Systemic Risk: The Great Recession vs. The Great Depression

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Motivation

- Financial crises can have severe consequences, depressing living standards and lengthening the time of recovery from recessions (Reinhart and Rogoff, 2014)
- Crisis of 2007-8 suggests linkages among financial institutions may have played a role in propagating financial distress
- Recent work on the Great Depression (Mitchener and Richardson 2013, 2015) shows how network linkages transmit distress *and amplify* the decline in credit during a crisis

Systemic Risk (SR) materializes from:

1. Heightened default probabilities of financial institutions (FI) or the belief they will occur
2. Connections between FIs (credit quality, interbank deposits, etc.)
   - Allen and Gale (2000), Elliott, Golub, and Jackson (2014), Acemoglu, Ozdaglar, and Tahbaz-Salehi (2015)

- Systemic risk matters if the risks and perceived or actual negative externalities are large
  - e.g., large-scale credit disintermediation and/or amplification of business cycles when systemically important FIs suspend or fail

Dodd-Frank Act (2010)

- Defined a systemically important financial institution (SIFI) as any FI that is:

1. Large
2. Complex
3. Connected to other FIs
4. "Critical" -- provides hard to substitute services to the financial system

- Assumption – The suspension or failure of *particular* FIs matters for the financial system's health
- Implication – Measuring institution i's contribution to systemic risk important for understanding potential for negative externalities

Our Research Agenda

- Examine *ex ante* systemic risk prior to the two largest American financial crises in (at least) the last 110 years
  - How prone was each system to failure?
  - How do the networks compare in structure?
  - Where were the vulnerabilities?
- Consider counterfactual stressors and outcomes

Disclaimer: comparisons across the two crises are interesting but challenging

- Changes in financial firms and reporting of them raise issues of comparability
- Measurement of networks
  - Market-based measures yield less data historically
  - More “banks” historically then presently
  - More shadow banks presently
- Reasons for linkages may have changed over 75 years
  - e.g., formal correspondent linkages more important in the past?

Economic History research on banking networks grown in last 5 years

- Heitfield, Richardson & Wang (2013) correspondent relationships of all banks operating in Tennessee, Mississippi and Alabama in 1930 to study the first banking panic.
- Mitchener and Richardson (2013, 2015) measure how interbank flows amplified credit downturn during Great Depression
- Carlson and Wheelock (2016) explore how founding of Fed influenced interbank network's ability to cope with solvency vs. liquidity shocks
- Paddrik, Park, Wang (2016) introduction of national banks, network concentration, and stability
- Lots of work still to be done, including links to the present ...

Methodology

- Use a common, flexible approach based on Das (2016) and Das et. al. (2017) to quantify risk for each era's financial network
- Allows us to consider empirically estimate "exposure" despite not knowing everything we might want about each network
  - Unlike 1929, formal networks are unobservable today – regulators (e.g., Fed & FDIC) do not collect information
  - Data on balance-sheet linkages between FIs is often opaque or incomplete, both historically and today

Generalized Systemic Risk Measure

Our overall systemic risk measure takes the following functional form:

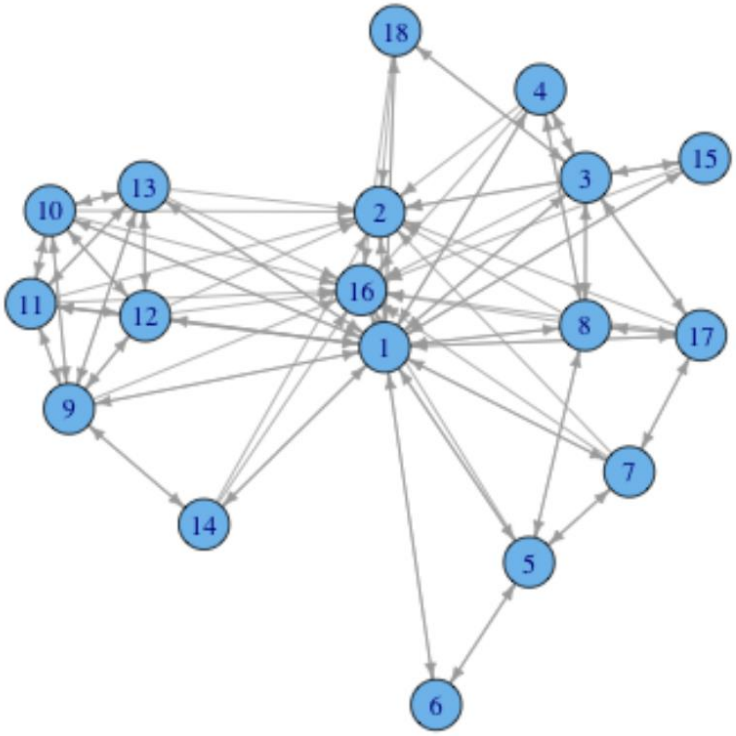
$$S = (C'\, EC)^{1/2}$$

where C is an $n\ x\ 1$ vector of credit risk measures and E is a network adjacency matrix.

Risk to the system from institution *i* has two components:

1) Internal Risk ("Compromise Risk")
   - The likelihood institution *i* fails or suspends and the impact that event has on the system
   - e.g., could be defined as credit risk
2) External Risk ("Connectivity Risk")
   - The chance that a collapse of institution *i* increases the likelihood that other institutions then suspend or fail

Example of a directed network with 18 nodes



Adjacency Matrix

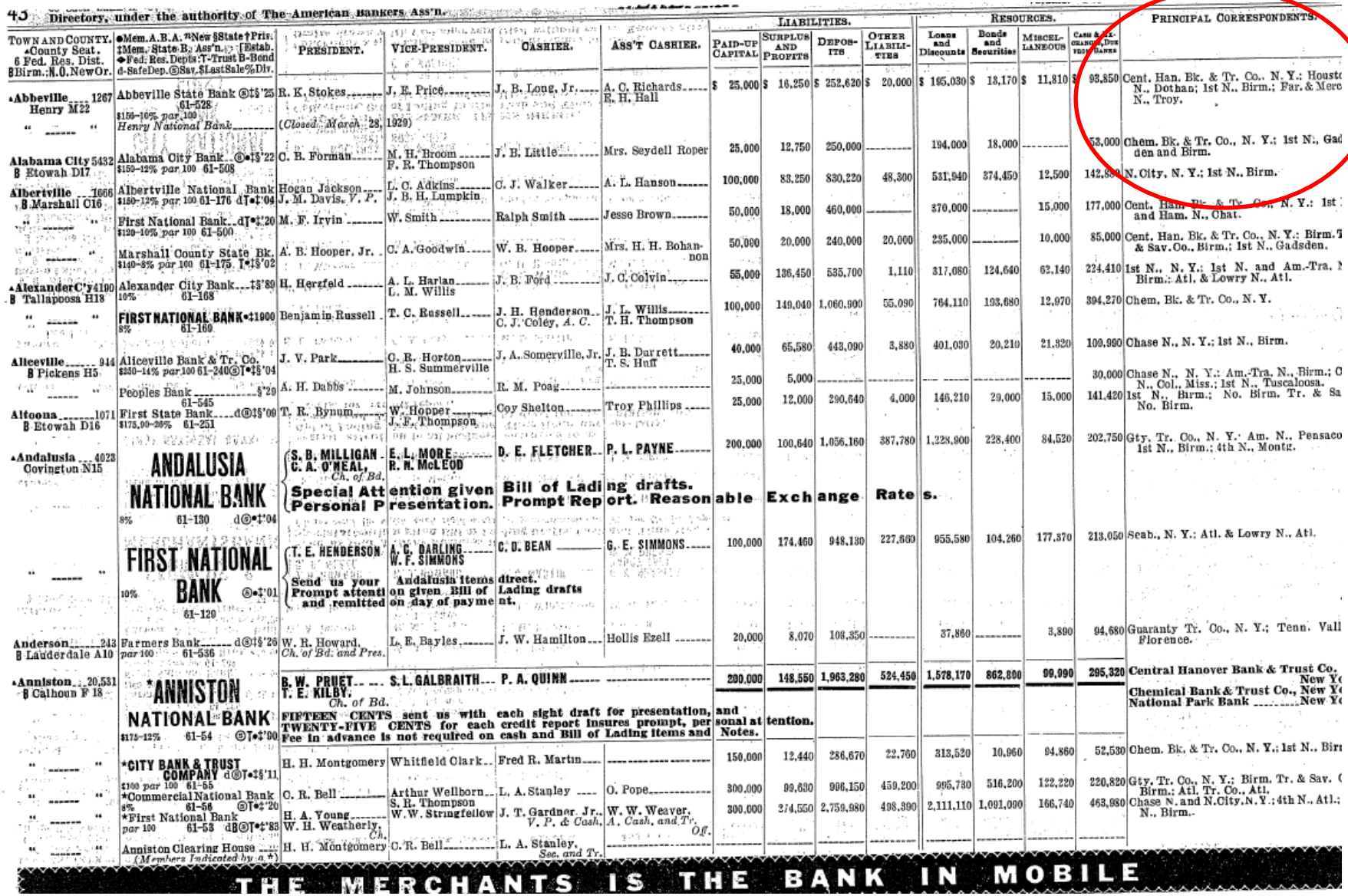
	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]	[,13]	[,14]	[,15]	[,16]	[,17]	[,18]
[1,]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
[2,]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[3,]	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1
[4,]	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
[5,]	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0
[6,]	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
[7,]	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0
[8,]	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0
[9,]	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0
[10,]	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0
[11,]	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0
[12,]	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0
[13,]	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0
[14,]	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0
[15,]	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
[16,]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
[17,]	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0
[18,]	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

One-way arrows means that risk flows in the direction of the arrow. Two-way arrows means risk flows in both directions. The network is summarized in the adjacency matrix.

1929 Data

- Hand collected from Rand McNally *Bankers' Directory*
  - Balance sheet information, location, correspondents
- All banks in the United States operating in 1929
  - 28,522 institutions
  - 4,040 correspondents
  - 72,991 linkages

In honor of the RAs



43 Directory, under the authority of The American Bankers Ass'n.

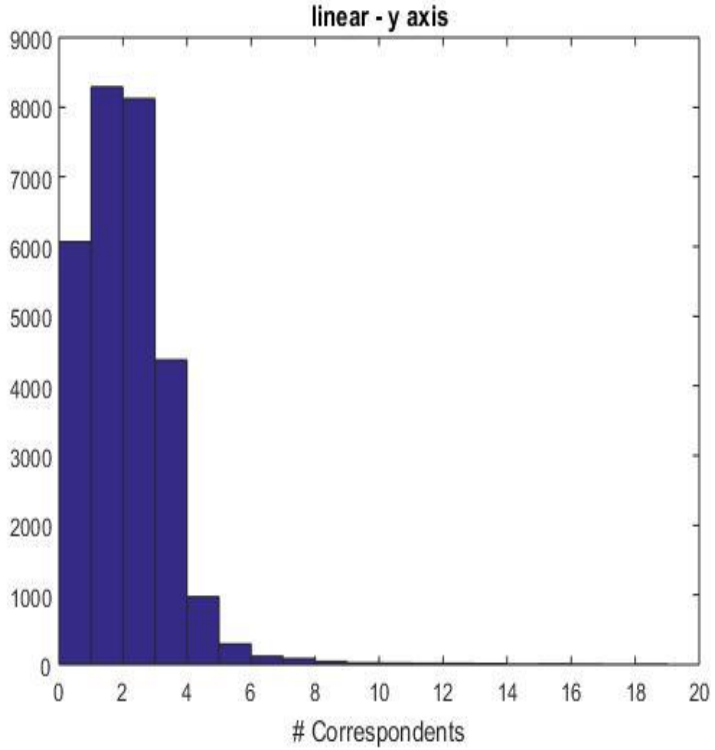
Town and County. ▲County Seat. 6 Fed. Res. Dist. B Birm. N.O. New Or.	●Mem. A.B.A. ¶New §State †Priv. ‡Mem. State B. Ass'n. : [Estab. ◆Fed. Res. Depts: T-Trust B-Bond d-SafeDep. ⓢSav. $Last Sale %Div.	President.	Vice-President.	Cashier.	Ass't Cashier.	Liabilities. Paid-up Capital	Surplus and Profits	Deposits	Other Liabilities	Resources. Loans and Discounts	Bonds and Securities	Miscellaneous	Cash & Exchanges, Due from Banks	Principal Correspondents.
▲Abbeville 1267 Henry M22	Abbeville State Bank ⓒ†$'25 61-528 $155–10% par 100 *Henry National Bank*	R. K. Stokes	J. E. Price (*Closed, March 28, 1929*)	J. B. Long, Jr.	A. C. Richards, E. H. Hall	$ 25,000	$ 16,250	$ 252,620	$ 20,000	$ 195,030	$ 13,170	$ 11,310	$ 93,850	Cent. Han. Bk. & Tr. Co., N. Y.; Houst N., Dothan; 1st N., Birm.; Far. & Merc N., Troy.
Alabama City 5432 B Etowah D17	Alabama City Bank ⓒ●†$'22 $155–12% par 100 61-508	C. B. Forman	M. H. Broom, F. R. Thompson	J. B. Little	Mrs. Seydell Roper	25,000	12,750	250,000		194,000	18,000		53,000	Chem. Bk. & Tr. Co., N. Y.; 1st N., Gad den and Birm.
Albertville 1666 B Marshall C16	Albertville National Bank $150–12% par 100 61-176 d†●†'04	Hogan Jackson	L. C. Adkins, J. B. H. Lumpkin	C. J. Walker	A. L. Hanson	100,000	83,250	830,220	48,300	531,940	374,450	12,500	142,880	N. City, N. Y.; 1st N., Birm.
" "	First National Bank d†●†'20 $120–10% par 100 61-500	M. F. Irvin	W. Smith	Ralph Smith	Jesse Brown	50,000	18,000	460,000		370,000		15,000	177,000	Cent. Han. Bk. & Tr. Co., N. Y.; 1st and Ham. N., Chat.
" "	Marshall County State Bk. $140–8% par 100 61-175 †●†$'02	A. B. Hooper, Jr.	C. A. Goodwin	W. B. Hooper	Mrs. H. H. Bohannon	50,000	20,000	240,000	20,000	235,000		10,000	85,000	Cent. Han. Bk. & Tr. Co., N. Y.; Birm. & Sav. Co., Birm.; 1st N., Gadsden.
▲Alexander C'y 4190 B Tallapoosa H18	Alexander City Bank †$'89 10% 61-168	H. Herzfeld	A. L. Harlan, L. M. Willis	J. B. Ford	J. C. Colvin	55,000	136,450	535,700	1,110	317,080	124,640	62,140	224,410	1st N., N. Y.; 1st N. and Am.-Tra. Birm.; Atl. & Lowry N., Atl.
" "	FIRST NATIONAL BANK ◆†1900 8% 61-160	Benjamin Russell	T. C. Russell	J. H. Henderson, C. J. Coley, *A. C.*	J. L. Willis, T. H. Thompson	100,000	149,040	1,060,900	55,090	764,110	193,680	12,970	394,270	Chem. Bk. & Tr. Co., N. Y.
Aliceville 944 B Pickens H5	Aliceville Bank & Tr. Co. $250–14% par 100 61-240 ⓒ†●†$'04	J. V. Park	C. R. Horton, H. S. Summerville	J. A. Somerville, Jr.	J. B. Darrett, T. S. Huff	40,000	65,580	443,090	3,880	401,030	20,210	21,320	109,990	Chase N., N. Y.; 1st N., Birm.
" "	Peoples Bank $'29 61-545	A. H. Dabbs	M. Johnson	R. M. Poag		25,000	5,000						30,000	Chase N., N. Y.; Am.-Tra. N., Birm.; C N., Col., Miss.; 1st N., Tuscaloosa.
Altoona 1071 B Etowah D16	First State Bank d ⓒ†$'09 $175.00–20% 61-251	T. R. Bynum	W. Hopper, J. F. Thompson	Coy Shelton	Troy Phillips	25,000	12,000	290,640	4,000	146,210	29,000	15,000	141,420	1st N., Birm.; No. Birm. Tr. & Sa No. Birm.
▲Andalusia 4023 Covington N15	ANDALUSIA NATIONAL BANK 8% 61-130 d ⓒ●†'04	S. B. MILLIGAN, C. A. O'NEAL, *Ch. of Bd.*	E. L. MORE, R. M. McLEOD	D. E. FLETCHER	P. L. PAYNE	200,000	100,640	1,056,160	387,780	1,228,800	228,400	84,520	202,750	Gty. Tr. Co., N. Y.; Am. N., Pensaco 1st N., Birm.; 4th N., Montg.
		Special Attention given Personal Presentation.		Bill of Lading drafts. Prompt Report. Reasonable Exchange Rates.										
" "	FIRST NATIONAL BANK 10% 61-129 ⓢ●†'01	T. E. HENDERSON	A. C. DARLING, W. F. SIMMONS	C. D. BEAN	G. E. SIMMONS	100,000	174,460	948,130	227,660	955,580	104,260	177,370	213,050	Seab., N. Y.; Atl. & Lowry N., Atl.
		Send us your Prompt attenti and remitted	Andalusia items on given Bill of on day of payme	direct. Lading drafts at.										
Anderson 243 B Lauderdale A10	Farmers Bank d ⓒ†$'26 par 100 61-536	W. R. Howard, *Ch. of Bd. and Pres.*	L. E. Bayles	J. W. Hamilton	Hollis Ezell	20,000	8,070	103,350		37,860		3,390	94,680	Guaranty Tr. Co., N. Y.; Tenn. Vall Florence.
▲Anniston 20,531 B Calhoun F 18	ANNISTON NATIONAL BANK $175–12% 61-54 ⓒ†●†'90	B. W. PRUET, T. E. KILBY, *Ch. of Bd.*	S. L. GALBRAITH	P. A. QUINN		200,000	148,550	1,963,280	524,450	1,578,170	862,880	99,990	295,320	Central Hanover Bank & Trust Co., New Y Chemical Bank & Trust Co., New Y National Park Bank, New Y
		FIFTEEN CENTS sent us with each sight draft for presentation, and TWENTY-FIVE CENTS for each credit report Insures prompt, personal attention. Fee in advance is not required on cash and Bill of Lading items and Notes.												
" "	*CITY BANK & TRUST COMPANY d ⓒ†●†$'11 $100 par 100 61-55	H. H. Montgomery	Whitfield Clark	Fred R. Martin		150,000	12,440	286,670	22,760	313,520	10,960	94,860	52,530	Chem. Bk. & Tr. Co., N. Y.; 1st N., Birm
" "	*Commercial National Bank 8% 61-56 ⓒ†●†'20	C. R. Bell	Arthur Wellborn, S. R. Thompson	L. A. Stanley	O. Pope	300,000	99,630	906,150	459,200	995,730	516,200	122,220	220,820	Gty. Tr. Co., N. Y.; Birm. Tr. & Sav. Birm.; Atl. Tr. Co., Atl.
" "	*First National Bank par 100 61-53 dⓒ†●†'83	H. A. Young, W. H. Weatherly, *Ch.*	W. W. Stringfellow	J. T. Gardner, Jr., *V. P. & Cash.*	W. W. Weaver, *A. Cash. and Tr. Off.*	300,000	274,550	2,759,980	498,390	2,111,110	1,091,090	166,740	463,980	Chase N. and N.City, N. Y.; 4th N., Atl.; N., Birm.
" "	Anniston Clearing House (*Members Indicated by a* *)	H. H. Montgomery	C. R. Bell	L. A. Stanley, *Sec. and Tr.*										

