

# Competitiveness of small states: Does size matter ? Some new evidence

**Dr Serge Allegrezza**  
**Observatoire de la compétitivité &  
STATEC**

Presentation prepared for the Conference:  
**Competitiveness Strategies for the EU Small States**  
Chambre de Commerce Luxembourg, Kirchberg  
19-20 April 2018

(Thank you to Max Jentgen and Vasja Sivec for their help)



LE GOUVERNEMENT  
DU GRAND-DUCHÉ DE LUXEMBOURG  
Ministère de l'Économie

Observatoire de la compétitivité



L-Università  
ta' Malta

**STATEC**



UNIVERSITÉ DU  
LUXEMBOURG

**LUXEMBOURG**  
LET'S MAKE IT HAPPEN

# Structure

---

## ➤ Hypotheses

- Size of single countries should not matter in the European Union (internal market, monetary union)
- Competitiveness is the main driver of economic success

## ➤ Questions

- How to define and measure success?
- How to define and measure the “size” of a country?
- What do we mean by “competitiveness”?

## ➤ Our approach

- Longitudinal regressions of *GNI/capita on competitiveness variables and population*
- Results

## ➤ Future steps

# Country size

---

- Compared to “large” states, “small” states are confronted with limitations of ...
  - Economies of scale
  - Access to large markets
  - Resources
  - Diversity
  - Bargaining capacity
  - ...
- Measures of size
  - Population
  - Political power
  - Surface
  - Export

# Competitiveness

---

- Definition of competitiveness
  - Concept of competitiveness is somewhat elusive
  - Competitiveness should be defined in detail
  - Well-known international benchmarks: WEF, IMD etc.
  
- Definition used by the Observatory of competitiveness (Ministry of the Economy, Luxembourg):
  - *“Competitiveness is the ability of a nation to sustainably improve the standard of living of its inhabitants and to provide them with a high level of employment and of social cohesion while preserving the environment”.*

# National Competitiveness Scoreboard, TBCO (I)

---

- A permanent monitoring tool to assess Luxembourg's competitiveness and related indicators and which considers national specificities
- Implemented in 2004 by the Observatory of competitiveness, based on a report elaborated by social partners with the help of Prof. Lionel Fontagné
- Revised in 2010 according to the recommendations made in an external audit from the Joint Research Centre (JRC) of the European Commission
- Computed and updated annually by the Observatory of competitiveness
- Publication: **“Bilan Compétitivité”**

# Bilan compétitivité (in french and english) available on:

<https://odc.gouvernement.lu/fr/publications/rapport-etude-analyse/perspectives-politique-economique/perspectives-politique-economique-33.html>

Le gouvernement  
luxembourgeois

Observatoire de la compétitivité

L'Observatoire

Actualités

Domaines d'activité

Statistiques

Publications

## Bilan compétitivité 2017: Le nouveau tableau de bord de la compétitivité



A travers la publication "Perspectives de politique économique", la Direction générale compétitivité et l'Observatoire de la compétitivité diffusent les résultats d'études et/ou de recherches commanditées auprès de chercheurs universitaires ou de consultants, ainsi que des documents de travail rédigés par les membres de la Direction générale du ministère de l'Economie. Cette publication a également pour objet de faire connaître les comptes rendus d'exposés, de séminaires ou de conférences que le ministère de l'Economie organise sur des thèmes de politique économique. Pour finir, elle a l'ambition d'éclairer les choix politiques possibles, d'évaluer l'efficacité de certaines mesures et d'alimenter ainsi le débat public sur la politique économique. Les opinions exprimées sont celles des auteurs et ne correspondent pas nécessairement à celles du ministère de l'Economie du gouvernement du Grand-Duché de Luxembourg.

