Exploring European Regional Trade

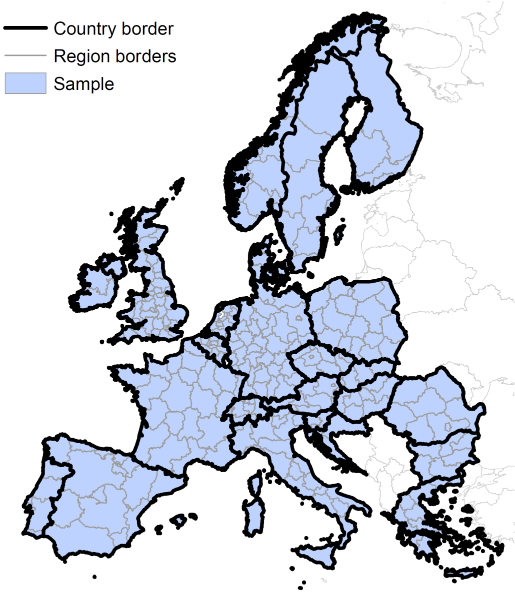
(https://crei.cat/wp-content/uploads/2023/04/EERT_pub-1.pdf)

(https://crei.cat/wp-content/uploads/2023/11/BE.pdf)

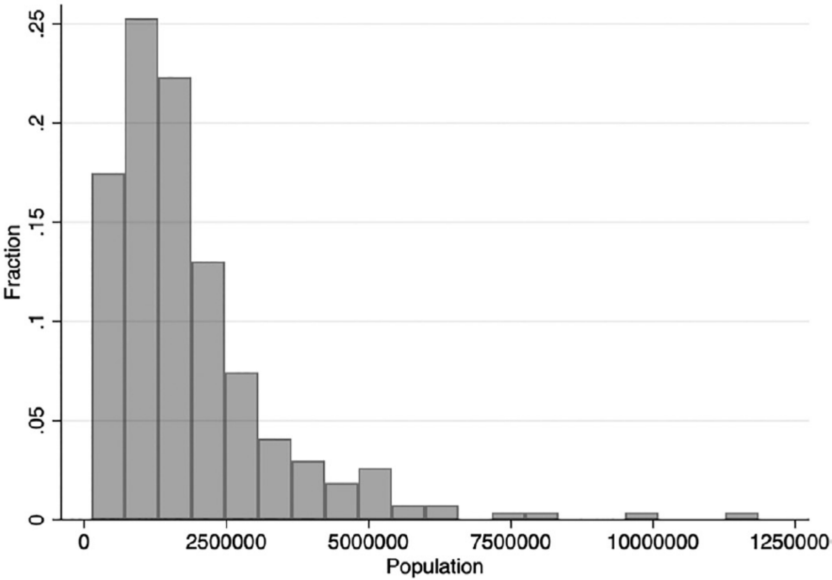
Jaume Ventura

Bojos per l'Economia! 2024

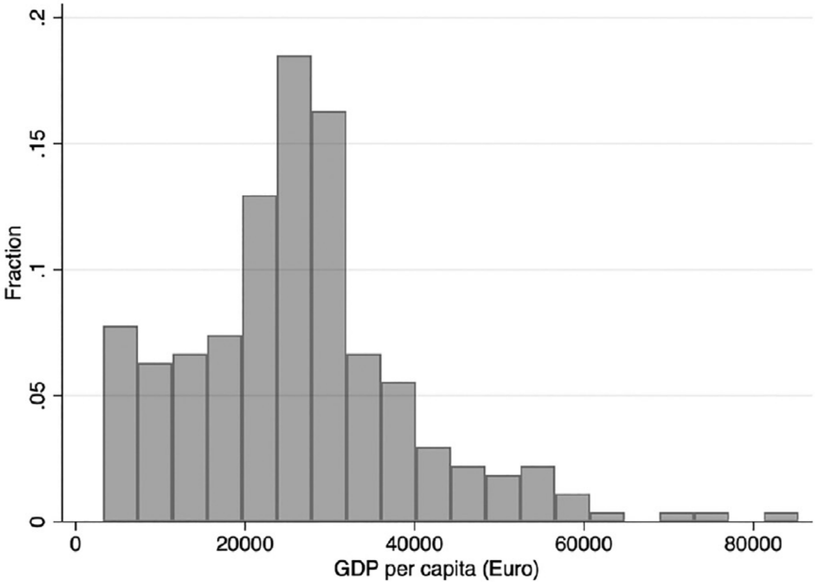
European regions



Distribution of population



Distribution of income



The bilateral trade matrix

- Order the regions from 1 to 269. The bilateral trade matrix is::

$$\mathbf{X} = \begin{bmatrix} X_{1,1} & X_{1,2} & \cdots & X_{1,269} \\ X_{2,1} & X_{2,2} & \cdots & X_{2,269} \\ \vdots & \vdots & \ddots & \vdots \\ X_{269,1} & X_{269,2} & \cdots & X_{269,269} \end{bmatrix}$$

  - What is $X_{3,123}$?
    - The exports (or sales) of region 3 to region 123
    - The imports (or purchases) of region 123 from region 3
    - Region 3 is the *origin* and region 123 is the *destination*
    - All entries measured as a share of total trade

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  - Adding within rows, we get incomes: $X_{1,1} + X_{1,2} + ... + X_{1,269} = X_1^O$
  - Adding within columns, we get expenditures: $X_{1,1} + X_{2,1} + ... + X_{269,1} = X_1^D$
  - Adding everything, we get one!

Computing trade probabilities