THE MERCHANTS IS THE BANK IN MOBILE

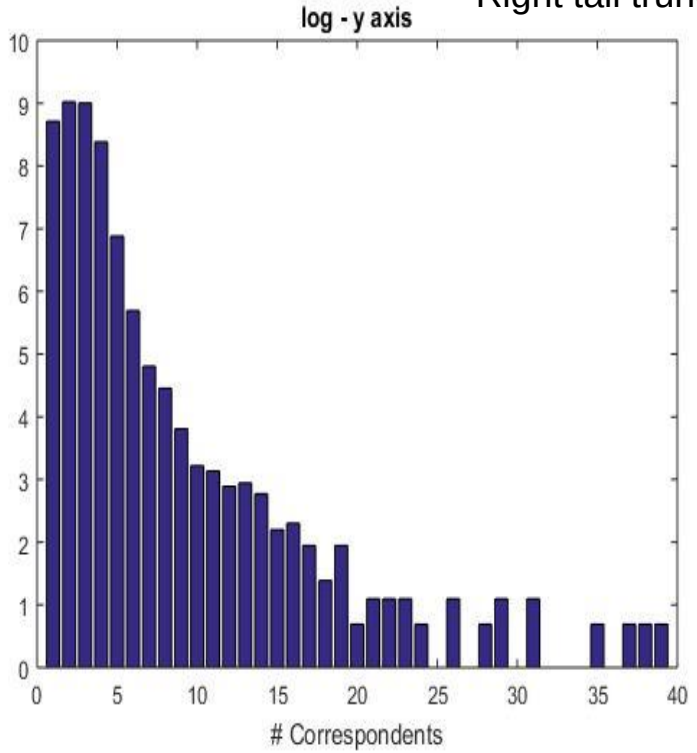
1929 Bank-level Analysis

- Average number of correspondents = 2.6
- Median number of correspondents = Mode = 2

Histograms



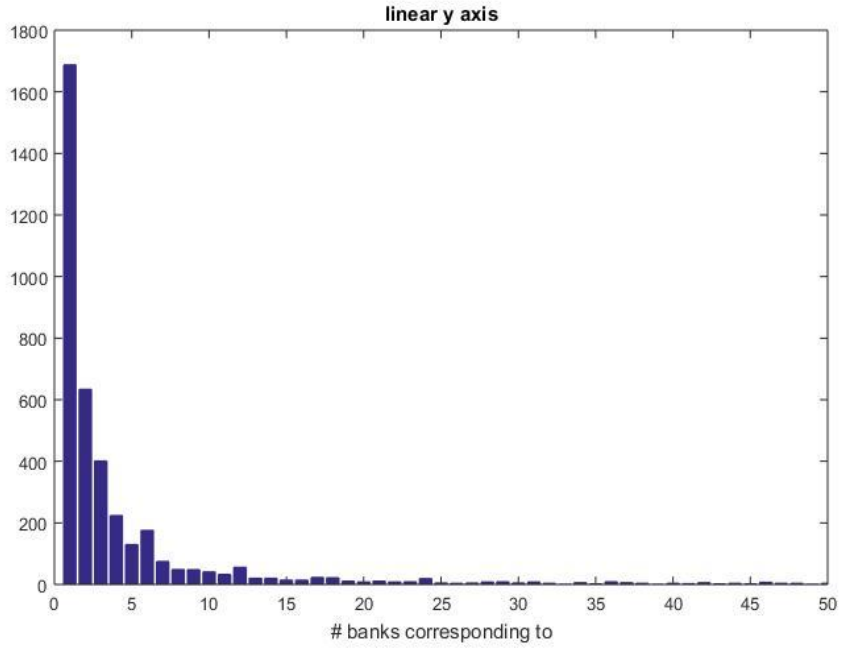
Right tail truncated

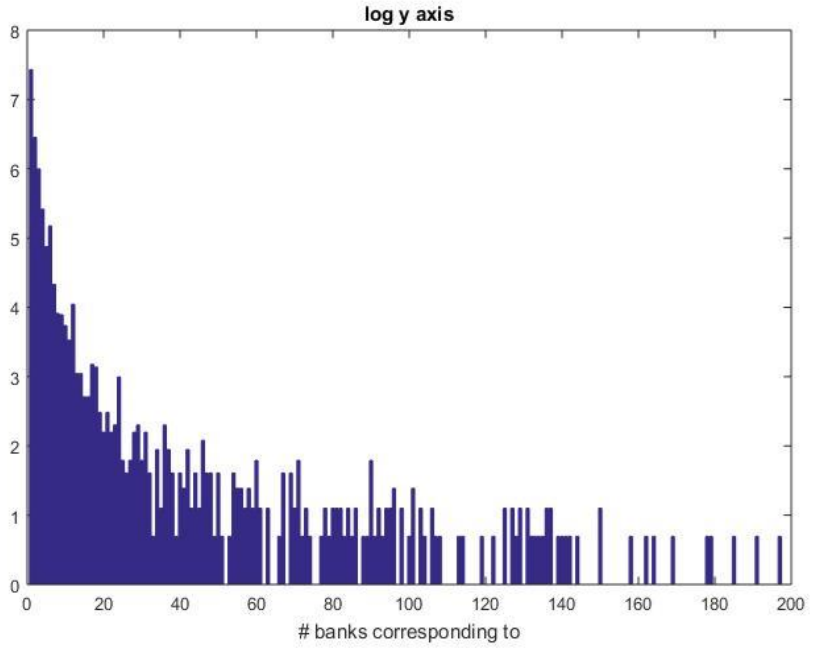


1929 Bank-level statistics

- For the 4,040 banks listed as correspondents
  - Average number of banks corresponding to = 18.1
  - Median number of banks corresponding to = 2, (Mode = 1)
  - Minimum = 1 and Maximum = 4,673 (guesses?)

Histograms





Banks with most relationships, 1929

Bank Name and Location	# corresponding to
1) Continental Illinois Bank and Trust Co. Chicago (in Chicago, IL)	4673
2) Chase National Bank (in New York City, NY)	3107
3) Central Hanover Bank and Trust Company (in New York City, NY)	2749
4) National City Bank (in Ney York City, NY)	1770
5) First National Bank Of Chicago (in Chicago, IL)	1750
6) Guaranty Trust Company of New York (in New York City, NY)	1729
7) National Park Bank (in New York City, NY)	1486
8) Irving Trust Company (in New York City, NY)	1133
9) The Philadelphia National Bank (in Philadelphia, PA)	1128
10) First National Bank (in Minneapolis, MN)	1081

1929 Analysis at the city level

Credit Risk in 1929

- Our measure of *C* is defined as

(Undivided profits + Surplus) / net worth

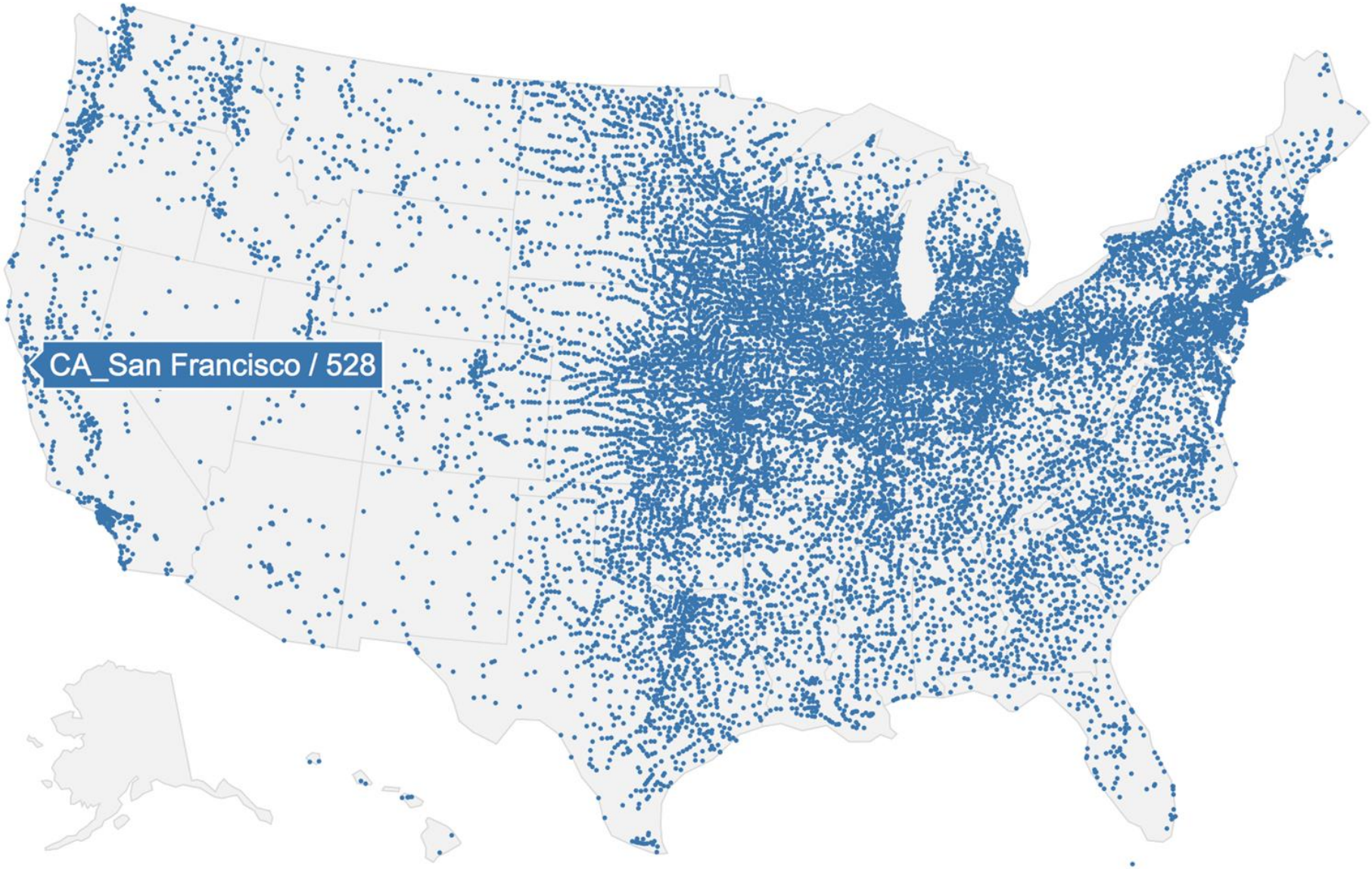
Where net worth = paid-in capital + Undivided profits + Surplus

