

Multiple Equilibria
Nobel Lecture
Economic Sciences 2022

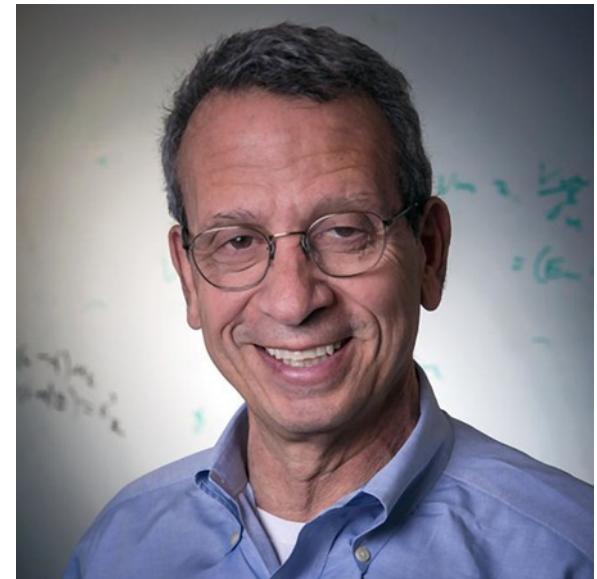
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Washington University in Saint Louis

Stockholm
December 8, 2022

no conflicts to report

Dedication

To the memory of the great financial economist Stephen A. Ross, the best advisor I can imagine. I owe more of my research skills to him than I can describe.



Multiple Equilibria and some Roots of the Prize Paper

Equilibrium in Economics

Prize Paper with Doug Diamond

Prior papers with Chester Spatt and Gerry Jaynes

“Sunspots” Dave Cass and Karl Shell

Empirical insights Manju Puri and alternative equilibrium David Pearce

Equilibrium in Economics

Equilibrium: models interactions among agents. Two traditional definitions:

- Competitive equilibrium: price vector at which supply equals demand.
- Nash equilibrium: a choice for each agent that is optimal given the choices of the other agents.

“Multiple equilibria” just means there is more than one vector of prices or choices that is an equilibrium.

Prize paper written with my longtime friend Douglas W. Diamond

My co-author Doug Diamond has been a good friend since graduate school. Working with him has been a pleasure.



Diamond, Douglas W., and Philip H. Dybvig, 1983, Bank Runs, Deposit Insurance, and Liquidity, *Journal of Political Economy* 91, 401–19.

Free copy <http://minneapolisfed.org/research/qr/qr2412.pdf>

Main features and results in the Prize paper

- Demandable deposits satisfy agents' desire for liquidity for private random expenditures.
- Bank assets are illiquid (pay less when sold before maturity).
- Even if the bank is fundamentally sound, there can be a good equilibrium and a bad equilibrium (bank run).
 - Good equilibrium: withdraw only when money is needed
 - Bad equilibrium (bank run): always withdraw
- Deposit insurance and other institutions can eliminate the bad equilibrium but leave the good equilibrium

Several markets in the 2008 financial crisis looked like our bad equilibrium.

A Surprisingly Accurate Quote from 1986

about the 2008 financial crisis!

Proposals to move toward 100% reserve banking would prevent banks from fulfilling their primary function of creating liquidity. Since banks are an important part of the infrastructure in the economy, this is at best a risky move and at worst could reduce stability because new firms that move in to fill the vacuum left by banks may inherit the problem of runs.

Diamond, Douglas W., and Philip H. Dybvig, 1986, Banking Theory, Deposit Insurance, and Bank Regulation, *Journal of Business* 59

Good and bad equilibria

Good equilibrium (no run): If I believe other agents will only withdraw when impatient, then I can compute that there will be plenty left to pay me off later, and I will only withdraw when impatient.

Bad equilibrium (bank run): If I believe others will withdraw whether or not they are patient, then I can compute that the bank, liquidating assets at a loss, will not have enough left to pay me if I wait, and I will withdraw too.