$$\mathbf{X} = \begin{bmatrix} X_{1,1} & X_{1,2} & \cdots & X_{1,269} \\ X_{2,1} & X_{2,2} & \cdots & X_{2,269} \\ \vdots & \vdots & \ddots & \vdots \\ X_{269,1} & X_{269,2} & \cdots & X_{269,269} \end{bmatrix}$$

- Pick a transaction at random. What is the probability that this transaction has origin 2 and destination 201?

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$$X_{2,201}$$

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$$X_{2,1} + X_{2,2} + ... + X_{2,269} = X_2^O$$

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- Pick a transaction with origin 2 at random. What is the probability that this transaction has destination 201?

$$\frac{X_{2,201}}{X_{2,1} + X_{2,2} + ... + X_{2,269}} = \frac{X_{2,201}}{X_2^O}$$

The matrix of bilateral trade for European regions

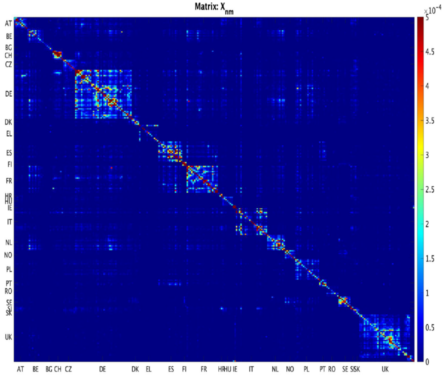
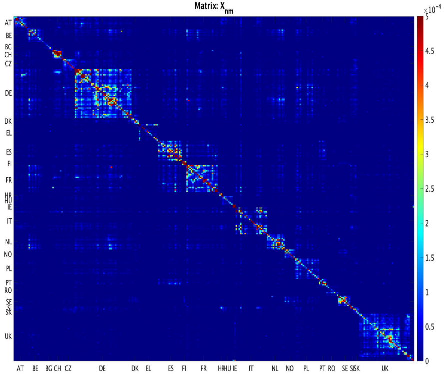


Fig. 2. Bilateral trade matrix for European regions.
Notes: The figure plots the trade probability for each region-pair, computed as explained in the text. Warmer shades represent higher values, while cooler shades represent lower values. Each cell is a region, and countries are labelled in the vertical and horizontal axis. The size of the country is represented by the number of regions it contains.

