26th October, 2017, Belgrade, Serbia
organized by
Institute of Economic Sciences, Belgrade and Faculty of Economics, Niš

9th International Scientific Conference
SUSTAINABLE GROWTH IN SMALL OPEN ECONOMIES

ENVIRONMENTAL TAX AND COMPETITIVENESS OF EUROPEAN COUNTRIES THROUGH THE LENS OF PORTER HYPOTHESIS

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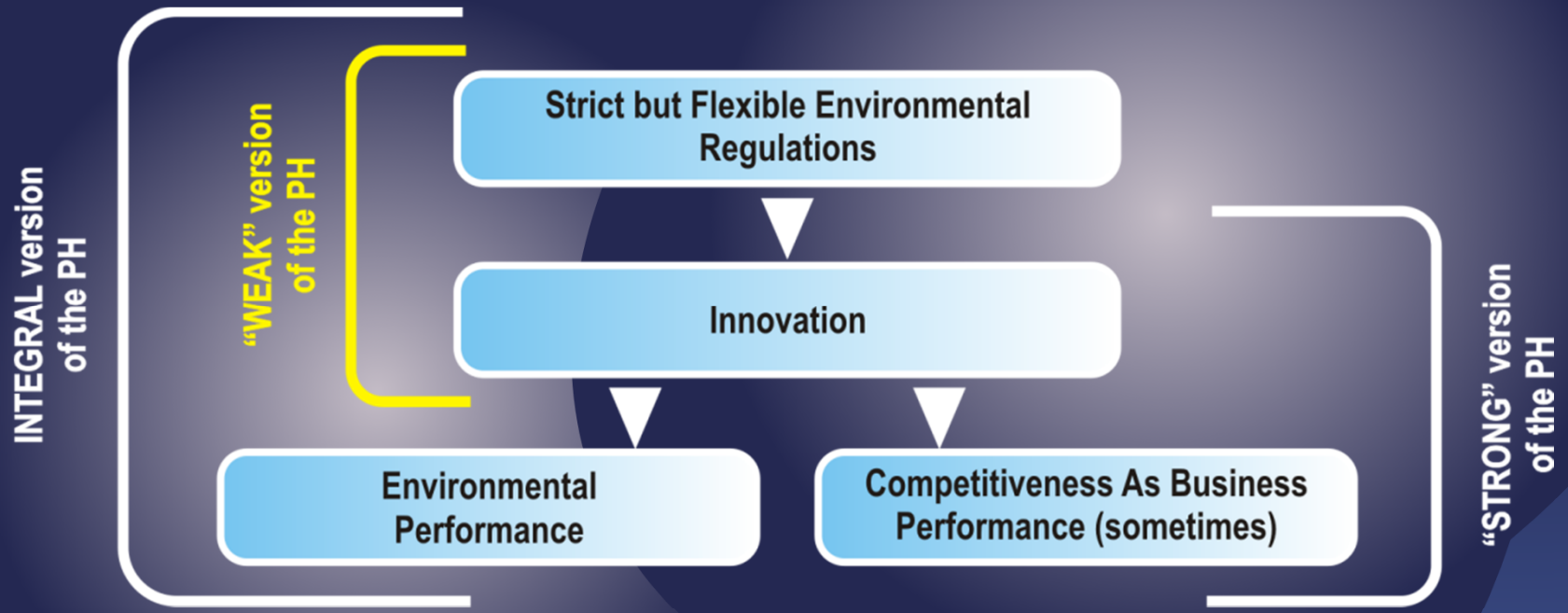
Introductory considerations

- In accordance with Porter hypothesis (PH), the paper investigates empirical proofs of positive relation between current environmental taxes on the example of 34 European countries and their innovation capacity.

- The aim of the paper is to examine the connection between a) environmental taxes as one of the forms of strict ecological regulation in European countries and b) innovation capacity of the countries expressed by the values of sub-index GCI - Innovation and sophistication factors.

- In accordance with the proposed model this would imply testing of the so-called weak part of PH.

