of economic globalization); and (2) the presentation of the most diffused measures of trade globalization. As such, the authors present the state of the art of existing research as well as the current research gaps.

Aiming to summarize the core ideas emerging from the definitions of globalization, the chapter starts the discussion with a short review of some of the most important definitions of globalization available in the literature. From Table 1 it becomes evident that the phenomenon of economic globalization is multi-dimensional and as such a clear, precise, and uniform definition is missing. Rather, globalization encompasses a wide set of influencing factors and therefore also a variety of indicators should be used to measure its development.

Table 1. Definitions of Globalization

	Definitions of Globalization
Definition 1	“a historical process which involves the widening, deepening, speeding up and growing impact of worldwide interconnectedness. This process, however, is highly uneven” (McGrew, 1992, p. 15)
Definition 2	“a process that erodes national boundaries, integrates national economies, cultures, technologies and governance, and produces complex relations of mutual interdependence” (Norris, 2000, p.155).
Definition 3	“a process of increasing interconnection and interdependence between societies” (Conley, 2002, p. 488)
Definition 4	“identifies globalization as the spread of transplanetary – and in recent times more particularly supraterritorial – connections between people. From this perspective, globalization involves reductions in barriers to transworld contacts. People become more able – physically, legally, culturally, and psychologically – to engage with each other in ‘one world’” (Scholte, 2002, p. 13-14).
Definition 5	“Contemporary globalisation is defined as the intensification of cross-national interactions that promote the establishment of trans-national structures and the global integration of cultural, economic, ecological, political, technological and social processes on global, supra-national, national, regional and local levels” (Rennen & Martens, 2003, p. 143).
Definition 6	“The term globalization is usually used to refer to the contemporary processes – especially flows of capital, commodities, and information – that are operating to form a unified global economy. Globalization is presumed to be accompanied by the decline of the nation-state and market homogenization as we proceed inexorably toward a vast, unregulated market system dominated by multinational corporations” (Schneider, 2003, p. 389-390).
Definition 7	“The process of globalization is an international economic order which lead to the progressive integration of the world economy through pulling the barrier of trade, exchange rate and greater mobility of factors of production” (Bhandari & Heshmati, 2005, p. 1).
Definition 8	“The term ‘globalisation’ has been widely used to describe the increasing internationalisation of financial markets and of markets for goods and services. Globalisation refers above all to a dynamic and multidimensional process of economic integration whereby national resources become more and more internationally mobile while national economies become increasingly interdependent” (OECD, 2005, p. 11).
Definition 9	“Globalization is a process that encompasses the causes, course, and consequences of transnational and transcultural integration of human and non-human activities” (Al-Rodhan and Stoudmann, 2006), p. 2).
Definition 10	“In its current incarnation, globalisation includes social, political as well economic factors. Hence, contemporary globalisation may be defined as the intensification of cross-national economic, political, cultural, social and technological interactions that lead to the establishment of trans-national structures and the global integration of economic, political and social processes on a global scale” (Dreher & Gaston, 2007, p. 6).
Definition 11	“Globalization is a broad concept casually used to describe a variety of phenomena that reflect increased economic interdependence of countries. Such phenomena include flows of goods and services across borders, reductions in policy and transport barriers to trade, international capital flows, multinational activity, foreign direct investment, outsourcing, increased exposure to exchange rate volatility, and immigration” (Goldberg & Pavcnik, 2007, p. 41).
Definition 12	“Globalisation – which we define as the increasing interdependence of economies via cross-border transactions in goods, services, natural resources, capital and labour” (di Mauro & Forster, 2010, p. 6).

Based on these definitions, it is first of all obvious that globalization cannot be adequately captured through simple and unidimensional measures (OECD, 2005). Second, due to decreasing trade barriers (namely communication and transport costs as well as the abolishment of tariffs and quotas), distance and space have become less important over time. In particular, freight costs were halved between the mid-1970s and the beginning of the 21st century due to the more extensive use of air transportation, bulk shipping and containerization (World Bank, 2009). Additionally, the World Trade Organization helped to decrease tariffs and customs duties on average below four per cent at the end of the 20th century, facilitating trade with faraway countries. This progressive “death of distance” is in fact the subject of an intense debate in this area of research, which can be summarized in the famous dichotomy “the world is flat” (Friedman, 2005) versus “the world is not flat” (Christopherson, Garretsen, & Martin, 2008). Third, the interconnectedness of places is increasing through the higher proportion of fragmentation in production processes that lead to the establishment of global value chains, where the different stages of production processes are located across different countries due to their competitive advantages (Feenstra & Hanson, 1996). This finer international division of labour leads to significant increases in bilateral trade relations as many countries are involved in producing single products (Stehrer, Ali-Yrkkö, Hanzl-Weiss, Foster, Rouvinen, Seppälä, Stöllinger, & Ylä-Anttila, 2011). Bearing this aspect in mind, it is important to consider that globalization impacts not only the number of countries involved in trade and the total volume of trade but also has a sectoral component, thus requiring a careful analysis of what happens at a more disaggregated level.

Before introducing the conceptual framework to evaluate the level of trade globalization in the next section, this chapter discusses the most commonly used measures of globalization. Special attention is given to the economic dimension in which trade is - by far - the most critical element.

The two most commonly applied measures of trade globalization are the total volume of trade and the degree of openness. Despite their simplicity (which is a merit), these indicators are, on the one hand, insufficient to deal with the complexity of the concept and, on the other hand, not adapted to a truly global perspective. In most cases, they are calculated at the country-level, which can be assumed as no more than a preliminary approach for the measurement of internationalization. Yet the quantification of globalization needs a different approach with the adoption of a supra-national level of analysis. This new approach is indispensable, in the opinion of the authors, to take into account not only the volume of trade but also its global structure, both in overall and sectoral terms. However, the answer to the limitations of the two measures above mentioned does not follow, in most of the cases, this line of reasoning. They opt instead to overcome the problem associated with the unidimensional nature of the measures, introducing therefore multidimensional metrics, which is, until now, the dominant approach. In the following, some of the most prominent indicators that follow this dominant approach are described.

The Foreign Policy/A.T. Kearney Index (A.T. Kearney, 2001, 2007) was one of the first measures proposed that takes into account a combination of many unidimensional factors at the country level. It aims to quantify the degree to which a country is connected with the remaining ones and the degree to which it is affected by globalization.

Since its proposal, several shortcomings were identified (see, for instance, Scholte, 2002; Lockwood, 2004; Heshmati, 2006) and this has led to the introduction of alternative metrics. In this context, the authors want to highlight for example the Maastricht Globalization Index (Martens & Zywietz, 2006; Martens & Raza, 2009; Figge & Martens, 2014), the KOF Globalisation Index (Dreher, 2006; Gygli, Haelg, Potrafke, & Sturm, 2019), and the New Globalization Index (Vujakovic, 2010). As one of its important differentiation factors, the first index adds the environmental dimension to the analysis of globalization, offering therefore a more comprehensive perspective. In turn, the KOF Index is the most diffused measure of globalization, covering not only the economic dimension but also the political, social, and cultural dimensions of the phenomenon. A key advantage of this index is the fact that it uses statistical analysis to obtain (in a more robust way) the weights given to the different variables (Dreher, Gaston, Martens, & Van Boxem, 2010). Finally, the index introduced by Vujakovic (2010) has also clear pros and cons. On the positive side, it is the only composite index that includes distance in the evaluation of trade globalization (as preconized in the next section). However, it does not include the number of countries that participate in world trade, being therefore inadequate to account for its structure, which is a critical element of the globalization process.

