Measurement, Analysis and Design of Financial Systems: First Principles as a Foundation for Policy

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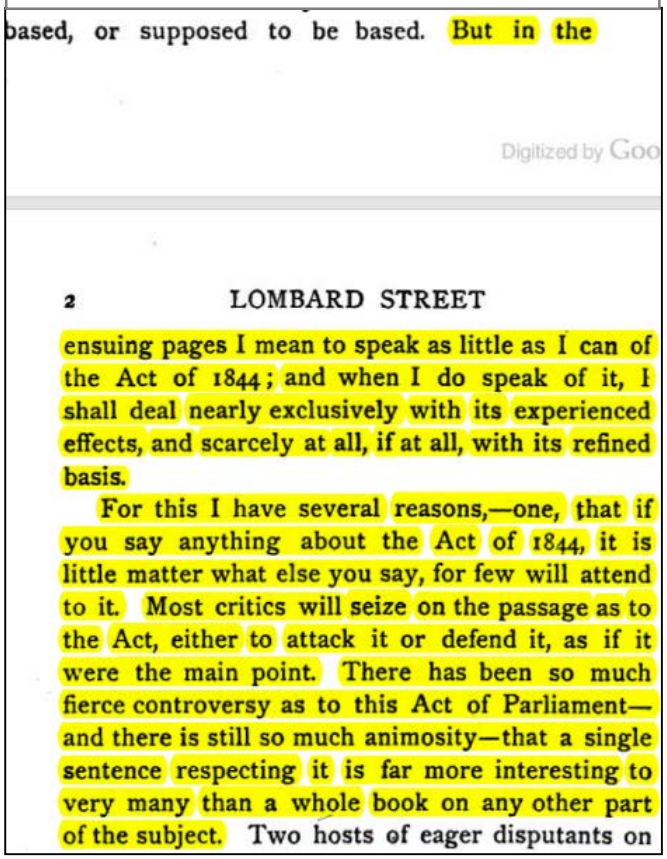
Motivation

- 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.

Bagehot (1962) Lombard Street: A Description of the Money Market.



based, or supposed to be based. But in the

ensuing pages I mean to speak as little as I can of the Act of 1844; and when I do speak of it, I shall deal nearly exclusively with its experienced effects, and scarcely at all, if at all, with its refined basis.

For this I have several reasons,—one, that if you say anything about the Act of 1844, it is little matter what else you say, for few will attend to it. Most critics will seize on the passage as to the Act, either to attack it or defend it, as if it were the main point. There has been so much fierce controversy as to this Act of Parliament—and there is still so much animosity—that a single sentence respecting it is far more interesting to very many than a whole book on any other part of the subject. Two hosts of eager disputants on

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
    - Shadow banking sector: Adrian & Shin (2010) "The Changing Nature of Financial Intermediation and the Financial Crisis of 2007–2009"
    - Gorton & Metrick (2010) "Regulating the Shadow Banking System"
    - Recommendations from Squam Lake: French et al. (2010) "The Squam Lake Report: Fixing the Financial System"
  - Government intermediation, repression: Reinhart & Rogoff (2013) "Financial and Sovereign Debt Crises: Some Lessons Learned and Those Forgotten"
  - Monetary Policy
    - Monetary policy at an aggregated level vs. payments: Bech, Martin & McAndrews (2012) "Settlement Liquidity and Monetary Policy Implementation"

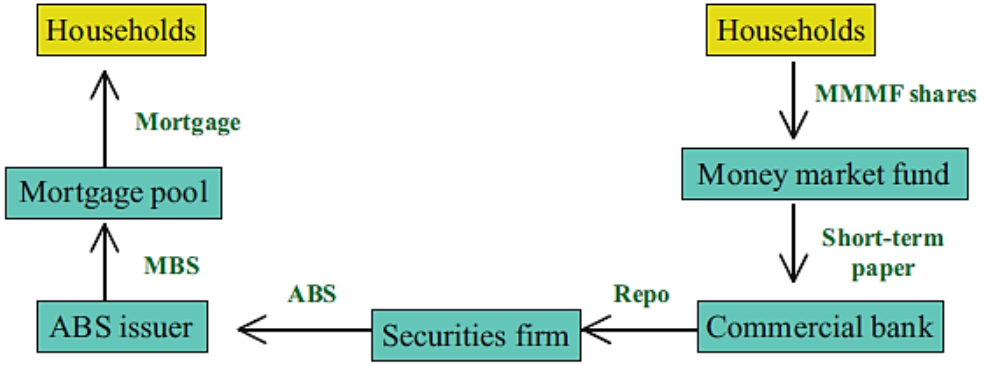


Figure 6

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
  - Crisis with finance companies: Aghevli (1999) “The Asian Crisis: Causes and Remedies”
  - Radelet & Sachs (1998) “The Onset of the East Asian Financial Crisis”
  - Financial sector plans: Devakula (2006) “Thailand's Financial Sector Master Plan Handbook”
  - Segmentation, bond markets: Asian Development Bank (ADB) Team (2012) “Thailand Bond Market Guide”
  - Financial access: Tambunlertchai (2015) “Financial Inclusion, Financial Regulation, and Financial Education in Thailand”
    - Micro credit
    - E-money
- China
  - Stimulus vs. regulation
    - Conundrum between micro and macro
  - Bloomberg News (Oct 25, 2015) “China's Leaders Shift From Short-Term Stimulus to Five-Year Plan”
  - 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

Complete Financial Accounts: For Monthly Rural and New Urban

Table A.2. *Income Statement of Household A*

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

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

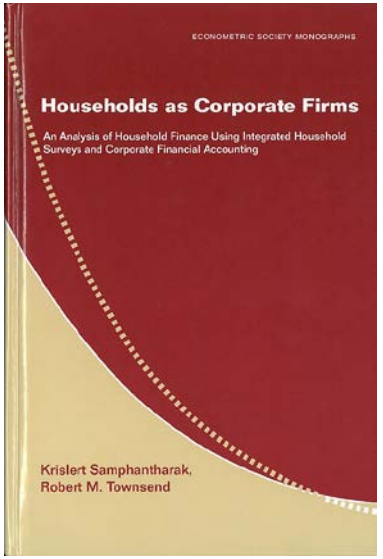
Month	5	6
Cash in Hand	1,966,139	1,862,121
Account Receivables	688,971	805,259
Deposits at Financial Institutions	167,271	167,969
ROSCA (Net Position)	33,000	37,000
Other Lending	153,136	153,136
Inventories	1,346,939	1,440,729
Livestock	326,280	323,018
Fixed Assets	967,342	973,759
Household Assets	598,758	596,261
Agricultural Assets	66,104	65,829
Business Assets	2,479	11,669
Land and Other Fixed Assets	300,000	300,000
Total Assets	**5,649,079**	**5,762,991**

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

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

Liquidity vs. Productivity

Balance Sheet vs. Wealth Accumulation



[Source: Samphantharak & Townsend, 2006]

Transactions-based Measurements Is The Key

Table 4.1. *Examples of Transactions and Their Records*

Transaction	Example of Corresponding Survey Questions	Balance Sheet	Income Statement	Statement of Cash Flows	Remarks
Receive wage income in cash	**JM4D** 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.	Increase in cash; Increase in cumulative savings	Revenue from labor	Net income (Cash inflow)	
Use cash to pay telephone bill	**XM1A [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?	Decrease in cash; Decrease in cumulative savings	Consumption	Consumption (Cash outflow)	
Deposit cash with the production credit group	**SM3B** How much have you deposited to [the production credit group] in total since the last interview?	Decrease in cash; Increase in deposits at financial institutions		Increase in deposits at financial institutions (Cash outflow)	

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

Appropriation Account

Production Account

Uses	Sources
Interest expenses	Production revenues
Less: Interest revenues	*Less:* Production expenses
Depreciation	
Insurance premium	
Property tax	
Profit	
Net income before tax	
Less: Capital gains	
Plus: Capital losses	
Less: Insurance indemnity	
Charge against output	**Output**

Balance of Payments Account

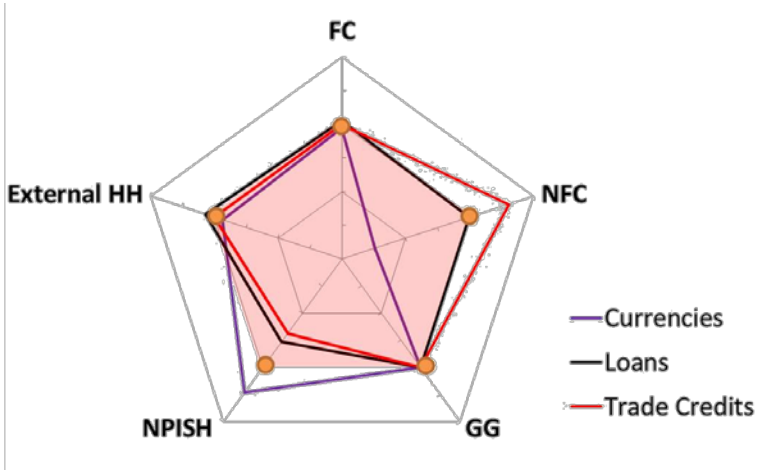
Saving-investment Account

Uses	Sources
Change in financial assets	Change in net worth
Change in inventories	Contributed capital
Change in livestock assets	Current retained earnings
Change in fixed assets	Depreciation
Plus: Depreciation	
Less: Change in liabilities	
Gross investment	**Gross saving**

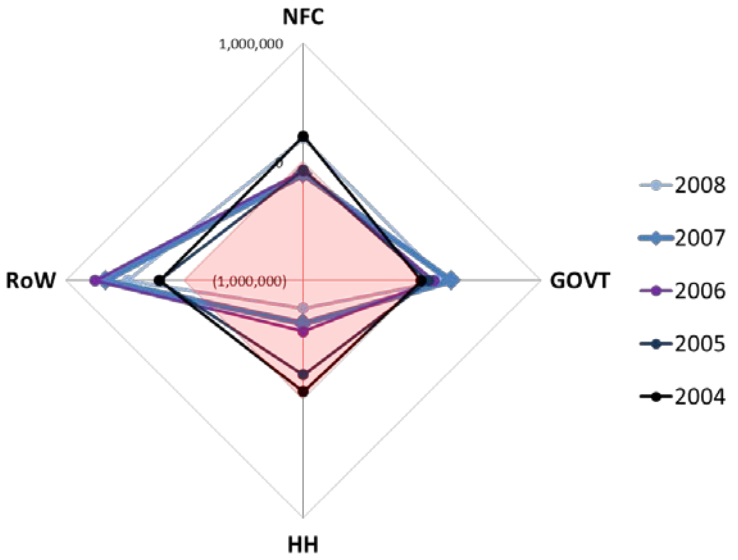
- Within country impact of financial deepening and increased trade
- Welfare distribution of gains and losses (due to price effects)

Flow of Funds Accounts: Measuring Nuts and Bolts of Financial Systems (with Narapong Srivisal, 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)

$$NAFA - NIL = GS - CF$$

(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

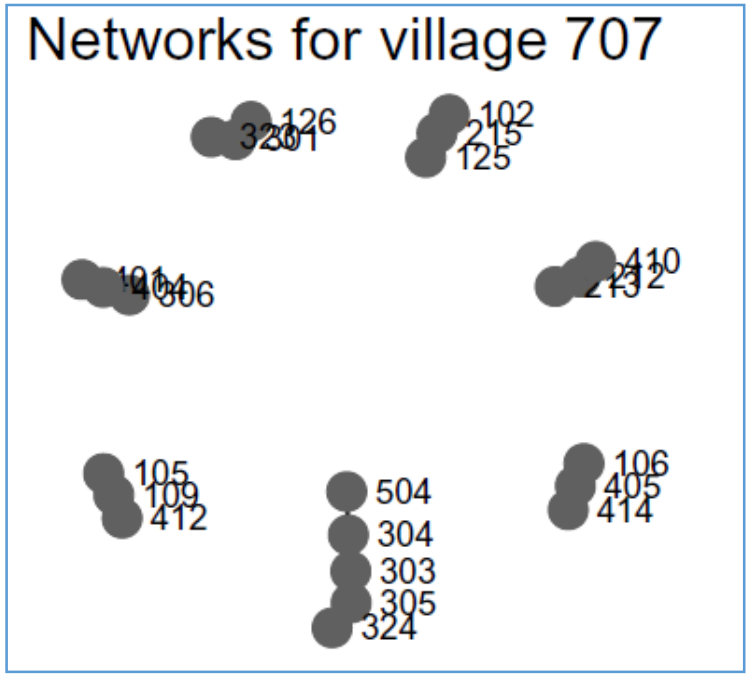
	TTMS	SCPC	DCPC	SCF	CE	PSID	HRS	NASCC	FD
Cash flow from Consumption and Investment (C&I)									
Consumption expenditure (-)	X		X						
Capital expenditure (-)	X		X						
Cash flow from C&I, Currency	X		X						
Cash flow from C&I, DDA			X						
Cash flow from C&I, Credit Card			X						
Cash flow from C&I, Prepaid			X						
Cash flow from Financing									
Change in Deposit at Financial Institution (-)	X		X						
Lending (-)	X								
Borrowing (+)	X								
Net Gifts Received (+)			X						
Cash flow from Financing, Currency	X		X						
Cash flow from Financing, DDA			X						
Cash flow from Financing, Credit Card			X						
Cash flow from Financing, Prepaid			X						

