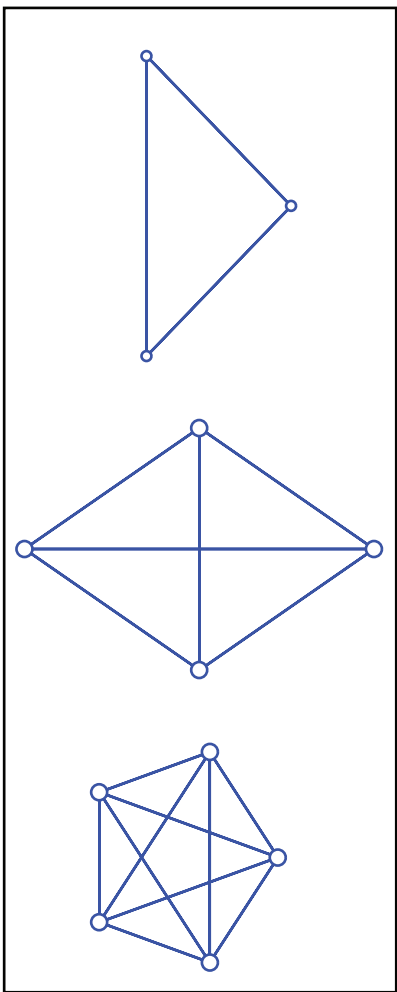# It's a small world: loan networks in rural India

The poor mitigate their risks by helping each other out in times of need, in return for similar help when the roles are reversed. Loan networks in 75 villages in Karnataka, India, are well-connected following small-world properties.
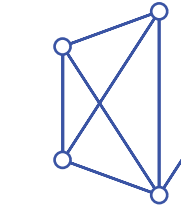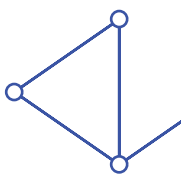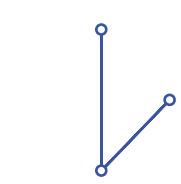
Subgraph nodes

n=3

n=4

n=5

Loan networks are organized into cliques (boxed sub-graphs) for group sizes of 3, 4 and 5, meaning that everyone is connected to everyone else.

This connected structure suggests that these villagers use self-help groups (SHGs) to manage their finances.

size scaled by frequency of occurrence

Sub-graphs in the lending network indicate self-help groups

Savings clubs called self-help groups are based on a shared pot of money

Rotational SHGs: at every meeting, members deposit the same amount of money in a common pot that is given to each member on a rotating basis. The advantages are lack of fees, ability to make small contributions, faster savings time than if done alone, and the groups are good places to seek advice.

4 members
4 rounds
$10 contribution
$40 in the pot

John
Carol $40 Mark
John
Linda

Carol $40 Mark
Linda

John
Carol $40 Mark
Linda

John
$40
Linda
Carol Mark

Illustration of a rotating SHG among 4 members for a 40$ pot.

Characteristic path length (L):
A parameter of the small world network. The median of the mean shortest path length of all individual nodes

