SOCIAL NETWORK ANALYSIS

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**THESIS: ANALYSIS OF NAFTA USING NETWORKS**

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**Introduction.**

The dataset which we are studying is the gravity dataset, which describes the country characteristics and relationship of trading partners from 1948 to 2016. The dataset was constructed by considering Iso alpha 3 codes of all countries and territories from the WTO database. Tracking of countries and territories was carried out using the CIA factbook and changes carried out dynamically. While inspecting the dataset, it was found to be consistent with very few missing values/ NA’s and values in numeric and binary form which is good for a statistical network analysis. It includes data from 1948 to 2016 which is a substantial period for studying macroeconomic factors of different countries. This could be useful for comparison between the past and the present. Additionally, we could use them to visualize trade networks, study relationships, analyze network of trading powers in the global landscape.

Having chosen the gravity dataset, we intend to study the effect of a major trade agreement which took place within this time frame like the NAFTA (North American Free Trade Agreement) and understand trade networks using network analyses and graphs.

The NAFTA is one of the most significant multiparty agreements of the 20th century in terms of trade. Studying an agreement as important as the NAFTA and trying to answer questions which were left unanswered in previous studies can help governments execute future agreements more effectively and mitigate unforeseen negative effects of such trade agreements. Additionally, if proved consistent with different hypotheses, network analyses could become one of the corner stones for validation of such agreements before they get rolled out at scale.

<https://en.wikipedia.org/wiki/North_American_Free_Trade_Agreement>

**Research Questions.**

1. What effect does NAFTA have on US, Canada, Mexico in terms of trade and economic growth? Are key economic indicators such as GDP, trade deficit, employment related to network metrics such as closeness, centrality, strength?
2. Can we understand the underlying effect of a policy using network metrics?
3. Can we study externalities using networks and identify social, cultural, catastrophic events as an effect of the policy?
4. Conduct a thorough RCA on a specific issue, such as why the USA was adamant on scrapping sect. 19 (dispute settlement mechanism) of the NAFTA, can we understand the cause and effect relationship of this problem through network analysis?
5. Do FTA’s lead to economic gaps between have and have-nots?

**Bibliography Search.**

**NAFTA side.**

The [North American Free Trade Agreement](https://www.investopedia.com/terms/n/nafta.asp) (NAFTA) is a pact eliminating most trade barriers between the U.S., Canada, and Mexico that went into effect on January 1, 1994.

The impetus for a North American free trade zone began with U.S. President [Ronald Reagan](https://en.wikipedia.org/wiki/Ronald_Reagan), who made the idea part of his 1980 presidential campaign. After the signing of the Canada–United States Free Trade Agreement in 1988, the administrations of U.S. President [George H. W. Bush](https://en.wikipedia.org/wiki/George_H._W._Bush), Mexican President [Carlos Salinas de Gortari](https://en.wikipedia.org/wiki/Carlos_Salinas_de_Gortari), and Canadian Prime Minister [Brian Mulroney](https://en.wikipedia.org/wiki/Brian_Mulroney) agreed to negotiate what became NAFTA. Each of these countries submitted the agreement for ratification in their respective capitals in December 1992, but NAFTA faced significant opposition in both the United States and Canada. Later, all three countries ratified NAFTA in 1993 after the addition of two side agreements, the North American Agreement on Labour Cooperation (NAALC) and the North American Agreement on Environmental Cooperation (NAAEC).

The NAFTA was introduced in order to improve trade, eliminate barriers, and reduce tariffs on imports and exports between Canada, the United States and Mexico intended to boost economic growth within these three countries.

Naturally, there were unintended effects of the NAFTA which put some of the parties at a disadvantage. The following were some of the key takeaways:

|  |  |  |  |
| --- | --- | --- | --- |
| Economic Indicators  (Real terms from 1993 – 2015) | U.S.A | Canada | Mexico |
| GDP | 39.3% | 40.3% | 24.1% |
| Trade Deficit | Increase | Decrease | Decrease |
| Unemployment | Increase | Neutral | Decrease |

Pros.

