

# A Economic Model of Friendship : homophily, minorities and segregation



Presented by Chengxin Liang (Vanessa) 301167072

# Content

- ◆ Importance of network structure
- ◆ Introductions of this research paper
- ◆ 3 empirical observations of friendship formation made by other researchers
- ◆ How the authors use new model to understand these observations
- ◆ Experiments
  - How these observations generated by
    - Biases in preferences
    - Biases in meeting
- ◆ Conclusions

# Importance of network structure

- ◆ The network structure of social interactions **influences** a variety of behaviors and economic outcome

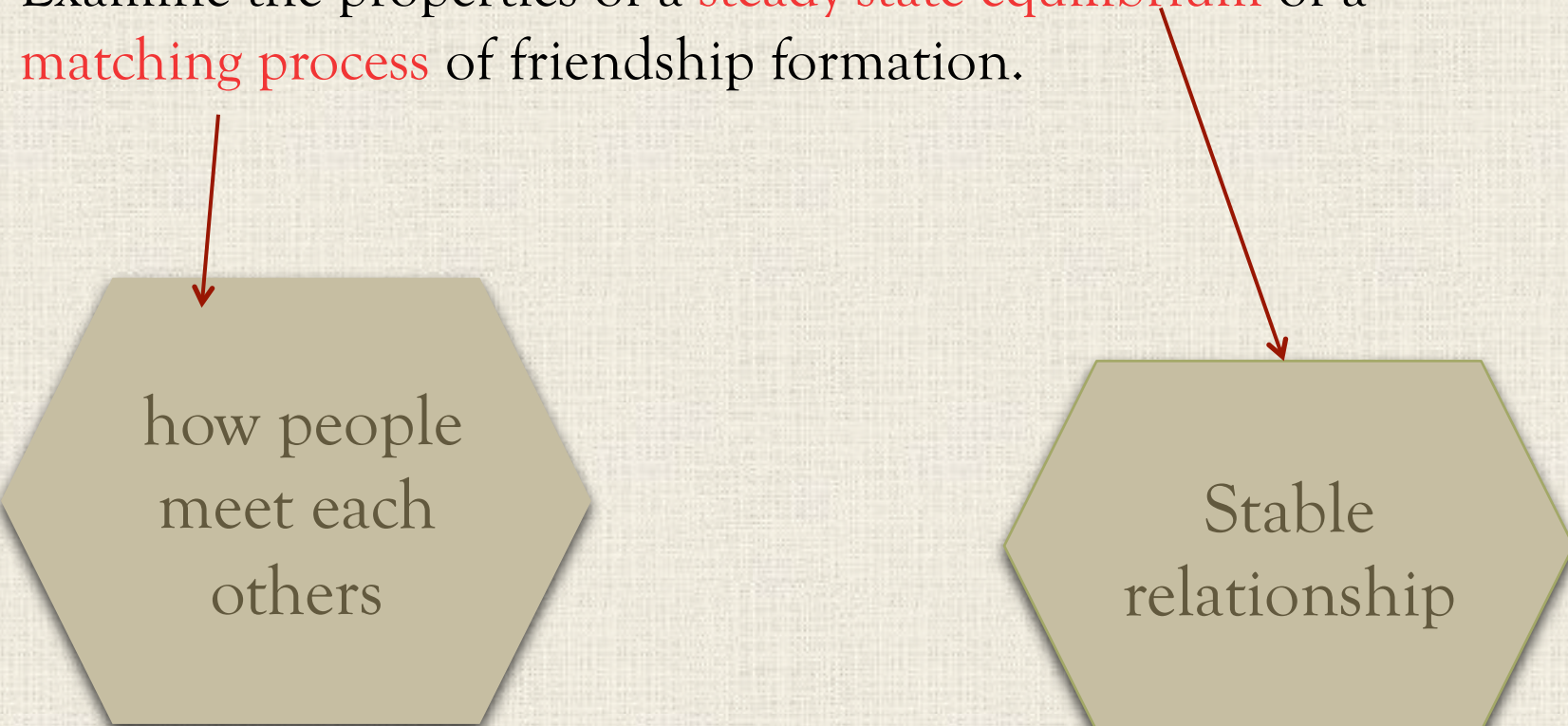
- Decisions of which product to buy
- Investment in education
- Access to jobs
- Social mobility
- How quickly information diffuse