As already mentioned, all the globalization indicators presented above include economic globalization as a core dimension, with trade globalization being one of the most important of its sub-dimensions (although the specific weights given to the economic dimension and trade sub-dimension differ in the distinct measures). Some of these multi-dimensional indexes evaluate trade globalization through the simple variables mentioned above. In particular, the degree of openness is largely used. A myriad of alternative specifications were considered to that effect, as discussed in detail by Squalli and Wilson (2011).

An important shortcoming of almost all of these metrics is the fact that they evaluate globalization at the country-level. In line with the discussion developed by Figge and Martens (2014), the authors argue that this procedure does not allow to capture the concept of globalization, accounting instead for the concept of internationalization. Although obviously connected, they are different concepts because the latter adopts a country-level perspective while globalization should be evaluated at a truly global/world level. Thus, all these measures lack the consideration of a critical dimension of the phenomenon – the structure of international trade.

One of the most interesting approaches that tries to overcome this problem is the network analysis. While this approach is applied in several areas of research, it is also useful for the evaluation of globalization. As mentioned for example by De Benedictis, Nenci, Santoni, Tajoli, and Vicarelli (2014) and De Lombaerde, Iapadre, McCranie, and Tajoli (2019), in this approach the countries are embedded in the web of trade relationships. Some empirical applications were already conducted to measure the level of globalization making use of network analysis. One of the most important studies in this area was developed by Arribas, Pérez, and Tortosa-Ausina (2009). This study assumes that globalization can be seen as a bounded phenomenon and therefore its main objective is the quantification of the gap between the current level of globalization and the maximum that can be achieved, which corresponds to what is called “perfect international integration”.¹ This idea is extremely useful but not without limitations. Two of those limitations should be highlighted. First, the specific meaning of “perfect international integration” corresponds to the notion of equilibrium in the international trade flows, which is an insufficient concept. Second, it ignores one of the most important (or even the most important) dimension: the volume of trade. In order to simultaneously retain the positive contribution of this approach and avoid its shortcomings, in the empirical exercise conducted in the current chapter the authors will make the distinction between bounded and unbounded dimensions of globalization, corresponding this last case to the total volume of world trade.

MAIN FOCUS OF THE CHAPTER

Issues, Controversies, Problems

The previous section clearly illustrates the complexity associated with the term “globalization” and one of its key components – trade globalization. Based on the definitions discussed, in this section the authors introduce some simple measures to evaluate the level and the evolution of trade globalization along the time. To that end, the first task is to define the dimensions that should be included in the globalization indexes. In this context, four critical dimensions of trade globalization are considered:

1. **Number of positive trade flows:** based on the idea that interdependence is one of the most important elements of globalization, the authors consider that the existence of more bilateral relations with positive trade implies a greater level of trade globalization, i.e., trade globalization positively depends on the number of positive bilateral trade flows. Of course, defining the existence of trade flows requires the identification of the specific threshold above which trade exists between those countries. In order to keep the analysis as simple as possible, the authors assume 0 as the valid threshold.
2. **Volume of trade:** this is the most traditional (and obvious) dimension of trade globalization. As data is available for a large set of countries and for long time periods, this indicator is often

used as a simple proxy for globalization. The idea is that the greater the volume of world trade, the greater the level of trade globalization.

3. **Distance:** another important element emerging from the definitions discussed in the previous section is that distance matters regarding the measurement of globalization. A more globalized world in terms of trade is a world in which the countries have trade flows with countries that are more distant and not only with the closest ones. This element allows us to make the distinction between globalization and regionalization. According to Johnson and Noguera (2012) and Baldwin and Lopez-Gonzalez (2015), despite the decline in trade costs, distance still matters for bilateral trade. Their work emphasizes that whereas trade occurs also over longer distances, regional trade relations remain the most important ones. They suggest to refer to regional trade blocs rather than talking about global value chains.
4. **Number of sectors:** a comprehensive analysis of trade globalization should include information at the sectoral level. This allows to identify differences between sectors in what regards the level of bilateral connection among the countries and, therefore, to verify how far the current situation is from the maximum level of trade globalization in this specific dimension (which occurs when there are trade flows of all sectors among all country pairs).

It is important to stress that the four dimensions above identified have different natures. While dimensions (1), (3), and (4) have a bounded nature since they all have an upper limit, the same does not occur in the case of volume of trade, which is, by definition, unbounded. This is an important aspect because, in what concerns the bounded dimensions of trade globalization, it is possible to verify how close the current level is to that upper limit or, on the contrary, whether there is still room to increase. Summing up, the concept of trade globalization can be summarized as presented in Table 2.

Table 2. Dimensions of Trade Globalization

Trade Globalization			
Unbounded Dimension	Bounded Dimensions		
Trade volume	Number of flows	Distance	Number of sectors

Once defined the concept of trade globalization, the discussion is shifted to the definition of measures able to capture the empirical importance of each one of these dimensions. With this objective in mind, the authors consider the matrices of bilateral trade. The generic element of this matrix is represented by y_{iht} , in which the exporting country is defined by i ($i = 1, 2, \dots, I$), the importing country by h ($h = 1, 2, \dots, H$), and t represents the period of time. Thus, y_{iht} is the exports from i to h in year t .

The total number of elements of this matrix is $I * (H - 1)$ since the countries do not trade with themselves.

Aiming to capture the four dimensions identified above, the authors first introduce the simplest index of trade globalization, which is designated as $TG(1)$. This index only takes into account the number of positive trade flows and is represented as:

$$TG(1)_t = \frac{\sum_{i=1}^I \sum_{h=1}^H p_{iht}}{I(H-1)} \quad (1)$$

in which p_{iht} is a dummy variable with value 1 when there is trade from country i to country h in year t :

$$p_{iht} = \begin{cases} 1 & \text{if } y_{iht} > 0 \\ 0 & \text{if } y_{iht} = 0 \end{cases} . \quad (2)$$

The index $TG(1)$ represents therefore, as equation [1] makes clear, the proportion of the total number of country pairs in which there is positive trade. $TG(1)$ ranges between 0 and 1, increasing with the level of trade globalization (evaluated exclusively through the number of positive bilateral trade flows). The next measure evaluates the second dimension of trade globalization – volume of trade. This is the most diffused dimension of trade globalization, with vast evidence of its strong increase since the mid-1980s (see, for instance, Catão & Obstfeld, 2019; Obstfeld, 2020). Aiming to capture this element, the authors compare the total volume of trade in t with the volume of trade in a given year taken as reference (the first year in the time period considered). In order to capture this dimension, the authors first calculate:

$$V_t^* = \frac{\sum_{i=1}^I \sum_{h=1}^H y_{iht}}{\sum_{i=1}^I \sum_{h=1}^H y_{iht-1}} \quad (3)$$

and then obtain:

$$TG(2)_t = V_t = V_{t-1} * V_t^* . \quad (4)$$

In the first year (in the case of the data used in this chapter, 1967), $V_{1967} = 1$. As mentioned above, this corresponds to the unbounded dimension of trade globalization.

