Economic impact assessment of technological diversification in European Regions: possible implications for Smart Specialization

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Pilot exercise:

S3 economic impact assessment – The use of RHOMOLO for Economic impact assessment of Operational Programs' thematic objective 1: "Strengthening research, technological development and innovation". Alentejo and Norte

Aim and motivation

- We investigate **macroeconomic impacts** of changes induced due to the **achievement** of the **regional targets** related to Operational Programs thematic objective 1 (OP TO1) result indicators.

- Two Portuguese regions: **Alentejo and Norte**

- We use the **RHOMOLO model**: a dynamic multi-regional computable general equilibrium model.

- This exercise can be used as an **ex-ante economic impact assessment of S3** in European regions (NUTS2).

Aim and motivation

- We propose to analyse counterfactual scenarios in which, it is assumed that by **2023**, **EU NUTS2 achieve their targets** in terms of result indicators related to "Strengthening research, technological development and innovation".

- If **we assume that Operational Programs should be executed in each region following the principles of S3**, our counterfactual scenario is the one in which regions develop all appropriate actions (based on their S3 strategies) to achieve the best possible outcome in terms of research, technological development and innovation (i.e. result indicators proposed in the OPs).

Aim and motivation

- Thus, **regions are evaluated based on their own specific objectives**. This respects the **place-based** approach of S3 as a regional innovation policy.

Four steps analysis

1. **Estimation** of Total Factor Productivity (TFP).
   - Econometric estimation.

2. Estimation of **a link between thematic objective 1 indicators and productivity**.
   - Econometric estimation.

3. **Assumptions** about achievement of operational targets.
   - Regions: Alentejo and Norte.

4. **Simulations** with a macroeconomic model.
   - RHOMOLO: spatial computable general equilibrium model for EU regions and sectors.

Economic context of Alentejo and Norte

Indicators	Alentejo (PT18)	Norte (PT11)	Portugal	EU28
GDP per capita (PPS)	18 400	17 000	20 500	26 800
Unemployment rate (%)	16.9	17.1	16.2	10.9
Tertiary Education attainment (%)	15.6	16.5	19.3	28.6
R&D (% of GDP)	0.46	1.39	1.33	2.02
Population	748 699	3 666 234	10 487 289	505 161 863
Population density (Inhabitants per km2)	23.6	171.7	113.4	116.4

1. Estimation of Total Factor Productivity

$$y_{rit} = \beta_1 k_{rit} + \beta_2 l_{rit} + \mu_{ri} + \lambda_t + tfp_{rit}$$

- y_{rit}: gross value added.
- k_{rit}: gross fixed capital formation.
- l_{rit}: employment.
- μ_{ri}: region-sector fixed effects.
- λ_t: time fixed effects.

- The dataset consist on **176 regions, 10 sectors, and 10 years** (2003-2012), resulting in an unbalanced panel of 1,440 NUTS2 region-sector – 13,699 observations.

Link thematic objective and productivity

$$gTFP_{rit} = \beta_1 gPatents_{rt} + \beta_2 gRnD_{rt} + \mu_{ri} + \lambda_t + \varepsilon_{rit}$$

- $gTFP_{rit}$: TFP growth.
- $gPatents_{rt}$: growth rates of patents.
- $gRnD_{rt}$: growth rate of business enterprise R&D expenditures respectively.

- The use of growth rates and the availability of date on the objective 1 results indicators limits the sample to a panel of **1,426 NUTS2 regions-sectors for the period 2004-2012** – a total of 12,221 observations.

Region	Year	Patents	BES R&D	BES R&D - average of the previous 3 years
Norte (PT11)	2003	0.29	0.23	0.24
	2004	0.36	0.24	0.24
	2005	0.41	0.26	0.24
	2006	0.52	0.39	0.24
	2007	0.57	0.51	0.30
	2008	0.66	0.71	0.39
	2009	0.67	0.67	0.54
	2010	0.64	0.76	0.63
	2011	0.59	0.75	0.71
	2012	0.54	0.87	0.73
	2013	0.54	0.83	0.79
	2014	0.58	0.83	0.81
	2015	0.61	0.83	0.84
	2016	0.65	0.84	0.83
	2017	0.68	0.84	0.83
	2018	0.72	0.85	0.84
	2019	0.76	0.85	0.84
	2020	0.79	0.85	0.85
	2021	0.83	0.86	0.85
	2022	0.86	0.86	0.85
	2023	**0.90**	**0.87**	**0.86**

