ECONOMIC GROWTH DUE TO EXPORT EXTERNALITIES: A SPATIAL ECONOMETRIC ANALYSIS FOR RUSSIAN REGIONS, 2003-2008

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Motivation-1

What does foster economic growth in a region? Does export diversification matter?

1. Traditional Explanations

Macro-level explanations
- Avoidance of dutch disease (Corden, Neary, 1982)
- More stable development under conditions of terms-of-trade shocks (Ghosh and Ostry, 1994)
- Terms-of-trade volatility restrains the long-run economic growth (Lutz and Singer, 1994; Easterly and Kraay, 2000)
- Avoidance of “the voracity effect” (Lane, Tornell, 1996; Tornell, Lane, 1999)
- “Learning-by-doing” and “learning-by-exporting” spillovers (Greenaway, Kneller, 2004)

Micro-level Explanations
- Efficiency increase due to reallocation of resource between industries (Bernard and Jensen, 2004)
- “Learning-by-doing” effects more frequently arise in exporting firms (Bernard and Wagner, 1997; Castellani, 2002; Girma et al., 2004; Baldwin and Gu, 2004)
Motivation-2

What does foster economic growth in a region? Does export diversification matter?

2. New Explanations
   - Hausmann, Hwang, Rodrik, 2006: export of “expensive” goods associated with export basket of countries with high GDP per capita level leads to higher economic growth

3. “New” New Explanations
   - Externalities from related industries
     Hausmann, Klinger, 2006; 2010: Rate of economic growth depends on the density of the product space near the area where each country has developed its comparative advantage
     - Spatial externalities from related industries
       Our hypothesis: Rate of economic growth in a region depends on spatial export externalities, i.e. export diversification externalities in neighboring regions
Motivation-3. Impact of related variety in producing goods on economic growth: recent empirical results

**THE UNITED KINGDOM**  
*(Bishop, Gripaios, 2010)*  
Value added: ?  
Employment: 0  
Labor productivity: ?

**THE NETHERLANDS**  
*(Frenken, Oort, Verburg, 2007)*  
Value added: ?  
Employment: +  
Labor productivity: 0

**GERMANY**  
*(Brachart, Kubis, Titze, 2011)*  
Value added: +  
Employment: +  
Labor productivity: +

**ITALY**  
*(Boschma, Iammarino, 2009)*  
Value added: +  
Employment: +  
Labor productivity: +

**SPAIN** *(Boschma, Minondo, Navarro, 2010)*  
Value added: +  
Employment: 0  
Labor productivity: 0

**RUSSIAN FEDERATION**  
*Need to be considered*

Note: «+» - positive significant impact; «->» - negative impact; «0» - insignificant impact; «?» – the impact hasn’t been considered
The basic idea: regional growth based on related variety in export basket

**Value added growth**
(Boschma, Iammarino, 2009; Boschma et. al., 2010)

**Employment growth**
(Frenken, Oort, Verburg, 2007; Boschma, Iammarino, 2009)

**Labor productivity growth**
(Boschma, Iammarino, 2009)

**Technological convergence**

**Absorption of spillovers**

**Knowledge sharing**

**Resource reallocation**

**Entry of new industries**
(Hidalgo et. Al., 2007; Hausmann, Klinger, 2007)

**ECONOMIC GROWTH**

**EXPORT DIVERSIFICATION**
Methodology

- **PRODY**: implied productivity level of each industry
  \[
  PRODY_{i,t} = \sum_c \left( \frac{x_{c,i,t}/\sum_i x_{c,i,t}}{\sum_c(x_{c,i,t}/\sum_i x_{c,i,t})} \times GRP_{percapita,c,t} \right)
  \]

- **EXPY**: degree of export structural sophistication
  \[
  EXPY_{c,t} = \sum_i \left( \frac{x_{c,i,t}}{\sum_i x_{c,i,t}} \times PRODY_{i,t} \right)
  \]

- **Ω**: potential export capability
  \[
  \Omega_{c,t} = \sum_{i} \sum_{j} \left[ \frac{\varphi_{i,j,t}}{\sum_i \varphi_{i,j,t}} (1 - x_{c,j,t}) x_{c,i,t} PRODY_{j,t} \right]
  \]

<table>
<thead>
<tr>
<th>For any region c holds</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x_{c,i,t} = \begin{cases} 1, &amp; \text{if } RCA_{i,c,t} &gt; 1 \ 0, &amp; \text{if } RCA_{i,c,t} \leq 1 \end{cases} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance between industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \varphi_{ij,t} = \min{P(x_{i,t}</td>
</tr>
</tbody>
</table>
Electronic copies of cargo customs declarations of the Federal Customs Service of Russia

→ Export value: f.o.b. export prices
→ Customs treatment: export (exclusive of re-export)
→ Industry classification: 4-digit codes of Customs Nomenclature of the Russian Federation foreign economic activity (1100 industries)
→ Period: 2003-2008
→ Territories: 77 Russian regions

Russian Federal State Statistics Service, the Database on Socio-economic figures in Russian regions

→ Data: Socio-economic indicators for Russian regions
→ Period: 2003-2008
→ Territories: 77 Russian regions
Export diversification and economic growth in Russian regions: actual or potential export is important?

