
Robert M. Townsend

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Gideon Fishelson Lecture
The Eitan Berglas School of Economics
Tel Aviv University
November 29, 2015
Motivation

- Much of the discussion of financial systems in a given country, and discussions about recommended policy, are topical, of immediate importance or relevance due to its relation with current events.

- The potential danger is that this can get in the way of scientific discussion.

- Lead example: Peel’s Act
  - Prior to 1844, commercial and provincial banks in Britain and Ireland issued their own banknotes
  - Under the Act, no bank other than the Bank of England could issue new banknotes
    - Commercial and provincial banks had to withdraw their existing notes
  - The Bank of England could issue new banknotes only if they were 100% backed by gold or government debt.
  - The Act gave the Bank of England an effective monopoly on the printing of new notes and served to restrict the supply of new notes reaching circulation.
Examples from Individual Countries

True in quite different countries, and in each they draw their own separate conclusions, a symptom of the danger of this approach

United States

- Financial crisis of 1997
- Mortgages and securitization
- Monetary Policy

Figure 6
Long intermediation chain. ABS, asset-backed security; MBS, mortgage-backed security; MMMF, money market mutual fund; repo, repurchase agreement.
Examples from Individual Countries (cont.)

- **Thailand**
  - As a regulated emerging market
    - Micro credit
    - E-money

- **China**
  - Stimulus vs. regulation
    - Conundrum between micro and macro
  - Financial platforms lead the way in e-commerce, rise in P2P platforms, but still reliant on state banks
  - Worried about next crisis
Measuring and Mapping Financial Systems

Why

- Need to know what is out there, what we are talking about
- Measure both as best we can from existing data and reconcile shortfalls that might be remedied by new data
- Part of this is survey design and part is reconciling the prospect of big data as allowing better measurement
### Table A.2. Income Statement of Household A

<table>
<thead>
<tr>
<th>Month</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue from Cultivation</td>
<td>30,485</td>
<td>27,753</td>
</tr>
<tr>
<td>Revenue from Livestock</td>
<td>28,985</td>
<td>27,753</td>
</tr>
<tr>
<td>Capital Gains</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>Revenue from Fish and Shrimp</td>
<td>184,360</td>
<td>145,360</td>
</tr>
<tr>
<td>Revenue from Business</td>
<td>11,440</td>
<td>11,440</td>
</tr>
<tr>
<td>Other Revenues</td>
<td>6,000</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Total Revenues</strong></td>
<td><strong>232,285</strong></td>
<td><strong>187,553</strong></td>
</tr>
<tr>
<td>Cost of Cultivation</td>
<td>31,944</td>
<td>30,281</td>
</tr>
<tr>
<td>Cost of Livestock</td>
<td>3,281</td>
<td>3,263</td>
</tr>
<tr>
<td>Depreciation (Aging)</td>
<td>28,663</td>
<td>27,018</td>
</tr>
<tr>
<td>Other Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of Fish and Shrimp</td>
<td>220,176</td>
<td>167,323</td>
</tr>
<tr>
<td>Cost of Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of Labor Provision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of Other Production Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cost of Production</strong></td>
<td><strong>252,120</strong></td>
<td><strong>197,604</strong></td>
</tr>
</tbody>
</table>

### Table A.1. Balance Sheet of Household A

<table>
<thead>
<tr>
<th>Month</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash in Hand</td>
<td>1,966,139</td>
<td>1,862,121</td>
</tr>
<tr>
<td>Account Receivables</td>
<td>688,971</td>
<td>805,259</td>
</tr>
<tr>
<td>Deposits at Financial Institutions</td>
<td>167,271</td>
<td>167,969</td>
</tr>
<tr>
<td>ROSCA (Net Position)</td>
<td>33,000</td>
<td>37,000</td>
</tr>
<tr>
<td>Other Lending</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventories</td>
<td>1,346,939</td>
<td>1,440,729</td>
</tr>
<tr>
<td>Livestock</td>
<td>326,280</td>
<td>323,018</td>
</tr>
<tr>
<td>Fixed Assets</td>
<td>967,342</td>
<td>973,759</td>
</tr>
<tr>
<td>Household Assets</td>
<td>598,758</td>
<td>596,261</td>
</tr>
<tr>
<td>Agricultural Assets</td>
<td>66,104</td>
<td>65,829</td>
</tr>
<tr>
<td>Business Assets</td>
<td>2,479</td>
<td>11,669</td>
</tr>
<tr>
<td>Land and Other Fixed Assets</td>
<td>300,000</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td><strong>5,649,079</strong></td>
<td><strong>5,762,991</strong></td>
</tr>
</tbody>
</table>

### Table A.3. Statement of Cash Flows of Household A

<table>
<thead>
<tr>
<th>Month</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income (+)</td>
<td>-22,684</td>
<td>-12,889</td>
</tr>
<tr>
<td>Adjustments:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation (+)</td>
<td>6,075</td>
<td>6,046</td>
</tr>
<tr>
<td>Change in Account Receivable (-)</td>
<td>-147,488</td>
<td>-116,288</td>
</tr>
<tr>
<td>Change in Account Payable (+)</td>
<td>149,960</td>
<td>149,960</td>
</tr>
<tr>
<td>Change in Inventory (-)</td>
<td>-126,465</td>
<td>-106,205</td>
</tr>
<tr>
<td>Change in Other Current Assets (-)</td>
<td>1,781</td>
<td>3,263</td>
</tr>
<tr>
<td>Consumption of Household-Produced Outputs (-)</td>
<td>-350</td>
<td>-314</td>
</tr>
<tr>
<td><strong>Cash Flow from Production</strong></td>
<td><strong>-139,171</strong></td>
<td><strong>-76,427</strong></td>
</tr>
</tbody>
</table>

