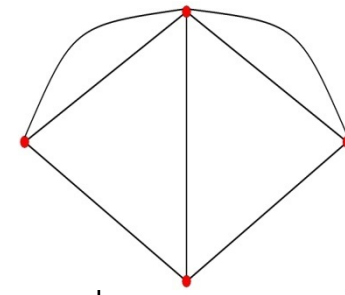


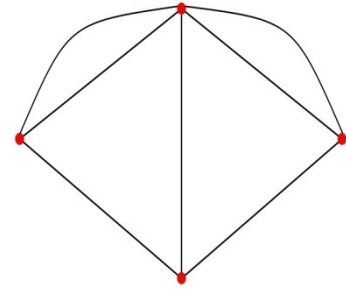
An Economic Model of Friendship: Homophily, Choice and Chance in Social Network Formation



Currarini, Jackson, Pin

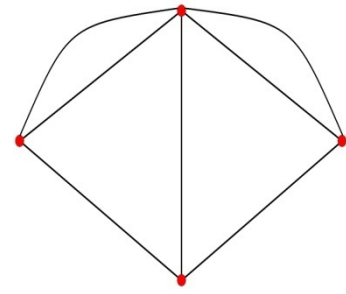
“Similarity begets friendship”
Plato, Pheadrus

Introduction



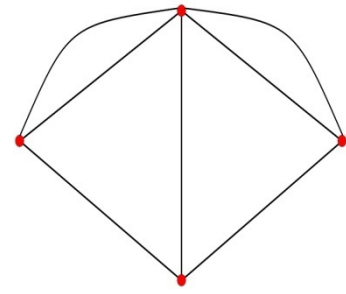
- Social structure important
 - Embeddedness of economic interactions
- Fundamental and pervasive observation:
Homophily
 - Bias of relationships towards own type
- Homophily impacts behavior and welfare:
 - Opinion formation, education pursuit...

Contributions



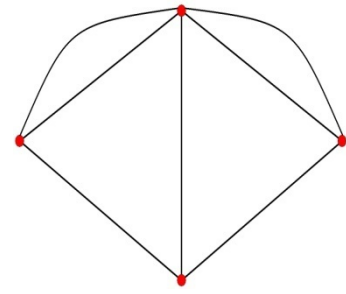
- Identify different forms and patterns of homophily
- Trace these via an economic model:
 - What is due to constraints of populations?
 - What is due to choice and preference?
 - What is due to the randomness in meetings?
- Provide a base for a welfare analysis

Contributions II



- Physics and Economics of Social Networks
 - Random Graph/Process versus Choice-Based Models
- Provide a Model with Both
- Both play critical roles in understanding the data

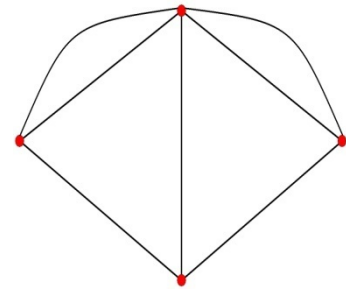
Outline



I. Background and Three Patterns in the Data

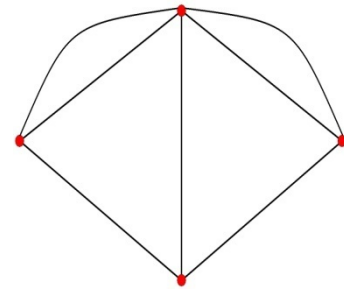
II. 'Economics' of Homophily – Roles of Choice and Chance

I. Background on Homophily:



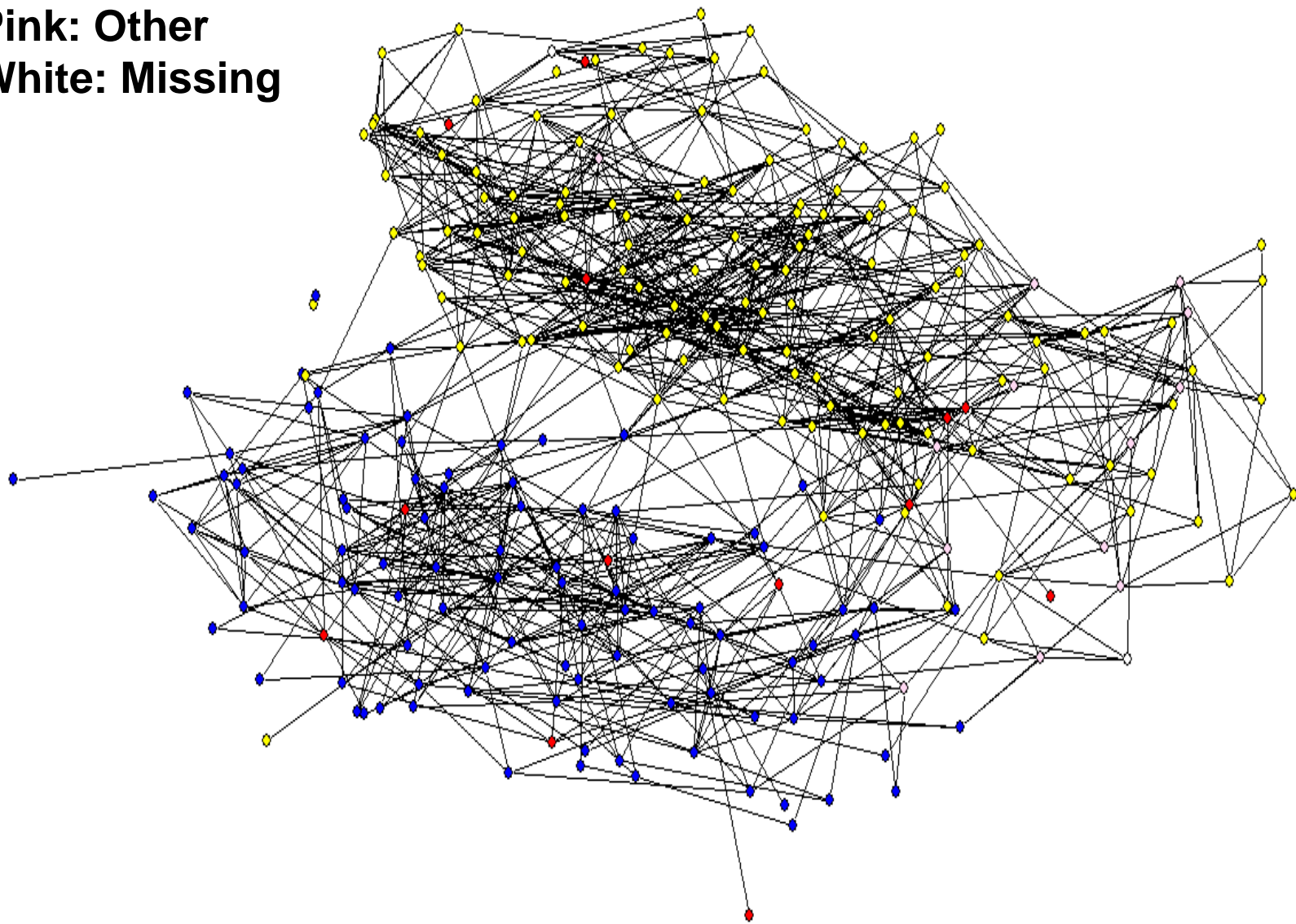
- ``Birds of a Feather Flock Together'' - Philemon Holland (1600 - ``As commonly birds of a feather will flye together'')
- age, race, gender, religion, profession....
 - Lazarsfeld and Merton (1954) ``Homophily''
 - Shrum (gender, ethnic, 1988...), Blau (professional 1974, 1977), Burt, Marsden (variety, 1987, 1988), Moody (grade, racial, 2001...), McPherson (variety, 1991...)...

Illustrations Homophily:

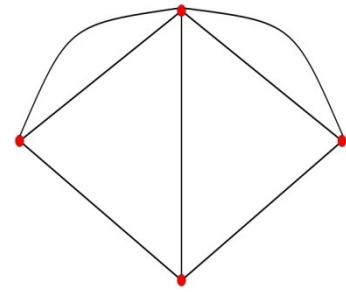


- National Sample: only 8% of people have *any* people of another race that they “discuss important matters” with (Marsden 1987)
- Interracial marriages U.S.: 1% of white marriages, 5% of black marriages, 14% of Asian marriages (Fryer 2006)
- In middle school, less than 10% of “expected” cross-race friendships exist (Shrum et al 1988)
- Closest friend: 10% of men name a woman, 32% of women name a man (Verbrugge (1977))

Yellow: Whites
Blue: Blacks
Reds: Hispanics
Green: Asian
Pink: Other
White: Missing

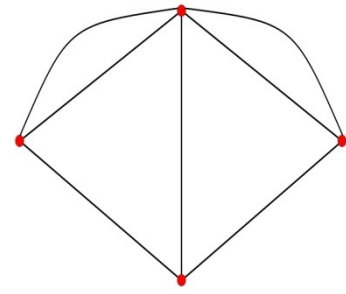


Adolescent Health, High School in US:



Percent:	52	38	5	5
	White	Black	Hispanic	Other
White	86	7	47	74
Black	4	85	46	13
Hispanic	4	6	2	4
Other	6	2	5	9
	100	100	100	100

