



Calhoun: The NPS Institutional Archive
DSpace Repository

Faculty and Researchers

Faculty and Researchers' Publications

2004

Two-sided Matching for Navy Enlisted Detailing: Deferred Acceptance vs. Linear Programming

Gates, Bill; Nissen, Mark; Ho, Joshua; Low, Eng Hwee

<http://hdl.handle.net/10945/59820>

This publication is a work of the U.S. Government as defined in Title 17, United States Code, Section 101. Copyright protection is not available for this work in the United States.

Downloaded from NPS Archive: Calhoun



Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

<http://www.nps.edu/library>

Two-sided Matching for Navy Enlisted Detailing: Deferred Acceptance vs. Linear Programming

Bill Gates

Mark Nissen

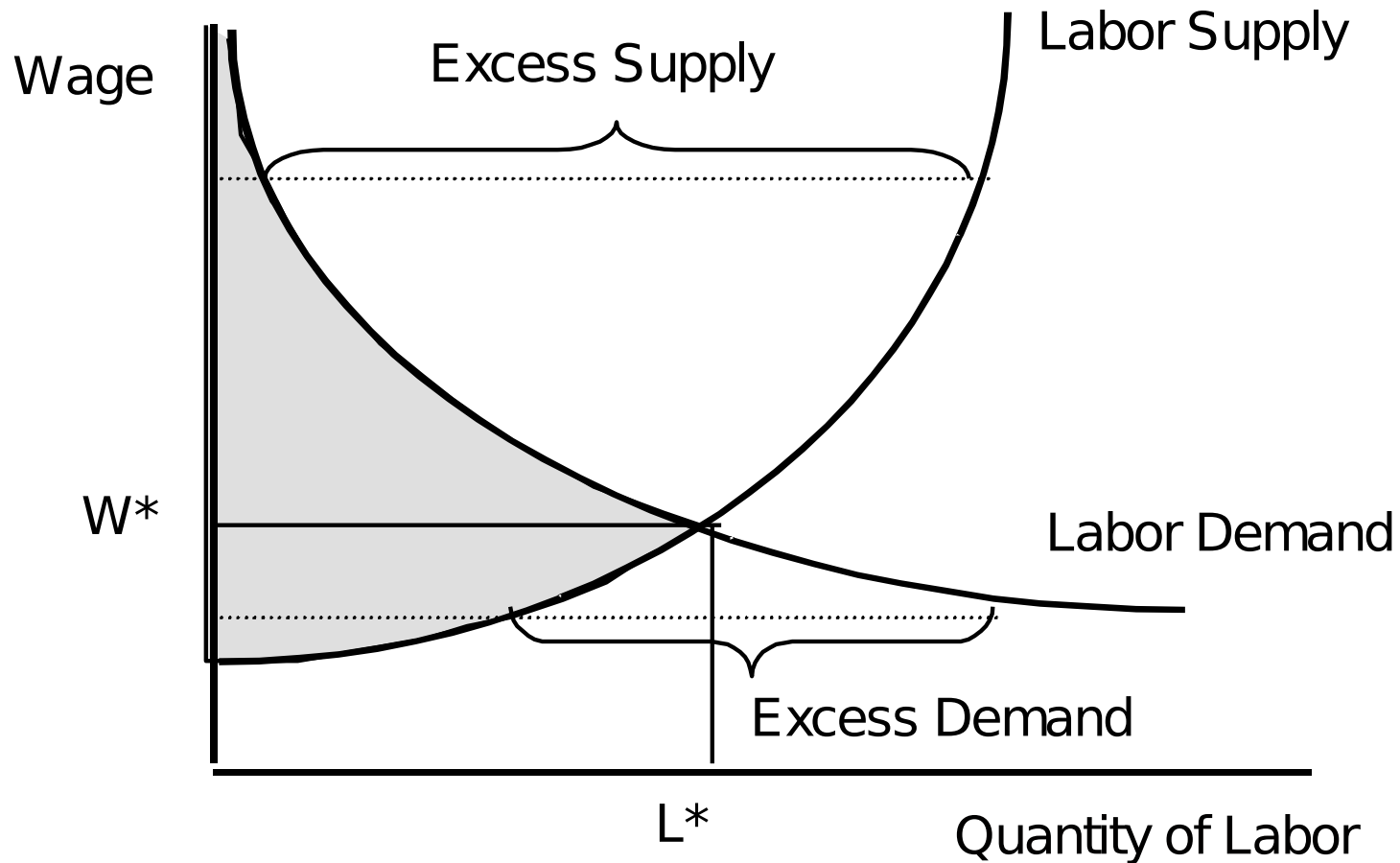
Joshua Ho

Eng Hwee Low

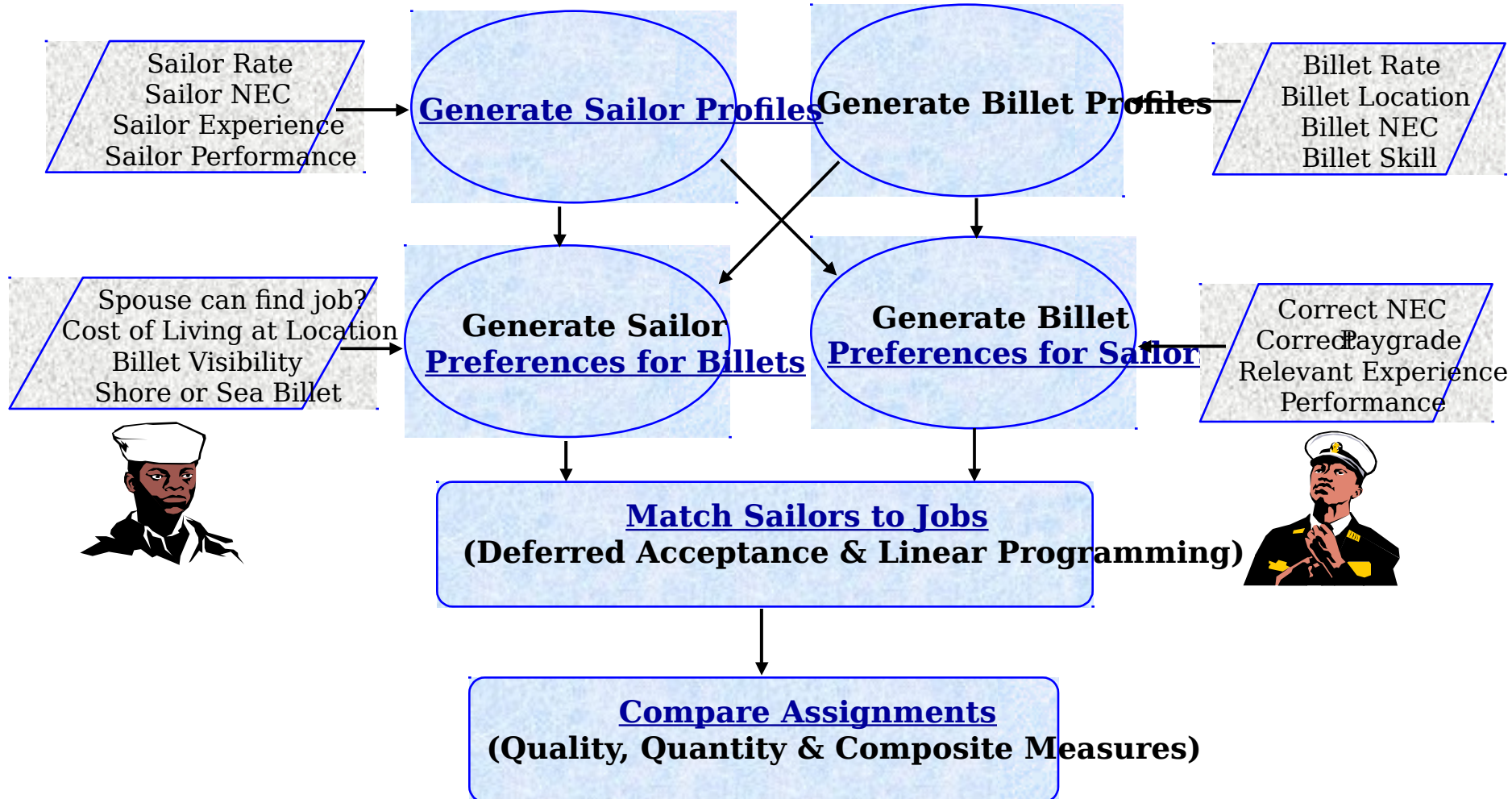
Research Questions

- What do we mean by a good fit between and sailor and a command?
 - Quantity
 - Quality
- What is the relative performance of the LP and the DA matching algorithm when applied to the U.S. Navy's enlisted assignment process?
- Sponsor: NPRST - PERS 1