Actual data
Simulation of future trends
Targets

Region	Year	Patents	BES R&D	BES R&D - average of the previous 3 years
Alentejo (PT18)	2004	0.07	0.15	0.14
	2005	0.12	0.17	0.14
	2006	0.14	0.26	0.15
	2007	0.24	0.34	0.20
	2008	0.22	0.63	0.26
	2009	0.29	0.27	0.41
	2010	0.20	0.17	0.42
	2011	0.26	0.22	0.36
	2012	0.37	0.27	0.22
	2013	0.37	0.23	0.22
	2014	0.37	0.28	0.24
	2015	0.38	0.32	0.26
	2016	0.38	0.37	0.28
	2017	0.38	0.42	0.32
	2018	0.39	0.46	0.37
	2019	0.39	0.51	0.42
	2020	0.39	0.56	0.46
	2021	0.39	0.61	0.51
	2022	0.40	0.65	0.56
	2023	**0.40**	**0.70**	**0.61**

Actual data
Simulation of future trends
Targets

The RHOMOLO model

- RHOMOLO is the model developed by the DG JRC for the **ex-ante and ex-post impact assessments of EU Policies**;

- It shows how **policy shocks** are expected to affect economic and social outcomes at the regional, country and sectoral level, analysed as deviation from baseline.

- It allows policy makers to have an idea of the **trade-offs and ramifications** of their policy options of their policy choices.

The RHOMOLO model

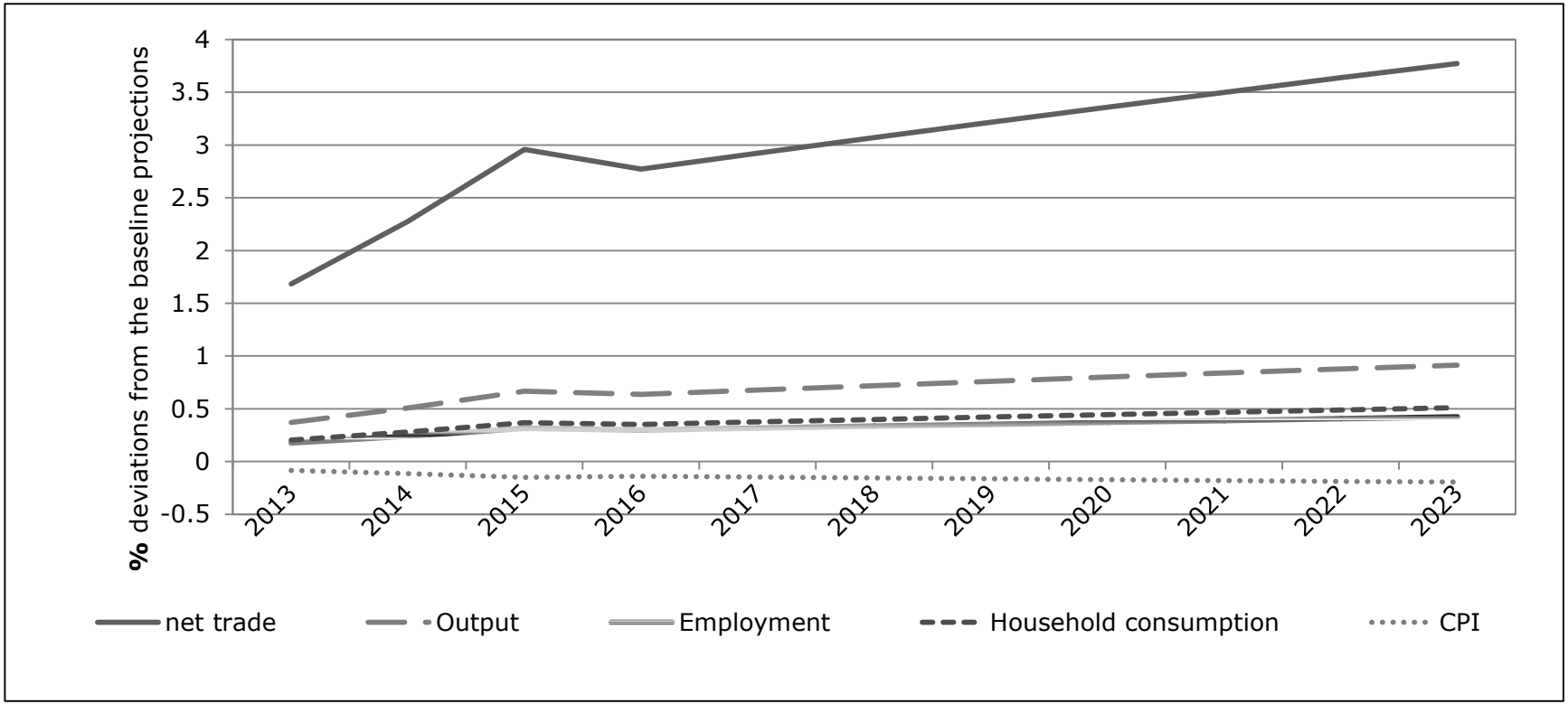
- Geographical coverage: 28 EU Member States + ROW ; 267 NUTS2 regions (French overseas territories are excluded).

