Economic Perspective on Non-economic Phenomena

3) Matching on the marriage market

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- Competition over the potential gains from marriage.
    - In modern societies, explicit price mechanisms are not observed.
- The assignment of partners and the sharing of the gains from marriage can be analyzed within a market framework.

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  2. Search and transaction costs
- Transferability of resources among the agents
  1. Transferable utility within the pair
  2. Non-transferable utility within the pair

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  2. There are no two (married or unmarried) persons who prefer to form a new union.
- If we assume the world without frictions (no transaction or search cost), the marriage structure which does not satisfy either the first or the second condition is not sustainable.

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3. Search models

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  - only monogamous marriages assumed- each person can have at most one spouse
  - agents cannot make transfers between each other

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- It captures situations where, because of public goods and social norms that regulate within family allocations
  - that the success of a marriage mainly depends on the attributes of the partners
- However, an undesired marriage can be avoided or replaced by a better one.

Gale-Shapley notation

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- For a given j, the entries v_{ij} describe the preference ordering of woman j over all feasible males, $i = 1, 2...M$.
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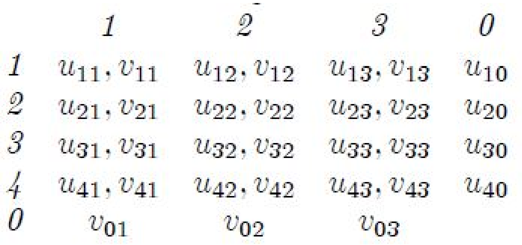
- Similarly, for a given i, the entries u_{ij}describe the preference ordering of man i over all feasible women $j = 1, 2 ... N$.
- We may incorporate the ranking of the single state by adding a column and a row to the matrix, (denoting by u_{i0} and v_{0j})

Matrix with utilities



$$\begin{array}{ccccc}
 & 1 & 2 & 3 & 0 \\
1 & u_{11}, v_{11} & u_{12}, v_{12} & u_{13}, v_{13} & u_{10} \\
2 & u_{21}, v_{21} & u_{22}, v_{22} & u_{23}, v_{23} & u_{20} \\
3 & u_{31}, v_{31} & u_{32}, v_{32} & u_{33}, v_{33} & u_{30} \\
4 & u_{41}, v_{41} & u_{42}, v_{42} & u_{43}, v_{43} & u_{40} \\
0 & v_{01} & v_{02} & v_{03} &
\end{array}$$

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- They suggested an algorithm which generates a stable outcome in a finite number of steps.
- For simplicity, we assume here that all rankings are strict.

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This mechanism is repeated until no male is rejected; then the process stops.

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- The process must yield a stable assignment because women can hold all previous offers.
- If there is some pair not married to each other
  - the man did not propose (he found a better mate or preferred staying single)
  - he proposed and was rejected (the potential wife had found a better mate or preferred staying single)

Example

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- Matrix of utility payoff

		Women		
		1	2	3
Men	1	3, 2	2, 6	1, 1
	2	4, 3	7, 2	2, 4
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- *What is the order of preferences of each individual?*

Men proposing

- *What will be the final assignment if men make the proposals?*

Women

		1	2	3
Men	1	3, 2	2, 6	1, 1
	2	4, 3	7, 2	2, 4
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Solution - men proposing

- Man 1 proposes to woman 1, and men 2 and 3 both propose to woman 2, who rejects man 3, but keeps man 2.

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- Man 1 proposes to woman 1, and men 2 and 3 both propose to woman 2, who rejects man 3, but keeps man 2.
- In the second round, man 3 proposes to woman 1 who rejects him.
- In the last round, man 3 proposes to woman 3 and is not rejected.

Women

		1	2	3
Men	1	**3, 2**	2, 6	1, 1
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- A different stable assignment may be obtained if women make the offers and men can reject or hold them.
- What is the difference between the allocations?
- *Which way of proposals (women proposing or men proposing) would be preferred by women?*
- It can be shown that if all men and women have strict preferences, the stable matching obtained when men (women) make the proposal is weakly preferred by all men (women).