The third index of trade globalization captures, for the first time in the analysis being developed, the importance of distance. It takes $TG(1)$ as departure point but gives less importance to flows occurring between closer countries. This index – $TG(3)$ – is obtained dividing the distance associated with trade (i.e., the sum of the distances between country pairs in which there is positive trade) and the sum of the distances between all country pairs (with or without trade). Thus, the index evaluates the percentage of the total distance among all the countries in which positive trade occurs, being calculated as follows:

$$TG(3)_t = \frac{\sum_{i=1}^I \sum_{h=1}^H D_{iht} p_{iht}}{\sum_{i=1}^I \sum_{h=1}^H D_{iht}} \quad (5)$$

in which D_{iht} means the distance between countries i and h . As occurs with $TG(1)$, this index ranges between 0 and 1. The upper limit is reached when there is bilateral trade among all country pairs. Therefore, $TG(3)$ increases with trade globalization. The joint consideration of $TG(1)$ and $TG(3)$ allow to identify the reasons for a given increase/decrease: number of flows, distance, or both.

Finally, the authors concentrate the analysis on the last dimension of trade globalization: the number of sectors. The key argument is that, *ceteris paribus*, trade globalization is higher when there are positive trade flows from a greater number of sectors. In order to capture this aspect, the sectors are defined by q ($q = 1, 2, \dots, Q$). The first step to obtain $TG(4)$ is to calculate the average number of sectors involved in bilateral trade. This is defined as N_t and can be obtained as:

$$N_t = \frac{\sum_{i=1}^I \sum_{h=1}^H b_{iht}}{I(H-1)} \quad (6)$$

in which:

$$b_{iht} = \sum_{q=1}^Q k_{ihqt} \quad (7)$$

and

$$k_{ihqt} = \begin{cases} 1 & \text{if } y_{ihqt} > 0 \\ 0 & \text{if } y_{ihqt} = 0 \end{cases}. \quad (8)$$

Calculating the ratio between N_t and the total number of sectors included in the analysis (Q), it is possible to obtain the proportion of sectors with trade. This measure is designated as $TG(4)_t$:

$$TG(4)_t = \frac{N_t}{Q}. \quad (9)$$

It is important to emphasize that the three bounded dimensions of trade globalization included in the conceptual framework range in the same interval: $[0, 1]$. The value 0 is obtained when there is no trade while the maximum value is reached when all sectors are traded in all bilateral relations.

Data

The empirical analysis conducted in the current chapter uses data from Chelem (provided by CEPII) and covers a period of fifty years (1967-2016). The analysis considers not only overall bilateral data for each of these years but also evidence at the sectoral level (manufacturing sector).² To that end, the authors consider ISIC at 4-digit level, which corresponds to 147 sectors. In order to calculate $TG(3)_t$ information about bilateral distances are also needed. These data are also retrieved from CEPII. The same occurs with the deflators required to obtain information in real terms.

The authors consider two different sub-periods: 1967-1990 and 1994-2016. This is needed due to the political changes occurred in Europe in the beginning of the 1990s. More specifically, it is necessary to take into account the disintegration processes occurred in Yugoslavia, URSS, and Czechoslovakia. For this reason, the authors consider a total of 72 countries in the first sub-period and 84 countries in the second one.³ Taken together, they account for around 96% of world trade.

For each year of the first sub-period there are 148 matrixes (the matrix of bilateral trade flows in overall terms and 147 sectoral matrixes, also containing information on bilateral trade). Since, in this period, $I = H = 72$, each matrix has 5,112 elements. In turn, in the second sub-period, $I = H = 84$. Thus, each matrix has 6,972 elements. Taking all matrixes together and the whole period under consideration, this study considers around 43 million bilateral trade flows.

KEY EVIDENCE

Four Indexes of Trade Globalization

The conceptual framework proposed above includes four key measures of trade globalization, allowing to capture different facets of the phenomenon. In the current section, the authors evaluate the results obtained for each of these measures.

The analysis starts by considering the evidence for $TG(1)$, which only takes into account the number of positive bilateral trade flows (see Figures 1 and 2). Given the political changes occurred in the beginning of the 1990s, it is necessary to consider two independent Figures – the first one refers to the sub-period 1967-1990 while the second panel refers to the sub-period 1994-2016.

Figure 1. Trade Globalization (1967-1990): Number of Trade Flows

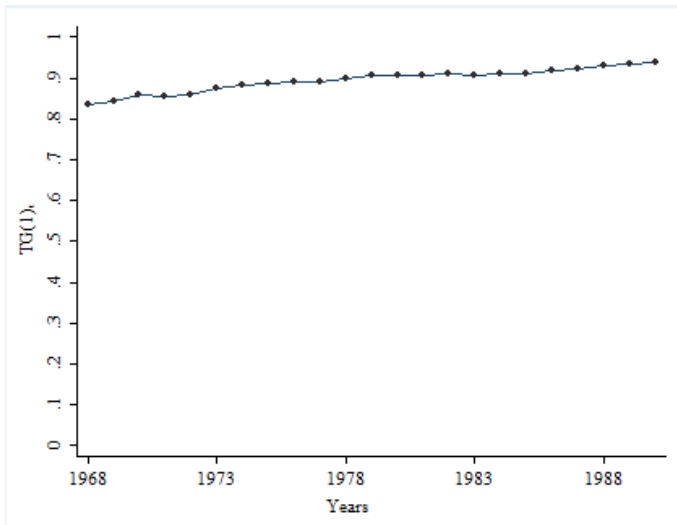
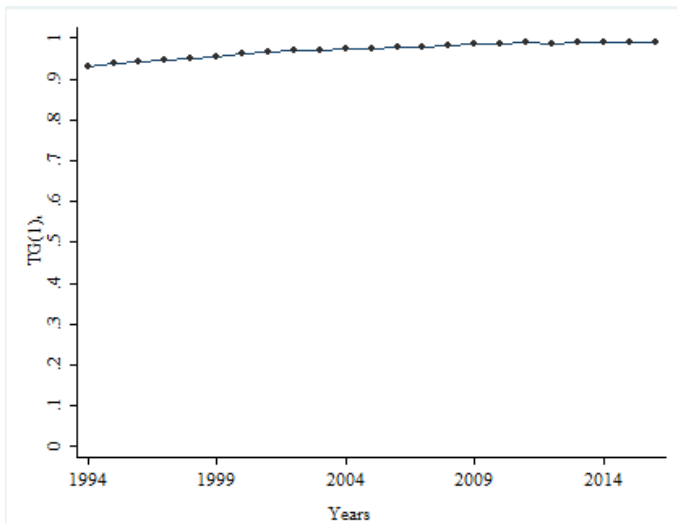


Figure 2. Trade Globalization (1994-2016): Number of Trade Flows



Regarding the evidence presented in Figures 1 and 2, some critical conclusions must be highlighted. First, the level of trade globalization evaluated through this first (simple) dimension was already very high (83.5% of the maximum) at the beginning of the period, which, of course, is connected with the fact that, in this approach, a trade flow exists for any positive value of trade. Thus, more important than the exact percentage in a given year, it is the evolution registered along the period that should be seen with special attention. Figures 1 and 2 clearly show that there is an increase in this level in almost all of the fifty years included in the empirical exercise. In fact, only in four years there is an opposite movement, with slight decreases in the percentage of bilateral relations with positive trade. Three of these years happen during the first sub-period, namely 1971, 1983, and 1985, while the most recent one occurred in 2012. The strongest decreases among these four cases occur in 1983 and 1971. In turn, the decrease registered in 1985 is the smallest one. Comparing the annual average growth rate in the two sub-periods, it is possible to verify that the growth is faster in the first sub-period (0.53% versus 0.29%). Analysing the results in more detail, the authors conclude that the most pronounced increase occurs between 1972 and 1973 ($TG(1)_{1972} = 0.8601$; $TG(1)_{1973} = 0.8740$). Finally, it is also possible to conclude that $TG(1)$ is higher than 0.98 since 2008, almost reaching its upper limit ($TG(1) = 1$) at the end of the period under scrutiny ($TG(1)_{2016} = 0.990$).