Financial Intermediaries

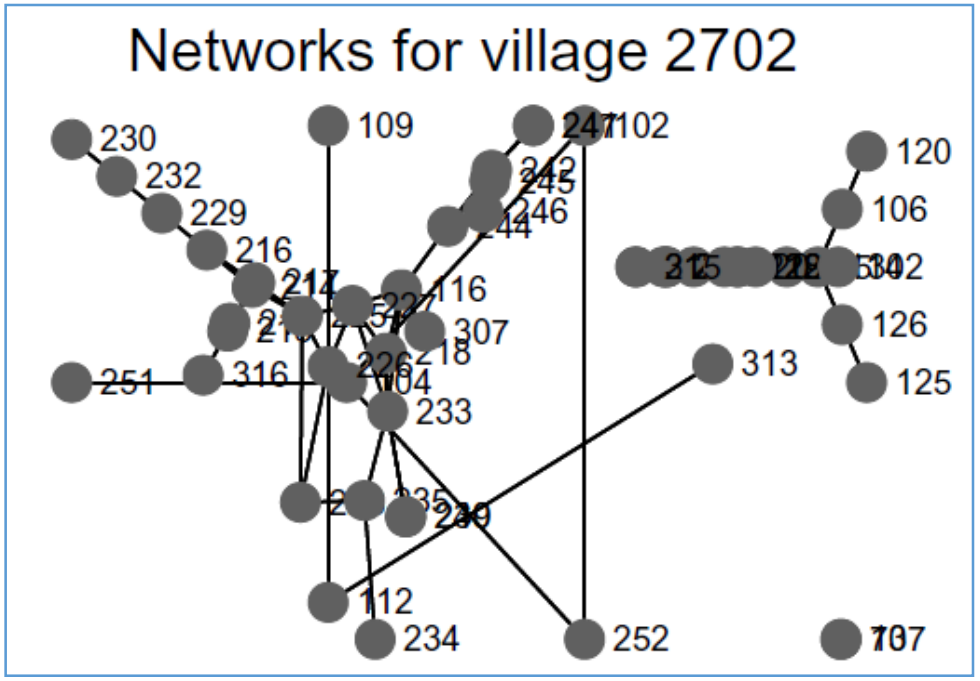
- Financial Intermediaries
  - Measuring transactions of not just households but firms and banks and all financial intermediaries.
  - Tobin & Brainard (1963) “Financial Intermediaries and the Effectiveness of Monetary Controls”
- Non-bank financial institutions in the U.S. flow of funds accounts of investors
  - Depository institutions, insurance companies, investment funds, pension and retirement funds, state and local governments, broker-dealers (includes NYSE P2P), and households (hedge funds)
  - Carpenter, Demiralp, Ihrig & Klee (forthcoming) “Analyzing Federal Reserve Asset Purchases: From whom does the Fed buy?”

Transactions Within Sector: Household
(Samphantharak, Kinnan & Townsend)

Chachoengsao

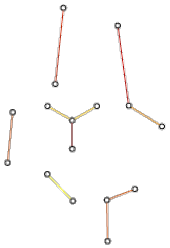


Buriram

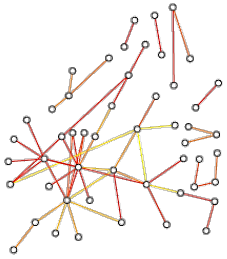


Within Sector: Financial Institutions

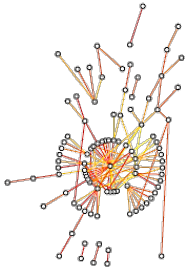
- Bech & Atalay (2008) "The Topology of the Federal Funds Market"



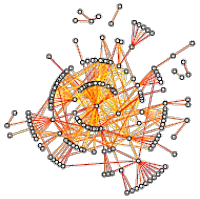
9:01 to 9:30 a.m.



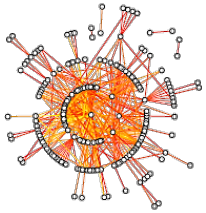
12:01 to 12:30 p.m.



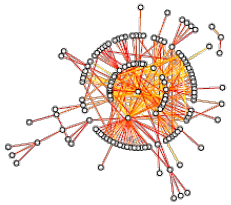
2:31 to 3:00 p.m.



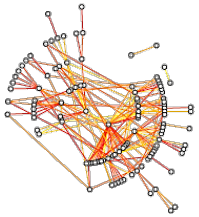
4:01 to 4:30 p.m.



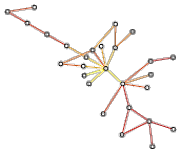
4:31 to 5:00 p.m.



5:01 to 5:30 p.m.



5:31 to 6:00 p.m.



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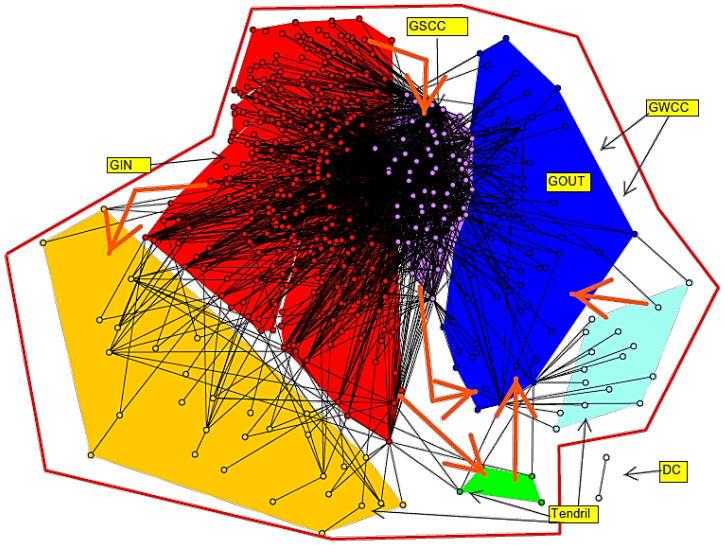


Figure 9: Federal funds network for September 29, 2006. GWCC = giant weakly connected component, DC = disconnected component, GSCC = giant strongly connected component, GIN = giant in-component, GOUT = giant out- component. On this day there were 57 nodes in the GSCC, 303 nodes in the GIN, 67 nodes in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

Within Sector: Firms

- Samphantharak (2002) "Internal Capital Markets in Business Groups"

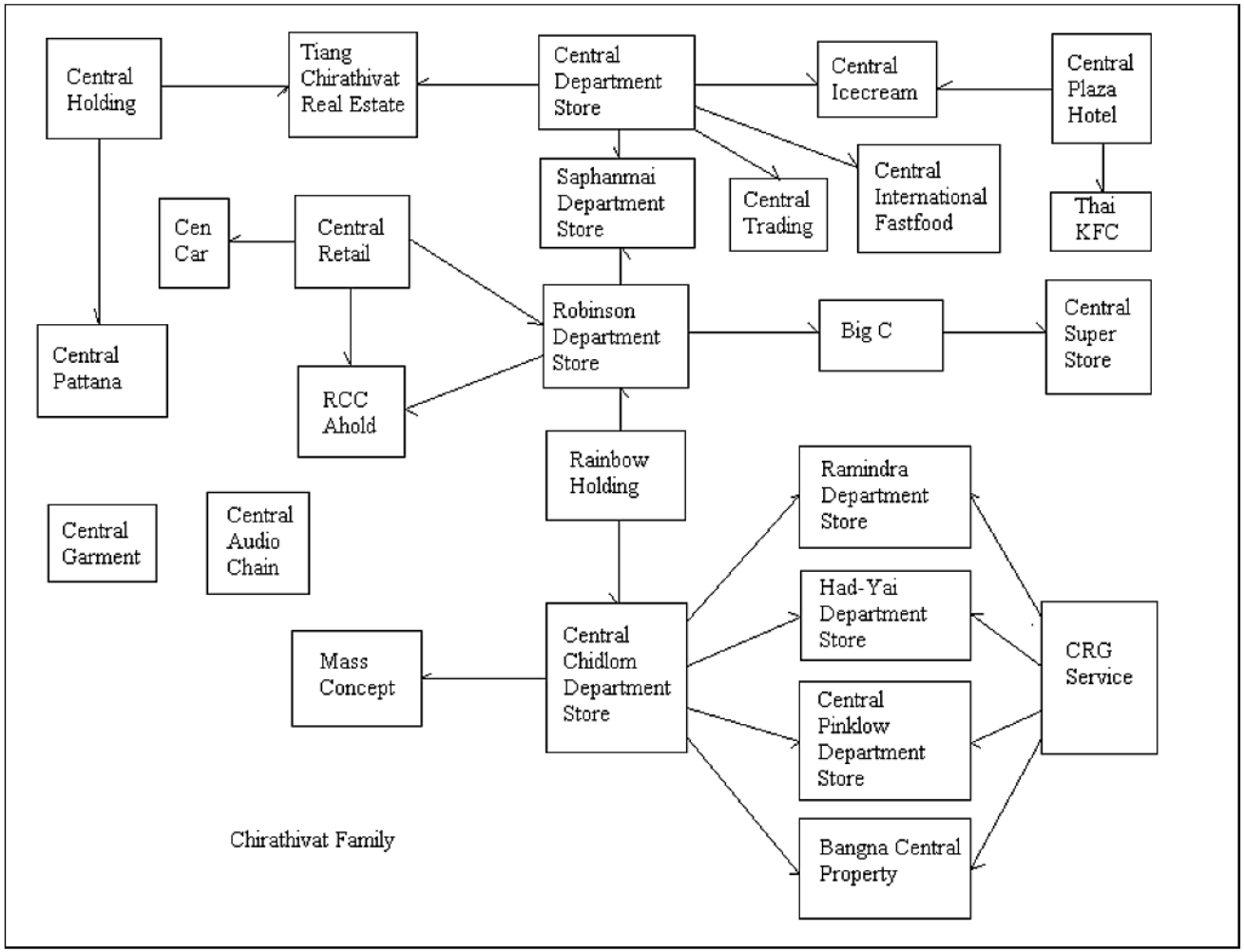


Figure 2 Example of Groups with Many Chain Shareholding and Many Pyramids

Geography, Financial Inclusion and Wall Street vs. Main Street

- 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

- Asdrubali, Sorensen and Yosha (1996) "Channels of Interstate Risk Sharing: United States 1963-1990"
  - 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