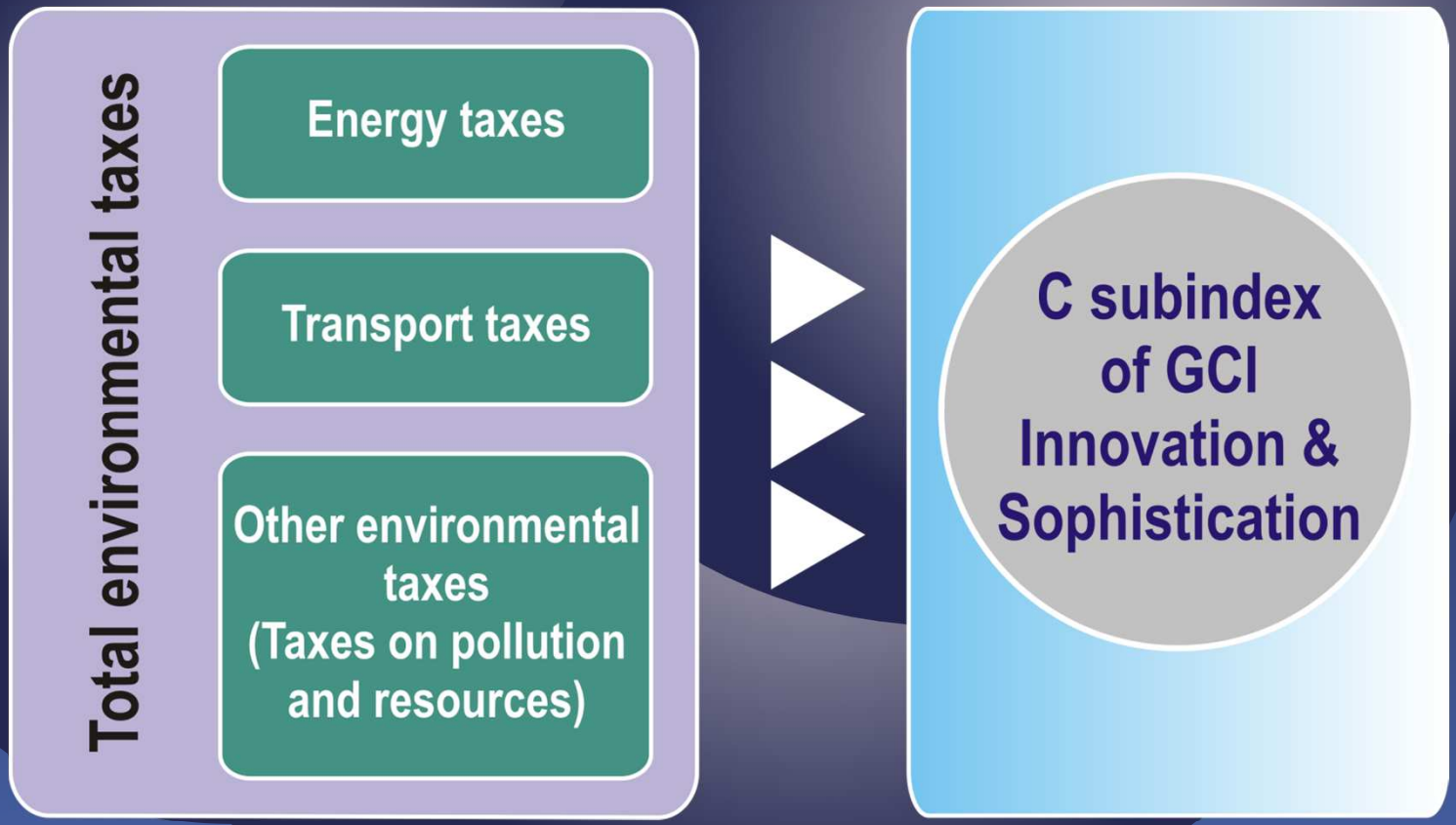
Porter's hypothesis - PH



PH assumes positive effects of:
- regulation on eco-innovation
- eco-innovation on competitiveness

