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Liquidity risk in sequential trading networks ☆

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ABSTRACT

This paper studies a model of intermediated exchange with liquidity-constrained traders. Intermediaries are embedded in a trading network and their financial capacities are private information. We characterize our model's monotone, pure-strategy equilibrium. Agents earn positive intermediation rents in equilibrium. An experimental investigation supports the model's baseline predictions concerning agents' strategies, price dynamics, and the division of surplus. While private financial constraints inject uncertainty into the trading environment, our experiment suggests they are also a behavioral speed-bump, preventing traders from experiencing excessive losses due to overbidding.

1. Introduction

In many decentralized markets, intermediary traders link producers and consumers. Two key variables determine the effectiveness of market intermediaries. First, a trader needs to have adequate financial resources—either in the form of cash on hand or credit—to pay for the goods that he wishes to trade. And second, each intermediary depends on his network of potential counter-parties to source goods and to find buyers. The interaction between these variables raises several open questions:

1. How do intermediary traders account for others' (possibly) limited financial capacity?
2. What price dynamics might we observe as goods are bought and resold in the market?

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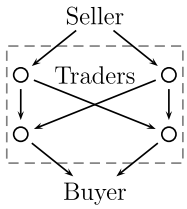

Fig. 1. A trading network.

3. What are the distributional consequences of the economy's network structure? Are some traders systematically advantaged because of their relationships or position in the market?

In this paper we are the first to investigate the interaction between an economy's extent of decentralization and the private financial capacity of its participants. We pursue complementary tracks involving theoretical and experimental analysis; we develop a tractable model that we test in the laboratory. Potential trading relationships and financial constraints are often shrouded or deliberately concealed in real-world markets. In a lab setting, we can directly control these key variables influencing behavior.

Our model, which builds on Gale and Kariv (2009), is simple, yet rich enough to adequately probe the above questions. There is a producer of a good or asset (the "seller") and a final consumer (the "buyer").[1] We assume that the seller and the buyer cannot trade directly. Instead, the asset must pass through a sequence of intermediary traders en route from the seller to the buyer. An instance of such a situation is illustrated in Fig. 1, with four intermediary traders. A network specifies the relationships among the agents and determines the feasible transactions among them. If agent i is linked to agent j, then these agents can trade; otherwise, transactions between them cannot occur. Traders, whose motives are purely speculative, buy and resell the asset facilitating its passage along links in the network from the seller to the buyer.

The key feature of our model, and where we substantively depart from Gale and Kariv (2009), is that each trader is liquidity or budget constrained. He has limited funds to finance his trading activity. These constraints are private information and inject considerable risk into the market. A successful trader must anticipate the funds available to his immediate counter-parties and be mindful of similar constraints elsewhere in the economy. For simplicity, we assume that transaction prices are set by a first-price auction. In equilibrium, intermediaries in our economy adopt subtle bidding strategies accounting for the compounding financing risks. Average prices systematically rise as the asset nears the final buyer. Traders closer to the buyer benefit from the reduction of uncertainty. They manage to garner a relatively larger share of the surplus than traders further away.

Our model's simplicity ensures that it can be readily tested empirically in a laboratory setting. Our experiments confirm the key conclusions from our theoretical analysis. Agents with ample funds shade their bid relative to their trading budget and intermediaries closer to the final buyer adopt uniformly more aggressive bidding strategies. Consequently, prices rise and intermediaries closer to the buyer tend to earn higher trading profits. Interestingly, our experiment also identifies a practical disciplinary role played by financial frictions and budget constraints. In the laboratory, we observe that traders who are flush with resources tend to experience a mild decline in profits relative to the equilibrium benchmark and to others. While a lax budget constraint allows a trader greater freedom to pursue his goals, it also allows him to err and overbid with greater frequency. The latter effect often dominates.

This paper is organized as follows. Section 2 briefly reviews the related literature. We link our study to both theoretical and experimental studies of networked markets and auctions. Section 3 introduces our model. The model's equilibrium analysis is presented in Section 4. We derive several implications concerning intermediary behavior, price dynamics, and welfare. Our experiment's procedures are summarized in Section 5. Data analysis is performed in Section 6. Section 7 provides a discussion of our results and our study's broader implications. Section 8 concludes. All proofs are gathered in Section 9. An Online Appendix contains supplementary material pertaining to our study and experiment.

2. Related literature

This paper contributes to literatures on networked markets and auctions. From a theoretical point of view, our study is closely related to recent examinations of sequential trade within networked economies. This literature builds upon Kranton and Minehart (2001) by incorporating market intermediaries into the trading process. By assumption, buyers and sellers must interact through intermediaries, who facilitate trade while respecting their network of relationships. Recent contributions to this literature include Gale and Kariv (2007), Blume et al. (2009), Gale and Kariv (2009), Kotowski and Leister (2018), Choi et al. (2017), Manea (2018), and Condorelli et al. (2017). Galeotti and Condorelli (2016) provide a recent survey.

[1] Following Gale and Kariv (2009), we call the traded good an "asset." Depending on the application, it may represent a financial product or a physical item.