Année de parution: **2017**  
Langue: **Français**  
Thème: **Statistiques Économie / Finances**  
Nombre de pages: **240**  
Format: **A4**  
Type: **Rapport / Etude / Analyse**  
ISBN: **978-2-919770-24-3**  
Poids: **3,64 Mo**

TÉLÉCHARGER

# National Competitiveness Scoreboard, TBCO (II)

---

- Scoreboard made up of EU-28 member states
- Analysis of Luxembourg's performance over time and compared to the EU average in every single indicator
- Rankings are relative by construction, meaning that a country's position depends not only on its own performance but also on that of the other countries
- Revision of the Competitiveness Scoreboard in 2017, in collaboration with the Economic and Social Council

# Computation of the composite indicator (tbco)

- Preliminary data processing:
  - Treatment of outliers
  - Imputation of missing values
- Computation of the composite indicator:
  - Standardization of all 77 basic indicators
  - Calculation of a composite index for all 10 categories
  - Standardization of the composite indices of each category
  - Calculation of the final composite indicator by aggregating the indices of the different categories

## Methodology

Concerning the methodology for calculating the composite indicator, we take the recommendations made by the audit into account (2010 Competitiveness Report, Perspectives économiques No. 15).

For some indicators, there are outliers. In particular, the indicators<sup>10</sup> on direct investment (A12), broadband Internet access rates (D7), basket of domestic royalties for 2 Mbits leased lines (D8) and number of ISO 14001 certifications (J1). For each of these indicators, there is a country that has a value significantly higher than all other countries: Luxembourg (A12), Greece (D7), Hungary (D8) and Italy (J1). Given the dramatic increase in the Irish GDP in 2015, indicators A2, C2 and C4 have also been processed as outliers for Ireland. As all these indicators are likely to influence the result too much, extreme values were replaced by the value of the country in second position.

In order to address the problem of missing values, the 'hot-deck imputation' method is used. The idea is to estimate a country's missing values based on the values of a country that shows a similar performance for the other indicators in the same category.

For the composite indicator calculation, basic indicators are standardized first. Each indicator is processed by the following formula by country  $j$  at time  $t$ .

$$y_{ij}^t = \frac{x_{ij}^t - \min_j x_{ij}^t}{\max_j x_{ij}^t - \min_j x_{ij}^t}$$

The composite index  $C$  for a category  $k$  ( $k = 1, \dots, 10$ ) at time  $t$  is calculated by averaging the sub-indicators of this category in the new scale:

$$C_{k,j}^t = \frac{1}{m_k} \sum_{i=1}^{m_k} y_{ij}^t$$

The composite indices of the 10 categories are then standardized in order to balance the impact of the 10 categories in the final composite indicator.

$$\hat{C}_{k,j}^t = \frac{C_{k,j}^t - \min_j C_{k,j}^t}{\max_j C_{k,j}^t - \min_j C_{k,j}^t}$$

The final composite indicator CI is achieved by a simple arithmetic mean of these composite indicators, which means the 10 categories are equally weighted.