Environmental taxes impact on inovations

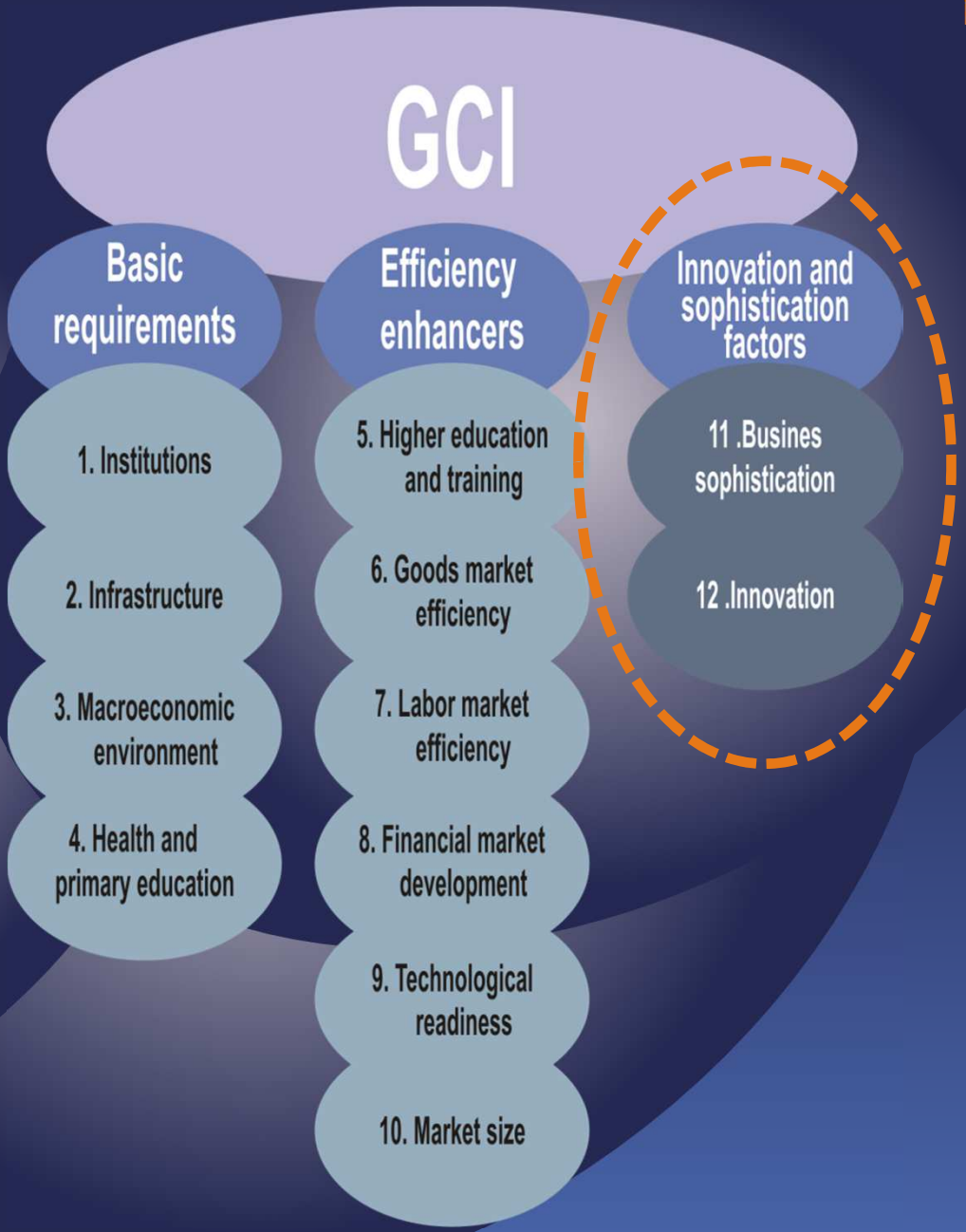
(as component og GCI)



Total environmentlal taxes as percentage of total revenues from taxes and social contributions (excluding imputed social contributions)

GCI (WEF) framework

(and GCI.C subindex of Innovation & sophistication)



Research

The research is focused on:

