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Undergraduate Studies:
A.B., Physics and Mathematics, Harvard University, *magna cum laude*, 2012

Graduate Studies:
Harvard University, 2012 to present
Ph.D. Candidate in Business Economics
Thesis Title: "Mapping Networks to Probability Distributions in the Economy"
Expected Completion Date: May 2019

References:

Professor Emmanuel Farhi
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Teaching and Research Fields:
Primary fields: Theory, Networks, Applied Theory

Secondary fields: Macroeconomics, Finance

Teaching Experience:

Spring 2015	Graduate Core Macroeconomic Theory (Economics 2010d), Harvard University, Teaching Fellow for Professor Emmanuel Farhi

Conference Presentations:

2018	Royal Economic Society Annual Conference, North American Summer Meeting of the Econometric Society, SIAM Workshop on Network Science, 9th International Conference on Complex Systems
2016	Midwest Economic Theory Conference

Seminar Presentations:

2017	MIT LIDS (Laboratory for Information and Decision Systems) & Stats Tea

Honors and Scholarships:

2010	Finalist for Jacob Wendell Scholarship Prize ("awarded annually to a Harvard College sophomore identified by the selection committee as the most promising and broad-ranging scholar in his or her class")
2008	Valedictorian, Plainview-Old Bethpage JFK High School
2007	First Place Grand Prize winner, Siemens Competition in Math, Science, and Technology, Team Category

Programming Languages/Software

LaTeX, Mathematica, Matlab, Python, R, Stata, VBA

Research Papers:

"*The Distribution of Outcomes for a Networked Economy*" (Job Market Paper)

This work develops a set of mathematical tools that allows us to map the topology of an economic network to a probability distribution of possible outcomes for the economy. We can apply these tools to analyze complex economic systems in closed form and to construct error bounds about the paths of aggregated networked economies. To generate this mapping from network topology to probability distribution, we focus on a class of economies that has the following three features: (1) a population of N agents, each with a binary-valued attribute, (2) a network on which these N agents are organized, and (3) decision-making by each networked agent that depends on the *local relative frequency* of the attribute's unit value. This class of economies also has an aggregate feature: the *global relative frequency* of the attribute's unit value. Given the system's aggregate feature, underlying network, and population size, we construct in closed form the distribution of possible local relative frequencies of the attribute. The topology of the network determines the extent to which the local relative frequency of the attribute can deviate from its global relative frequency, thereby determining the extent to which the outcome of the economy can deviate from a benchmark outcome. Given this distribution and agents' decision-making behavior, we then construct the distribution of possible outcomes for the economy. For realistic agent interaction structures featuring a very large population of agents, the distribution of outcomes is meaningfully non-degenerate. We adapt the theoretical framework and mathematical tools developed in this work to study locally formed macroeconomic sentiment and how agents' interaction structure shapes the capacity for there to exist non-fundamental swings in aggregate sentiment, with implications for the outcome of the 2016 U.S. presidential election and for our understanding of animal spirits.

"*The Distribution of Multipliers in a Networked Economy and Topology-Induced Negative Multipliers*"

We have a collection of N agents and an outside entity that is interested in the population's aggregate action. The outside entity would like to enact a policy with the intention of increasing the aggregate action; for example, if the outside entity were a national government, it might be interested in enacting a policy that increases aggregate output and stimulates economic growth. The policy of the outside entity allocates $\varepsilon > 0$ units of additional wealth to $n \leq N$ agents, funded either by internal transfer or by an external source. Our outside entity would like to know the exact effect of its planned policy on the aggregate action, and it would like to know the corresponding economic multiplier, that is, the change in the aggregate action from the ε shock. Now, even though the setting is simple, the effect is complicated:

the population of agents is networked; agents' actions are interdependent, so depending on which subset of agents actually receives the positive shock, the change in the aggregate action and the corresponding economic multiplier can both widely differ. In this work, we consider three broad settings with network-based interaction: (1) networked environments with strategic complements and substitutes, (2) networked environments with coordination and anti-coordination, and (3) networked environments with production. We show how there is an entire distribution of possible aggregate actions and economic multipliers associated with a particular policy: given n, for each environment, we map the topology of agents' interaction network to the distribution of possible resulting aggregate actions and economic multipliers. The mathematics is the same across all three environments. We can compute the features of these distributions in closed-form, including the maximum and minimum possible aggregate actions and economic multipliers for a particular network topology. We can also rank networks so that the outside entity's policy is more effective the higher ranked the network. We show how non-trivial network topologies generate negative multipliers. Across all three settings, there is a non-zero probability that the enacted policy will reduce the aggregate action below its no-intervention level, and we can compute this probability in closed form.