

Data Science Reveals NAFTA's Problem: and it's not what you think

By Dr. Kayvan Miri Lavassani

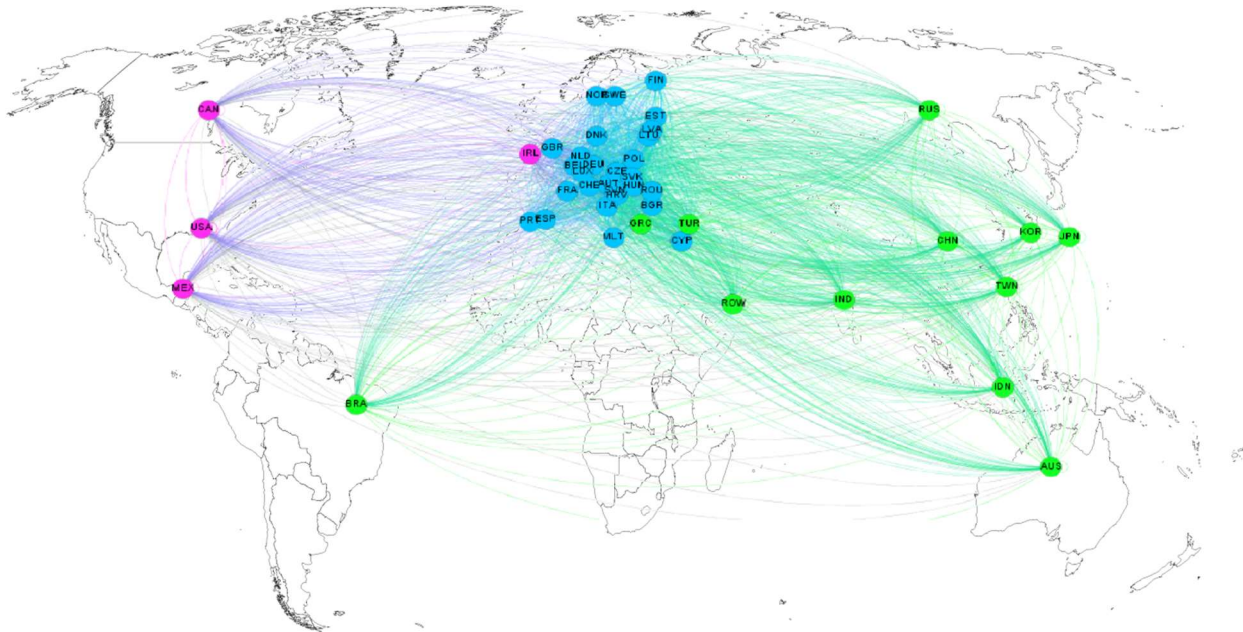
The purpose of this article is to introduce an example of the application of analytical techniques that can help policymakers to evaluate the effectiveness of offensive and defensive trade policies. The intent of this article is not to promote or deter trade policies that affect competitiveness of businesses, industries, and countries, rather the goal is to promote analytical tools that can be utilized to help managers and policymakers to make better-informed decisions. My colleagues and I have worked on several projects that apply these techniques at the country, industry and individual company levels and have gained valuable (and previously unknown) insight into the fast changing global business environment. The application of big data and analytical tools has been presented in the case of NAFTA ecosystem to demonstrate how such techniques can enable policymakers to better uncover hidden patterns of trade and implement trade policies based on actual patterns of trade, i.e. business ecosystem perspective. A business ecosystem analysis of trade can provide valuable insights which are not easily identifiable through the traditional study of the trade blocks.

The Changing Nature of Competition: From Trade Blocks to Trade Ecosystems

The global competition has evolved over the past centuries. There are multiple layers of competition and collaborations that should be analyzed to gain an in-depth view of global trade patterns. Countries, industries, and companies (large, medium, and small) are engaged in global competition and cooperation (coopetition) through international trade and other modes of collaboration. When actors from different layers of global trade networks work together, they form complex relationships that “create ecosystem competency”¹. These complex ecosystems shape the 21st century patterns of trade. In this article, it is demonstrated that focusing on a narrow view of regional treaties can be misleading in the analysis of actual patterns of trade. Using empirical examples this article describes how the ecosystem view of the trade will provide more accurate view of the global trade patterns.