Intuition: leverage ratio

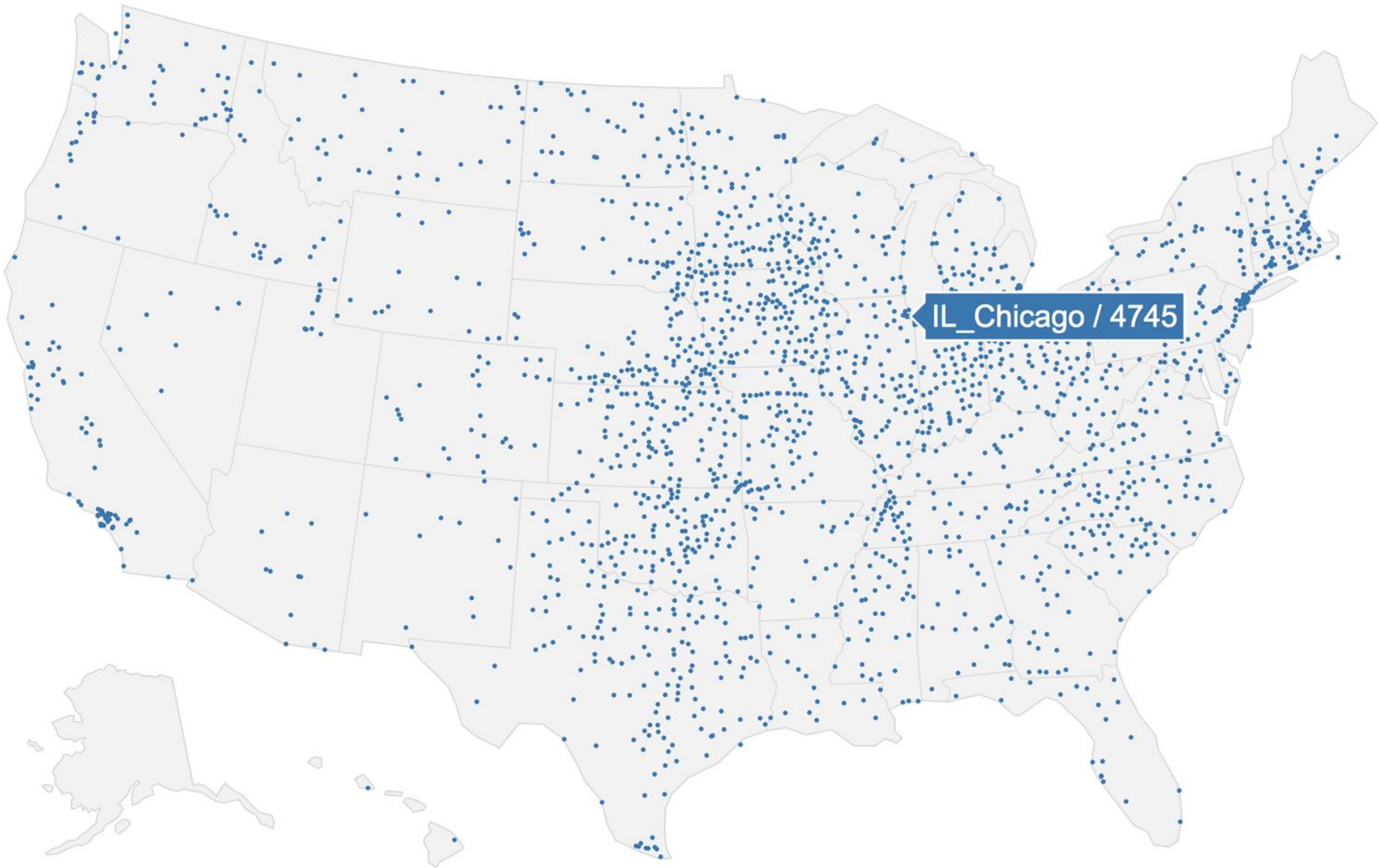
Basic Network Statistics for 1929

- We begin by defining a link as a connection between banks with HQs in two distinct cities
  - Not at the bank level - gives a better depiction of network than single one-off transaction for each bank.
- Number of nodes (cities) = 15,697
- Number of links between cities = 43,237
- Largest connected cluster size = 15,617 (almost all cities are connected)
- Diameter is the *longest shortest path between any two connected nodes*
  - For our largest cluster (i.e., all cities) = 17
  - Implications for contagion

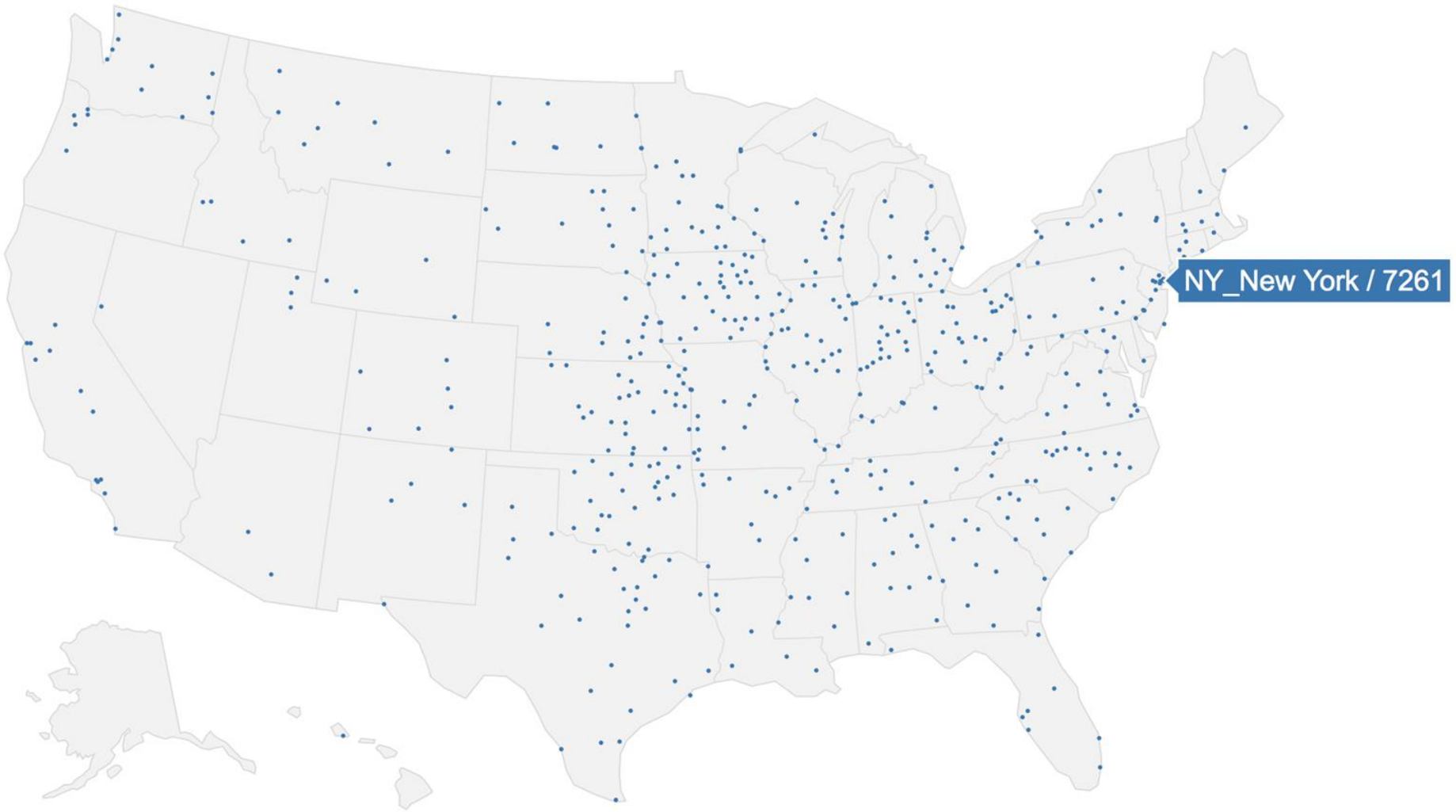
1929 All Nodes



Minimum of 5 City Connections (connections defined at city level)

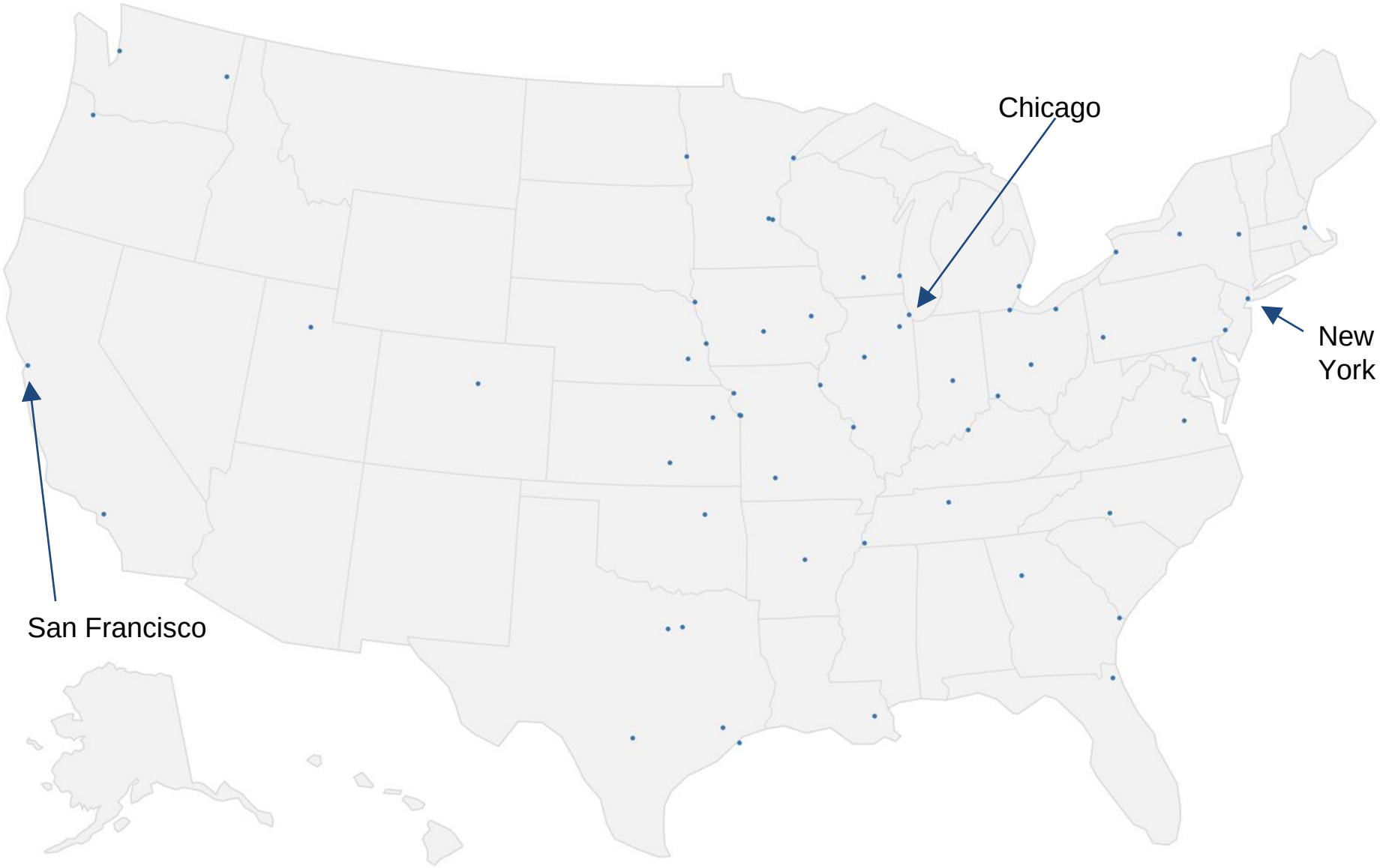


Minimum of 10 City connections (connections defined at city level)



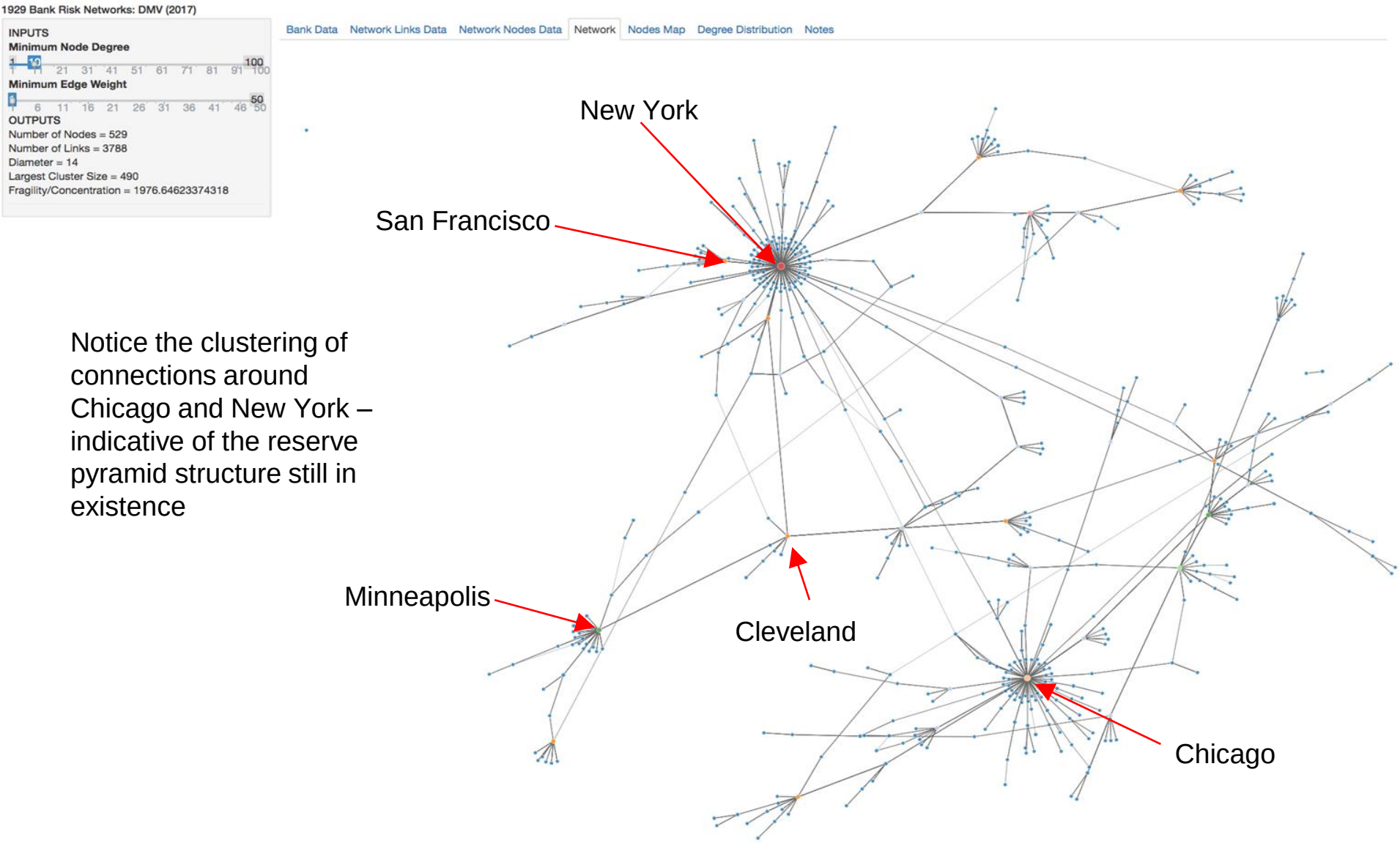
Minimum of 100 city connections

(High Correspondence with Reserve Cities)



