PRESCRIPTIVE ANALYTICS

Justice courts in Poland

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Inputs

No. employees
Salaries
Assets

Represent the resources used by the courts (human resources, finances, assets) to perform their functions.

Outputs

Solved Cases

Represent the results achieved by the courts (solved cases, pending cases) in terms of case resolution and workload management.

Constant Returns to Scale

Assumes perfect scalability

Adding staff might not always lead to perfectly proportional increases in case resolution due to indivisible tasks (judges needed for hearings) and specialization (specific judges for specific cases).

Variable Returns to Scale

Allows for diminishing returns

This assumption acknowledges that as courts grow larger, adding resources might not always translate to perfectly proportional increases in case resolution.

CRS vs VRS

Given the nature of court operations the **Variable Returns to Scale** reflects the complexities and variations in how resources are translated into outputs in the justice system.

Courts can experience varying efficiencies based on the scale of their operations, the types of cases they handle, and the resources available to them.

VRS provides a more nuanced and flexible framework to assess and understand these dynamics, making it suitable for the real case study of assessing the efficiency of justice courts in Poland.

Common and exogenously fixed salaries assumption

The assumption of common and exogenously fixed salaries is generally valid but not perfectly so for all categories of employees.

Salaries for judges and clerks are typically standardized and regulated by the government, following specific pay scales based on experience and rank. These salaries are fixed and exogenously determined.

For Court clerks, Probation officers, Assistants and Other workers, these categories exhibit variability in salaries due to differences in experience, specific roles, and sub-categories of employment. Salaries are not fixed and can vary significantly within each category.

Mix Model Implications

Fixed Salaries for Judges and Clerks (Fare Approach)

- *Salaries for these categories can be considered fixed and treated as such in the efficiency analysis using Data Envelopment Analysis (DEA).*

Variable Salaries for Court Clerks, Probation Officers, Assistants, and Other Workers + Assets (Tone Approach)

- *Salaries for these categories should be adjusted to reflect the variability and treated as variable inputs in the DEA model.*

Model in MATLAB

Variables:

- Inputs: 7
- Outputs: 3
- Combined Input Matrix (X): *data(:,1:inputs)*
- Output Matrix (Y): *data(:, inputs+1:end)*

Fixed and Non-Fixed Components:

- Fixed Component: *X_fix = data(:,1:inputs-5)*
- Non-Fixed Component:
  *X_non = data(:,outputs:inputs).*prices_non_fixed*

Objective:

- *Minimize cost based on fixed and non-fixed prices.*

Model in MATLAB

Constraints:

Input Constraints: *[-eye(inputs) [X_fix X_non]']*

Output Constraints: *[zeros(outputs, inputs) Y']*

Gurobi Optimization:

Minimize combined cost using Gurobi solver.

Calculate cost efficiency for each observation.

Observed Cost:

Calculate observed cost using fixed prices: *sum(X.*prices,2)*

Cost Efficiency:

Efficiency Ratio: *result.objval / observed_cost_fix(i, 1)*

Cost efficiency of courts

Most efficient courts (with cost efficiency equal 1):

Unit 2

Unit 45

Unit 70

Most inefficient courts:

Unit 69 (0.0365) ⟶ recommendation: decrease cost of assets

Unit 62 (0.0378) ⟶ not so many solved cases, many workers and assets

Conclusion

Results suggest that most courts could improve their efficiency by learning from the practices of the few more efficient ones identified by the model. This can lead to better resource allocation, potential cost savings, and increased productivity in terms of the number of cases solved.

Based on lamdas values, Court 45 has a higher contribution compared to Court 70, indicating it might be operating more efficiently or effectively utilizing its resources. Regarding Court 2, this unit is locally efficient, but it does not contribute to the optimal weighted combination of courts that defines the efficiency frontier for the entire dataset.

Thank you!

Questions?