Homophily Indices



Let $w_i = N_i / N$ be proportion of type i

- Homophily Index (Raw):

$$H_i = s_i / (s_i + d_i)$$

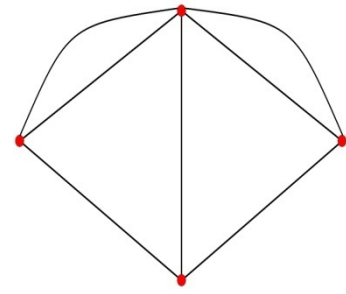
- **Baseline:** $H_i = w_i$; **Inbreeding:** $H_i > w_i$

- Coleman's Inbreeding Homophily (Normalized):

$$IH_i = (H_i - w_i) / (1 - w_i)$$

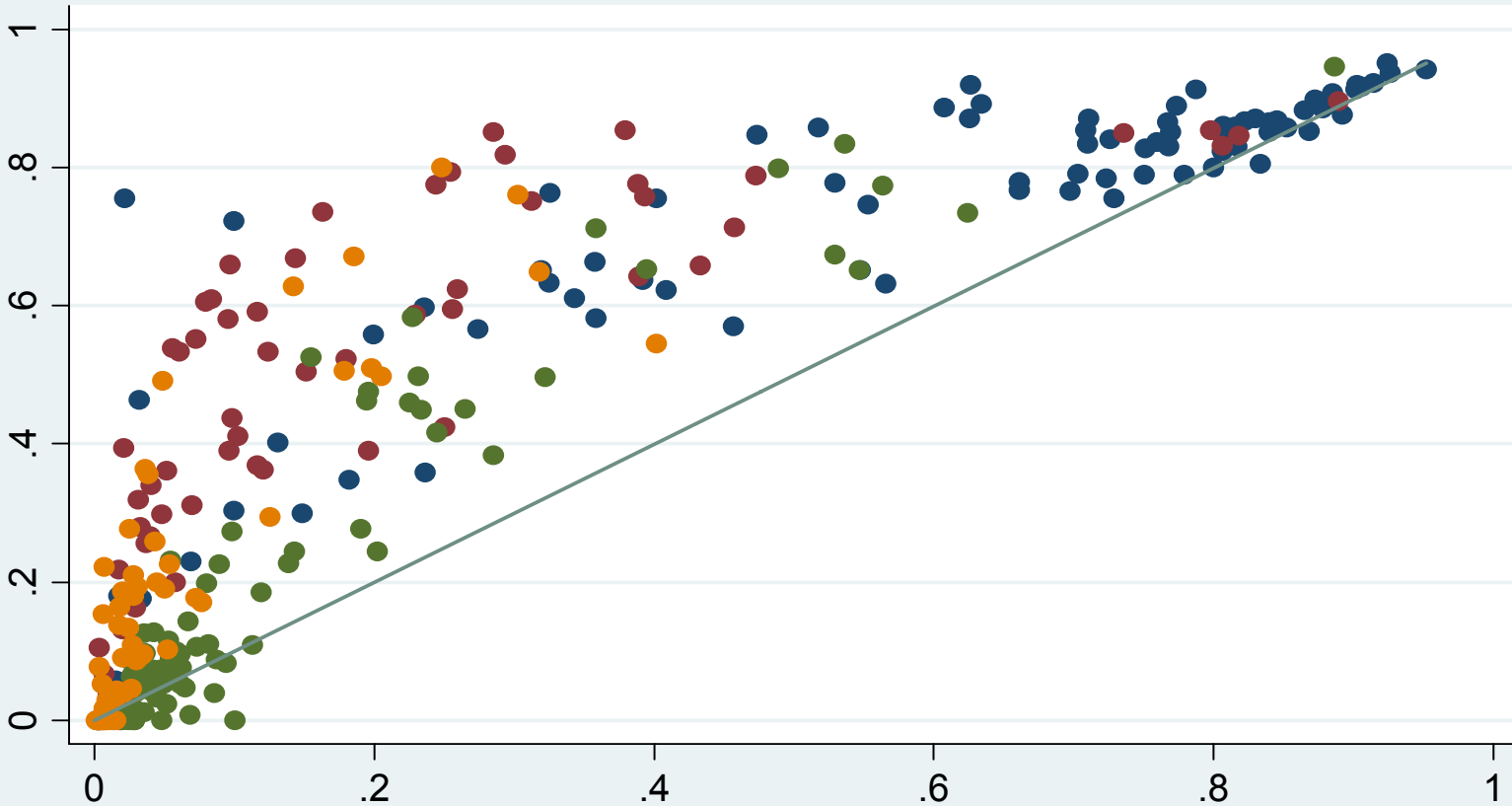
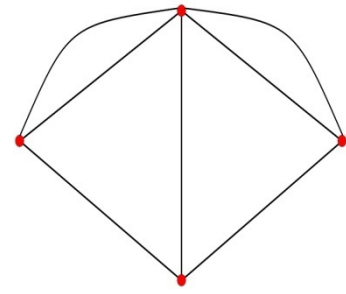
- **Baseline** = 0, **Inbreeding** > 0

Three Strong Patterns:



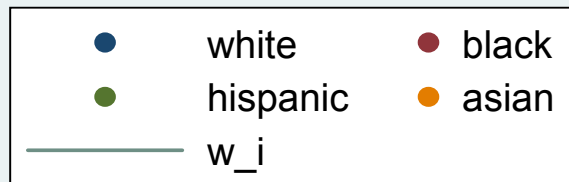
- **Relative Homophily** - Higher homophily for larger groups, higher s , lower d
- **Larger groups form more friendships** per capita
- **Inbreeding Homophily** for most groups, and highest for middle-sized groups

Relative Homophily

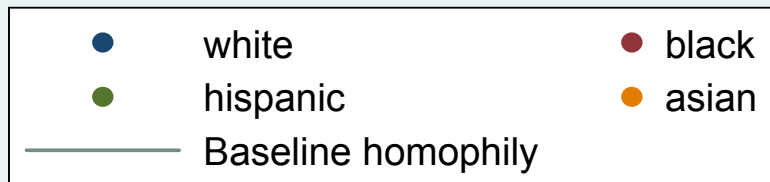
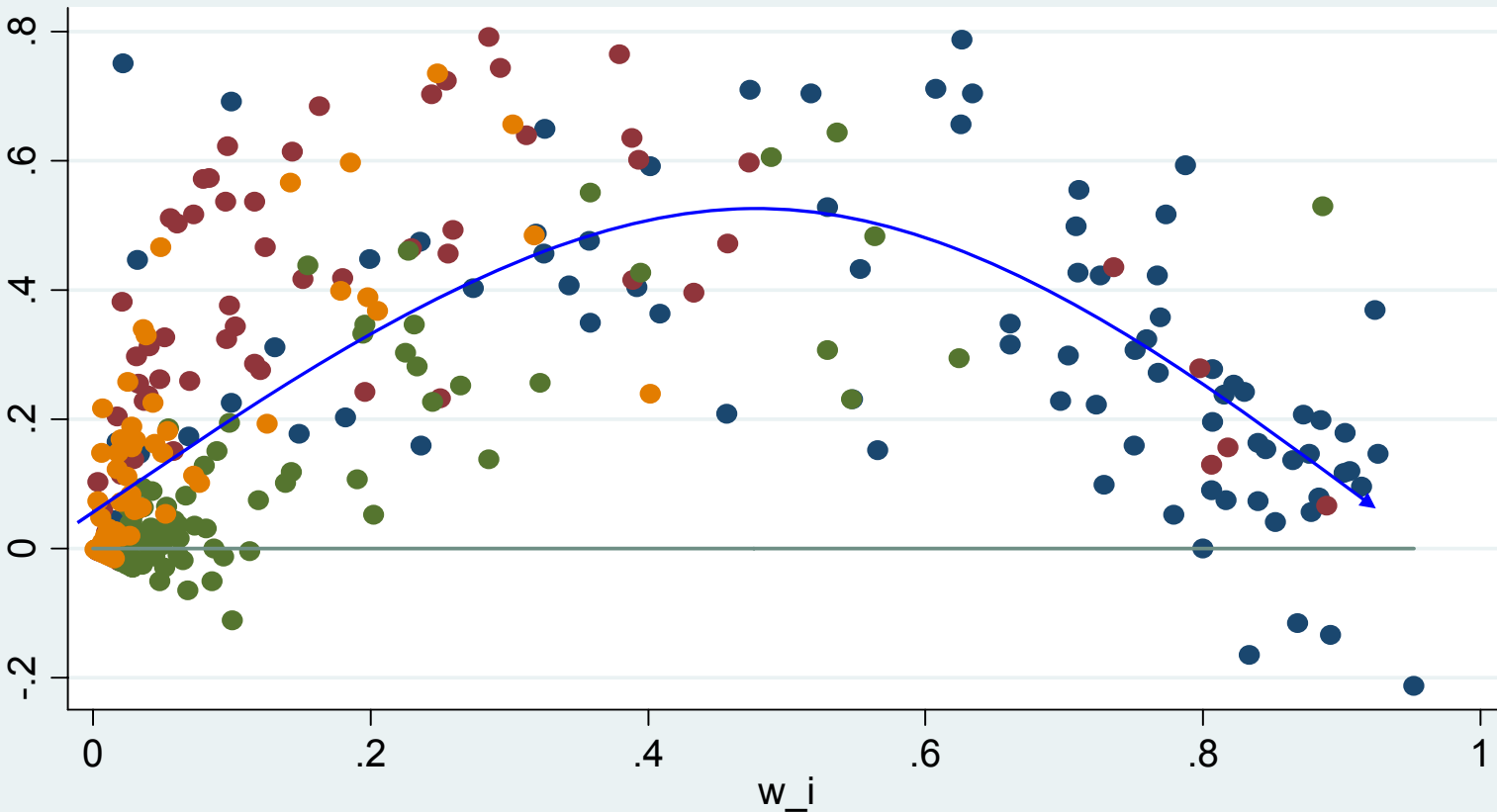
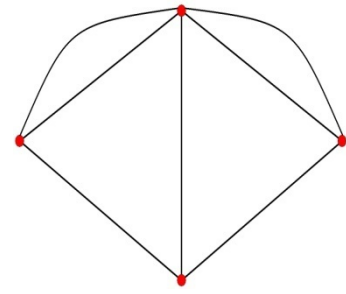