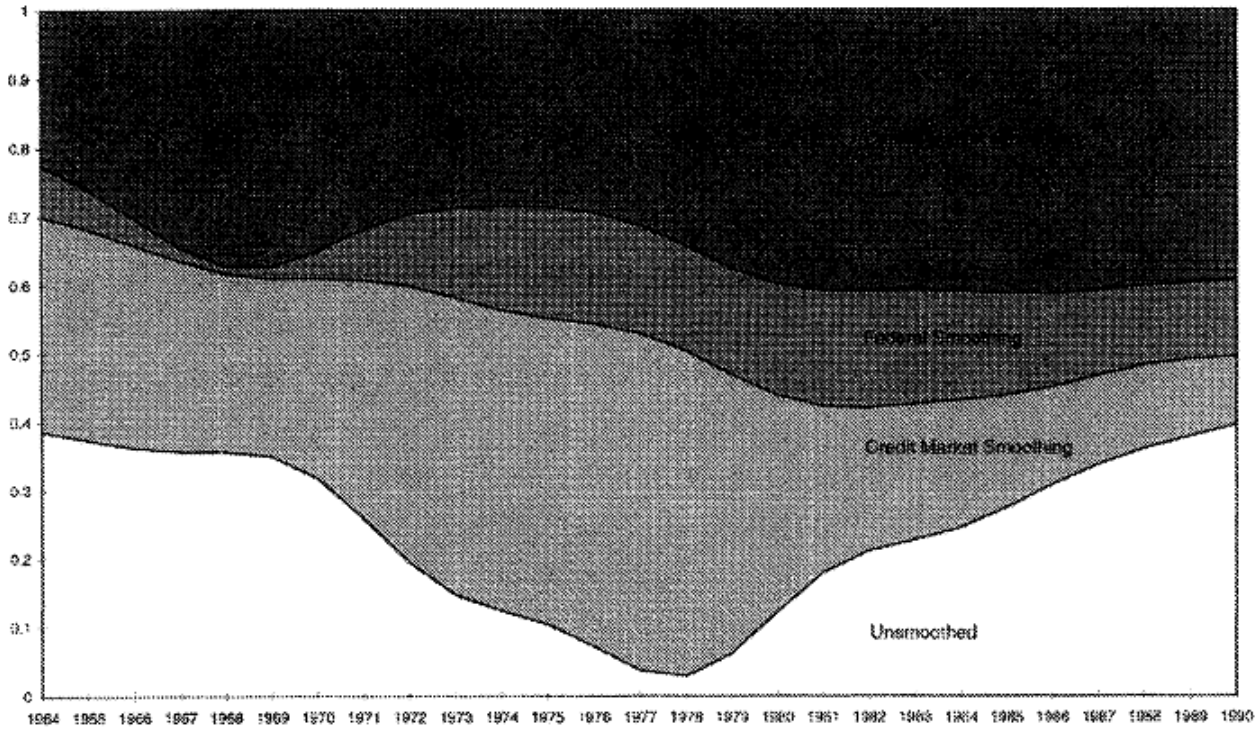


FIGURE I
Year-by-Year Income and Consumption Smoothing

Versus Big Finance

- Barattieri, Eden & Stevanovic (2013) "The Connection between Wall Street and Main Street: Measurement and Implications for Monetary Policy"

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

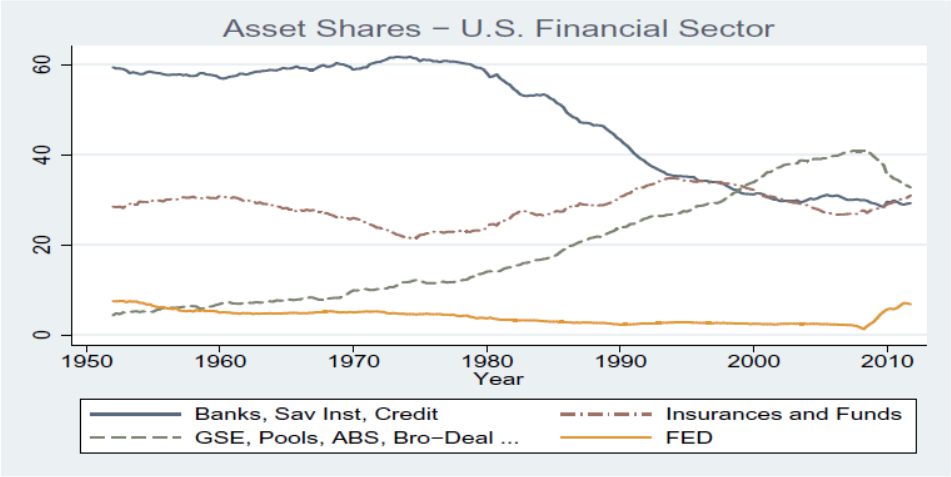
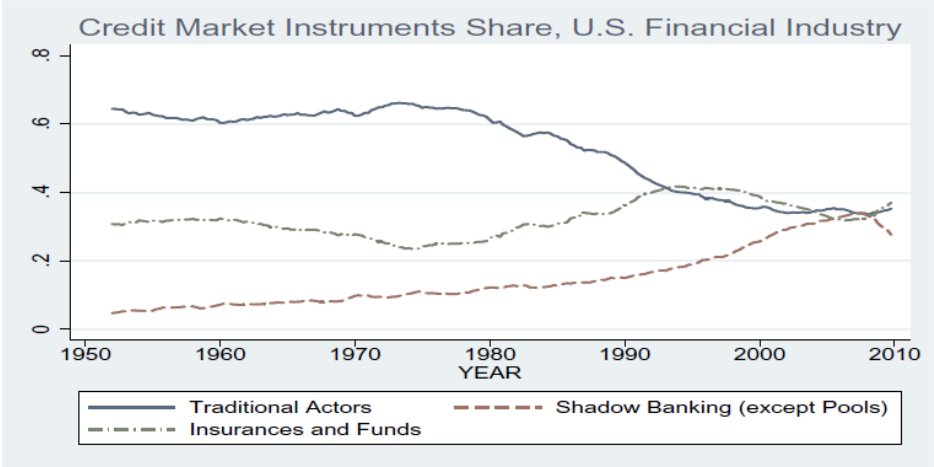
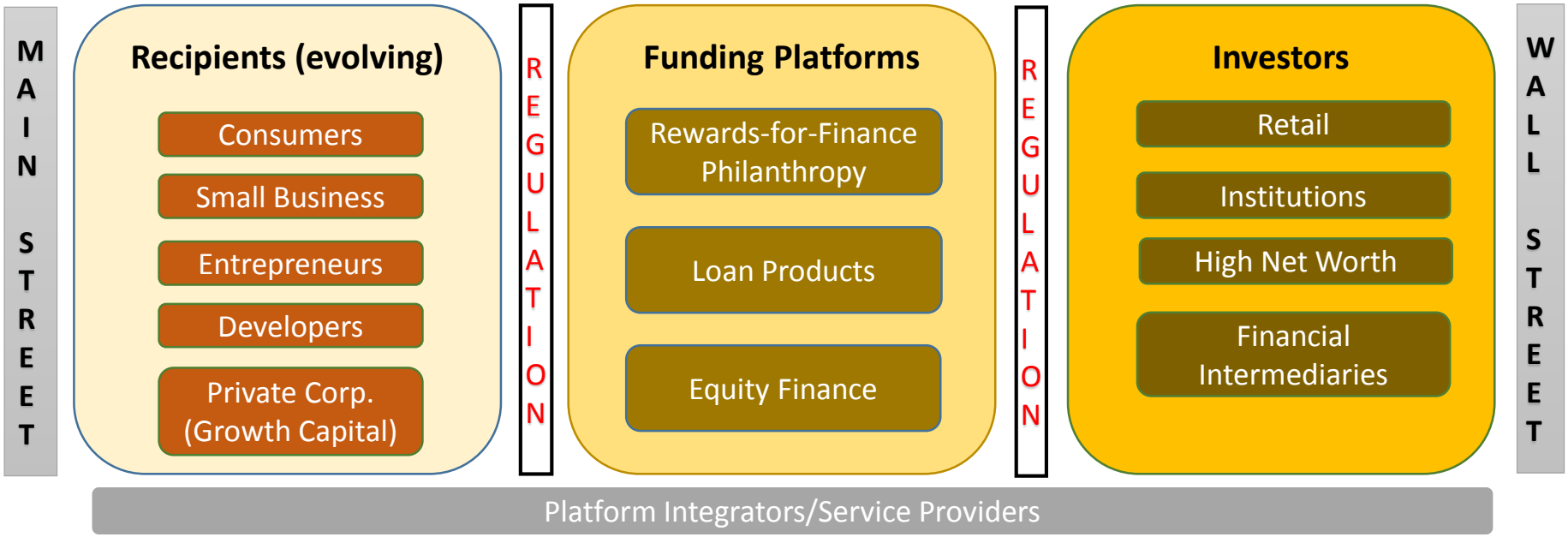


Figure 7: Shares of Credit Market Instruments



Crowdfunding and Marketplace Finance



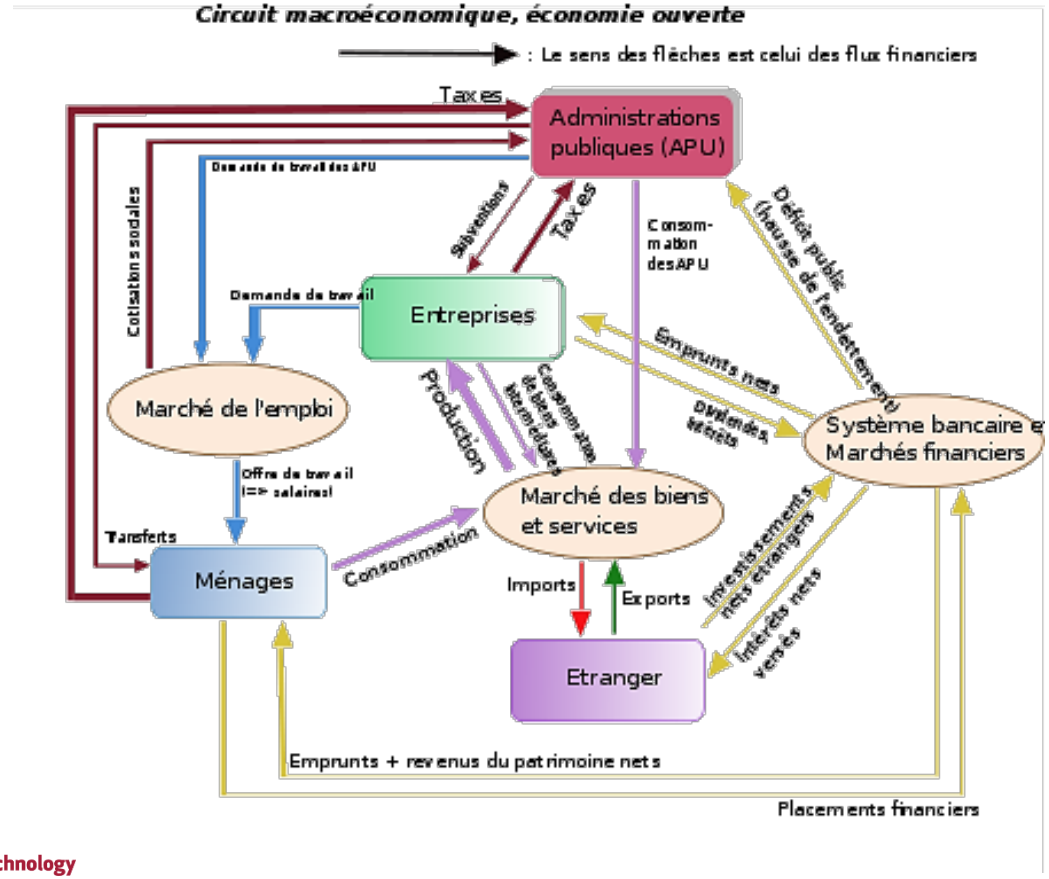
(Graphic courtesy of Adair Morse)

Recent Advances in Mapping Financial Systems: Big Data and Electronic Records

- Voluntary consumer linking services: Mint
  - Baker (2014) "Debt and the Consumption Response to Household Income Shocks"
- Federal Reserve Bank of New York data sets
  - Agueci et al (2014) "A Primer on the GCF Repo® Service"
  - CDS contracts on 35 North American financial firms (Shachar, 2013)
- New flow of funds for U.S.
  - Enhanced Financial Accounts: https://www.federalreserve.gov/apps/fof/efa/enhanced-financial-accounts.htm
- 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