The matrix of bilateral trade for European regions



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- *Home trade*: 40% (269 entries and no zeroes)
- *Country trade*: 41% (4,958 entries and 157 zeroes)
- *Foreign trade*: 19% (67,134 entries and 25,699 zeroes)

From data to theory

- Why does the bilateral trade matrix have this specific shape?
- We need a 'good' (simple, intuitive, realistic, precise, ...) theory of the determinants of regional trade to derive empirical predictions/implications
- *Random theory*: "All regions are equally likely to trade with each other"
  - What does this theory imply for the bilateral trade matrix?
  - In particular, what does this theory predict for $X_{2,201}$?

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$$\hat{X}_{2,201} = X_2^O \times X_{201}^D$$

where $\hat{X}_{2,201}$ is our theoretical prediction for $X_{2,201}$.

How good is the random theory of trade?

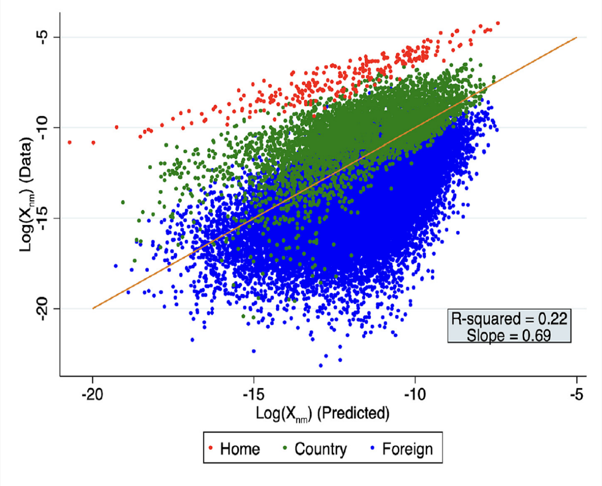


Fig. 4. Actual vs predicted trade (log) probabilities.
Notes: The figure plots the actual (log) trade probability over the predicted (log) trade probability under the independence benchmark. Home region-pairs are plotted in red, country region-pairs are plotted in green and foreign region-pairs are plotted in blue. The linear fit slope coefficient and R-squared are reported.

Distance matters

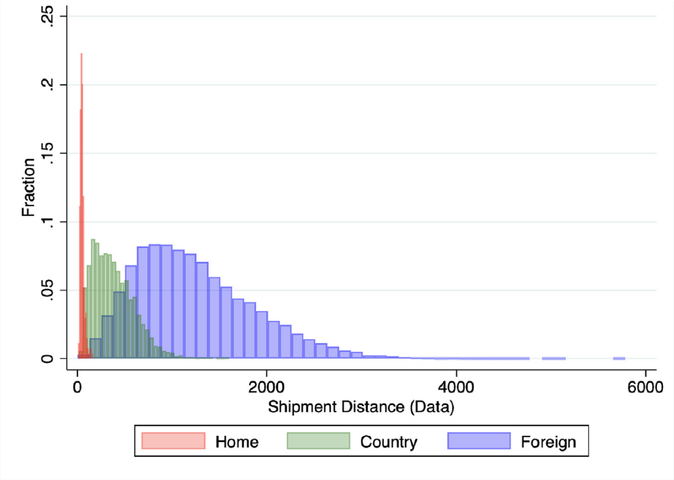
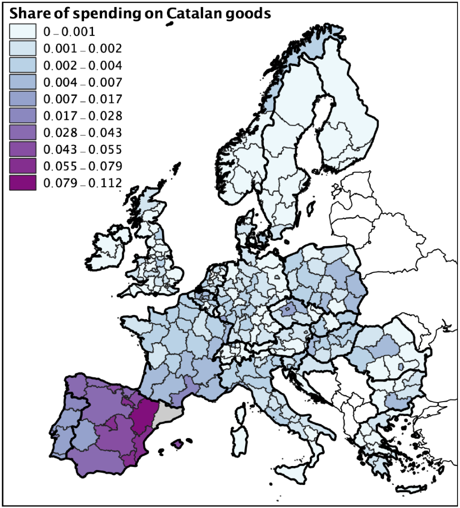