Over the past half-century, regional treaties have been the main building blocks of cooperation and competition. Trade blocks have historically been used to differentiate the *partners* and *competitors*. For example, the members of NAFTA are considered trade partners of the U.S. and have come together to create regional core competencies in various industries. The EU members, on the other hand, are considered competitors to the U.S. economy. With the rise of coopetition –i.e. countries/industries/companies competing and cooperating with each other– a business ecosystem view provides a more practical and in-depth view of complex globalization of industries. Our analysis indicates that while trade blocks are in some cases acceptable predictors of the partners and competitors (patterns of trade), however, due to the complex nature of trade, regulations and tax law (among other factors) they are subject to deficiencies. For examples, we analyzed the global trade of all intermediary goods and services at the country level and identified 3 major trade blocks which are identified in Figure 1 by blue, purple and green nodes².

Figure 1: Global Trade of Goods and Services by Country

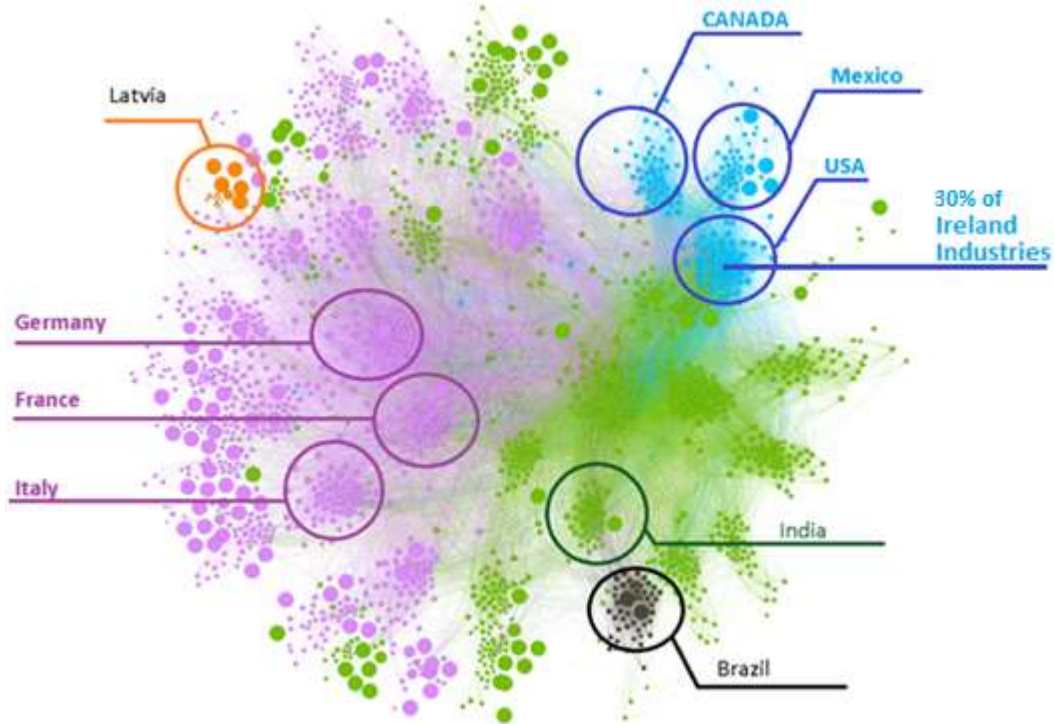


Network clustering algorithms were used to identify the global trade ecosystems. The goal of this article is not to present methodologies of technical analysis, however, it is noteworthy to mention that the algorithms utilized in this work are similar to the ones used by data scientist in the analysis of large engineering systems, social networks and other similar complex networks. Figure 1, displays the three major trade ecosystems with three colors. At this level of analysis, the world trade is comprised of three trade ecosystems. The 44 nodes in this figure represent 43 major economies while other developing economies categorized in one node as rest of the world (ROW).