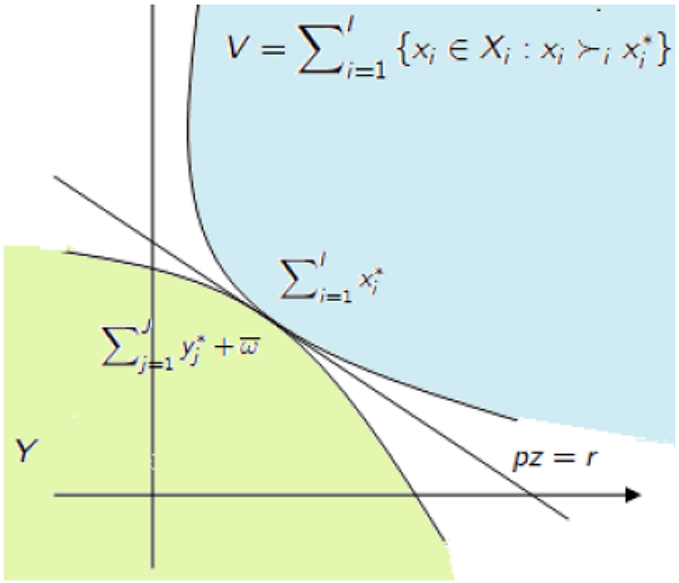


Figure 5: Second Welfare Theorem

Financial Accounts in General Equilibrium

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

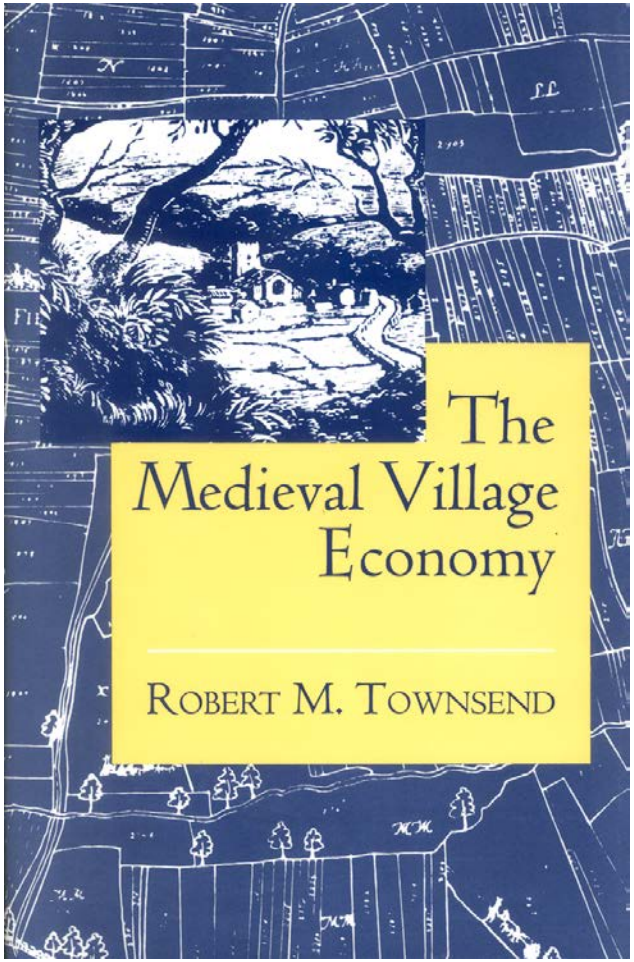
	Production of Good 1	Production of Good 2
Production		
Value of production	20	26
Value of input use of factor 1	12	10
Value of input use of factor 2	8	16
	Consumer 1	**Consumer 2**
Demands		
Value of demand for good 1	9	11
Value of demand for good 2	9	17
Income	18	28
Income sources		
Value of endowment of factor 1	10	12
Value of endowment of factor 2	8	16
Income	18	28

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
  - Ulph & Ulph (1975) “Transaction Costs in General Equilibrium Theory-A Survey”

Village Economies: A Way of Proceeding with Extensions

Townsend (1995) “Financial Systems in Northern Thai Villages”



- 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 9.4 Multiperiod private- and full-information solution, two goods

Values for $(\theta^a_{1x}, \theta^a_{1y})$	(c^a_x, c^a_y)	*Values for* (δ_x, δ_y)	*Values for* $\theta^a_{2x}, \theta^a_{2y}$	(c^a_x, c^a_y)	
(0.4, 0.6)	(2, 8)	(1, 1)	(0.6, 0.4)	8.01	2.0
		(0.5, 1.5)	(0.3, 0.6)	1.0	8.0
		(1.5, 0.5)	(0.9, 0.2)	10.0	0.82
(0.6, 0.4)	(8, 2)	(1, 1)	(0.4, 0.6)	2.0	8.0
		(0.5, 1.5)	(0.2, 0.9)	0.82	10.0
		(1.5, 0.5)	(0.6, 0.3)	8.0	1.0

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

	Location	*1*	*2*
Date	1	(a, b)	(a', b')
	2	(a, b')	(a', b)

Competitive Equilibria and Financial Modeling

- 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
  - Woodford (1998) “Doing Without Money: Controlling Inflation in a Post-Monetary World”
  - Buera & Nicolini (2014) “Liquidity Traps and Monetary Policy: Managing a Credit Crunch”

Again, to be realistic in structural modeling, , need computation

General Equilibrium and Guide to Policy Interventions

- 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

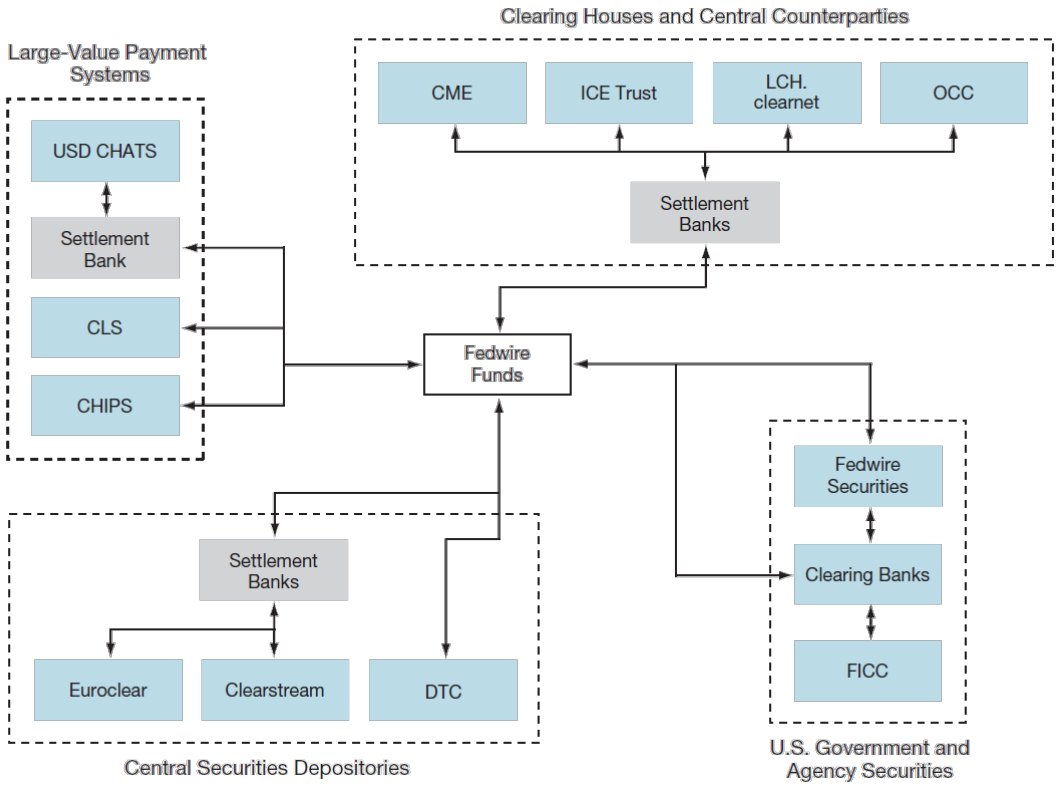
Actual Markets and Institutions: Good and Bad Forms of Trading Rules and Competition

- 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

- Wilson (1978) "Competitive Exchange"
  - 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[1]
    - Barter exchange as in Wicksell triangle[2]
- Dubey (1982) "Price-Quantity Strategic Market Games"
  - 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

The U.S. Dollar Wholesale Clearing and Settlement Network



[1] See the "Emergency Economic Stabalization Act of 2008" a copy of which can be found at this location: http://web.archive.org/web/20090110184334/http://www.uiowa.edu/ifdebook/issues/bailouts/eesa.shtml

[2] For example the bartering exchange IBE Barter. See http://ibebarter.com/

The Good: Trading Platforms

- Townsend (1983) "Theories of Intermediated Structures"
  - 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
    - Tepper (2015) "A Wholesale Online Market in China Offers a New Online Procurement Program"
- 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
    - Salmon, the U.S. salmon distribution system: Knapp, Roheim & Anderson (2007) The Great Salmon Run: Competition Between Wild and Farmed Salmon, Ch. 10.
    - Grain: Chicago Board of Trade (1982) "Grains, production, processing, marketing"
    - The competitive impact of commercial bank underwriting on the market for municipal revenue bonds: Daniels & Vijayakumar (2001) "The Competitive Impact of Commercial Bank Underwriting on the Market for Municipal Revenue Bonds"

Actual Markets And Institutions: The Bad (But With Potential Fixes)

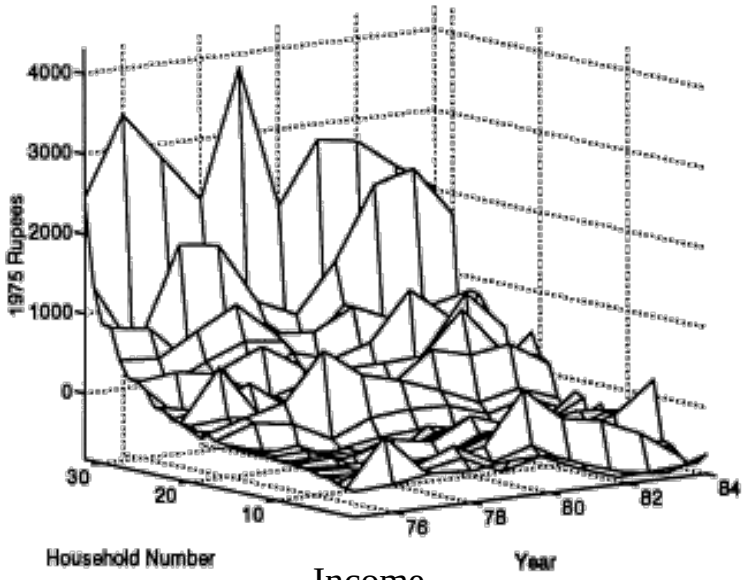
- Yanelle (1997) "Banking Competition and Market Efficiency"
  - First competition in the acquisition of funds for firms from lenders directly and banks for deposits from lenders, and then, second, competition of banks to fund firms
    - Considers an alternative version of this model where the timeline is rearranged so that banks first compete for projects before competing for loans
- Breuer, Jandacka, Summer & Vollbrecht (2015) "Endogenous 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

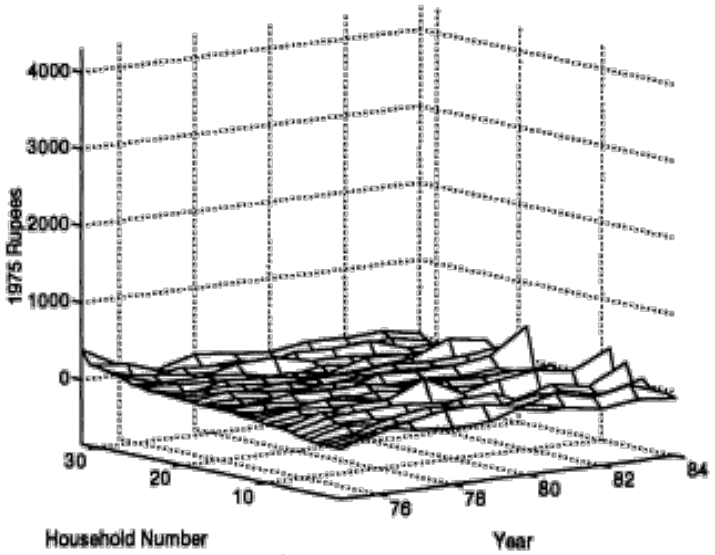
- Max weighted sums of ex ante expected utility subject to resource constraints, all in the space of state contingent goods (as usual). This delivers Pareto efficient allocations.
- Interpretation of the solution
  - Idiosyncratic shocks are shared and completely pooled away
  - Aggregate shocks must 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

