Taste Does Not Endure: The Dynamics of Ingredient Pairings, Colombia, 1977-2017

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1 Introduction

- Given that organic dairy farming is more profitable than conventional dairy farming, why has been the adoption of organic dairy farming slow in the USA?
- What is the logic behind choosing a geographical location to start an organic dairy farming or handling operation?
- Can networks partially explain the geographic location of organic dairy farming and handling facilities in the USA?
- What are the risks and advantages posed by the current state of the organic dairy supply chain?

2 Dataset

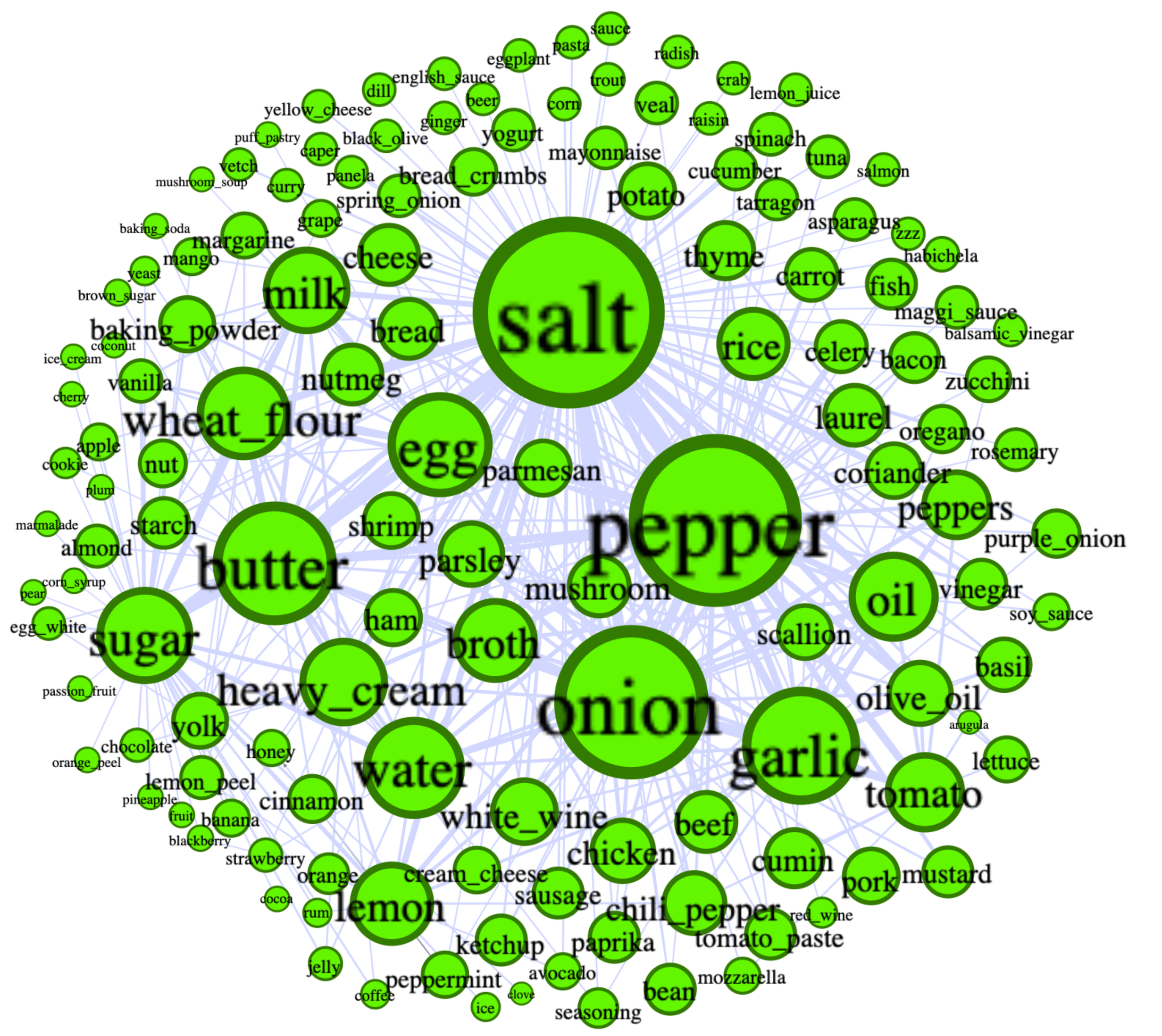
- Dynamic database: USDA Integrity Database: Every organic operation is recorded in this publicly available database. It contains information starting from 2002 when the National Organic Standards became law. Each operation (farming or handling) includes an address.
- Static Database (2018): Whole Foods supermarkets, Whole Foods website.

3 Methods and Results

- Find GPS coordinates for each organic dairy production, handling, and supermarket facility $\longrightarrow$ Google Maps API.
- Infer networks based on different levels of sociability (5% increments), distance parameters, and cumulative connections.
- Visualize networks.
- Use network analysis statistics to test for clustering at the farmer-farmer and supply chain levels.
- Analyze potential risks and advantages given the supply chain distribution.

3.1 Network: Backbone Extraction

First, we consider the farmer-farmer layer. This is a crucial layer for the development of the organic dairy supply chain as organic certification happens at the level of farms and handling facilities. This is the building block of the supply chain.

