

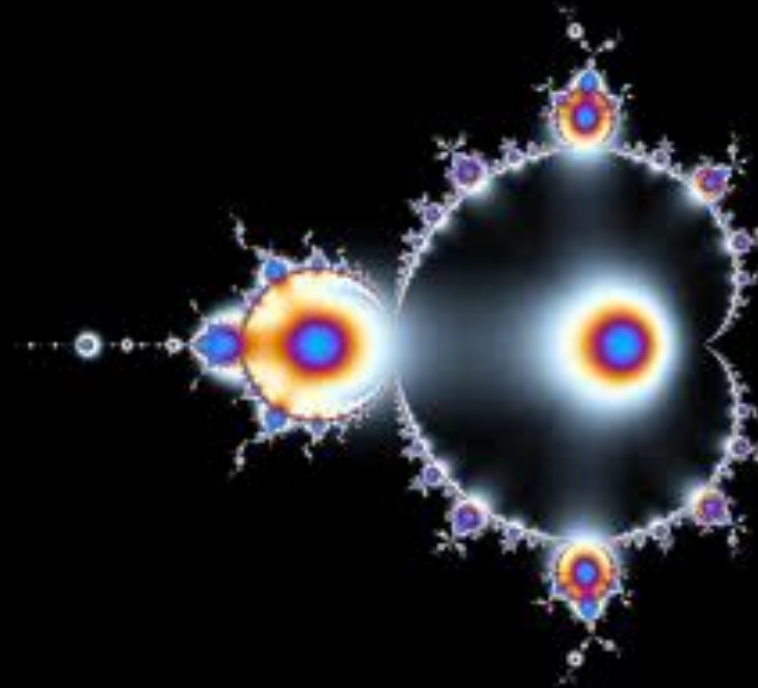
# Mismanaging Complexity

- 1. Fat Tails vs. Fat Heads,  
Black Swans vs. Black Scholes**
- 2. Hierarchical Networks**
- 3. Complexity and Collapse**

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# 1: FAT TAILS vs. FAT HEADS BLACK SWANS vs. BLACK SCHOLES



## NEWTONIAN PHYSICS, ECONOMICS, AND FINANCE

- ***Newton: the complex motion of heavenly bodies has a simple, deep structure: mathematical laws.***
- ***The physical universe regulates itself like clockwork. No need for a divine being to intervene, except to set the rules.***
- ***Adam Smith: a complex economy regulates itself, as if by an invisible hand. No need for governments to intervene, except to set the rules.***
- ***Capital allocation can be ordered by a few rules. Even uncertainty can be tamed by:***
  - ***Arbitrage on markets that impound all information in asset prices.***
  - ***Mathematics of diffusion processes, option pricing, Value at Risk, credit ratings, etc.***
- ***“The Washington Consensus” was that “the Great Moderation” ensued from “deep, liquid, well-regulated financial markets”.***

## **“THE COMING COLLAPSE OF CHINA”**

- ***Gordon Chang: China’s state firms are insolvent, as are its state banks. A bank run will collapse Party rule.***
- ***Will Hutton: “The Writing is on the Wall”. To survive, China must learn the Enlightenment virtues of democracy and rule-based governance.***

### **HOWEVER...**

- ***Wall Street self-destructed. Then US rule-based governance failed to tighten financial rules whose inadequacy was clear***
  - ***Bloomberg 30/6/10: Volcker .. Disappointed With Final Version of His Rule.***

### **WHILE...**

- ***China’s unruly “social market economy with Chinese characteristics” powered through the financial crisis.***
  - ***Bloomberg 13/1/2011: China Overtakes U.S. as Biggest Economy When Measured by Purchasing Power***



## POST-NEWTONIAN MATHS FORETELLS THE FALL OF NEWTONIAN ECONOMICS

- ***The Great Moderation saw the rise of Post-Newtonian mathematics, which upstaged Newtonian mathematics via realistic representations of natural systems (mountains, coastlines, turbulent flow, weather) that are:***
  - ***Super-sensitive to initial conditions (Chaos Theory)***
  - ***Self-similar (The Fractal Geometry of Nature)***
  - ***Prone to sudden collapse because governed by power laws (Self-Organized Criticality)***
- ***Post-Newtonian maths foretold the sudden collapse of Newtonian finance, for***
  - ***Financial systems evolve chaotically***
  - ***Financial returns are self-similar***
  - ***Self-similar systems are governed by power laws that imply a high probability of extreme outcomes (fat tails).***

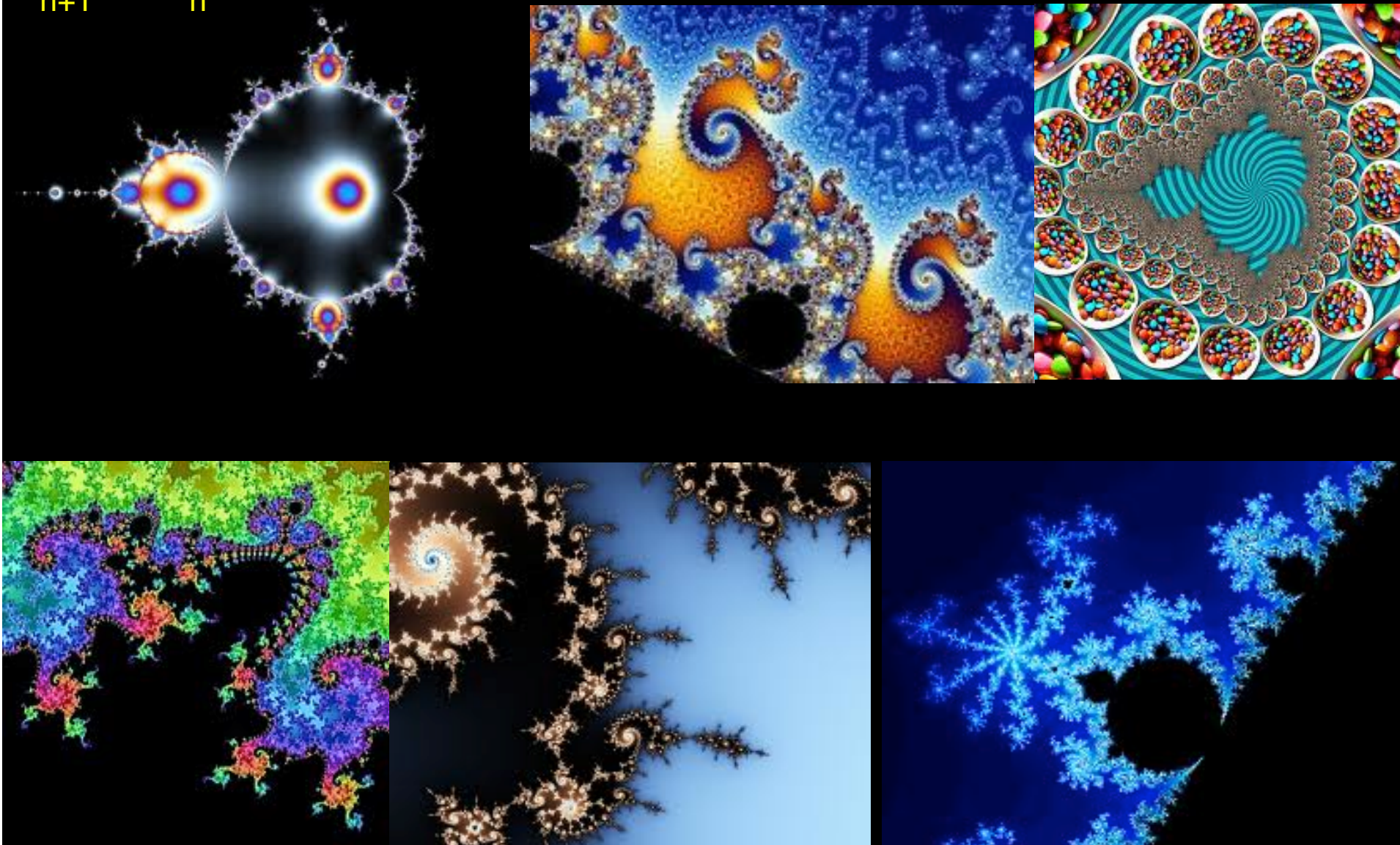
# Chaos Theory

$$x \rightarrow r x (1 - x)$$



# Fractals: Self-Similarity

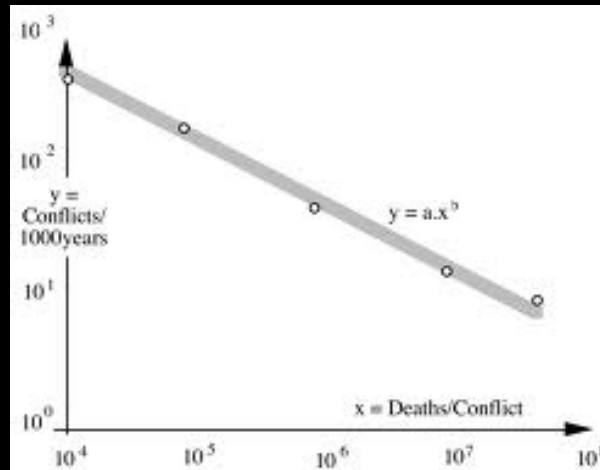
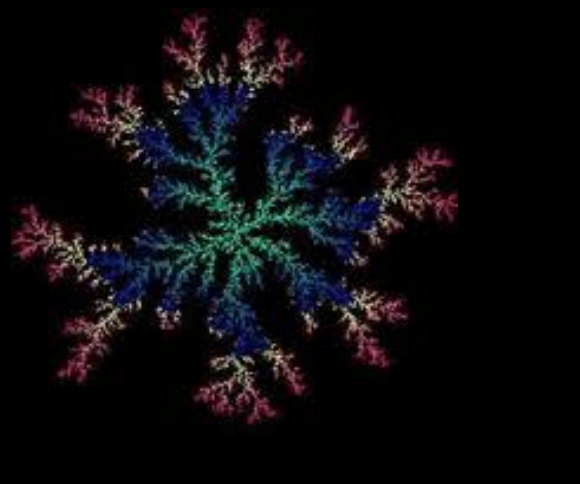
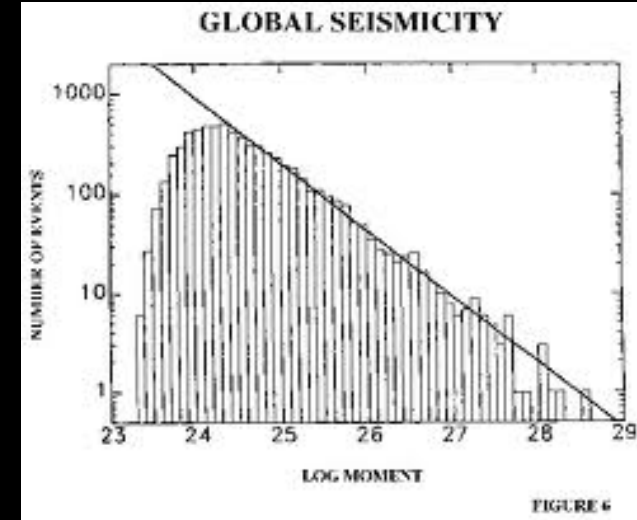
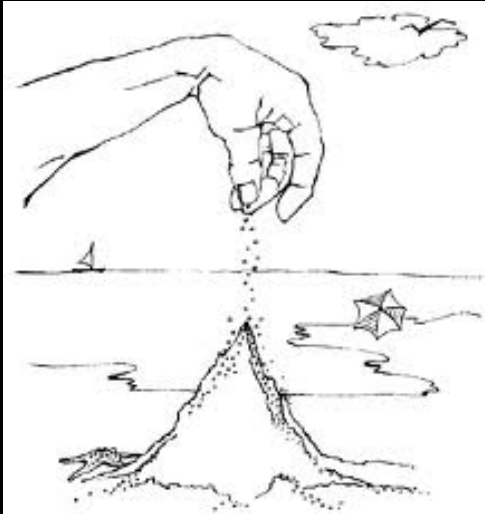
$$z_{n+1} \rightarrow z_n^2 + c$$