Fig. 3. Home, country and foreign distances.
Notes: The figure plots the distribution of shipment distances (averaged across years for each region-pair) from the European Road Freight Survey. The red distribution corresponds to home trade, the green distribution to country trade and the blue distribution to foreign trade. Distances are in kilometers.

A look from Catalonia

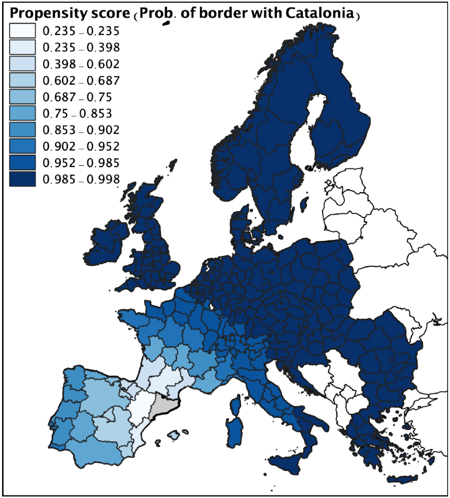


Notes: The figure shows the share of spending on Catalan goods in each European region. The shading represents the value of the market share, with darker shares representing larger market shares. The spending shares come from our newly built regional trade dataset (see Section 2).

What is the effect of borders?

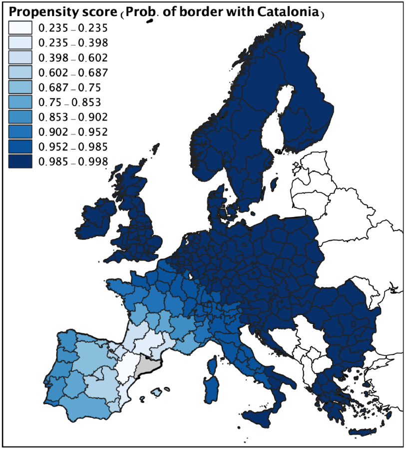
- Key policy question: What is the effect of borders on trade?
  - Conceptual problem: geography has a causal effect on borders!
- Borders have a causal effect on trade by creating a:
  - national preference bias in preferences (procurement, language, migration,...)
  - national cost advantage (national regulations, court biases, ...)
- Geography has a causal effect on trade because distance raises trade costs
- Controlled versus natural experiments

Probability of sharing a country with Catalonia



Notes: The figure shows the probability of finding a border between Catalonia and each European region based on a set of geographical covariates (propensity score). The shading represents the value of this probability, with darker shares representing probabilities closer to one.

Probability of sharing a country with Catalonia



Notes: The figure shows the probability of finding a border between Catalonia and each European region based on a set of geographical covariates (propensity score). The shading represents the value of this probability, with darker shares representing probabilities closer to one.

- Borders reduces trade to 17.5% of its potential
- New borders (post 1910) reduce trade to 28.8% of its potential

Sharing A Government

(https://crei.cat/wp-content/uploads/2020/02/SHG_pub-1.pdf)