slope
.98
t=31

w_i

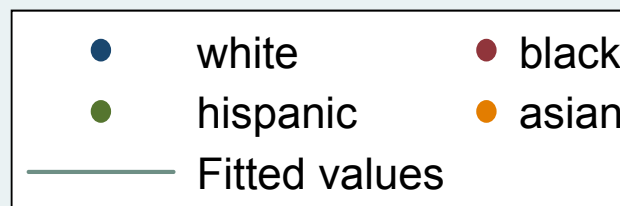
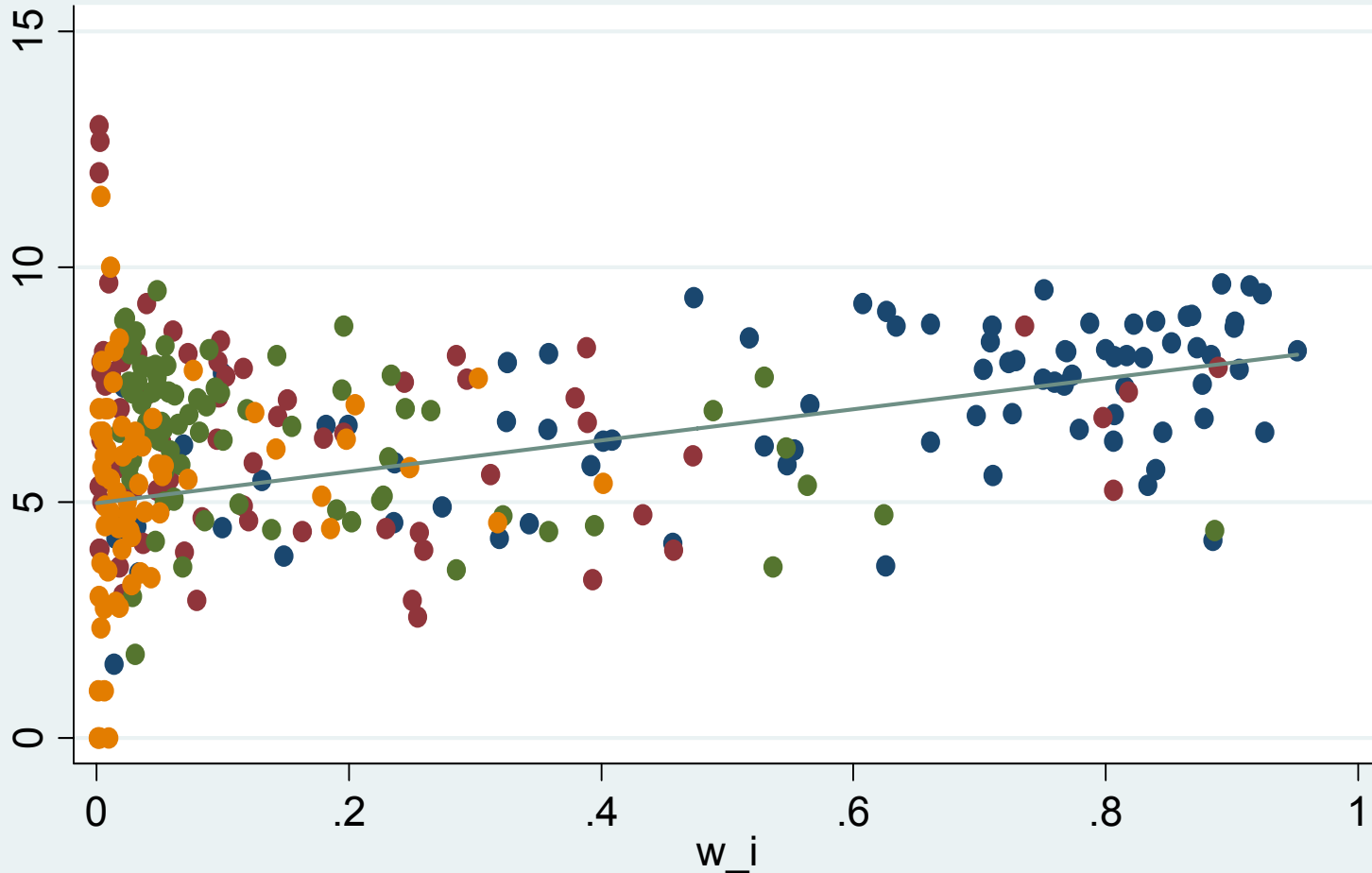
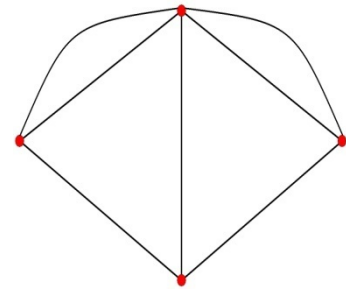


Inbreeding Homophily



$2.2 w_i$
 $-2.3 w_i^2$
 $t=17,$
 -16

Larger Group=More Friends



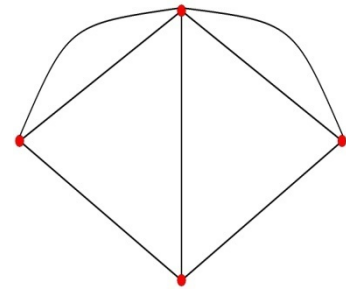
slope 3.3

$t=7.1$

int= 5.0

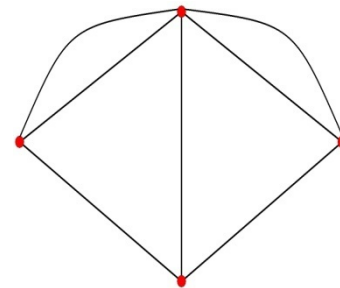
$t=29$

Three Strong Patterns:



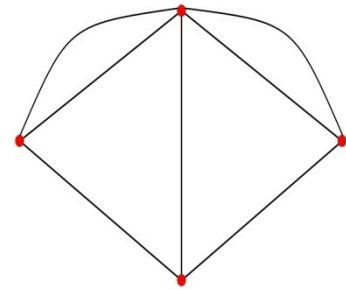
- **Relative Homophily** - Higher homophily for larger groups, higher s , lower d
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A Nested Set of Models



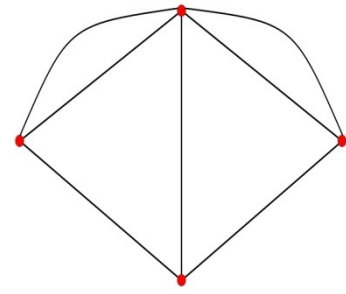
- People come with different `types' and choose friends
- Benefits from friendships depend on mix of `same' types and `different' types
- Cost of meeting friends
- Mix of meetings endogenous to a matching - look at equilibrium