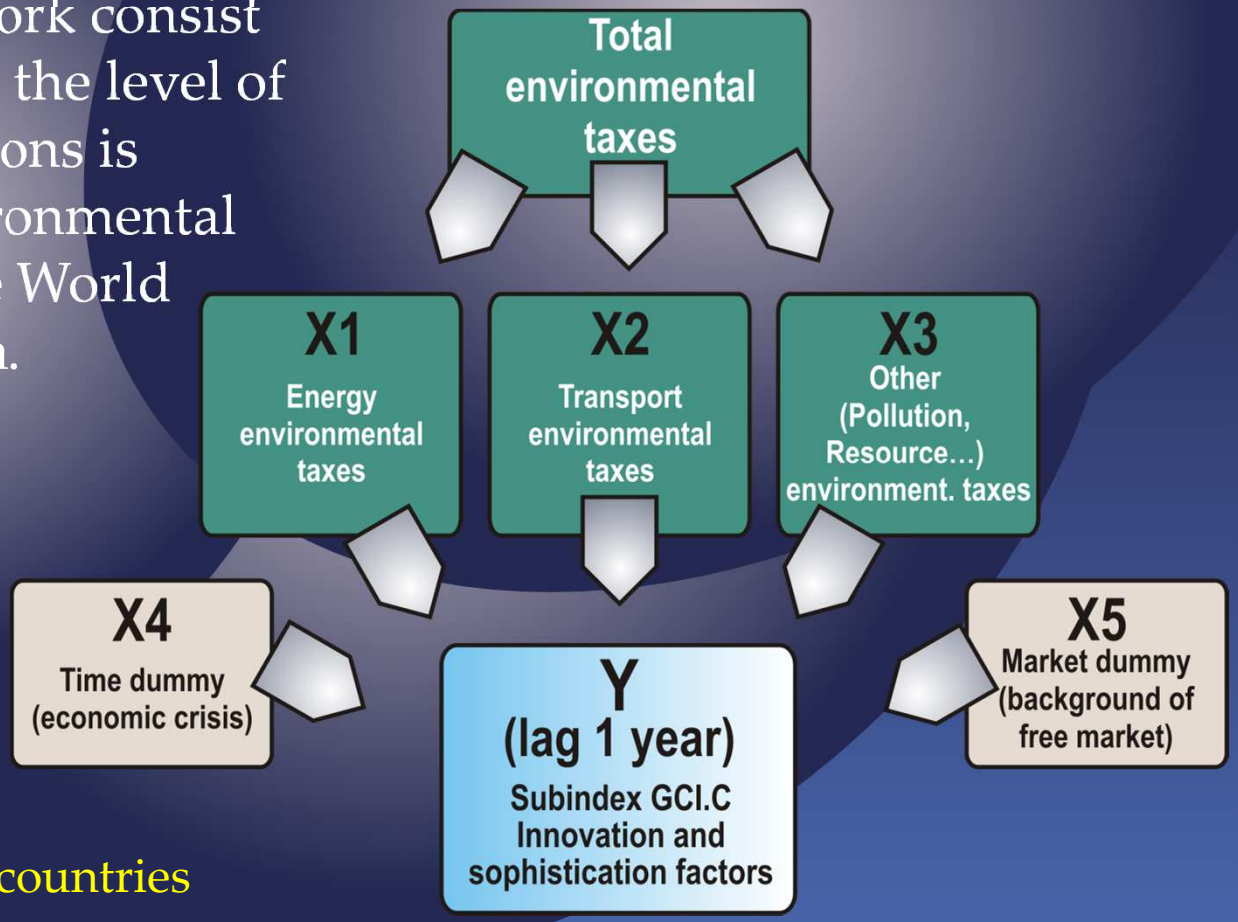
1. Europe countries group (32 countries);
2. Time perod 2006-2016 (last decade)
3. Time lag of +1 year for depend variable

Scope of reserch 2006 - 2016

Model

* Environmentlal taxes as percentage of total revenues from taxes and social contributions (excluding imputed social contributions

- The basis for defining innovativeness is WEF's GCI.C subindex (GCI framework consist of 3 sub-indices), while the level of environmental regulations is quantified by the Environmental taxes*, according to the World Bank and Eurostat data.