* Between 1993 and 2019, trade between the three members quadrupled from $290 billion to $1.23 trillion.
* Prices of oil, food and garment imported by the US lowered.
* NAFTA boosted U.S. economic growth by as much as 0.5% a year.
* Close to 75% of the parts used in cars produced in the US were manufactured within the three countries.
* NAFTA increased close to 5 million net new jobs within the 3 countries.
* US FDI in Mexico increased by 4 times.
* NAFTA allowed firms in member countries to bid on all government contracts. That created a level-playing field for all companies within the agreement's borders. It cut government [budget deficits](https://www.thebalance.com/budget-deficit-definition-and-how-it-affects-the-economy-3305820) by allowing more competition and lower-cost bids.
* Canada saw a 63.5% increase in trade with the US
* Canada had a 243% increase in FDI. Real GDP grew faster than the US and Mexico.
* Oil imports from Canada to the US grew by 5 times and Canada became the largest supplier to the US.
* Cost of garments reduced drastically.

Cons

* A steep decline in Automotive jobs in the U.S, 27% below the Pre-NAFTA level.
* Trade deficit of the US increased substantially.
* Number of Mexican immigrants from the Mexico to the US doubled.
* 85% decline of jobs in the garment manufacturing sector in the US.

Source: (NAFTAs winners and losers |The six main benefits of NAFTA | Canadian Global affairs institute- NAFTA, a primer for Canadians).

**Network Side.**

The Study of trade using Networks shows visualizations of the network and describe topological properties and network statistics. Network Analysis is used to describe bilateral trade relations among countries when interdependence matters, when trade relations are characterized by high dimensionality and strong heterogeneity. The relative position within the World Trade Network can vary greatly depending on the neighbour's centrality, the type of trade flow considered (global or sectoral flows), as well as the type of bilateral relationship, in its unweighted (i.e. binary) and weighted (e.g. trade flows). The result is a framework that emphasizes the importance of US and European countries as a player in international trade (degree and strength indices), the centrality of US as a hub in the World Trade Network (closeness, eigenvector), the importance of China as a partner of the major advanced countries (eigenvector).

Results of various studies confirmed several intuitions related to mainstream economic disclosure. The increase in the number of nodes and edges somewhat steadily between 1995 and 2005, confirm the general hypothesis in mainstream economic and political disclosure that “trade has become more globalized”. This can be linked to the “Principle 5 of Economics” that Trade can make everyone better-off. With more countries interacting and trading with one another like never, it proves the “densification power law” that the number of edges grow more rapidly that the number of nodes. It was also seen that countries that have higher betweenness centrality prove to be the most stable countries which goes with the “principle of de-risking and reducing dependency”. The entrance of China as a key player in world trade seemed to have formed “communities which are mostly geographic in nature”.

Additionally, we understood that close to ~90% of the world trade comes from less than 10% of the links (keeping each country as a node). Hence, trade just like any other business aspect follows the Pareto principle more intensely, that 80% of the effects come from 20% of the causes, indicating concentration and helping us understand where to focus.

Metrics & Methodologies used : (1) Force directed algorithm (ex. balanced spring system). (2) Measurement of centrality using weighted and unweighted measures. (3) Measurement of closeness centrality and eigen vector centrality within trade networks.

Source: (Network analysis on world trade using BACI-CEP II dataset | Network analysis of Global trade at Stanford | The Structure and function of complex networks by SIAM (Society of Industrial and Applied Mathematics) | The International trade networks; weighted network analysis and modelling | The Oxford handbook of public Policy; Chapter 20.)

**Analysis.**

Data Understanding.

The dataset we have chosen is the Gravity dataset which describes country characteristics and relationships between two trading partners, while the dataset covers many macroeconomic indicators, we understood that one key feature missing in our data was trade data between partnering countries. Hence, we merged our dataset with the BACI, CEP-ii dataset, this dataset is extensive, reliable and curated (developed in accordance with WTO guidebook for measurement and storage of trade information). Having done this, we understand that all features necessary for conducting our hypothesis around the effect of the NAFTA on the USA, Canada and Mexico through network analysis is being satisfied.

Data Analysis.

Data Analytics.

In order to have better understanding of the network, we visualize world trade in 5 year intervals from 1995 (the period when the NAFTA was signed) until 2017 which involves a period of 23 years, significant enough for policies to have impact on the economic and trade indicators. Moreover, this will help us understand the evolution of trade over time and uncover hidden trends.

Visualization of the Global trade network from 1995-1999.