# Introductions of the paper

◆ Purpose of this paper:

Examine the properties of a **steady-state equilibrium** of a **matching process** of friendship formation.



how people  
meet each  
others

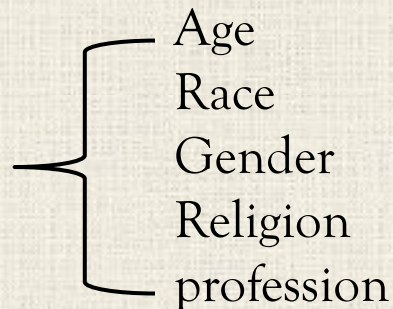
Stable  
relationship

# Introductions of the paper

◆ Main focus of the paper : **Homophily**

◆ Homophily

- a phenomenon of social networks
- this refers to a tendency of **various types of individuals** to associated with others who **are similar to** themselves in terms of :



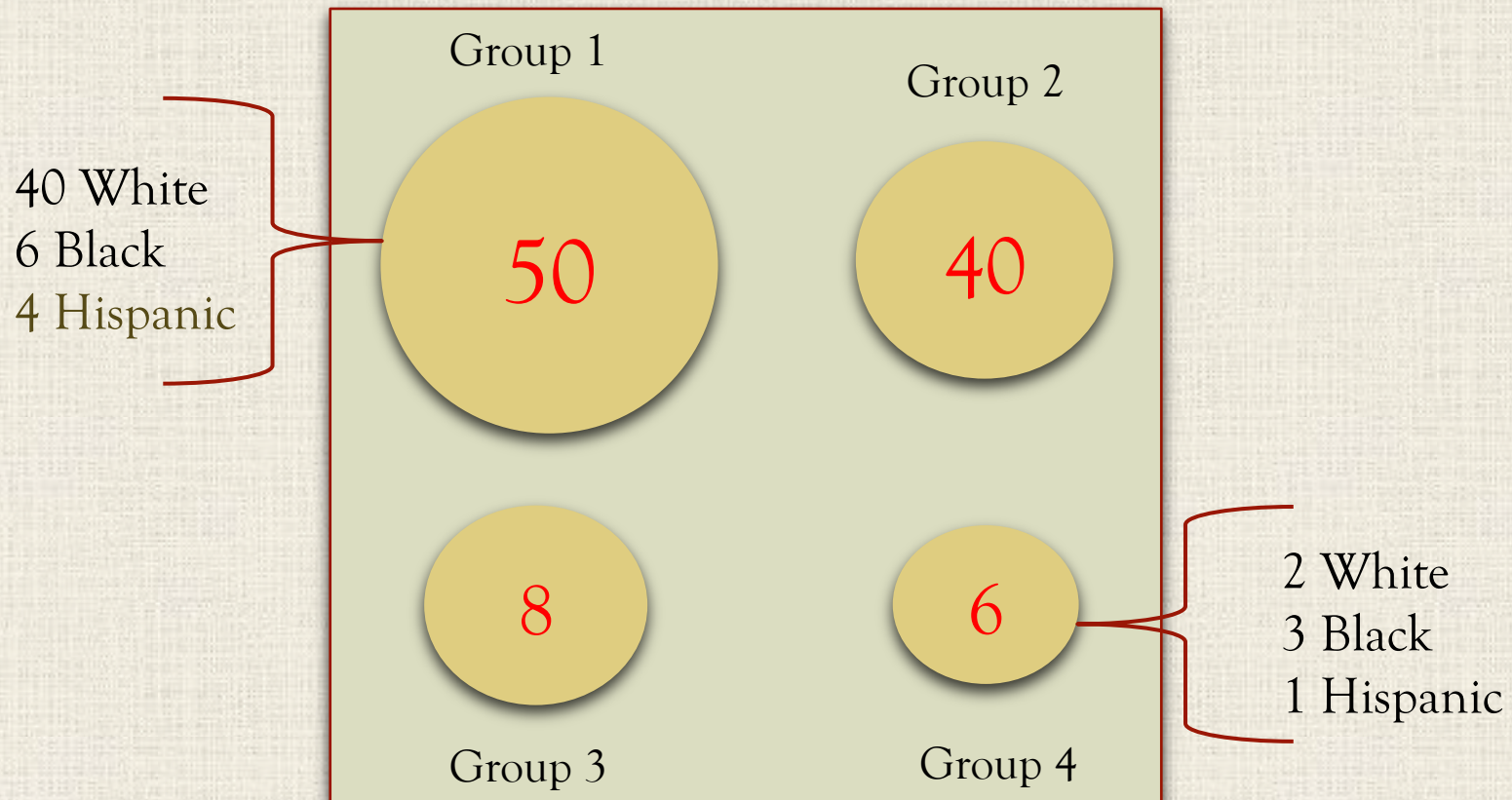
Age  
Race  
Gender  
Religion  
profession