* X4 is 1 for crisis years
* X5 is 1 for post- transition countries

The main hypothesis

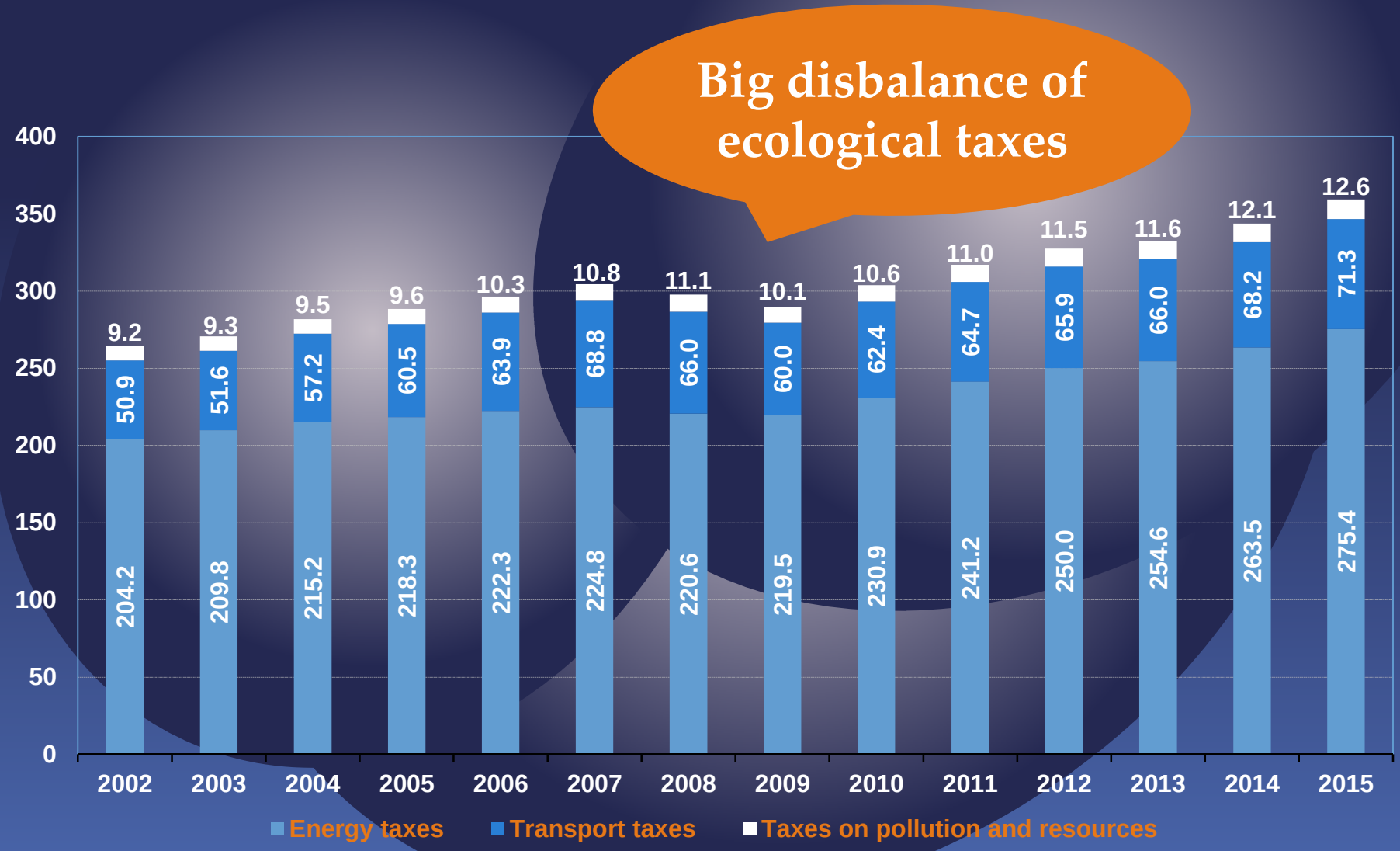
H0: Increasing levels of national environmental tax: Energy taxes (X1), Transport taxes (X2) and Other environmental taxes (pollution, resources, …) (X3) has a desirable positive and synergic influence on the exogenous variable – GCI Innovativeness & Sophistications subindex (Y).