# Self-Organized Criticality

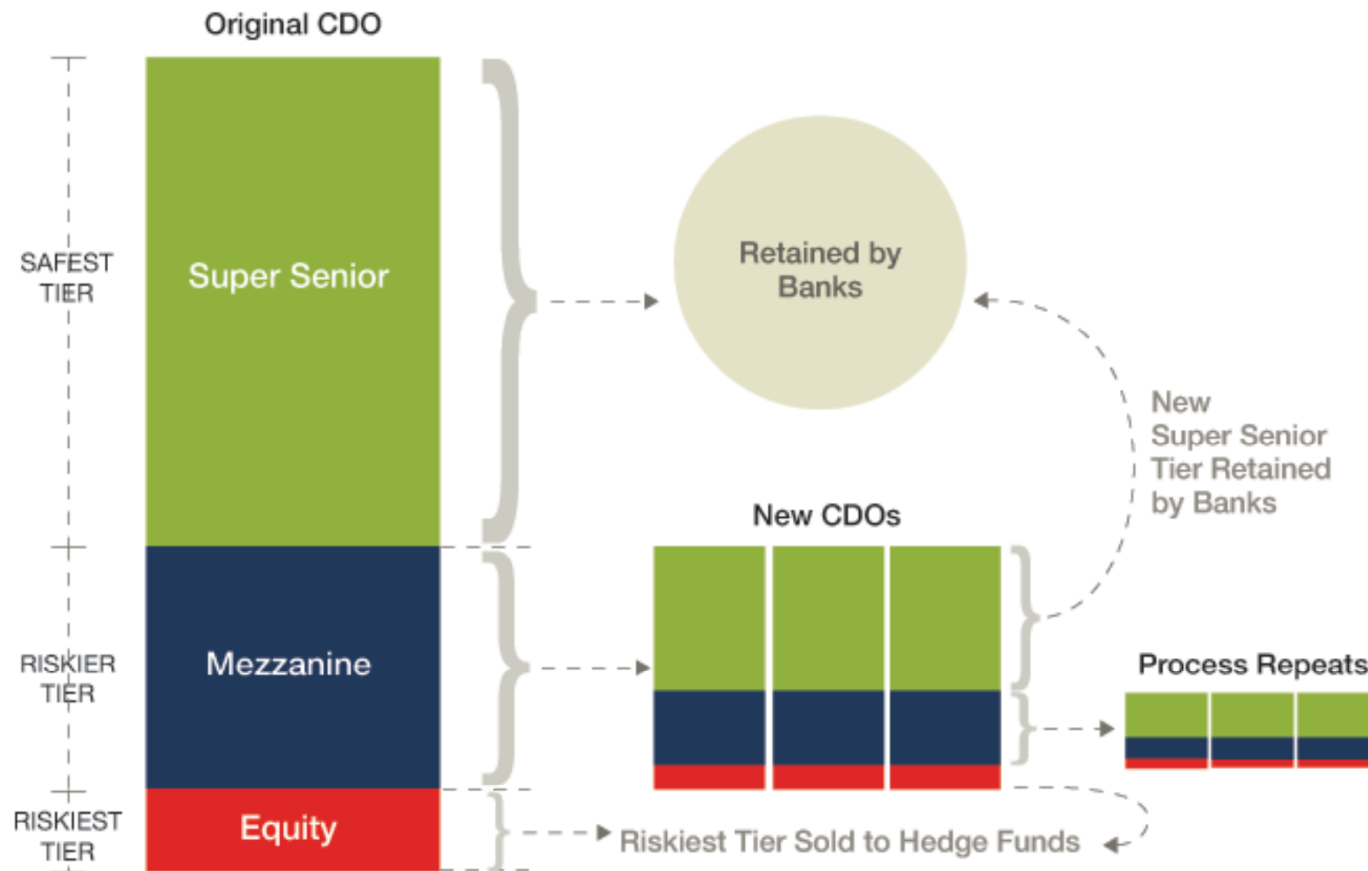
Bak-Tang-Wiesenfeld sandpile



## POST-NEWTONIAN LIFE IMITATES POST-NEWTONIAN ART

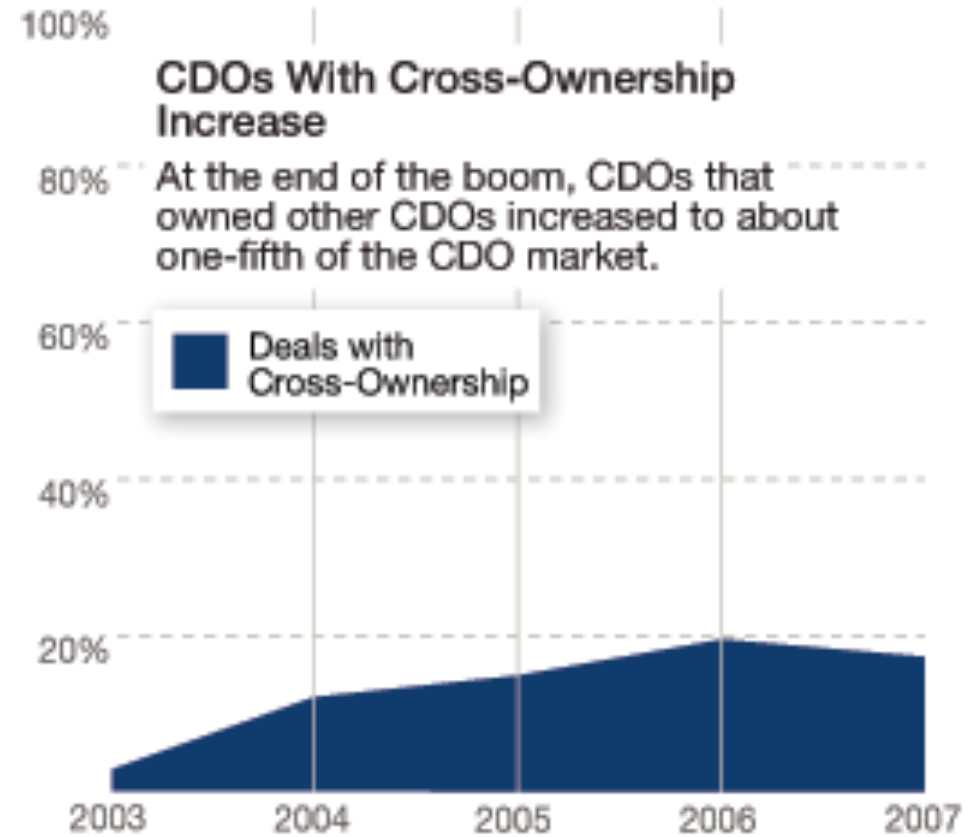
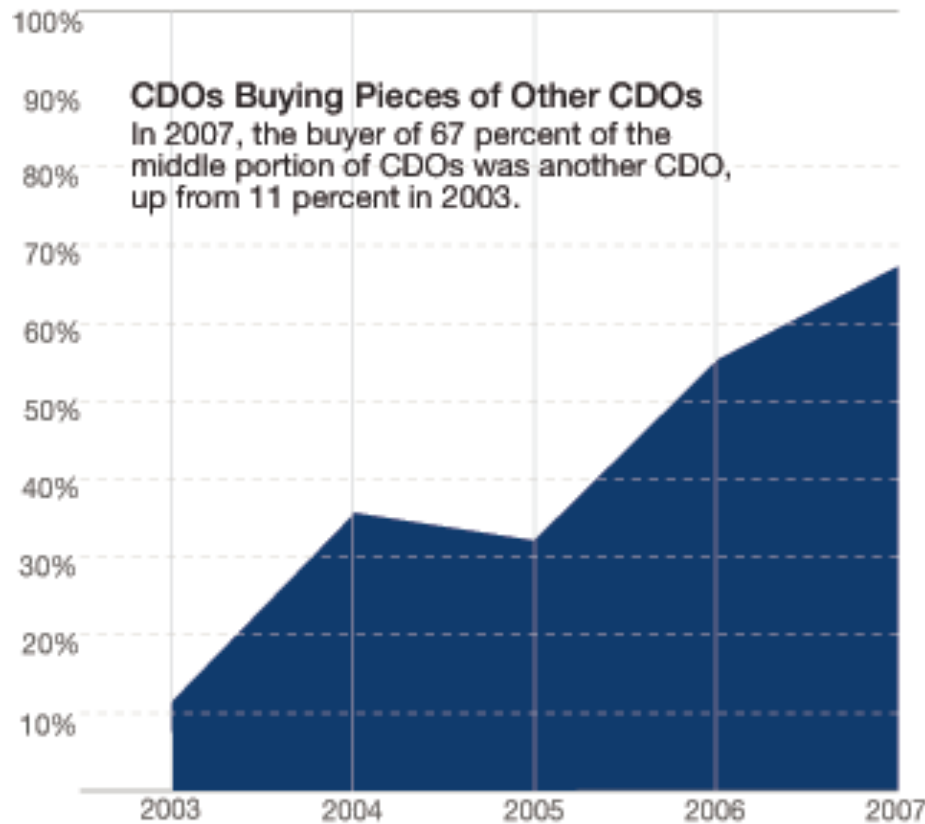
- *In fact, Post-Newtonian maths simply applied computers recursively to Newtonian maths to generate new, more complex patterns — see Chaos Theory, the Mandelbrot Set, the Bak-Tang-Wiesenfeld sandpile*
- *Meantime, the Newtonian economy applied computers recursively to Newtonian financial maths to generate new, more complex financial instruments, markets and institutions — and organized itself into a self-similar/chaotic/critical state.*
- *Thus, the Newtonian economy lived out the recursions that Post-Newtonian maths described — and suffered a Post-Newtonian collapse into chaos.*

# Recursion on Wall Street I

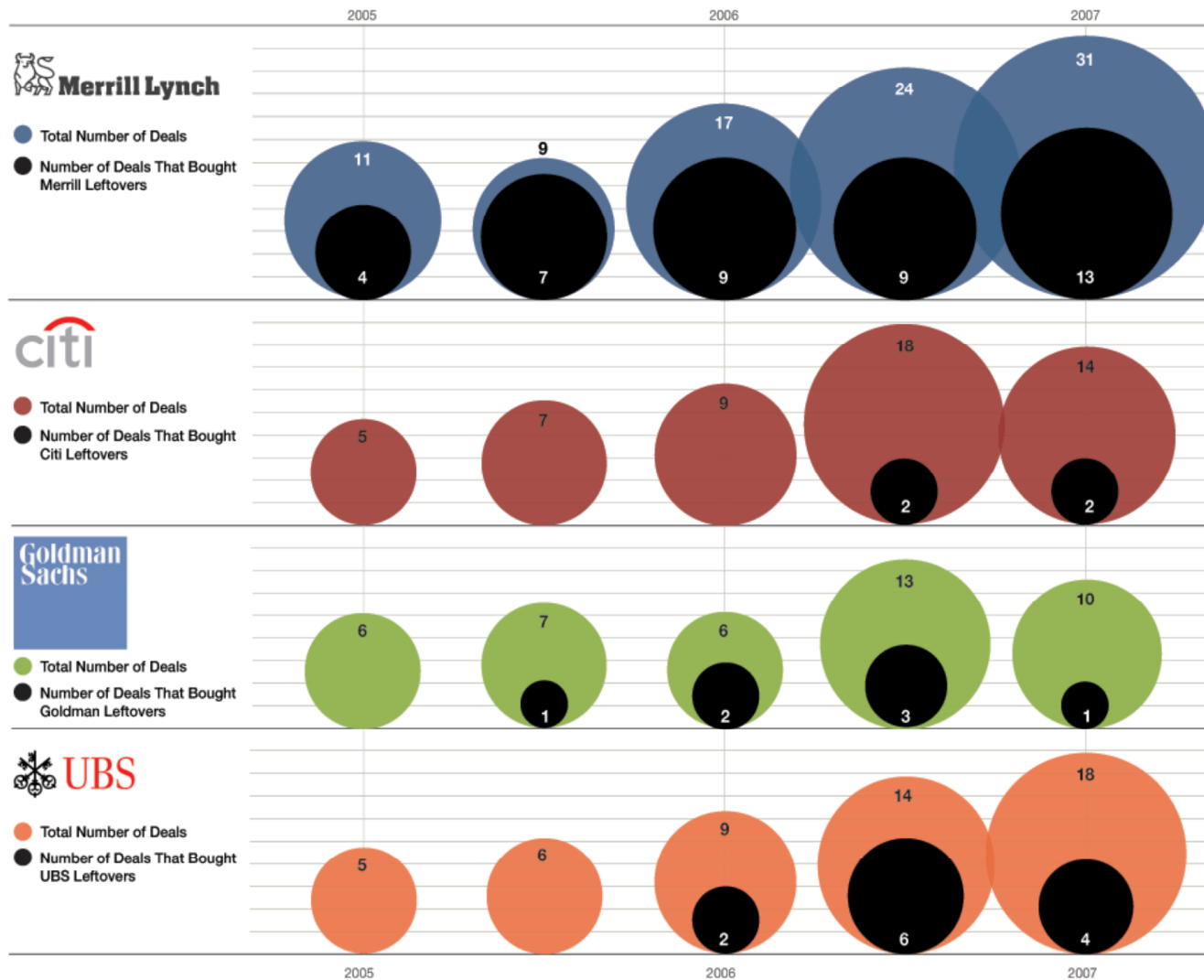


Banks created CDOs from mortgage-backed securities. Banks often retained the large top portion, called the "Super Senior." The bottom portion, or "Equity," was often sold off to hedge funds. The middle portion, or "Mezzanine," often went into new CDOs. The main buyers of those new CDOs were once again the banks.