What is the explanation to this increase in the level of world trade integration, evaluated through the proportion of positive bilateral trade relations? Looking in detail at the data, it is possible to conclude

that, at the beginning of the period under consideration, only a small group of countries (Sweden, Finland, Japan, and United States) exported to all trade partners in the sample but, on average, each country exported to 59 countries (out of the 72 countries included in the sample). These numbers increase during the period, which is fundamentally due to the better integration of less integrated countries in the world trade web (e.g., Brunei, Gabon, Vietnam, and Cameroon). This trend is very clear, for example, in the 1980s. At the end of this decade, the first measure of trade globalization ($TG(1)$) reaches almost 0.94.

Due to the political instability of the first half of the 1990s, this measure shows a slight decrease from 1990 to 1994 but after that moment the positive trend was resumed. In the last year included in the analysis, 79% of the countries register positive trade with all the remaining ones and $TG(1)$ index reaches 0.990, showing that the opportunity to further increases in the level of trade globalization cannot be founded in this dimension since the current level is very close to the upper limit.

In what follows, the analysis focuses on the evolution of the volume of trade. This dimension is captured through the index $TG(2)$. The results are shown in Figures 3 and 4.

Figure 3. Trade Globalization (1967-1990): Total Volume of Trade

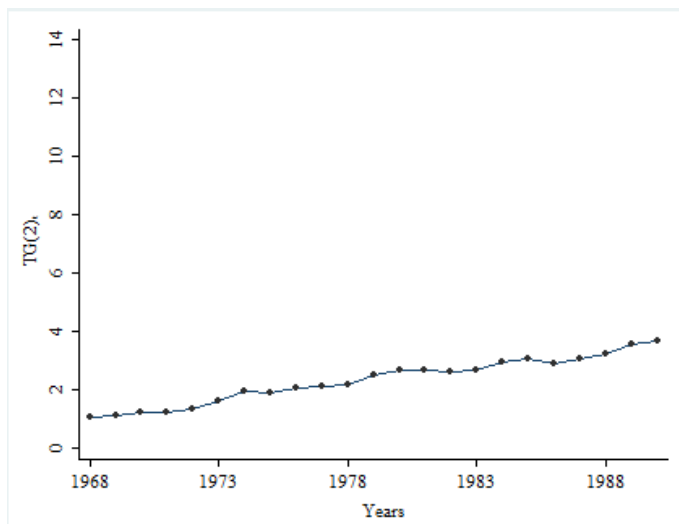
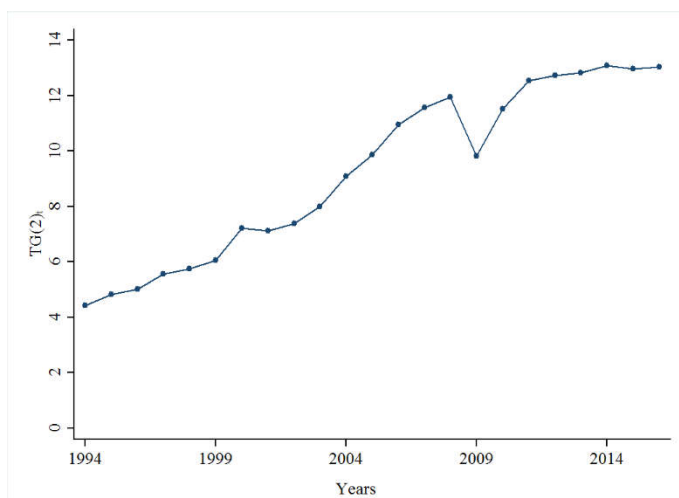


Figure 4. Trade Globalization (1994-2016): Total Volume of Trade



The very strong growth of world trade in the last decades is a well-known fact. This result is the most important evidence commonly used to support the idea that the current wave of globalization has started in the mid-1980s. The evidence in Figures 3 and 4 shows that a remarkable uprising trend is already visible before that period. However, it is also true that the average growth rate is remarkably higher in the second sub-period. The significant reduction, at the world-level, of several components of trade costs (including transport and communication costs, elimination of trade barriers, technological progress, among other factors) explain this evolution.

This positive trend of the trade volume at the world-level is largely consistent along the whole period, the most important exception being the Great Recession that has started in 2009 (WTO, 2018). This year – 2009 – is by far the one with the strongest decrease in the overall volume of trade. The other five years with negative growth are 1975, 1982, 1986, 2001, and 2015.

In conclusion, the evolution of this dimension of trade globalization – volume of trade – shows a strong upward trend during the period analysed and does not reveal until now any solid evidence of stabilization.

Once considered the unbounded dimension of trade globalization, the authors now return to the evaluation of its bounded dimensions. The index $TG(3)$ retains the combined influence of distance and number of flows. Since this last dimension was already captured through the index $TG(1)$, their joint analysis allow to infer the evolution of the distance as a dimension of trade globalization. Figures 5 and 6 show the results obtained.

Figure 5. Trade Globalization (1967-1990): Number of Flows and Distance

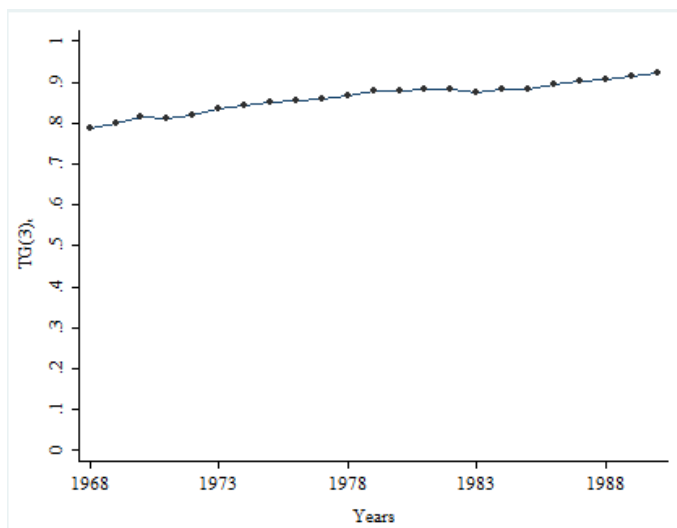
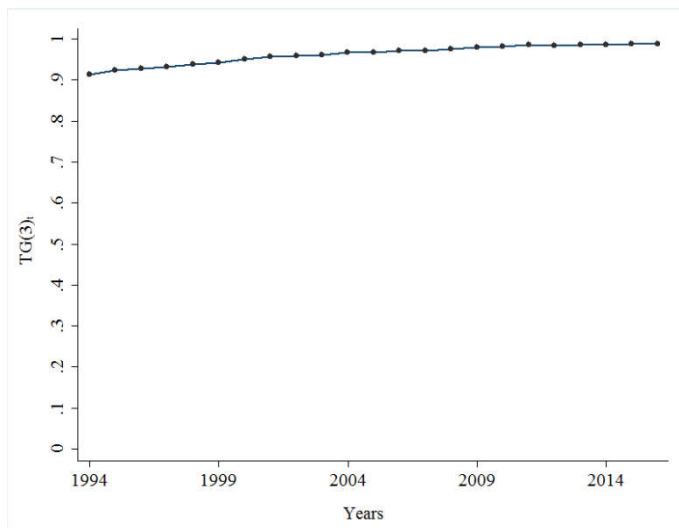