1929 Network

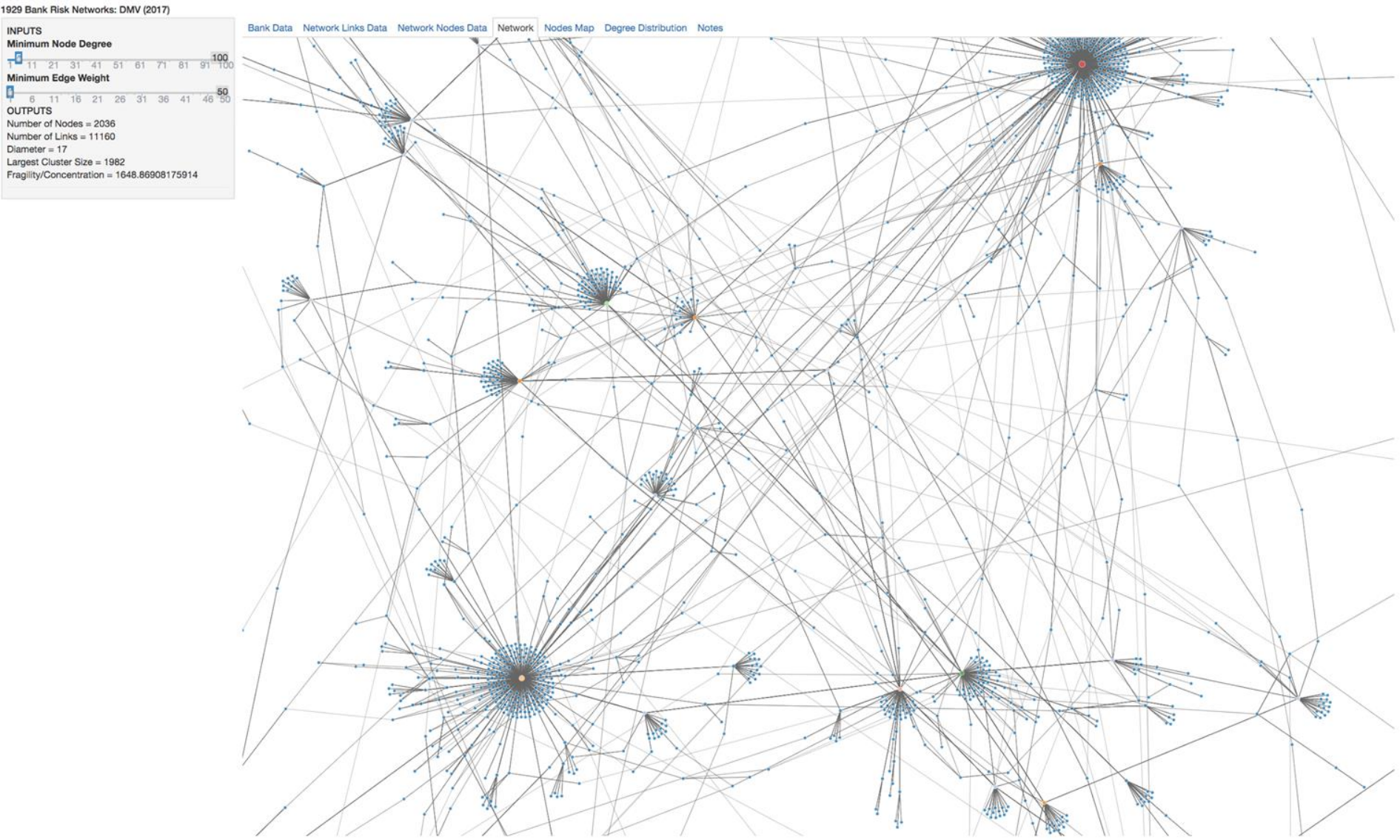
(Nodes with at least 10 connections)



Notice the clustering of connections around Chicago and New York – indicative of the reserve pyramid structure still in existence

1929 Network

(Nodes with at least 5 connections)



Interacting with the data

1929 Bank Risk Networks: DMV (2017)

INPUTS

Minimum Node Degree

1 10 100

1 11 21 31 41 51 61 71 81 91 100

Minimum Edge Weight

1 50

1 6 11 16 21 26 31 36 41 46 50

OUTPUTS

Number of Nodes = 529
Number of Links = 3788
Diameter = 14
Largest Cluster Size = 490
Fragility/Concentration = 1976.64623374318

Bank Data | Network Links Data | Network Nodes Data | Network | Nodes Map | Degree Distribution | Notes

Show 10 entries Search:

	StateCity	Unique	State.Initial	State	TownName	TownPopulation	TownMapCoordinates	CountyName	NameofBank	RoutingNumber
	All	All	All	.	All	All	All	All	All	All
1	AL__	AL___Bank Of Louisville	AL	Alabama	_	504	L20	Barbour	Bank Of Louisville	61-319
2	AL_Abbeville	AL_Abbeville_Abbeville State Bank	AL	Alabama	Abbeville	1267	M22	Henry	Abbeville State Bank	61-528
3	AL_Abbeville	AL_Abbeville_Henry National Bank	AL	Alabama	Abbeville	1267	M22	Henry	Henry National Bank	61-439
4	AL_Alabama City	AL_Alabama City_Alabama City Bank	AL	Alabama	Alabama City	5432	D17	Etowah	Alabama City Bank	61-508
5	AL_Albertville	AL_Albertville_First National Bank	AL	Alabama	Albertville	1666	C16	Marshall	First National Bank	61-500
6	AL_Albertville	AL_Albertville_Albertville National Bank	AL	Alabama	Albertville	1666	C16	Marshall	Albertville National Bank	61-176
7	AL_Albertville	AL_Albertville_Marion Junction State Bank	AL	Alabama	Albertville	1666	C16	Marshall	Marion Junction State Bank	61-175
8	AL_Alexander City	AL_Alexander City_First National Bank	AL	Alabama	Alexander City	4190	H18	Tallapoosa	First National Bank	61-169
9	AL_Alexander City	AL_Alexander City_Alexander City Bank	AL	Alabama	Alexander City	4190	H18	Tallapoosa	Alexander City Bank	61-168
10	AL_Aliceville	AL_Aliceville_Peoples Bank	AL	Alabama	Aliceville	944	H5	Pickens	Peoples Bank	61-545

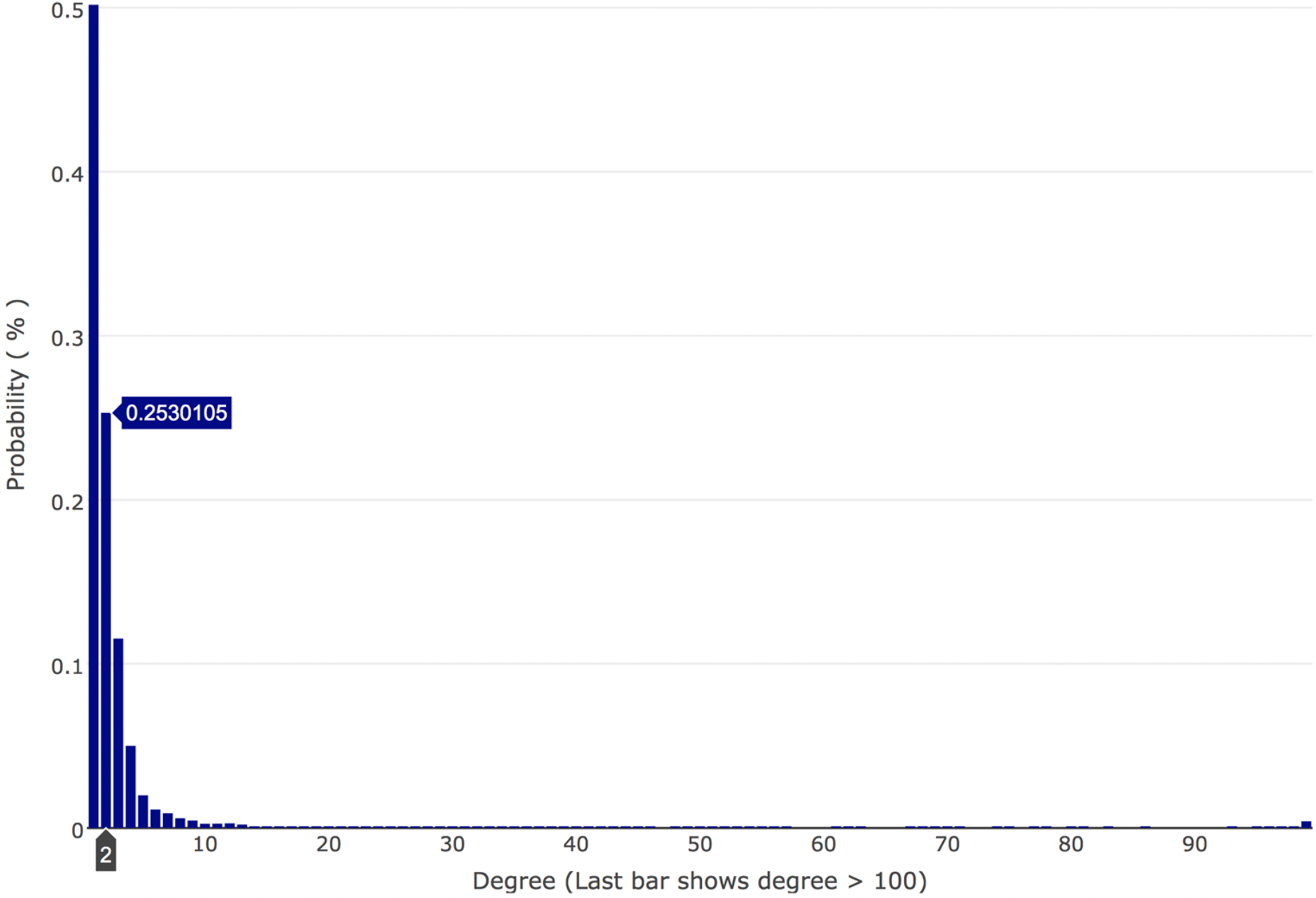
Showing 1 to 10 of 28,527 entries

Previous 1 2 3 4 5 ... 2853 Next

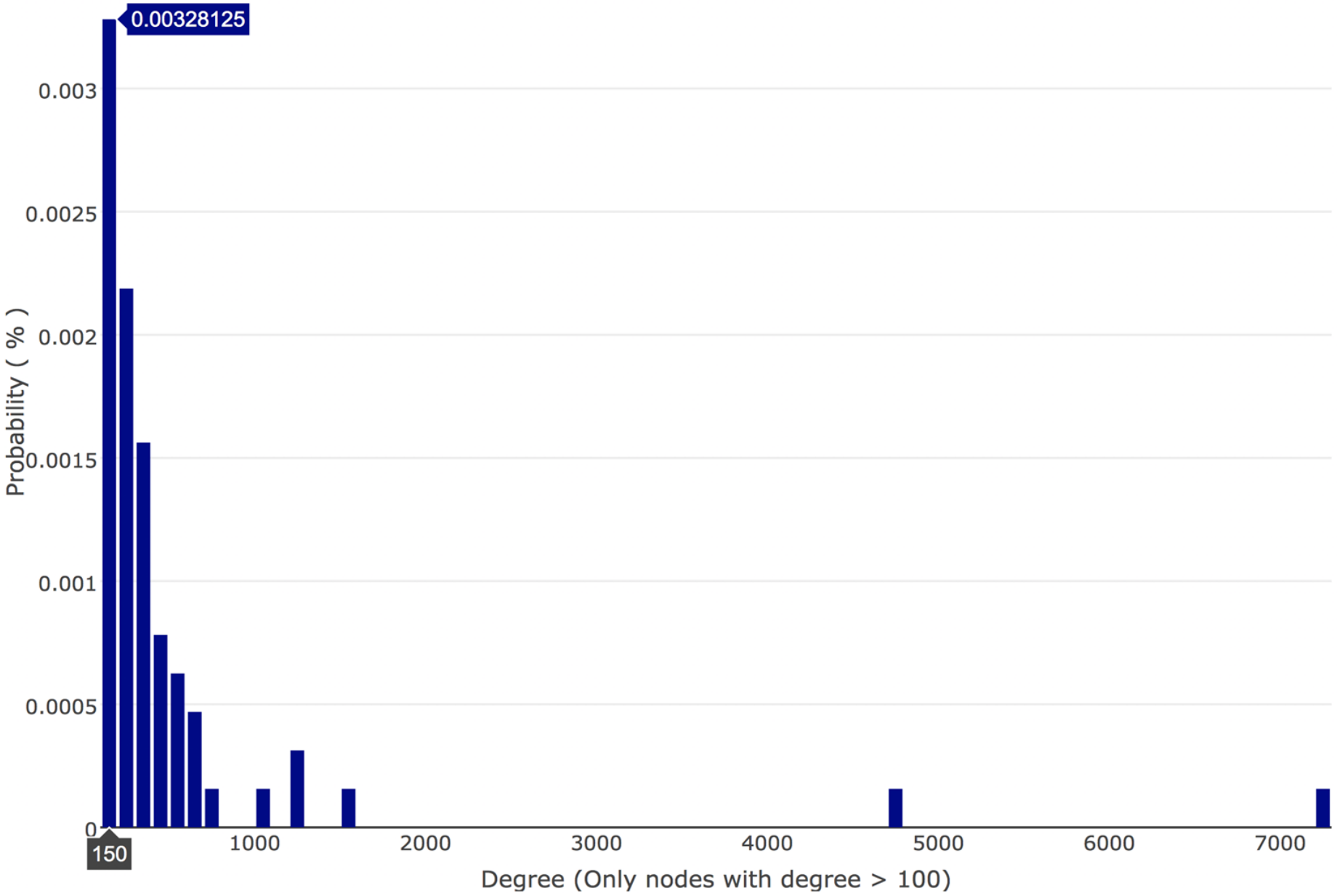
Network Structure

- Random network theory predicts most nodes will have roughly the same number of links
  - Nodes typically follow a Poisson distribution with a bell shape
- Social & economic networks tend to follow power laws (Barabasi and Bonabeau, 2003; Gabaix, 2003)
  - The probability that any node was connected to j other nodes was proportional to $1/j^{\alpha}$
  - So, if $\alpha \sim 2$, any node was roughly four times as likely to have just half the number of incoming links as another node.
  - Characterized by continuously decreasing function