Applications/Test at Village Level

- India: For the most part, come close to passing
  - Townsend (1994) “Risk and Insurance in Village India”



Income



Consumption

Decentralization in Markets: Another Interpretation

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

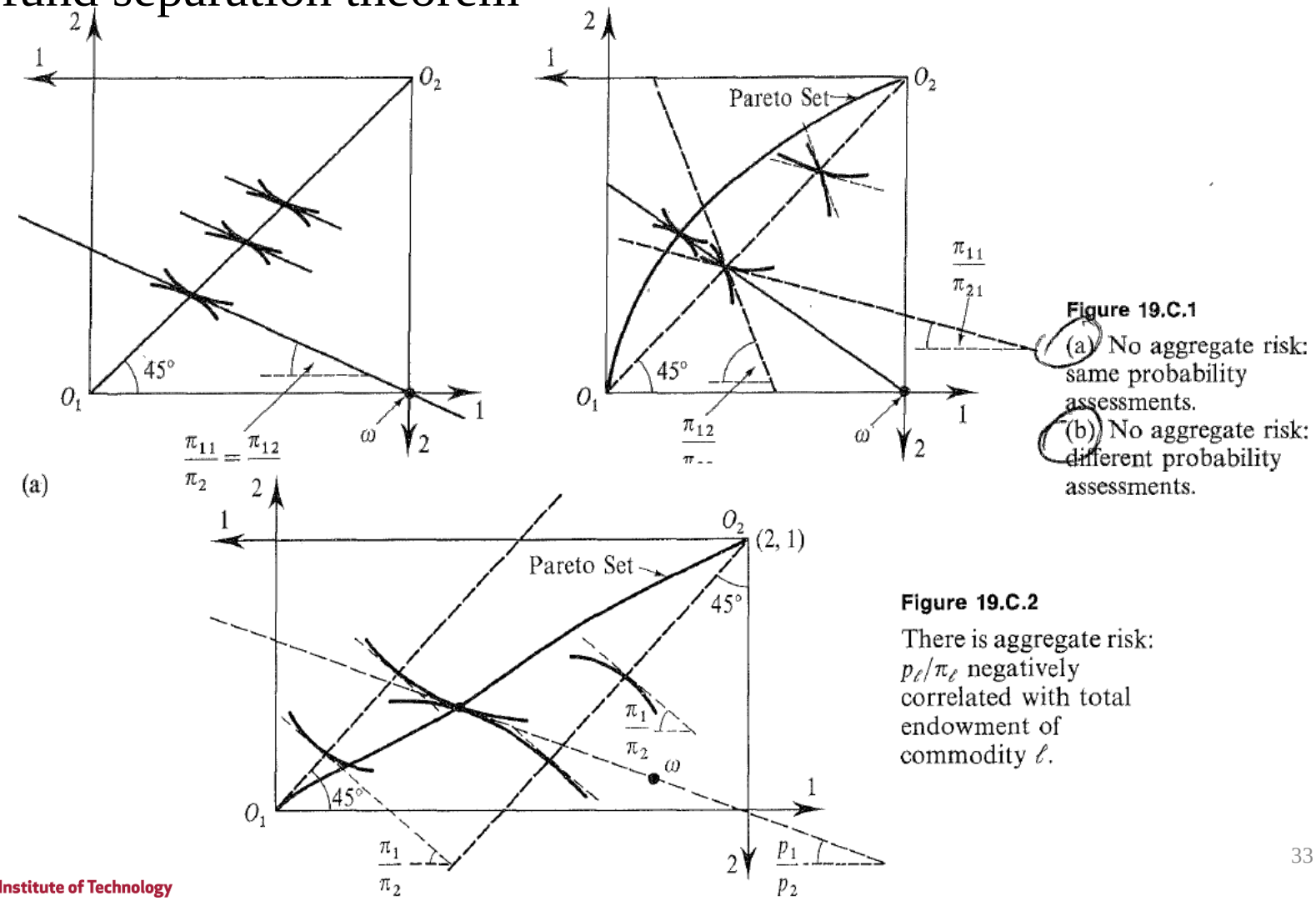


Figure 19.C.1
(a) No aggregate risk: same probability assessments.
(b) No aggregate risk: different probability assessments.

Figure 19.C.2
There is aggregate risk: p_ℓ/π_ℓ negatively correlated with total endowment of commodity ℓ.

Extensions of the Theory

- Testing within and across villages
  - Kenya: Suri (2013) “Estimating the Extent of Local Risk Sharing Between Households”
  - Thailand: Paweenawat & Townsend (2012) “Village Economic Accounts: Real and Financial Intertwined”
- Extension to
  - Production
  - Capital
  - Labor
- Extension to
  - Diversity in beliefs: Wilson (1968) “The Theory of Syndicates”
    - Optimal risk sharing allows trading that can resemble betting

Aggregating Up to Larger Units: Counties within a Country

Table 1

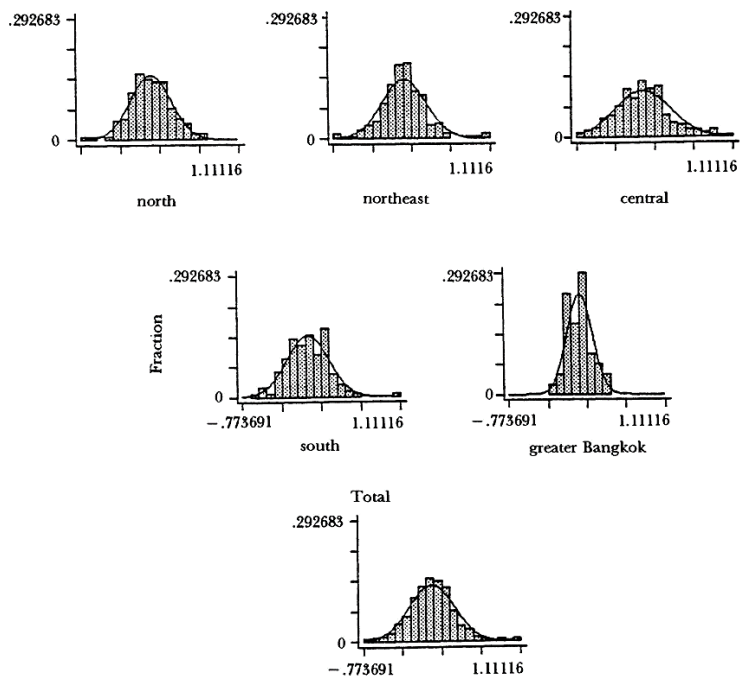
Number of Sampled Households and Amphoes

	Kingdom	*North*	*Northeast*	*Central*	*South*	*Bangkok*
Number of households in matched amphoes						
1975–81: 1975	8306	2008	2599	1709	986	1004
1981	8501	1784	2469	1637	923	1688
1981–86: 1981	1737	531	322	206	380	298
1986	2266	690	357	319	563	337
1986–88: 1986	7120	1633	1558	1691	1205	1033
1988	1905	431	347	321	403	403
1988–90: 1988	7351	1664	1688	1551	1192	1256
1990	8090	1690	1857	1688	1381	1474
Number of matched amphoes						
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



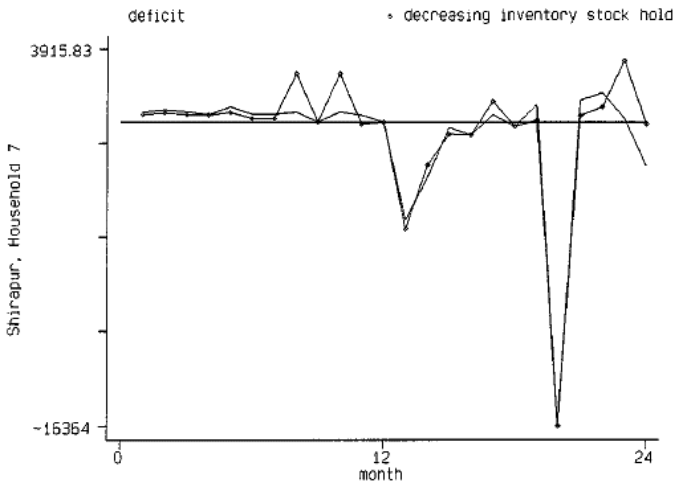
Notes: X-axis is county average income growth from 1988–1990 (1.0 = 100%). Y-axis is the fraction of counties in the regional sample with income growth in the various cells or categories. See Table 1 for details concerning the number of households and number of counties that underlie the graph.

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

VCOV in Thailand							
	D=C+I-Y				D=C-Y		
	1st	2nd	3rd		1st	2nd	3rd
Deposit	-0.0275	0.3217	5.3472	Deposit	-0.1994	0.1057	2.7157
ROSCA	0.0000	0.0000	0.0000	ROSCA	0.0000	0.0000	0.0000
Lending	0.0000	0.0000	0.0284	Lending	0.0000	0.0000	0.0116
Borrowing	-0.0110	0.9701	8.5992	Borrowing	-0.8406	0.2031	5.5284
Gift	2.8147	11.6544	36.9412	Gift	1.3905	6.5552	27.1336
Cash	35.4849	65.0895	86.5538	Cash	32.0445	63.7537	87.4978

