

A longitudinal overview of the European national innovation systems through the lenses of the Community Innovation Survey



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Background

- Ever since Schumpeter **innovation** is defined as **the** critical dimension of economic development.
- **Policy makers** focus on developing coherent economic policies which stimulate spending on innovation activities and **increase the efficiency** of the innovation process.
- This can only be done if the **current and past structural features** of the innovation activities within an economy **are known**.
- **Standard approach** for unfolding the innovation system in an economy:
 - 1) Utilize **microdata** capturing the innovation activities of the firms in the country.
 - 2) estimate the famous **CDM econometric framework** to analyze the relationships between innovation and productivity.

Motivation

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- CDM is usually estimated using:

- 1) **Panel data** for only **one** country;

- 2) **Cross-sectional** data for **one or several** country groups.

- **Our contribution:**

A longitudinal overview of the **9 European national innovation systems** by utilizing three waves of the Community Innovation Survey

Methods – Crepon, Duguet and Mairesse (1998)

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- 4 – stage procedure.
 - **1st and 2nd stage:**
 - A Heckman selection model for the interdependence between
 - 1) the decision to innovate, and
 - 2) the innovation input.
 - **3rd and 4th stage:**
 - A three-stage least squares estimation for the potential endogeneity between:
 - 3) the innovation output, and
 - 4) The productivity of a firm.

Data – Community Innovation Survey (CIS)

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- Most widely used **micro-level** survey **data** for research **on innovation**.
 - Executed by national statistical offices throughout **the EU**.
 - We create a **panel** dataset by using three waves of data (CIS10, CIS12, CIS14).
 - We utilize data on **9 countries**:
Bulgaria, Czech Republic, Germany, Hungary, Norway, Portugal, Romania, Slovakia and Spain.
- We conduct **separate CDM** estimation for each country.

Results - Decision to innovate

VARIABLE	BULGARIA	CZECH REP.	HUNGARY	ROMANIA	SLOVAKIA	GERMANY	SPAIN	NORWAY	PORTUGAL
Firm Size	0.183***	0.156***	0.192***	0.093***	0.131***	0.184***	0.015***	0.049***	0.206***
Market participation									
National	0.249***	0.243***	0.202***	0.185***	0.122**	0.310***	0.376***	0.317***	0.164***
European	0.271***	0.211***	0.146***	0.087***	0.255***	0.389***	0.231***	0.430***	0.195***
Other	0.233***	0.338***	0.259***	0.322***	0.340***	0.438***	0.430***	0.411***	0.214***
Part of a group	0.134***	0.164***	0.110***	0.169***	0.238***	0.241***	0.197***	0.010	0.075***
Abandoned or ongoing innovations	3.712***	2.542***	8.113***	7.585***	6.979***	0.704***	0.712***	1.997***	2.881***
Innovations									
Organizational	0.778***	0.861***	0.885***	0.776***	1.004***	0.477***	0.687***	0.671***	0.909***
Marketing	0.648***	0.886***	0.699***	0.697***	0.863***	0.430***	0.534***	0.887***	0.832***
Observations	39,039	15,555	15,783	24,308	7,718	11,806	96,082	15,076	18,076

*** p<0.01, ** p<0.05, * p<0.1

Results – Innovation input

VARIABLE	BULGARIA	CZECH REP.	HUNGARY	ROMANIA	SLOVAKIA	GERMANY	SPAIN	NORWAY	PORTUGAL
Firm size	0.409***	0.329***	0.268***	0.012	0.338***	1.210***	0.024**	0.132***	0.342***
Market participation									
National	-0.011	0.085	-0.445***	-0.081	-0.138	0.170**	0.335***	0.231***	0.217***
European	0.197**	0.059	0.257**	0.164	0.085	0.207***	0.124***	0.488***	0.101*
Other	0.470***	0.497***	0.347***	0.085	0.441***	0.406***	0.297***	0.633***	0.153***
Part of a group	0.548***	0.386***	0.395***	0.287	0.136	0.771***	0.434***	-0.146**	0.398***
Abandoned or ongoing innovations	1.547***	0.234***	0.266	-0.788	0.165	0.272***	0.527***	0.419***	0.155**
Innovations									
Organizational	0.717***	0.350***	0.373***	-0.11	0.423**	-0.480***	0.362***	0.290***	0.352***
Marketing	0.370***	0.221***	0.179	-0.314	0.179	-0.123*	0.265***	0.125*	0.164***
Funding									
Local	0.285	0.175	0.883***	0.063	-0.251	0.640***	0.571***	0.297***	0.105
Government	0.742***	0.851***	0.797***	1.006***	0.863***	0.703***	1.069***	1.027***	0.804***
EU	1.044***	0.713***	1.048***	1.004***	0.826***	0.815***	0.878***	0.851***	0.771***
Observations	39,039	15,555	15,783	24,308	7,718	11,806	96,082	15,076	18,076

*** p<0.01, ** p<0.05, * p<0.1

Findings – Heckman selection

- **1st stage:**

- There are **no differences** in the significance of the explanatory variables between the countries.