[Source: Samphantharak & Townsend, 2006]
## Table 4.1. Examples of Transactions and Their Records

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Example of Corresponding Survey Questions</th>
<th>Balance Sheet</th>
<th>Income Statement</th>
<th>Statement of Cash Flows</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive wage income in cash</td>
<td><strong>JM4D</strong> What is the total amount of cash payments that you received since the last interview for doing this job? Include the value of any cash tips, bonuses or overtime payments. If no cash payments were received, record 0.</td>
<td>Increase in cash; Increase in cumulative savings</td>
<td>Revenue from labor</td>
<td>Net income (Cash inflow)</td>
<td></td>
</tr>
<tr>
<td>Use cash to pay telephone bill</td>
<td><strong>XM1A</strong> [6] Since the last interview, have you or members of your household made any cash purchases of [telephone and telecommunication services]? If yes, what is the total amount that you and members of your household have spent on [telephone and telecommunication services] since the last interview?</td>
<td>Decrease in cash; Decrease in cumulative savings</td>
<td>Consumption</td>
<td>Consumption (Cash outflow)</td>
<td></td>
</tr>
<tr>
<td>Deposit cash with the production credit group</td>
<td><strong>SM3B</strong> How much have you deposited to [the production credit group] in total since the last interview?</td>
<td>Decrease in cash; Increase in deposits at financial institutions</td>
<td></td>
<td>Increase in deposits at financial institutions (Cash outflow)</td>
<td></td>
</tr>
</tbody>
</table>
NIPA Accounts: From Household, to Village, to Diverse Regions, to Macro Aggregates (Paweenawat & Townsend, 2012)

- We create village/county economic accounts by aggregating the economic accounts of every household

<table>
<thead>
<tr>
<th>Uses</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest expenses</td>
<td>Production revenues</td>
</tr>
<tr>
<td>Less: Interest revenues</td>
<td>Less: Production expenses</td>
</tr>
<tr>
<td>Depreciation</td>
<td></td>
</tr>
<tr>
<td>Insurance premium</td>
<td></td>
</tr>
<tr>
<td>Property tax</td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td></td>
</tr>
<tr>
<td>Net income before tax</td>
<td></td>
</tr>
<tr>
<td>Less: Capital gains</td>
<td></td>
</tr>
<tr>
<td>Plus: Capital losses</td>
<td></td>
</tr>
<tr>
<td>Less: Insurance indemnity</td>
<td></td>
</tr>
<tr>
<td>Charge against output</td>
<td>Output</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Uses</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in financial assets</td>
<td>Change in net worth</td>
</tr>
<tr>
<td>Change in inventories</td>
<td>Contributed capital</td>
</tr>
<tr>
<td>Change in livestock assets</td>
<td>Current retained earnings</td>
</tr>
<tr>
<td>Change in fixed assets</td>
<td>Depreciation</td>
</tr>
<tr>
<td>Plus: Depreciation</td>
<td></td>
</tr>
<tr>
<td>Less: Change in liabilities</td>
<td></td>
</tr>
<tr>
<td>Gross investment</td>
<td>Gross saving</td>
</tr>
</tbody>
</table>

- Within country impact of financial deepening and increased trade
- Welfare distribution of gains and losses (due to price effects)
Flow of Funds Accounts: Measuring Nuts and Bolts of Financial Systems (with Narapong Srivilas, NESDB & UTCC)

- Flow of funds between a village in Chachoengsao and the other sectors in November 2009

- Flow of Funds from Financial Corporation – National
  - Updating, need more data

- **NFI** = Net Acquisition of Financial Assets (NAFA) – Net Incurrence of Liabilities (NIL)
  \[
  \text{NAFA} - \text{NIL} = \text{GS} - \text{CF}
  \]

- (Financial) Surplus
- Gross Savings – Expenditures on Capital

- Monetary policy transmission mechanism onto villages (Srivisal)

- Inter-regional flow of funds from rural to urban, Northeast to Central (Moll, Townsend & Zhorin)
## Cash Flow Statement

- Project with FRB-Boston and Townsend Thai Project
  - Comparing income, balance sheet across all major U.S. surveys

<table>
<thead>
<tr>
<th>Cash flow from Consumption and Investment (C&amp;I)</th>
<th>TTMS</th>
<th>SCPC</th>
<th>DCPC</th>
<th>SCF</th>
<th>CE</th>
<th>PSID</th>
<th>HRS</th>
<th>NASCC</th>
<th>FD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption expenditure (-)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital expenditure (-)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow from C&amp;I, Currency</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow from C&amp;I, DDA</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow from C&amp;I, Credit Card</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash flow from C&amp;I, Prepaid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cash flow from Financing</th>
<th>TTMS</th>
<th>SCPC</th>
<th>DCPC</th>
<th>SCF</th>
<th>CE</th>
<th>PSID</th>
<th>HRS</th>
<th>NASCC</th>
<th>FD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Deposit at Financial Institution (-)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lending (-)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrowing (+)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Gifts Received (+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

| Cash flow from Financing, Currency                            | X    | X    |      |     |    |      |     |       |    |
| Cash flow from Financing, DDA                                  |      |      |      |     |    |      |     |       |    |
| Cash flow from Financing, Credit Card                         |      |      |      |     |    |      |     |       |    |
| Cash flow from Financing, Prepaid                              |      |      |      |     |    |      |     |       |    |
Financial Intermediaries

- Measuring transactions of not just households but firms and banks and all financial intermediaries.
- Tobin & Brainard (1963) “Financial Intermediaries and the Effectiveness of Monetary Controls”