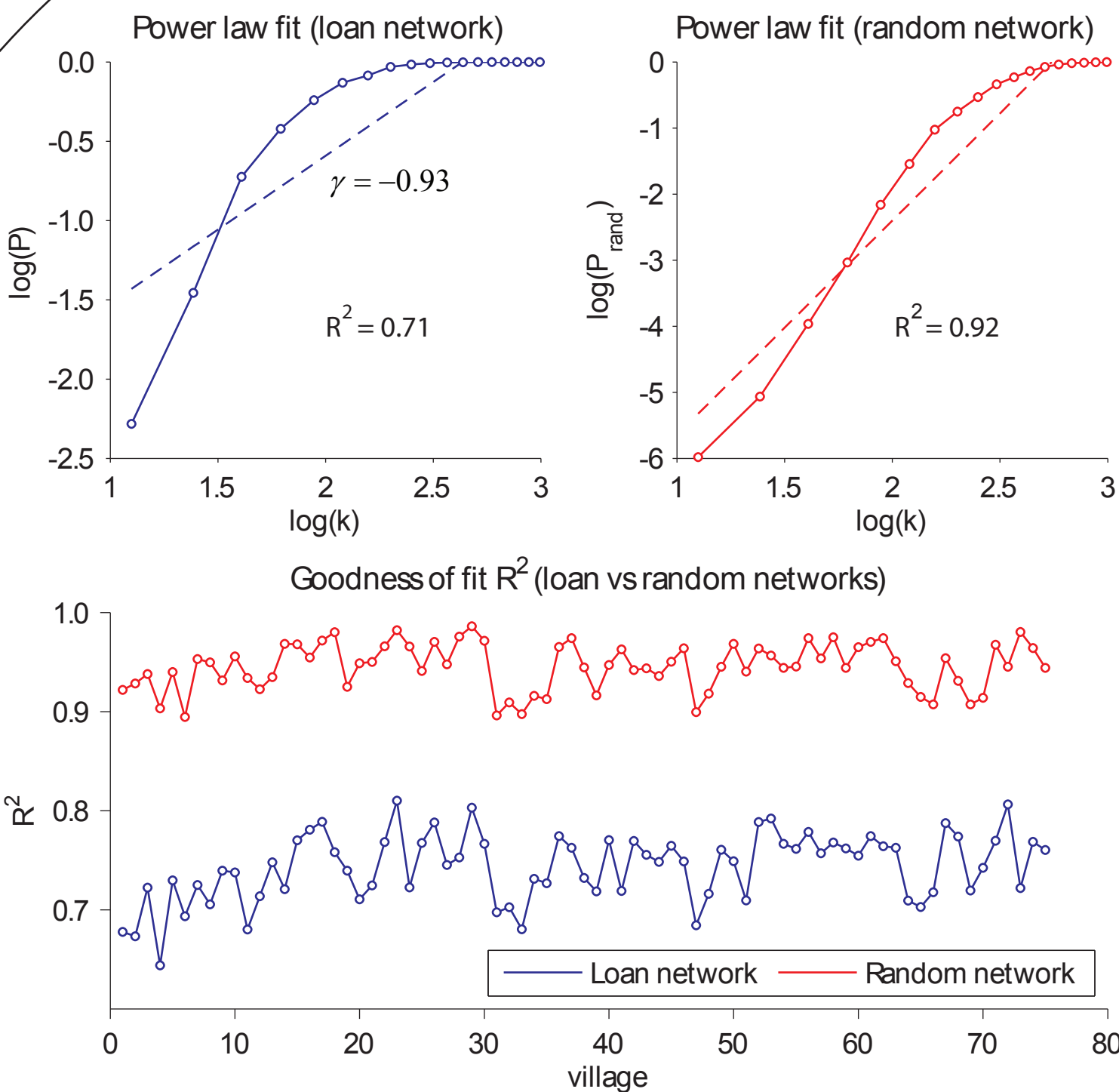**Small-worldedness coefficient (S):**
Measures the extent of small-worldedness.

Distribution of S across villages (Bin size=10)

Village count (N)

