Climate Change and Financial Complexity

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Climate change poses not just a challenge to the planet, but for and to the financial system

- **Retrofitting** the global economy to respond to climate change (reducing emissions) will require large investments
- Changes in asset prices associated with climate change will have large and complex **repercussions** for financial system
  - There will eventually be a **price of carbon**
  - Price of carbon will be reflected in prices of various sources of energy
  - These changes will lead to **large change in asset prices**
  - These asset prices will lead to large changes in prices of corporations
  - **Rapid** adjustments could pose **systemic risks**
I. A Missed Opportunity

• The central problem facing the global economy today is lack of **aggregate demand**
• Lack of demand is causing weak growth in the US, near-stagnation in Europe, slowdown in Asia
• **Retrofitting** the global economy to face the challenges of **climate change** would have **stimulated** the economy, improving **growth and employment**
• And in doing so would have helped address one of the other major challenges of our time—increasing **inequality**
But even were there a carbon price, how can these “climate investments” be financed?

• Bernanke (Chairman of the Federal Reserve) blamed the crisis on a *savings glut*
  • Excessive savings in Asia

• But there is not a savings glut or a dearth of good investments
  • There is a huge need for climate investments
  • As well as infrastructure investments

• The failure is in our private financial markets to bring savings and these investment opportunities together
  • This is *supposed* to be one of their central *social functions*
  • They failed in this, as they failed in so many other dimensions
  • This failure has long run consequences
Intermediation

- Investment needs are long term
- Many of the sources of savings are long term
  - Sovereign Wealth Funds
  - Pension Funds
- Intermediating between long term investment needs and long term savers are financial institutions, many of which have a very short term focus
  - Central policy question is how to change their focus from quarterly returns to long term
  - Major issue in US Presidential Debate
The Good News: New Institutions

• The creation of new development banks (The Brics Banks and the Asian Infrastructure Bank)
• Discussions about creating new facilities in the World Bank and a Global Infrastructure Investment Platform
• These institutions and facilities can help recycle surpluses
  • Not only from reserves
  • But from the trillions of dollars in Sovereign Wealth Funds
  • Some of which have a longer run focus than the short run focus of private markets and have more sensitivity to the social importance of climate investing
II. Climate financial risk

- If we are successful in limiting increase in temperature to 2°C degrees
- Then we will not be able to use all of the “reserves” of oil and gas that have already been discovered (let alone coal)
- **Stranded assets**
  - “Zero value”
  - But market does not currently value them at zero
- When the market discovers that they are worthless, there will be large changes in values of companies that own these assets
  - Markets are often short sighted—have not yet fully taken on board the implications of climate change
  - The adjustment could occur slowly
  - But it could also happen suddenly—”herding behavior”
Some evidence that market is beginning to realize “climate risk”

- By some accounts, value of reserves (overvalued as they are) exceeds the market value of the corporations that own them
  - Consistent with “agency” perspective
    - Managers of oil companies will dissipate value as they continue to explore for additional oil
    - Marginal value of discoveries likely to be considerably less than the cost of exploration
  - Explains the negative “residual” value of corporation
  - Market value maximization would entail stripping out reserves from corporations
Real challenge: highly interdependent financial markets

- Banks lend to corporations
- Corporations own shares in other corporations
- Banks and corporations have a wide range of interdependencies with producers of fossil fuels
- Decrease in value of fossil fuel companies—with many bankruptcies—will have systemic effects
- Analyzing systemic effects is important
Broader research agenda

- Importance of similar systemic effects exposed by financial crisis
- Where bankruptcy of Lehman Brothers turned out to have systemic effects
- Had they conducted “network analysis” this would have been discovered
- Fed failed to do this, even though some research had highlighted risk
- Inconsistency of models used by Fed, IMF
  - Emphasized importance of diversification before a crisis
  - But emphasized contagion after crisis
  - Contagion exacerbated by greater linkages
  - Needed a coherent approach taking both sets of effects into account
    - Optimal degree, form of diversification
- Since then there has been considerable progress in analyzing impacts of “network architecture,” the effects of networks on systemic stability, the role of contracts (CDSs, derivatives)
  - Privately profitable contracts may not be socially desirable
  - Excessive diversification may lead to increased systemic risk
Main insights from network analysis

• Systemic risk can be measured and monitored with network-based indicators
• To contain systemic risk it may be desirable
  • to limit interconnectedness, complexity (of structure and instruments), and correlations\(^1\)
  • to construct a richer ecology of financial institutions (not just universal banks).
• Architecture matters\(^2\)
  • Some architectures better able to absorb small shocks
  • Some architectures more resilient to large and correlated shocks
  • Some architectures more likely to give rise to bankruptcy cascades
  • Circuit breakers can help prevent cascades
    • Capital controls can be thought of in an analogous way

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2 Battiston, Delli Gatti, Gallegati, Greenwald, Stiglitz JEDC 2012; JFS 2012
General Principles

Systemic Risk

• Not just a matter of too big to fail
• Too “central” to fail
• Too interlinked to fail
• To correlated to fail

Extent of systemic risk endogenous

• There is an international network of TBTF institutions that are too interconnected to fail. But we have national authorities.
• Moral hazard in a network context.
The financial system as a network

• The financial system can be seen as a **multi-level network**¹
  • It is a collections of actors (market players) and relations (contracts)
  
  *Note*: financial networks not only entail **direct linkages** (contracts); they encompass **bank-asset** and **bank-firms** linkages

• We argue that thinking the financial system as a (multi-level) network
  • improves our understanding of how it functions both within countries and at a macro-economic level
  • provides insights into long-standing issues
    • Role of capital controls
    • Role of clearing houses
  • allows us to better design policies that make the financial system better serves its social function

Origins of interest

- East Asia crisis 1997-1998
  - 70% of firms in Indonesia went into default, more than 50% in Korea, almost 50% in Thailand
  - Hard to establish value of any firm—depended on what they received from those who owed them money; and that depended on how much their debtors received from those who owed them money
  - Complex general equilibrium problem
Severe Consequences

- Paralysis
- Costly delay in restructuring
- Proposals: Super-chapter 11 (Miller-Stiglitz)
Climate change represents new arena where network analysis will be essential

- Calculations are complex
- Systemic effects are likely to be larger than impact effects
- Fiduciary responsibility
- Managers of funds, realizing that there is likely to be large adjustments in asset prices in coming years, need to take precautionary measures now in adjusting portfolios
  - Divestment from carbon assets
  - But also asking, what other assets are likely to be affected indirectly as the price of carbon and other prices adjust
Concluding comments I

• Seldom has there been an instance in which the world has been put on notice that prices are markedly wrong
  • Carbon price is now zero or near zero
  • But in not too distant future, carbon price is likely to be large
• The sooner that this is recognized, the more quickly the world will move to a **carbon-neutral** economy
• But the more discrete the change in carbon price and the recognition of the fact that there will be a high carbon price in the future, the **more likely that we might face a financial crisis**
  • In principle, the economy should be able to easily absorb the adjustment
  • But **systemic risk analysis** suggests that this may not be the case
Putting a price on carbon provides the best opportunity for the world economy to return to full employment quickly.

In principle, there should be no problem funding the necessary “climate investments.”

But institutional innovations may facilitate the transition.

The transition does pose systemic risks.

Only through network analysis can we understand the nature of these systemic risks.

And take appropriate preventive measures.