Non-bank financial institutions in the U.S. flow of funds accounts of investors

- Depository institutions, insurance companies, investment funds, pension and retirement funds, state and local governments, broker-dealers (includes NYSE P2P), and households (hedge funds)
Transactions Within Sector: Household
(Samphantharak, Kinnan & Townsend)
Within Sector: Financial Institutions


Figure 9: Federal funds network for September 29, 2006. GWCC = giant weakly connected component, DC = disconnected component, GSCC = giant strongly connected component, GIN = giant in-component, GOUT = giant out-component. On this day there were 57 nodes in the GSCC, 303 nodes in the GIN, 67 nodes in GOUT, 50 nodes in the tendrils and 2 nodes in a disconnected component.
Within Sector: Firms


Figure 2 Example of Groups with Many Chain Shareholding and Many Pyramids
Two distinct approaches to measurement

Via flow of funds, direct
- Thailand NESDB project
- CFSP Mexico project, rural to urban, metro areas

Indirect
- Feldstein-Horioka puzzle
  - China, Germany

In the U.S.
- In 1950, FRBNY, rural areas see funds flowing into regional financial centers, and on into NY/Chicago
- The U.S. wheat example: Moving the crop
Geography and Flow of Funds

  - 39% of shocks to gross state product are smoothed by capital markets
  - 13% are smoothed by the federal government
  - 23% are smoothed by credit markets
  - Remaining 25% are not smoothed

**Figure I**
Year-by-Year Income and Consumption Smoothing
Versus Big Finance


Figure 1: Asset Shares of Different Actors (source: FED Flow of Funds)

Figure 7: Shares of Credit Market Instruments
Crowdfunding and Marketplace Finance

**Recipients (evolving)**
- Consumers
- Small Business
- Entrepreneurs
- Developers
- Private Corp. (Growth Capital)

**Funding Platforms**
- Rewards-for-Finance Philanthropy
- Loan Products
- Equity Finance

**Investors**
- Retail
- Institutions
- High Net Worth
- Financial Intermediaries

**Platform Integrators/Service Providers**

**Opportunity**
1. New Segments
2. New Linkages
3. Mainstreaming
4. Linkages to Main Street & Wall Street

**Impending Risks**
1. Business Cycle
2. Regulations & Self Regulations (Ratings)
3. Counterparty

**Opportunity**
1. Securitization & Secondary Market
2. Capture of Capital Pools
3. Linkages to Wall Street

(Graphic courtesy of Adair Morse)
Recent Advances in Mapping Financial Systems: Big Data and Electronic Records

- Voluntary consumer linking services: Mint

- Federal Reserve Bank of New York data sets
  - CDS contracts on 35 North American financial firms (Shachar, 2013)

- New flow of funds for U.S.

- National Academy of Sciences group
  - Panel on Improving Federal Statistics for Policy and Social Science Research Using Multiple Data Sources and State-Of-The-Art Estimation Methods
Theory and Measurement

- Theory/Models are needed both for the measurement itself and for analysis of how well or poorly financial systems are operating
- Its base is quite naturally GE modeling
- Quesnay (1758) *Tableau Économique*
Modern General Equilibrium Theory

Financial Accounts in General Equilibrium

Table 1
An example of a microconsistent data set used in calibration of a simple general equilibrium model

<table>
<thead>
<tr>
<th></th>
<th>Production of Good 1</th>
<th>Production of Good 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of production</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Value of input use of factor 1</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Value of input use of factor 2</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td><strong>Demands</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of demand for good 1</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Value of demand for good 2</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Income</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td><strong>Income sources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of endowment of factor 1</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Value of endowment of factor 2</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Income</td>
<td>18</td>
<td>28</td>
</tr>
</tbody>
</table>

Figure 5: Second Welfare Theorem
The Building Blocks of General Equilibrium Theory

- The discipline of specifying a model is to specify the environment

- Commodity space
  - States of the world
  - Location
  - Indivisibilities
  - Private information
  - Limited communication

- Preferences

- Endowments

- Technology

- Intermediation and transaction costs
Village Economies: A Way of Proceeding with Extensions

Metaphors for the economic life of groups of associated agents, by kin or by other relationships

Much larger national economies as in intra-regional (and international) trade, examples include

- Geography and trade costs
- Computation becomes a big part

Communication as E-Commerce

- Oral assignment system
- Portable concealable objects
- Multiple portable tokens with written message
- Electronic telecommunications

<table>
<thead>
<tr>
<th>Values for $(\theta_{1x}, \theta_{1y})$</th>
<th>$(c^a_x, c^a_y)$</th>
<th>Values for $(\delta_x, \delta_y)$</th>
<th>Values for $(\theta_{2x}, \theta_{2y})$</th>
<th>$(c^a_x, c^a_y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0.4, 0.6)</td>
<td>(2, 8)</td>
<td>(1, 1)</td>
<td>(0.6, 0.4)</td>
<td>8.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.5, 1.5)</td>
<td>(0.3, 0.6)</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.5, 0.5)</td>
<td>(0.9, 0.2)</td>
<td>10.0</td>
</tr>
<tr>
<td>(0.6, 0.4)</td>
<td>(8, 2)</td>
<td>(1, 1)</td>
<td>(0.4, 0.6)</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.5, 1.5)</td>
<td>(0.2, 0.9)</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.5, 0.5)</td>
<td>(0.6, 0.3)</td>
<td>8.0</td>
</tr>
</tbody>
</table>

**Table 9.5 Agent pairings in the four-agent two-location model**

<table>
<thead>
<tr>
<th>Location</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>(a, b)</td>
<td>(a', b')</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(a, b')</td>
<td></td>
</tr>
</tbody>
</table>

MIT
Massachusetts Institute of Technology
Walrasian, competitive equilibrium is on top of this, with prices, budget sets and market clearing.