# 3 empirical observations

- ◆ Larger groups tend to form **more same-type ties** and fewer other ties
- ◆ Larger groups form **more ties per capita**
- ◆ All groups are **biased towards same-type** relative to demographics with most **extreme bias** coming from **middle size** group

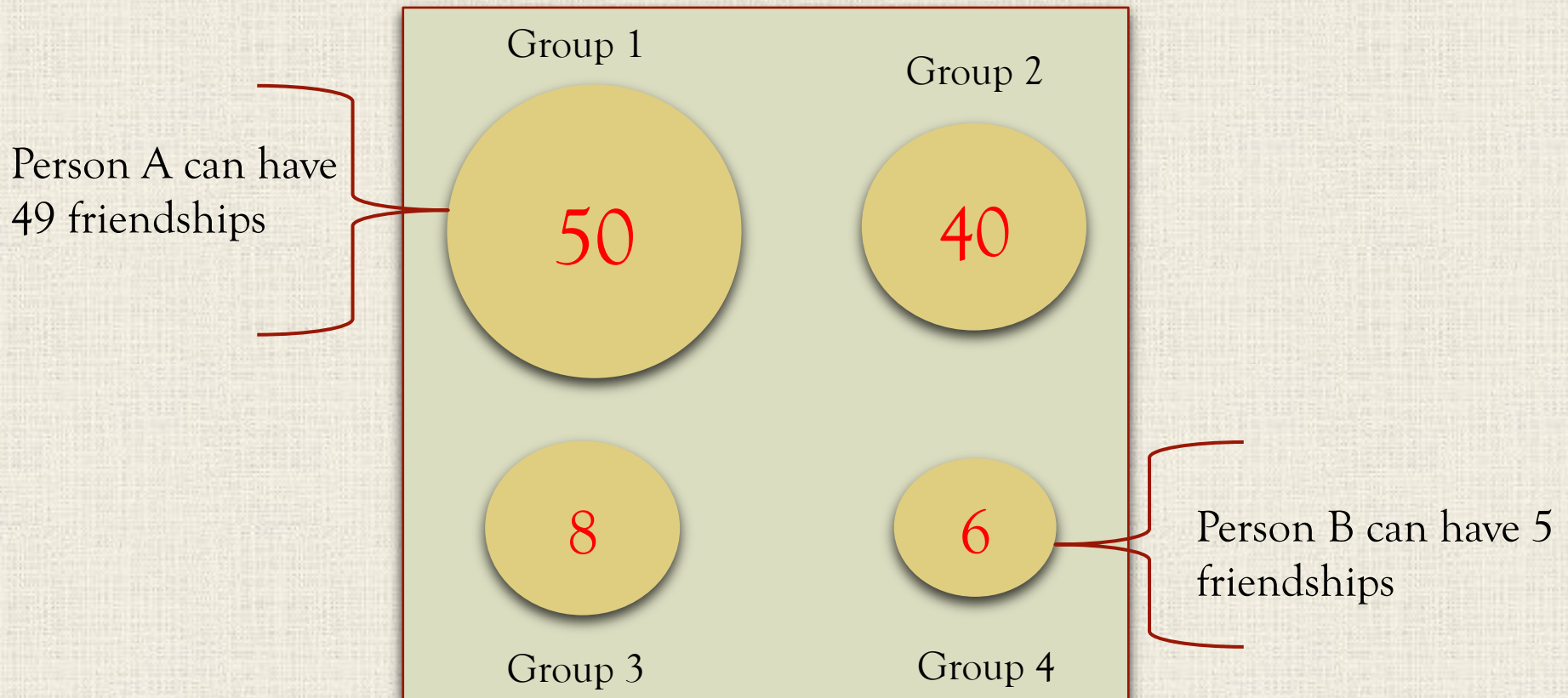
# 3 empirical observations

- ◆ Larger groups tend to form more **same-type ties** and **fewer other ties**



# 3 empirical observations

- ◆ Larger groups form more ties (friendships) per capita

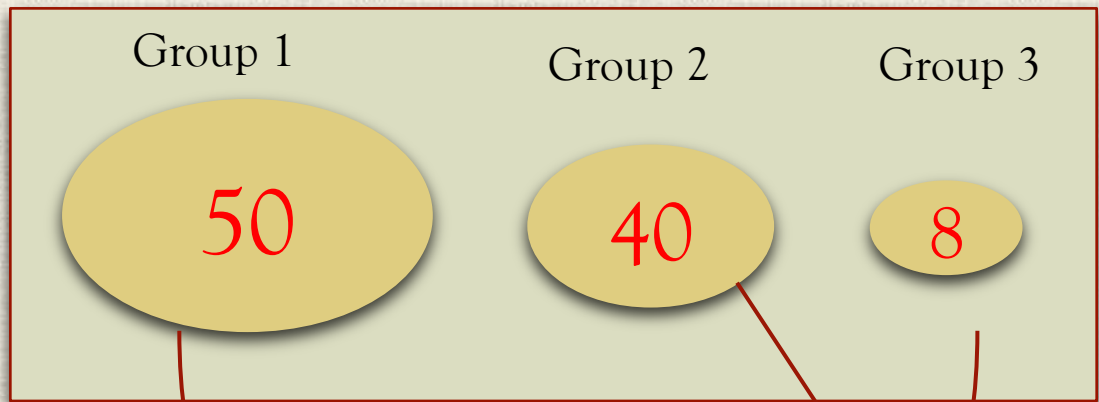




# 3 empirical observations

- ◆ All groups are biased towards same-type relative to **demographics** with most extreme bias coming from middle size group