Does hold

Basic result of Hausmann, Hwang, Rodrik (2007)

Weak or zero dependence

Adjusted export productivity results in strong dependence

Strong positive dependence
Export of goods and services (% of GRP) in Russian regions, 2003

95% of national export belongs to regions with quota >15%
Actual export productivity $\text{EXPY}$ in Russian regions, 2003

Potential export capability $\Omega$ in Russian regions, 2003
Empirical estimation

\[ \Delta Y_{c,t+5} = \beta_0 + \beta_1 Y_{c,t} + \beta_2 X_{c,t} + \beta_3 UrbanizationEconomies_{c,t} + \beta_4 HDI_{c,t} + \varepsilon_{c,t} \]

where:

<table>
<thead>
<tr>
<th>Variable (in logs)</th>
<th>Proxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta Y_{c,t+5} )</td>
<td>Average annual growth rate of the dependent variable between year ( t ) and ( t+5 )</td>
</tr>
<tr>
<td>( Y_{c,t} )</td>
<td>Dependent variable reflecting economic growth in year ( t )</td>
</tr>
<tr>
<td>( X_{c,t} )</td>
<td>Export productivity measure in year ( t )</td>
</tr>
<tr>
<td>( UrbanizationEconomies_{c,t} )</td>
<td>Urbanization economies in year ( t )</td>
</tr>
<tr>
<td>( HDI_{c,t} )</td>
<td>Human capital in year ( t )</td>
</tr>
</tbody>
</table>

Number of students enrolled in higher educational institutions per 10,000 population
Regression results without spatial dependence (the whole dataset)

<table>
<thead>
<tr>
<th></th>
<th>GRP per capita growth</th>
<th>GRP per person employed growth</th>
<th>Employment growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value added, initial</td>
<td>0.0429</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor productivity, initial</td>
<td></td>
<td>0.0529</td>
<td></td>
</tr>
<tr>
<td>Employment, initial</td>
<td></td>
<td></td>
<td>0.0267**</td>
</tr>
<tr>
<td>Export potential Ω</td>
<td>0.1726***</td>
<td>0.1732***</td>
<td>0.0614***</td>
</tr>
<tr>
<td>Urbanization economies</td>
<td>0.0002</td>
<td>0.0000</td>
<td>-0.0000</td>
</tr>
<tr>
<td>Human capital</td>
<td>-0.0403</td>
<td>-0.0342</td>
<td>-0.0338***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0203</td>
<td>0.0789</td>
<td>0.0417</td>
</tr>
<tr>
<td>N</td>
<td>78</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-54.0649</td>
<td>-35.9554</td>
<td>110.973</td>
</tr>
<tr>
<td>Akaike info criterion</td>
<td>118.13</td>
<td>81.9107</td>
<td>-211.945</td>
</tr>
<tr>
<td>Schwarz criterion</td>
<td>130.224</td>
<td>94.0049</td>
<td>-199.851</td>
</tr>
<tr>
<td>Moran’s I (error)</td>
<td>0.9412</td>
<td>-0.7505</td>
<td>3.1704***</td>
</tr>
<tr>
<td>Lagrange Multiplier lag</td>
<td>0.1268</td>
<td>2.8396*</td>
<td>0.5489</td>
</tr>
<tr>
<td>Robust LM lag</td>
<td>0.00001</td>
<td>2.0510</td>
<td>0.0083</td>
</tr>
<tr>
<td>Lagrange Multiplier error</td>
<td>0.5325</td>
<td>0.8297</td>
<td>8.6066***</td>
</tr>
<tr>
<td>Robust LM error</td>
<td>0.4057</td>
<td>0.0410</td>
<td>8.0660***</td>
</tr>
<tr>
<td>Lagrange Multiplier SARMA</td>
<td>0.5325</td>
<td>2.8807</td>
<td>8.6149**</td>
</tr>
</tbody>
</table>

Note: Significance at the 1, 5 and 10% level is signaled by *** , ** and *, respectively.
Theoretical model (1) based on Glaeser et al. (1992)

Basic assumptions:

(1) We assume a simple one-factor production function

\[ y_t = A_t f(l_t) \]

(2) Final good is perfectly competitive, labor market is homogenous and integrated

\[ \max \pi_t = A_t f(l_t) - w_t l_t \quad \Rightarrow \quad A_t f'(l_t) = w_t \]

(3) In case of k-period dynamic model (2) could be rewritten:

\[ \log \left( \frac{A_{t+k}}{A_t} \right) = \log \left( \frac{w_{t+k}}{w_t} \right) - \log \left( \frac{f'(l_{t+k})}{f'(l_t)} \right) \]

, where production function is given by \( f(l_{i,t}) = l_{i,t}^{1-\alpha}, \quad 0 < \alpha < 1 \)
Theoretical model (2) based on Glaeser et al. (1992)