# Recursion on Wall Street II



# Recursion on Wall Street III

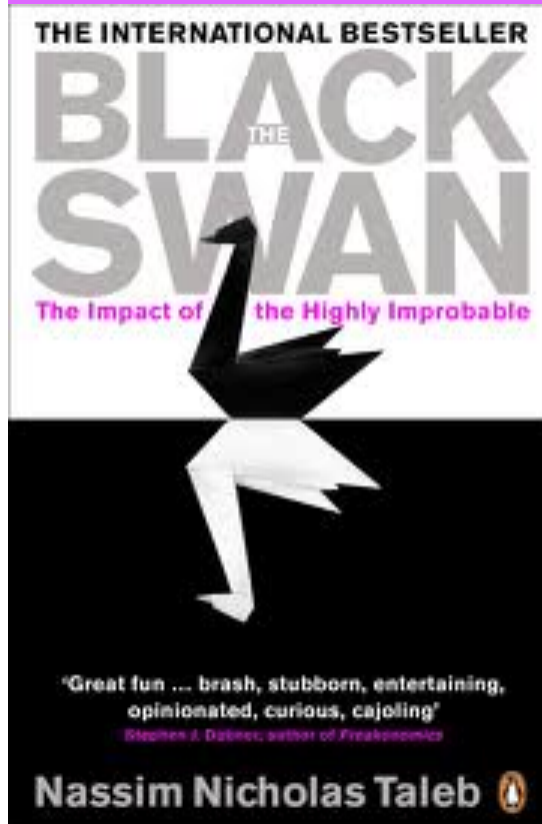


In the last two years of the boom, CDOs created by one bank commonly purchased slices of other CDOs created by the same bank. Market leader Merrill Lynch outpaced its competitors. Nearly half of all of its CDOs bought significant portions of other Merrill CDOs.

The black circles represent the number of deals in which banks' CDOs held a significant portion of their own prior CDOs (more than one-third of the overall CDO slices in the deal) while the colored circles represent the total number of deals completed by that bank in that half year



# Black Swan



“Globalization creates interlocking fragility, while reducing volatility and giving the appearance of stability. In other words it creates devastating Black Swans. We have never lived before under the threat of a global collapse. Financial Institutions have been merging into a smaller number of very large banks. Almost all banks are interrelated. So the financial ecology is swelling into gigantic, incestuous, bureaucratic banks: when one fails, they all fall. The increased concentration among banks seems to have the effect of making financial crises less likely, but when they happen they are more global in scale and hit us very hard. We have moved from a diversified ecology of small banks, with varied lending policies, to a more homogeneous framework of firms that all resemble one another.”

# BLACK SWANS vs. BLACK-SCHOLES

*Standard finance models represent asset returns by a normal distribution. Taleb argued that*

- extreme events are more likely than a normal distribution indicates;*
- the financial system is fragile because tightly-interconnected.*

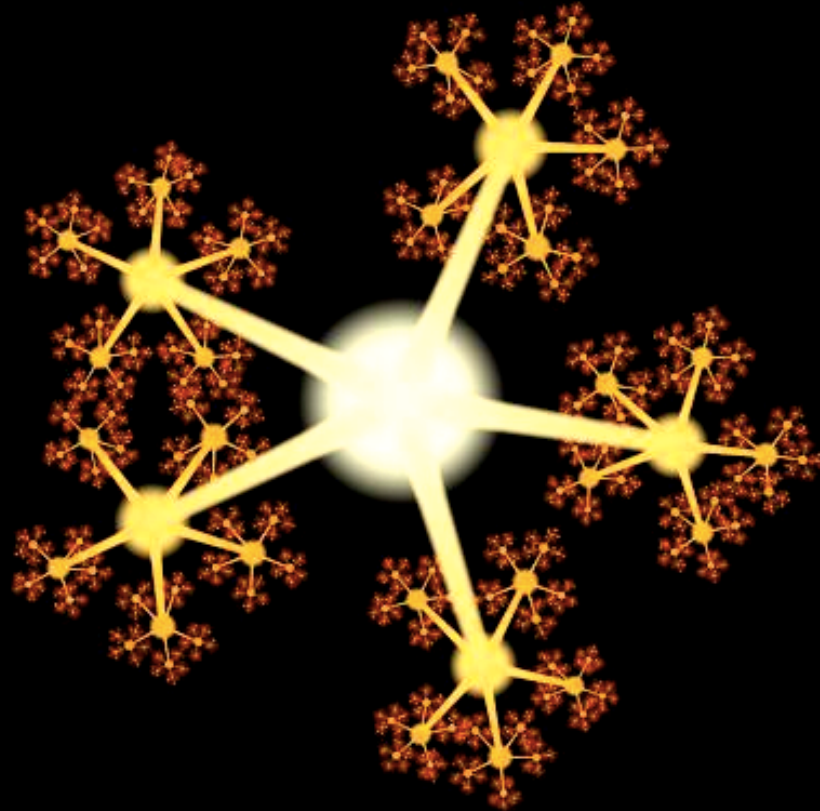
**BUT...**

- 1. Why do fat tails prevail in finance?*
- 2. How do fat tails undermine financial calculations? Can't we get good enough approximations by postulating high variances?*
- 3. Why do extreme shocks collapse the financial system?*
- 4. Why is a tightly-interconnected financial system fragile?*
- 5. How are (3) and (4) related to (1) and (2)?*

# FINANCE UNDERCUTS NEWTONIAN ECONOMICS

- ***Society gains when a wider range of goods is traded. So society should gain when a wider range of financial instruments is traded:***
  - *increasing opportunities for arbitrage and sharing risk*
  - *decreasing the likelihood of extreme outcomes for the financial system.*
- ***Why did widening the range of financial instruments destabilize the financial system?***
  - *Financial instruments differ from goods because buyers and sellers remain linked after they trade.*
  - *More innovation, arbitrage and risk sharing multiplies the links, so it increases network complexity and fragility.*
- ***This undercuts the Central Limit Theorem that justifies the use of normal distributions in finance: adding instruments/markets adds random variables that:***
  - *are correlated with the returns on pre-existing instruments/markets*
  - *increase the correlations across those pre-existing returns.*
- ***This leads to a fat-tailed distribution, not a normal distribution.***

## 2. Hierarchical Networks



# FINANCIAL NETWORKS

- *Each financial instrument is a credit in one trader's portfolio and a debit in another trader's portfolio. The financial system is a network of financial instruments that links portfolios.*
- *Economics overlooked the structure of this network until its paralysis brought down the financial system. The typical economic model assumes that each trader trades with "the market"; the model is closed when total demand equals total supply in each market.*
- *Thus, economics neglected the individual transactions between pairs of buyers and sellers. This neglect did not matter for most commodity trade because, after the trade, buyer and seller are no longer linked.*
- *However, the buyer A and seller B of a financial instrument remain linked after their trade — by B's obligations to A under the instrument. B's ability to honour those obligations depends on his portfolio, hence on the solvency of the counter-parties C, D, etc. of the instruments in his portfolio, hence on the solvency of the counterparties of C, D,...*

## NETWORKS TRANSMIT SHOCKS

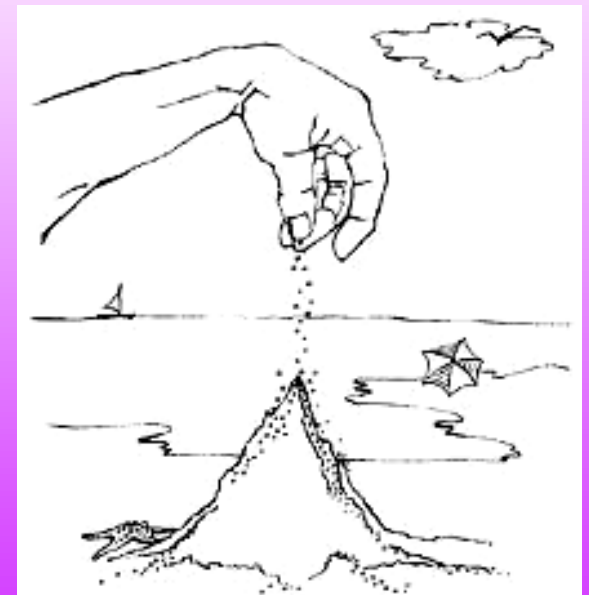
- *The stability of the financial system depends on its network structure. Two nodes (portfolios) in this network are neighbours if they are linked by a financial instrument.*
- *Default by A on a financial instrument hits portfolios  $B_1, B_2, \dots$  holding that instrument, i.e., A's neighbours in the network. In turn, this shock is transmitted to the neighbours of  $B_1, B_2, \dots$  if it leads them to default on one of their instruments.*
- *A node hit by shocks from several neighbours might default and transmit the shock to yet other neighbours.*
- *In a network where all nodes have multiple links to other nodes, a shock to one node can be transmitted to many other nodes via multiple pathways; each other node that was hit multiple times would transmit the shock further.*
- *Thus, a dense network tends to amplify shocks.*



# SELF-ORGANIZED CRITICALITY

- *Innovation, arbitrage and risk sharing added links to the financial network, multiplying the channels for shocks, and increased its fragility.*
- *This brought the network to “the edge of chaos”: poised at maximal complexity between order and disorder; so tightly linked that it could collapse under any shock, but too complex for us to predict which one (Bear Stearns? Lehmans? AIG? Fannie Mae? California? State Pensions? Commercial Real Estate? Greece?)*

*This is like the Bak-Tang-Wiesenfeld model of self-organized criticality: drops of sand organize themselves into a pile at “the edge of chaos”: poised at maximal complexity between order and disorder, so tightly linked that one more grain could collapse it, but too complex for us to predict which one.*