Segments of human population broken down by age or sex or income. ect



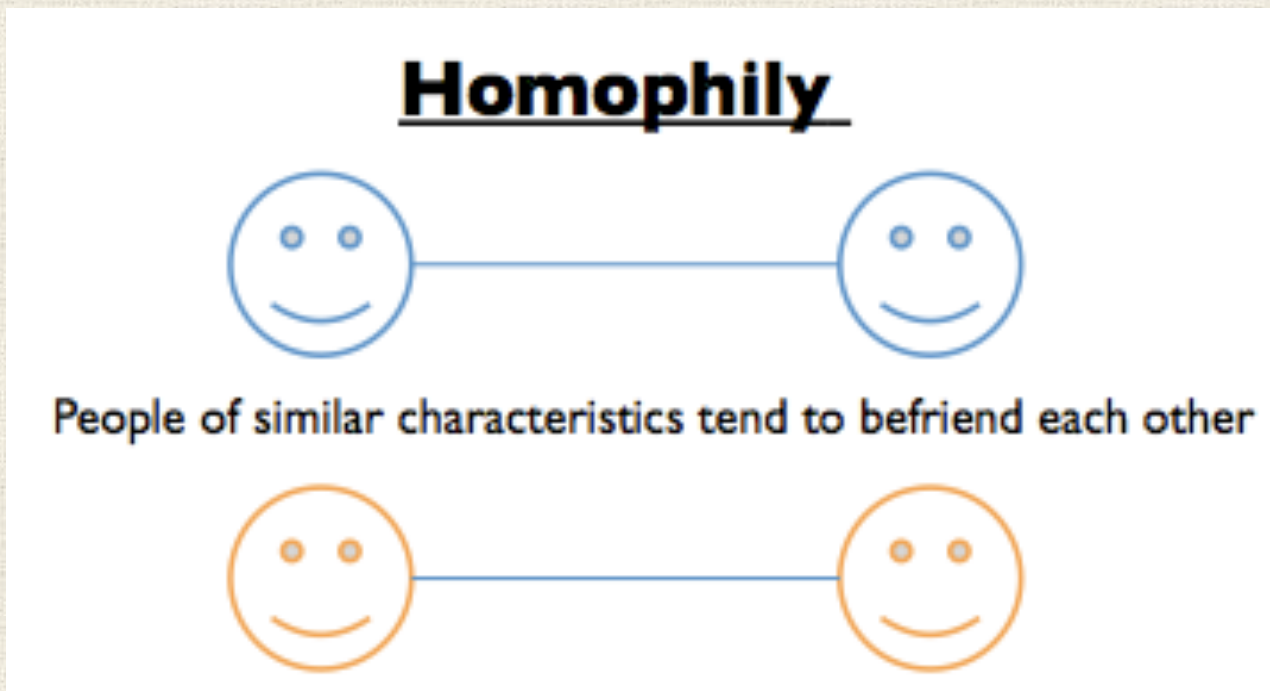
All groups are biased towards same-type

Most extreme bias

# Use model to understand the observations

## ◆ Homophily

- a tendency of **various types of individuals** to associated with others who **are similar to** themselves.



# Use model to understand the observations

- Measurement of Homophily

$N_i$  = number of type  $i$  person

$N$  = the total populations

$W_i$  = fraction of type  $i$  in a population

$$w_i = \frac{N_i}{N}$$

Example:

- Suppose there are 10 persons in our classroom
- 6 Chinese
- 4 Canadian

$$W_{CH} = 6 / 10 = 0.6$$

$$W_{CA} = 4 / 10 = 0.4$$

# Use model to understand the observations

- Measurement of Homophily

- Definition 1:

$H_i$  = homophily index

$S_i$  = same-type friendship

$d_i$  = different-type friendship

$$H_i = \frac{s_i}{s_i + d_i}$$

Example : Group 1

- $S_i = 3$  friendships between Chinese & Chinese
- $d_i = 4$  friendship between Chinese & Canadian

$$H_{CA} = 4 / 3+4 = 0.57$$

Example : Group 2

- $S_i = 6$  friendships between Chinese & Chinese
- $d_i = 1$  friendship between Chinese & Canadian

$$H_{CH} = 6 / 6+1 = 0.85$$

# Use model to understand the observations

- Measurement of Homophily

- ◆ Definition 2:

A profile  $(s, d) = (s_1, d_1, s_2, d_2, \dots, s_K, d_K)$  satisfies relative homophily if  $W_i > W_j$  implies  $H_i > H_j$ .

- ◆ Do a comparison of these 2 values:

$$w_i = \frac{N_i}{N}$$

$$H_i = \frac{s_i}{s_i + d_i}$$

It satisfy **relative homophily**, if  $W_i > W_j$  implies  $H_i > H_j$

**In our example** :  $W_{CH}=0.6 > W_{CA}=0.4$ , **then**  $H_{CH}=0.85 > H_{CA}=0.57$

# Use model to understand the observations

- Measurement of Homophily

## Definition 3 :

The profile  $(s, d) = (s_1, d_1, s_2, d_2, \dots, s_K, d_K)$  satisfies **baseline homophily** if for all  $i$ :

$$w_i = \frac{N_i}{N} = H_i = \frac{s_i}{s_i + d_i}.$$


baseline homophily  $\longrightarrow$  relative homophily  
 $\longleftarrow$

Use model to understand the observations

- Measurement of Homophily

**Definition 4 :** The profile  $(s, d)$  satisfies **inbreeding homophily** for type  $i$  if

$$H_i > W_i$$



In favor of same-type  
friendship

**Definition 5:** The profile  $(s, d)$  satisfies **heterophily** for type  $i$  if

$$H_i < W_i$$



In favor of different-  
type friendship

# Use model to understand the observations

- Measurement of Homophily

**Definition 6** : The inbreeding homophily of type  $i$  is

$$IH_i = \frac{H_i - w_i}{1 - w_i}.$$

$IH_i > 0$     inbreeding homophily ( in favor of same-type friendship)