If the deposit contract provides liquidity, it is also has a run equilibrium.

Adoption Externalities as Public Goods[†] with Chester S. Spatt

The benefit of having a phone increases when other people have phones. Can be (at least) two equilibria:

- Nobody has a phone
- (Almost) everyone has a phone



These two equilibria are very similar to the equilibria in the Prize paper.

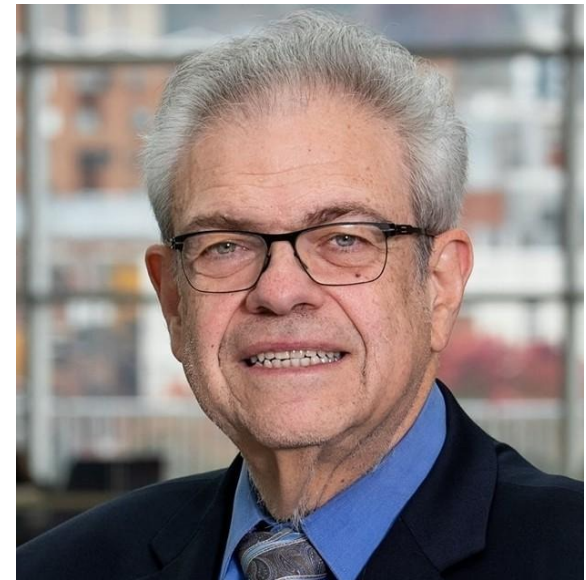
With competing technologies, the less efficient one might be adopted, or different people could adopt different ones. In the US, wrench sets are sold with both metric and imperial wrenches.

[†] *Journal of Public Economics* **20** (1983)

Does it Pay to Maintain a Reputation? Consumer Information and Product Quality,[†] with Chester S. Spatt

Restaurant food quality is costly, and quality is observable but not contractable. Then there are different equilibria:

- The lowest possible quality is offered.
- Some larger quality is offered.



Improving the consumer's information tends to improve the highest quality that can be produced in equilibrium.

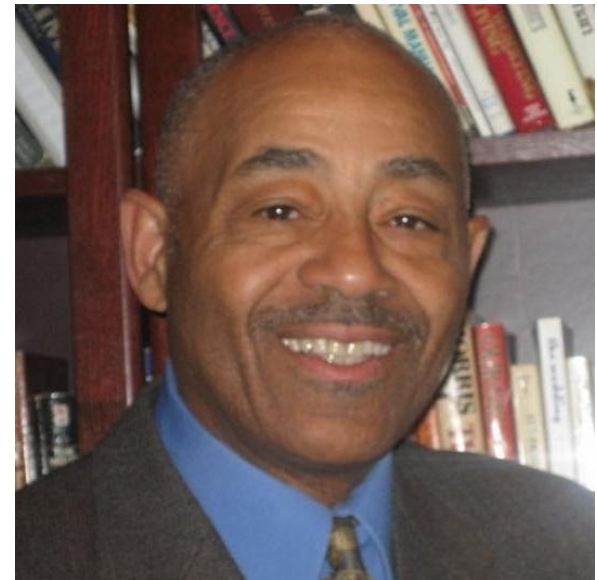
[†]Yale working paper, 1983

Microfoundations of Wage Rigidity and Unemployment,[†] joint with Gerald David Jaynes

Firms have training costs and workers randomly leave for higher-paying jobs. Then there are different equilibria:

- All firms pay a wage that leads to full employment.
- Some larger wage is offered and there is unemployment, but firms cannot profit by hiring unemployed workers because of the high quit rate.

Anticipated Farmer (2008, 2012, 2013).