$$CI_j^t = \frac{1}{10} \sum_{k=1}^{10} \hat{C}_{k,j}^t$$

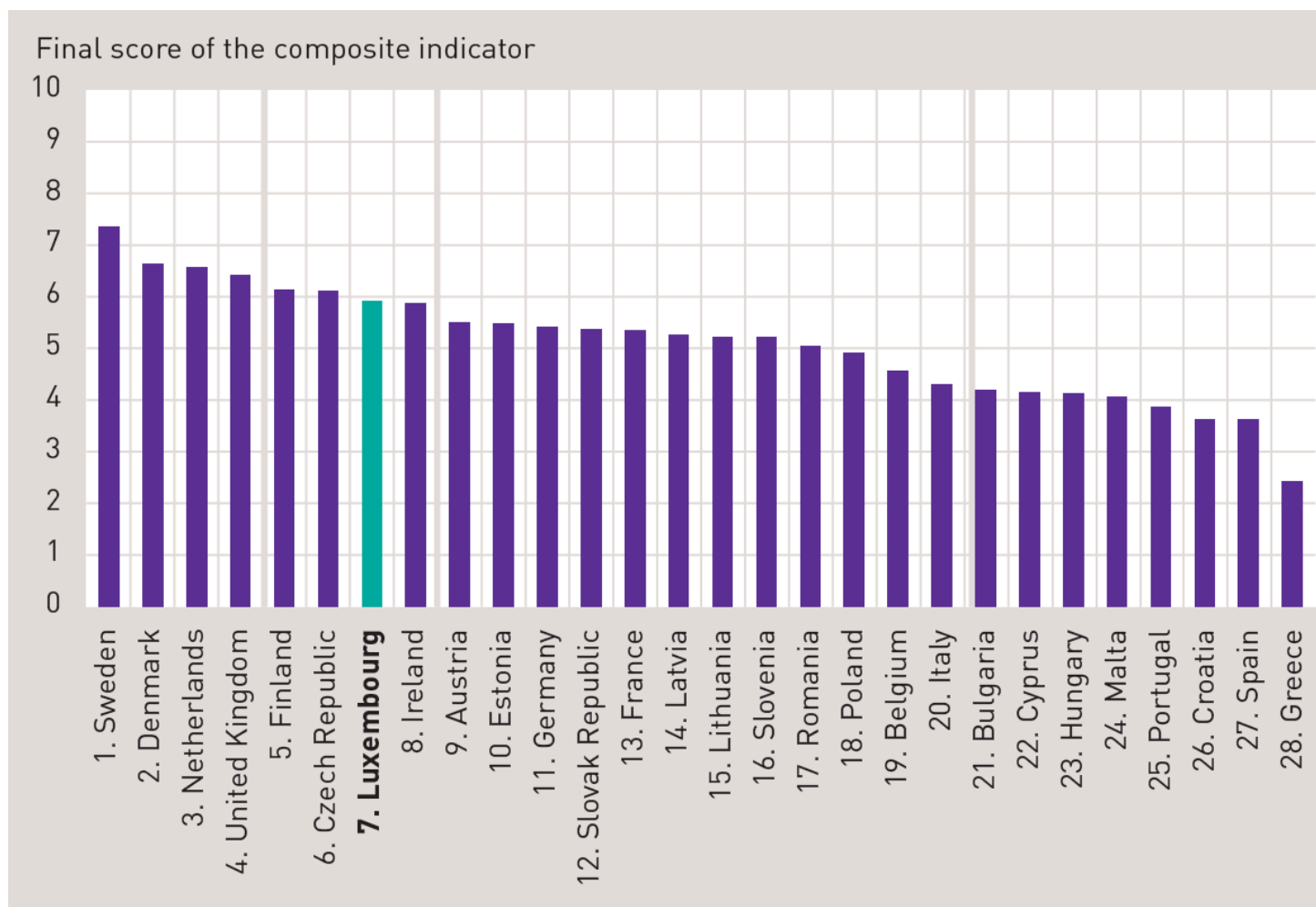
# Components of competitiveness (ranks)

- 10 categories to consider in detail different aspects of competitiveness
- The performance of each country varies in the different categories
- No country shows only good or bad performances in every domain

	Cat A	Cat B	Cat C	Cat D	Cat E	Cat F	Cat G	Cat H	Cat I	Cat J
Germany	13	3	12	17	14	27	17	4	18	19
Austria	19	8	19	4	12	21	13	6	12	16
Belgium	26	18	8	9	23	24	21	9	8	24
Bulgaria	4	17	21	13	21	4	22	28	26	17
Cyprus	23	21	14	23	13	15	19	20	17	27
Croatia	17	27	24	18	27	25	14	21	20	10
Denmark	9	4	18	2	8	26	3	3	4	21
Spain	24	26	17	22	16	17	27	19	23	12
Estonia	8	6	28	7	2	16	5	11	25	7
Finland	22	9	15	20	7	23	2	1	5	11
France	21	13	9	3	20	12	11	10	6	22
Greece	28	28	25	27	28	2	23	22	22	28
Hungary	5	16	26	26	25	22	20	16	13	13
Ireland	3	12	1	24	1	20	15	13	15	23
Italy	25	25	20	8	24	10	24	14	16	5
Latvia	20	11	23	5	9	6	12	26	24	3
Lithuania	18	10	27	12	6	1	4	25	27	8
<b>Luxembourg</b>	<b>1</b>	<b>15</b>	<b>4</b>	<b>16</b>	<b>5</b>	<b>18</b>	<b>16</b>	<b>7</b>	<b>10</b>	<b>26</b>
Malta	7	14	6	28	10	14	28	18	9	25
Netherlands	14	2	5	6	4	13	6	5	7	18
Poland	10	19	16	14	18	7	8	24	19	20
Portugal	27	20	22	21	15	8	26	17	21	15
Romania	2	24	3	1	26	3	25	27	28	1
United Kingdom	12	5	13	10	3	9	9	8	14	9
Slovak Republic	15	22	11	19	22	5	18	23	11	2
Czech Republic	11	7	7	15	17	19	10	15	3	4
Slovenia	16	23	10	25	19	11	7	12	1	14
Sweden	6	1	2	11	11	28	1	2	2	6

