Spatial labor market frictions and economic convergence: policy implications from a heterogeneous agent model

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1 Introduction
2 The Model
3 Set up of the Model
4 Results
   • Base Scenario
   • HC Policy
   • Tech Policy
5 Conclusions

- European Union → integration process of economies with differing per-capita GDP.
- Facilitation of convergence of per-capita income and productivity among European regions is one of the main goals of EU (economic) policy.
About 0.4% of the total GDP of the EU is spent for cohesion policies.

2 main policy instruments:

- European Regional Development Fund ERDF (Euro 201 bn, 2007-2013)
  - Direct aid to **investments in companies**
  - Infrastructure linked notably to **research and innovation**
  - ...
- European Social Fund (Euro 76 bn, 2007-2013)
  - Strengthening **human capital**
  - Adapting workers and enterprises
  - ...
Research Questions

- Do the considered policies indeed foster convergence in output/output growth/technology?
- How are the policy effects influenced by labor mobility?
- (Does timing and sequencing of policy introduction have an effect?)
- (Is the effect of combined application of these policies qualitatively different from isolated application?)
Closed macroeconomic Agent-Based model substantially extending the model developed during the EU-funded project EURACE (2006-2009).

Overall Objective: Develop an agent-based simulation platform that is suitable for (macro)economic analysis and the evaluation of the effect of economic policy measures.
Production of Consumption Goods

- Consumption goods are produced using (vintage structured) capital and labor.
- Complementarity between quality of investment goods and level of specific skills of workers.
- Distinction between general and specific skills.
- If capital stock is not fully used, oldest vintages are made inactive first.
- Actual productivity of each vintage is determined by the (minimum of the) quality of the vintage and average skills of the firm’s employees.
Investment good producer (IGP) offers a range of investment goods with different quality (vintages), which are supplied at differentiated prices.

New vintages with improved quality are added to the product range following stochastic innovation cycles.

Diffusion of new technologies depends on the investment activities of consumption goods producers (CGP) and their vintage choice.

When investing a CPG chooses a vintage according to a logit choice model based on estimated future productivity of the vintage over a planning horizon (depends on the skills of the firm’s employees).
Skill Dynamics

- Specific skills of workers increase due to learning by doing if they are employed.

\[ b_{w,t+1} = b_{w,t} + \chi(b_{w}^{gen}) \times \max[A_{i,t} - b_{w,t}, 0] \]

- Learning speed \( \chi \) depends on general skills of worker \( b_{w}^{gen} \).

- (Local) knowledge flows and spillovers through the labor market.
  - Workers transfer specific skills when changing employer.
Initialization

- 2 regions:

<table>
<thead>
<tr>
<th></th>
<th>R1: high tech</th>
<th>R2: low tech</th>
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</thead>
<tbody>
<tr>
<td>Population size (HH/Firms):</td>
<td>800/40</td>
<td>800/40</td>
</tr>
<tr>
<td>Initial quality of capital stock:</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Initial specific skills:</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>General skill distribution (high/low)</td>
<td>0.8 / 0.2</td>
<td>0.2 / 0.8</td>
</tr>
</tbody>
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- Initial investment good quality at frontier: 1.7.
- Varying levels of commuting costs: from zero to prohibitively high commuting costs.
Policy Experiments

1. Human Capital (HC) Policy: Upgrade general skill distribution in region 2 to that of region 1
   - Skill upgrading takes effect after 120 months.

2. Technology (Tech) Policy: Subsidize firm investments in region 2 (by 5%) if technology on the frontier is chosen.
   - 15 runs for 750 months carried out for each commuting cost scenario.
Comparison of regional outputs

left: highly integrated labor market; right: separated labor markets
Black line: Region 1; red line: Region 2
Comparison of regional outputs

left: Region 1; right: Region 2
left: highly integrated labor market; right: separated labor markets
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Output effect of a HC Policy

left: Region 1; right: Region 2
Output effect of a Tech Policy

left: highly integrated labor market; right: separated labor markets
Black line: Region 1; red line: Region 2
Output effect of a Tech Policy

left: Region 1; right: Region 2
Without policy

- The agent-based Eurace@Unibi macro-model has been developed and used to explore effects of different cohesion policies in different institutional setups.

- **Prohibitively high commuting costs:** no change in the output gap.

- **Reduction of commuting costs:**
  - non-monotonic impact on regional outputs.
  - Generally: Lower commuting costs (less spatial frictions) facilitates divergence.
With policy

- **Low frictions:**
  - **HC policy** facilitates divergence. Policy has positive impact on output in region 1.
  - **Tech policy** facilitates convergence. Tech policy has negative impact on output in region 1.

- **High frictions:**
  - **HC policy** facilitates convergence. Policy has negative impact on output in region 1.
  - **Tech policy** facilitates convergence. Tech policy has neutral impact on output in region 1.
Policy implication

- Conflict of goals: integration of markets and economic convergence of regions.

- Policy makers should carefully choose the measures as, depending on the spatial frictions, some policies can have diametrically opposed effects on the economic convergence.
Related Literature

- Neoclassical growth literature and convergence debate: e.g. Mankiw et al. (1992), or Barro & Sala-i-Martin (1992), Islam (2003)
Thank you for your attention!

Information about Eurace@Unibi and an extensive model documentation at:
http://www.wiwi.uni-bielefeld.de/vpl1/research/eurace-unibi.html