Wealth

- At given prices and the specification of a numeraire, wealth is a price-weighted sum of commodity endowments plus the discounted present value sum of claims on profits.

Indirect utility, value functions over wealth at specified prices.

Active spot market trade and intertemporal dynamics

- Securities are naturally claims on wealth in particular states and dates.
- Money
  - small open economy
  - entire economies and fiat money.
- Inside money and circulating private debt/liquidity.
- Securitization, traunching.

Monetary economies and the limit of real economies


Again, to be realistic in structural modeling, need computation.
Pareto optimality
- Natural welfare criterion allocations such that one cannot make someone better off without harming others
- By maximizing a weighted sum of ex ante utilities
- This is sometimes referred to as the planning problem

Welfare theorems
- Given existence, any Walrasian equilibrium is Pareto optimal, and further any Pareto optimal allocation can be attained by suitable distributions of initial wealth (typically with lump sum taxes and transfers)

Welfare Theorems 1
- Can fail
  - Pollution, borrowing lending with collateral, and incomplete markets
  - In another instance, with overlapping generations or incomplete markets, the interest rate is too low, and this can generate value money and bubbles: Geerolf (2013) “Reassessing Dynamic Efficiency”

Welfare Theorem 2
- Can fail, non-convexities

Conclusion
- If efficient do not fix, except for redistribution
- If theorems fail, either remedy the problem or work on ex ante optimal design
General Equilibrium theory provides us with a way to judge whether a given financial market structure with its rules for trading is good or not.

- Namely does it achieve the Walrasian (hence Pareto optimal) allocations in the limit, at least as the number of traders gets large.
  - or achieve a core allocation.
- It is an advantage of this literature that we can have virtually no obstacles, i.e., full information and perfect commitment and still ask this question with content, i.e., some things work and some do not.

An earlier literature provides us with some insights that are quite relevant today.

- It is also in security markets and money, not just the goods.
- This literature applies to individual platforms, but its real thrust is the general equilibrium.
First, The Good: Auctions

  - Multi good auctions with somewhat disinterested auctioneer
    - Vector of blocking bids
  - Application
    - Examples are Treasury reverse auctions in TARP where the vector of desired trades can be ordered, i.e., the Treasury is demanding securities in exchange for cash, and sellers the opposite
      - Barter exchange as in Wicksell triangle

  - Traders submit limit orders in terms of currency (or unit of account)
  - But markets are interconnected
  - A default penalty parameter is imposed for bankruptcy
  - Application
    - Fed funds, clearing
    - Security Markets are interconnected, not one at a time

---


2 For example the bartering exchange IBE Barter. See [http://ibebarter.com](http://ibebarter.com)
The Good: Trading Platforms

  - Any trader can offer to make a market by announcing a rate of exchange and attempting to attract customers
  - If agents can trade with two (or more) platforms simultaneously, then arbitrage, but Budish, Cramton & Shim (2015) “The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response”
  - If the rule is ex ante competition among platforms then agents can only choose one to trade with, requires exclusivity
  - Some issues with small numbers and large size of traders: Kilenthong & Qin (2014) “Trade through endogenous intermediaries”
  - A version of this is e-commerce with B2B sites with some businesses buying goods as inputs from producers

- Note that the model does not insist that trade be done on platforms
  - It is enough to have broker dealers announcing prices and attempt to attract trades, but we need the IO analysis of this to make sure its working
    - Grain: Chicago Board of Trade (1982) “Grains, production, processing, marketing”
Yanelle (1997) “Banking Competition and Market Efficiency”  
- First competition in the acquisition of funds for firms from lenders directly and 
banks for deposits from lenders, and then, second, competition of banks to 
  fund firms  
  - Considers an alternative version of this model where the timeline is rearranged so 
    that banks first compete for projects before competing for loans

Leverage and Asset Pricing in Double Auctions”  
- Coordination of the asset and bond markets  
  - To buy an asset one may need to issue a bond, but to issue the bond one needs to 
    be able to pledge the asset as collateral  
- There are ways to solve this issue  
  - Introduce the ABM so that agents can trade assets directly against bonds
Risk Sharing and Mutualization: Key Example of Evaluation and Policy Algorithm

- Max weighted sums of ex ante expected utility subject to resource constraints, all in the space of state contingent goods (as usual). This delivers Pareto efficient allocations.

- Interpretation of the solution
  - Idiosyncratic shocks are shared and completely pooled away
  - Aggregate shocks must be borne by someone but allocated according to risk aversion

- Interconnectedness is a good thing on both idiosyncratic and aggregate shocks

- Crisis and (especially) bad times do not get special modeling
  - The idea is to plan ex ante on who will bear the down-side
  - This is risk assessment, but with ex ante action plan rather than ex post rationalization of intervention
India: For the most part, come close to passing

- Townsend (1994) “Risk and Insurance in Village India”
Decentralization in Markets: Another Interpretation

- Decentralization of the risk-sharing optima with Walrasian scheme
- Mutual fund separation theorem

Figure 19.C.1
(a) No aggregate risk: same probability assessments.
(b) No aggregate risk: different probability assessments.