This analysis revealed several unexpected patterns which would not have been identified through the traditional view of trade blocks. The focus of this article is mainly on the North American trade ecosystem which it is referred to as “NAFTA ecosystem” throughout this article. The clustering algorithm identified that the USA, Canada, and Mexico are members of one trade ecosystem. Looking at trade from the perspective of trade blocks, this result was expected. However, based on the global trade networking analysis, Ireland was identified to acts as a member of the NAFTA trade ecosystem (Purple nodes) as well, and not as a member of EU trade ecosystem (Blue nodes). The reason for this unexpected trade pattern we believe is the tax evasion practices employed by large North American corporations to the extent that from the perspective of global trade patterns, Ireland practically acts as a member of the NAFTA.

The above result is based on the analysis of trade at the country level. The analysis can also be conducted at the industry level to further identify which specific industries are contributing to this unexpected pattern of trade. Figure 2, displays the analysis at industry level. This model is built based on more than 5.5 million trade transactions. At this level of analysis, the economy of each country is presented by 54 industry groups.

Figure 2: Global Trade of Goods and Services by Industry Group



Using several algorithms, the global trade ecosystems were constructed at the industry level. Each node represents a particular industry from one specific country. The color identifications in Figure 1 and 2 are independent of each other. In Figure 2, the colors identify the membership of each industry in different trade ecosystems. For example, in this figure, most of the blue nodes represent industries in the NAFTA block. However, similar to country-level analysis we identified that certain industries from Ireland and rest of the world (from developing economies) display trade patterns similar to the members of NAFTA. Table 1 displays the list of non-NAFTA industries that displayed trade patterns similar to the members of NAFTA.

Table 1: 17 non-NAFTA Industry Groups, active within the NAFTA Ecosystem

Industry	Country	Industry	Country
Air transport	Ireland	Manufacture of machinery and equipment n.e.c.	Ireland
Computer programming, consultancy, and related activities; information service activities	Ireland	Other professional, scientific and technical activities; veterinary activities	Ireland
Crop and animal production, hunting and related service activities	Ireland	Publishing activities	Ireland
Land transport and transport via pipelines	Ireland	Telecommunications	Ireland
Manufacture of basic pharmaceutical products and pharmaceutical preparations	Ireland	Warehousing and support activities for transportation	Ireland
Manufacture of chemicals and chemical products	Ireland	Wholesale trade, except of motor vehicles and motorcycles	Ireland
Manufacture of computer, electronic and optical products	Ireland	Administrative and support service activities	ROW DE*
Manufacture of food products, beverages, and tobacco products	Ireland	Advertising and market research	ROW DE*
Manufacture of furniture; other manufacturing	Ireland		

* Rest of the World: developing economies

17 non-NAFTA industries are identified to be members of the NAFTA ecosystems. Two industries are from developing economies (ROW DE) which are mostly engaged in service outsourcing activities such as telemarketing and customer service. The rest of the industries (15 industries) are from Ireland. Irish industries active in the NAFTA ecosystem are engaged in notable manufacturing, high tech, agriculture, and service industries. Surprisingly, close to 30% (15 out of 54) of the Ireland's industries operate in the NAFTA ecosystem. This is despite the fact that none of the (162) industries from US, Canada, and Mexico, operate outside the NAFTA ecosystems. It is noteworthy to mention that while Ireland is not among the top-10 non-NAFTA trade partners of the US, none of the industries from the top-10 non-NAFTA trade partners of the US, operate within the NAFTA ecosystems. As businesses and policymakers debate the effectiveness of NAFTA such analysis provide evidences that can significantly change the course of discussions and negotiations.

Synthesis

This work was presented in a concise format without the use of technical jargon and discussion of analytical methodologies. This article is one of the several analyses that my colleagues and I have conducted over the past few years. We have also conducted industry-specific analysis, one example is our work in the global telecommunications industry³ which revealed interesting patterns of changing global trade and business. While the analysis of global trade and business using the formal treaties and trade blocks are notable, however, a business ecosystem analysis using factual trade data provides crucial information to policymakers and businesses. In this article, analysis at the country and industry levels were presented using the example of NAFTA. Similar analysis can be conducted at company level which provides much-needed insight into our understanding of the global trade. My colleagues and I have been promoting such analysis over the past few years. We believe a better appreciation of the complexities in global trade along with the application of contemporary data science tools can help policymakers and businesses to more effectively navigate their businesses, industries, and countries in the changing global business environments.

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References

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