Figure 6. Trade Globalization (1994-2016): Number of Flows and Distance



The impact of distance on trade is extensively debated in international economics. Some authors argue that distance is not a barrier anymore, that the “world is flat” and that the world can be seen as a “global village”. On the contrary, other studies conclude that distance still matters and that the intensity of trade flows are stronger with closer partners, concluding therefore that the actual scenario in world trade relations is better described as the overlap of several levels of regionalization than through a real globalized structure of trade flows.

The evidence obtained for $TG(3)$ allows to retain some useful conclusions. Starting with the numbers for the first year under analysis, the quantitative importance of trade globalization is higher when it is measured with $TG(1)$ than when the index $TG(3)$ is considered. This fact means that there is, at the beginning of the period under analysis, an overrepresentation of bilateral trade flows between close countries. Using data for 1968, it is possible to verify that $TG(1)_{1968} = 0.835$ and $TG(3) = 0.786$. The existence of a positive gap between these measures remains valid along the entire period but its magnitude is strongly reduced over that period. Thus, the relevance of distance as a trade barrier diminishes in the last fifty years. As an additional measure, the authors calculate the proportion of total trade occurring between countries with a maximum distance of 1,000 km, 3,000 km, 5,000 km, and 7,500 km. In all cases, this proportion decreases, being the reduction stronger in the first two cases (around 5 p.p. in the second sub-period of time) and weaker in the last two cases (around 2 p.p. in the same period).

A final element that is important to consider in order to obtain a comprehensive perspective about the evolution of trade globalization is the number of sectors involved in trade. This corresponds to the fourth dimension of the conceptual framework discussed above. The evidence for this dimension is captured by $TG(4)$ and the results are shown in Figures 7 and 8.

Figure 7. Trade Globalization (1967-1990): Number of Sectors Involved in Trade

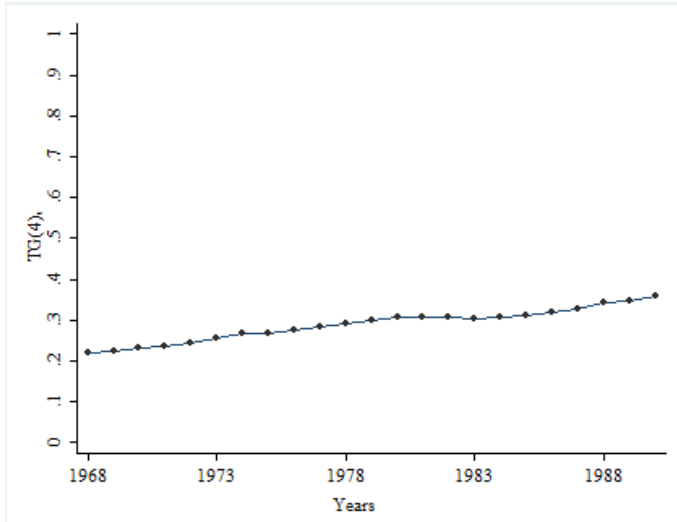
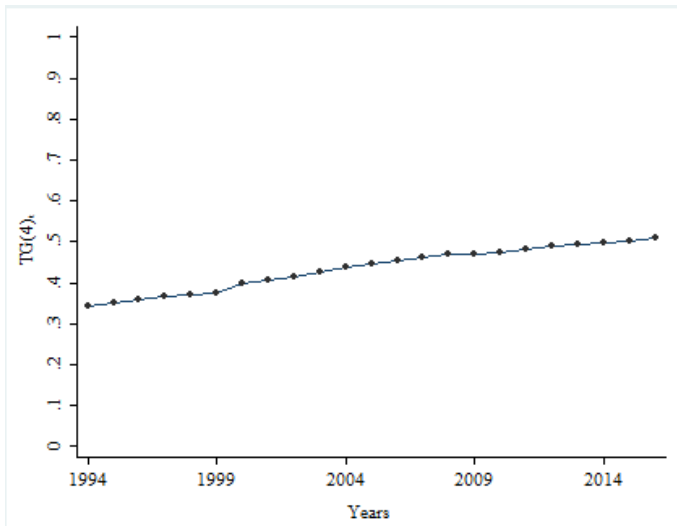


Figure 8. Trade Globalization (1994-2016): Number of Sectors Involved in Trade



The evidence shown in Figures 7 and 8 is not only very interesting but also much less explored in the empirical analysis of trade globalization. At least, three critical conclusions can be retained. First, comparing with the previous indexes, trade globalization is significantly lower when the evaluation takes $TG(4)$ as reference. Second, during the fifty years included in the sample there is remarkable increase of this dimension of trade globalization. While in first year considered this index does not exceed 0.218, it reaches 0.3 in 1980, 0.4 in 2001 and 0.5 in 2015. Third, despite this strong positive trend, there is still wide room for further improvements in the level of trade globalization.

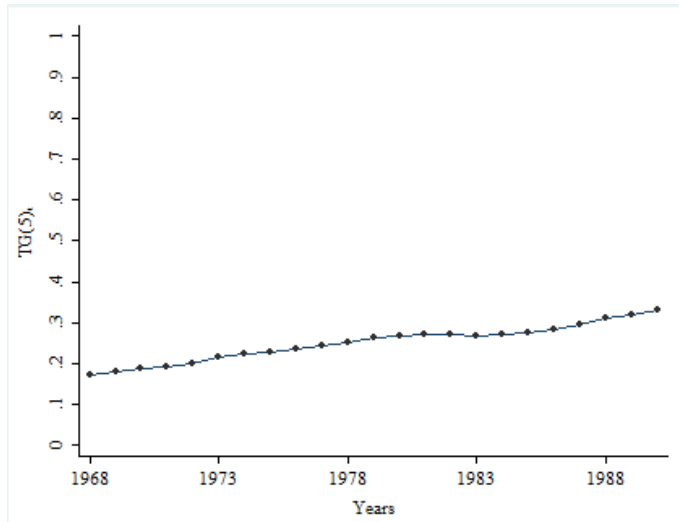
Bounded Dimensions of Trade Globalization