Note: Cat. A Macroeconomic Performance, Cat. B Employment, Cat. C Productivity and Labour Costs, Cat. D Market Operations, Cat. E Institutional and Regulatory Framework, Cat. F Entrepreneurship, Cat. G Education and Training, Cat. H Knowledge Economy, Cat. I Social Cohesion, Cat. J Environment

# The composite indicator of competitiveness (2016)



Source: Calculation *Observatoire de la compétitivité*



# Distribution of pop, gni/capita and tbco

. summarize pop rnbttete tbco, detail

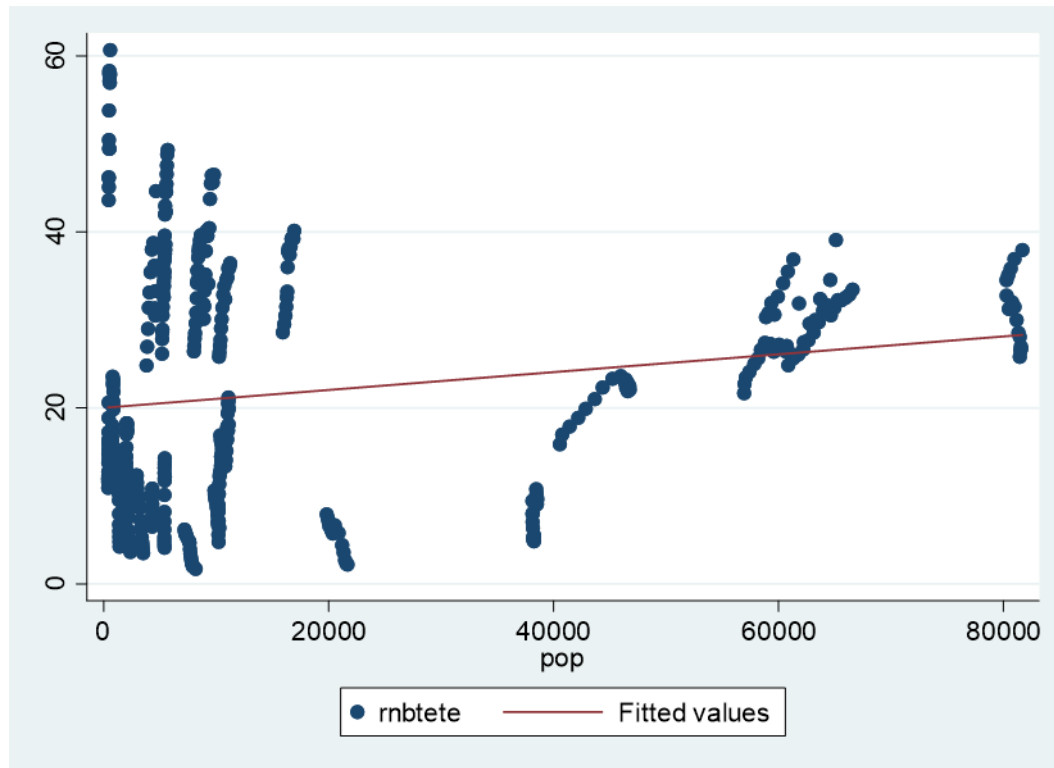
pop				
	Percentiles	Smallest		
1%	401.16	389.96		
5%	472.93	393.09		
10%	850.88	395.93	Obs	446
25%	3499.5	398.57	Sum of Wgt.	446
50%	8586.725		Mean	17792.48
			Std. Dev.	22543.87
75%	16863	Largest		
		81517		
90%	60646.4	81549	Variance	5.08e+08
95%	64974	81578	Skewness	1.537139
99%	81457	81687	Kurtosis	3.99289
rnbttete				
	Percentiles	Smallest		
1%	2.309453	1.710001		
5%	4.557513	1.999419		
10%	5.795533	2.212423	Obs	441
25%	10.17069	2.254953	Sum of Wgt.	441
50%	18.27673		Mean	21.83535
			Std. Dev.	13.35903
75%	32.26488	Largest		
		57.94423		
90%	38.75001	57.99251	Variance	178.4637
95%	45.44111	58.30182	Skewness	.513005
99%	57.71025	60.66737	Kurtosis	2.455737
tbco				
	Percentiles	Smallest		
1%	2.69315	2.28875		
5%	3.19371	2.40473		
10%	3.45508	2.55508	Obs	435
25%	3.99718	2.69079	Sum of Wgt.	435
50%	4.82975		Mean	4.902742
			Std. Dev.	1.161349
75%	5.79116	Largest		
		7.37907		
90%	6.46253	7.55522	Variance	1.348731
95%	6.99161	7.57472	Skewness	.2270156
99%	7.35053	7.94702	Kurtosis	2.2899