$IH_i < 0$     inbreeding heterophily ( in favor of different-type friendship)

$IH_i = 0$     baseline homophily (relative homophily)

$IH_i = 1$     completely inbreeds (completely homophily)



# Use model to understand the observations

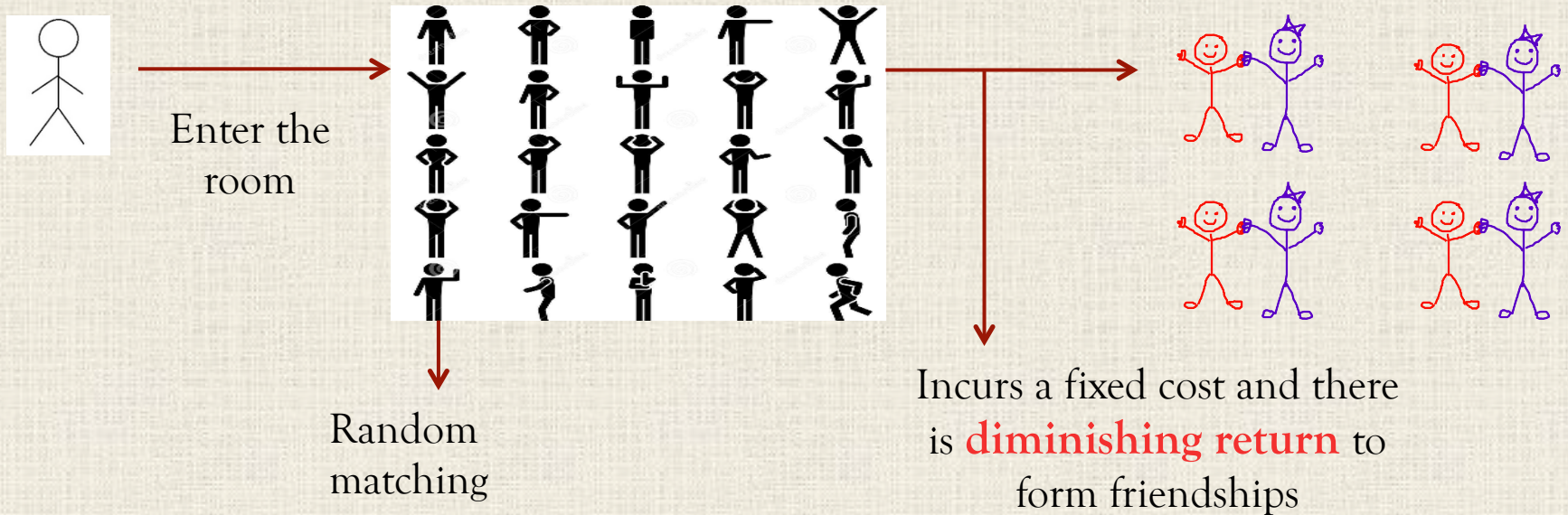
- Pattern of US high school friendship

Percent of Friends by Ethnicity:	Ethnicity of Students			
	White	Black	Hispanic	Others
	n=131 %=51	n=96 %=38	n= 13 %=5	n=15 %=6
White	85	7	47	74
Black	4	85	46	11
Hispanic	4	6	2	4
Others	7	2	5	11

- The IH index of inbreeding homophily is **0.69** for **whites** (whose relative population is 51%)
- **0.76** for **blacks** (relative population 38%)
- **0.11** for **Hispanics** (2% of population)