- All of them display a **positive marginal effect**.

- **2nd stage:**

- Differences appear in:

- 1) Czech Rep. - **market participation** is insignificant

- 2) Hungary - **abandoned or ongoing innovations** is insignificant

- 3) Romania- **only funding** appears significant

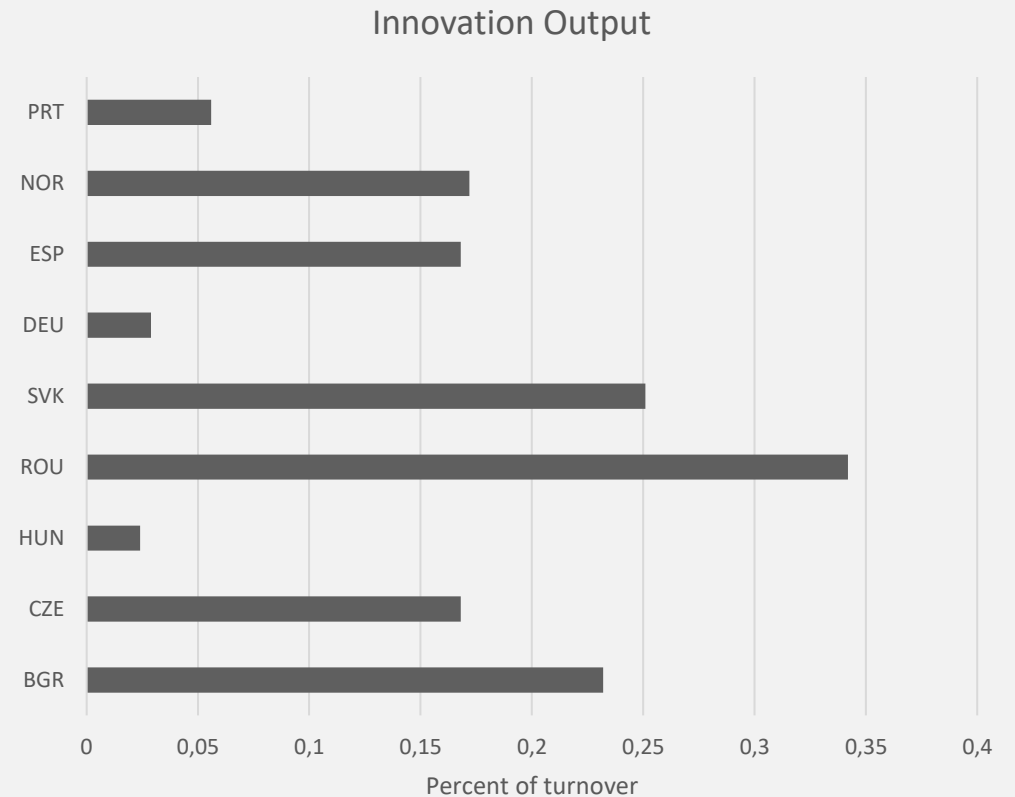
- 4) Slovakia - **market part., part of a grp., abndnd. or ongoing innovations** are insignificant.

Results – Innovation Output

VARIABLE	BULGARIA	CZECH REP.	HUNGARY	ROMANIA	SLOVAKIA	GERMANY	SPAIN	NORWAY	PORTUGAL
Firm size	-0.021	-0.224***	-0.326***	0.001	-0.183	-0.767***	-0.110***	-0.363***	-0.172***
Mills's ratio	-0.735	0.353	-2.506*	1.585	5.042**	0.683**	-0.857**	0.294	0.192
Innovation input	-0.387***	0.220**	0.353*	0.787*	0.588*	0.417***	-0.475**	0.254***	0.210
Productivity	-0.002	0.056	-0.367*	-0.776***	0.086	0.001	0.043	0.300**	-0.467***
Innovations									
Organizational	0.476***	0.095**	-0.201	0.527**	0.837***	0.458***	0.135***	-0.111*	0.146***
Marketing	-0.004	-0.075*	-0.22	0.464*	0.688**	0.031	0.130***	0.132**	-0.095**
Funding									
Local	0.431**	-0.089**	-0.09	0.109	0.366	-0.175***	0.344**	0.049	-0.059
Government	0.516***	-0.191**	-0.314	-0.583	-0.274	-0.297***	0.571**	-0.114	-0.159
EU	0.309**	-0.181**	-0.430*	-0.823*	-0.363	-0.172***	0.501**	-0.079	-0.169
Observations	3,199	3,586	1,502	683	565	2,224	11,363	2,893	3,832
	*** p<0.01, ** p<0.05, * p<0.1								

Findings – Innovation output

- **Firm size:** almost always has a negative impact in each country.
- **Mills's Ratio:** never significant at 1%.
- **Innovation input:**
 - Negative impact in Bulgaria and Spain;
 - Positive in Germany and Norway.
- **Productivity:**
 - Negative impact in Romania and Portugal;
 - Positive impact in Norway.
- **Innovations:** insignificant only in Hungary.
- **Funding:**
 - Negative impact in Czech Rep. and Germany;
 - Positive impact in Bulgaria and Spain.