- The **Rest of the World** is introduced in the model as an exogenous external institutional sector.

- Sector disaggregation: **10 tradable NACE rev.2 sectors** (A, B-E, C, F, G-I, J, K-L, M-N, O-Q, R-U); can be perfectly or imperfectly competitive.

- Final goods are consumed by Households, Governments and Investors whilst firms consume intermediate inputs.

Results: Norte (PT11)



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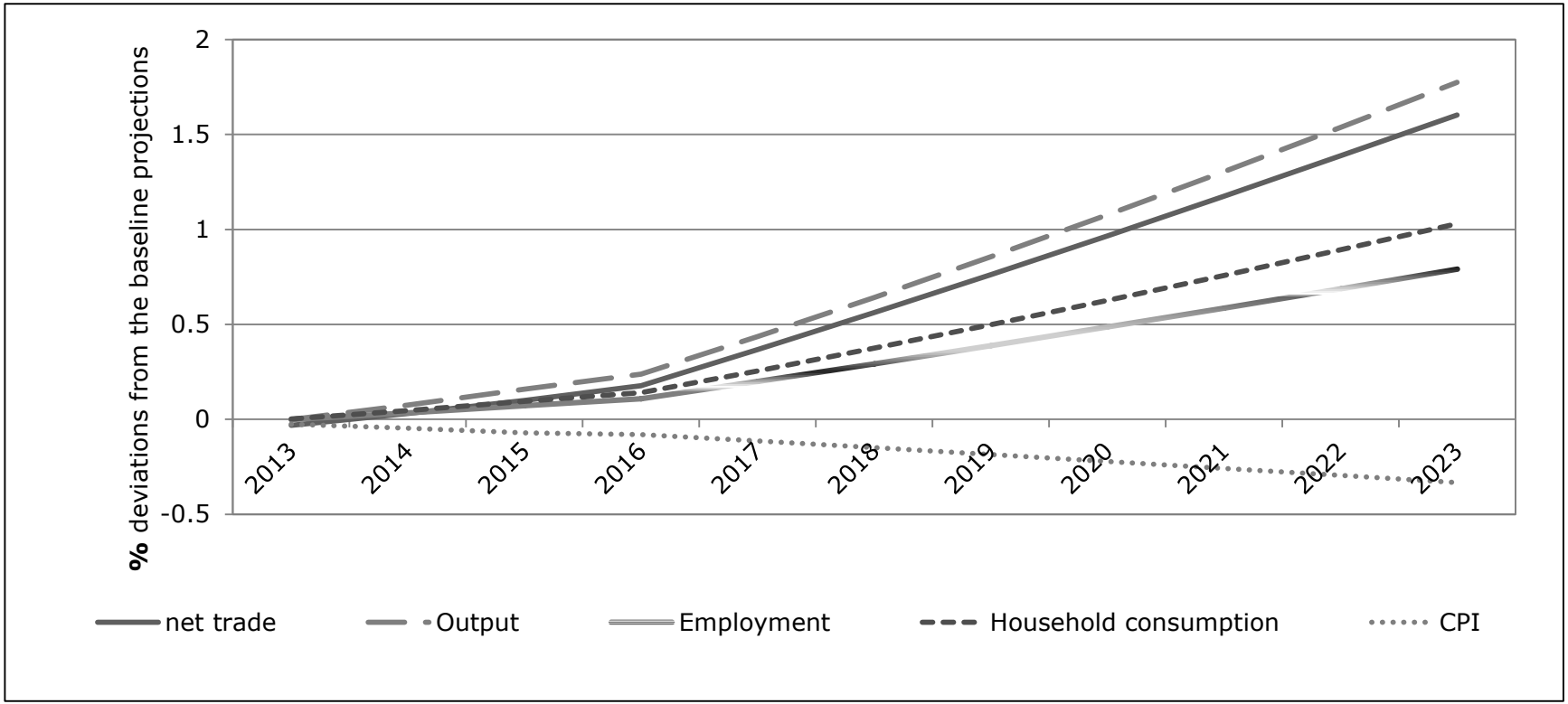
Results: Alentejo (PT18)