$$Y = a_0 + a_1*X_1 + a_2*X_2 + a_3*X_3 + (a_4*X_4 + a_5*X_5)$$

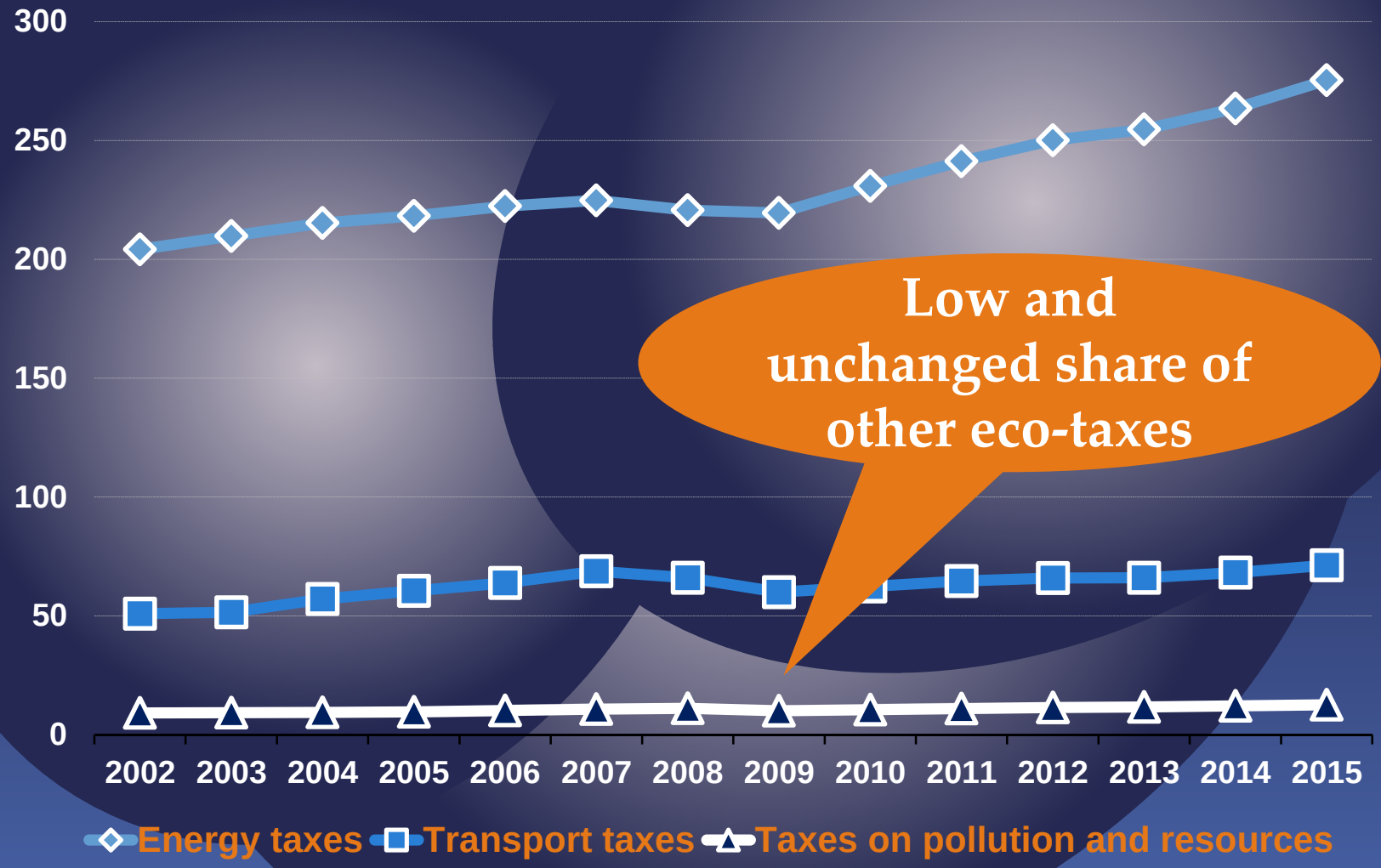
- Y (the dependent variable) – GCI *Innovativeness & Sophistications*;
- X_1 (independent variable 1) – *Energy taxes ;*
- *X2 (independent variable 2) – Transport taxes ;*
- *X3 (independent variable 3) – Other environmental taxes (pollution, resources, …);*
- *X4 (dummy variable 3) – Time dummy (economic crisis);*
- *X5 (dummy variable 3) – Market dummy (historical background of countries free market)*
- a_i (i = 0 - 5) – are constants acquired from multiple regression process.