# Descriptives of the data set

---

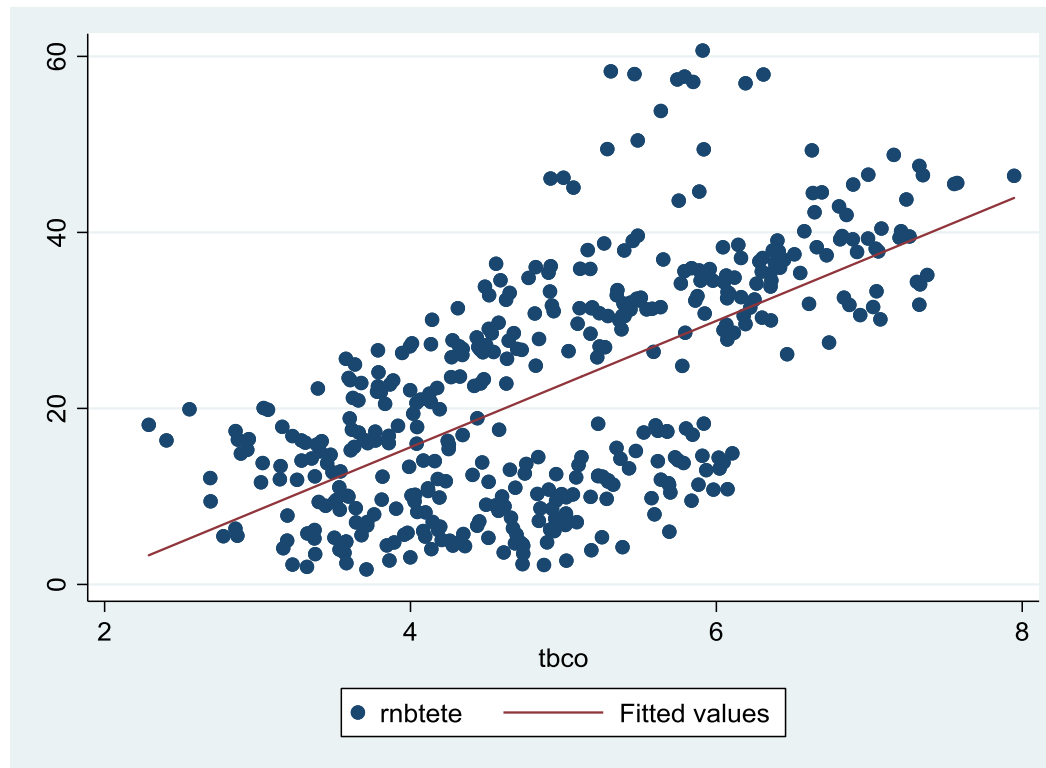
- Mean population (pop) = 17,7 mio (st error=22,5mio)
- Mean GNI/capita=21,83 (000 eur) (st.error=13,35)
- Mean competitiveness indicator tbco= 4,9 (st.error=1,16)
- Correlation: tbco and gni/capita: 0,62
- Correlation pop and gni/capita: 0,15
- Sample: 430 obs, 27 countries (Croatia excluded because of incomplete data points)