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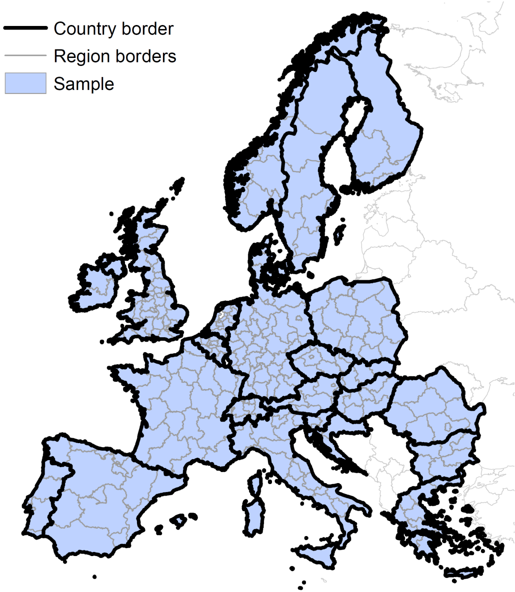
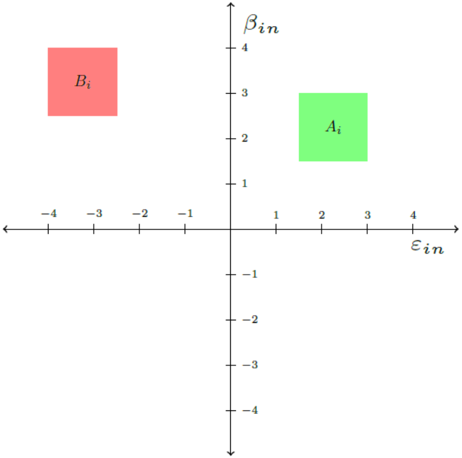
European regions



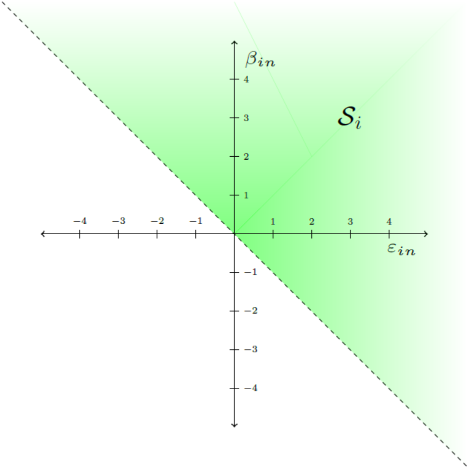
The classic assignment problem

- Many regions, each with its own government, share a union government:
- There are many political projects to decide:
  - Building a new infraestructure, changing public health or pensions coverage, enacting new laws that regulate the banking industry, imposing restrictions on school curriculae, ...
- Projects generate local benefits and externalities
- Designing a fiscal constitution:
  - What level of government (parliament) should decide these projects?

The project space

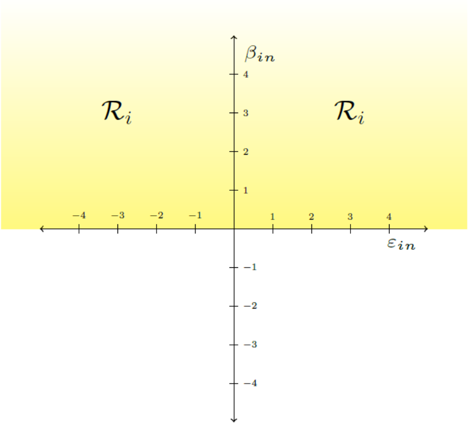


Economic efficiency



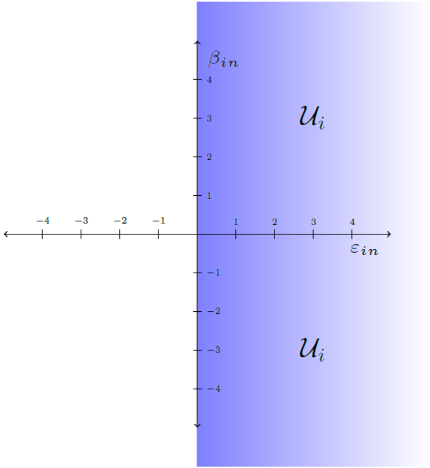
$$\mathcal{S}_i = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : \beta_{in} + \varepsilon_{in} \geq 0\}$$