## LIFE: COMPLEX BUT STABLE

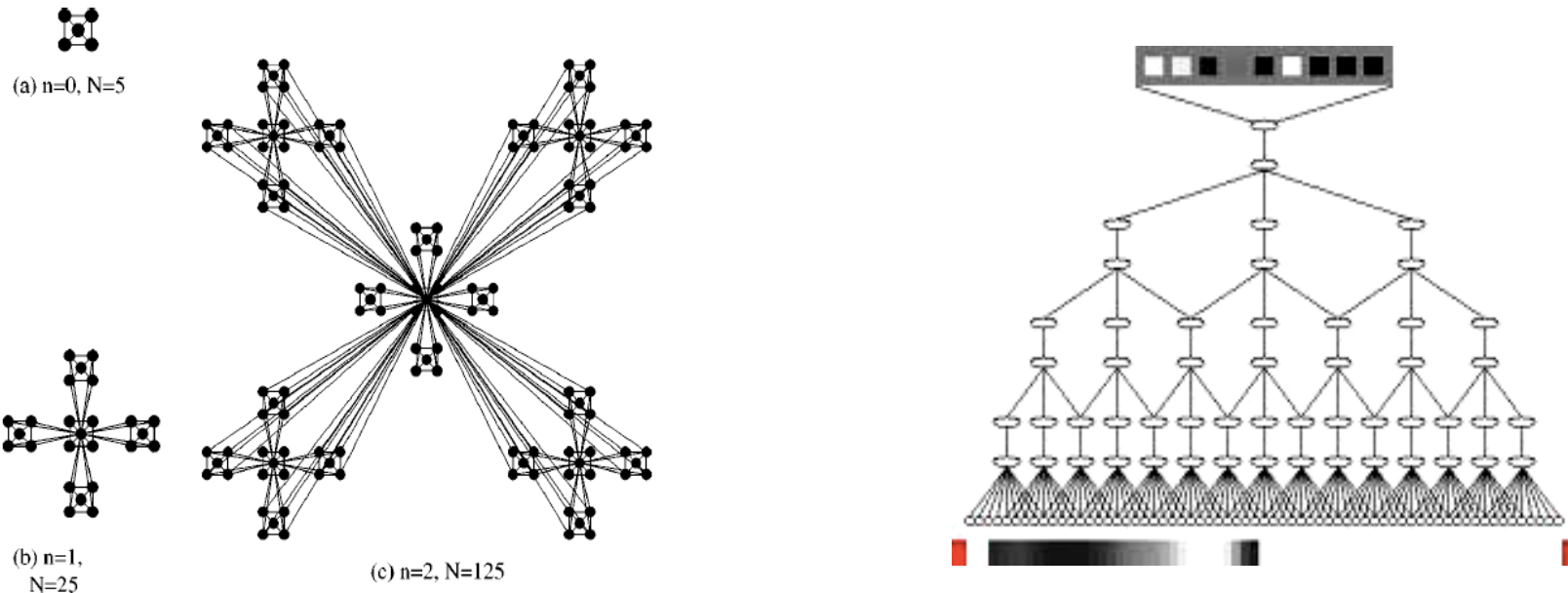
- *Living creatures are complex but stable. Why?*
- *A natural species comprises discrete macro-modules — “organisms”. The death of one organism affects few others. A species comprising discrete organisms is more stable than one comprising macro-modules that share vital organs.*
- *Each organism comprises meso-modules — “organs” with few links to other organs. The organism can survive the collapse of some organs (e.g., a lung or kidney) if most others remain intact.*
- *Each organ comprises micro-modules — “cells” with few links to other cells; the organ can survive the collapse of a few cells*
- *Natural selection has generated lifeforms that are modular at multiple scales — because this form is stable under shocks from the environment and from each other.*



# STABLE MODULAR NETWORKS

- *The organization of an organism into organs can be modelled as a hierarchical network, which is modular at multiple scales.*
- *Module: group of nodes with few outside links.*
- *A network consisting of modules is stable: shocks to one module would have little impact on other modules.*
- *In a hierarchical network,*
  - *the generic module comprises hub and spokes: spokes link to each other only via the hub.*
  - *the hub of each module is a spoke in a higher-order module.*

# HIERARCHICAL NETWORKS

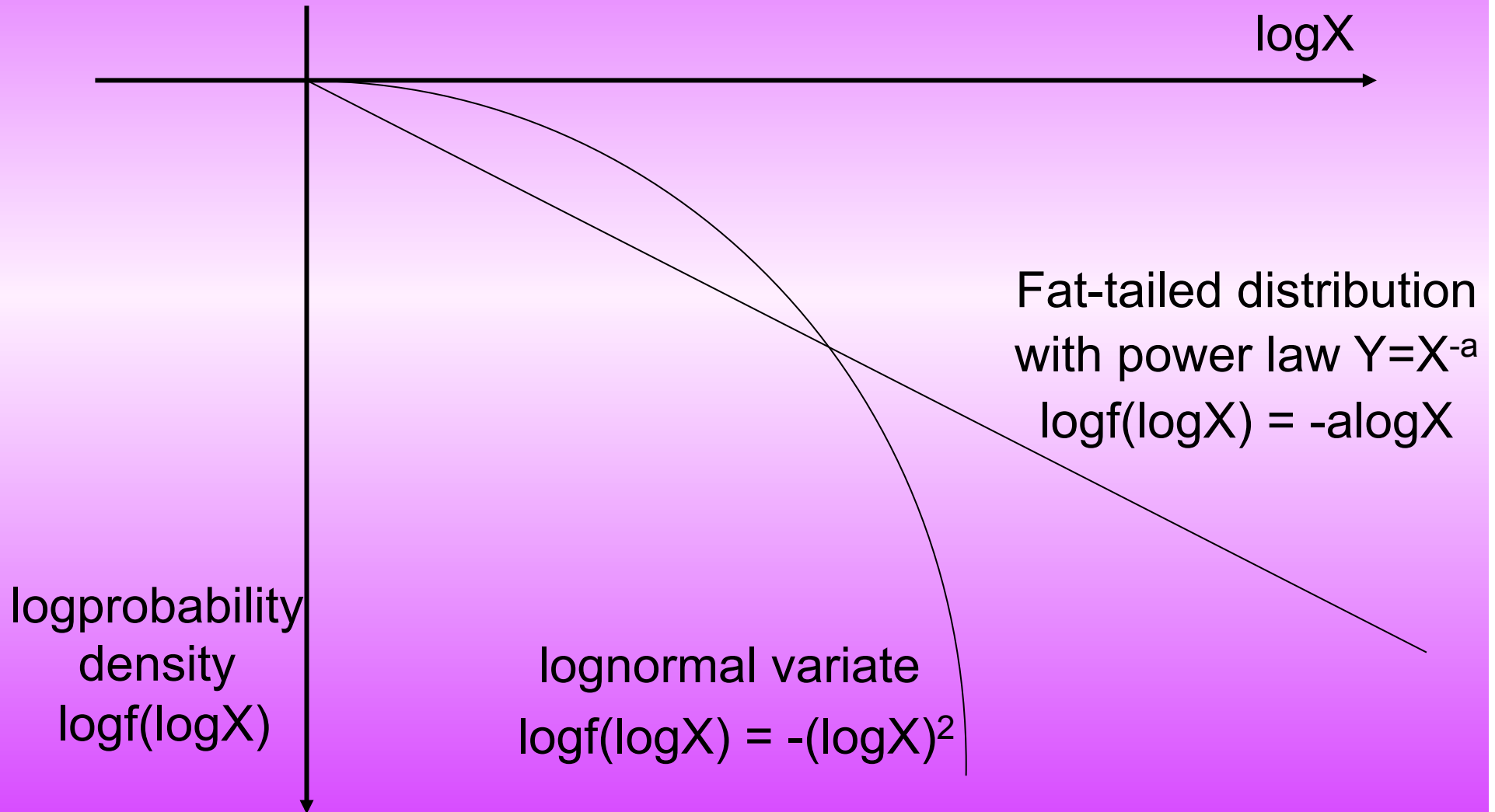


- ***Hierarchical networks can withstand shocks to a node near the base of the hierarchy. Such a shock is not amplified: it does not generate multiple shocks that hit other hubs via multiple links.***
- ***A shock to a high-order hub could be transmitted down to all its spokes, thence to all subordinate modules. However, the shock could not be transmitted to modules that are connected only to other high-order hubs.***

# HIERARCHY IMPLIES FAT TAILS

- *The degree of a node is the number of links to other nodes. For each degree  $d = 1, 2, \dots$ , count the number of nodes with that degree. The frequency distribution of degrees is the network's "degree distribution".*
- *If links were added randomly to nodes in a network, then its degree distribution would be flat.*
- *A hierarchical network is self-similar: its degree distribution obeys a power law and thus has fat tails, i.e., more nodes than expected have numerous links.*
- *Such a network is vulnerable to the catastrophic collapse of a hub — a black swan.*
- *It follows that the density function of losses in such a financial system also has fat tails.*

# Power Laws and Fat Tails



## WIKIPEDIA FORETOLD THE 2008 CRASH?

- *“As with all systems characterized by a [power law](#) distribution, the most notable characteristic in a scale-free network is the relative commonness of vertices with a degree that greatly exceeds the average. The highest-degree (most connected) nodes are often called “hubs”... the major hubs are closely followed by smaller ones. These ones, in turn, are followed by other nodes with an even smaller degree*
- *This hierarchy allows for a [fault tolerant](#) behavior. Since failures occur at random and the vast majority of nodes are those with small degree, the likelihood that a hub would be affected is almost negligible. Even if such event occurs, the network will not lose its [connectedness](#), which is guaranteed by the remaining hubs.*
- *On the other hand, if we choose a few major hubs [Lehmans, AIG] and take them out of the network, it simply falls apart and is turned into a set of rather isolated graphs. Thus hubs are both the strength of scale-free networks and their [Achilles' heel](#).”*

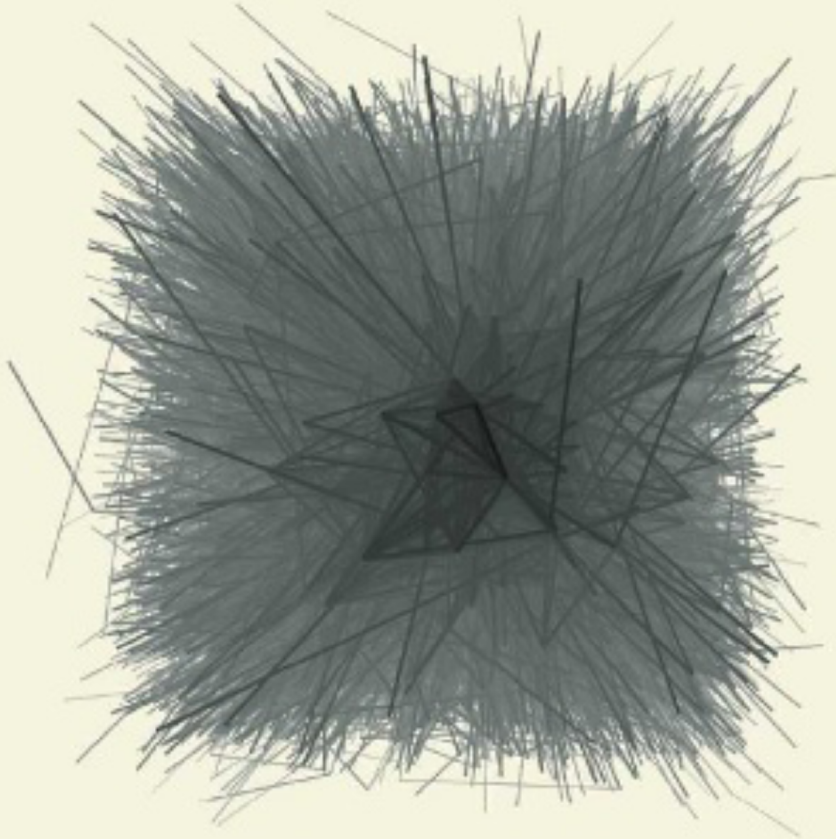
[http://en.wikipedia.org/wiki/Scale-free\\_networks](http://en.wikipedia.org/wiki/Scale-free_networks).

## WALL STREET' S NEAR-DEATH EXPERIENCE

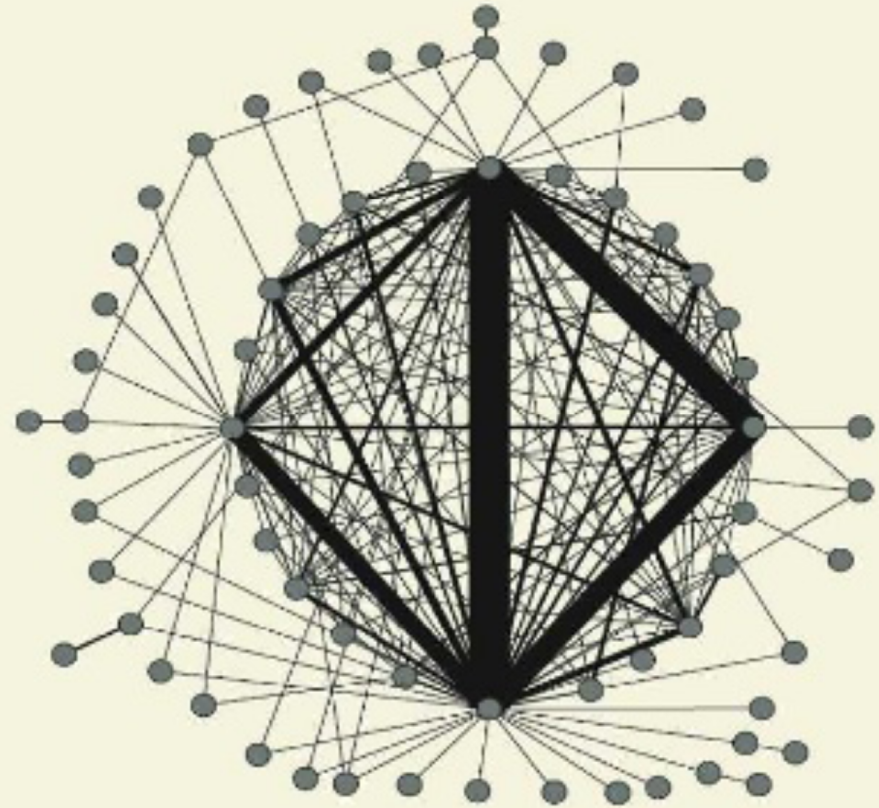
- *A banking system is a network: banks are the nodes; two banks are linked if they transact.*
- *The degree distribution of the typical banking system indicates a hierarchical character. So it would be stable to most shocks, but vulnerable to a shock that hits a hub.*
- *Indeed, Wall Street was even more vulnerable than a strictly hierarchical network, for key hubs were tightly linked; these links in fact channeled most inter-bank transactions.*
- *So when a key hub (Lehmans) collapsed, the shock propagated immediately to other hubs, thence to the entire system.*



# Fedwire Interbank Payment Network



This 'furball' depiction takes in thousands of banks and tens of thousands of links representing US \$1.2 trillion in daily transactions.