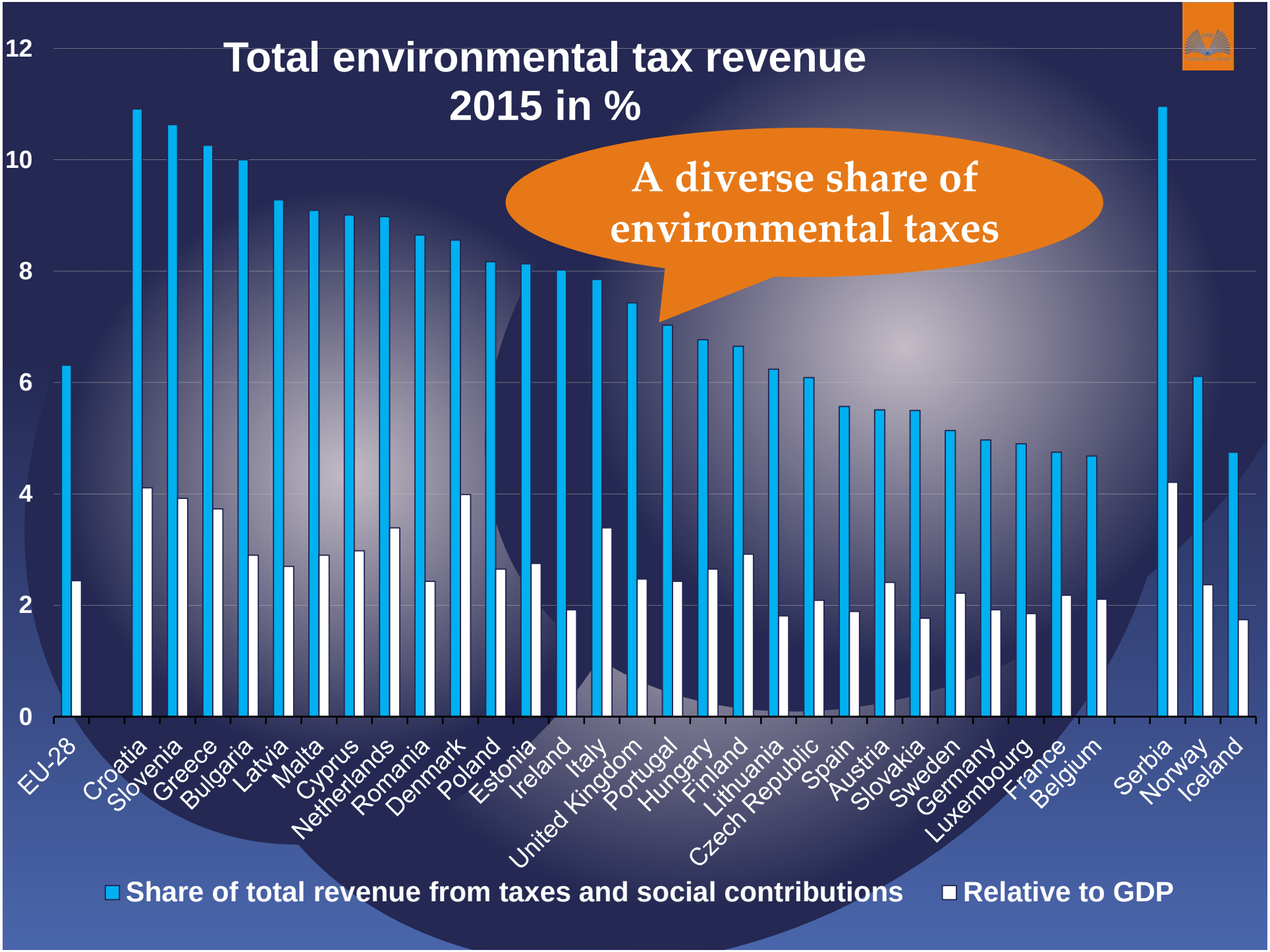
Research background

Total environmental tax revenue by type of tax, EU-28, 2002–15 (billion EUR)