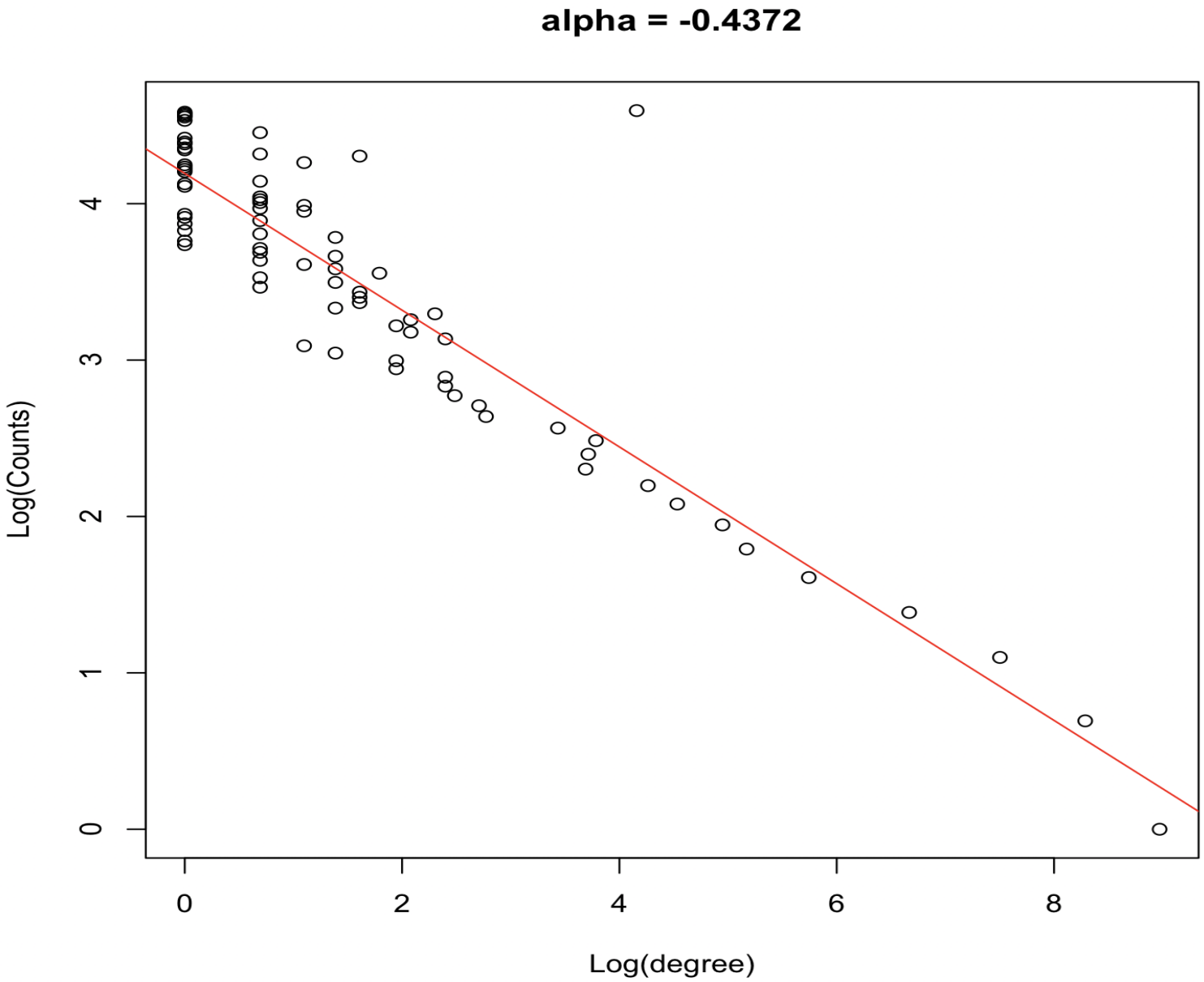
Distribution of Linkages



Right tail of linkage distribution



Power Law Coefficient



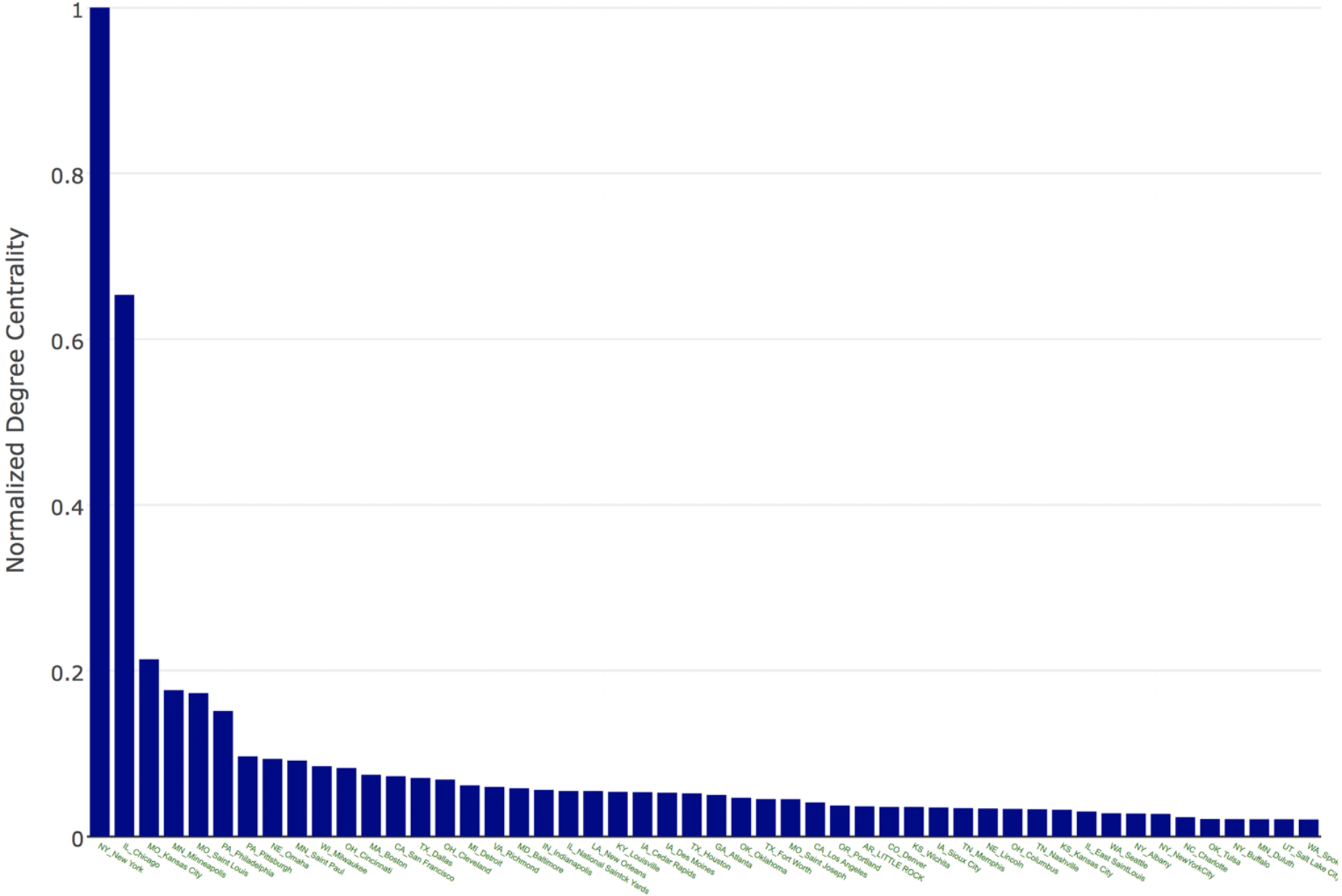
Centrality of Nodes

- The node that is most important in terms of connectivity
- Influence of any node, x_i , in a network comes from connections to other nodes *j*. These nodes are impacted by the nodes they are connected to and so on, such that

$$x_i = \sum_{j=1}^{n} E_{ij} x_j$$

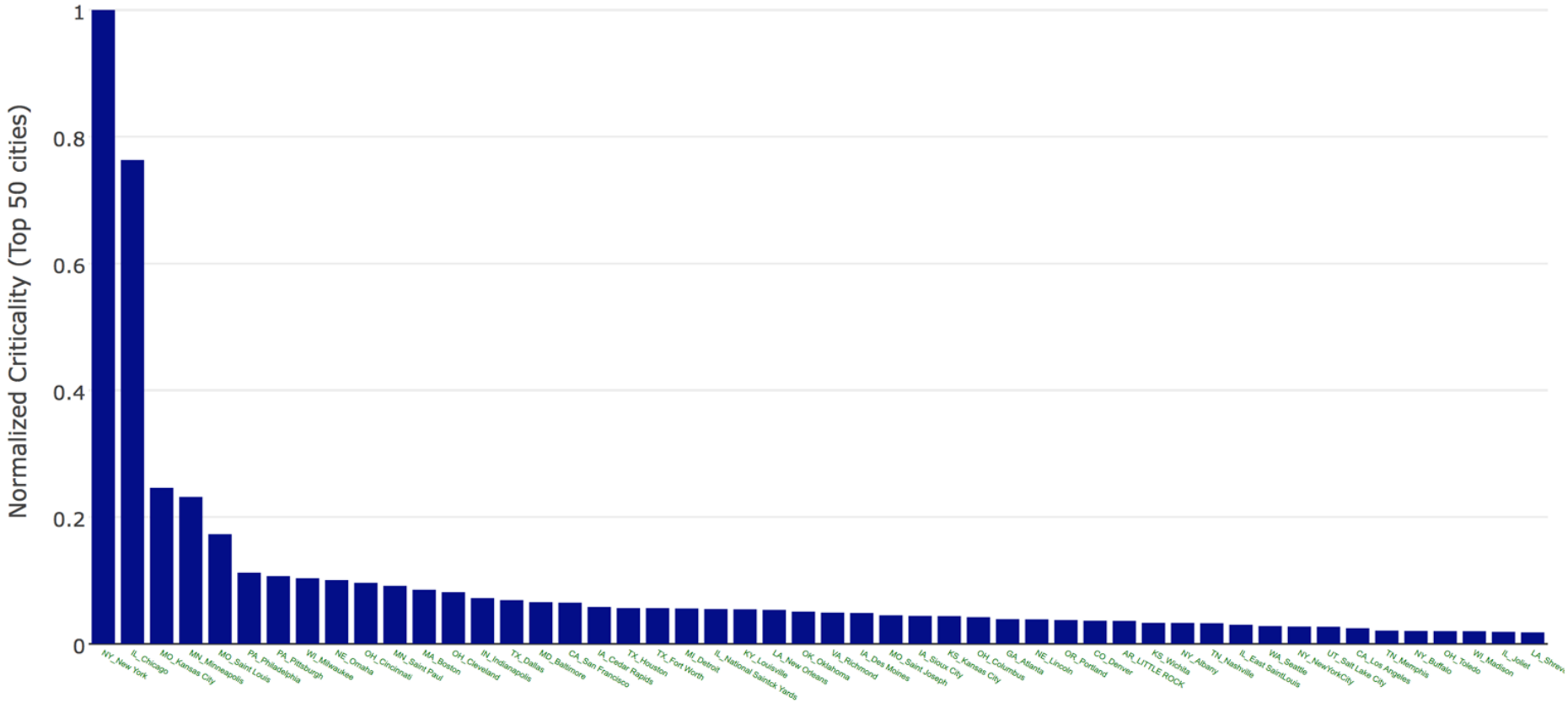
- LHS of system of equations is a n-vector *x* which provides a score for the influence or centrality of each node in the network.

Centrality in 1929



Criticality in 1929

- Ordering depends on credit quality of banks as well as centrality
- Criticality = Centrality x Leverage (proxy for credit risk)



Systemic Risk

We implement the simple systemic risk measure

$$S = (C' \, EC)^{1/2}$$

Where *C* is the risk vector, i.e., leverage, and *E* is the network (0,1) adjacency matrix (linkages).

S = 826.13 -- hard to interpret as there is no time series of these values

Risk Decomposition: Impact of each institution on S

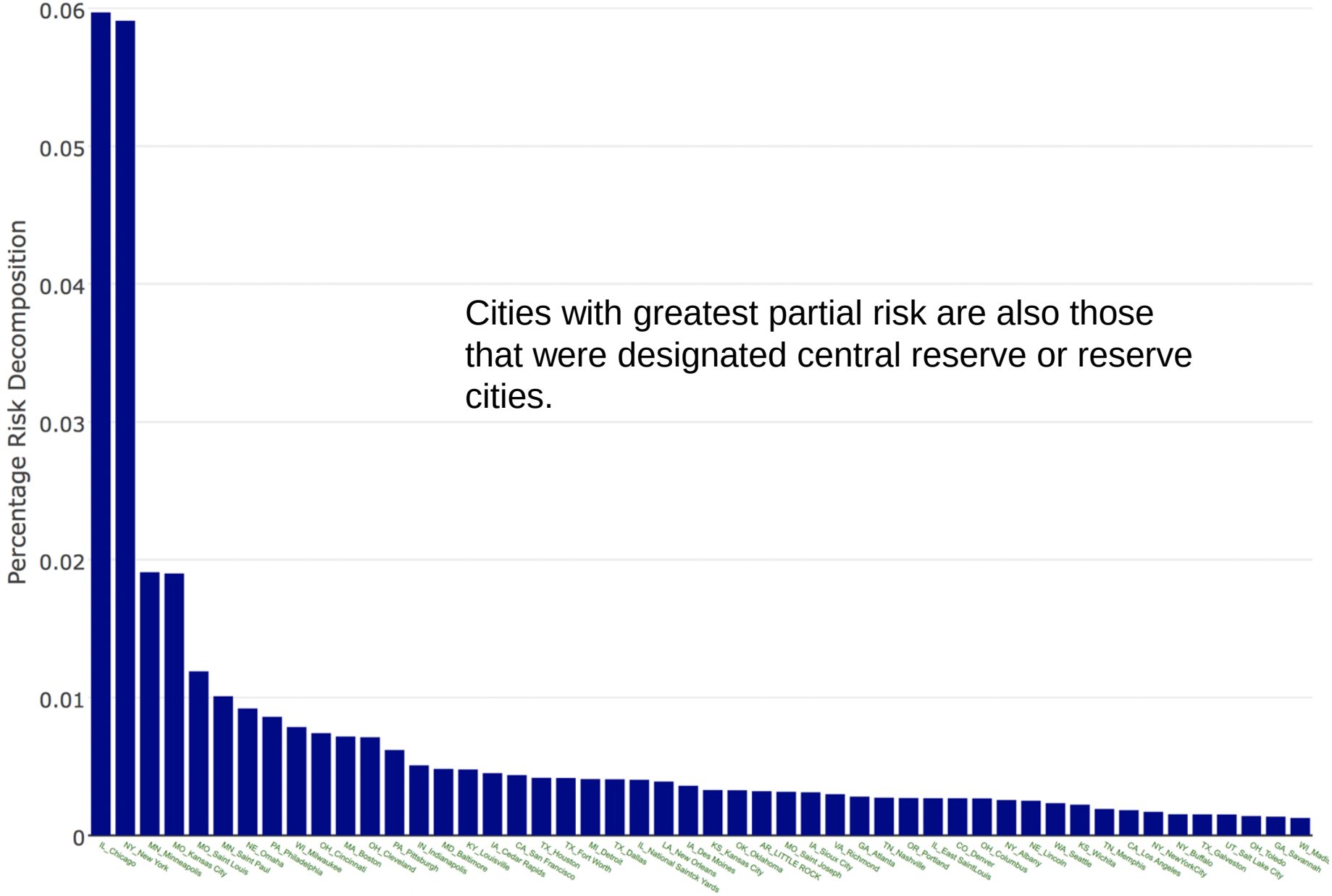
Decompose S into the sum of n components by differentiating with respect to C