Figure 19.C.2
There is aggregate risk: \( p_1/\pi \) negatively correlated with total endowment of commodity \( \ell \).
Extensions of the Theory

- Testing within and across villages

- Extension to
  - Production
  - Capital
  - Labor

- Extension to
    - Optimal risk sharing allows trading that can resemble betting
Aggregating Up to Larger Units: Counties within a Country

Table 1
Number of Sampled Households and Amphoe

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>North</th>
<th>Northeast</th>
<th>Central</th>
<th>South</th>
<th>Bangkok</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>8501</td>
<td>1784</td>
<td>2469</td>
<td>1637</td>
<td>923</td>
</tr>
<tr>
<td>1986</td>
<td>2266</td>
<td>690</td>
<td>357</td>
<td>319</td>
<td>563</td>
</tr>
<tr>
<td>1986–88: 1986</td>
<td>7120</td>
<td>1633</td>
<td>1558</td>
<td>1691</td>
<td>1205</td>
</tr>
<tr>
<td>1988</td>
<td>1905</td>
<td>341</td>
<td>347</td>
<td>321</td>
<td>403</td>
</tr>
<tr>
<td>1988–90: 1988</td>
<td>7351</td>
<td>1664</td>
<td>1688</td>
<td>1551</td>
<td>1192</td>
</tr>
<tr>
<td>1990</td>
<td>8090</td>
<td>1690</td>
<td>1857</td>
<td>1688</td>
<td>1381</td>
</tr>
</tbody>
</table>

Number of matched amphoe

| 1975–81 | 227  | 60 | 56 | 59 | 41 | 11 |
| 1981–86 | 42   | 12 | 7  | 6  | 13 | 4  |
| 1986–88 | 128  | 28 | 27 | 28 | 31 | 14 |
| 1988–90 | 691  | 158| 193| 172| 127| 41 |

Note: All households must have resided in current amphoe for 10 or more years.

Figure 1
Histograms of County Income Growth, 1988–1990

Notes: X-axis is county average income growth from 1988–1990 (1.0 = 100%). Y-axis is the fraction of counties in the regional sample with income growth in the various cells or categories. See Table 1 for details concerning the number of households and number of counties that underlie the graph.
How Do They Do It Actually, in Village Economies, and Across Regions

- See the actual gaps and how they are filled
  - Consumption deficit
  - Investment deficit
  - Overall deficit
  - Then either RMSE or VCOV

<table>
<thead>
<tr>
<th>VCOV in Thailand</th>
<th>D=C+I-Y</th>
<th>D=C-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td>Deposit</td>
<td>-0.0275</td>
<td>0.3217</td>
</tr>
<tr>
<td>ROSCA</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Lending</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Borrowing</td>
<td>-0.0110</td>
<td>0.9701</td>
</tr>
<tr>
<td>Gift</td>
<td>2.8147</td>
<td>11.6544</td>
</tr>
<tr>
<td>Cash</td>
<td>35.4849</td>
<td>65.0895</td>
</tr>
</tbody>
</table>

Lim and Townsend (1998), RMSE
Transactions Within Sector: Household
(Kinnan & Townsend, 2012; Sripakdeevong)

- Consumption smoothed by active networks
- Investment by kin, threat for default
- Not linked in any way are most vulnerable
  - This was somewhat concealed before

Active Financial Network

Family Ties

Panel B: A Village in Srisaket

Bridge Loans: Correlation Between Amount Repaid and Amount Borrowed

<table>
<thead>
<tr>
<th>Lender 1 (Long Term)</th>
<th>Lender 2 (Short Term)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan A (Old)</td>
<td>Loan B</td>
</tr>
<tr>
<td>Loan C (New)</td>
<td></td>
</tr>
</tbody>
</table>
Featured Institutions: In the U.S.

- U.S. applications/institutions, both historical and contemporary
  - Historical: Mutual insurance societies in the U.S.
    - Ben Franklin
  - Portfolios of stock, index funds
CAPM taken to Village Risk

Chachoengsao

Lopburi

Buriram

Srisaket

(mean) roa  Fitted values

(mean) roa  Fitted values

(mean) roa  Fitted values

(mean) roa  Fitted values
# Decomposition of Risk and Risk Premia

## Panel A: Simple Model

<table>
<thead>
<tr>
<th>Region: Township (Province):</th>
<th>Chachoengsao</th>
<th>Lopburi</th>
<th>Buriram</th>
<th>Srisaket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Risk</td>
<td>1.9%</td>
<td>2.4%</td>
<td>6.0%</td>
<td>34.1%</td>
</tr>
<tr>
<td>Idiosyncratic Risk</td>
<td>98.1%</td>
<td>97.6%</td>
<td>94.0%</td>
<td>65.9%</td>
</tr>
</tbody>
</table>

### Panel A.1: Decomposition of Risk (Variance)

<table>
<thead>
<tr>
<th>Region: Township (Province):</th>
<th>Central</th>
<th>Northeast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Risk</td>
<td>78.4%</td>
<td>-18.7%</td>
</tr>
<tr>
<td>Idiosyncratic Risk</td>
<td>21.6%</td>
<td>118.7%</td>
</tr>
</tbody>
</table>

Number of Observations: 129, 140, 131, 141

## Panel B: Robustness Model

<table>
<thead>
<tr>
<th>Region: Township (Province):</th>
<th>Chachoengsao</th>
<th>Lopburi</th>
<th>Buriram</th>
<th>Srisaket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Risk</td>
<td>15.1%</td>
<td>12.0%</td>
<td>20.3%</td>
<td>45.0%</td>
</tr>
<tr>
<td>Idiosyncratic Risk</td>
<td>84.9%</td>
<td>88.0%</td>
<td>79.7%</td>
<td>55.0%</td>
</tr>
</tbody>
</table>

### Panel B.1: Decomposition of Risk (Variance)

<table>
<thead>
<tr>
<th>Region: Township (Province):</th>
<th>Central</th>
<th>Northeast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Risk</td>
<td>67.4%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Idiosyncratic Risk</td>
<td>32.6%</td>
<td>88.4%</td>
</tr>
</tbody>
</table>