Preferences



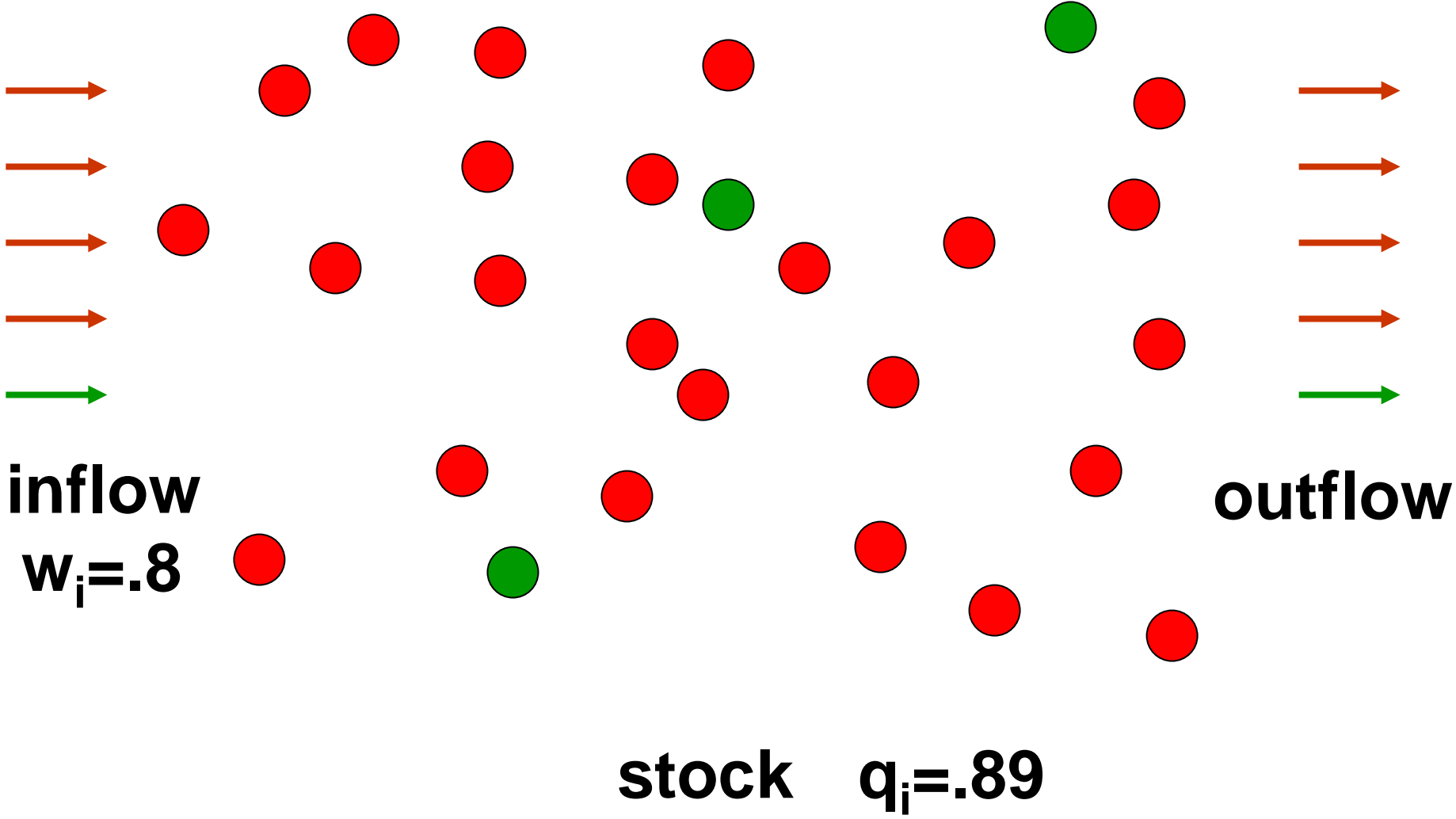
- Types: $i \in \{1, \dots, K\}$
- $s_i = \#$ same-type friends
- $d_i = \#$ different-type friends
- $U(s_i, d_i)$ utility to i
 - increasing in each variable
 - diminishing returns to scale