The core of the network, with 66 banks accounting for 75% of the daily value of transfers, and with 25 of the banks being completely connected.

## **Hierarchical Networks and “The Coming Collapse of China”**

- ***Why did China’s financial system prove more stable than the US?***
- ***China allocates state capital via conglomerates — hierarchical networks of corporations. The hubs are the State Asset Management Companies of a local government or of the central government.***
- ***Financial links across hubs are few. This limits the spread of shocks from the collapse of a conglomerate.***
- ***Local governments are themselves organized in a hierarchical network linked by administrative lines of control and patron-client pyramids.***
- ***There are few financial links across local governments, so the financial collapse of one would have little impact on others.***
- ***Top-level hubs (like a provincial government or a state conglomerate) are linked only via state banks; their stability is guaranteed by the central government, for their collapse would endanger the state itself.***



# Management of China's Political Economy

- *Managers of state-linked firms are rewarded according to business performance but also face political pressure to meet political and social goals, like employment.*
- *A conglomerate controlled by a local government serves as an “internal market” for both capital and managers. Inter-firm debt is enforced, not by courts and contracts, but by conglomerate headquarters. This limits the scope of inter-firm debt, hence the impact of firm default.*
- *Big shocks are contained by local officials via bailouts from other conglomerates and local branches of state banks.*
- *Local officials are promoted according to their success in growing — and stabilizing — their local economies.*
- *Senior officials are organized into a tight hierarchical network, overseen by the Central Organization Department.*

## Growth Implies Political Promotion

“The annual GDP growth rate has a positive impact on the probability of promotion and a negative impact on the probability of termination. The coefficient of annual growth rate is positive, and is significant at the five percent level.

When the annual growth rate increases by one standard deviation (0.06) from the mean (0.10), the probability of promotion will increase by 0.011, or 15 percent of the average probability of promotion (0.075), and the probability of termination will decrease by 0.015, which is also 15 percent of the average probability of termination (0.103).”

“Political Turnover and Economic Performance: The Incentive Role of Personnel Control in China” Hongbin Li and Li-An Zhou, *Journal of Public Economics* 2005

## Elites and Stability: China vs. US

- *The US financial elite likes financial networks that are tightly interconnected, hence turbulent on small and medium scales, even if this implies large-scale turbulence. Such a “power law” distribution of shocks allows elite bets that “privatize the upside and socialize the downside”, since large shocks would bring state intervention to prevent system collapse.*
- *Financial innovation, diversification and arbitrage spread complex claims between nodes and made the financial system more complex, hence more difficult to understand. This enhanced the elite’s comparative advantage in IQ and information and its potential gains from leveraged bets.*
- *By contrast, China’s Communist Party, comprising political/financial elites, has a strong collective interest in macro-financial stability, which is crucial to its legitimacy. It has the organization and discipline to impose this collective interest upon key hubs.*

# Cognition and Capital

- *The security of A's claim against B depends on the security of B's claims against its counter-parties C, D, etc, hence on the security of C and D's claims on their counter-parties, etc.*
- *It is difficult to predict the impact of shocks in a complex network. So A lends to B only if B has enough capital to insulate A against default by its counterparties. Thus, capital substitutes for:*
  - (i) information about the structure of the network of debt*
  - (ii) cognitive capacity to forecast the impact of a shock to the system.*
- *As a network grows more complex, it grows more fragile; its behaviour becomes more difficult to forecast, so A needs B to hold more capital.*
- *In fact, A enjoys an external benefit if B's counter-parties C and D hold more capital. So the financial system tends to hold less capital than is socially optimal.*
- *But top managers seek to maximize the upside return on capital, being protected against downside risk by their incentive contracts, and by the laws of bankruptcy and limited liability, so they place bets that jeopardize capital, hence system stability.*

# Relational versus Financial Capital

- *US financial system links legal entities via legal obligations: financial instruments, margin requirements, collateral requirements, etc. Each link is transparent and enforceable within an objective legal system.*
- *So the legal obligations are fungible: the financial instruments purchased for A's portfolio provide capital that underpins A's sales of financial instruments to B, collateral for repo transactions with C, etc.*
- *The fungibility of financial obligations let them be assembled into tiers (Mortgages, Mortgage Backed Securities, CDO, CDO<sup>2</sup>) and networks. These grew more complex under advances in telecommunication and information technology.*
- *In China, financial relationships are underpinned by a network of interpersonal relationships: between friends or between patron and client.*
- *Two people with a relationship have each deposited "relational capital" with the other. A can secure a debt by drawing down his holdings of relational capital with B. This increases B's holdings of relational capital with A — as if some relational capital were transferred from A's account with B to B's account with A. This is like the transfer of collateral from A to B in US finance.*

## Relational versus Financial Capital: Fungibility

- *A's holdings of relational capital from others in his inter-personal network play a role similar to the capital on the balance sheet of a legal entity in the US system.*
- *But a crucial difference is that relational capital has limited fungibility.*
- *In the US, the collateral that A transfers to B can be "rehypothecated": B can use it as collateral in a repo transaction with C, who can rehypothecate it in a repo with D...*
- *In China, A might use his relationship with B to get a loan for C, but A is unlikely to be able to get B to lend to D on the basis of A's relationship to C and C's relationship to D.*

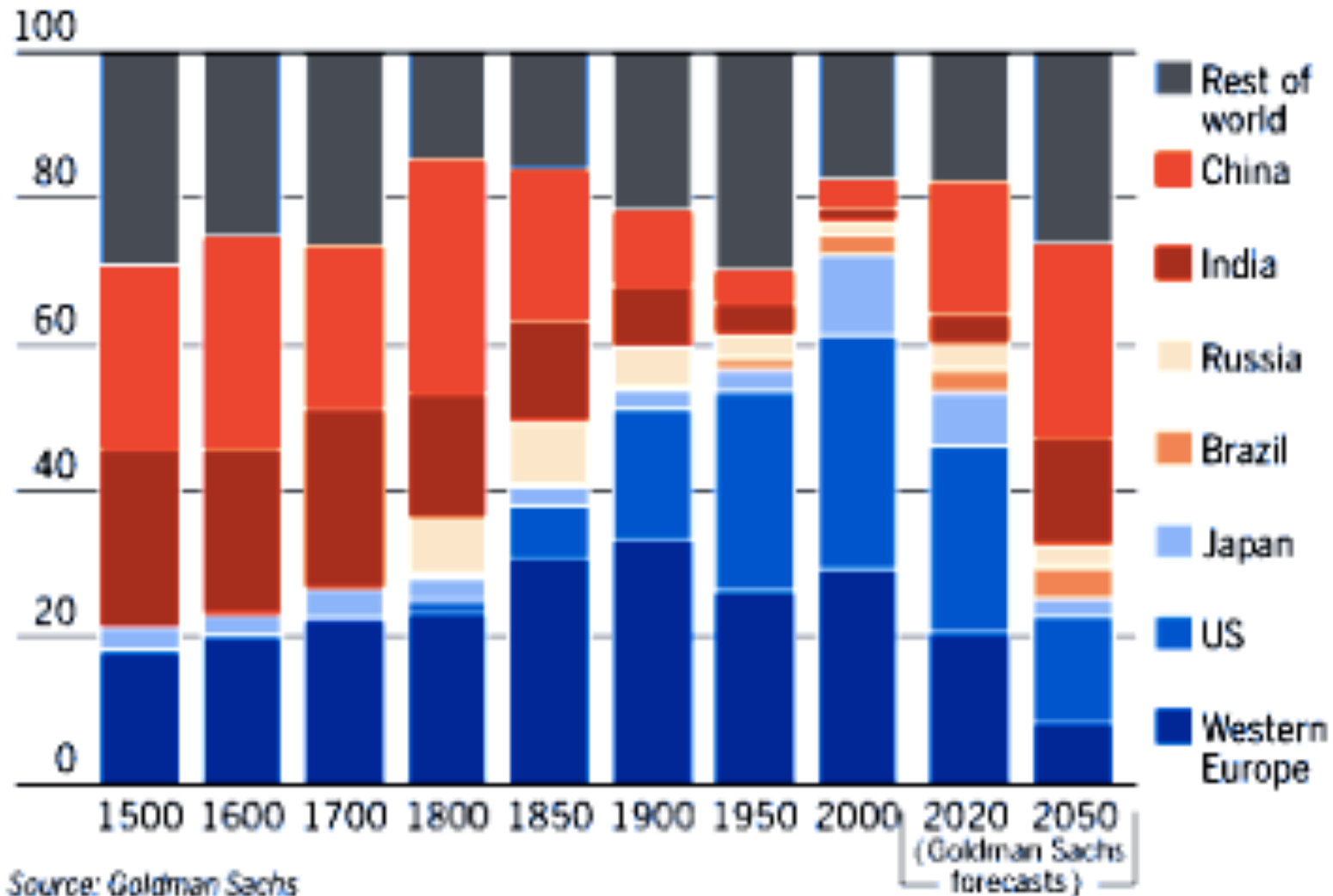
## Relational versus Financial Capital: Stability

- *So a financial system that relies on relational capital to guarantee debt cannot proliferate financial links. This limits financial innovation, arbitrage and risk sharing. But it also prevents the system from destabilizing itself by recursion — of complex financial instruments and transactions.*
- *In the US, when more financial transactions link the hubs of distinct hierarchical networks, this sets up more channels for transmitting shocks. So it makes the financial system more fragile.*
- *In China, when the top managers of two distinct hierarchical networks are linked by guanxi, their relational capital provides insulation against shocks to either network: each can help the other out with a quick loan. So the proliferation of inter-personal links makes the financial system less fragile.*



# 3. Complexity and Collapse

Share of world GDP (%)





# Complexity and The Historical Rise of China

- The Chinese conceptualized the cosmos as irreducibly complex — too complex to grasp in one scheme entire. Daoism saw the world as self-ordering, but does not try to reduce complexity via laws and principles. Instead, the sage understands one aspect of the complex world by analogy with other aspects. He goes with the flow, mindful of the inherent limitations to knowledge. Confucianism highlighted each person's situation within a social nexus that imposes complex personal obligations, which have to be handled respectfully through ritual. Legalism imposed uniformity and order on an inherently complex society through tough top-down rules.
- China comprised the largest, most prosperous empire for most of history because it arrived early at effective systems to coordinate labour and mobilize capital, based on Legalism, Confucianism and Daoism. Each grand Chinese dynasty rose by forcibly simplifying the structure of its economy and society (by land reform and rebooting the civil service) so that they could be handled by those systems. Each grand dynasty declined as the elite managers of the systems sought higher rents from informational monopolies by gratuitously complicating the systems, until they collapsed.

# Classical Chinese Systems for Managing Complexity

- Legalism coped with complexity via a strong state that imposed:
  - uniformity, e.g., the writing system, tax obligations, even the length of wagon axles
  - discipline, not just on subjects, but also on administrators through tight supervision and detailed procedures to limit corruption and the abuse of power.
- Confucianism coped with complexity by delegating social choice and management to righteous people who were enjoined to lead by example. Righteous conduct was defined, not by general rules, but as that which upheld social order and ritual propriety.
- Daoism coped with complexity by arguing that society, like nature, can order itself without government intervention. It emphasized the difficulty of improving society through intervention, given the complexity of the consequences.