Number of Observations: 129, 140, 131, 141

## Panel A.2: Decomposition of Risk Premium

### Table A.7 Correlation Coefficients Between Gifts Received and Idiosyncratic Component of Rate of Return

<table>
<thead>
<tr>
<th>Central</th>
<th>Chachoengsao</th>
<th>Lopburi</th>
<th>Buriram</th>
<th>Srisaket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>-0.0844***</td>
<td>-0.0303***</td>
<td>-0.0097</td>
<td>-0.0409***</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>18,241</td>
<td>16,698</td>
<td>30,574</td>
<td>29,470</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Northeast</th>
<th>Chachoengsao</th>
<th>Lopburi</th>
<th>Buriram</th>
<th>Srisaket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>(0.0000)</td>
<td>(0.0001)</td>
<td>(0.0904)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>18,241</td>
<td>16,698</td>
<td>30,574</td>
<td>29,470</td>
</tr>
</tbody>
</table>

**Remark:** Unit of observation is round-month-household, where each round represents a moving time window. Gift received in thousand bahts. Idiosyncratic component of ROA is computed from the residual from equation (6). *** p-value<0.01.
Policy Implications

Market participation, network shocks: Financial centrality
- Are a real economic risk, hence potentially insurable liquidity
- Corrected measures of financial centrality need to take into account the economics of risk sharing

Creating New Products, Platforms
- Equity crowd funding
  - Even by Even Responsible Finance, Inc., “Extra money when your pay is low, interest-free. Intelligent savings when your pay is high. So you can stop worrying about payday, and start getting ahead.”
- Targeting the small on main street
Policy Implications from General Equilibrium

- But actual impact of intervention? At a local level, if (local) aggregate shocks cannot be insured by definition, then can be allocated/borne according to risk aversion.

- Hence completing markets can cause welfare losses for some:
  - The less risk averse were implicitly insuring the more risk averse

- Evidence from aggregate rainfall shocks and take up:
Incorporating Obstacles

- Information-constrained optima: Enigmatic institutional forms

- Long term relationships
  - Private information about urgency for liquidity as for a financial institution or firm, or the value of an underlying income realization, as for a household
  - There is evidence that at least banks, and perhaps broker dealers, are engaged in this practice: Berlin & Mester (1999) “Deposits and Relationship Lending”; Kirk, McAndrews, Sastry & Weed (2014) “Matching Collateral Supply and Financing Demands in Dealer Banks”

- Concealment
  - This could be done on a formal platform
  - Sending messages, interim reports
  - If private information is two sided, on the part of a buyer/seller or borrower/lender, then a third party as a mediator, acting in their interest, should be hiding information from market participants: Townsend (1988) “Information Constrained Insurance: the Revelation Principle Extended”
  - Dark pools where trades of one party are kept secret from the market or others on the financial platform: Picardo (2014) “An Introduction to Dark Pools”; Zhu (2014) “Do Dark Pools Harm Price Discovery?”

- Delegation
  - It is in the interest of a group of traders to surrender their trading rights and decision making to an entity which has no more expertise but nevertheless controls the overall portfolios and savings decisions: Townsend (1988) “Information Constrained Insurance: the Revelation Principle Extended”
  - Cooperatives, ETFs, wealth managers have the potential, given the way these institutions are designed, to implement these arrangements (For more on wealth management see Prince (2014) at http://www.forbes.com/sites/russalanprince/2014/05/16/what-is-wealth-management/)
  - Even with privately uncontrolled residual decisions on the part of investors, there can be gains to this collectivity, with the group engaged in external market trades on behalf of the agents: Doepke & Townsend (2006) “Dynamic Mechanism Design with Hidden Income and Hidden Auctions”
Information Constrained Allocations

- Predictions for allocations which can be tested
- There are implications for allocations even if we do not see the overall contract
- But having operating system of bank is even better, Liberti and Townsend
- We can determine with data which obstacle or set of obstacles to trade are likely to be determining the arrangement, CSV after village fund program

<table>
<thead>
<tr>
<th>KIN 0 (no relatives)</th>
<th>KIN 1-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>stde</td>
<td>mu</td>
</tr>
<tr>
<td>0.203689</td>
<td>0.299533</td>
</tr>
<tr>
<td>0.015712</td>
<td>0.198685</td>
</tr>
</tbody>
</table>
We start by creating the list of all non-financial firms of which 50% or larger share is held by an individual or family (shareholder type is “Una o más personas físicas o familias”). For all firms in this list (280,534) we record their name and fiscal ID number.

We enlarge the above list of family-owned firms using a recursive algorithm to include other firms that are held by the firms in the list from Step 1. The idea is to enlarge the initial list of family firms with those firms whose shareholders can be considered family firms as well.

Note a Borrowing regime means exogenously incomplete, MH is better.