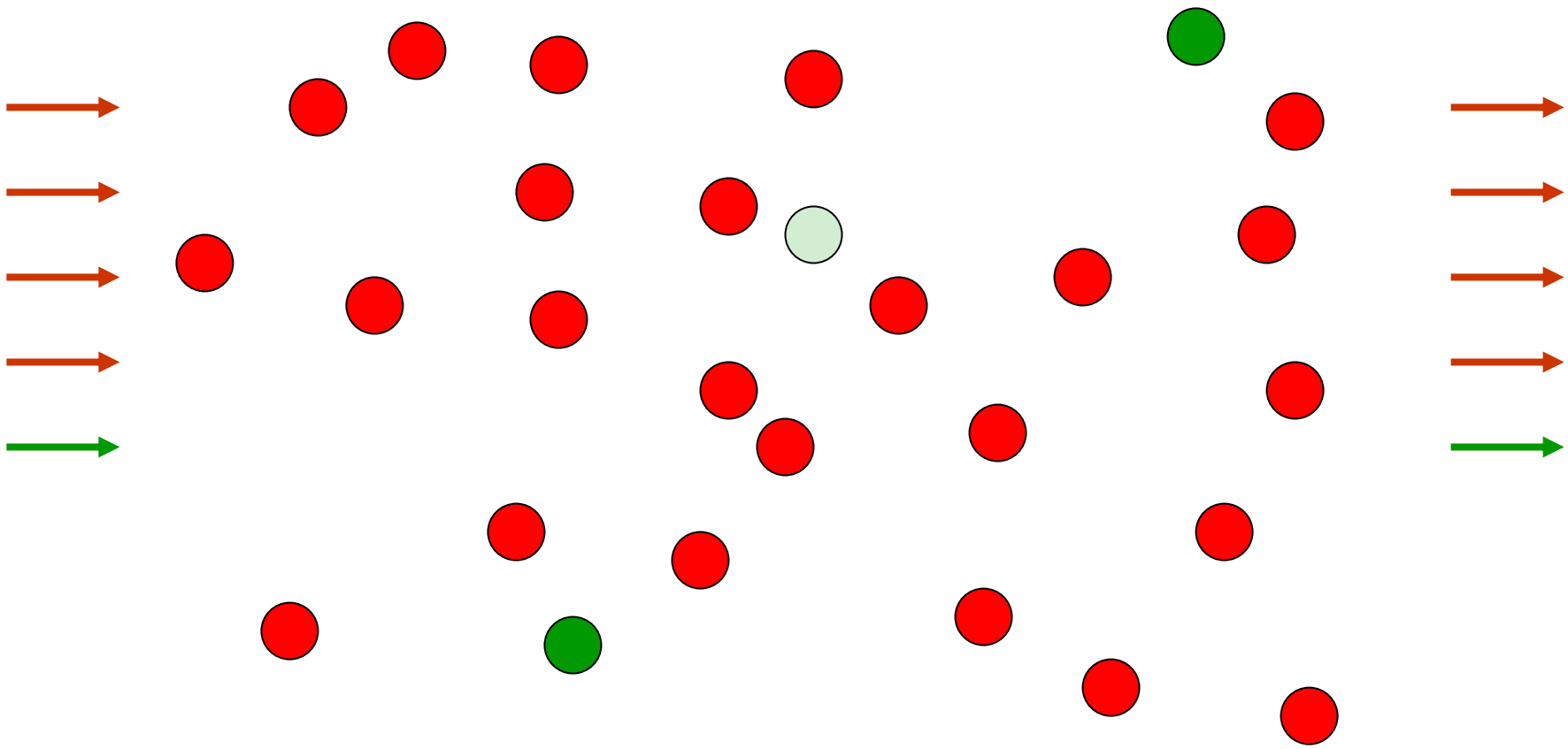
Examples/Applications

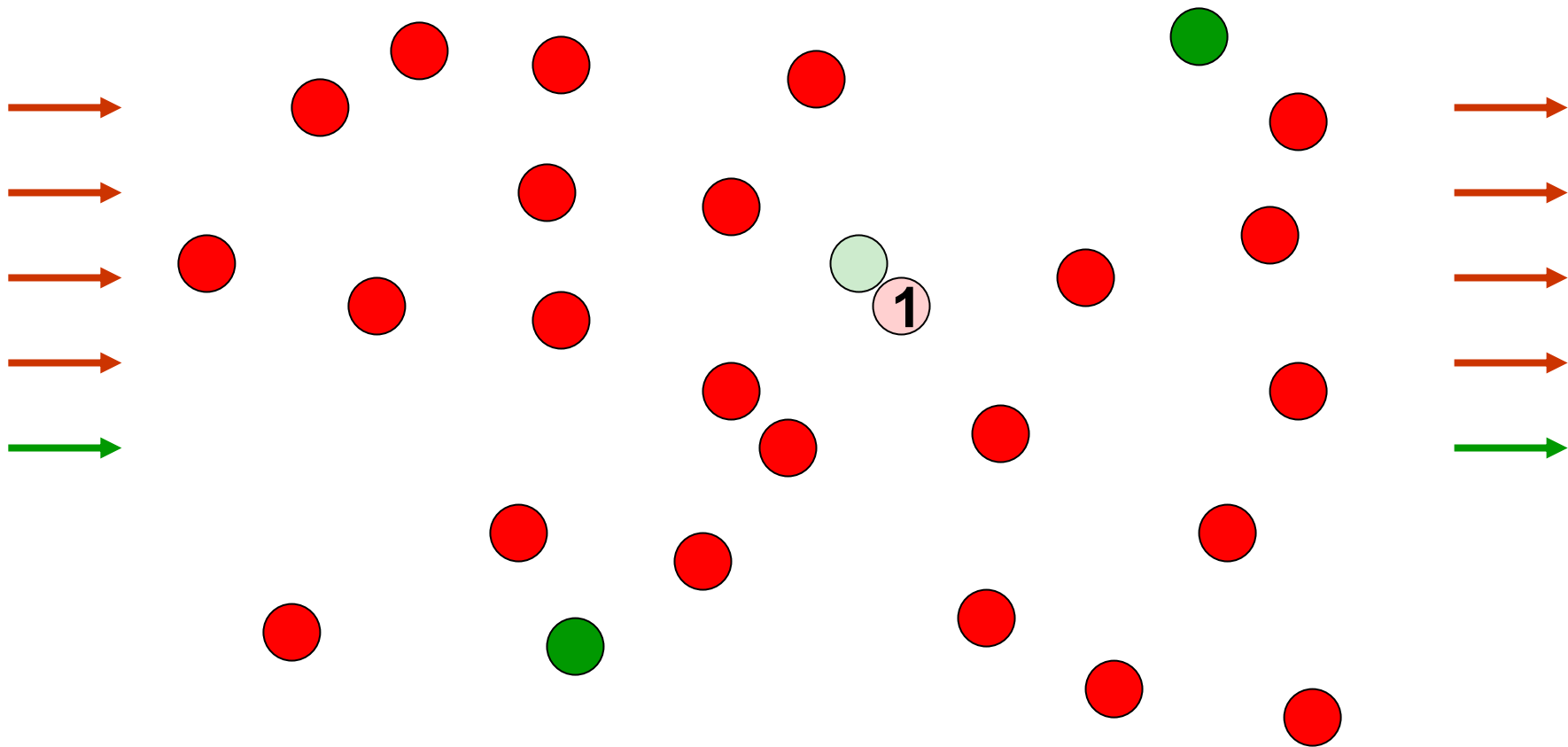


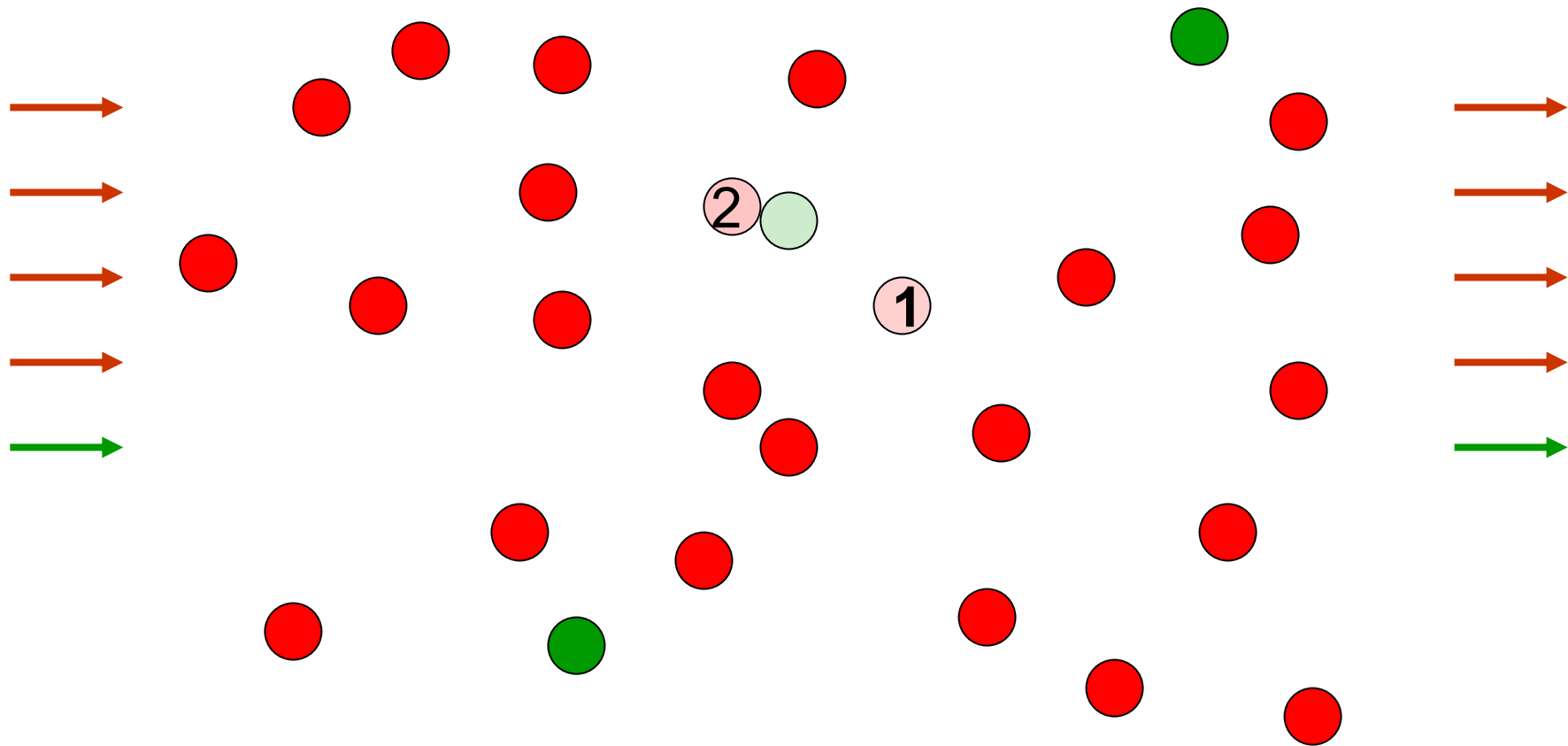
- **Information:** same type easier to communicate with but offers less diverse information
- **Professional/Teams:** same type easier to communicate with but offers less creative synergy
- **Purely social:** share more interests with same type
- **Risk sharing:** same type has more correlated shocks, but “closer” - lower cost to risk share

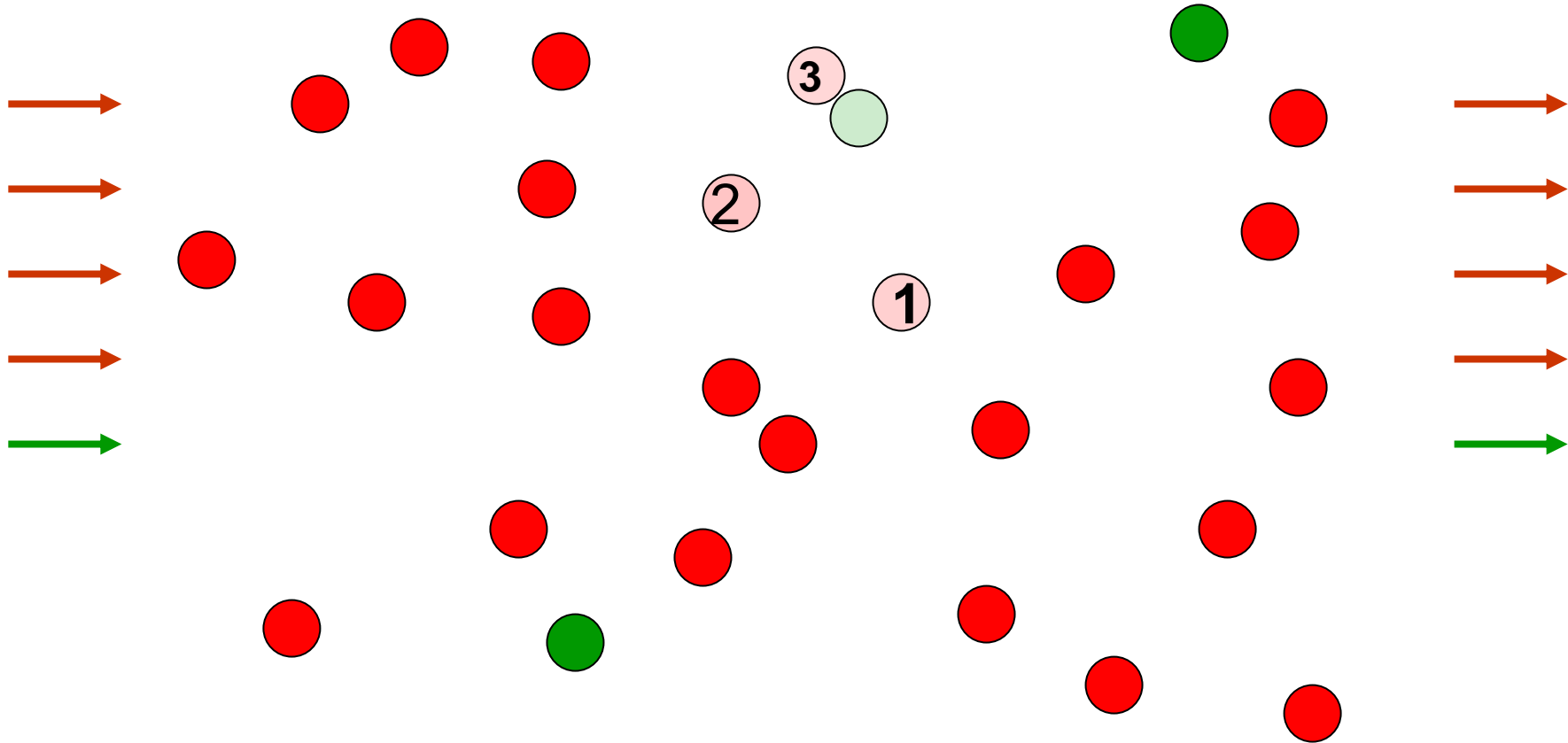
Matching Process:

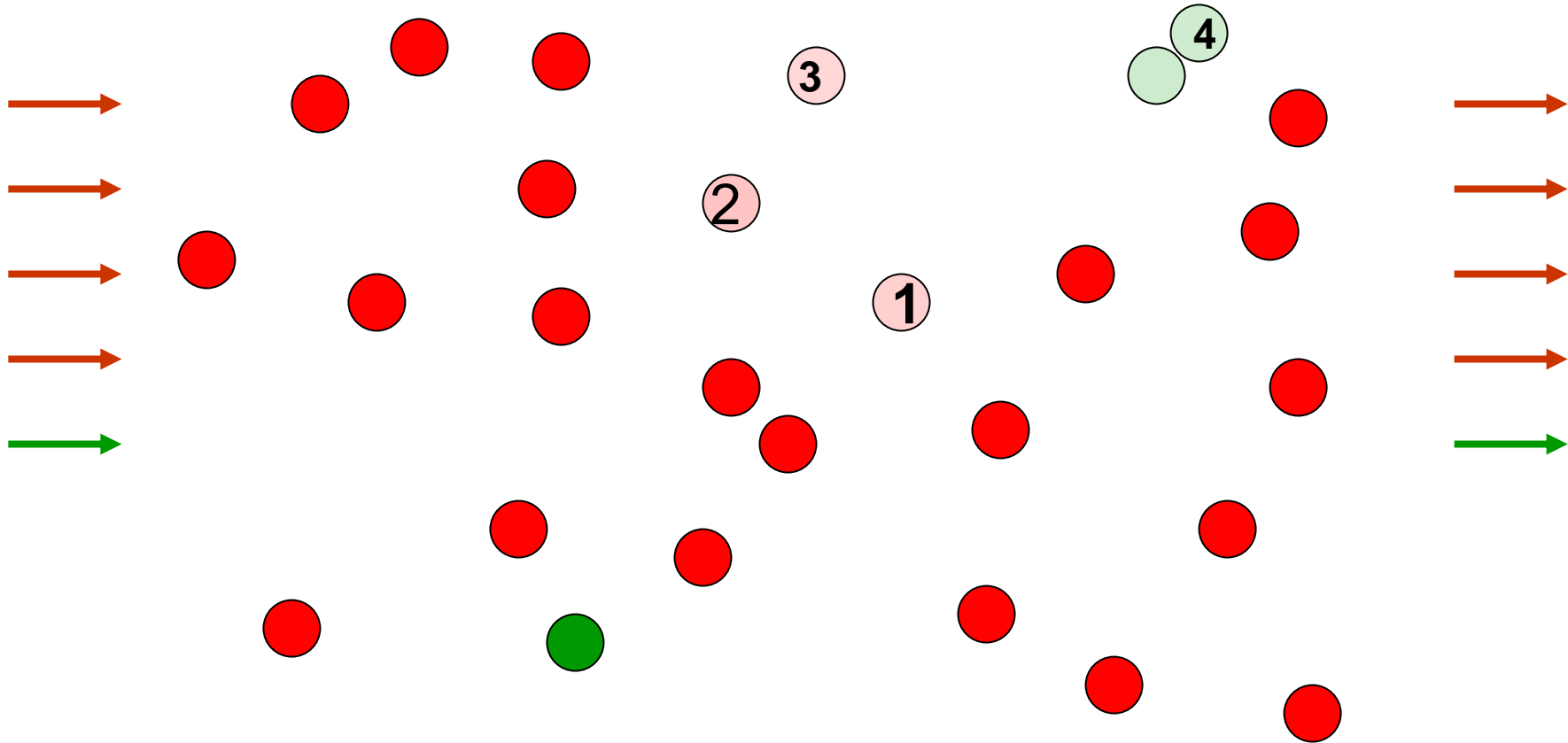


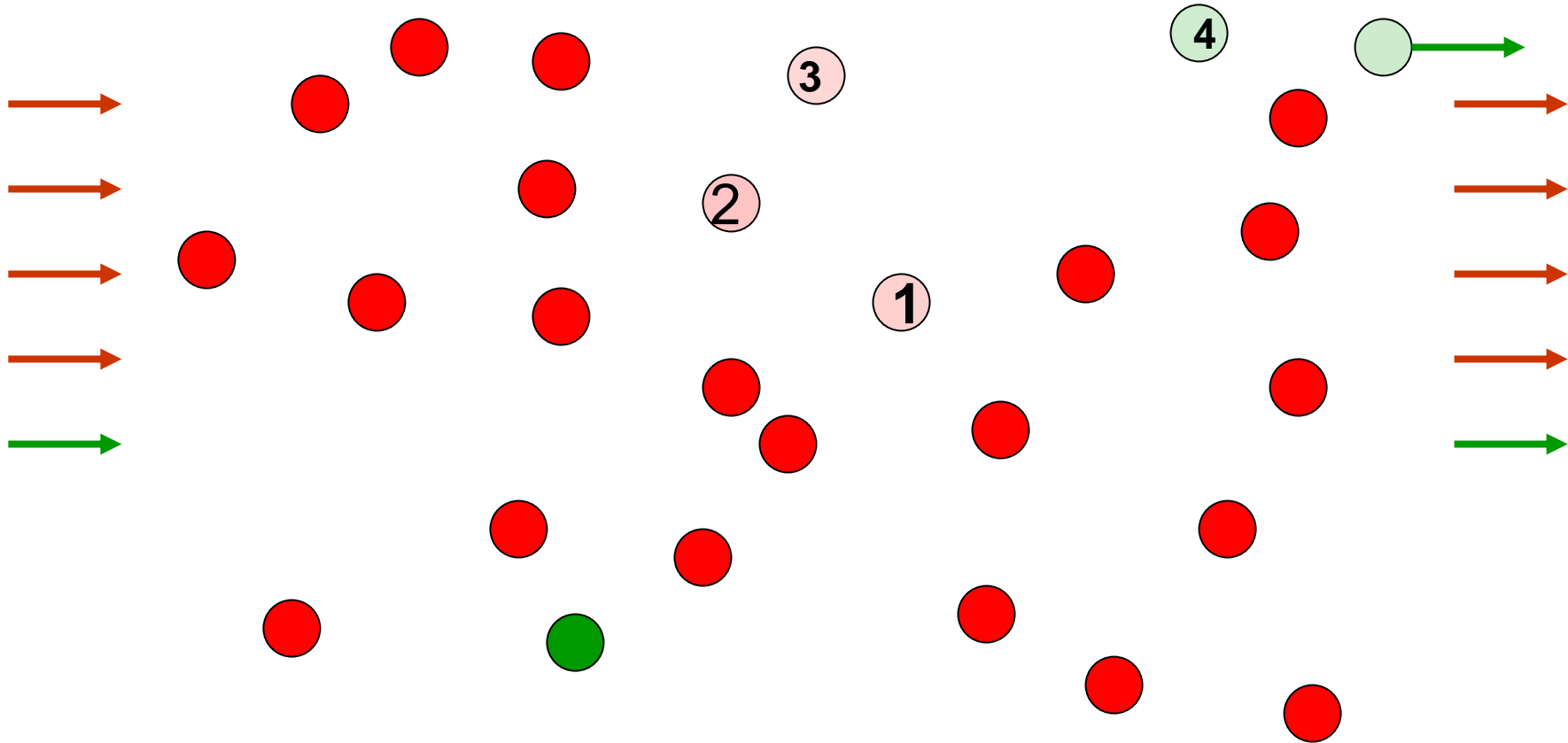




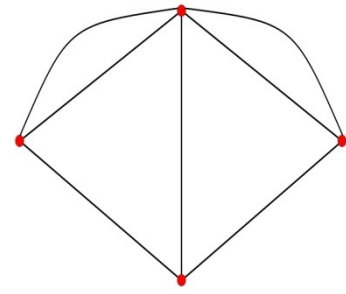








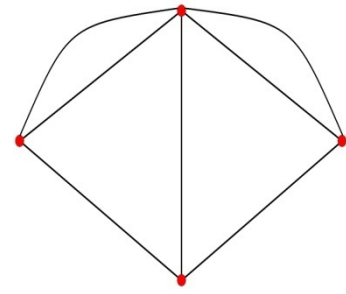
Steady State



- behaviors for each type
- outflows, stocks determined behaviors, inflow
- outflows match inflows
- behaviors are optimal given preferences, stocks

Steady-State exists, unique with sufficient concavity

1. Implications: Steady-State Alone

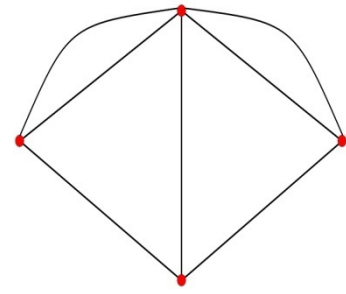


Larger group forms fewer 'different' friendships per capita:

- $N_i d_i = N_j d_j$ cross group friendships add up
- $N_i > N_j$ implies $d_i < d_j$

Relative Homophily - higher H_i for larger group

2. Preferences



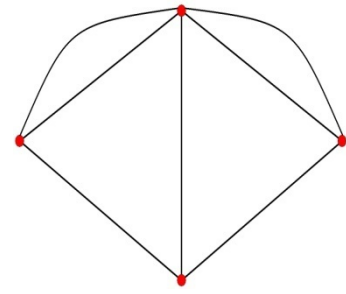
- Preferences independent of type would give baseline homophily:

$$H_i = s_i / (s_i + d_i) = w_i$$

- And all types would form same number of friendships

Meet as many people per unit time, do not care about type...