# Information Technology and Complexity in Classical China

- Both the long-term success and the periodic failure of these systems for coping with complexity can be traced to the information technology developed in the Han dynasty: paper. This reconfigured the relationship between rulers and subjects, between literate officials and illiterate masses.
- Paper lowered the cost of communicating and storing information, but this benefited only those with the intellect and resources to master China's subtle, allusive language and complex writing system. The result was that China fell under the control of the literati, the only ones who could communicate via the new, low-cost medium.
- Paper allowed China greater bureaucratic control than any other pre-modern state. Paper also allowed the literati to store and revisit the wisdom of earlier eras. That literature became China's counterpart to a religious text; the literati became its counterpart to a priesthood. Literacy fused with morality, as every classroom taught literacy out of texts on ethics.
- Later dynasties used examinations in the Confucian classics to screen for entry into the civil service, hence higher social status and power. These classics defined the ethos and culture of China's elite.

## The Fall of Classical China: Mismanaging Complexity

- But the Confucian texts and examinations took on a life of their own as the focus of intellectual life and the only pathway into the elite. The texts became encrusted with commentary, which also had to be studied by exam candidates. Pressure to select the most talented forced examinations to be graded according to ever-finer points of style, which then had to be mastered by all who would join the elite. Morality became pedantry, as the language of the literati grew so terse and allusive as to be unintelligible to the masses.
- From a screen for upright, talented people, the literary examinations became a barrier to entry into the elite: success required years of sophisticated training that only literati families could afford. So the simple Confucian system for managing complexity through upright people itself became endlessly complicated, detaching the literati from its function as moral leaders. The most talented dissipated their energy in zero-sum competitions for a few high status posts.

# The Rise of the West: Managing Complexity

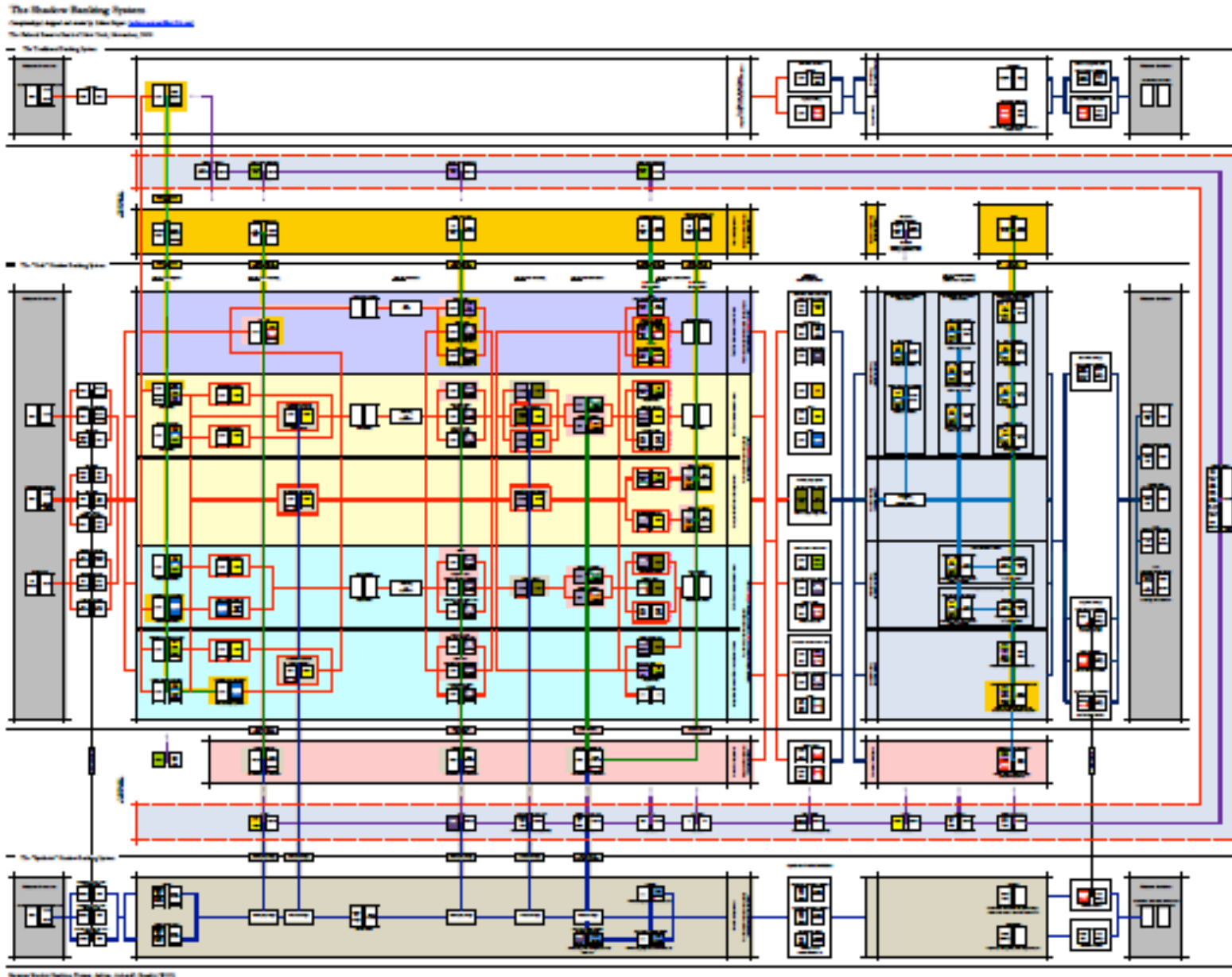
- The Judeo-Greek heritage of the West implied a religious/metaphysical view of the complex world as fundamentally simple, stable and predictable because rule-governed.
- Copernicus, Kepler and Newton confirmed this for the complex movements of the heavenly bodies.
- The Enlightenment obviated religious justification for the social order by enunciating constitutional democracy, law and the invisible hand.
- This approach proved successful: it gave rise to modern societies and economies. It enabled the West to develop a complex economy, which coordinated a complex division of labour.
- This was achieved by developing abstract frameworks for organizing large groups — management — and by formulating and trading abstract indirect claims on physical goods — accounting and finance.

## The Fall of the West: Mismanaging Complexity

- Such large-scale coordination of people and goods placed a premium on information, hence on the development of technology to process and transmit information. Rapid development of information technology increased the capacity to manage complexity. But, the elite managers of the systems for handling complexity sought higher rents from their informational monopolies by gratuitously complicating those systems, until they collapsed.
- The US response to the resulting current financial crisis has been slow, confused and ineffective — because entangled in the rules that define its political and corporate governance, which require the government to respect property rights and contracts and allows it to require actions by individuals only by applying existing laws or by passing laws through the legislature.



# Shadow Banking System



# The Fall of the West: Mismanaging Complexity

<b>Typical contract details(a)</b>		
[1]	Pages in CDO <sup>2</sup> prospectus	300
[2]	Pages in ABS CDO prospectus	300
[3]	Pages in RMBS prospectus	200
[4]	Number of ABS CDO tranches in CDO <sup>2</sup>	125
[5]	Number of RMBS in a typical CDO	150
[6]	Number of mortgages in typical RMBS	5,000
<b>Metrics of complexity(a)</b>		
[1] + [3]*[5]*[2]*[4]	Pages to read for a CDO <sup>2</sup> investor	1,125,000,300
[2] + [3]*[5]	Pages to read for an ABS CDO investor	30,300
[4]*[5]*[6]	Max. number of mortgages in a CDO <sup>2</sup> <sup>(b)</sup>	93,750,000
[5]*[6]	Max. number of mortgages in an ABS CDO <sup>(c)</sup>	750,000
Sources: Bloomberg, deal documents and Bank calculations		
(a) CDO <sup>2</sup> is used as short-hand for CDO of ABS CDO.		
(b) Assuming there is no overlap in the composition of the RMBS pools that back the CDO or the CDO pools that back the CDO <sup>2</sup> .		
(c) Assuming there is no overlap in the composition of the RMBS pools that back the CDO.		

# The Rise of Modern China: Managing Complexity

- China developed fast in modern times by mixing the Western approach to complexity with its historical approach. It used the price mechanism to decentralize economic decisions by
  - (i) growing a private sector with little access to formal capital markets
  - (ii) delegating the management of state assets downward to local government officials who remained tightly controlled by the Party but are rewarded and promoted according to “market” criteria: the local rate of GDP growth.
- This loose/tight system has enabled a swift, coherent and effective response to the financial crisis. Ironically, the Chinese conceptualization of the cosmos as too complex to grasp in one grand scheme has brought forth a political economy that is coping exceptionally well with the complexity that has just hit the world economy.

# The Fall of Modern China: Mismanaging Complexity?

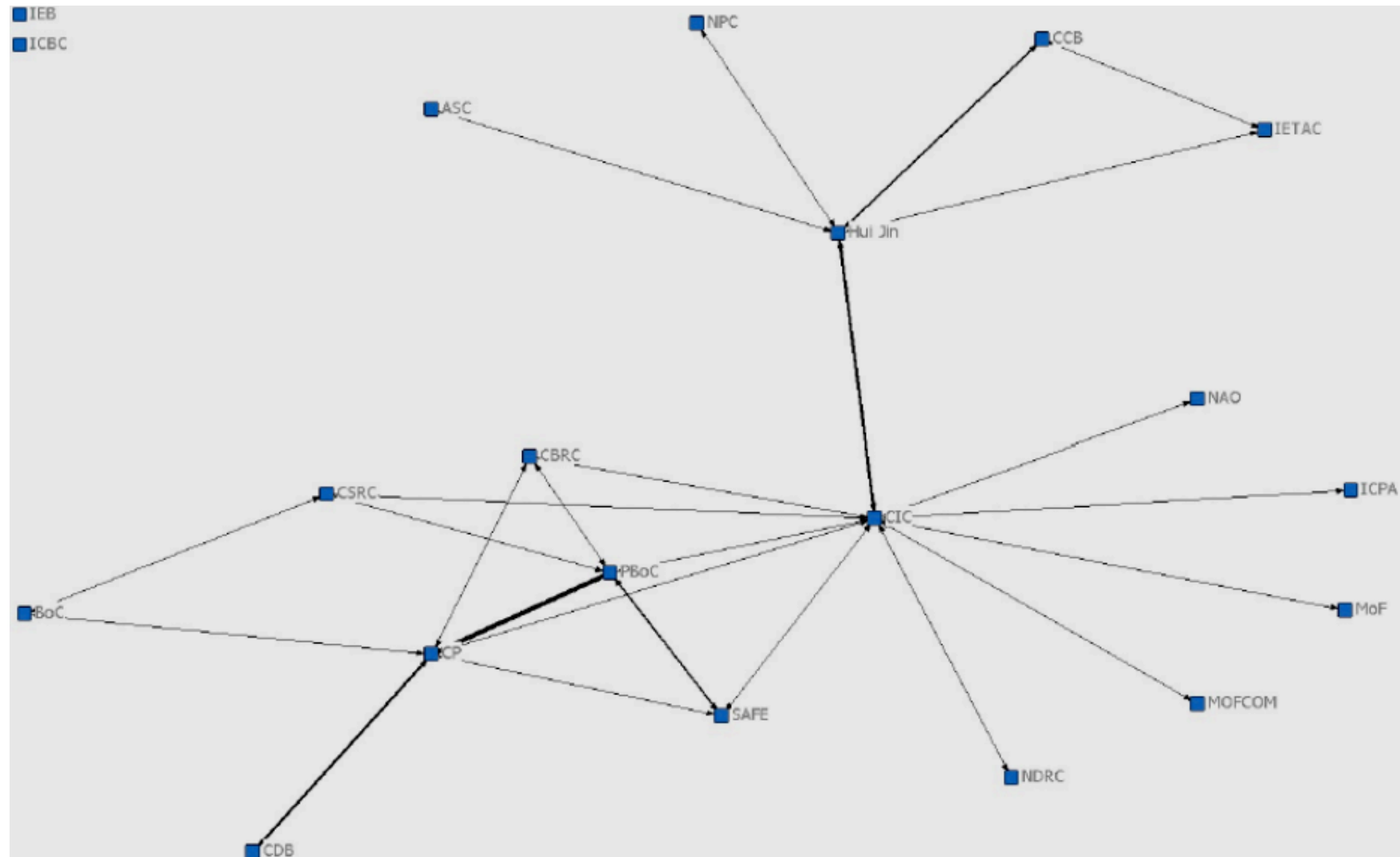
- *In the US financial network, firms traded innovative financial instruments to arbitrage and share risk. The network grew dense, fragile and too complex to understand. Wall Street became paralyzed when top managers could not forecast the impact of a major shock.*
- *China's politics and finance has a clear hierarchy of status and authority. But, power actually resides in a network of relationships amongst the elite who control key hubs.*
- *The stagnation of Japan since 1983 provides an early warning of the dangers of such a power structure.*