### Table 3 - Vuong test model comparisons - Family network status

<table>
<thead>
<tr>
<th>Comparison:</th>
<th>A. firms in family network</th>
<th>B. firms not in network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MH v B</td>
<td>MH v A</td>
</tr>
<tr>
<td>1. Whole sample, 1997-00, continuing banking status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 1997, unbanked</td>
<td>B***</td>
<td>A***</td>
</tr>
<tr>
<td>1.2 1997, single-banked</td>
<td>MH***</td>
<td>tie</td>
</tr>
<tr>
<td>1.3 1997, multi-banked</td>
<td>B***</td>
<td>A***</td>
</tr>
<tr>
<td>1.4 2000, unbanked</td>
<td>tie</td>
<td>tie</td>
</tr>
<tr>
<td>1.5 2000, single-banked</td>
<td>MH***</td>
<td>MH</td>
</tr>
<tr>
<td>1.6 2000, multi-banked</td>
<td>B***</td>
<td>MH***</td>
</tr>
</tbody>
</table>
Competitive Markets with Private Information

- Much of the policy literature implicitly builds on the view that limited information can cause a problem for the operation of competitive markets

- Key references
  - Stiglitz & Weiss (1981) “Credit Rationing in Markets with Imperfect Information”

- The robustness of the welfare theorems is perhaps still under appreciated

- Environments with unobserved liquidity/urgent-patient preference shocks, private information in labor supply preferences, and moral hazard in effort in firms employing capital decentralize as competitive equilibria which are efficient

- The first welfare theorem is straightforward if there is appropriate competition in the space of contracts

- The second welfare theorem needs to be qualified to take into account envy
Broker-Dealer, Financial Intermediary as Key Institution

- A broker-dealer, intermediation sector makes contracts with household, taking in and/or giving out resources to each household, but pooling risk and engaged in security transformation (re-bundling risk and time)

- Constant returns, the number and size of these intermediary platforms is indeterminate

- Model does not take a stand on what we should see in terms of size and number of platforms or investment banks

- But does have implication for pricing and for underlying allocations
  - And platforms which cannot cover costs do not exist

- Some examples
  - Bank CDs with the option for early withdrawal
  - Retirement funds with the option to cash out in lump sum or convert
  - Firms funded with bank contracts that bundle together implicit insurance and credit
    - A package of input, financing and output pay off or insurance indemnity
    - The package must be bought by the firm and is sold by financial institution
More Complex Financial Institutions: From Cropping Groups to Banks, and currently, new market-place exchanges

- Complex institutions with their own internal organization (nexus of contracts and incentive compensation schemes)
  - Yet trading with others
  - Can coexist with simple proprietorships and these broker dealers, in equilibrium

- Multi-tenant cropping groups in village economies

- Banks in developed economies are examples of these more complex organizations

- Social networks and P2P lending
  - Lin, Prabhala & Viswanathan (2011) “Judging Borrowers by the Company They Keep: Friendship Networks and Information Asymmetry in Online Peer-to-Peer Lending”
  - Mexico and Philippines: Ludwig (2014) “Lenddo’s Borrowers in Mexico and The Philippines Get Credit Via Facebook”

  - Data on the geography of capital flows provide preliminary evidence that is consistent with the thesis that syndicates significantly reduce the information asymmetry problem
  - If syndicates reduce the information asymmetry problem, then we expect to see more distant backers on syndicated compared to non-syndicated deals because investors have less need to be co-located with the venture in order to meet them offline to address information asymmetry issues since investors can rely on the lead investor to do that offline work
Competition and Its Limits: need Ex Ante Regulation or Improved Design

- Not “anything goes”
- Simply pooling risk ex post undercuts high powered incentives implicit in the original contracts.
  - Back to the moral hazard production environment
- If there is no way to enforce exclusivity, then hold outs can engage ex post in privately beneficial trades, independent of their unobserved shocks
- If contracts are not indexed by aggregate, observable shocks, then outcomes can be information-constrained inefficient and there is scope for periodic crises, but then why not introduce indexed products
- Adverse selection
  - Fundamental problem which can potentially wreak havoc with the welfare theorems
  - Still, one can decentralize with restrictions on the commodity space, here’s how:
    - Bisin & Gottardi (2006) “Efficient Competitive Equilibria with Adverse Selection”
    - Competition with menus and commitment can work
Single vs. Multiple Economy-wide Platforms

- If the size of a cluster or platform is allowed to be freely determined, given other forces in the underlying environment, we can consider whether it might be best to have
  - One financial platform
  - Several platforms potentially completing with one another
  - Or mixed systems, such as hierarchy or tiering

- Single, unified platforms: Various distinct economic models make clear some of the forces for single, unified platforms, equivalently all trade through one institution
  - A model of banks engaged in security transformation
  - And credit registries, covenants
    - Bizer & DeMarzo (1992) “Sequential Banking”
  - Direct financing in markets vs. bank intermediation
    - Starts with an incomplete security structure for dealing with risk, due to minimal scale requirement
    - The optimal allocation can be achieved in competitive markets
    - But only if firms creating the securities deal with a banking sector and not with household investors directly
Forces for Multiple Platforms

- **Costly bilateral exchange:** Townsend (1978) “Intermediation with Costly Bilateral Exchange”
  - If there is a cost of forming a network or coalition, as the gain from further diversification is positive but goes to zero, though per capita transaction costs are decreasing also. Finite size is possible.

  - Applicability to
    - credit card networks (merchants and consumers), interchange fees, mkt participation fees
    - Competition determines the number and mix of platforms and their users

  - An incomplete security structure, due to collateral constraints, exogenous incomplete markets
  - This creates a pecuniary externality and would lead to an inefficient allocation
  - If member in financial platforms can be priced and is exclusive, then the externality can be internalized and the competitive outcome is again constrained efficient
  - Application to GCF repo
Mixed Systems: Joint Liability Groups

- **Joint liability group**
  - A set of borrowers enter into a collaboration with each other, and effectively deal with a lender as a single unit.
  - There are various models of what is going on within such groups:
    - Adverse selection in which agents vary by a priori default risk
    - Within group monitoring in which actions taken by borrowers can be observed at a cost by savers
    - Coordination in the project choice among borrowing members
    - Informal penalties for default of a joint liability partner