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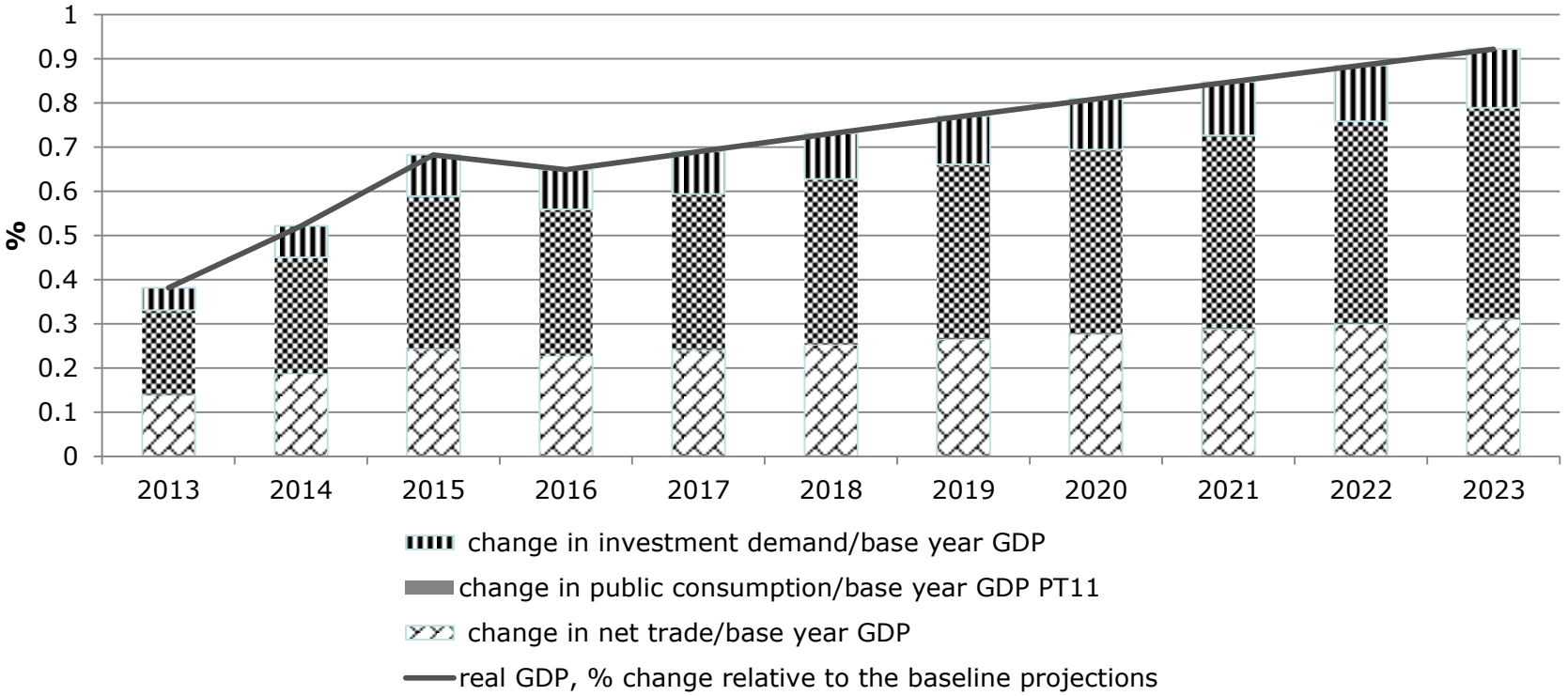
Decomposition of GDP impacts: Norte (PT11)



