DISSERTATION PROPOSAL

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"Essays on Network Economics"

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In the first chapter, we investigate how the information or news content is manipulated in a network of Bayesian agents. We assume that all agents are strategic and want to influence the action taken by a specific agent. We focus on the hierarchical case in which agents are connected along an information chain, and thus, can communicate to each other only through a chain of intermediators, for example, because they have to obey institutionalized communication protocols. We show that every subgame perfect equilibrium is outcome equivalent to some simple equilibrium in which, on the equilibrium path, all agents except for the first one reveal all the information they receive. The set of equilibrium outcomes is thus the solution of the first agent's optimization problem under appropriate incentive compatibility constraints for other agents; we provide a recursive characterization of these constraints. Finally, we will take a look at efficiency of the equilibria and impact of private information.

In chapters two and three, we take the first steps of analyzing complex networked markets by focusing on the US natural gas market.

In the second chapter, using an extensive panel of daily data on natural gas flows through interstate pipelines, we obtain an overall view of the natural gas flows in the network by applying machine learning methods. We perform demand estimation to derive price-elasticity of demand in different sectors: residential, commercial, industrial, and electric utility. Our results suggest that while demand in all these sectors is relatively inelastic with respect to the average price, electric utility is the most elastic sector and industrial sector is the most inelastic one. We also investigate one of the largest mergers among natural gas interstate pipelines demonstrating that this merger had a significant effect on natural gas transportation prices even though the two pipelines were not in the same physical market. We then investigate the role of storage in the natural gas market by first testing the standard rational expectations competitive storage model to estimate natural gas demand and storage costs. Finally, we quantify the effect of temperature, storage, and pipeline congestion on natural gas prices.

In the third chapter, we first investigate the network effect in the natural gas market confirming that a change or shock in the temperature of one geographical region can have a significant effect on prices even in the farthest regions. This observation can be rationalized by the change of natural gas route in the pipeline network from low-demand regions to high-demand regions. We plan to analyze the impact of changing the network as a result of adding a new pipeline or storage facility and the choice of their location to dampen the price increases during demand hikes. This calculation is particularly important in determination of standards of issuing permits for new pipelines or storage facilities. We also plan to analyze the effect of merger policies or other changes in regulations – e.g., cost controls, price ceilings, tariff approval policy - on the market outcomes, such as prices in various parts of network, especially the points that were not impacted directly. It is important to note that the traditional way of thinking about merger policy is not necessarily applicable to networked markets as it ignores the network structure by distinguishing between vertical and horizontal mergers, notions that are not easily defined in a networked market.