Decisions in regional parliaments



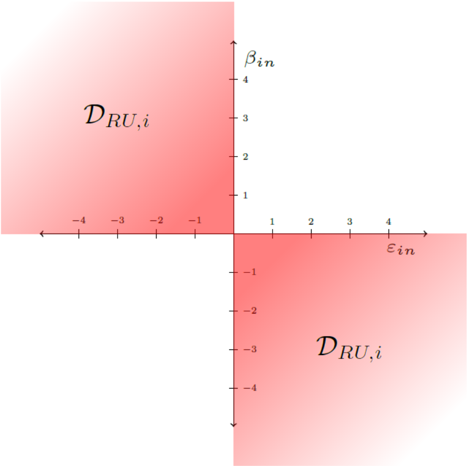
$$\mathcal{R}_i = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : \beta_{in} \geq 0\}$$

Decisions in the union parliament



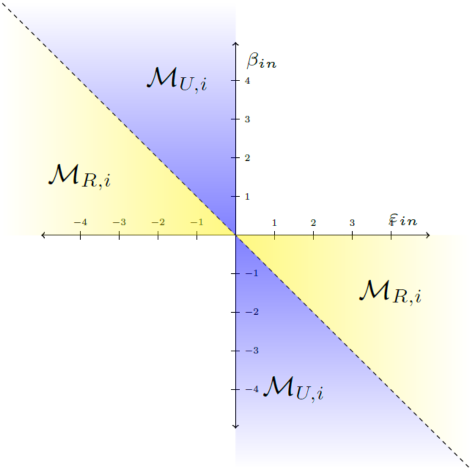
$$\mathcal{U}_i = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : \varepsilon_{in} \geq 0\}$$

Disagreement between parliaments



$$\mathcal{D}_{RU,i} = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : \beta_{in} \cdot \varepsilon_{in} < 0\}$$

Comparing mistakes



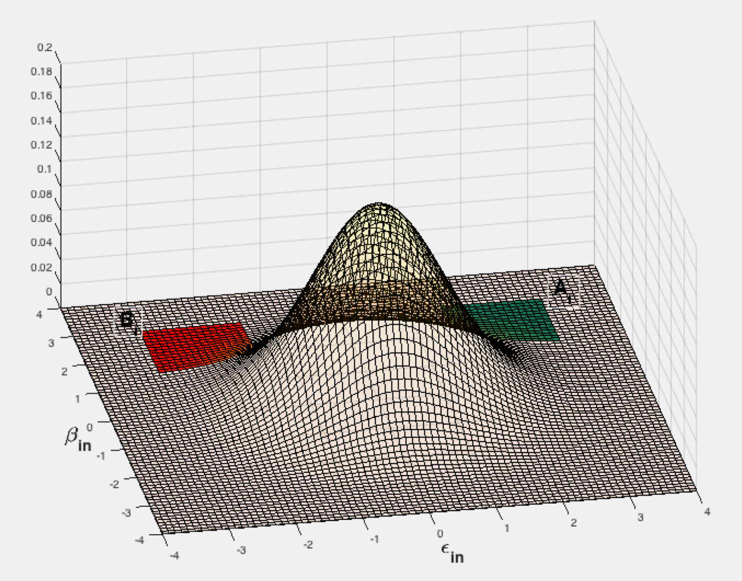
$$\mathcal{M}_{R,i} = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : |\beta_{in}| < |\varepsilon_{in}| \text{ and } n \in \mathcal{D}_{RU,i}\}$$

$$\mathcal{M}_{U,i} = \{(\beta_{in}, \varepsilon_{in}) \in \mathbb{R}^2 : |\beta_{in}| \geq |\epsilon_{in}| \text{ and } n \in \mathcal{D}_{RU,i}\}$$

Fiscal constitutions

- Fiscal constitutions are an incomplete contract:
  - All projects of a given type i and region n are decided in the same way
- Fiscal constitutions assign projects typically between two options:
  - Projects of type i for region n should be decided by the parliament of region n
  - Projects of type i for any region should be decided by the union parliament
- Let us search for the fiscal constitution that maximizes surplus
  - What additional piece of information do we need to do so?