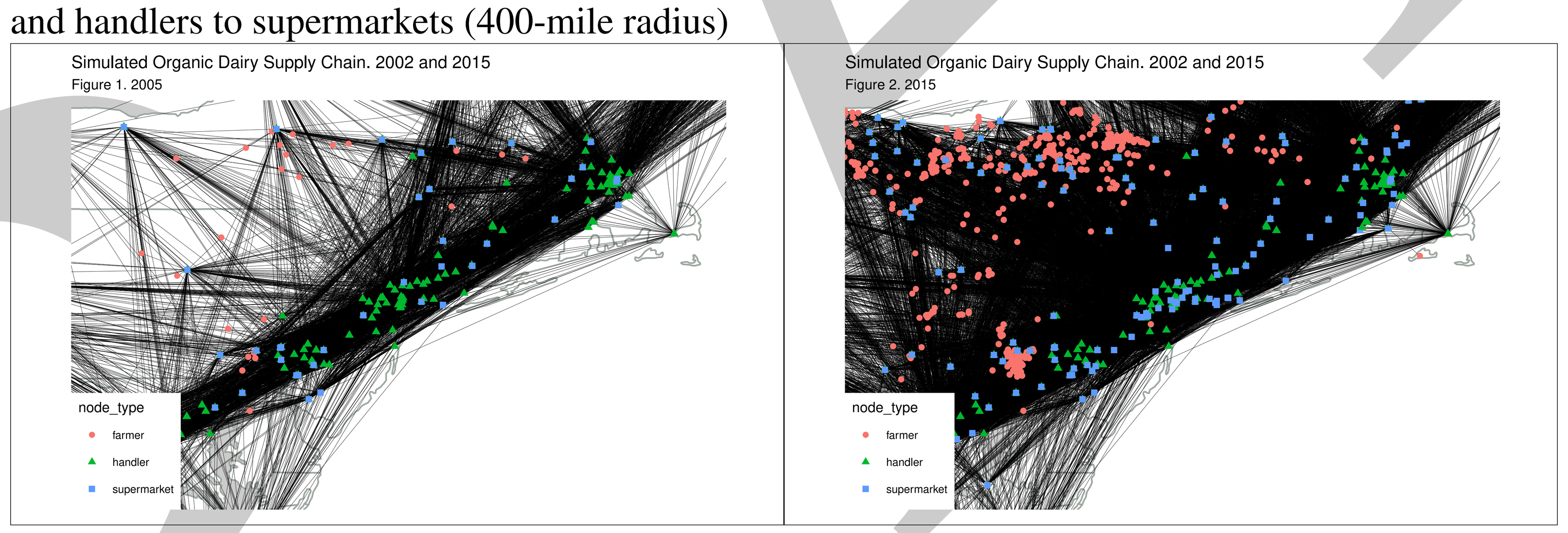


To maintain the relevance of closer connections we use the standardized inverse from 0 to 1 for the weight of the edges.

- The **average shortest path** is relatively stable over time. This is particularly clear for the cases of higher probabilities of being connected. This is a surprising result as most models for network evolution suggest that as the number of nodes grows, the average shortest path increases. This result may be due to the fact that our simulated networks are disconnected .
- On average a farmer that wants to reach another farmer will need to go through 4 farmers during the
- Before 2010 the **clustering coefficient** decreased, indicating that the closest neighbors became more tightly connected.
- After 2010 this doesn't hold true. The change in the clustering coefficient after 2010 may be due to the increase in new farmers over this period, which may have decreased the tightness of local communities. The change may have been a consequence of the sector's 2008 response to the recession.
- **Relative size of the largest cluster** remains relatively stable, this is remarkable given the fact that the number of new entrants has increased over time.
- In spite of new entrants, the largest cluster remains quite large, covering almost 40% of the total number of farmers. This is particularly interesting as this network has been constructed with a 50-mile radius.
- Around 40% of the farmers in the country can be reached with hops that don't exceed 50 miles between each other.
- The **average degree** decreases in the first years and increases in the more recent years, especially after 2008. The effect is stronger the greater the sociability assumed, as the top lines in the chart show steeper increases in the average degree increase, particularly after 2009.
- These findings support the idea that new entrants cluster around other established or new entrant organic dairy farmers.

3.2 Supply Chain

Second, we consider the whole supply chain, for this we connect farmers to handlers (200-mile radius) and handlers to supermarkets (400-mile radius)



- The supply chain presents two main regions: The East and the West. The East is characterized by a larger number of farmers. The West is characterized by a smaller number of farmers. These results are in line with the literature. These differences can be explained by larger farming operations in the West.
- The detail of the Northeast region, centered in New York City evidences how farmers respond to demand in large affluent urban areas. While in 2005 there were a few farming operations, in 2015 there is a considerable amount of them.
- From a risk perspective the differences between East and West can be interesting. On one hand, a fewer number of farmers makes traceability easier, for example in the event of food poisoning. On the other hand, larger operations concentrated in one particular point may be less resilient to natural risks.

4 Limitations

- Further research is be needed to isolate the effect of networking in the adoption of organic dairy production (farmer level) as to control for the effects of weather, land characteristics, population, and other economic effects such as income.
- There is no data on the size of farming, handling, or supermarket operations.
- The distances between nodes are calculated using geographical (Euclidean) distances, this does not take into account topography or transportation networks.
- The networks are constructed using simulations, they do not represent actual connections between farmers, handlers, and/or supermarkets.

5 Conclusion

- The results evidence that the geo-location of new organic dairy producers may reflect advantages from proximity to peers such as potentially benefiting from knowledge spillovers, know-how transmission, minimizing risk arising from uncertainty, and minimizing discrimination towards organic production.
- These effects may explain partially why the adoption of organic dairy production, which is more profitable has not been adopted in some regions of the country.

THANK YOU
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