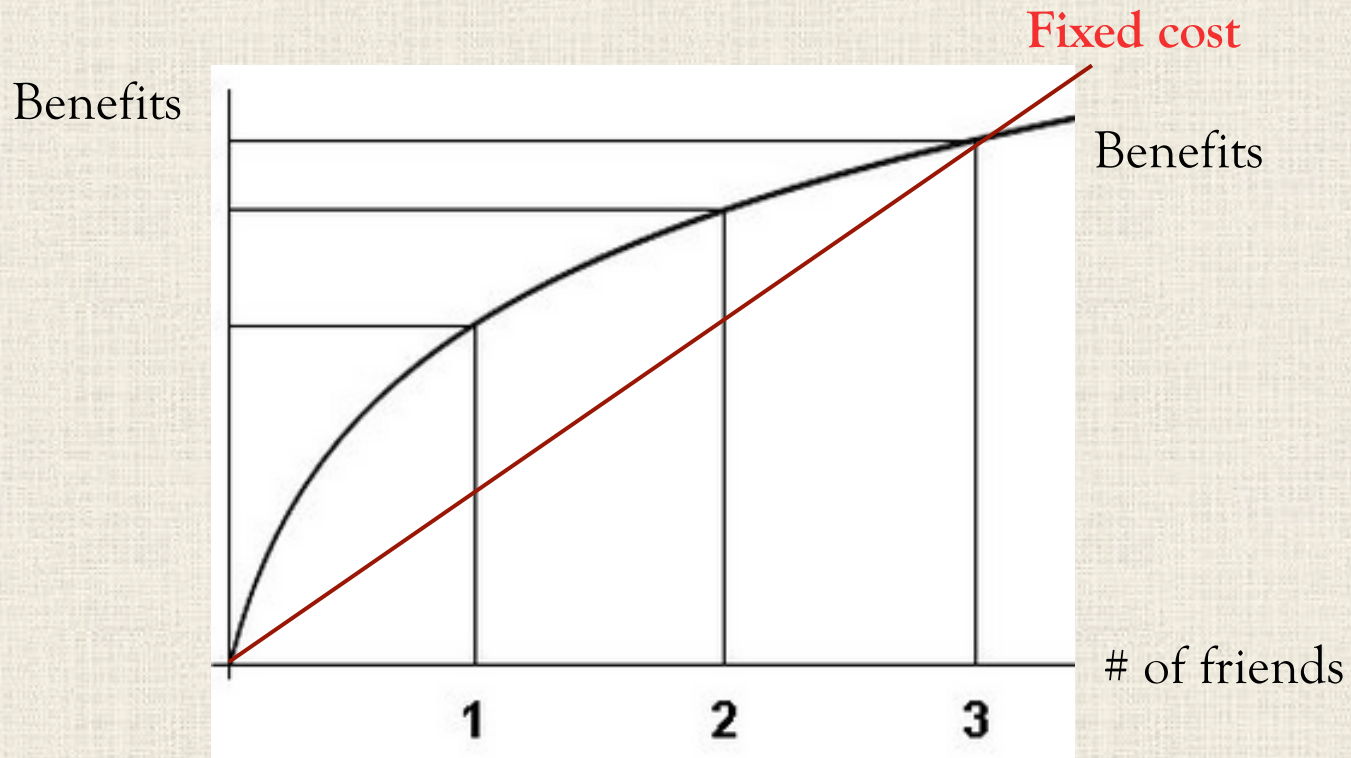
# Experiment

- ◆ Conduct **an experiment** on a representative sample of US high schools students.
- ◆ Simple Model:



# Experiment

Diminishing return to from friendship



# Experiments

- **Outcomes :**

The determinant of an individual's strategy of finding a friend is : **his/ her preference & the types he/ she faced**

## 2 implications of the model:

- If agents' preferences over friendships are **insensitive to type**, then all agents form the same number of friendships.
- types are matched in **frequencies** in proportion to their **relative stocks** in the matching process cannot generate inbreeding.( probability of meeting same-type or different types)

# Experiment

Given the 2 implications from the model

- Examine **type- sensitivity of preference** to show that if Agent see higher marginal returns when form a mix of friendship that is biased towards same-type

Match with the 2<sup>nd</sup> observation:

**Larger groups form more ties per capita**

- **Examine bias in meeting**
  - Generate inbreeding homophily
    - Deal to :
      - Tracking
      - Membership
      - Meet friends through friends

Match with 3<sup>rd</sup> observation:

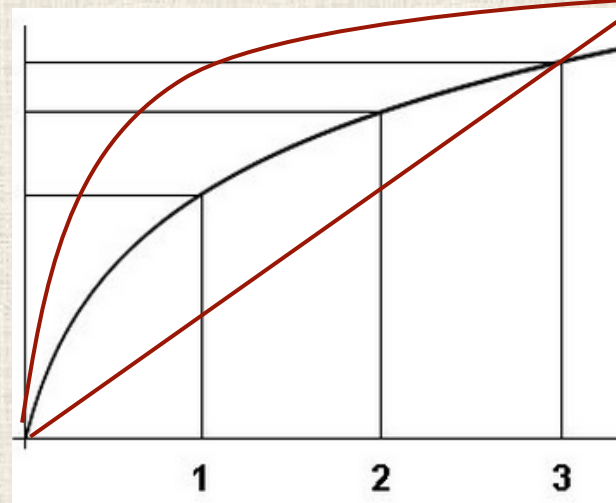
**biased towards same-type and generate inbreeding homophily**

# Experiment

Given the 2 implications from the model

- Examine type- sensitivity of preference to show that if Agent see higher marginal returns when form a mix of friendship that is biased towards same-type

Benefits



Benefit for sensitive type

Benefit for insensitive type

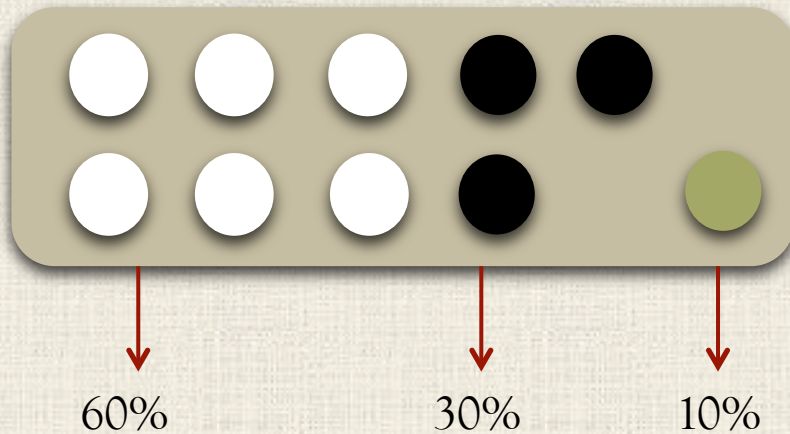
# of friends

# Experiment

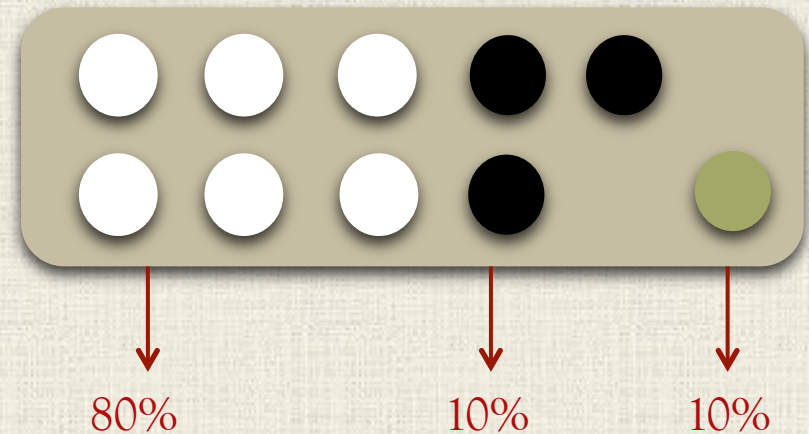
Given the 2 implications from the model

- Examine type- sensitivity of preference to show that if Agent see higher marginal returns when form a mix of friendship that is biased towards same-type

Random matching



Random matching *with preference/bias*



# Conclusions

- Started a experiment in a selected sample of American high schools:
- **Find that**
  - larger racial groups form more friends per capita
  - while all groups display inbreeding homophily
  - with highest levels for middle size group
- **it shown that:**
  - If all types meet the same number of friends per unit of time
  - then generating differences in per capita friendships in our model requires more than just having preferences on # of friends .



# Conclusion

- So, without differences in meeting rates across type, to generate observed data preferences need to be **sensitive to types**.
- The paper finds that the observed inbreeding homophily patterns can only be generated with some **bias in the meeting process** in favor of **own type**.
- **Thus** according to this model's results, both **type sensitive preferences** and **biased opportunities** play a role in friendship formation.

# Question Time

