ASSESSING FEDERAL INSURANCE EXCHANGE COMPETITION THROUGH NETWORK STRUCTURE PROPERTIES

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One of the key motivations behind the Affordable Care Act of 2010 was the need to increase competition between insurers, which took the form of an integrated insurance exchange mechanism where insurance plans and cost information would be readily available for comparison purposes [1]. Given the insurance exchanges have since deployed and two enrollment periods have passed as of this writing, are the exchanges becoming the competitive environment that was expected? How should we measure competition here? Competition in this context is commonly measured by comparing the number of insurers present in a given state with cost [2]; however, this approach can lead to misleading results since insurers provide diverse plans to varying regions within a state and so cannot be treated as a homogenous group and the interaction between some insurers may be stronger in some states than others. We propose an alternative approach to assess competition by analyzing a competition network extracted from insurance exchange plan data from the launch of the federal exchange until February 2015. We study the evolution of some key structural parameters for this network and demonstrate how these parameters can be used as indicators of national and regional competition.

To build the insurer competition network we first obtained all insurance exchange plan data, that we will refer to as HGOV data, that has been published on Healthcare.gov from the earliest days of its launch (2013-09-14) until the date of this writing (2015-02-20). These data contain plan costs by county and insurer for all plans available in the exchange and number nearly 100,000 plans in the latest period alone.

![Network Diagrams](image)

**Figure 1**: Federal Insurance Exchange Structural Changes Over Time. The four panels represent pair-wise comparisons of the insurer network at times: 2013-09-14 (A), 2013-12-19 (B,C), and 2015-2-20 (D); projected from the Insurer-to-County insurance plans bipartite network. Red links and black nodes (marked by red arrow) are missing in the next time period. Blue links and nodes (marked by blue arrow) are new in the time period shown. Edges are weighted by bipartite path count or frequency of competition between insurers at the county level (high weight example marked by pin arrow). Weight is used to calculate strength in Figure 2.

We first cleansed the HGOV data aligned the county data with data from the US Census and then merged US Census data (population, income, and poverty statistics) into the HGOV data by county. We then aligned the multitude of plan provider (insurer) names to merge regional variants. With these data
we created a bipartite (two-mode) network of insurers and counties where insurance providers and counties constitute each of the two modes. The networks span all states in the federal exchange (34 states since late 2013) and range in size from 2181 to 2593 nodes and from 5141 to 8106 edges, where an edge is present between county and insurer for each unique plan offered by an insurer to a 27-year-old adult in the target county. We then performed a one-mode insurer projection of the insurer-to-county two-mode network; the resulting insurer-to-insurer network is weighted based on the quantity of counties in which the insurers interact. If two insurers do not provide plans to any counties in common then there will be no edge (link) between the insurers, whereas insurers that provide plans to many counties will share a highly weighted edge (thicker edges in Figure 1). To assess competition we introduce the notion of a network competition ratio which equates to the network strength (average of the sum of edge weights for each insurer) divided by the network modularity [3]. This structural competition metric is based on the the intuition that higher strength insurer networks result from more insurer interaction (and so competition) through counties that they have in common and more modular social networks are naturally more cooperative and so less competitive [4].

The results are shown in Figure 2, where the strength/modularity ratio increases significantly over time (roughly doubling since launch), though initially decreases in late 2013 and early 2014. The notion that competition has increased is verified by ~ 1/3 increase the variety of plans available at the county level, in Figure 2(B), since we expect competition to result in a wider variety of plans available.

![Figure 2](image_url)

**Figure 2:** Effects of Structural Change. The left panel (A) is the ratio of insurer strength to modularity (the competition ratio) versus time and the right panel (B) is average plan choice versus the same competition metric grouped by date. Each date shows multiple points, one for each subnetwork of the federal exchange with one state removed (e.g., starting with 34 states and removing one in turn to create 34-choose-33 networks (or 34)); dispersion differences show changes in local network effects versus time.

**References**