Results – Productivity

VARIABLE	BULGARIA	CZECH REP.	HUNGARY	ROMANIA	SLOVAKIA	GERMANY	SPAIN	NORWAY	PORTUGAL
Firm size	-0.030	0.516**	1.642	0.177***	0.235***	0.936***	-0.173**	0.120**	-0.384**
Innovations									
Organizational	0.430***	-0.192	-1.189	0.194*	0.265	-0.625***	0.149*	0.128***	0.558***
Marketing	0.01	0.237	-0.344	0.093	0.237*	-0.043	0.177**	-0.004	-0.236*
Innovation output									
	-0.642*	2.248	7.313	-0.066	-0.558	1.868***	-2.970***	-0.229	-3.034***
Observations	3,199	3,586	1,502	683	565	2,224	11,363	2,893	3,832

*** p<0.01, ** p<0.05, * p<0.1

Findings - Productivity

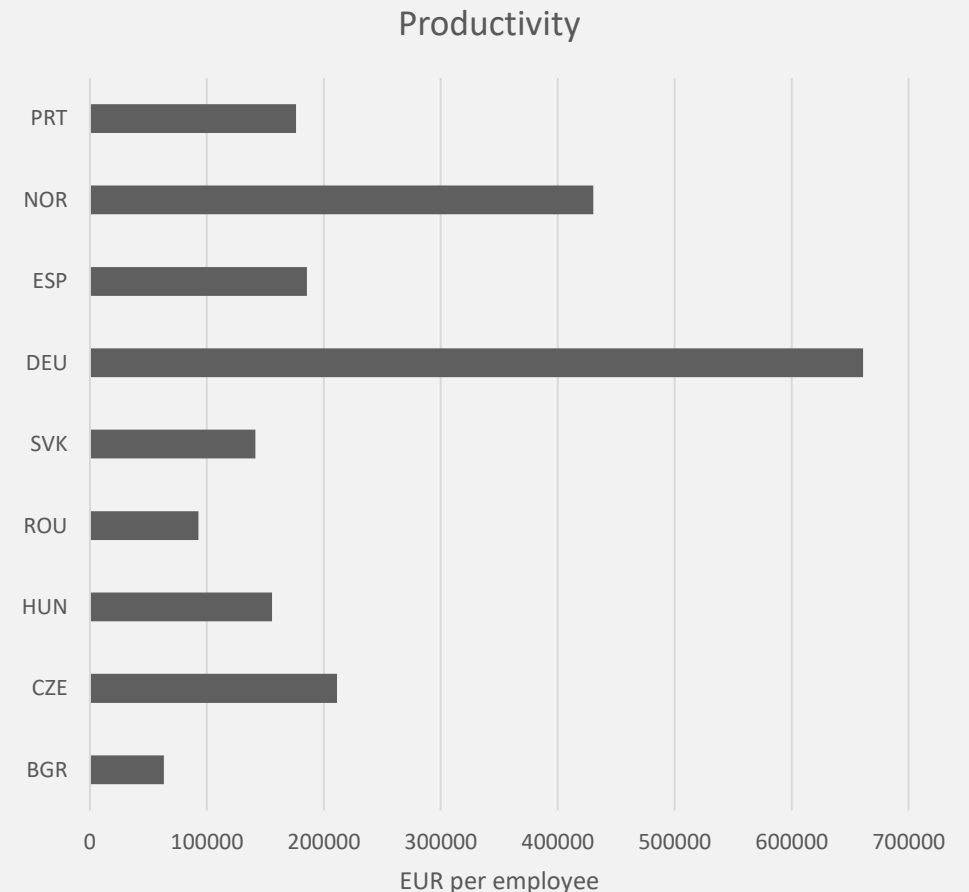
- **Firm size:**

- Insignificant in Bulgaria and Hungary;
- Negative impact in Portugal.

- **Innovation output:**

- Negative impact in Portugal and Spain;
- Positive in Germany.

- **Innovations:** Moderately significant!



Discussion

- In the aftermath of **the financial crisis**, the **innovation output** shows **no impact** on the productivity in less developed countries.

- **Hypothesis:**

As the level of development of an economy decreases, the national innovation system becomes vulnerable. In periods of crises higher level of innovation output results in lower labor productivity.

- **Possible solution:**

Reconstruction of the national innovation systems by implementation of EU policies aimed at reducing the increasing inequality.