As mentioned above, the conceptual framework proposed in this chapter and the evidence discussed above includes three bounded dimensions and one unbounded dimension of trade globalization. The inclusion of these bounded dimensions allows the comparison between the current level of trade globalization and the possible maximum. In order to obtain an integrated perspective, it is necessary to put together the three bounded dimensions. To that end, a fifth index of trade globalization is calculated. It can be obtained as follows:

$$TG(5)_t = TG(3)_t * TG(4)_t. \tag{10}$$

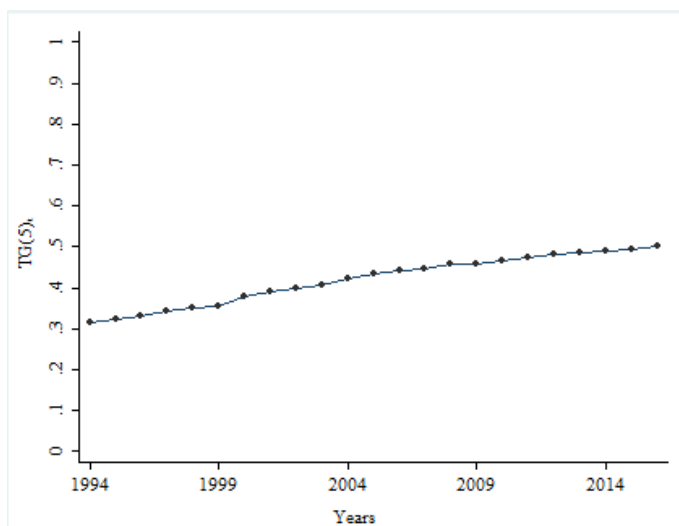
Given the results previously discussed, a consistent increase of $TG(5)$ was to be expected. The results confirm this and evidence is presented for the two sub-periods in the Figures 9 and 10.

Figure 9. Bounded Dimensions of Trade Globalization (1967-1990)



During the first decades of our analysis, a positive growth occurs in all years with the exception of 1982 and 1983. The level of trade globalization increases dramatically when evaluated through its bounded dimensions: while, at the beginning of the period considered, $TG(5)_{1968} = 0.172$, this value already reaches 0.331 in 1990.

Figure 10. Bounded Dimensions of Trade Globalization (1994-2016)



This positive growth trend also continued throughout the second sub-period and highlights the strong and continuous increases in trade globalization since the 1990s. Hence, in 2016, it is greater than 0.5 ($TG(5)_{2016} = 0.502$). This last value however also clearly shows that trade globalization is not yet at its maximum and there is still enough potential for enhancing further globalization processes. While two of its bounded dimensions – trade flows and distance – show a very small room to increase, the same is not true regarding the sectoral dimension. Trade globalization can still increase through a more

diversified sectoral participation of the different countries in world trade. This is a key message to retain from the quantitative evaluation of the phenomenon undertaken in this chapter. In this respect, digitalization could also boost trade globalization in sectors that have not yet fully integrated into global trade networks. On the other hand, trade wars resulting in higher tariffs and quota could even slow down trade globalization in future years.

Sectoral Evidence

Until now, the authors concentrated the analysis on the overall evidence, which include the four dimensions proposed in the conceptual framework (number of flows, volume of trade, distance, number of sectors). However, it is useful to complement that discussion with a short evaluation of the differences at the sectoral level. Since the disaggregated analysis for each of the 147 sectors that integrate the data is not feasible, in this chapter the authors opt to consider a simple sectoral taxonomy, which divides the sectors according with the intensity of R&D activities. Four categories are considered: high-technology, medium-high, medium-low, and low.

In order to evaluate the evolution of the level of trade globalization, the authors consider the basic dimensions above identified. Since the analysis is now conducted at the sectoral level, the authors are forced to exclude the fourth indicator. The evidence for the first three measures, capturing the number of trade flows, the volume of trade, and the distance and number of flows is presented in Figures 11 and 12 (number of flows), 13 and 14 (volume of trade), and 15 and 16 (distance and number of flows).

Figure 11. Sectoral Evidence: Number of flows (1967-1990)

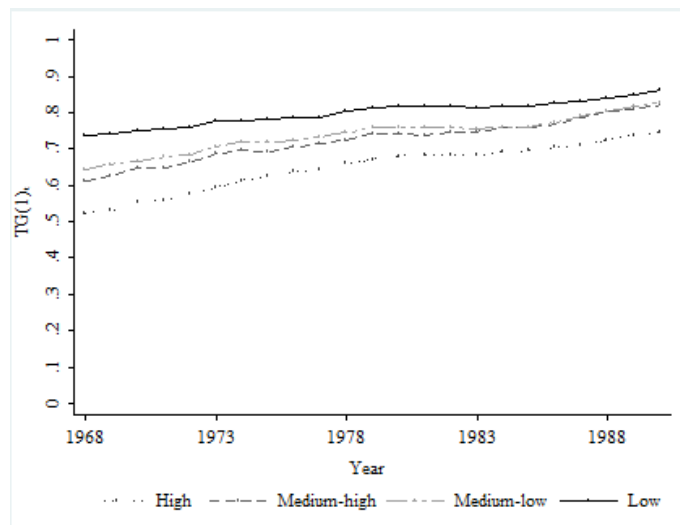


Figure 12. Sectoral Evidence: Number of flows (1994-2016)

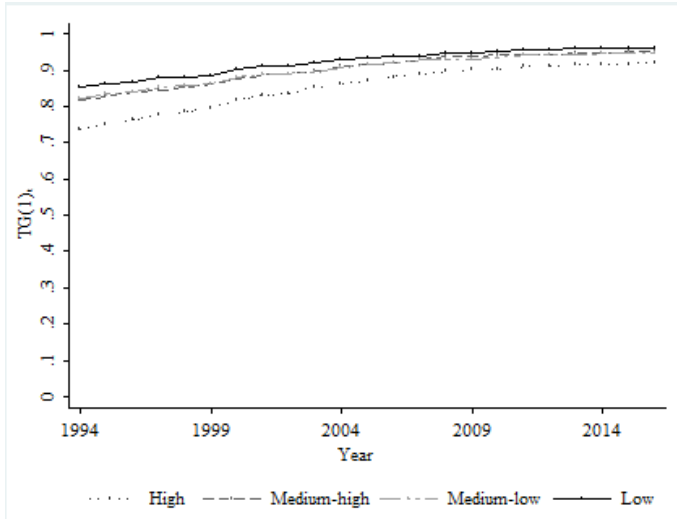


Figure 13. Sectoral Evidence: Volume of Trade (1967-1990)

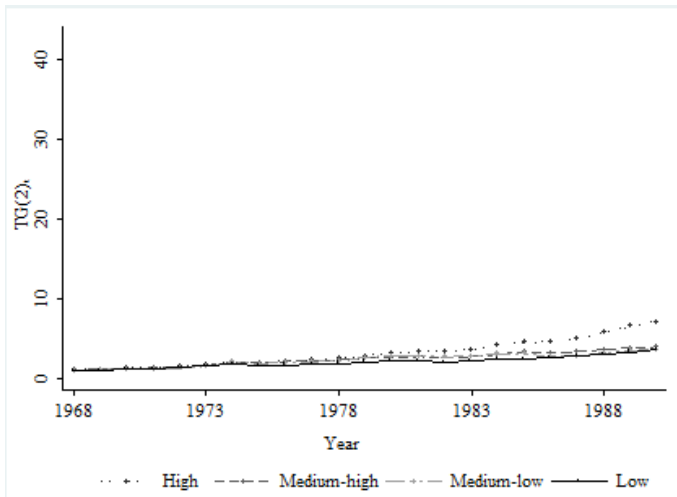


Figure 14. Sectoral Evidence: Volume of Trade (1994-2016)