Labor Markets



Navy Enlisted Detailing Simulation Model: NEDSim



Optimization

- Maximize quality of fit (minimize quasi-prices)
 - Minimize sailor/command rank-order-preferences (ROP)
 - Maximize sailor/command utility
 - Use weighted average ROP/utility
 - ❖ $0.5U_s + 0.5U_c$

Two-sided Matching

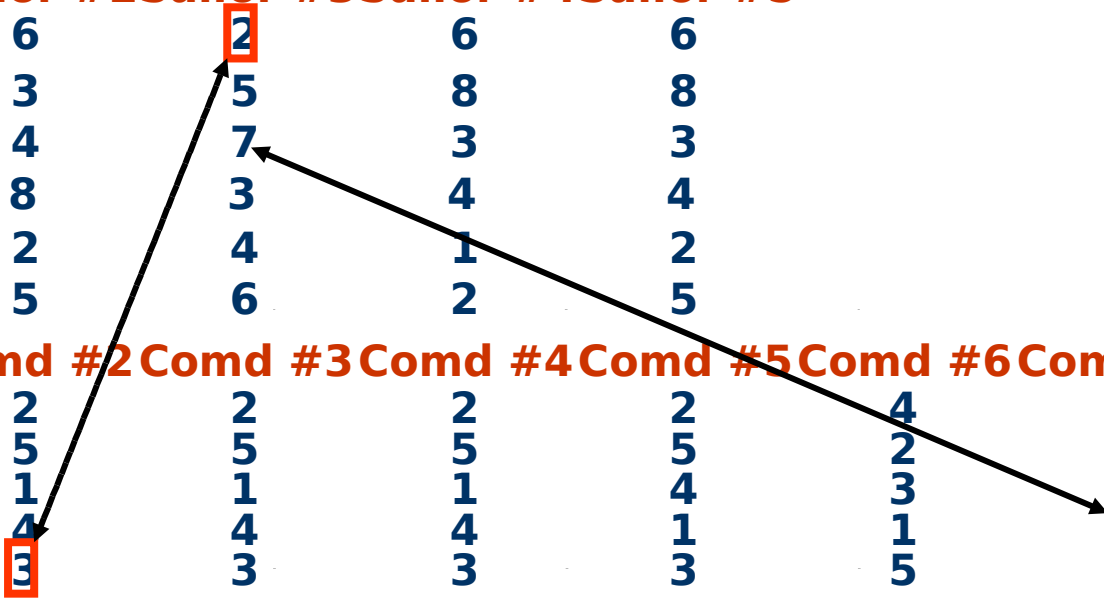
Example: Sailor-Bias

Sailor #1 Sailor #2 Sailor #3 Sailor #4 Sailor #5

6	6	2	6	6
3	3	5	8	8
4	4	7	3	3
8	8	3	4	4
2	2	4	1	2
5	5	6	2	5




Comd #1 Comd #2 Comd #3 Comd #4 Comd #5 Comd #6 Comd #7 Comd #8

2	2	2	2	2	4	2	2
5	5	5	5	5	2	4	1
1	1	1	1	4	3	1	4
4	4	4	4	1	1	3	3
3	3	3	3	3	5	5	5



Sailor 1	Sailor 2	Sailor 3	Sailor 4	Sailor 5
6	6	2	6	6
3	3	7		8
4				

Evaluation Criteria

- Quantity measure
 - ❖ Percentage Matching 
- Quality measure
 - ❖ Percentage Average Utility 
 - ❖ Percentage Unstable Matches 

Findings: Priority 1 Billets

	Sailors		Commands	
	DA	LP	DA	LP
Percent Matched	17.7%*	19.8%*	88.2%*	98.8%*
Percent Average Utility	66.8%	68.7%	73.6%*	78.2%*
Percent Unstable	0.0%	22.0%	0.0%	22.0%

***Significant at the 95% level**

Findings: Priority 2 Billets

	Sailors		Commands	
	DA	LP	DA	LP
Percent Matched	19.5%*	35.7%*	14.2%⁰	25.9%*
Percent Average Utility	85.1%	84.6%	67.3%*	38.7%*
Percent Unstable	0.0%	0.7%	0.0%	0.7%

***Significant at the 95% level**

Findings

- **More Robust Simulation**
 - Actual sailor and billet profiles
 - Actual sailor and command preference factors
- **Multiple Criteria for Success Defined**
 - Quantity Measure - Percent matched
 - Quality Measures - Average Utility, Percent Stable
- **Optimal algorithm depends on Navy's tradeoff between the quantity and quality performance measures**
 - Likely restricted to sailor rank order lists