# GNI/capita and size (population)



- X-axis: population (thousand persons)
- Y-axis: GNI/capita (current prices, thousand euro)
- Slightly positive correlation between population size and Gross National Income per capita

# GNI/capita and competitiveness



- X-axis: Score Competitiveness Scoreboard (composite indicator)
- Y-axis: GNI/capita (current prices, thousand euro)
- Positive correlation between competitiveness and Gross National Income per capita

# Estimation method

---

- $GNI/head_{it} = \beta_1 POP_{it} + \beta_2 COMP_{it} + \alpha_i + u_{it}$
- $\alpha_i$  unknown intercept,  $i=1...28$  member states
- $\beta_1, \beta_2$  = coefficients
- $u_{it}$  = error term,  $t=2000-2016$
- Estimation methods: Least square dummy with country and time binary variables, Fixed effects model, Between effects, Random effects, ...

$POP_{it}$  = population in thousands

$COMP_{it}$  = competitiveness indicators (single dimensions or composite indicator)

## Pooled regression (27 countries, 2001-2016 )

---

Variable	pooldedext~d	pooldedtbc
pop	0.0000**	0.0001***
reg	9.8524***	
ent	1.2277	
soc	5.9509***	
educ	-4.6822*	
know	33.3673***	
env	-9.0701***	
tbc		7.1450***
_cons	5.9387**	-14.5441***
N	430	430
r2	0.7282	0.4109
r2_a	0.7237	0.4082

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

F-test on country dummies and year dummies, prob < 0.000:  
H0 that dummies are 0 is rejected

# GNI/capita and competitiveness components

- Regressors: basic components of the competitiveness index, except indicator "macro" containing GNI growth
- Methods: Least square dummy models and Fixed effects

Variable	extendedls~y	extendedfe
pop	-0.0003*	-0.0003
reg	4.0449***	4.0449*
ent	0.6641	0.6641
soc	3.5786***	3.5786*
educ	1.8759	1.8759
know	-0.1708	-0.1708
env	-2.5485**	-2.5485
annee		
2001	0.6513	0.6513***
2002	1.9609***	1.9609***
2003	2.2144***	2.2144***
2004	3.2782***	3.2782***
2005	4.5296***	4.5296***
2006	5.3221***	5.3221***
2007	7.0496***	7.0496***
2008	7.9860***	7.9860***
2009	5.8074***	5.8074***
2010	6.9765***	6.9765***
2011	7.4241***	7.4241***
2012	7.7880***	7.7880***
2013	8.4474***	8.4474***
2014	9.1752***	9.1752***
2015	9.7829***	9.7829***
country		
2	-18.7718*	
3	-18.6231*	
4	-45.9615***	
5	-35.2615***	
7	-12.3558	
8	-18.9593***	
9	-43.0818***	
10	-20.3313*	
11	-6.4917**	
12	-31.4836***	
13	-40.5810***	
14	-21.6006*	
15	-8.9729**	
16	-42.2439***	
17	-44.2828***	
18	-2.9354	
19	-40.0003***	
20	-15.5510*	
21	-34.3694***	
22	-34.3337***	
23	-39.2214***	
24	-5.0985*	
25	-41.7432***	
26	-38.6258***	
27	-13.2720	
28	-39.2760***	
_cons	43.8737***	17.5099***
N	430	430
r2	0.9855	0.7742
r2_a	0.9837	0.7620