- **Application**
    - The models can sometimes be distinguished
    - Repayment is affected negatively by joint liability and social ties, as would be the case in a moral hazard model with a debt burden, causing a shift to risky assets
    - Likewise in adverse selection joint liability pushes marginal, safer borrowers out the market
    - But repayment is affected positively by social sanctions and correlated returns, as in the less developed Northeast Thailand
    - Lessons here are that obstacles may vary and joint liability may be doing different things in different places: Central vs. Northeast

- **Joint liability vs. relative performance:** Ahlin and Townsend (2007) “Selection Into and Across Credit Contracts: Theory and Field Research”
  - Sometimes whether or not to cluster is the featured choice with the model
  - The bank can try to keep clients separate and then is able to make inferences of effort from the comparison of project returns, so-called relative performance evaluation
Hybrid Systems

- **Endogenous Fluctuation**
  - This same model of relative performance and risk sharing groups can address fluctuations and even seeming crisis and institutional forms flip back and forth with high frequency

  - Costly state verification and costly ex post communication
  - The extent of debt vs. equity depends on the magnitude of shocks

- **Long term relations vs. switching: Prescott & Townsend (2006) “Private Information and Intertemporal Job Assignments”**
  - Allow mixed systems in which some agents as supervisors or monitors are switching over time and space, over platforms
  - Forces for long term relations vs. switching and anonymity are highlighted
monetary policy, the provision of central bank money to financial institutions and markets, (or liquidity policy)

whether liquidity shortages and other liquidity problems such as clearing require external remedies (or industry self-regulation)

It proves useful to consider models with explicit micro underpinnings and, ideally, to couple this with the requisite measurement
Cash Management in Thailand

530929

530929

month

530929

month

formal & informal deposits
minus formal & informal withdrawals
net cash (inflow-outflow)
Flows of Fiat Money and E-money

- Fiat money
- Reserves

Central Bank

Commercial Bank

Agent

Agent

Agent

Aggregator

Aggregator

Cell phone operator

E-remitances

Goods
## Table 5: How Often Do Agents Run Out?

<table>
<thead>
<tr>
<th></th>
<th>e-Money</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fraction</td>
<td>Fraction</td>
</tr>
<tr>
<td>More than once a day</td>
<td>3.2%</td>
<td>More than once a day</td>
</tr>
<tr>
<td>Once a day</td>
<td>6.4%</td>
<td>Once a day</td>
</tr>
<tr>
<td>Once a week</td>
<td>14%</td>
<td>Once a week</td>
</tr>
<tr>
<td>Once a month</td>
<td>5.6%</td>
<td>Once a month</td>
</tr>
<tr>
<td>Once every three months</td>
<td>1.2%</td>
<td>Once every three months</td>
</tr>
<tr>
<td>Once every six months</td>
<td>0.4%</td>
<td>Once every six months</td>
</tr>
<tr>
<td>Less often than that</td>
<td>12%</td>
<td>Less often than that</td>
</tr>
<tr>
<td>Never</td>
<td>57.2%</td>
<td>Never</td>
</tr>
</tbody>
</table>
Chart 2
Value of Payments Originated over Fedwire
Annual Growth and Value to GDP

Sources: U.S. Department of Commerce, Bureau of Economic Analysis, GDP Press Release (Table 3); http://www.federalreserve.gov/paymentsystems/fedfunds_qtr.htm; authors’ calculations.

Even “Routine” Problems Emerge as Typical: “Explaining Settlement Fails” (Fleming and Garbade, 2005)

- The Federal Reserve now makes available current and historical data on trades in U.S. Treasury and other securities that fail to settle as scheduled.
- An analysis of the data reveals substantial variation in the frequency of fails over the 1990-2004 period.
- It also suggests that surges in fails sometimes result from operational disruptions.
- but often reflect market participants’ insufficient incentive to avoid failing.


Note: The chart plots average daily delivery fails of the primary dealers for the week ending July 4, 1990, through the week ending December 29, 2004.
Back to Theory: How to Design Payments

▶ Ostroy Star: Money and the impossibility of decentralized exchange
  ➢ Generically, the financial system must be centralized if the goal is to reach the target Walrasian allocation in one round

▶ Shubik: Trading posts and multiple equilibria
  ➢ Maximizing strategies depends on the strategies of others in a natural way, as one needs others around in order to trade

▶ Giving up on quid pro quo in every exchange, consider deferred payment mechanisms
  ➢ But these require implicit or explicit credit
    o For example, deficit-inducing trades, as in purchases before sales, are allowed but are required to be matched with surplus-generating trades
  ➢ Issues arise
    o How long can deferred payments be deferred, who is keeping track of what, and what about the possibility of bankruptcy.
Townsend & Wallace (1987) "Circulating Private Debt: An Example with a Coordination Problem"

- Debts can circulate as high velocity, privately issued monies
  - problem has to do with a multiplicity of equilibria and the need for communication across space that was somehow supposed to be ruled out a priori

Trust and inter-dealer markets

- In decentralized systems, key players can be mediators, allowing exchanges through private money backed by trust
- An agent can deal with a stranger if there is a mediator they both trust
- But the level and distribution of trust matters for what can be accomplished with virtual currency, and they are not fully equivalent with fiat money systems with the same overall liquidity

Clearing and high value payments systems

- The goal of contemporary high value payments systems seems related, yet turns the problem on its head
- Rather than try to achieve certain target allocations subject to constraints, the goal is trying to maximize the volume of trade which can be sustained with current liquidity balances, e.g., accounts at a Central Bank, and rejected requests for payment that are infeasible
Conclusion

- Used theory and data to analyze financial systems
- Application to villages or New York financial markets from common core ideas
- Derived policy, where markets work and where not, and with rules
- Ex ante optimal design