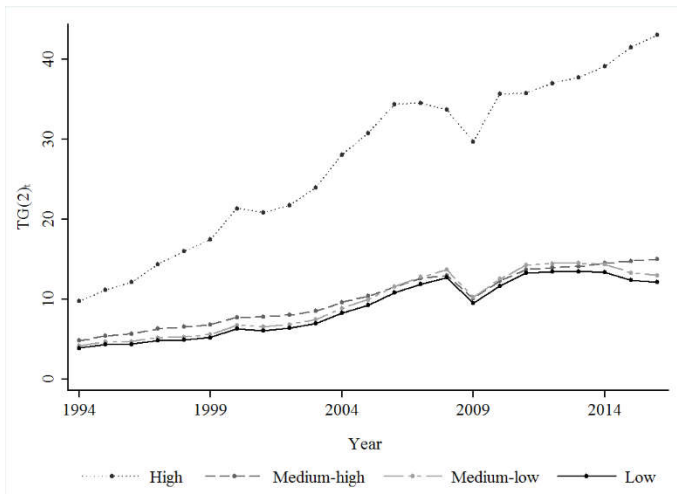


Figure 15. Sectoral Evidence: Distance and Number of Flows (1967-1990)

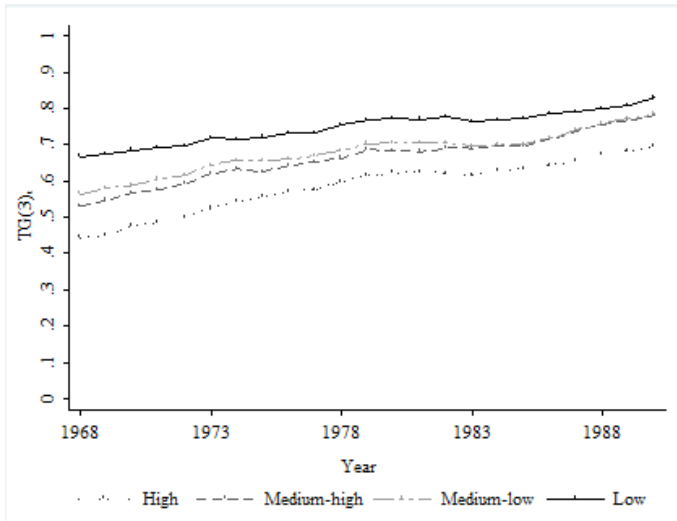
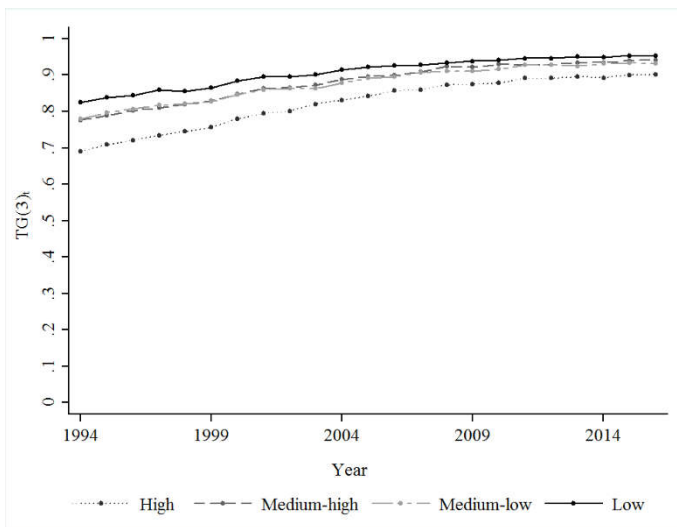


Figure 16. Sectoral Evidence: Distance and Number of Flows (1994-2016)



Considering the results shown in Figures 11 and 12, it is visible the corroboration of the overall evidence presented in Figures 1 and 2. Thus, two key messages should be retained: (1) a general uprising trend of trade globalization, valid for all the four categories represented in Figures 11 and 12; (2) a very high level of trade globalization at the end of the period analysed. Additionally, low-tech sectors have the highest level of trade globalization (evaluated with this first index) while the high-tech sectors are characterized by the lowest level of trade globalization (along the entire period). Taking the last year as reference, the sectors showing the highest levels of trade globalization are plastic products, other fabricated metal products, and wearing apparel, except fur.

Considering simultaneously the evidence in Figures 11 and 12 and 15 and 16, it is also important to highlight the existence of a remarkable catching-up process of the high-tech sectors to the highly globalized low-tech sectors. These Figures demonstrate that globalization first occurs in sectors that have low requirements in R&D and are labour-intensive, such as the textile sector. It is in this kind of sectors that developing countries have a competitive advantage and first enter the world trade network. In Pakistan, for instance, more than 40 per cent of the labour force worked in the textile sector accounting for more than 50 per cent of Pakistan's exports in 2016. Yet, as developing countries can diversify both production and exports, the share of low-tech exports decreases and the number of sectors that countries trade with increases. Overall, the export of high-tech sectors involves comparatively more capital investment and higher education. Therefore, the contribution of exports in these sectors evolve much more slowly than in low-tech and low-skill sectors. Figures 15 and 16 also demonstrate that the

importance of distance as a barrier to trade decreases in these fifty years, independently of the type of sectors considered.

The most accentuated differences among sectors concern the evolution of trade volume. As shown in Figures 13 and 14, along the period under scrutiny there is a tremendous growth of trade volume (calculated in real terms) for the high-tech sectors, suggesting that the global value chains for these products are longer than for other sectors. While increases in trade volume are also visible for the other groups of sectors, they are much more moderate than occurs for the high-tech sectors.

Digitalization is expected to increase automation, substituting labor through machines and thus making the production of goods in high-wage countries more profitable again. This could then have major implications on the structure of global value chains. Over the last two decades, a central cornerstone of global value chains was that tasks of production which are labor-intensive and require only low skills and a low degree of capital, have been transferred to countries that have a competitive advantage at producing low-cost. Even more so, as distance has become less important for international trade. Automation now could change the global picture regarding the competitiveness of low-wage countries and re-shape (trade) globalization especially in low-tech sectors. Thus, digitalization could have a reversal trend on sectoral globalization.

Butollo (2020) however suggests that there is not a clear trend towards re-shoring from low-wage Asian countries to high-wage European countries and the US. Even though digitalization and the advantages of closer producer-consumer proximity can affect the competitiveness of firms and location decisions of production, technological change does not make global value chains entirely obsolete. However, recent research has already shown that new digital technologies can influence the nature of global value chains and global production networks for a wide range of sectors (Foster & Graham, 2017; Sturgeon, 2017). Andersson, Berg, Hedrich, and Magnus (2018) for instance point out that in the textile sector, the cost of labor in production was the most central argument for the location of a company. Yet, with regional flexibility to react to customers' demand and automation making production more profitable in high-wage countries again, reshoring many activities from low-wage countries such as Bangladesh, Pakistan and China could become the new reality – even more so in times when the insecurity about the well-functioning of international value chains during a pandemic is shaping location decisions. Yet, Butollo and Lüthje (2017) also point towards the potential catch-up of developing countries with respect to automation and digitalization, hence making reshoring less likely as not only advanced economies but also countries like China learn to make full potential of new technologies.