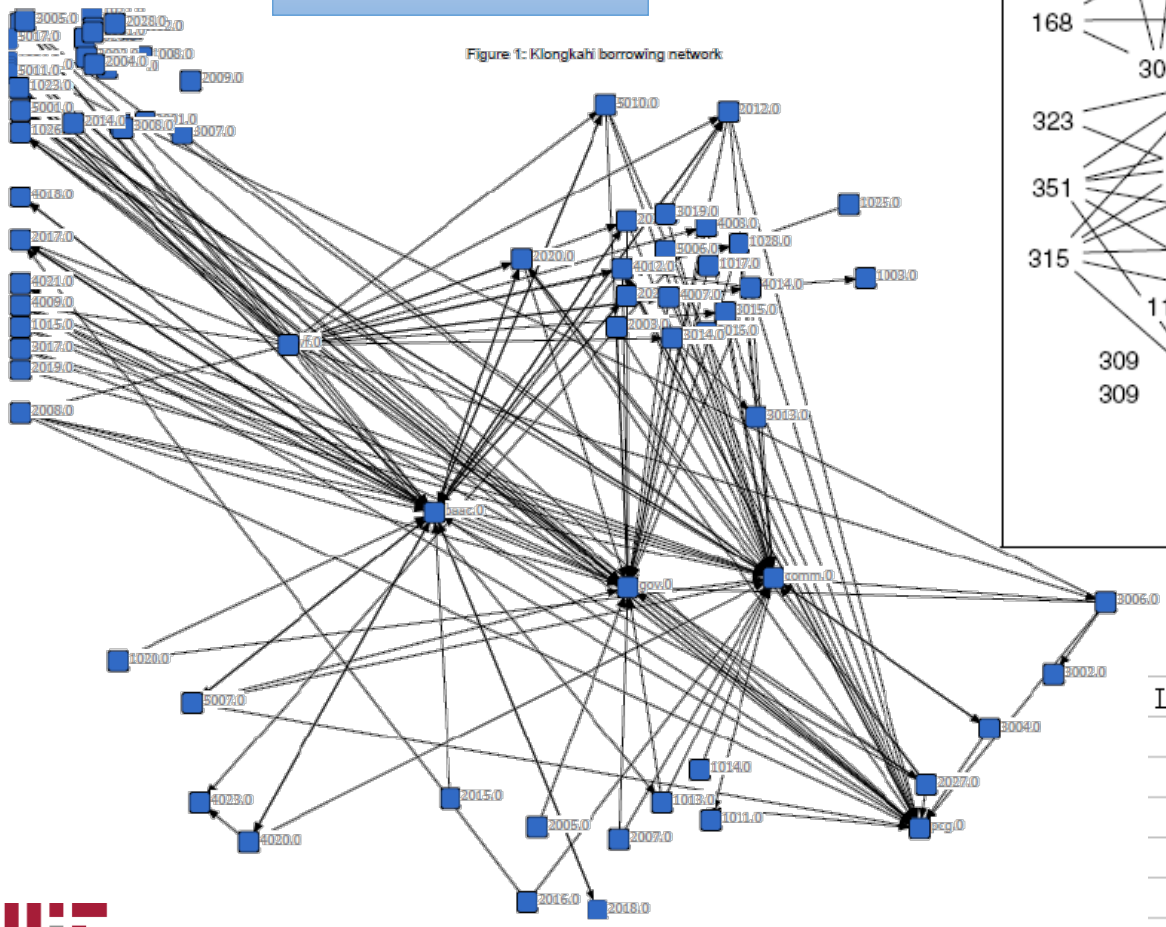
Lim and Townsend (1998), RMSE



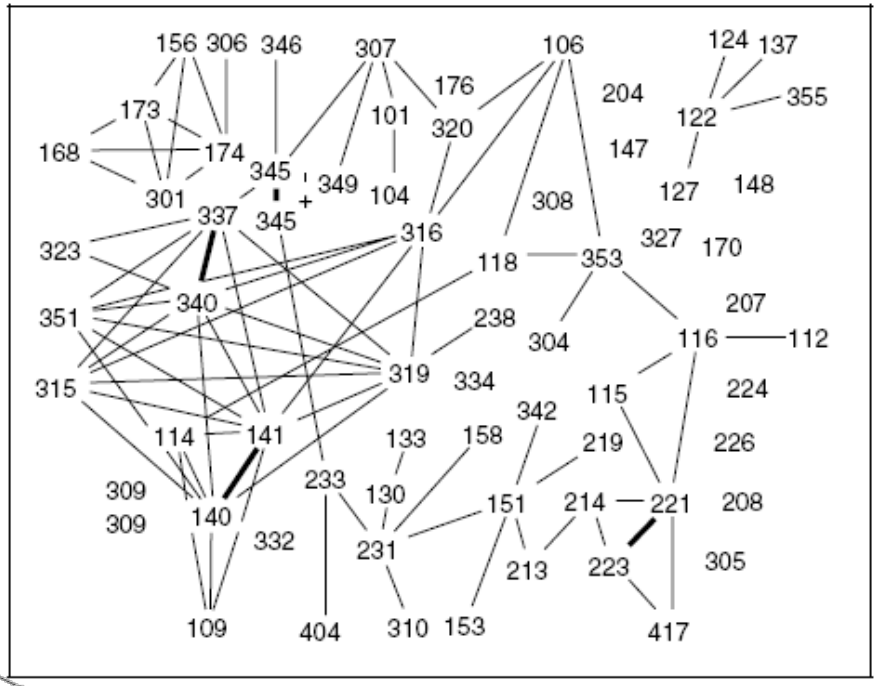
Transactions Within Sector: Household
(Kinnan & Townsend, 2012; Sripakdeevong)

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

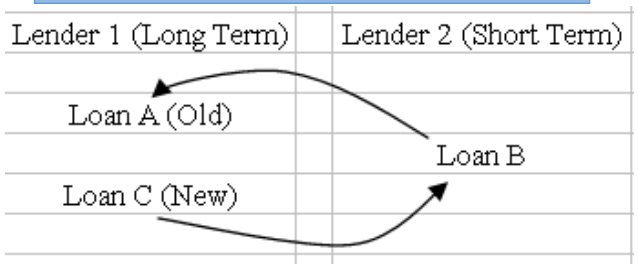
Active Financial Network



Family Ties



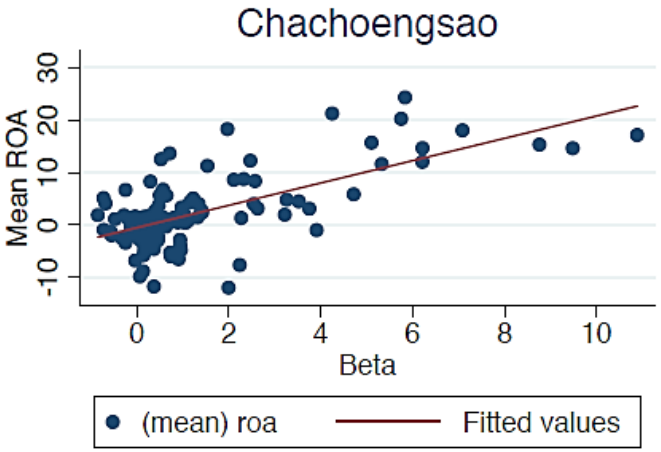
Bridge Loans: Correlation Between Amount Repaid and Amount Borrowed

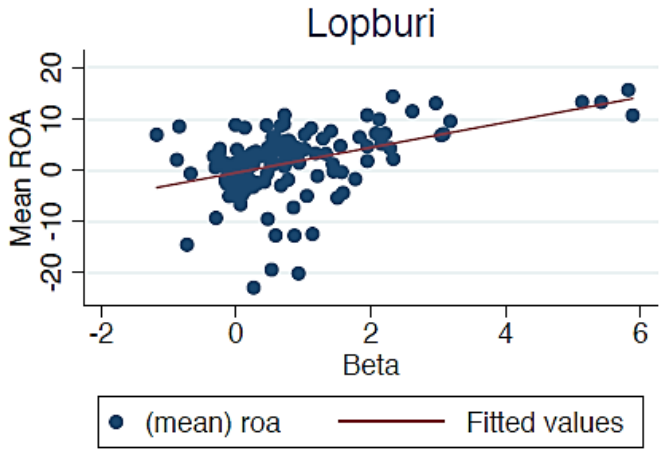


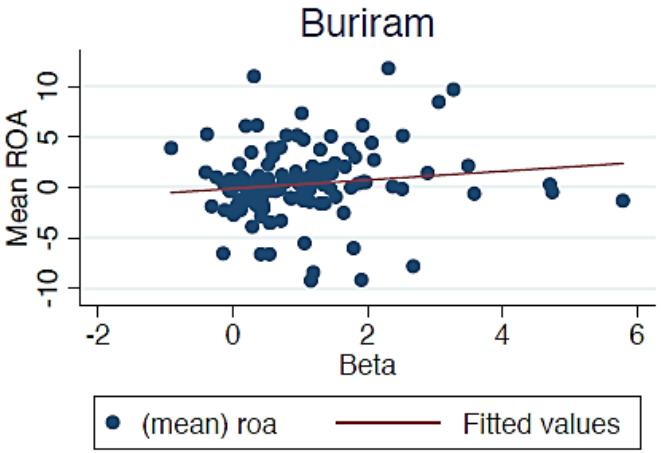
Featured Institutions: In the U.S.

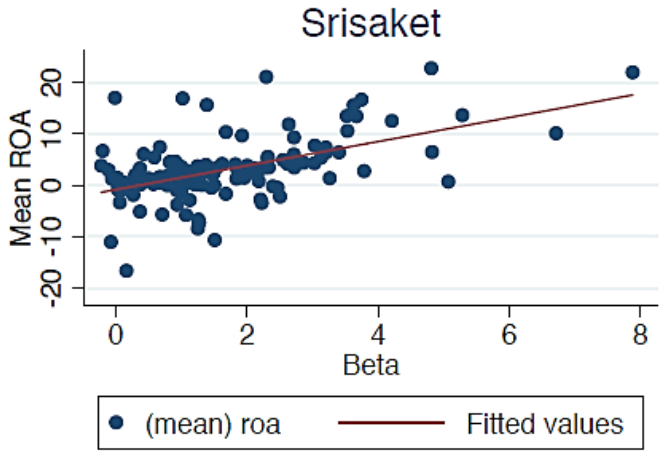
- U.S. applications/institutions, both historical and contemporary
  - Historical: Mutual insurance societies in the U.S.
    - Ben Franklin
  - Central Counterparty Clearing, mutualization of losses: Clavijo (2013) “Risk Capital Allocation for a Guarantee Fund in a Central Counterparty Clearing House”
  - Portfolios of stock, index funds
  - Hurricanes, Futures for weather damage: CME Group's temperature-based index futures and options http://www.cmegroup.com/trading/weather/
  - Case-Shiller index for mortgages: Shiller (1993) Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks

CAPM taken to Village Risk









Decomposition of Risk and Risk Premia

Panel A: Simple Model

Panel A.1: Decomposition of Risk (Variance)

Region:	Central		Northeast	
Township (Province):	Chachoengsao	Lopburi	Buriram	Srisaket
Aggregate Risk	1.9%	2.4%	6.0%	34.1%
Idiosyncratic Risk	98.1%	97.6%	94.0%	65.9%

Panel A.2: Decomposition of Risk Premium

Region:	Central		Northeast	
Township (Province):	Chachoengsao	Lopburi	Buriram	Srisaket
Aggregate Risk	78.4%	38.5%	-18.7%	71.2%
Idiosyncratic Risk	21.6%	61.5%	118.7%	28.8%
Number of Observations	129	140	131	141

Panel B: Robustness Model

Panel B.1: Decomposition of Risk (Variance)

Region:	Central		Northeast	
Township (Province):	Chachoengsao	Lopburi	Buriram	Srisaket
Aggregate Risk	15.1%	12.0%	20.3%	45.0%
Idiosyncratic Risk	84.9%	88.0%	79.7%	55.0%

Panel B.2: Decomposition of Risk Premium

Region:	Central		Northeast	
Township (Province):	Chachoengsao	Lopburi	Buriram	Srisaket
Aggregate Risk	67.4%	45.1%	11.6%	80.5%
Idiosyncratic Risk	32.6%	54.9%	88.4%	19.5%
Number of Observations	129	140	131	141

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

	Central		Northeast	
	Chachoengsao	Lopburi	Buriram	Srisaket
Correlation Coefficient	-0.0844***	-0.0303***	-0.0097	-0.0409***
	(0.0000)	(0.0001)	(0.0904)	(0.0000)
Number of Observations	18,241	16,698	30,574	29,470

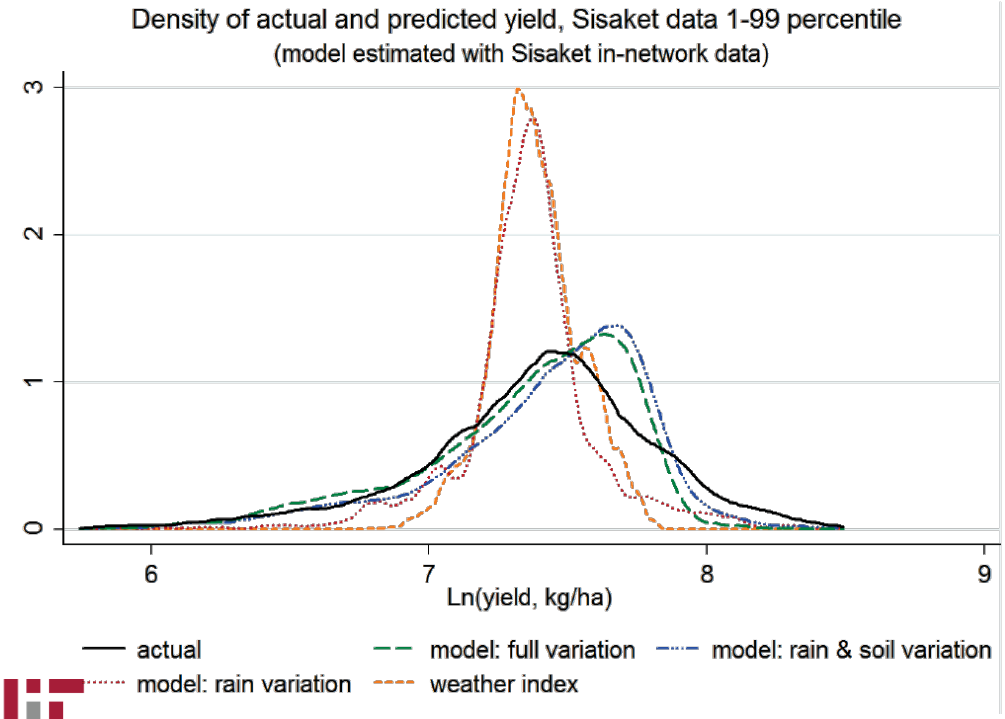
Remark: Unit of observation is round-month-household, where each round represents a moving time window. Gift received in thousand bahts. Idiosyncratic component of ROA is computed from the residual from equation (6). *** p-value<0.01.