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

Variable	facomp	tbco
pop	-0.0003*	-0.0004**
reg	4.0449***	
ent	0.6641	
soc	3.5786***	
educ	1.8759	
know	-0.1708	
env	-2.5485**	
country		
Autriche	-18.7718*	-23.7319**
Belgique	-18.6231*	-23.6045**
Bulgarie	-45.9615***	-52.0902***
Chypre	-35.2615***	-39.3940***
Danemark	-12.3558	-17.2214
Espagne	-18.9593***	-22.1375***
Estonie	-43.0818***	-49.7015***
Finlande	-20.3313*	-25.1708**
France	-6.4917**	-7.3172***
Grece	-31.4836***	-36.9528***
Hongrie	-40.5810***	-46.4993***
Irlande	-21.6006*	-25.0869**
Italie	-8.9729**	-12.5135***
Lettonie	-42.2439***	-50.5559***
Lituanie	-44.2828***	-50.3806***
Luxembourg	-2.9354	-6.8838
Malte	-40.0003***	-43.9359***
Pays-Bas	-15.5510*	-19.2207*
Pologne	-34.3694***	-37.6545***
Portugal	-34.3337***	-39.6197***
Roumanie	-39.2214***	-47.2738***
Royaume-Uni	-5.0985*	-6.4015*
Slovaquie	-41.7432***	-47.5706***
Slovénie	-38.6258***	-43.4335***
Suède	-13.2720	-19.5695*
républiqu..	-39.2760***	-44.5143***
annee		
2001	0.6513	0.9894
2002	1.9609***	1.9513***
2003	2.2144***	2.2598***
2004	3.2782***	3.4059***
2005	4.5296***	4.3979***
2006	5.3221***	5.3956***
2007	7.0496***	6.9339***
2008	7.9860***	7.6023***
2009	5.8074***	5.7992***
2010	6.9765***	6.9017***
2011	7.4241***	7.5058***
2012	7.7880***	7.7028***
2013	8.4474***	7.9586***
2014	9.1752***	8.6709***
2015	9.7829***	9.8154***
tbco		0.7436***
_cons	43.8737***	50.4504***
N	430	430
r2	0.9855	0.9841
r2_a	0.9837	0.9824