Preference condition:

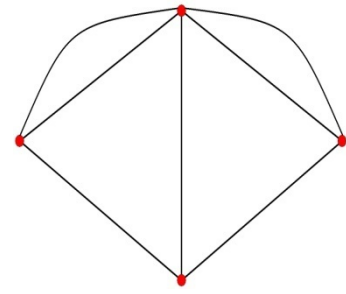


- **Same type bias:** Higher *marginal* returns when more sames than different

so scale up friendships, higher gain if richer mix of sames to different than vice versa.

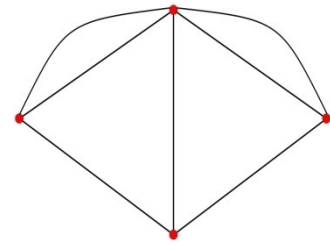
example: benefit from friends same across types and diminishing, but `cost' is lower for having friend of same type

Implications – Preference/ Choice effects



Same type bias implies

- Larger groups form **more total friendships.**
- **Inbreeding homophily** for larger groups



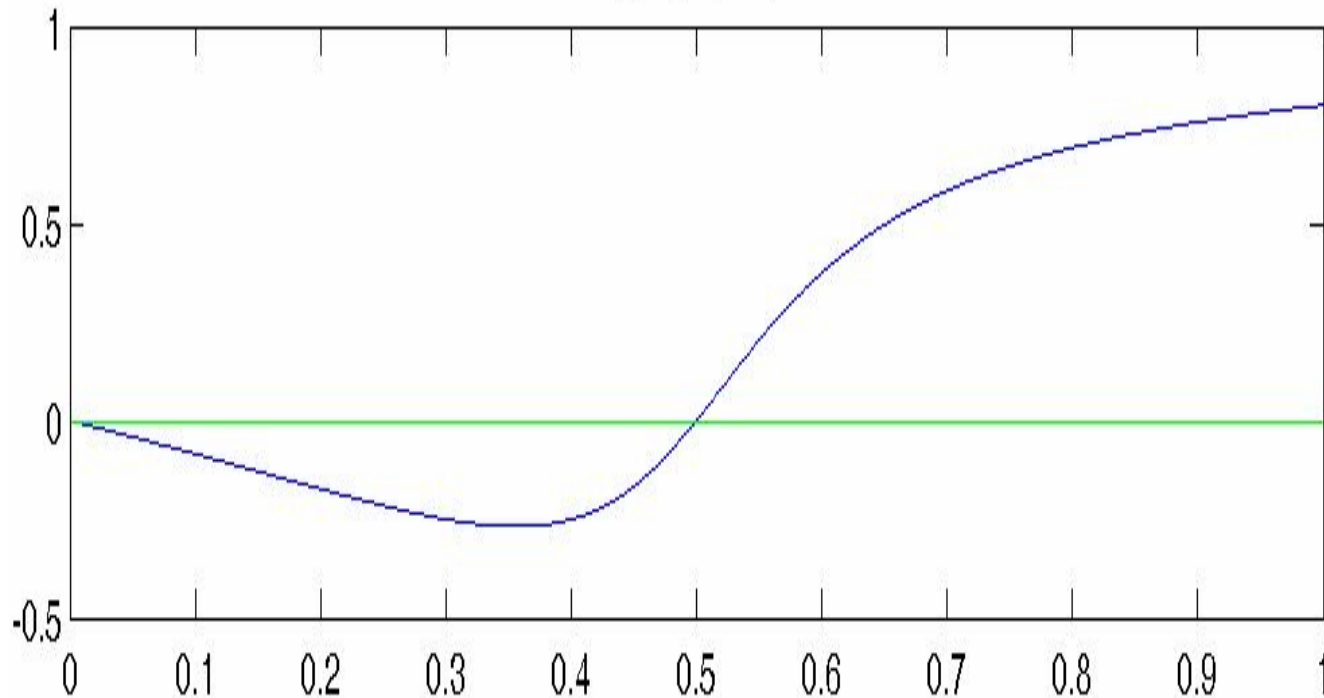
- ***Necessarily*** get Heterophily for small group:

$$|H_1| > 0 \quad \text{if and only if} \quad |H_2| < 0$$

$$q_1 > w_1 \quad \text{if and only if} \quad 1 - q_1 < 1 - w_1$$

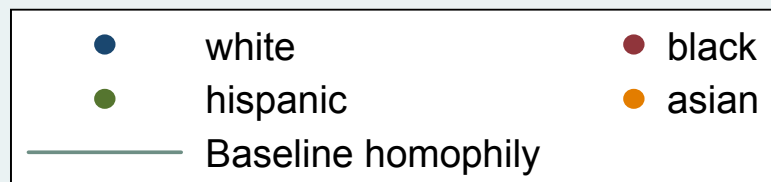
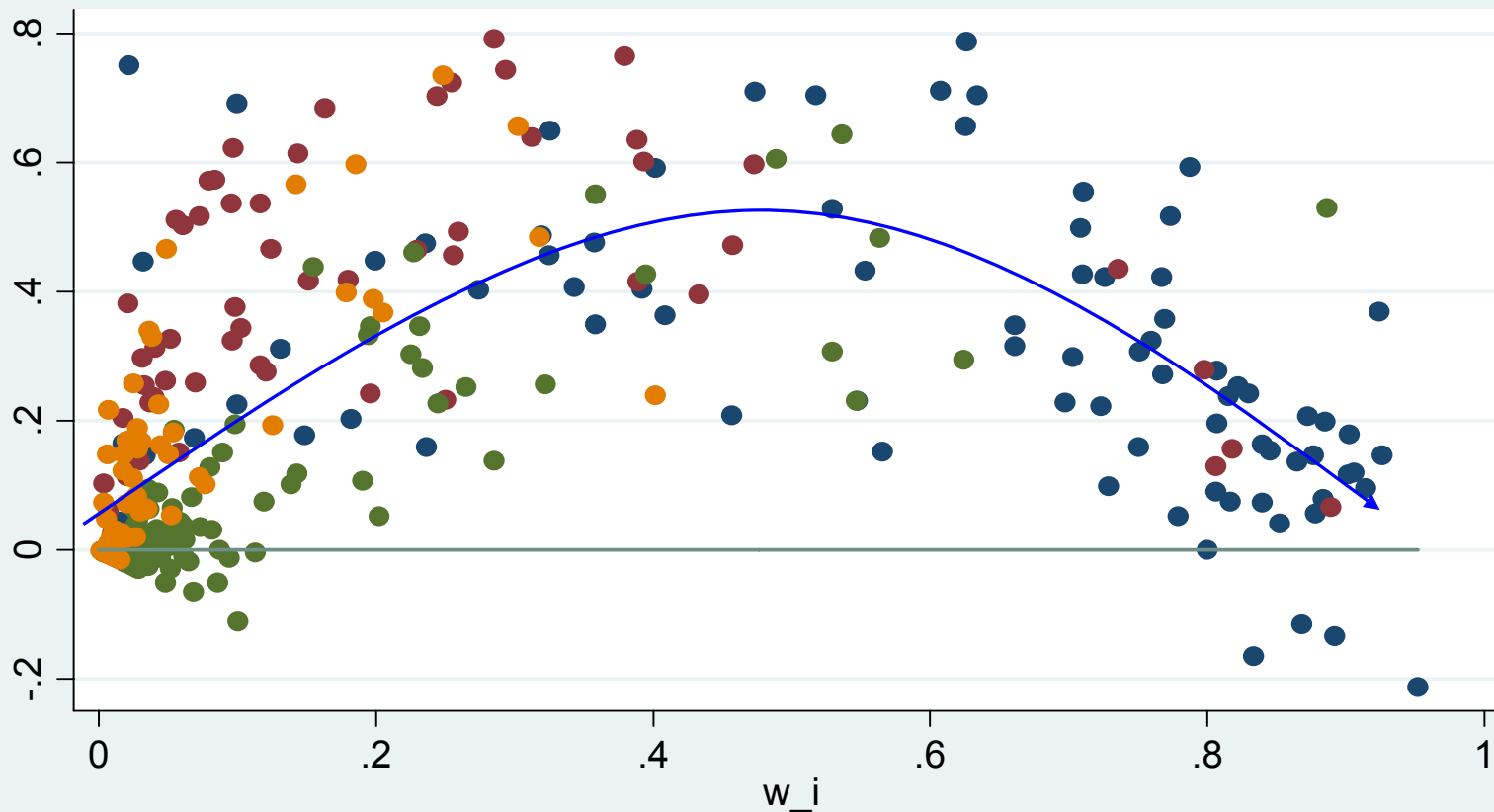
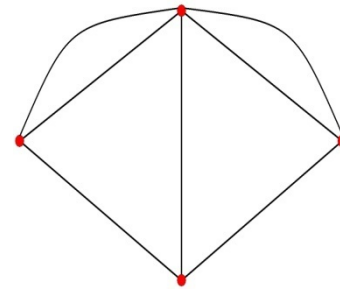
Inbreeding Homophily

for $U(s,d) = (s + .3d)^{-5}$, $c=1$

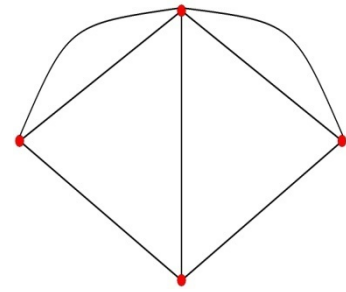


Group Size

Does not match:



3. Meeting Technology

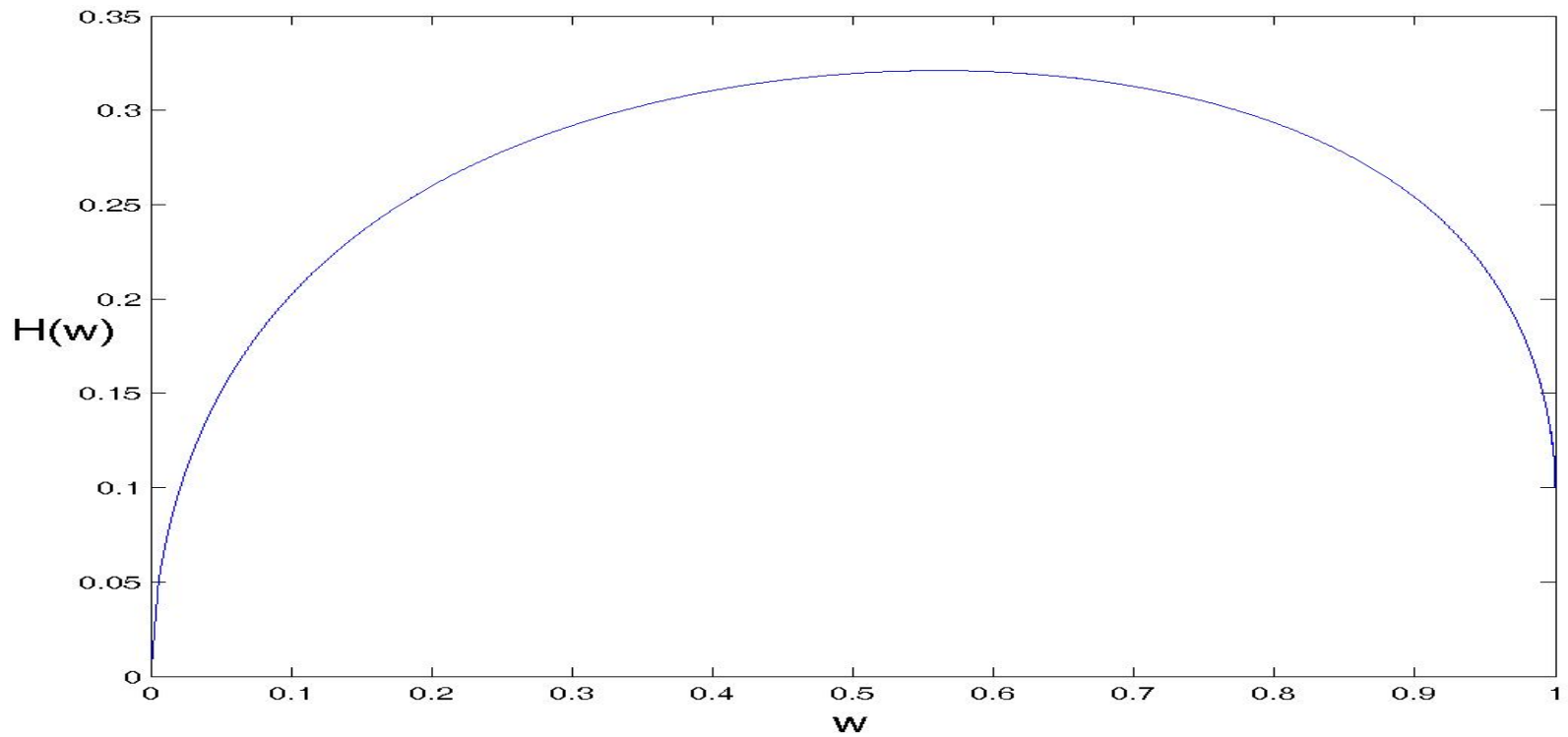


- **Bias meetings towards own type**
- **Clubs, meet friends via friends,**

$$q_1^b + q_2^b = 1$$

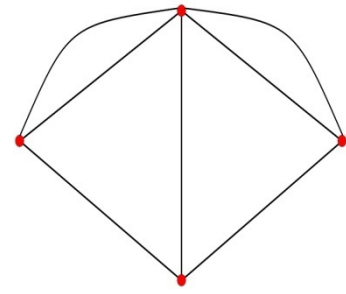
$b > 1$ meet own types faster than stocks

$$U(s,d) = (s + .3d)^{-5}, \quad c=1, \quad b=5/3$$



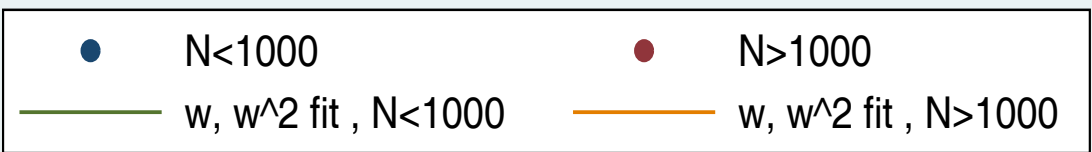
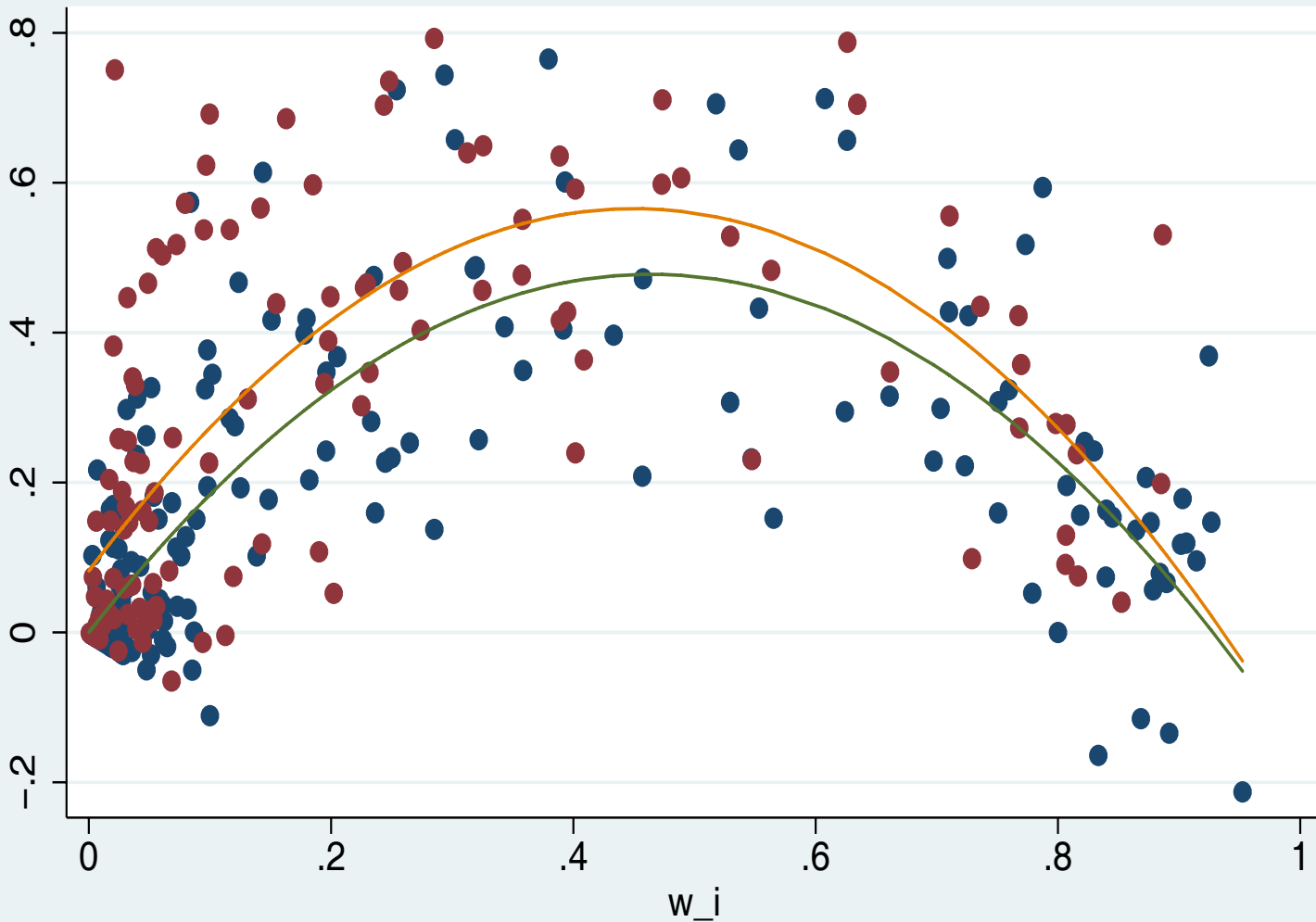
Group Size

Conclusions



- **Observations and Sources of Homophily:**
 - Relative homophily - steady-state constraints
 - Larger implies more - Choice - Preference Bias
 - Inbreeding homophily - Chance - Matching Bias
- **Advantage of an Integrated Model: Welfare**
 - Larger groups fare better
 - Sensitive to preference details

Inbreeding Homophily by School Size



intercept
higher
for larger
(by .1, $t=3$)

Larger
=more
meeting
bias?

Inbreeding Homophily by Race