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- Woman 2 proposes to man 1 and women 1 and 3 both propose to man 2, who rejects woman 3, but keeps woman 1.

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- Woman 2 proposes to man 1 and women 1 and 3 both propose to man 2, who rejects woman 3, but keeps woman 1.
- In the second round, woman 3 proposes to man 1 who rejects her.
- In the third round woman 3 proposes to man 3 and is not rejected

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Compare

Men proposing

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- Equilibrium depends on which side of the marriage market makes the proposals.
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- *What do you think will be the effect of increase in the number of women on the welfare of men/women?*

Becker- Shapley- Shubick: Assumptions

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    - Difficult to maintain

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- Whenever one commodity at least is privately consumed, a spouse can reduce her private consumption to the partner’s benefit, which de facto implements a compensation.

Basic features of the model

- Instead of introducing two exogenous matrices $u = (u_{ij})$and $v = (v_{ij})$ as in the case of non-transferable utility, we now consider a unique output matrix with entries ζ_{ij} which specifies the total output of each marriage.

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  - If i and j form a match –> $u_{ij} + v_{ij} = \zeta_{ij}$
- In the previous approach, the matrices of u and v were given. Now, they are endogenous.

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- What are the corresponding allocations of output within each marriage?
- More difficult than in the case with no transfers, since the distribution of output between members is now endogenous and has to be determined in equilibrium.
- **!!! One can show that a stable assignment must maximize total output over all possible assignments !!!**

Stability - example

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- Two possible assignments: {M1+W1,M2+W2} or {M1+W2, M2+W1}
- When testing for stability, the potential marital gains ζ_{ij} are given and divisions of u_{ij} and v_{ij} are given.

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- *Why?*
- If the inequalities do not hold, then for example man 1 and woman 1 can marry and increase their current situation
- From the condition of transferable utility in the match ($u_{ij} + v_{ij} = \zeta_{ij}$) we must have:

$$u_{12} + v_{12} = \zeta_{12} \text{ and } u_{21} + v_{21} = \zeta_{21}$$

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- This is also the sufficient condition for stability

Stability - implications

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Women

Men

	1	*2*	*3*
1	5	8	2
2	7	9	6
3	2	3	0

Becker- Shapley- Shubick: Result

- With transferable utility, the unique assignment that maximizes aggregate marital output, indicated by the bold numbers

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- Comparison: With non-transferable utility the result was diagonal assignment (which yields aggregate output of 14). This assignment yields the total output of 16.

Explanation

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Transferable utility

- For example, man 1 can, despite his lower contribution to the marital output, bid away the best woman by offering her a larger amount of private consumption and still be better off than in the initial match with woman 1.

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    - Everybody could submit preferences for 5 schools
    - The list sent to the schools which make decisions
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    - The list sent to the schools which make decisions
        - Strategizing of schools: withholding capacity
        - Strategizing of schools: importance of the first stated preference
    - Only 40% receiving an offer, the rest goes to waiting list (3 rounds)
    - 17,000 of students received more offers (only 4% did not take the first one)
    - About 30,000 students assigned to schools out of their preferences

New system: G&S algorithm

1. Students submit their preferences
    1.1 Random decision about all ties in the preferences
    1.2 Each student proposes to his/her first choice...
    1.3 ...each rejected student proposes to his/her second choice...