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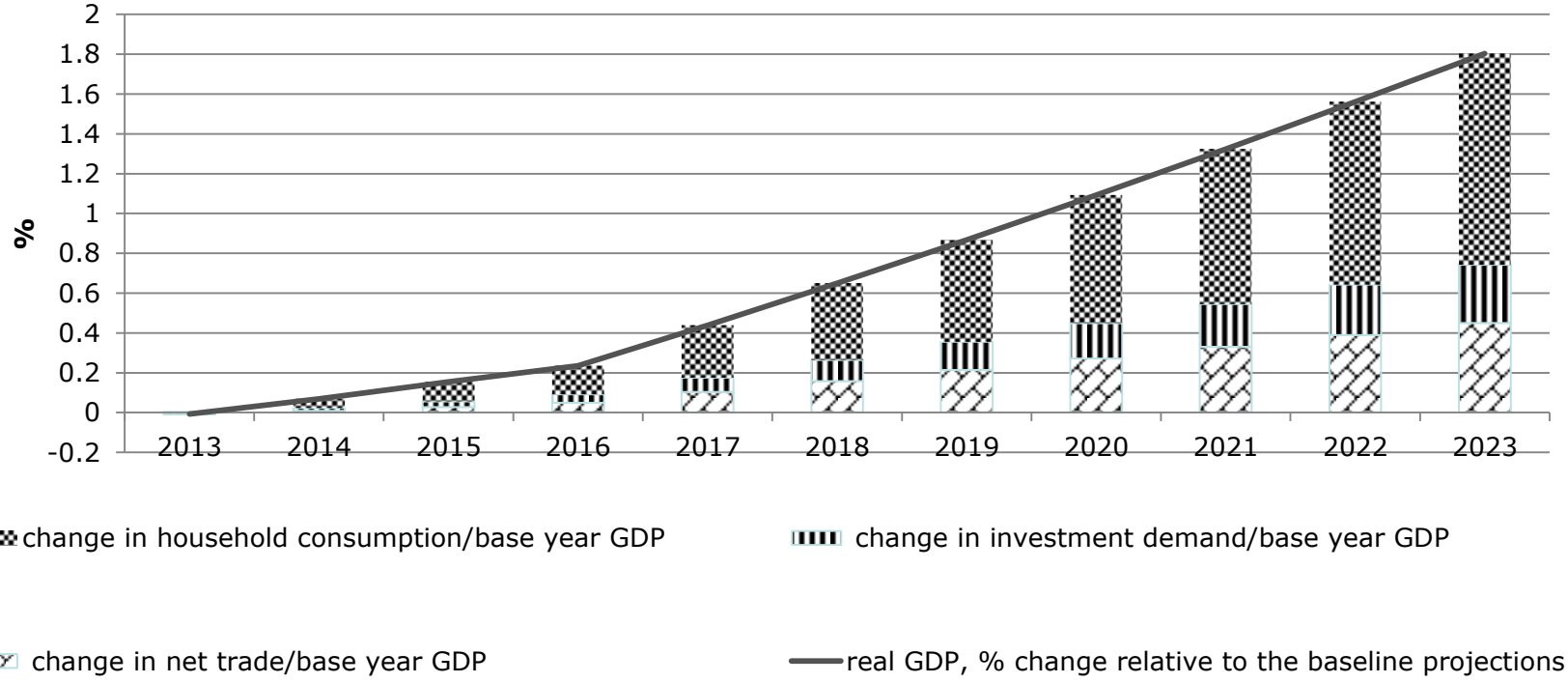
Decomposition of GDP impacts:Alentejo (PT18)