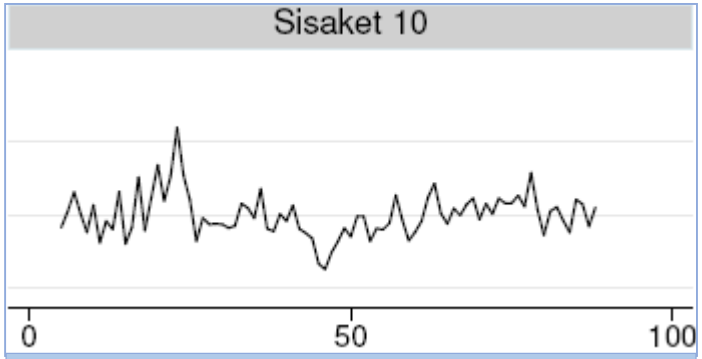
Policy Implications

- 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
  - Chandrasekhar, Townsend & Xandri (2015) "Network Financial Centrality and the Price of Personalized Debt"
- 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

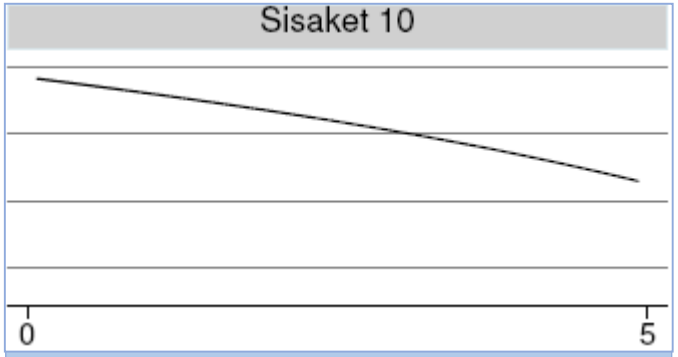
Policy Implications from General Equilibrium

- 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
  - Chiappori, Samphantharak, Schulhofer-Wohl and Townsend (2014) "Heterogeneity and Risk-Sharing in Village Economies"
- Evidence from aggregate rainfall shocks and take up
  - Tazhibayeva & Townsend (2012) "The Impact of Climate Change on Rice Yields: Heterogeneity and Uncertainty"





Aggregate Shocks



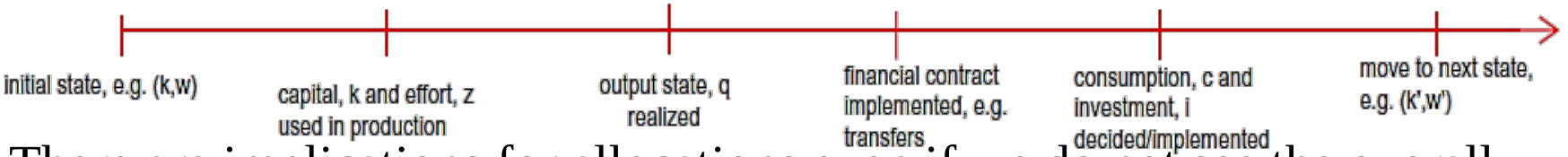
Welfare gains & losses of removing aggregate shocks

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
  - Long term relationships for borrowing/lending and insurance Pareto dominate single-period spot contracting: Townsend (1982) “Optimal Multiperiod Contracts and the Gain from Enduring Relationships under Private Information”
  - 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

Entire Period 1999 to 2011 (C,Q, I, K Low Wealth 25%)							
	stde	sigma	theta	mu	gamma	Kapa	MLE
MH	0.2174	0.0007	1.0239	0.3515	0.0479		-6.5882
S	0.1382	1.1059	1.9868	0.0005	0.7669		-6.2584
B	0.1382	1.4064	1.9054	0.0001	0.9710		-6.2408
CSV	0.13667	0.107844	0.150309	0.20104	0.159595	0.093571	-6.1728

Entire Period 1999 to 2011 (C,Q, I, K Low Wealth 25%)							
	Kapa	stde	sigma	theta	mu	gamma	MLE
KIN 0 (no relatives)	0.203689	0.299533	0.060515	0.142807	0.567956	0.015246	8.4573
KIN 1-10	0.015712	0.198685	0.012259	0.191398	0.246769	0.094437	6.4108

Family Networks in Spain, Unbanked but..

- 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 fisicas 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

	A. firms in family network				B. firms not in network			
Comparison:	MH v B	MH v A	B v A	Best fit	MH v B	MH v A	B v A	Best fit
1. Whole sample, 1997-00, continuing banking status								
1.1 1997, unbanked	B***	A***	B**	**B**	MH***	A**	A***	**A**
1.2 1997, single-banked	MH***	tie	A***	**MH,A**	B**	MH**	B***	**B**
1.3 1997, multi-banked	B***	A***	B***	**B**	B***	MH***	B***	**B**
1.4 2000, unbanked	tie	tie	B***	**B,MH**	tie	A***	A***	**A**
1.5 2000, single-banked	MH***	MH*	A***	**MH**	B***	MH***	B***	**B**
1.6 2000, multi-banked	B***	MH***	B***	**B**	B***	MH***	B***	**B**

Competitive Markets with Private Information

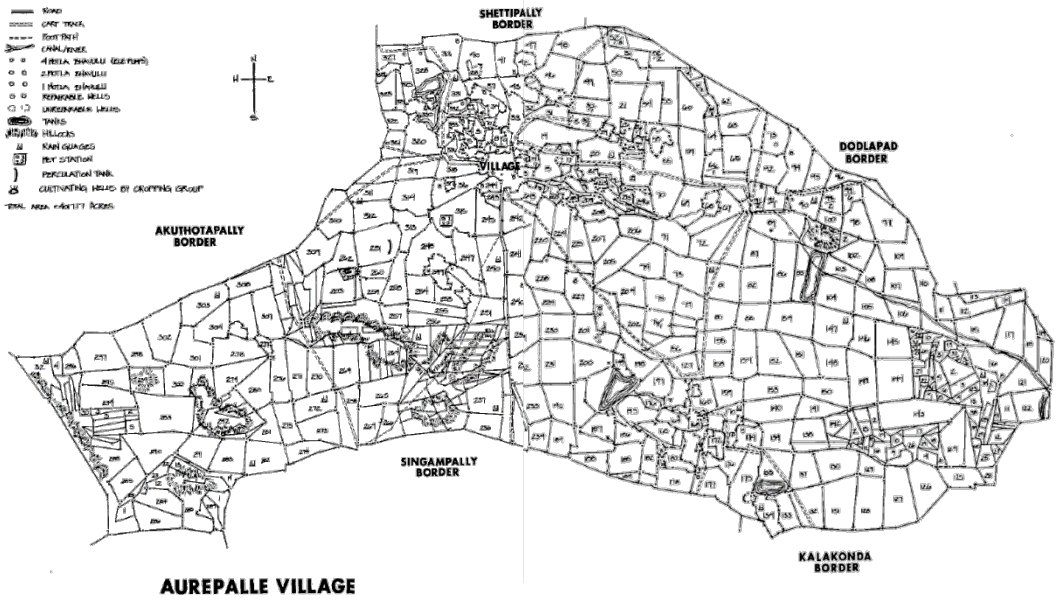
- Much of the policy literature implicitly builds on the view that limited information can cause a problem for the operation of competitive markets
- Key references
  - Stiglitz & Weiss (1981) "Credit Rationing in Markets with Imperfect Information"
  - Rothschild & Stiglitz (1976) "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of 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
  - Preference/liquidity shocks: Prescott & Townsend (1984) "General Competitive Analysis in an Economy with Private Information"
  - Labor supply: Prescott & Townsend (1984) "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard"
  - Single firms with moral hazard: Prescott & Townsend (2006) "Firms as Clubs in Walrasian Markets with Private Information"
- 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"



- Equity syndicates: Agrawal, Catalini & Goldfarb (2015) "Are Syndicates the Killer App of Equity Crowdfunding?"
  - 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 there unobserved shocks
  - Jacklin (1987) "Demand Deposits, Trading Restrictions, and Risk Sharing"
- 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
  - Allen & Gale (2004) "Financial Intermediaries and Markets"
- 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:
    - Netzer & Scheuer (2010) "Competitive Markets without Commitment"
    - Bisin & Gottardi (2006) "Efficient Competitive Equilibria with Adverse Selection"
    - Competition with menus and commitment can work
      - Townsend & Zhorin (2014) "Spatial Competition among Financial Service Providers and Optimal Contract Design"

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
    - Diamond (1984) “Financial Intermediation and Delegated Monitoring”
  - And credit registries, covenants
    - Bizer & DeMarzo (1992) “Sequential Banking”
  - Direct financing in markets vs. bank intermediation
    - Bank coalitions are best: Boyd & Prescott (1986) “Financial Intermediary-Coalitions”
  - Risk innovation: Acemoglu & Zilibotti (1997) “Was Prometheus Unbound By Chance? Risk, Diversification and Growth”
    - 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.
- Two-sided markets: Jain and Townsend (2015) "The Economics of Platforms in a Walrasian Framework"
  - Applicability to
    - credit card networks (merchants and consumers), interchange fees, mkt participation fees
    - Competition determines the number and mix of platforms and their users
- Kilenthong & Townsend (2015) "A Market Based Solution for Fire Sales: Segregated Security Exchanges with Ex Ante Rights to Trade"
  - 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
  - Using data on repayment in joint liability borrower groups in Thailand: Ahlin and Townsend (2007) "Using Repayment Data to Test Across Models of Joint Liability Lending"
    - 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