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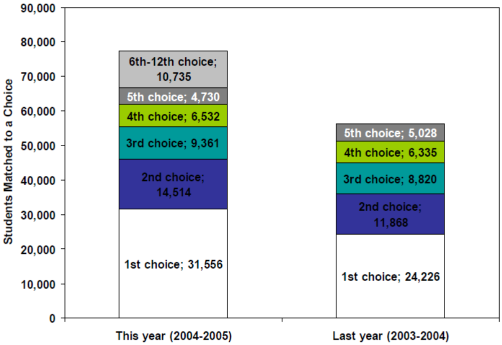
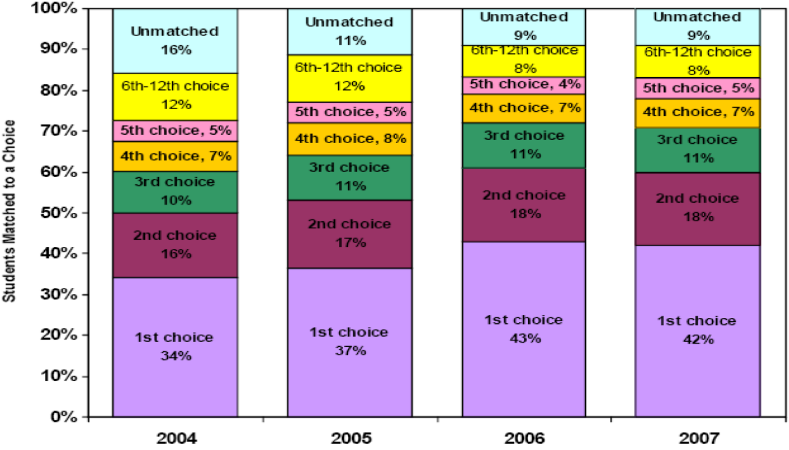
    1.3 ...each rejected student proposes to his/her second choice...
    - Change of motivation towards reporting of true preferences
    - More details in the corresponding article (reference at the last slide): 12 rounds, exceptions for talented/specialized students

Results: the first year



- **21,000** more students matched to a school of their choice
- **7,000** more students receiving their first choice
- **10,000** more students receiving one of their top 5 choices

Results: next years



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- The participants in the process must therefore spend time and money to locate their best options
- The realized distribution of matches and the division of the gains from each marriage are therefore determined in an equilibrium which is influenced by the costs of search and the search policies of other participants.

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- Each partner anticipates their share in the joint marital output.
- If the gains for both partners from forming the union exceed their expected gain from continued search then these partners marry.
- Otherwise, they depart and wait for the next meeting to occur.

Overview of the models

1. Matching without transfers (Gale - Shapley)
    1.1 The outcome of the match is full determined and no subsequent transfers are possible
    1.2 A stable allocation is the result of the finite number of proposal rounds
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3. Search models
    3.1 Incorporate search cost and uncertainty about the marriage outcome
    3.2 The agents compare the expected utility of the match with the expected utility of further search

Summarizing example

- Assume the following utilities from the matches

		Women			
		1	***2***	***3***	***4***
Men	***1***	2,5	7,2	0,7	3,4
	2	4,6	1,1	5,1	2,5
	3	1,0	6,3	4,3	0,0
	4	3,3	1,4	2,6	5,1

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1. *What will be the stable allocation if the utility within the match is non-transferable and*
    1.1 *men propose?*
    1.2 *women propose?*
2. What will be the stable allocation if the utility within the match is transferable?

Suggested readings

- Suggested readings for today
  - Browning, Chiappori, Weiss, Economics of the Family, Cambridge University Press, 2014 (chapter 7)
  - More technical approach: Abdulkadiroglu, Atila, and Tayfun Sönmez. "Matching markets: Theory and practice." Advances in Economics and Econometrics (Tenth World Congress). 2013.
  - Search approach: Mortensen, Dale T., ‘Matching: Finding a Partner for Life or Otherwise’, American Journal of Sociology, 94 (1998, supplement), s215- s240.
  - IDEA study (in Czech only): Vyberove_parovani_partneru
  - Abdulkadiroğlu, Atila, et al. "The Boston public school match." American Economic Review 95.2 (2005): 368-371.
  - Abdulkadiroglu, Atila , Parag A. Pathak, and Alvin E. Roth, "The New York City High School Match," American Economic Review, Papers and Proceedings, 95,2, May, 2005, 364-367.

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