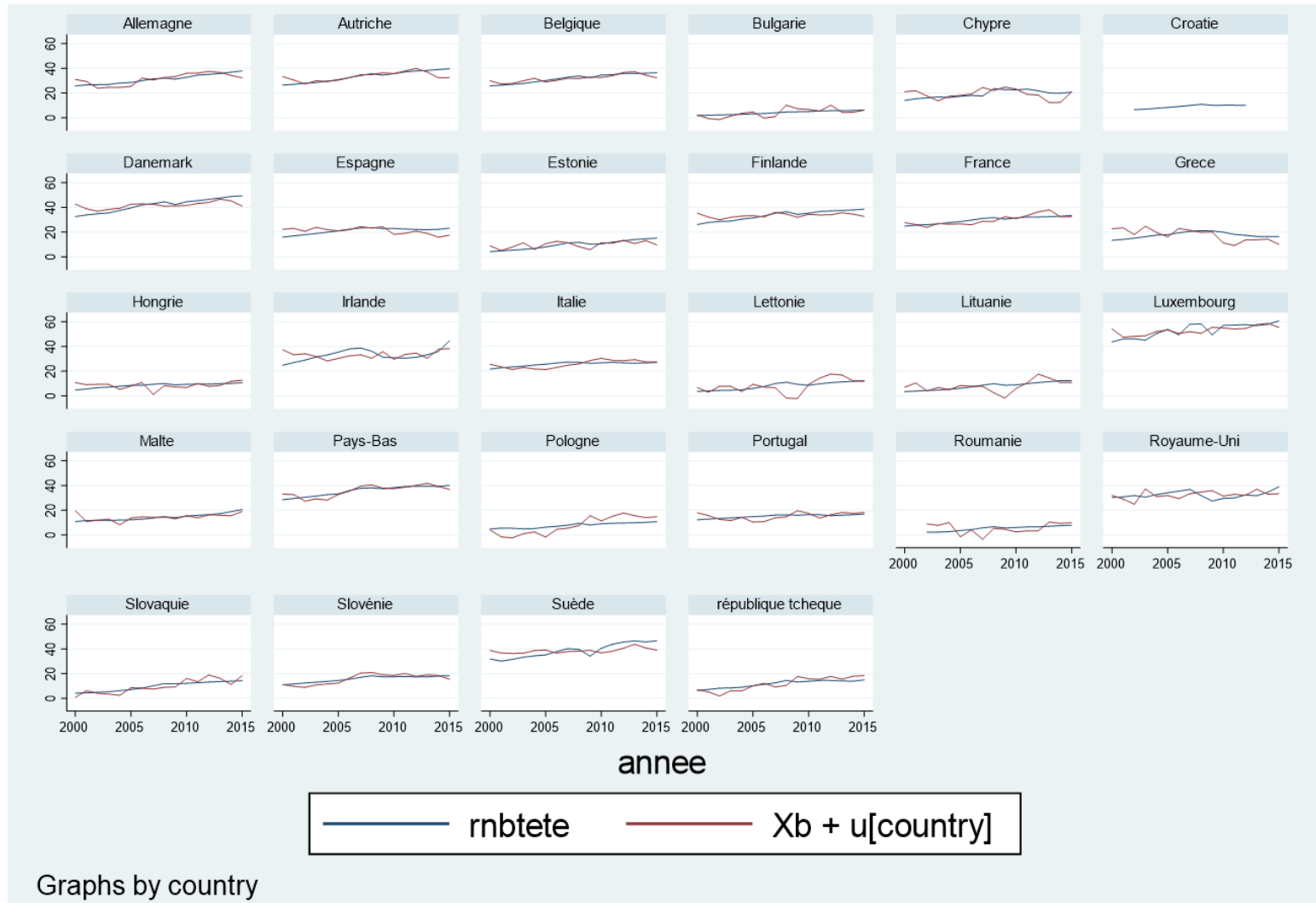
legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

# Results of estimations (fixed effects, random effects, between, gls)

Variable	fix	ran	be	gls
pop	-0.0004	0.0002**	0.0001	0.0001***
tbco	0.7436	3.2911***	7.9848***	7.0664***
annee				
2001	0.9894***			2.6378
2002	1.9513***			4.1680
2003	2.2598***			2.9977
2004	3.4059***			4.6807
2005	4.3979***			4.9953
2006	5.3956***			5.0302
2007	6.9339***			6.1080*
2008	7.6023***			6.5071*
2009	5.7992***			3.9193
2010	6.9017***			5.0904
2011	7.5058***			5.2208
2012	7.7028***			3.9779
2013	7.9586***			4.3400
2014	8.6709***			5.9971*
2015	9.8154***			7.1846**
_cons	19.4727**	1.8669	-18.7037	-18.7144***
N	430	430	430	430
r2	0.7523		0.4499	
r2_a	0.7421		0.4040	

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

# Estimated vs actual GNI/capita by size and competitiveness (between regression)



# Some conclusions and more questions

---

- Size does not seem to play a major role, competitiveness is key
- Good news for small countries
- **But more work needs to be done:**
  - Explore other measures of size and competitiveness and performance
  - Explore clusters of countries (Eurozone members, tax profiles, ...)
  - Explore other competitiveness benchmarks (WEF, IMD, ...)

# Thank you for your attention



LE GOUVERNEMENT  
DU GRAND-DUCHÉ DE LUXEMBOURG  
Ministère de l'Économie

Observatoire de la compétitivité



L-Università  
ta' Malta

STATEC



UNIVERSITÉ DU  
LUXEMBOURG

LUXEMBOURG  
LET'S MAKE IT HAPPEN