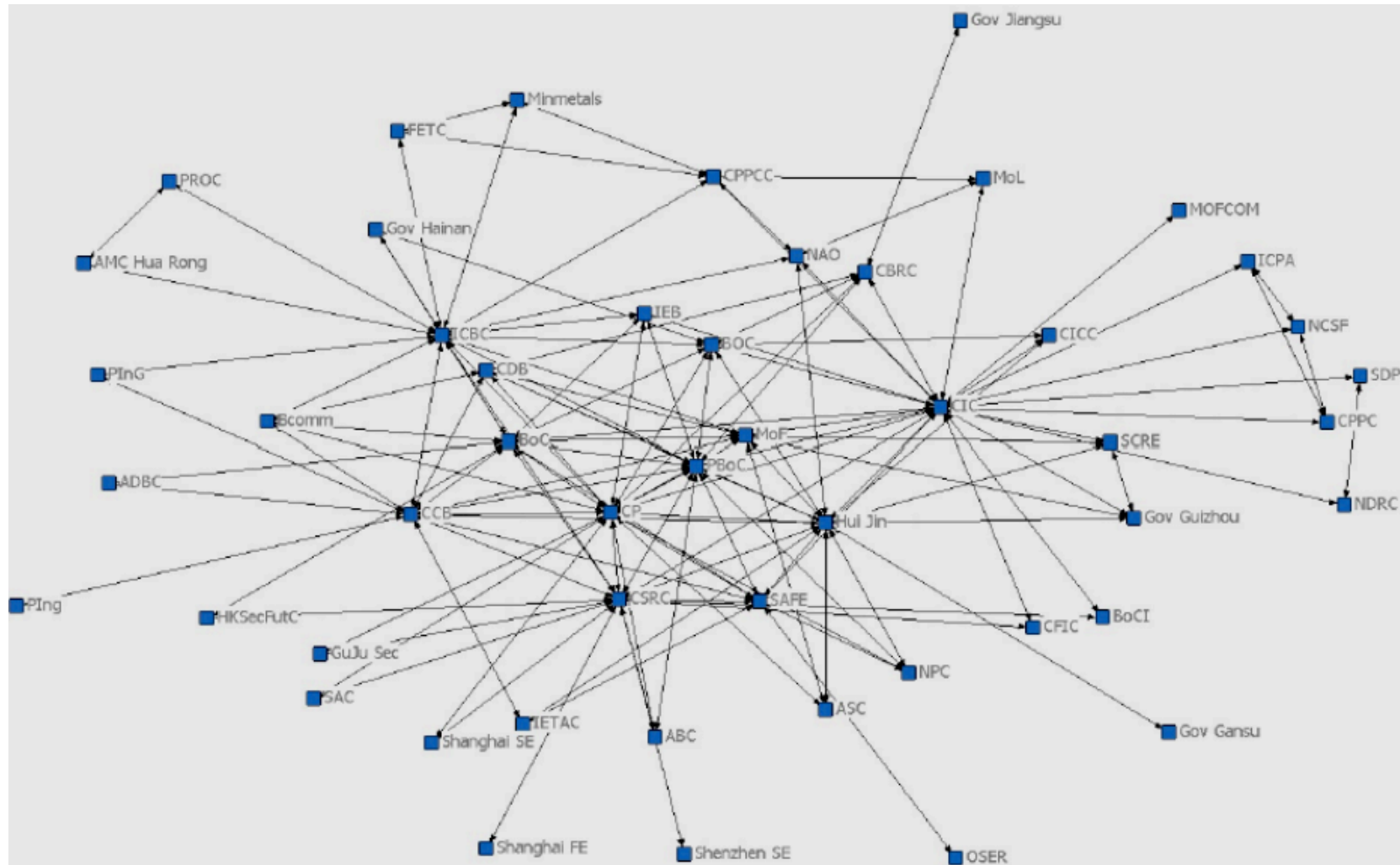


# Informal Control of China's Financial Institutions I



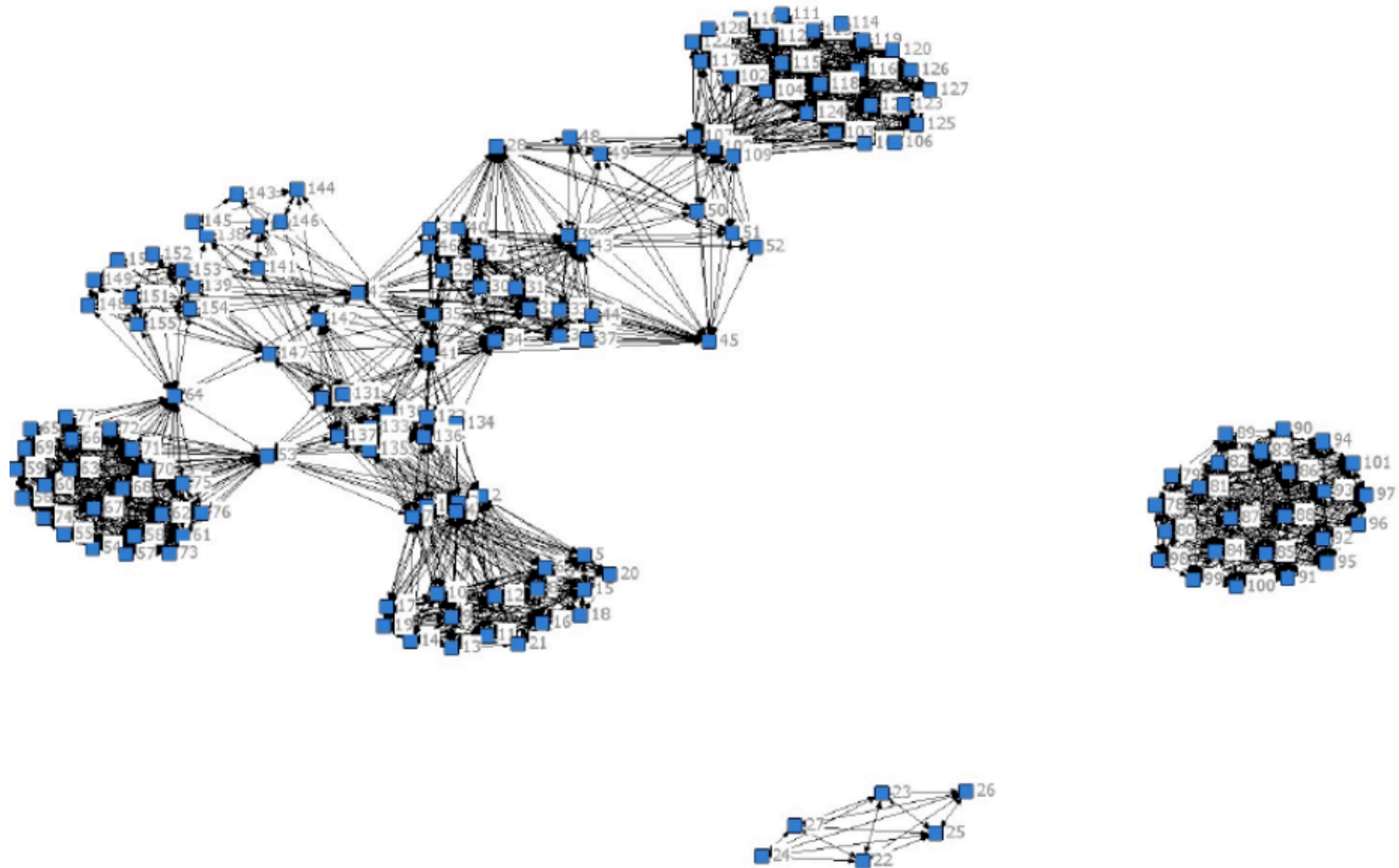
Two entities are linked if one cadre currently holds a top position in both

# Informal Control of China's Financial Institutions II



Two entities are linked if one cadre holds a top position in both either concurrently or previously. CIC, Huijin, the PBOC occupy central positions in this network; each is linked to many other institutions via positions held by their top cadres either concurrently or sequentially.

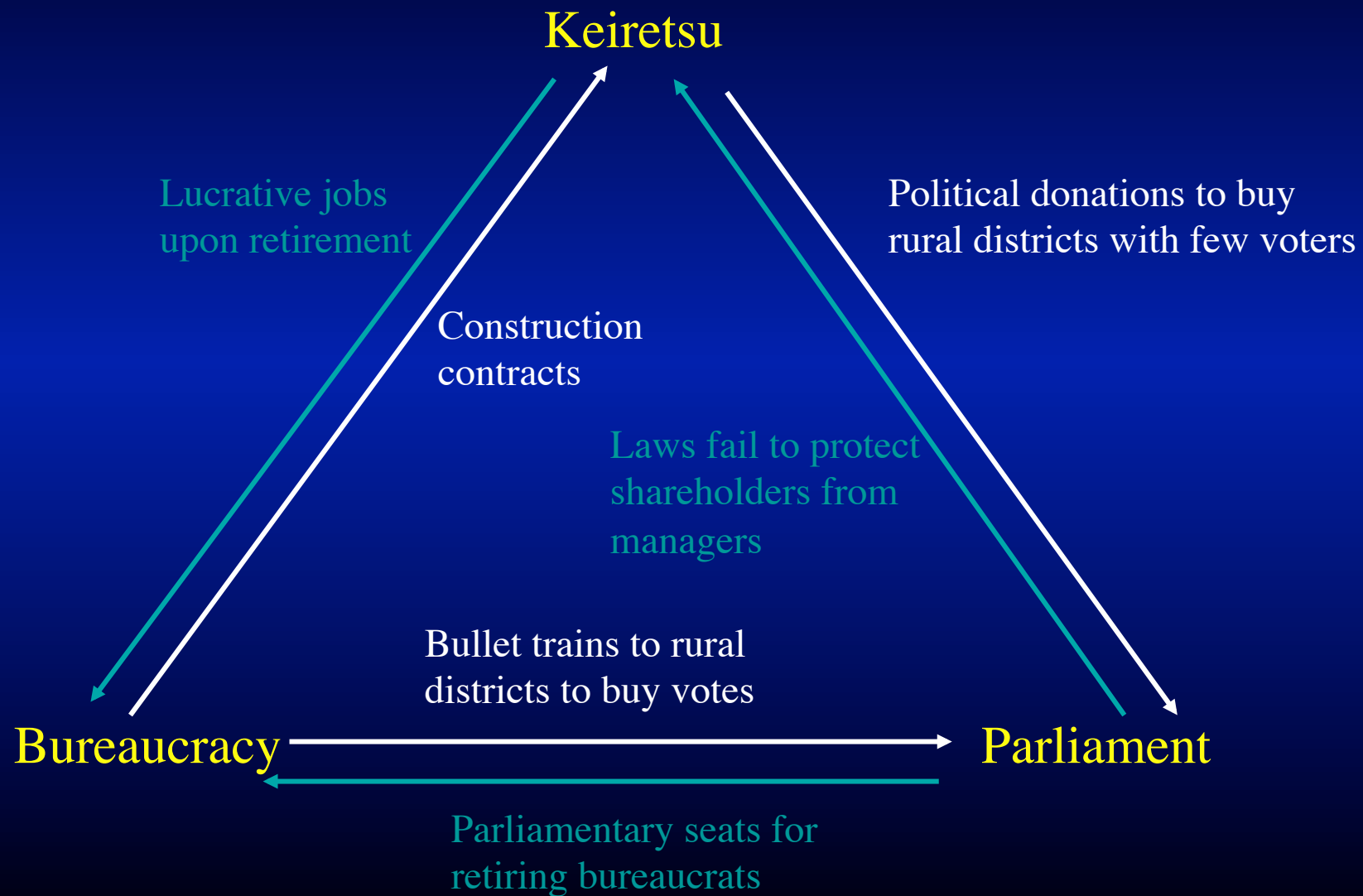
Relationships among the 155 top financial cadres via organizations with which they share affiliations.