Technology assumptions:

(4) The overall level of technology is assumed to consist of national and local components

\[ A_t = A_{t}^{\text{national}} \times A_{t}^{\text{local}} \]

(5) Considering k-period dynamic model yields:

\[
\log\left( \frac{A_{t+k}}{A_t} \right) = \log\left( \frac{A_{t+k}^{\text{national}}}{A_t^{\text{national}}} \right) + \log\left( \frac{A_{t+k}^{\text{local}}}{A_t^{\text{local}}} \right)
\]

(6) Assumption of export- and spatial externalities leads to the following:

\[
\log\left( \frac{A_{i,t+k}^{\text{local}}}{A_{i,t}^{\text{local}}} \right) = g(Exp_{i,t}, HC_{i,t}, Wage_{i,t}, W_i \cdot Exp_{i,t}, W_i \cdot HC_{i,t}, W_i \cdot Wage_{i,t}) + e_{i,t+k}
\]
Theoretical model (3) based on Glaeser et al. (1992)

Final equation:

(7) Rearranging and combining the equations above yields:

\[
\alpha \log \left( \frac{l_{i,t+k}}{l_{i,t}} \right) = \log \left( \frac{A_{i,t+k}^{\text{national}}}{A_{i,t}^{\text{national}}} \right) + g(\text{Exp}_{i,t}, \text{HC}_{i,t}, \text{Wage}_{i,t}, W_{i} \cdot \text{Exp}_{i,t}, W_{i} \cdot \text{HC}_{i,t}, W_{i} \cdot \text{Wage}_{i,t}) + e_{i,t+k}
\]

where:
Exp – potential export capability
HC – human capital
Wage – wage
W – matrix of spatial weights
## Regression results with spatial dependence (sector-specific data)

<table>
<thead>
<tr>
<th></th>
<th>Mining</th>
<th>Manufacturing</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage in region-industry</td>
<td>0.24*</td>
<td>-0.15***</td>
<td>0.03</td>
</tr>
<tr>
<td>Wage in region-industry in neighboring regions</td>
<td>0.23*</td>
<td>0.15***</td>
<td>0.05</td>
</tr>
<tr>
<td>Potential Export productivity</td>
<td>-0.04*</td>
<td>0.03***</td>
<td>0.02*</td>
</tr>
<tr>
<td>Potential Export productivity in neighboring regions</td>
<td>-0.08*</td>
<td>-0.04***</td>
<td>-0.02*</td>
</tr>
<tr>
<td>Human development</td>
<td>0.00</td>
<td>-0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td>Human development in neighboring regions</td>
<td>0.12*</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Initial Employment</td>
<td>-0.05*</td>
<td>-0.01*</td>
<td>-0.01</td>
</tr>
<tr>
<td>Average employment growth outside</td>
<td>-0.26*</td>
<td>0.10*</td>
<td>-0.22**</td>
</tr>
<tr>
<td>Cons</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>N</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>R2</td>
<td>0.0752</td>
<td>0.3256</td>
<td>0.1543</td>
</tr>
<tr>
<td>R2 adj</td>
<td>0.0000</td>
<td>0.2527</td>
<td>0.0629</td>
</tr>
<tr>
<td>AIC</td>
<td>85.47</td>
<td>-176.6</td>
<td>-79.98</td>
</tr>
<tr>
<td>BIC</td>
<td>107.2</td>
<td>-154.9</td>
<td>-58.21</td>
</tr>
</tbody>
</table>

Note: Significance at the 1, 5 and 10% level is signaled by ***, ** and *, respectively.
Results

1. Verification of new explanations

- Potential export capacity $\Omega$ results in economic growth in contrast to actual export productivity $\text{EXPY}$ that doesn’t.

- Regions with high potential export capacity are “locomotives” of economic growth.
  $\Rightarrow$ It is necessary to distinguish regions with high potential export capacity from regions with high actual export productivity level.

2. Verification of “New” new explanations

In case of economic growth in adjacent regions negative labor mobility effects on export diversification are higher than positive inter-regional technological spillovers.
THANK YOU!
Actual vs. Potential Export Rating for Russian regions: Resource-abundant regions

MAIN FEATURES

- Export-orientation
- Lack of urbanization

*Rating is done on a 1 to 77 scale with 1 being the highest and 77 the lowest rating according to corresponding export productivity measure.
Actual vs. Potential Export Rating for Russian regions: Distressed regions

MAIN FEATURES

- regional underdevelopment
- high unemployment

*Rating is done on a 1 to 77 scale with 1 being the highest and 77 the lowest rating according to corresponding export productivity measure.
Actual vs. Potential Export Rating for Russian regions: Locomotives of the growth*

**MAIN FEATURES**
- Significant contribution to GDP
- High R&D potential
- Agglomeration potential

*Rating is done on a 1 to 77 scale with 1 being the highest and 77 the lowest rating according to corresponding export productivity measure*