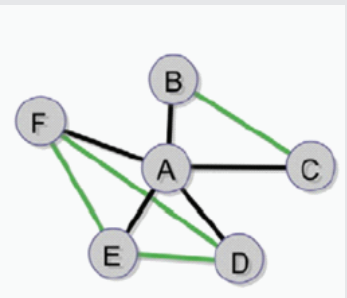$S=(C/C_{rand})/(L/L_{rand})$
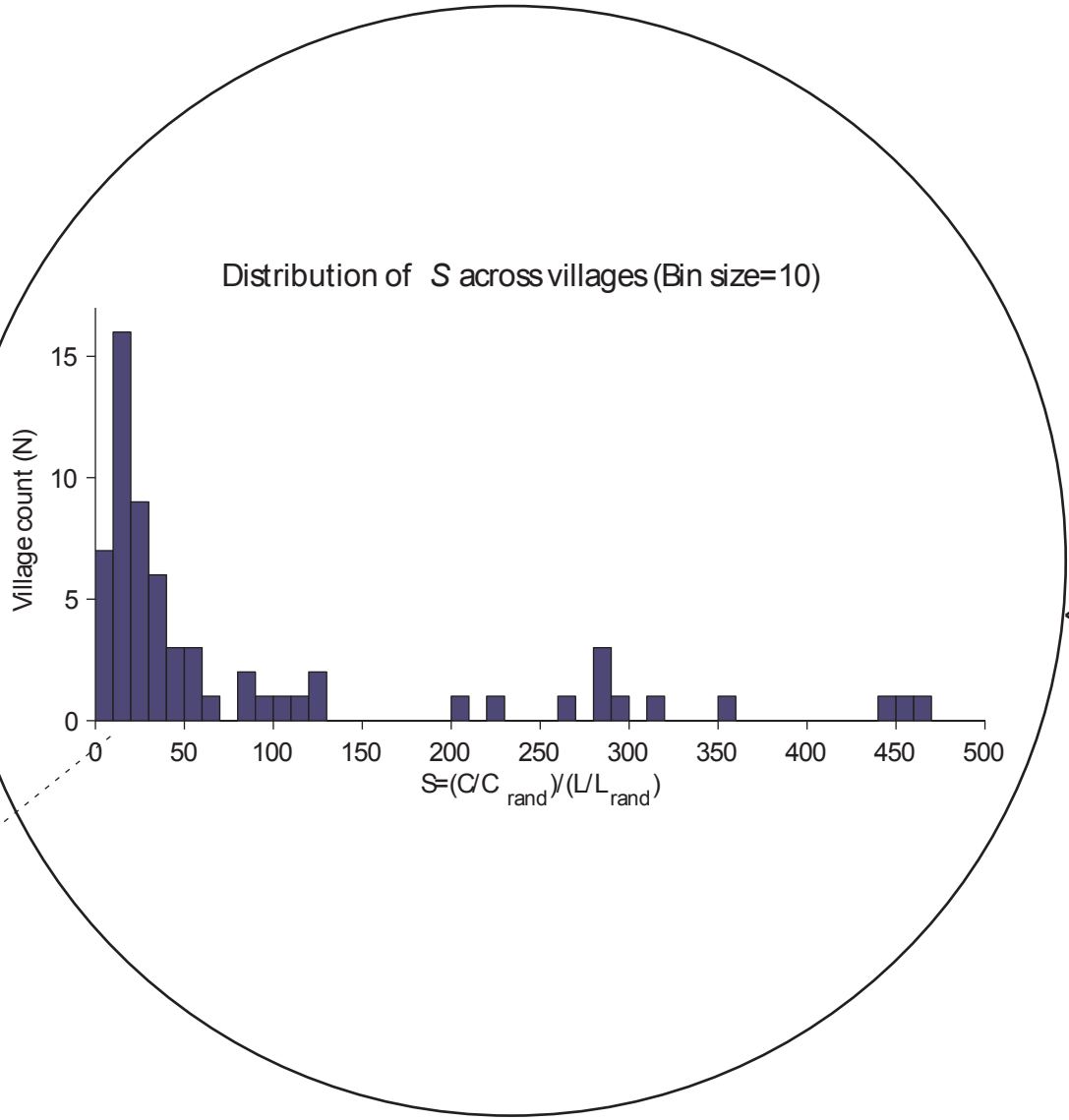
Loan networks are de-centralized across villages

If the loan-networks are scale-free, then high-degree nodes called "hubs" would be common. Here, the data do not satisfy the power-law relationship for this type of network (gamma outside of range, and linear fits worse than for a random network).

Power law fit (loan network)

$\gamma = -0.93$

$R^2 = 0.71$

log(P)

log(k)

Power law fit (random network)

$R^2 = 0.92$

$log(P_{rand})$

log(k)

Goodness of fit R^2 (loan vs random networks)

R^2

village

— Loan network   — Random network

Clustering Coefficient (C):
This gives the fraction of connections between neighbours out of all possible connections between them

Distribution of S across villages (Bin size=1)

Village count (N)

