

Measuring Regional Trade Integration

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Abstract

Preferential trade agreements are meant to promote trade within the targeted region. Once such agreements are put into effect, it is interesting to investigate the impact and effectiveness in the targeted region. This paper analyzes world trade network as a graph and introduces the measure to evaluate a change in strength or degree of regional integration. The measure or index introduced also captures the contribution of member countries in the regional integration.

Introduction

The Number of preferential trade agreements has been increasing since the 1990s and has increased more than four-fold ([Limão, 2006](#))([Fink et al.](#)). Do preferential trade agreements foster trade between the member countries? This question has been as important today as it was when such agreements were formed. This paper analyzes world trade network data to answer this question.

The main aim of such agreements is to foster mutual trade in the region and they are considered helpful for promoting the regional economic competitiveness as well([Estevadeordal et al., 2009](#)). Whereas the impact of such agreements is not homogeneous across countries, the impact is large for industrialized nations and small for developing nations([Fink et al.](#)).

Several measures of regional integration are devised and found in the literature ([Hamanaka, 2012](#)) ([Chauvin and Gaulier, 2002](#)) ([Iapadre and Tajoli, 2014](#)) ([Wei and Liu, 2012](#)). Intra-regional trade share (S_i) measures the ratio of regions i intra-regional trade to total trade ([De Lombaerde, 2006](#)). Intraregional Trade Share, Intraregional Trade Intensity Index, and Regional Trade Introversion Index measure the degree of trade interdependence in a certain region ([Hamanaka, 2012](#)). This paper analyze Regional Trade Integration Index and introduce an index, which measures the individual contribution of member countries in the given region.

Methodology

This paper introduces an index to study regional trade integration and examines trade data before and after the formation of such agreements. Collection of countries around the world and their trade relationship is represented by graph $G(W, E)$. W represents a set of all countries and E represents a set of all directed edges or all possible exports. Let e_{ij} represents the amount of export from country i to j country.

Regional Trade Integration Index (RTII): This index is the ratio of the sum of exports of all member nations within the region to the sum of export of member nations outside the region. The index range from 0 to 1. Index 0 indicates the member countries do not export within region index 1 indicates the members in a group export everything to other group members.

Let $g(W', E')$ be a subgraph of $G(W, E)$ and $W' \subseteq W$ and $E' \subseteq E$. In real world, graph $G(W, E)$ all countries in the world and their export relationship. And, subgraph $g(W', E')$ represent some preferential trade agreements e.g. NAFTA. Regional Trade Integration Index (RTII) for subgraph g is calculated as I_g .

$$I_g = \frac{\sum_{i: \forall i \in W'} \sum_{j: \forall j \in W'} e_{ij}}{\sum_{i: \forall i \in W'} \sum_{j: \forall j \in W} e_{ij}}$$

Individual contribution to the regional integration is computed as Individual Contribution Index (ICI)

$$ICI_g^i = \frac{\sum_{j: \forall j \in W'} e_{ij}}{\sum_{i: \forall i \in W'} \sum_{j: \forall j \in W} e_{ij}}$$

Where, ICI_g^i is the ICI for a country i in subgraph g .

The weighted sum of Individual Contribution Index is equal to Regional Trade Integration Index .

$$I_g = \sum_{i: \forall i \in W'} ICI_g^i$$

Individual Trade Integration Index (ITII): The index indicates how integrated a country is in a certain or group. The index compares the country's export within the region to export outside the region. Or, the index calculates the ratio of the sum of the export of a country to all another member country in a region to the sum of export of the country to all nations around the globe. This index range from 0 to 1. Integration index 0 indicates the country export within the region is 0 or the country doesn't export at all to the member countries in the region. Integration index 1 indicates the country's whole export is within the region and exports nothing outside the region.

This paper introduces an integration index I_g^i , which represents the integration of a country i in some region g or trade agreement or subgraph is given by

$$I_g^i = \frac{\sum_{j: \forall j \in W'} e_{ij}}{\sum_{j: \forall j \in W} e_{ij}}$$

Discussion

This paper analyzes and investigates the trend of regional integration for regional trade agreements NAFTA. The ITII of a country with respect to a particular region indicates the country's contribution to regional integration and RTII represents a ratio of the region's export within the same region to export to all other countries.

Figure 1 shows RTII for the NAFTA region and the ITII for all countries in the that region. The figure shows RTII for the NAFTA region is almost at the same level in 1990 and 2016 with some fluctuations in between. RTII shown by the red solid line in the figure indicates, the percentage of trade export that NAFTA does within the region compared to all around the world. The RTII trend indicates gradual increment from the inception of NAFTA to downward trend particularly during the global financial slowdowns around the year 2008. The RTII was 0.430114 when the group was formed and reached up to 0.576939 in 2002, then decreased

to 0.487429 in 2009, eventually follows an increasing trend after the financial crisis of 2008. Downward trend before 2008 and the upward trend after 1999 is noticeable.

If we look at the individual countries ITII, Mexico's the ITII index is highest among the three countries followed by Canada and the USA. Notably, the ITII is moving parallel for three nations.