Using Euler's theorem, the decomposition is:

$$S = \frac{\partial S}{\partial C} C = \sum_{i=1}^{n} \frac{\partial S}{\partial C_i} C_i = \frac{C}{2S}(E'C + EC) \in R^n$$

Therefore, each component, $\frac{\partial S}{\partial C_i} C_i$, defines the corresponding institution risk measure of institution *i.*

Risk Decomposition Plot

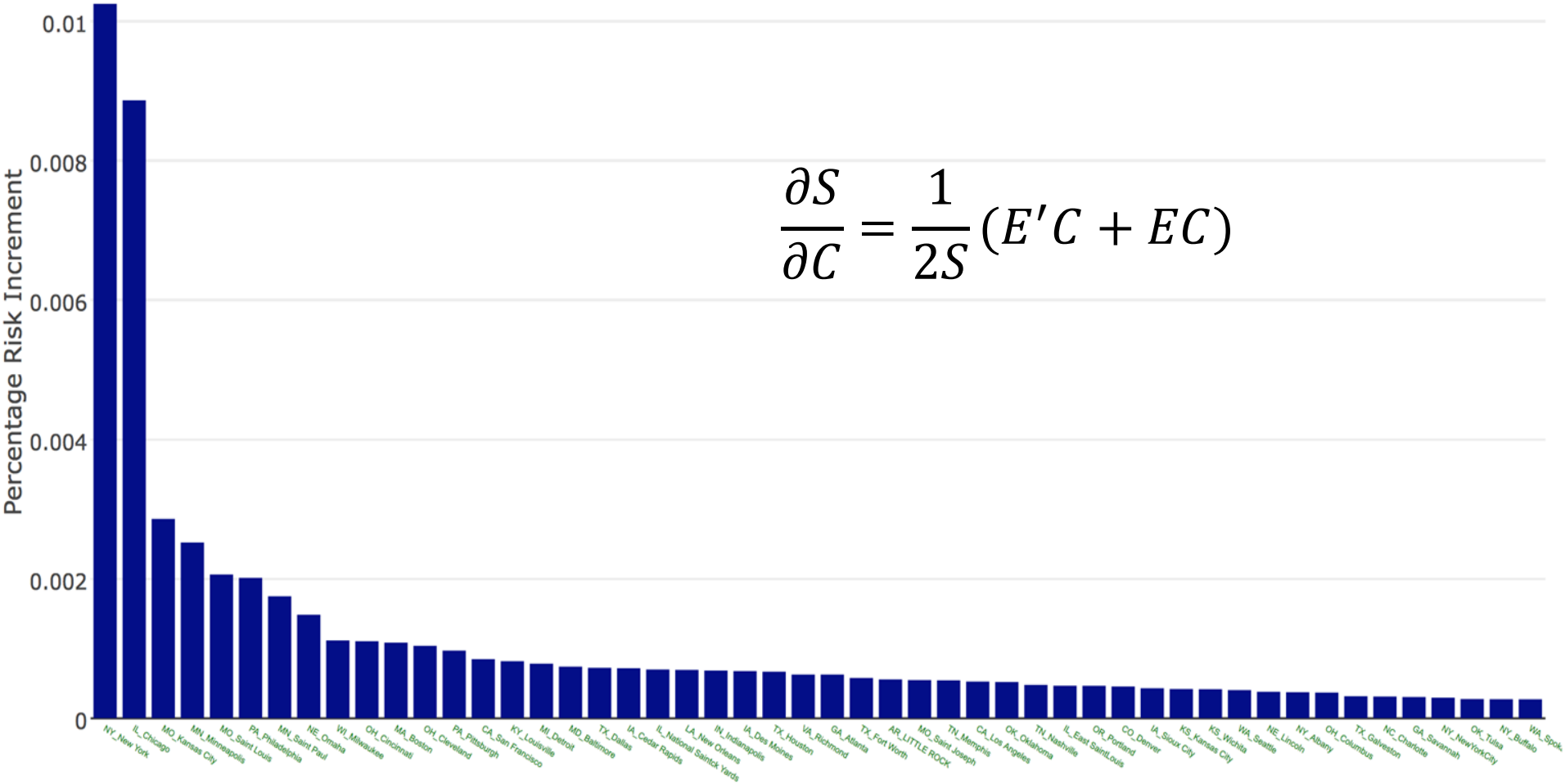


Cities with greatest partial risk are also those that were designated central reserve or reserve cities.

Risk Increment

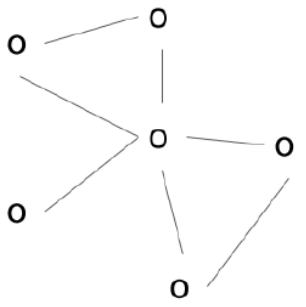
The effect of a one-unit worsening in risk score for the city's average bank leverage on systemic risk

$$\frac{\partial S}{\partial C} = \frac{1}{2S}(E'C + EC)$$



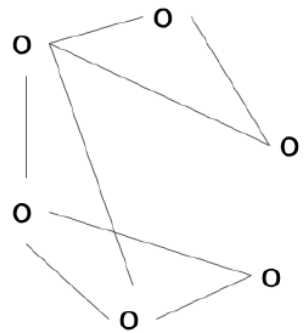
Fragility

- Networks with focal points are ones that are highly concentrated
- Implication: A highly concentrated network tends to spread distress more quickly



NETWORK A

Hub-and-spoke



NETWORK B

Less Fragile

Fragility

- A measure that increases as the concentration in the network increases.
- Concentration results in a greater likelihood that bank-specific risk will lead to systemic risk.
- Fragility, R, is computed as $R = \frac{E(d^2)}{E(d)}$ where *d* is the number of connections to other nodes and *E(.)* is the expectations operator
- Fragility in the 1929 network was = 1031
  - This is very high: the network is super concentrated
  - Herfindahl=0.0119

The 2007 Network

Construction of the network

- We begin by defining a link between banks using a Granger causality regression between two banks to build a *directed network*.
- A directed link in the network is projected from node i to node j if a regression of stock returns *r(j,t)* on *r(i,t-1)* and *r(j,t-1)* evidences a significant coefficient on *r(i,t-1)*.
- Methodology based on:

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Econometric measures of connectedness and systemic risk in the finance and insurance sectors ☆

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2007 Data

- We use 581 publicly traded financial institutions
- Data obtained from CRISP
- Listed under the following major Standard Industrial Classification Codes (SIC):
  - Group 60: Depository institutions
  - Group 61: Non-depository credit institutions
  - Group 62: Security and commodity brokers, dealers, exchanges, and services

Building 2007 Network

- Using Merton (1974), we calculate daily asset values and their volatilities to derive daily asset returns where the former are generated from measures of:
  - Market capitalization
  - Annualized equity return volatilities
  - Total face value of debt
  - Annualized risk free rate of return (based on constant maturity US Treasuries)

- Using the daily asset returns, we then compute Granger causality regressions that examine whether the returns between institutions *i* and *j* are "causally" linked which gives us the adjacency matrix *E*

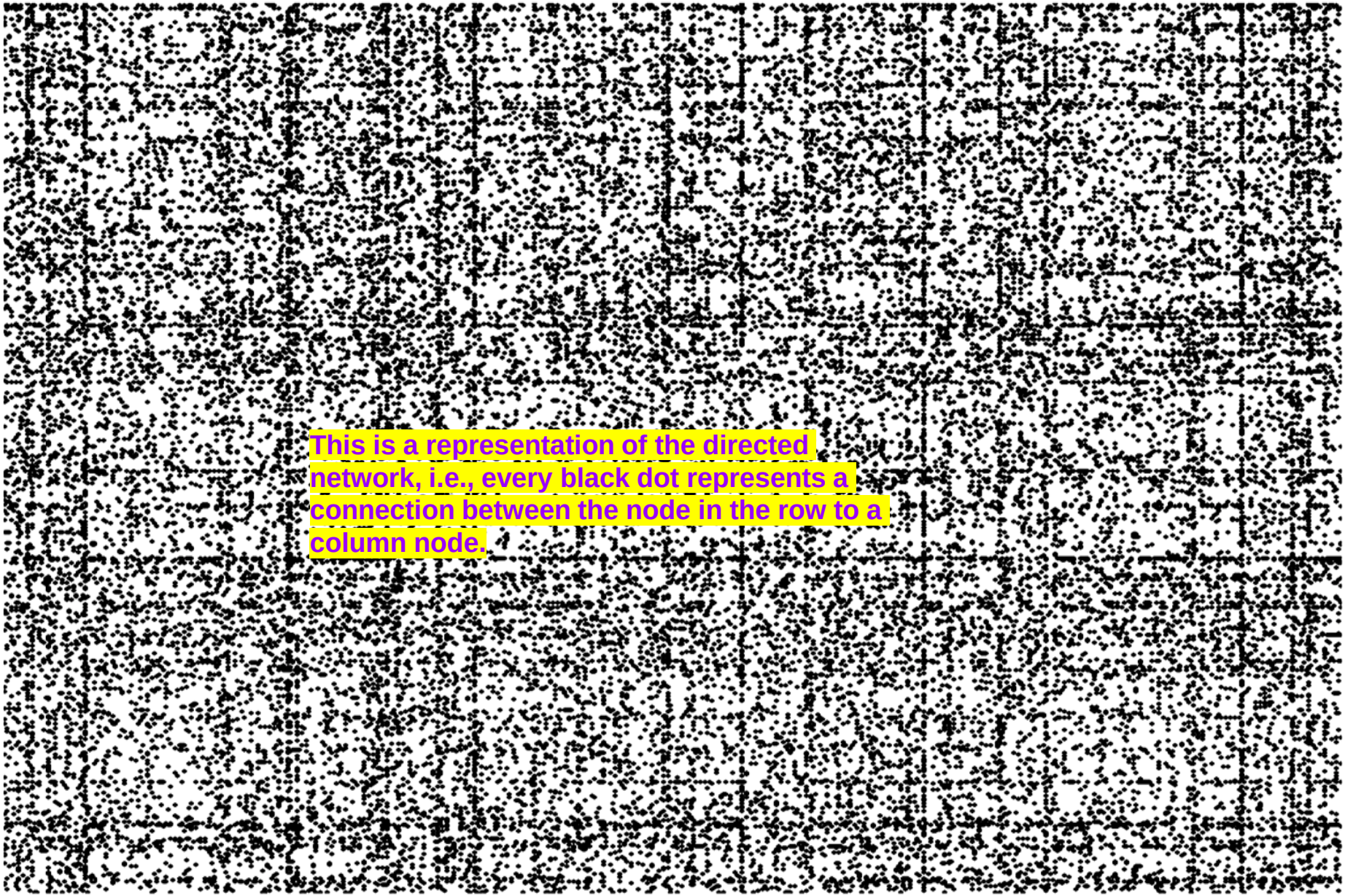
2007 Credit Risk

- From the daily asset returns, we compute asset betas on a rolling basis and then calculate expected asset returns using CAPM
- The expected asset returns are used to determine the annualized probability of *default* (c_i) for a given institution *i*
  - i.e., the probability of the market value of the FI's assets > FI's debt

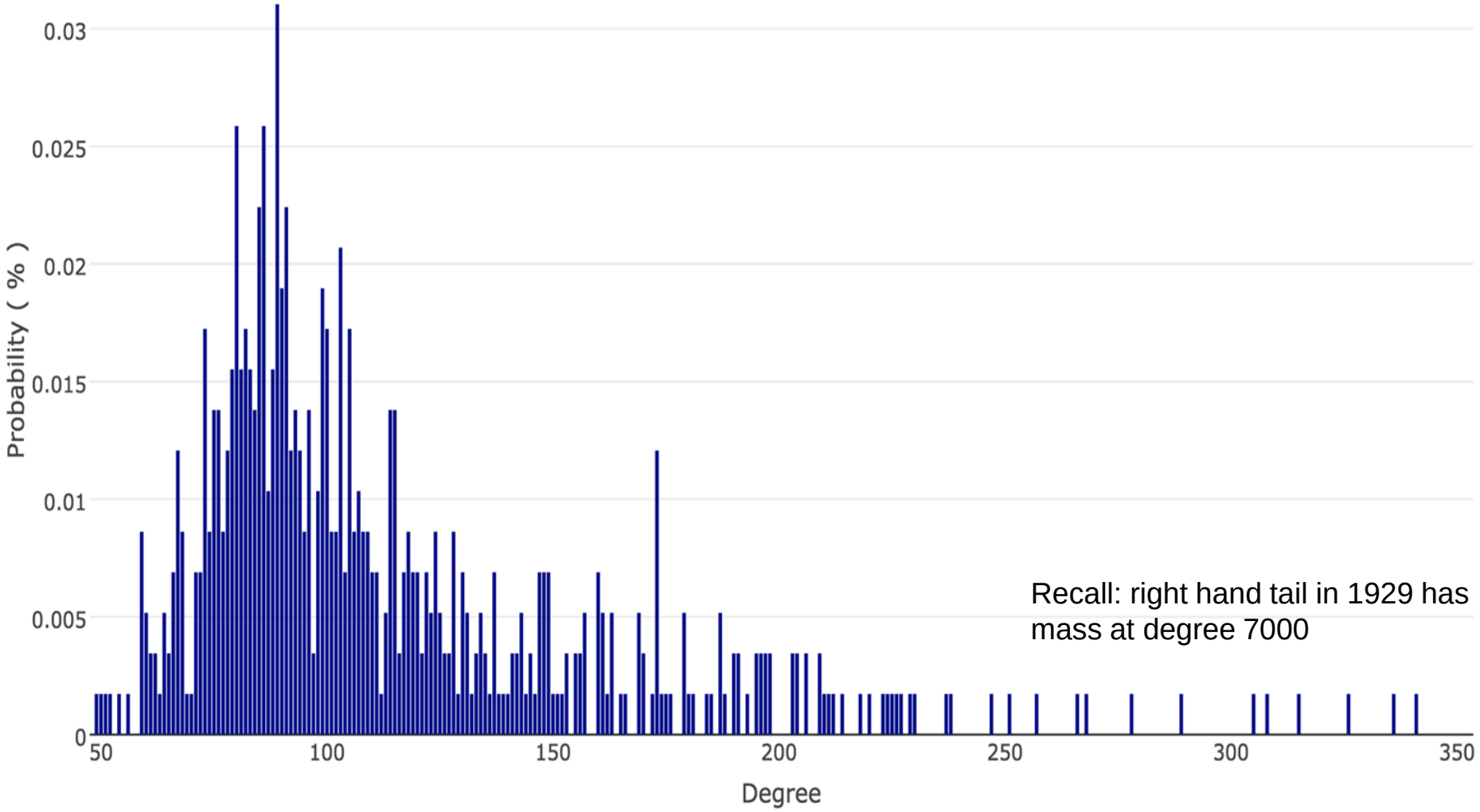
Basic Network Stats for 2007

- Number of nodes = 581
- We run 336,980 regressions to create the network.
- Number of Links = 32,979
- Largest connected cluster size = 581 (all banks are connected)
- Diameter (maximal shortest path between any two connected nodes) of large cluster = 3
  - Implications for contagion