Small world networks

$S=(C/C_{rand})/(L/L_{rand})$

F B
A C
E D

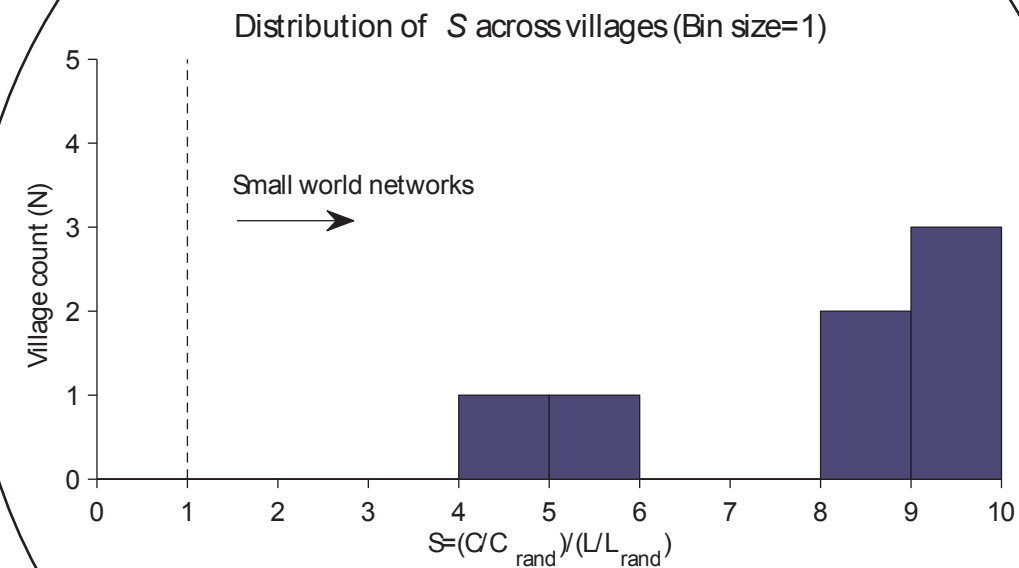$$C_A = \frac{4}{{}^5C_2} = 0.4$$

Degree (k):
The total number of incoming and outgoing connections to a node

Gamma:
A parameter that controls the degree distribution and falls in the range 2 to 3.
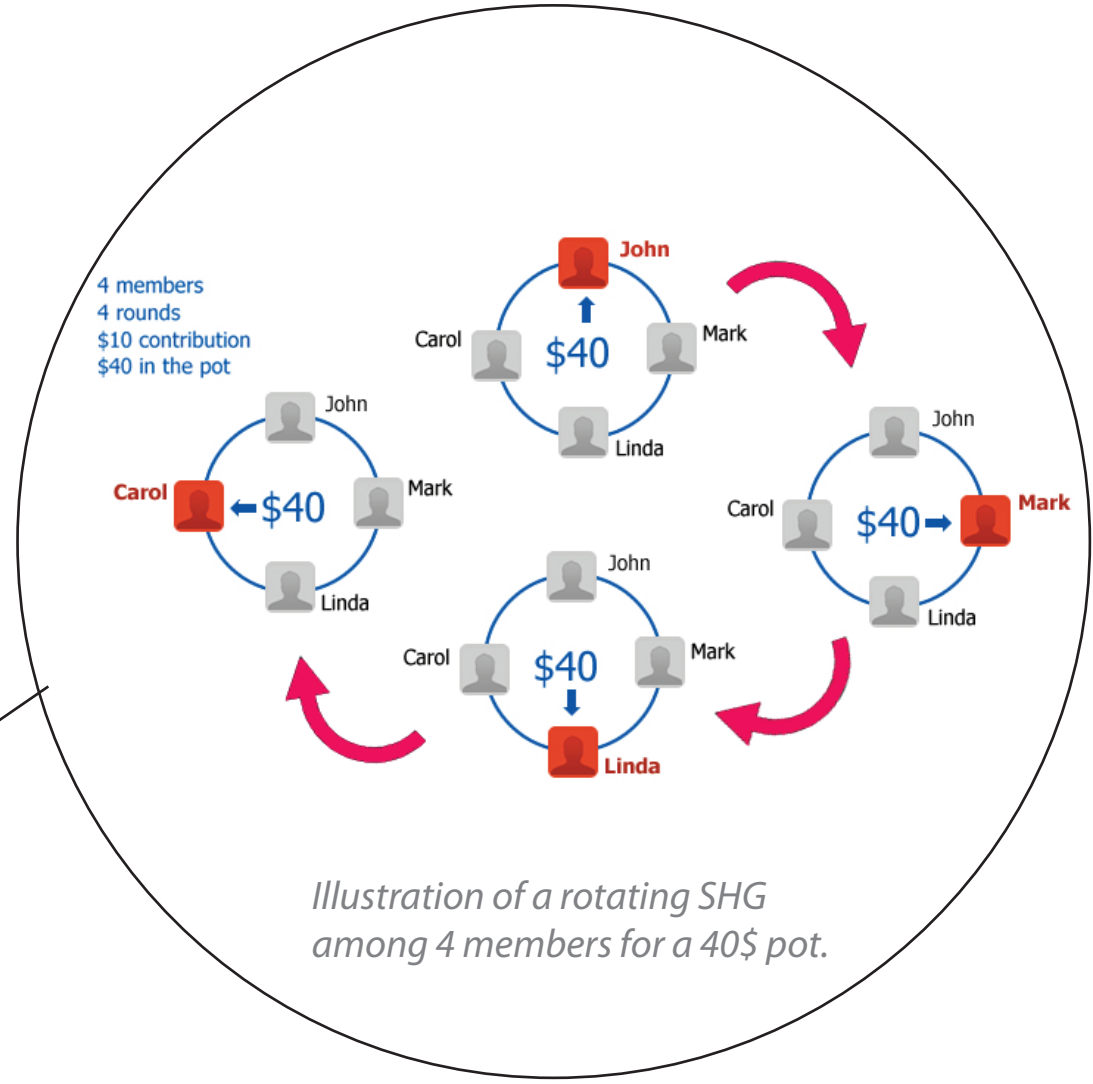
Random network:
Edges between two nodes are connected randomly, independently of other edges.

Loan networks obey small-world properties

Most nodes are not neighbours of one another, but they can be reached from every other by a small number of hops.