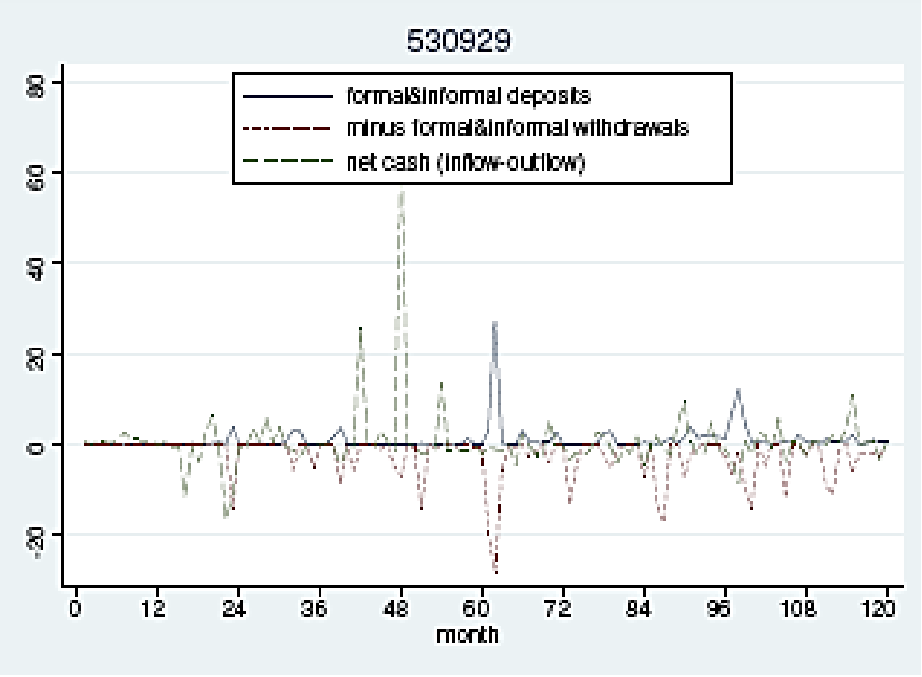
Hybrid Systems

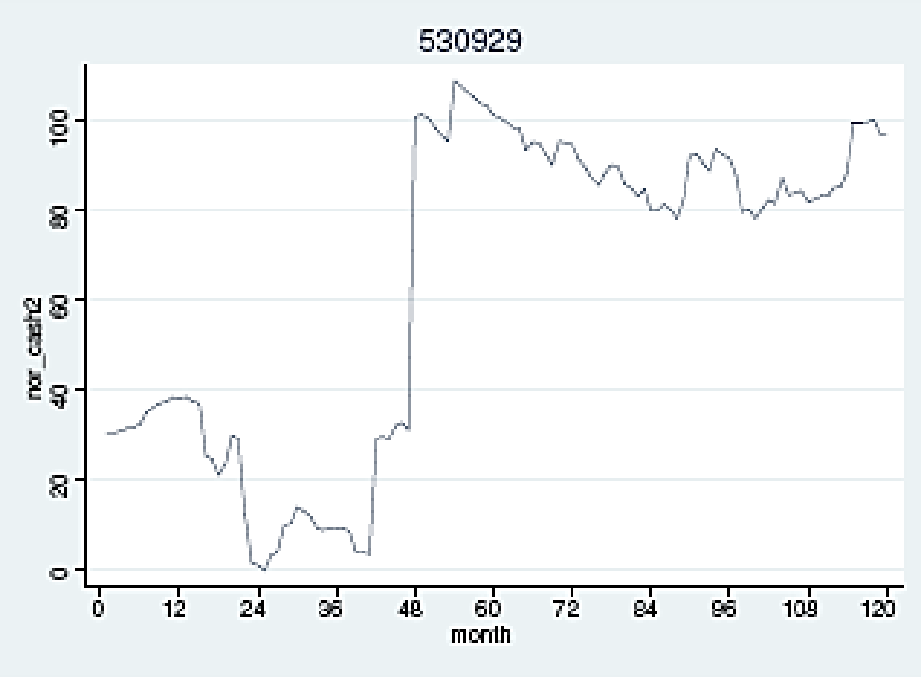
- Endogenous Fluctuation
  - This same model of relative performance and risk sharing groups can address fluctuations and even seeming crisis and institutional forms flip back and forth with high frequency
- Endogenous and optimal ex post contagion: Bond (2004) “Bank and Nonbank Financial Intermediation”
  - 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

Money, Payments, Clearing and Credit

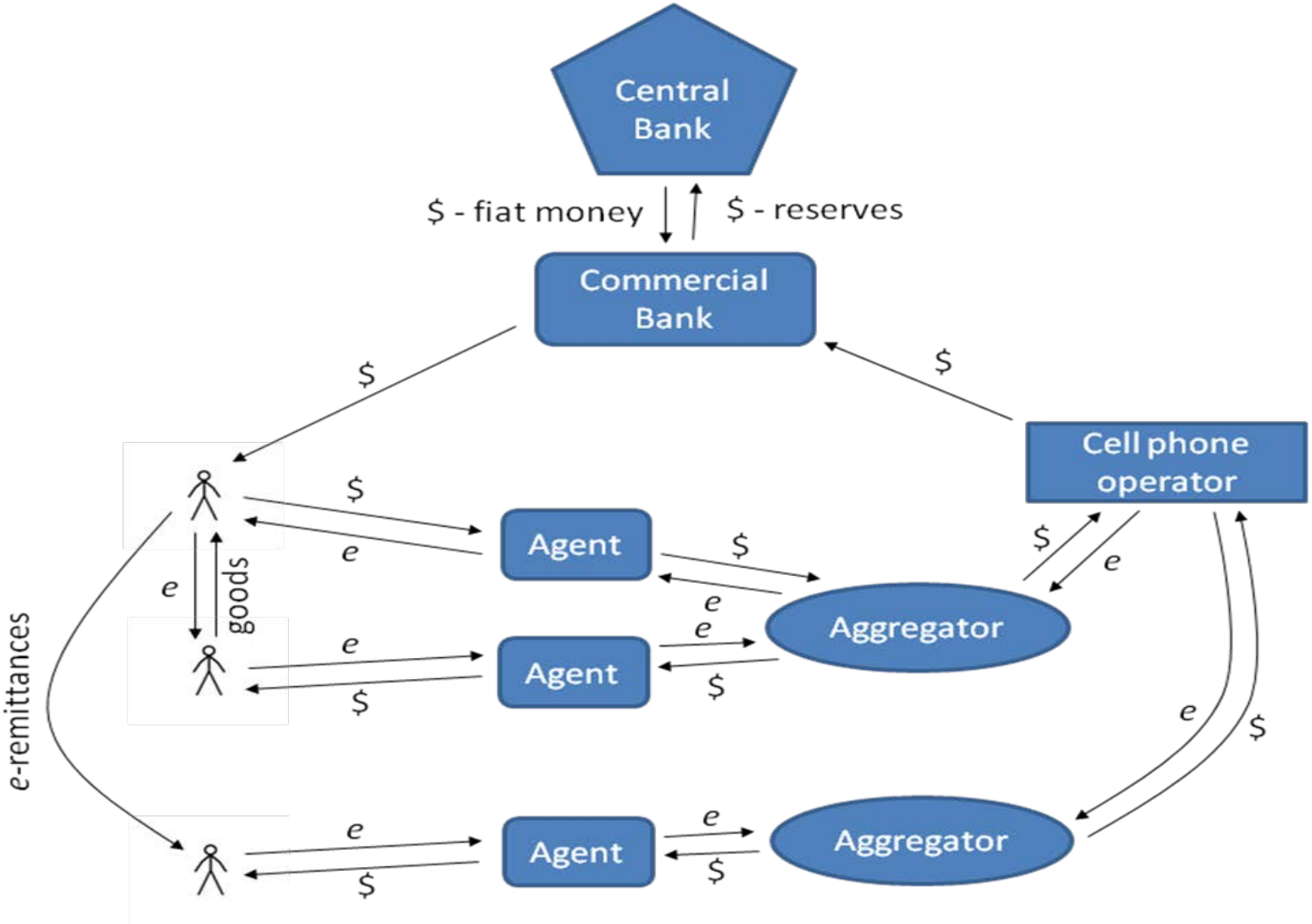
- monetary policy, the provision of central bank money to financial institutions and markets, (or liquidity policy)
- whether liquidity shortages and other liquidity problems such as clearing require external remedies (or industry self-regulation)
- It proves useful to consider models with explicit micro underpinnings and, ideally, to couple this with the requisite measurement

Cash Management in Thailand





Flows of Fiat Money and E-money



A Survey of 250 M-PESA Agents in Kenya in Late 2008: Liquidity, Shortages

Table 5: How Often Do Agents Run Out?

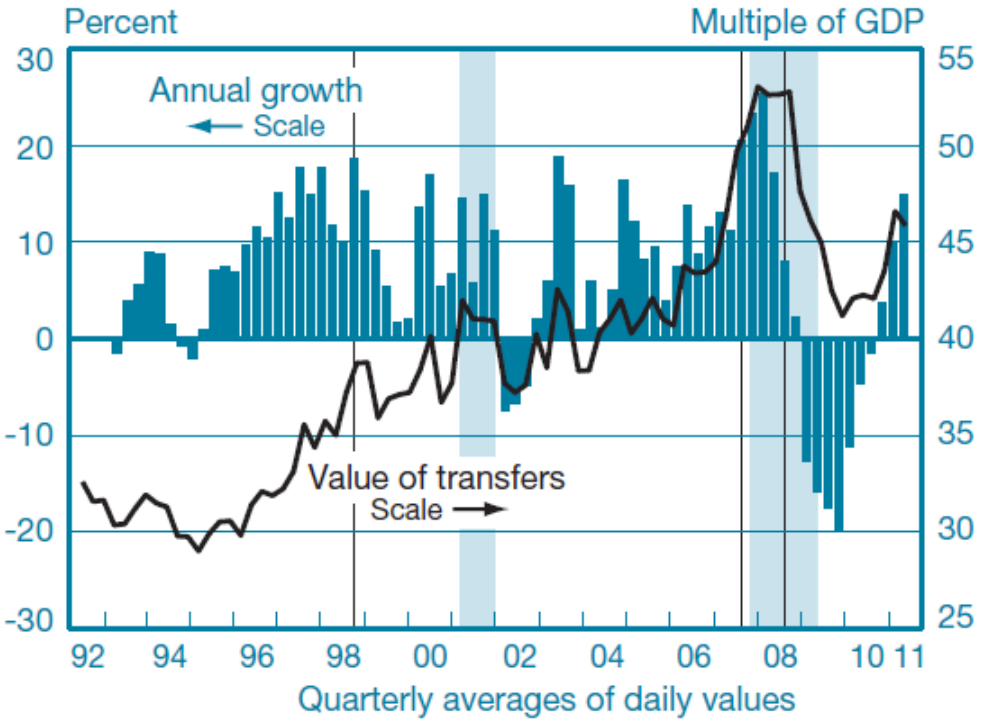
e-Money		Cash	
	Fraction		Fraction
More than once a day	3.2%	More than once a day	3.2%
Once a day	6.4%	Once a day	8.4%
Once a week	14%	Once a week	10%
Once a month	5.6%	Once a month	4.8%
Once every three months	1.2%	Once every three months	1.2%
Once every six months	0.4%	Once every six months	0.4%
Less often than that	12%	Less often than that	22.4%
Never	57.2%	Never	49.6%

"Settlement Liquidity and Monetary Policy Implementation — Lessons from the Financial Crisis"
(Bech, Martin and McAndrews, 2012)

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.

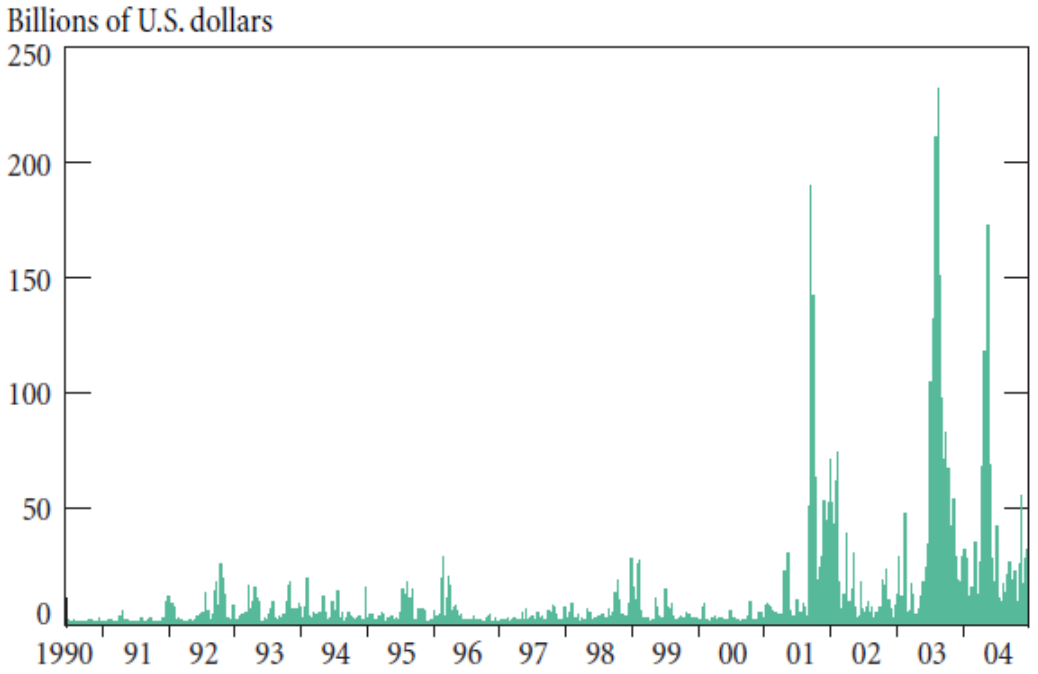
Notes: Vertical lines denote September 23, 1998, August 9, 2007, and September 15, 2008. Bands denote NBER recessions.

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

Chart 1

Settlement Fails in U.S. Treasury Securities



Source: Federal Reserve Bank of New York, <http://www.newyorkfed.org/markets/pridealers_failsdata.html>.

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
    - For example, deficit-inducing trades, as in purchases before sales, are allowed but are required to be matched with surplus-generating trades
  - Issues arise
    - How long can deferred payments be deferred, who is keeping track of what, and what about the possibility of bankruptcy.

Back to Theory: How to Design Payments (cont.)

- 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