A Theory of Rent-Based Facilities Management

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What’s the research problem?

• Issue
  – The Navy has over 600,000 people in over 6,000 units with over 115,000 facilities in hundreds of locations around the world
  – Units provided an operational budget to purchase resources and access to real estate type assets (e.g. office/hanger/pier space) at no cost (to the unit)
  – Units have some freedom to allocate their operational budget
    ▪ Only use the amount of real estate allocated
    ▪ Space is “free” => units may expand to fill extra allocated space

The size and complexity of the Navy infrastructure, along with the incentive structures, make it difficult to manage infrastructure costs.
In-kind transfers vs. cash transfers

- The Navy could potentially allocate space using either of two types of allocation systems frequently compared in the economics literature:
  - In-kind transfers – Direct provision of specific goods or services
    - e.g. food stamps, Medicare/Medicaid
  - Cash payments – Direct provision of money, with which the recipients then purchase goods or services
    - e.g. Social Security

- We built a constrained optimization model to examine both systems in the context of an organization like the Navy
  - The point of our theoretical model is to show comparisons, not to measure magnitudes
Rent theory visualization

- Current system limits unit to initial allocation
- Rent system could provide a larger budget but charge the unit for the cost of any space used
- Allow for different allocation on a higher productivity curve with same costs (or same productivity with lower costs)
Space management model

- Our constrained optimization model:

- We allow for multiple unit types
  - Within (and across) unit types, space productivity (measured by $\beta_{ij}$) varies across units

- We assume the resource sponsor knows the average $\beta_{ij}$ of a unit type, but not the individual $\beta_{ij}$’s of specific units
  - This makes it harder for the resource sponsor to pick the best allocation for each individual unit
Space management model

- Using the model, we solved for the optimal actions of units and resource sponsors under two different use cases:

  1. *Space-allocation system* - the resource sponsor provides each unit with a fixed amount of space and an operational budget (in-kind space transfer)

  2. *Rent-based management system* - the resource sponsor provides each unit with a (larger) operational budget, and charges units rent for space (a cash payment)

- Then, we simulated the resulting environment in both cases

  - We set parameters to match the Navy when possible (e.g. number of units and number of unit types)
Simulation results - value

- Similar value can be produced at lower cost or more value can be produced at the same cost

Red: rent-based management system
Blue: (current) space-allocation system
*The value on the y-axis is dimensionless and for illustrative purposes only
Changes in SFEs between the two systems

- Each “line” represents a unit type

- Within a unit type, units with high $\beta_{ij}$ tend to use more space after switching to a rent-based management system, while units with low $\beta_{ij}$ tend to use less space
Changes in value between the two systems

- Each curve represents a unit type
- Within a unit type those that adjusted their space most saw the greatest efficiency gains
Model conclusions

• Imperfect information, due to size of the organization, leads to inefficient allocation of resources within an organization

• Cash transfer instead of in-kind transfer can increase efficiency and negate the imperfect information

• Model extensions looking at interactions between resource sponsor and units:
  – Units signal space needs; or
  – Agency problem

• Estimate potential efficiency gains using other data sources
  – Food stamp programs or medicare provision?
Questions?

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