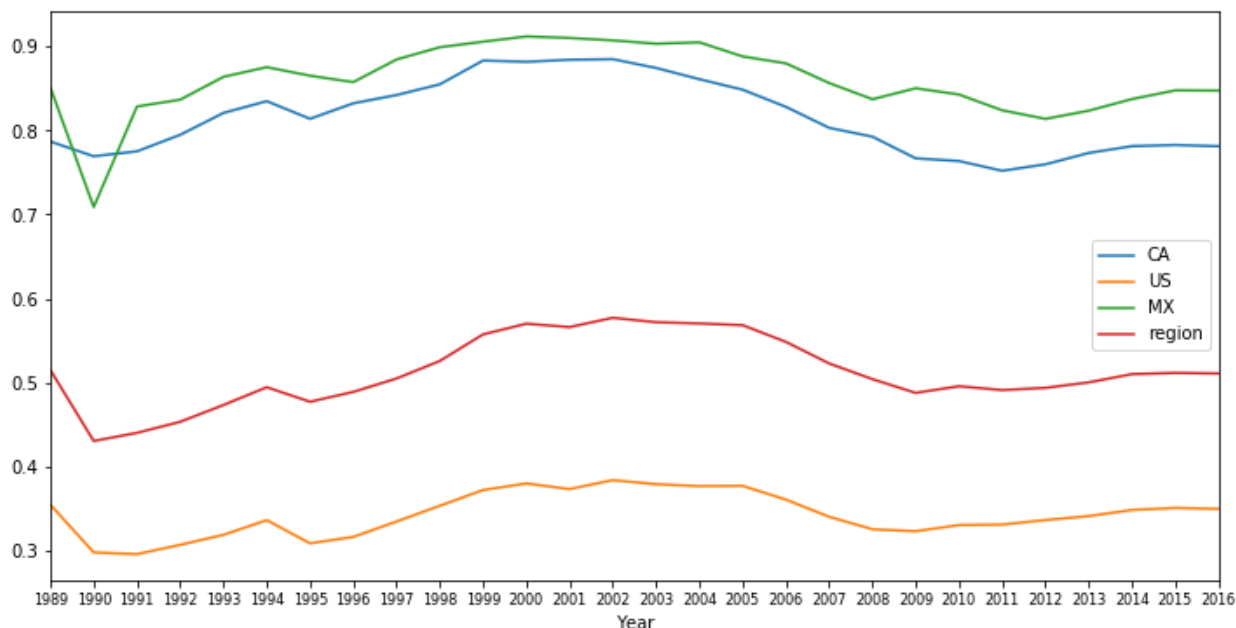


Figure 1: Regional Trade Integration Index (RTII) for NAFTA regions and Individual Trade Integration Index (ITII) for all countries in the regions

Figure 2 shows the RTII and Individual Contribution Index (ICI) for all three member countries, where the sum of the ICIs is equal to RTII. The ICI gives some noticeable pattern in addition to the ITII. The ICI shows which nation is contributing to the regional integration the most. Mexico's the ITII is highest among other countries, but ICI tells it is lowest. This is because the size of Mexico economy compared to others. Mexico's the ITI depicts increasing trends during study periods whereas Canada's the ITI shows somewhat decreasing trends. This indicates the contribution of Mexico has an increasing contribution to regional integration. Whereas, Canada's contribution towards regional integration shows ups and down with overall decrement.

If we look at the contribution of individual countries to their regional integration, US contribution to the regional integration has been increasing, in overall, since 1990. The Figure depicts that US share and contribution to regional integration has increased compared to Canada.

Conclusion

This paper regional trade integration to show the degree of integration or share of the trade of a region within that region compared to the rest of the world. The index shows the fluctuations in the degree of trade during the study period. The individual contribution index used in this paper has discriminatory power to look at the regional integration from the individual perspective. This index clearly shows the variations in individual trade share.

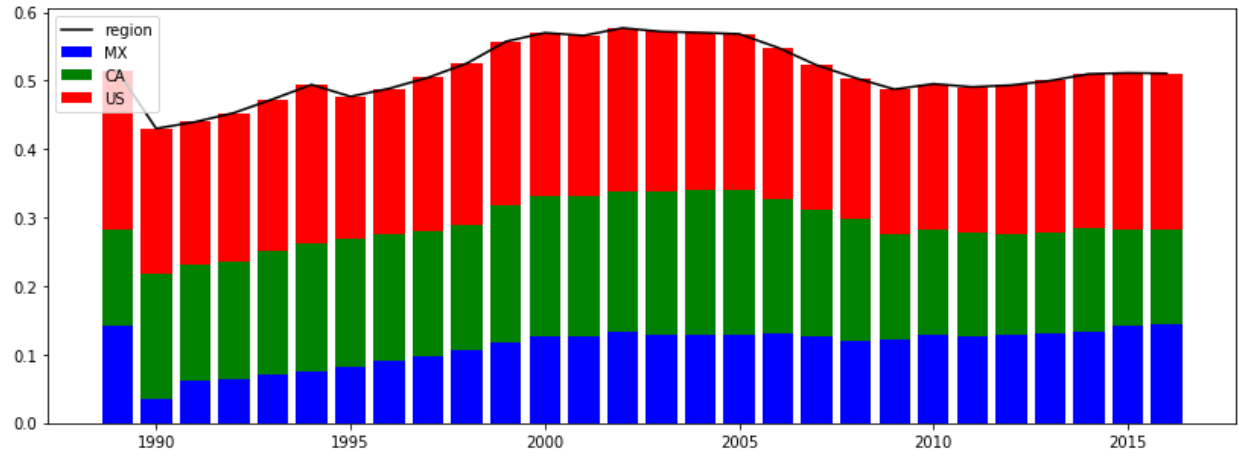


Figure 2: Regional Trade Integration Index (RTII) for NAFTA region and Individual Contribution Index (ICI) for all countries in the region

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