The distribution of projects



Example

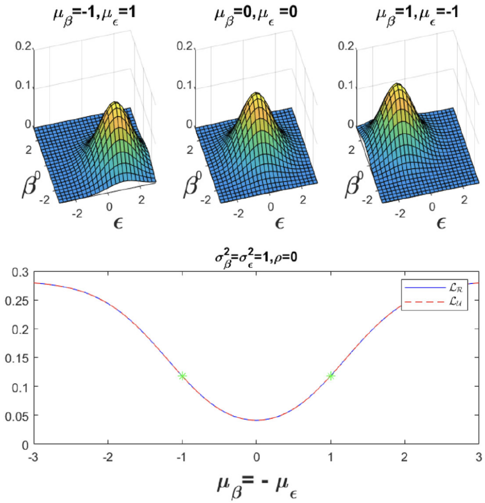


FIGURE 6. Effects of changing μ_β and μ_ε keeping $\mu_\beta + \mu_\varepsilon = 0$.

Example

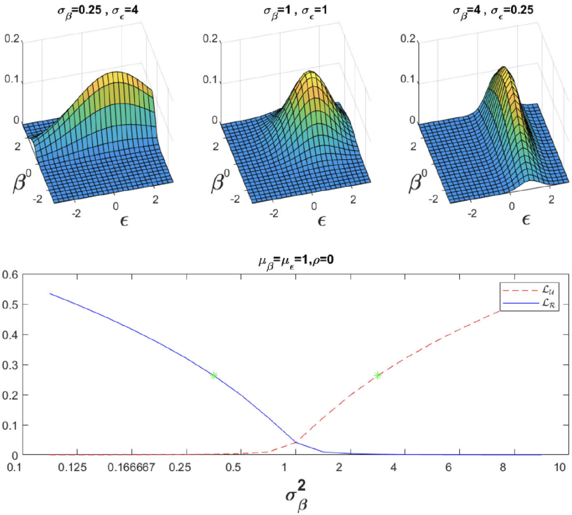


FIGURE 7. Effects of changing σ^2_β and σ^2_ε keeping $\sigma^2_\beta \sigma^2_\varepsilon = 1$.

Example

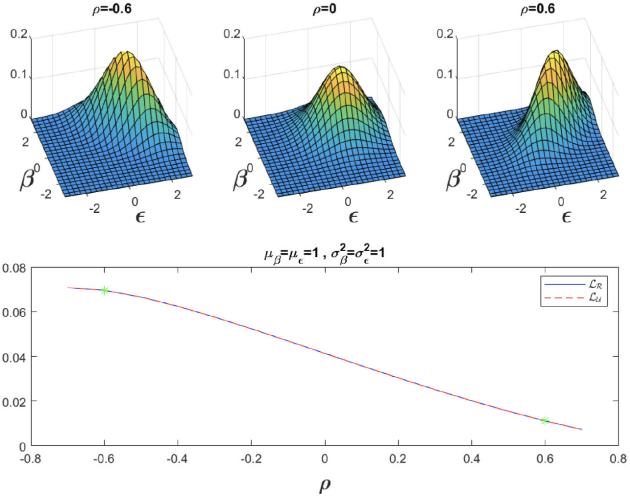


FIGURE 8. Effects of changing ρ.

Are there ways to restore efficiency?

- This model shows that parliaments are likely to make errors:
  - Projects that deserve funding are discarded
  - Projects that do not deserve funding are funded
- Could regions bypass the union parliament and make Coasian bargains?
  - regions own the right to decide a project in their territory
  - regions can sell these rights in exchange for a monetary transfer
  - regions can solve free-rider problems
- Could legislative bargains make the union parliament a market for policies?
  - "If you vote for my project, I will vote for yours."
  - These bargains are not effective and create additional inefficencies