Foreign trade impact on employment efficiency – an analysis using R

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Scope

- External trade in goods impact on employment
- Sustainable development on export:
  1. specific market share growth
  2. higher/high-qualified human resources.

  ➡️ High quality goods, technological transfer, quality of work promotion, increasing companies’ competitiveness on international markets

- The research is based on:
  - Companies’ typology on main activity (NACE Rev.2 classification, 4 digits),
  - Capital ownership,
  - Technological level of exported goods, with focus on high-tech.
Macroeconomic data

Exports of goods and services in % of GDP

Data source: Eurostat database
### Macroeconomic data (II)

Exports of goods and services in selected countries, in the period 2007-2016 (% of GDP)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>EU-28</td>
<td>44.1</td>
<td>6.2</td>
<td>9.3</td>
<td>0.1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>28.2</td>
<td>3.3</td>
<td>2.0</td>
<td>0.6</td>
</tr>
<tr>
<td>France (the lowest share after Brexit)</td>
<td>29.3</td>
<td>2.2</td>
<td>5.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>Luxembourg (the highest share)</td>
<td>221.3</td>
<td>38.4</td>
<td>57.2</td>
<td>-1.4</td>
</tr>
<tr>
<td>Hungary</td>
<td>92.5</td>
<td>14.2</td>
<td>17.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Poland</td>
<td>52.3</td>
<td>13.7</td>
<td>15.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>79.5</td>
<td>13.1</td>
<td>20.8</td>
<td>-1.5</td>
</tr>
<tr>
<td>Romania</td>
<td>41.4</td>
<td>12.3</td>
<td>14</td>
<td>0.3</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>63.6</td>
<td>11.2</td>
<td>21.3</td>
<td>-0.5</td>
</tr>
<tr>
<td>Greece</td>
<td>30.2</td>
<td>7.7</td>
<td>11.2</td>
<td>-1.7</td>
</tr>
<tr>
<td>Italy</td>
<td>29.8</td>
<td>2.4</td>
<td>7.3</td>
<td>-0.1</td>
</tr>
</tbody>
</table>

Data source: Eurostat database
The software used for the analysis is R, with the package *vars*.

R - the most used open source statistical software among academic communities.

Building some multivariate VAR models, using macroeconomic data from Romania, in the period 2008-2015.

Several models tested, out of which only three were selected based on the evidence against the null hypothesis.

Selected VAR models tested in terms of number of employees (*NE*), export of goods (*E*), labor costs per unit of export (*LCE*), labor productivity (*W*), and export intensity (*EI*).
Models tested for:

- Total export - all companies (+62% in 2015 as against 2008 in terms of export)
- Companies performing external trade in lohn system (share in total export: 35% in 2008 and 30% in 2015)
- Companies exporting high-tech products (share in total export: 41% in 2008 and 54% in 2015)
- Companies with Foreign Direct Investments (FDI) in Romania (share in total export: 70% in 2008 and 67% in 2015).

For companies performing external trade in lohn system, none of the performed tests were valid.
Results (II)

Model 1: Number of employees, Export, Labor costs per unit of export

- Total level: export is influenced by a higher level of labor productivity and higher remuneration for employees.

- FDI companies: highly oriented towards export activity, making benefits in Romania from the low salary level or natural resources.

Protection-type measures through national legislation is necessary to ensure a sustainable development of Romania by exporting processed products rather than raw resources or low processed goods.

- Companies exporting high-tech products: Increasing openness to the foreign markets leads directly to the increase of the number of employees, production increase, assortment extension, innovation, etc.

Measures needed: Increasing labor productivity and wage levels by increasing the efficiency of the production price.
**Results (III)**

**Example for Model 1**

Companies with FDI in Romania

Estimation results for equation \( NE \) in Model 1 (\( NE, E, LCE \)):

\[ NE = NE.l1 + E.l1 + LCE.l1 + \text{const} \]

|                | Estimate | Std. Error | t value | Pr(>|t|) |
|----------------|----------|------------|---------|----------|
| NE.l1          | -0.6402  | 0.5330     | -1.201  | 0.316    |
| E.l1           | 0.6526   | 0.2574     | 2.535   | 0.085    |
| LCE.l1         | 1.0160   | 0.5971     | 1.702   | 0.187    |
| const          | 2.5209   | 1.5051     | 1.675   | 0.193    |

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01058 on 3 degrees of freedom

Multiple R-Squared: 0.9084, Adjusted R-squared: 0.8168

F-statistic: 9.917 on 3 and 3 DF, p-value: 0.04575
Model 2: General labor productivity, Export, Labor costs per unit of export

- Total level: export is directly influenced by the level of company productivity and labor cost per unit of export.

- FDI companies: The labor cost per unit of export has an inverse relationship with the level of labor productivity and directly proportional to the export level. → the great export intensity of FDI companies in Romania.

- Companies exporting high-tech products: export is positively influenced by the level of labor productivity and by the salary implied for an exported unit.
## Results (V)
### Example for Model 2

**Total export (all companies)**

Estimation results for equation Export in Model 2 (W, E, LCE):  
Export = W.l1 + Export.l1 + LCE.l1 + const

|                | Estimate | Std. Error | t value | Pr(>|t|) |
|----------------|----------|------------|---------|----------|
| W.l1           | 2.3611   | 1.4796     | 1.596   | 0.2088   |
| E.l1           | -1.1514  | 0.8134     | -1.416  | 0.2518   |
| LCE.l1         | 0.8904   | 1.8139     | 0.491   | 0.6572   |
| const          | 12.0495  | 4.9032     | 2.457   | 0.0911   |

Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.0413 on 3 degrees of freedom  
Multiple R-Squared: 0.9069, Adjusted R-squared: 0.8137  
F-statistic: 9.737 on 3 and 3 DF, p-value: 0.04688
Model 3: Number of employees, Labor costs per unit of export, Export intensity

- Total level: The labor cost per unit of export have an inverse relationship with export intensity in previous year (export / turnover).

The export intensity is in a direct relationship with the labor cost per unit of export and an inverse relationship with the number of employees.

- FDI companies: The more they produce, the lower the labor cost per unit of export is.

- Companies exporting high-tech products: The developments in number of employees are influence by the developments in exports and are in inverse relationship with labor cost per unit of export.
Results (VII)
Example for Model 3

Companies exporting high-tech products

Estimation results for equation NE in Model 3 (NE, LCE, EI):
NE = NE.l1 + LCE.l1 + EI.l1 + const

Estimation results for equation NE in Model 3 (NE, LCE, EI)

| Estimate | Std. Error | t value | Pr(>|t|) |
|----------|------------|---------|----------|
| NE.l1    | 0.0169     | 0.3082  | 0.055    | 0.9597   |
| LCE.l1   | -0.2693    | 0.4374  | -0.616   | 0.5816   |
| EI.l1    | 0.1826     | 0.2997  | 0.609    | 0.5853   |
| const    | 5.6760     | 1.7277  | 3.285    | 0.0462 * |

Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error: 0.01217 on 3 degrees of freedom
Multiple R-Squared: 0.9038, Adjusted R-squared: 0.8076
F-statistic: 9.396 on 3 and 3 DF,  p-value: 0.04916
Conclusions

- Romanian exports grow year by year, based especially on demand
  - Higher level of conjuncturality
- Less performant domestic capital, based mainly on small and medium firms, with no solid strategic orientation for external market,
- Inverse relationship between export growth and developments in unit labor costs,
- Dependence of exports on foreign-owned companies,
- FDI – important role in economic development of a region,
- National policies of protectionist nature in the case of primary resources.
Thank you for your attention!