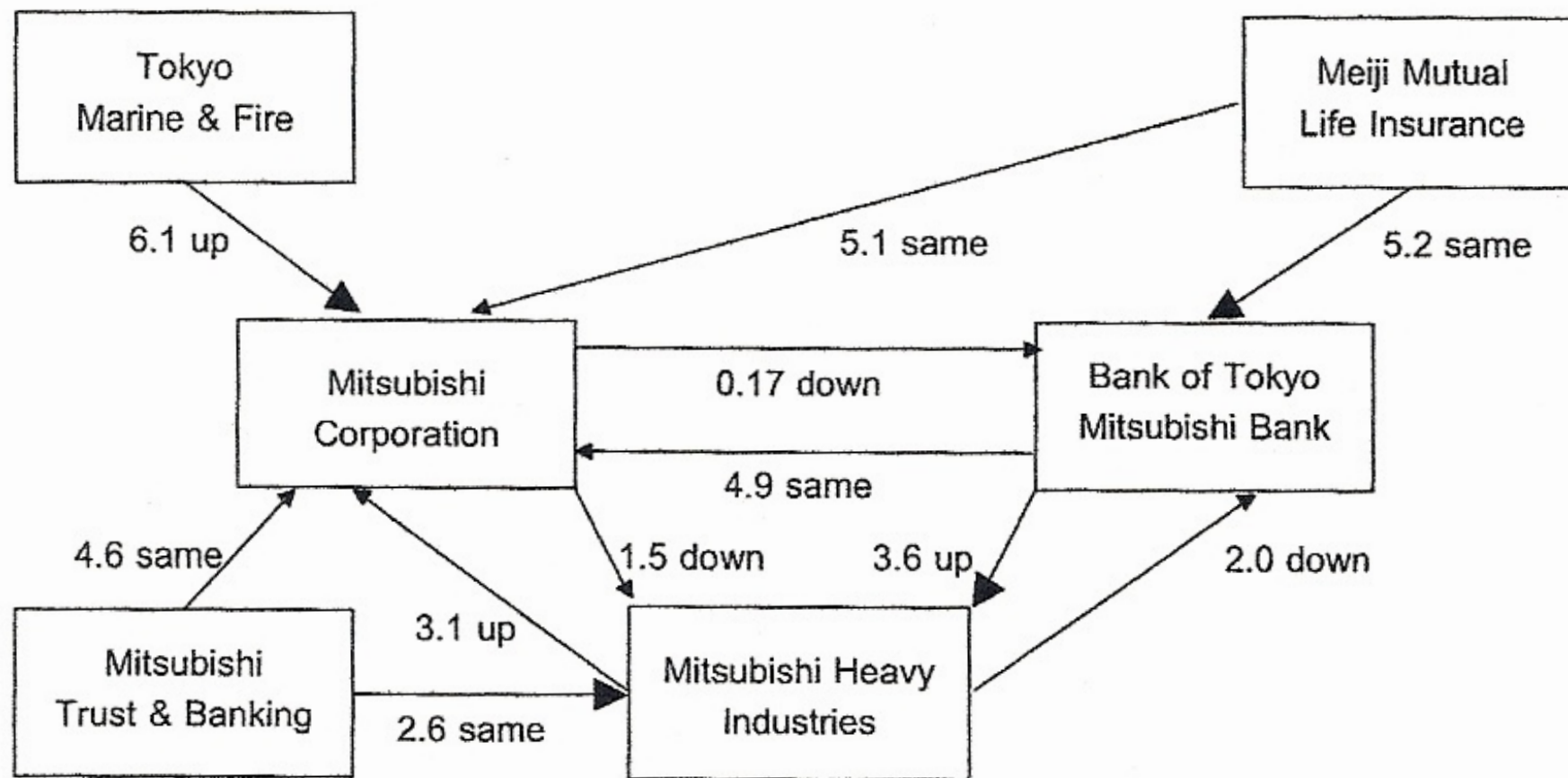
# **The Fall of Japan and the US: Mismanaging Complexity?**

- ***The overthrow of Japan's wartime elite opened up space for a dynamic new elite focused on rebuilding the nation. But success refocused the elite on building personal and group links that provided security and benefits, but prevented effective national leadership. For, these elite interpersonal networks:***
  - ***fostered intra-elite exchange of favours that reduced system efficiency***
  - ***required so much maintenance as to distract the elite from their duties***
  - ***grew so complex that they paralyzed elite leadership when it faced a national crisis.***
- ***For the same reasons, the US political/financial elite failed to provide effective national leadership before and after its financial crisis.***

# JAPAN INC: THE ULTIMATE KEIRETSU



# Mitsubishi Keiretsu: Equity Cross-Holdings

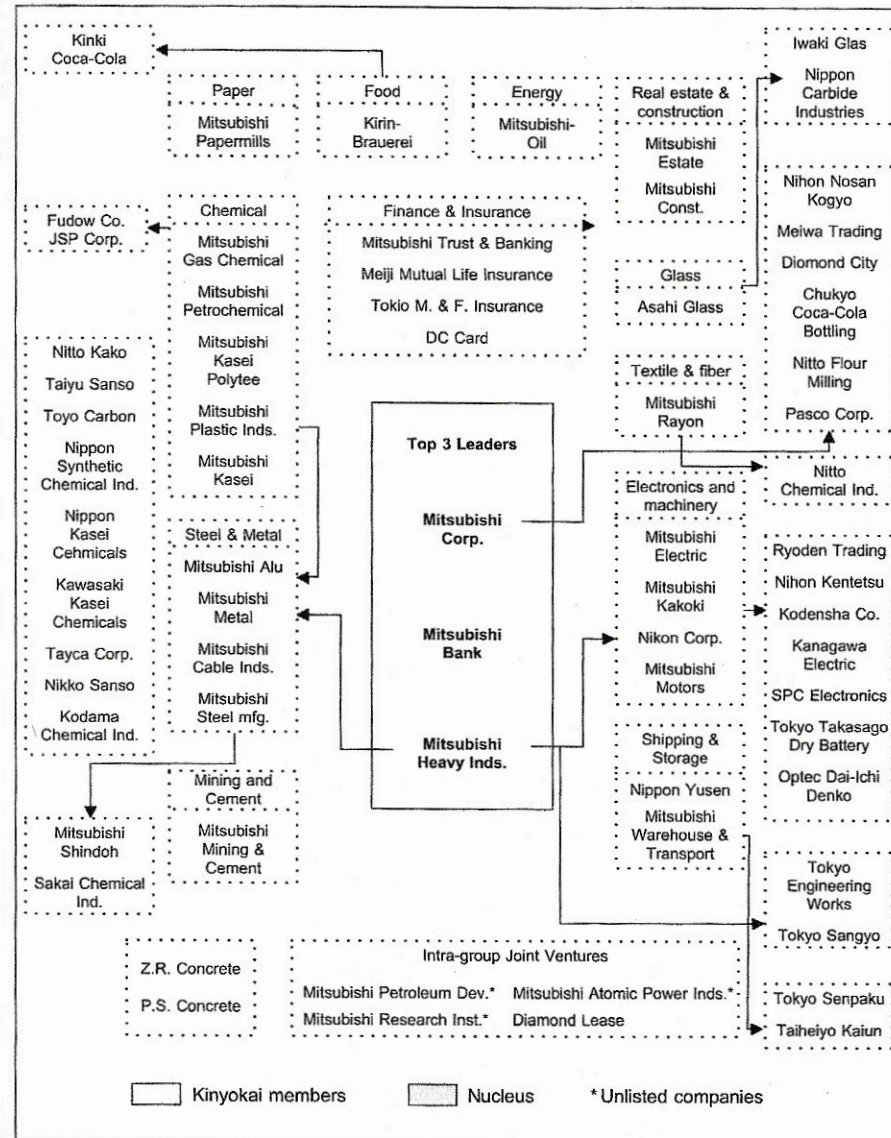


—▶ Biggest shareholder  
—▶ Shareholding

Figures show percentages 1990 with trend 1990–2000

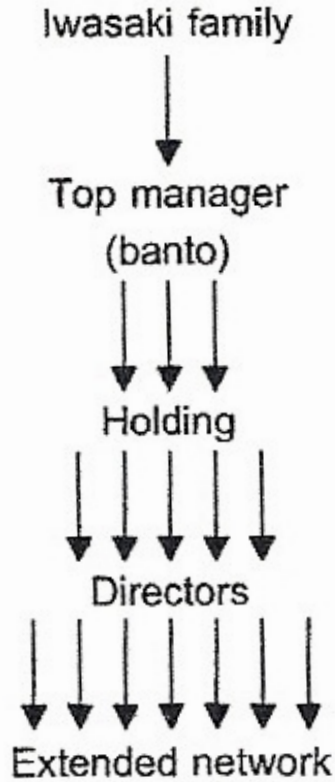


# Mitsubishi Keiretsu: Kinyokai (Friday Club)

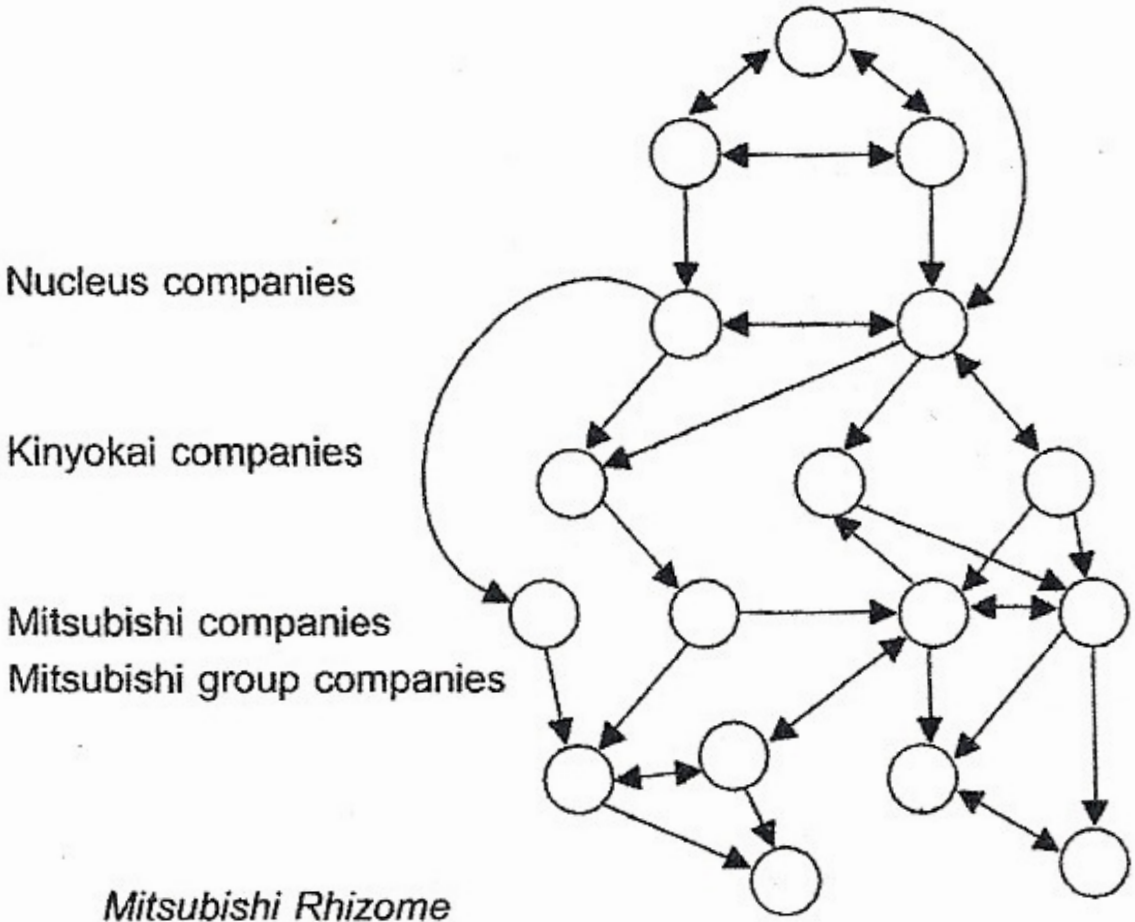


# Mitsubishi Directors' Network: Zaibatsu vs. Keiretsu

*Mitsubishi Zaibatsu*



*Mitsubishi Keiretsu*



# Mitsubishi Heavy Industries as Sub-Keiretsu