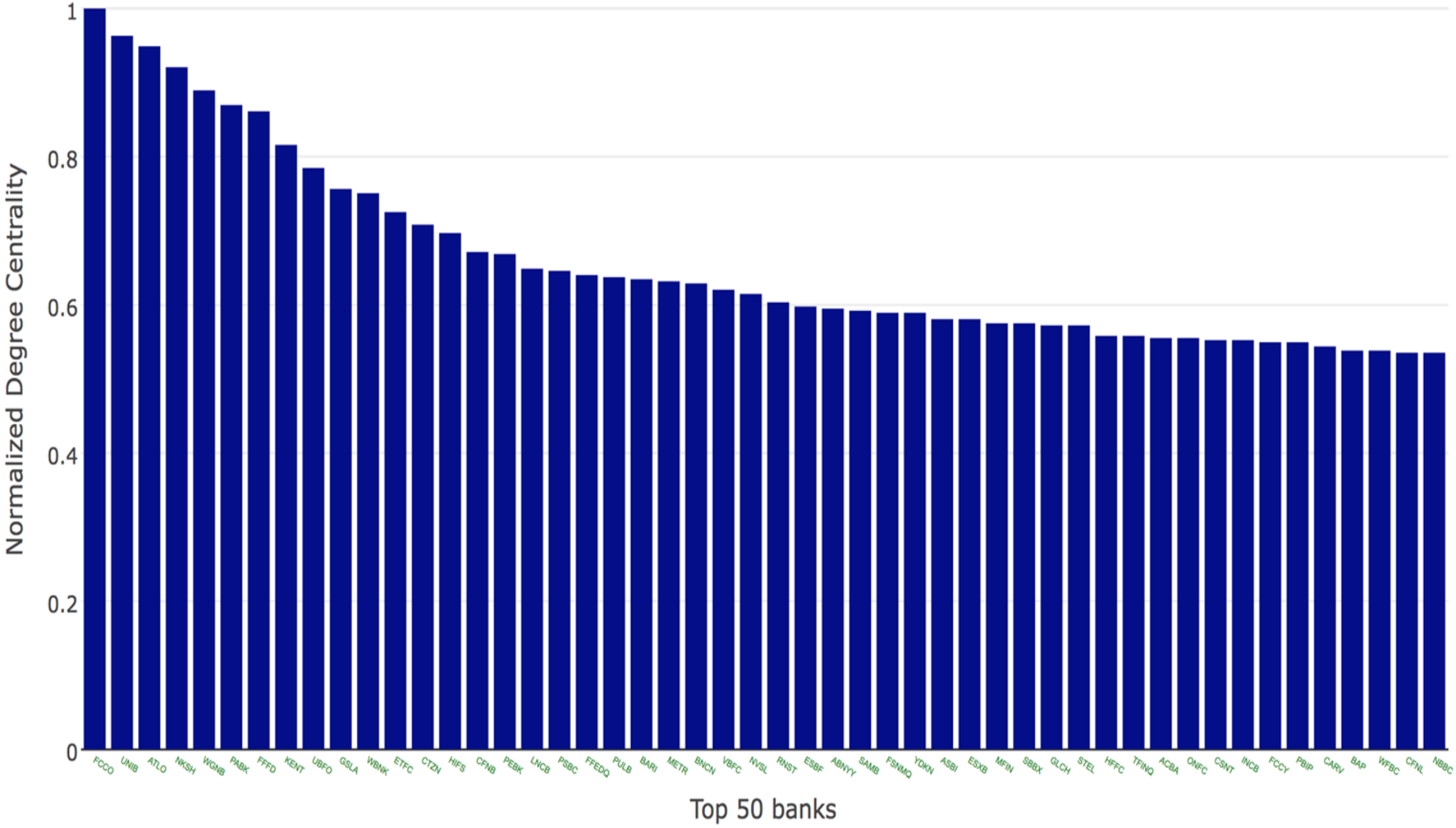
Adjacency Matrix Contour Plot (581 x 581)



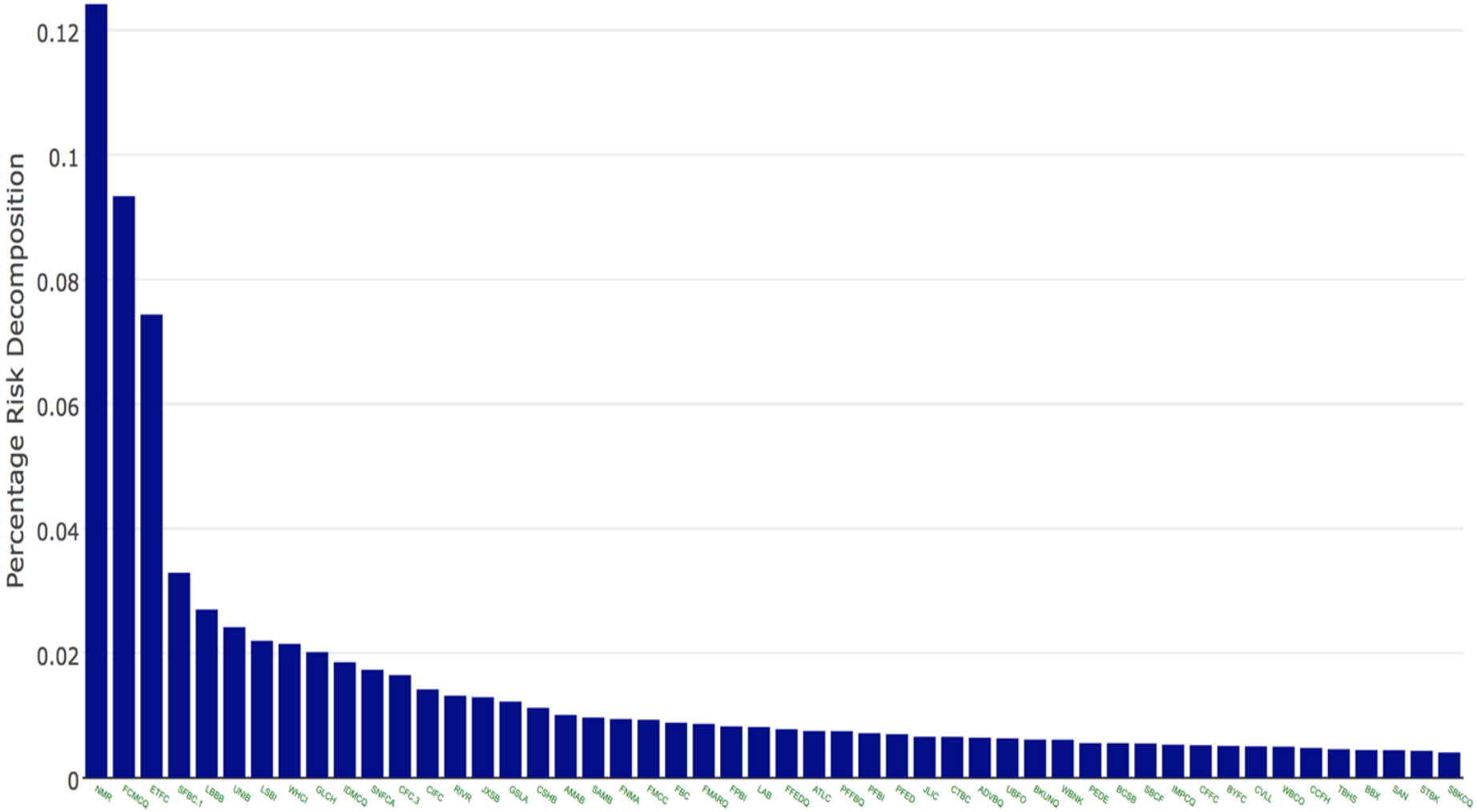
Distribution of Linkages: 2007



Centrality 2007



Risk Decomposition Plot 2007



Fragility of System: 2007

- Fragility in the 2007 network = 134
- This is still very high, but less than 1929 = 1031
  - Herfindahl (2007)=0.002
  - Herfindahl (1929)=0.0119

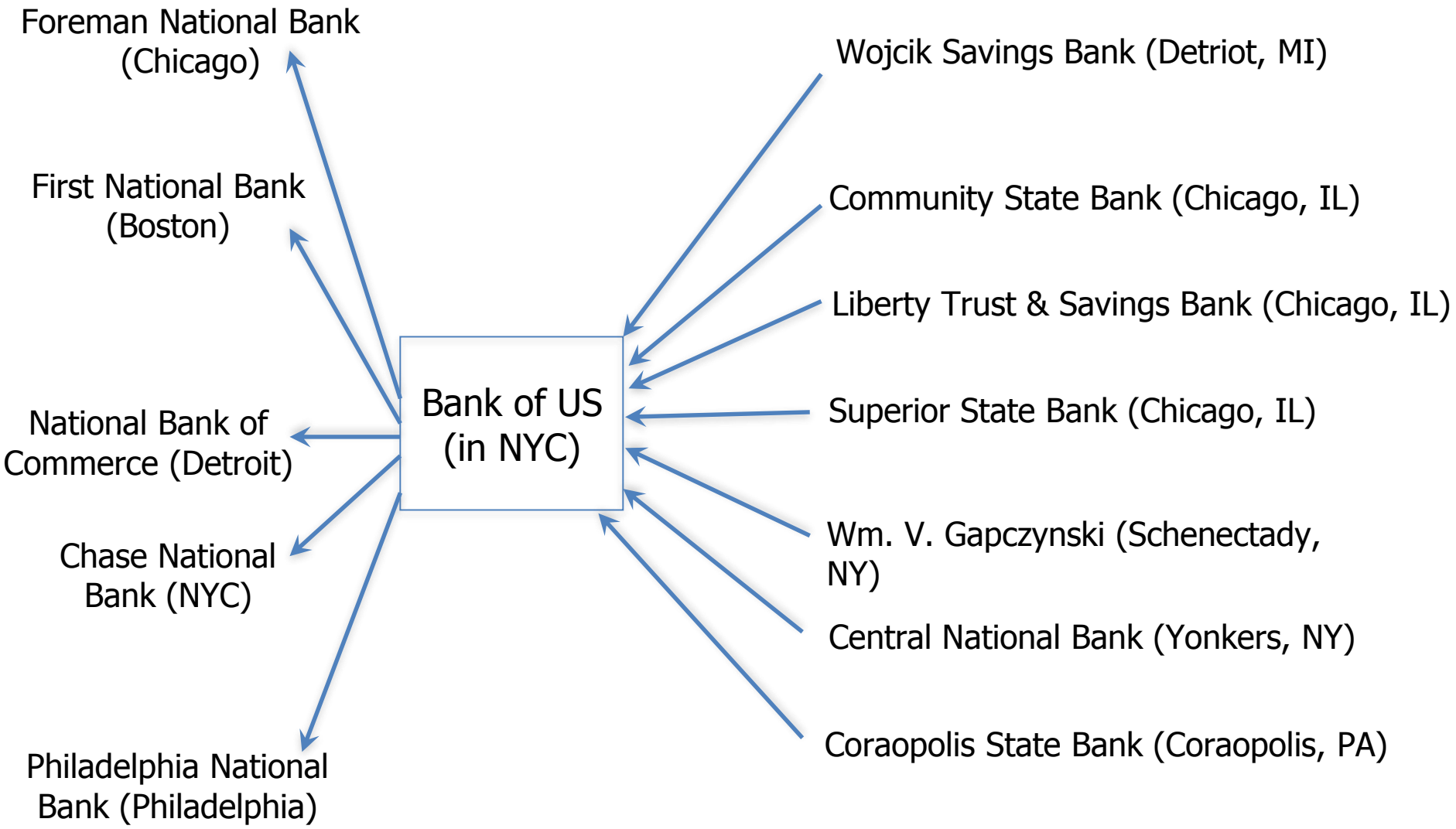
Preliminary Findings

- 1929 is a dense network
  - Perhaps related to geography/technology and institutions
- Ex ante system fragility was higher in 1929
- Pyramid reserve system concentrates risk in the city centers -- fatter tail
  - Hub and spoke

Future Directions

- What features explain the higher ex ante risk of 1929 network?
  - Pyramid system
  - Branch and group banking
  - Size of banks
- Examine how bank suspensions and failures changed systemic risk
- Examine counterfactuals to key known entities
  - Lehman in 2007
  - Bank of U.S. vs. Caldwell in 1930
- More data
  - All banks in U.S., not just publicly traded
  - Formal linkages for 2007?