FUTURE RESEARCH DIRECTIONS

As highlighted by the empirical results in the previous section, (trade) globalization is a multi-dimensional phenomenon and, as such, should be studied using a set of indicators rather than by one proxy alone. Yet, almost equal attention as to choosing a variety of indicators should be given to the effort of capturing the interrelatedness of countries in order to understand globalization proper. For that endeavor it is beneficial to analyze the importance of distance as well as the number of sectors involved in global trade networks. Regarding these two indicators, digitalization is likely to have significant impact and will likely continue to do so in the future.

This chapter has already shown that applying a set of indicators is beneficial for shedding more light on the driving factors of (trade) globalization. Therefore, future research could focus on incorporating additional factors. Yet, it should be made sure that indicators are able to capture globalization proper rather than studying internationalization of individual countries in isolation. More data on digitalization, trade in data and information and the adaptation of digitalization of individual countries could be advantageous research directions. This is even more so as the organization of trade itself can become ever more paperless, reducing burden for small firms to take part in international trade as complex trade-related documents can more easily be handled electronically (World Economic Forum, 2017). Thus, the potential to decrease trade costs by further technological progress should be tackled in further studies.

One further effect of digitalization and automation could be on the location decisions of firms. This, in turn, could affect countries that trade with one another as well as the total amount of trade. Future

research could thus also shed more light on the question whether a new paradigm of higher localization and regionalization has occurred due to higher degrees of uncertainty in international trade (due to political and health crisis) as well as due to the fact that technological change regarding digitalization has been much more pronounced in advanced economies. Thus, global value chains could prove to be more fragile than regional value chains, thus having a dampening effect on globalization proper. Moreover, in low-tech sectors such as textiles, time has become an ever more important factor for trade thus making distance a more important factor again and automation making producing countries closer to high-wage customer markets such as Mexico and Turkey more competitive again (Andersson et al., 2018).

Additionally, digitalization could increase trade in services significantly, making it more important to study not only the global trade in manufacturing goods but also of services and to which extent there are differences between these two categories of trade. Yet, by incorporating data on digitalization and services directly, there is a trade-off with the time span that can be analyzed as well as the set of countries under study and thus the new insights that can be taken from future research.

CONCLUSION

This chapter showed that trade globalization is a multi-faceted phenomenon that should not be analyzed only by the evolution of trade volume. The authors highlighted the importance of incorporating additional factors to gain a deeper understanding of the trade globalization processes. In this context, the current study proposed a conceptual framework that includes four dimensions of trade globalization: number of positive trade flows, volume of trade, distance, and number of sectors involved in trade. Moreover, this chapter focused on elaborating the advantages of studying trade globalization from a truly global perspective rather than analyzing internationalization tendencies and aggregating these developments to a global index.

The results show significant increases in all dimensions of globalization, despite substantial differences between the measures, highlighting the need to analyze globalization with a comprehensive set of indicators. Regarding the number of positive bilateral trade flows, globalization was already high at the beginning of the period under study and is almost completed by 2016. The importance of distance as a trade barrier also diminished throughout the period analyzed, but neighboring countries still share stronger trade relations.

An important advantage of the framework introduced in this study is the separation between bounded and unbounded dimensions of trade globalization. This allowed to verify that trade globalization is very close to its upper limit in what regards the number of positive trade flows and distance but a wide room for further increase is still open concerning the number of sectors involved in trade.

The replication of the empirical analysis for a specific taxonomy of sectors indicates that trade globalization for high-tech sectors varies significantly from the evolution seen in other sectors, especially large, low-tech sectors. The latter tend to show the highest level of trade globalization over the whole period, but the former group could catch up considerably. Analysing trade globalization with the help of trade volume in goods, the impact of the Great Recession in 2009 on trade volume is remarkable. Whereas trade globalization thus has slowed down (but did not reverse) measured by this one criterion, sectoral trade globalization did only decline for low-tech and medium-low tech sectors. Regarding the number of sectors that were involved in international trade, the positive growth trend also continued in recent years.

It remains open, however, which long-term effects the latest protectionist trends will have on the evolution of trade globalization. As tariffs and quotas have been re-introduced, this could not only have an impact on trade volume but also on the sectoral component of trade globalization. Moreover, the worldwide health crisis due to Covid-19 is expected to lead to an even larger recession in 2020 compared to the recession in the course of the financial crisis of 2008/2009. Declining private demand, a high level of insecurity, restriction in traveling as well as uncertainties regarding the well-functioning of global value chains could lead to re-locations of production. More and more governments also state to intend reallocating the production of essential goods in order to be less dependent on international markets. Yet, both slowbalization as well as de-globalization trends could be only short, transitional

processes if the advantages of global value chains outweigh their disadvantages again. In this respect, the role of automation and digitalization on location decisions could also play an important role.

Altogether, it is too soon to reach conclusions whether the short-run dynamics that de-globalization and slowbalization of some measures of trade globalization will also change the underlying structures of globalization developments in the long run. Moreover, diverging trends regarding sectoral trade globalization are also possible due to the variety of influencing factors ranging from wage differentials, automation probabilities to tariffs and quota regimes.

ACKNOWLEDGMENT

This research was supported by the Styrian Government for the Project “(Un)Divided Inequalities in the Digital Revolution: Regions, Labor Markets and Policy Responses; and the Fundação para a Ciência e a Tecnologia [grant number UIDB/00315/2020].

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ENDNOTES

¹ Arribas, Bensassi, and Tortosa-Ausina (2020) recently presented a new study following the same methodological approach.

² It is important to emphasize however that even considering that trade in services has increased in the last years, it accounts for no more than 21% of total trade in 2017. The projections for 2030 suggest that this value will increase to around 25% meaning, therefore, that the data considered in this empirical exercise account for a very large proportion of world trade, as illustrated by the WTO (2018).

³ Countries included in the analysis in the sub-period 1967-1990: Albania, Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Brunei Darussalam, Bulgaria, Cameroon, Canada, Chile, China, Colombia, Cote d'Ivoire, Cyprus, Denmark, Ecuador, Egypt, Finland, Former Czechoslovakia, Former USSR, Former Yugoslavia, France, Gabon, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Libyan Arab Jamahiriya, Luxembourg, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Saudi Arabia, Singapore, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela, and Viet Nam. Countries included in the analysis in the sub-period 1994-2016: Albania, Algeria, Argentina, Australia, Austria, Bangladesh, Belarus, Belgium, Bolivia, Bosnia and Herzegovina, Brazil, Brunei Darussalam, Bulgaria, Cameroon, Canada, Chile, China,

Colombia, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Gabon, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Latvia, Libyan Arab Jamahiriya, Lithuania, Luxembourg, Macedonia, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Serbia and Montenegro, Singapore, Slovakia, Slovenia, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela, and Vietnam.