

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

By Dr. Kayvan Miri Lavassani

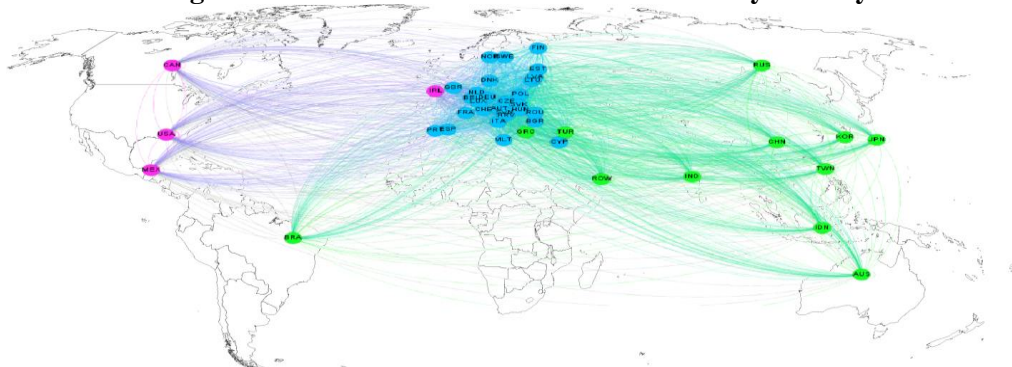
The purpose of this article is to introduce an example of the applications of analytical techniques that can help policymakers to measure the effectiveness of offensive and defensive trade policies. While we do not intend to promote or deter trade policies that affect competitiveness of businesses, industries, and countries, nevertheless we hope the analytical tools utilized in this paper 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 in to the fast changing global business environment. In this article, using an example we will explain that the availability of big data and analytical tools can enable the policymakers to better uncover hidden patterns of trade and implement trade policies from a business ecosystem perspective. We also argue that 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. Countries, industries, and companies (large, medium, and small) are engaged in global competition and cooperation (coopetition) through international trade and other modes of collaborations. 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 the patterns of trade. In this article, we argue that the focus on a narrow view of regional treaties can be misleading in the analysis of actual patterns of trade. We will demonstrate 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. The trade blocks have historically been used to differentiate the *partners* and *competitors*. The members of the 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. Our analysis indicates that while trade blocks are in many 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 levels and identified 3 major trade blocks: North America, Europe, and Asia (Figure 1)².

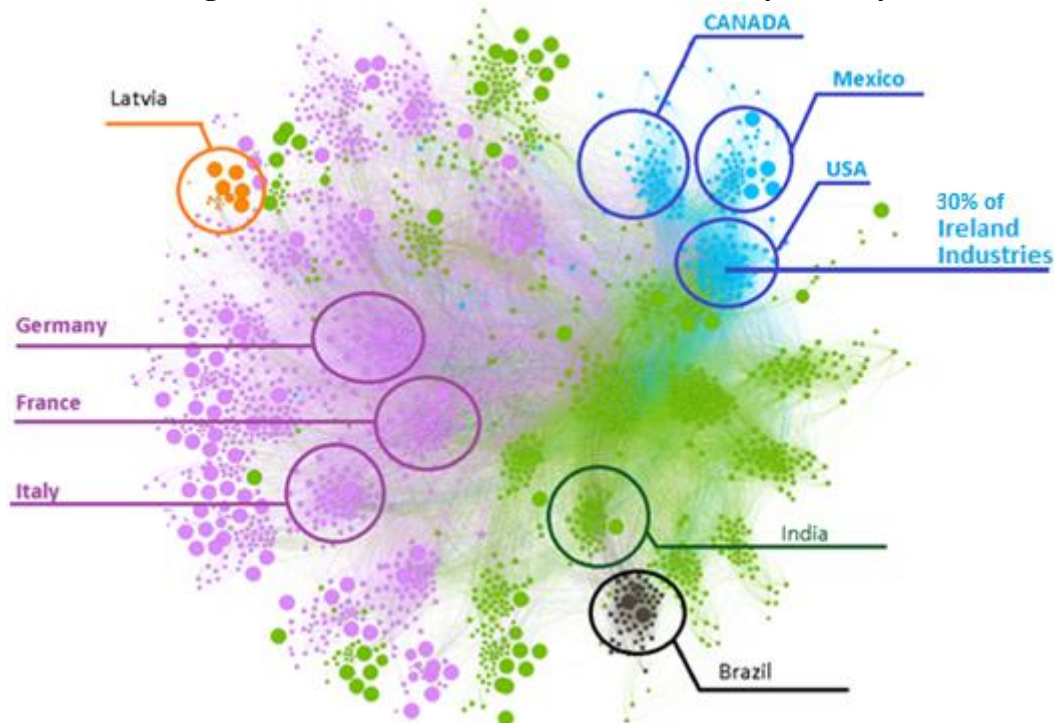
Figure 1: Global Trade of Good and Services by country



We used network clustering algorithms to identify the trade ecosystems. The goal of this article is not to present methodologies of technical analysis, however, it is noteworthy to mention that the algorithms we have used are similar to the ones used in the analysis of large social networks and other similar complex systems by the data scientist. 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 that several unexpected patterns which would not have been identified through the traditional view of trade blocks. In this article, we only focus on the North American region. The clustering algorithm identified the USA, Canada, and Mexico to be part of one trade ecosystem. Looking at the 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 NAFTA, not EU. The reason for this we believe is due to 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 NAFTA. The above results are based on the analysis of trade at the country level. We can also conduct analysis at the industry level to further identify which specific industries are contributing to this unexpected pattern of trade. Figure 2, displays the analysis at the industry level. This model is built based on more than 5.5 million trade transactions.

Figure 2: Global Trade of Good and Services by industry



Using several algorithms, we constructed the global trade ecosystems at the industry level. Each node represents a particular industry from one specific country. The data includes trade volumes from 54 industries. 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 trade 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 industries, 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 trade 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 NAFTA ecosystem are engaged in notable manufacturing, high tech, agriculture, and service industries. Additionally, based on the analysis of global trade patterns, while, 100% (162 out of 162) of the industries from US, Canada, and Mexico, belong to the NAFTA ecosystems, however, close to 30% (15 out of 54) of the Ireland's industries belong to NAFTA trade ecosystem. As businesses and policymakers debate the effectiveness of NAFTA such analysis provide evidences that can significantly change the course of discussions and negotiations.

Synthesis

We tried to present this work in 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 data analytics techniques provides crucial information to policymakers and businesses. In this article, we demonstrated analysis at the country and industry levels 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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An award-winning educator and researcher, Dr. Miri Lavassani has received institutional award for teaching excellence, as well as research awards from institutions in the US, Canada, and Europe.

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