Bank of United States

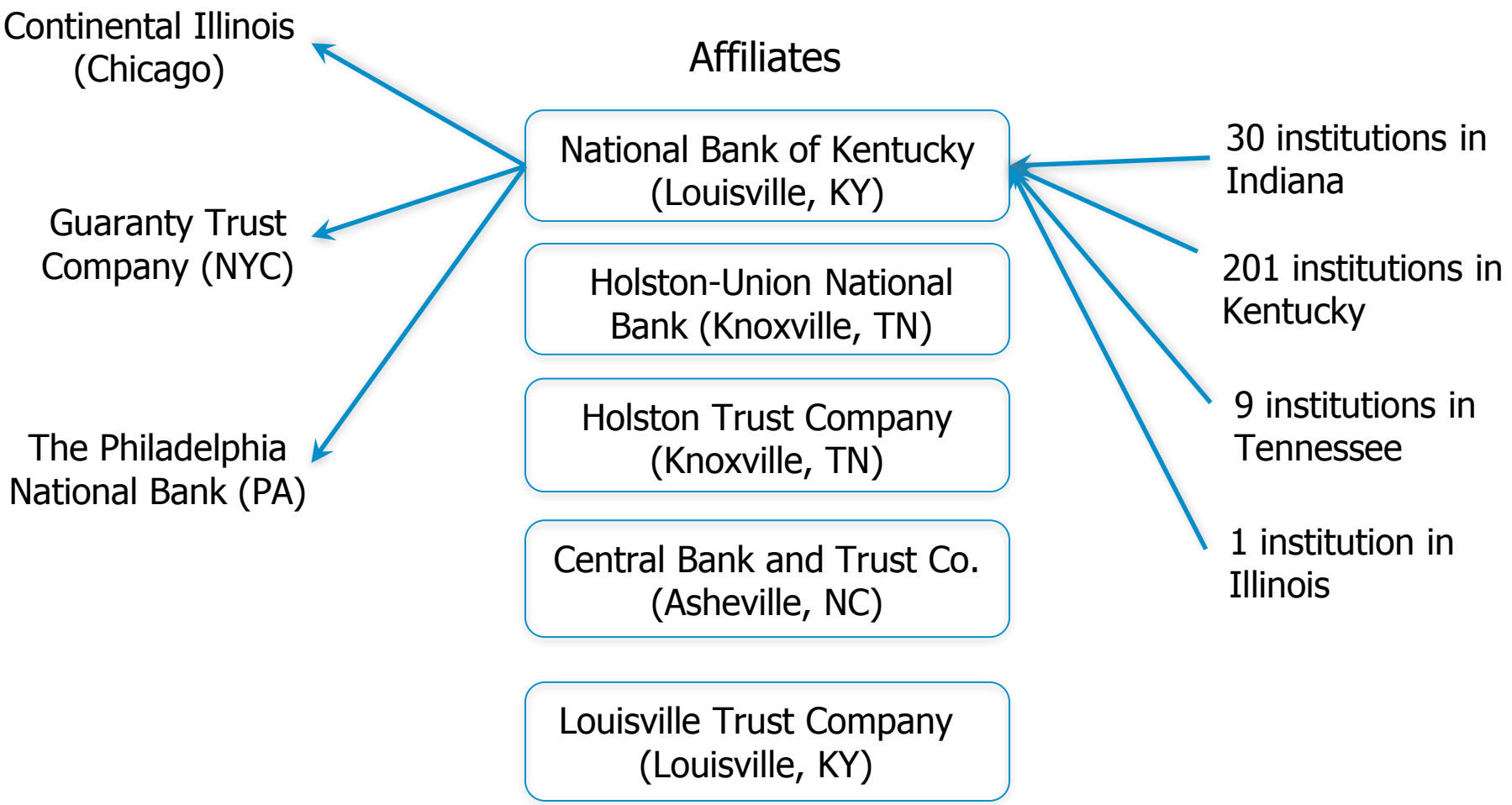


Caldwell and Company features prominently in the First Banking Panic of the Great Depression

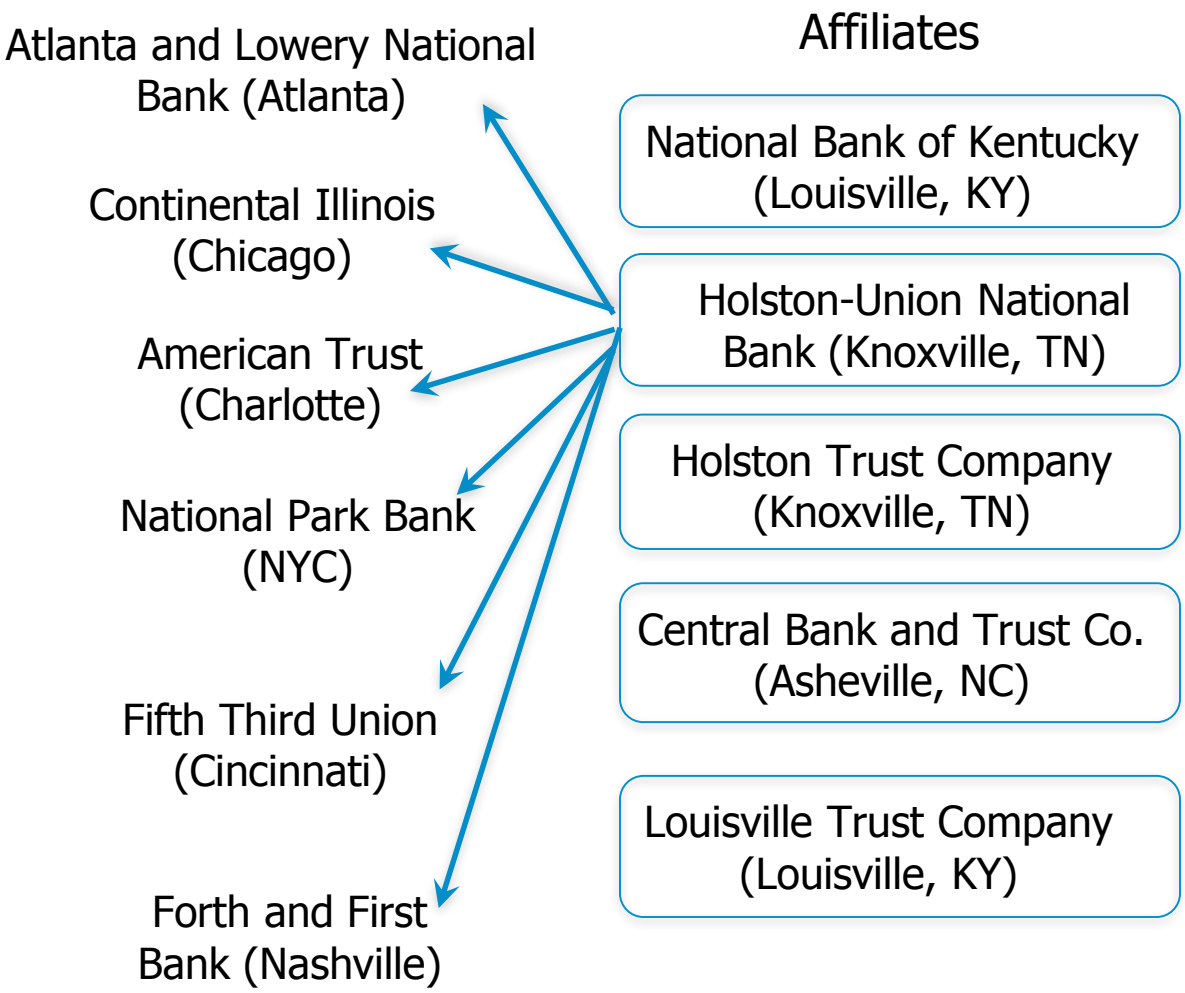
Consider just 5 of the Affiliates

- National Bank of Kentucky (Louisville, KY)
- Holston-Union National Bank (Knoxville, TN)
- Holston Trust Company (Knoxville, TN)
- Central Bank and Trust Co. (Asheville, NC)
- Louisville Trust Company (Louisville, KY)

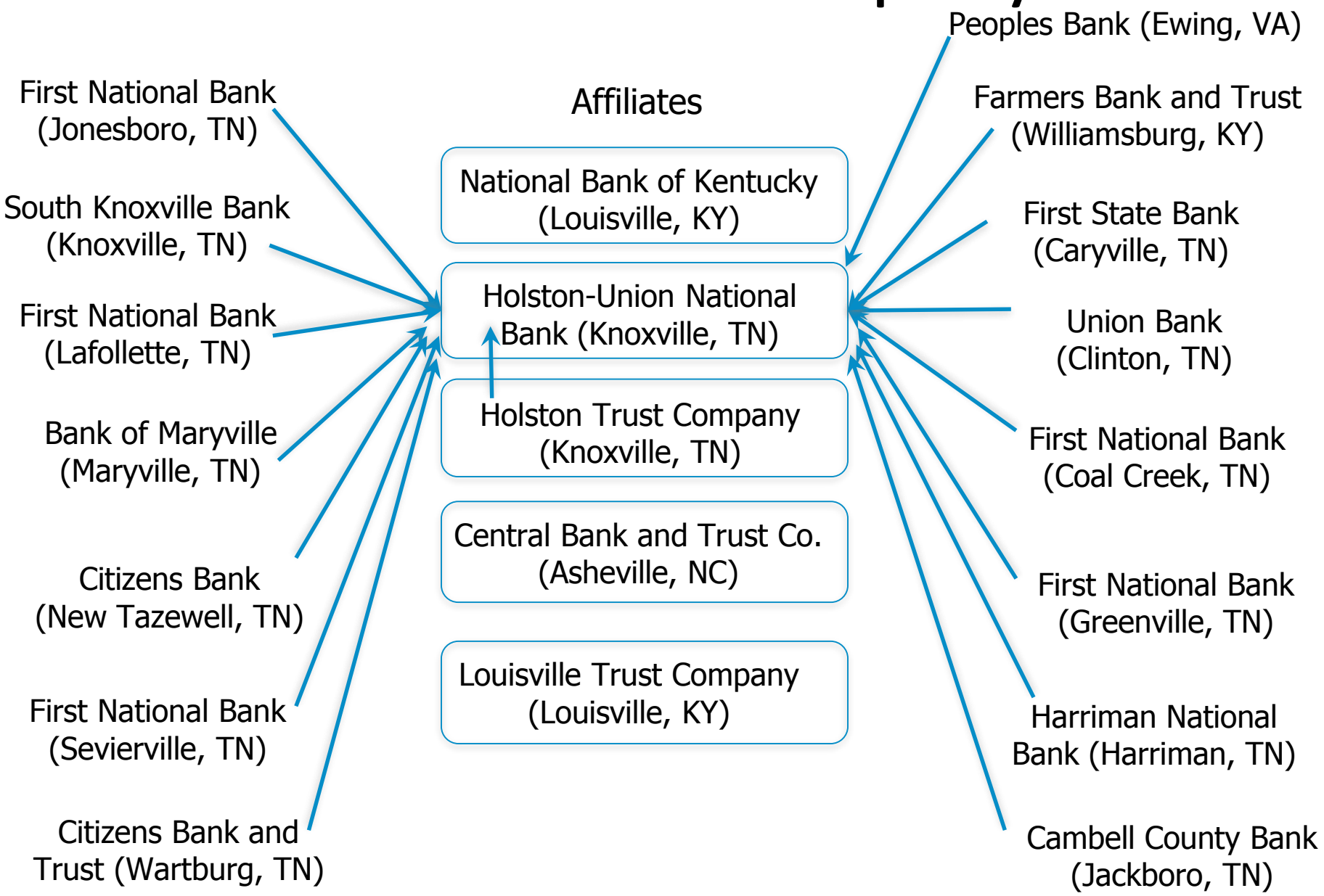
Caldwell and Company: linkages to sample of affiliates



Caldwell and Company

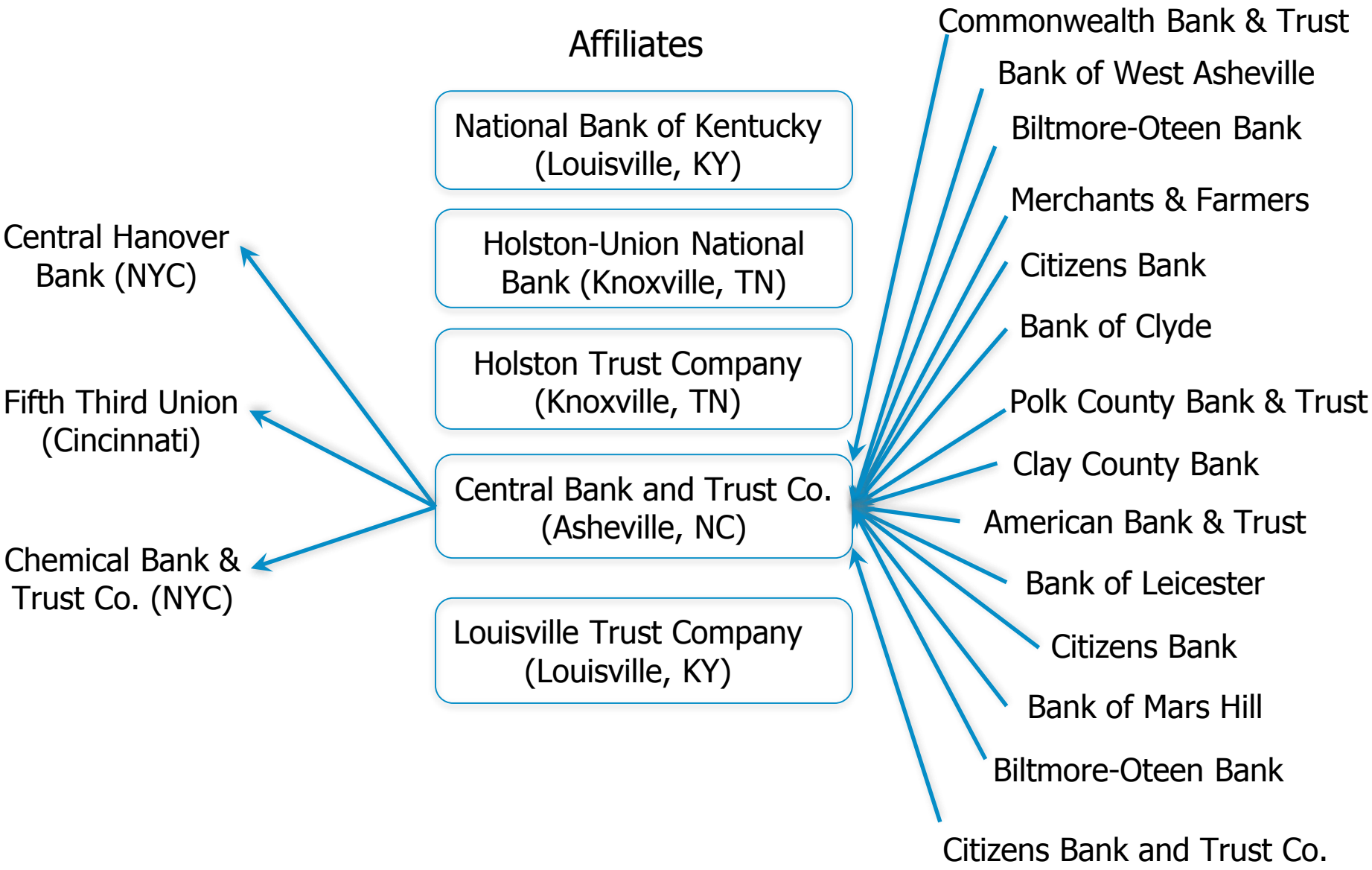


Caldwell and Company



Caldwell and Company

ALL NC



Caldwell and Company