Project Proposal

To the NBER Conference on

Big Data and High-Performance Computing for Financial Economics

Cambridge, MA: July 13, 2019

Big Data Scalability and Bond Market Networks

Mark D. Flood, Dept. of Finance, University of Maryland

Dror Kenett, School of Arts and Sciences, Johns Hopkins University

Jonathan Simon, Dept. of Mathematics, University. of Iowa

Mathew Timm, Dept. of Mathematics, Bradley University

April 2019

Big Data Scalability and Bond Market Networks

Background

Market activity can grow only until it exhausts the operational capacity in some dimension. Different markets expand in different ways, with distinct big data scalability issues. Equity markets, for example, are dominated by competition for latency, and velocity is the salient big-data scalability challenge; see Ye, et al. (2013).

In contrast, corporate bond markets are decidedly low-frequency. Instead, variety is the big-data scalability challenge. The U.S. markets, for example, trade roughly an order of magnitude more corporate bond CUSIPs than corporate equity CUSIPs. It is not uncommon for a single large firm to have 20 or more bond issues outstanding. Bonds differentiate in many ways, including maturity, structuring (such as callability), collateralization, and other covenants.

One result of this variety is to disperse investor interest across a much broader universe of securities. Liquid (illiquid) markets create a positive (negative) feedback effect by attracting (discouraging) additional investors. As a result, corporate bond market liquidity has been the subject of significant recent academic (e.g., Bongaerts, et al., 2017; Bessembinder, et al., 2018) and policy research (e.g., Mizrach, 2015).

Data and Plan of Study

We propose to study the implications of variety in corporate bond markets by examining the formation and dynamics of interdealer transaction networks. We have access to a special subset of the transaction-level FINRA/TRACE corporate bond data, which provides anonymized identification of the dealers involved in every trade. We will use this to assemble network representations of transaction activity over time.

Corporate bonds trade in an over-the-counter dealer market, with a core-periphery topology (Wang, 2017). The networks formed by interdealer and dealer-customer trades in this market are a rich source of information. Network data can go beyond high-level market summaries, like price and volume, to illuminate the pathways by which trading activity percolates across participants. Well designed network measures can capture meaningful variation in local features of the transaction graph.

Like most markets, the corporate bond markets exhibit clustering in volatility and episodes of (relatively) high and low trading volume. We plan to exploit this time-series variation in order flow, and track its implications as the transactions ramify through the network. There is also considerable cross-sectional variation in trading activity in corporate bonds. Lastly, we can generate variation in bond-trading networks by careful temporal and cross-sectional aggregation from the large universe available through the TRACE dataset.

Our initial efforts will focus on extending to the corporate bond market the sorts of network analysis that Li and Schürhoff (2019) apply to the municipal bond market. From there, we will develop and apply topological measures of network feedback and complexity, to better understand the network signature and of different sorts of transaction flows as they pass

across dealer inventories from net sellers to net buyers. se Python for most of our analysis, augmenting the toolkit with standard econometric packages (e.g., Stata) as appropriate.

Lastly, we will correlate our network measures with key measures of financial interest, such as market liquidity, volatility (and clustering), correlation, and price impact, to better understand the interactions between the networked structure of the marketplace and the relevant financial outcomes.

Personnel

The team has deep expertise in both financial econometrics and network theory. Dror Kenett is an associate editor of the J. of Network Theory in Finance and of Frontiers AI in Finance. Mark Flood is an Associate Editor of the J. of Financial Stability. Jonathan Simon and Mathew Timm are academic mathemeticians with deep expertise in topology (including network topology).

Flood, Kenett and Simon met as (former) colleagues in the research group at the Office of Financial Research, where they worked together and with others on studies of financial networks and market dynamics, including empirical work on market liquidity (Flood, et al., 2015). Together with Robin Lumsdaine, Flood, Kenett, and Simon produced a recent NBER working paper on the network complexity of bank holding companies (Flood, et al., 2017). Flood, Simon, and Timm have collaborated (and continue to work) on theoretical and empirical analyses of counterparty networks in financial markets (e.g., Flood, et al., 2016) and have presented talks on this work at conferences.

References

Bessembinder, H., Jacobsen, S., Maxwell, W., and Venkataraman, K. (2018) “Capital commitment and illiquidity in corporate bonds,” *Journal of Finance*, 73(4), 1615-1661.

Bongaerts, D., De Jong, F., and Driessen, J. (2017) “An asset pricing approach to liquidity effects in corporate bond markets,” *Review of Financial Studies*, 30(4), 1229-1269.

Flood, M., Kenett, D., Lumsdaine, R., and Simon, J. (2017) “The Complexity of Bank Holding Companies: A Topological Approach,” *NBER Working Paper No.* 23755, August.

Flood, M., Liechty, J., and Piontek, T. (2015) “Systemwide Commonalities in Market Liquidity,” *OFR Working Paper* 15-11, May.

Flood, M., Simon, J., and Timm, M. (2016) “Measures of Financial Network Complexity: A Topological Approach,” presentation, Cambridge University Centre for Risk Studies, *Conference on Financial Risk and Network Theory*, September.

Li, D., and Schürhoff, N. (2019) “Dealer networks,” *Journal of Finance*, 74(1), 91-144.

Mizrach, B. (2015) “Analysis of corporate bond liquidity,” *Research Note*, FINRA Office of the Chief Economist.

Wang, C. (2017) “Core-periphery trading networks,” working paper, Stanford University, October.

Ye, M., Yao, C. and Gai, J. (2013) “The Externalities of High Frequency Trading,” working paper, U. of Illinois.