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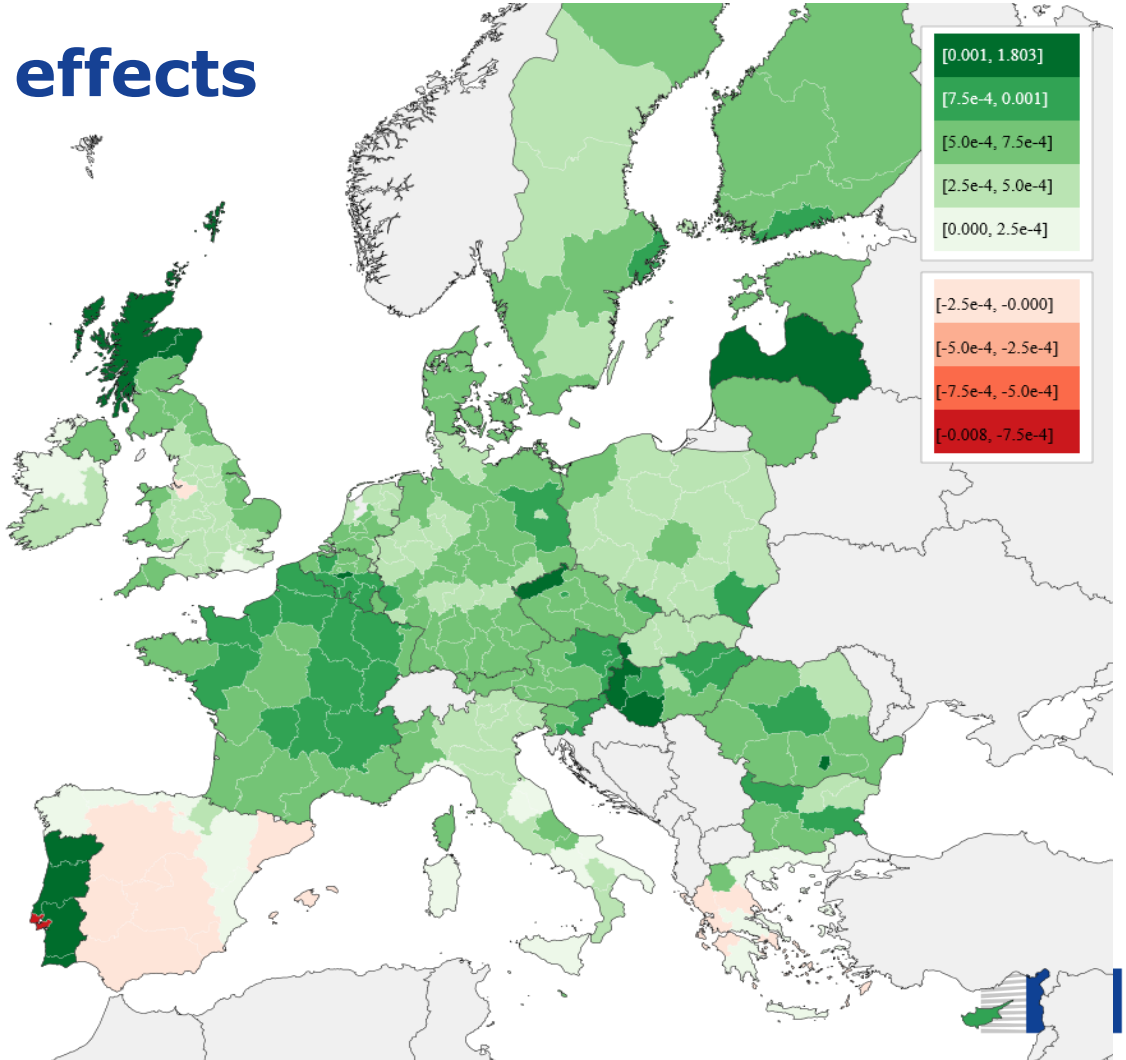
Spillover effects



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Thank you!

All comments are welcome

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

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