[†]Yale working paper, 1979

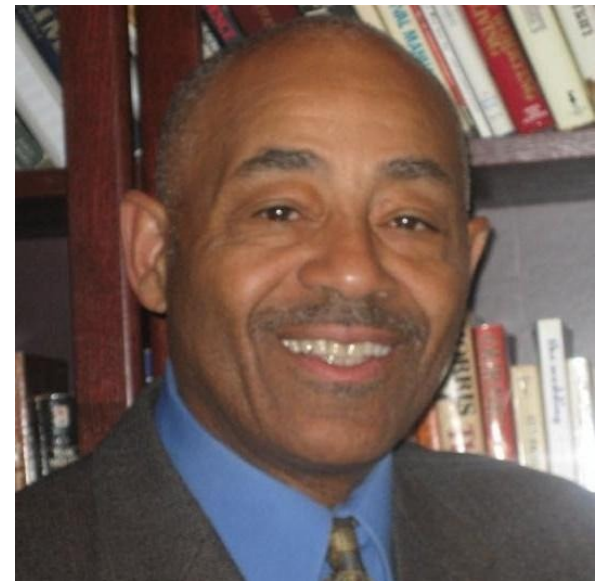
A related quote from Keynes

As Keynes (1936) said, "... the postulates of the classical theory are applicable to a special case only and not to the general case, the situation which it assumes being a limiting point of the possible positions of equilibrium."

Output Supply, Employment, and Intra-Industry Wage Dispersion,[†] joint with Gerald David Jaynes

In basically the same model with training costs, there are even more equilibria:

- Any single-wage equilibrium in the previous paper
- Many equilibria in which different firms offer different wages but are just indifferent between offering a high wage with a low quit rate or a low wage with a high quit rate



Anticipated Burdett and Mortensen (1998).

[†]Cowles Foundation Discussion Paper 546, Yale University, 1980

Shout out to Karl Shell

Karl was my mentor in graduate school. Doug and I cited his paper with Dave Cass (also my professor) on sunspot equilibrium (equilibrium selection based on a commonly observed random variable) to explain why someone might invest in a bank that can fail (because failure happens with sufficiently small probability). He and his students have also written many interesting papers extending my paper with Doug.



Ideas for future work

Manju Puri studied actual runs, which can motivate more realistic theoretical models.



David Pearce has the concept of *rationalizability* that is like saying people do not know what equilibrium the others have on their minds. (Bernheim has an alternative version of this.)



Thanks to some other mentors



Bill Brainard



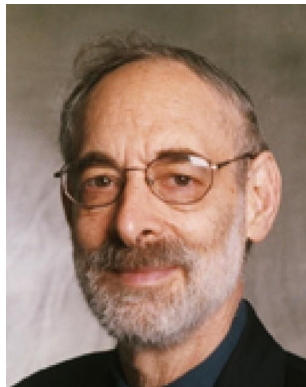
Don Brown



Mike Magill



Sharon Oster



Bob Pollak



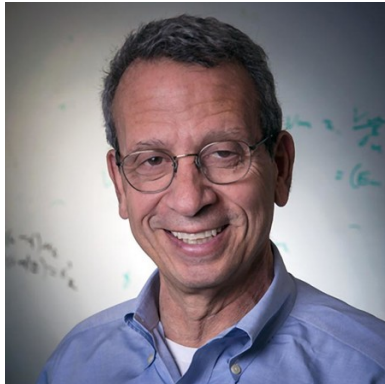
Al Klevorick

Thanks to my colleagues and mentors!

It is fun to trace my thinking in the Prize paper with Doug Diamond back to my mentors Steve Ross and Karl Shell and my joint work with co-authors Chester Spatt and Gerry Jaynes.



Doug Diamond



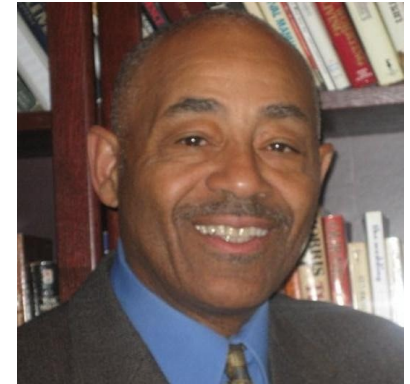
Steve Ross



Karl Shell



Chester Spatt



Gerry Jaynes