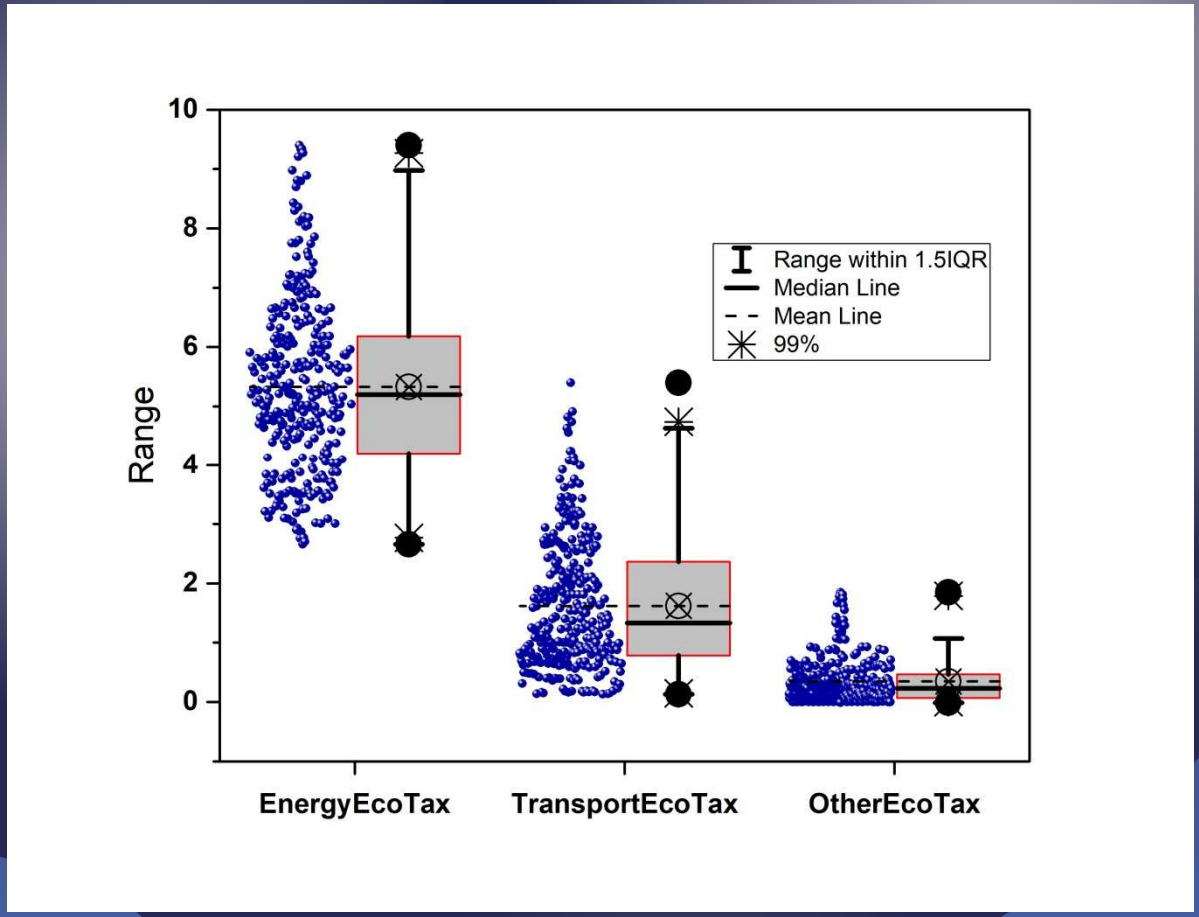
Total environmental tax revenue by type of tax, EU-28, 2002–15 (billion EUR)



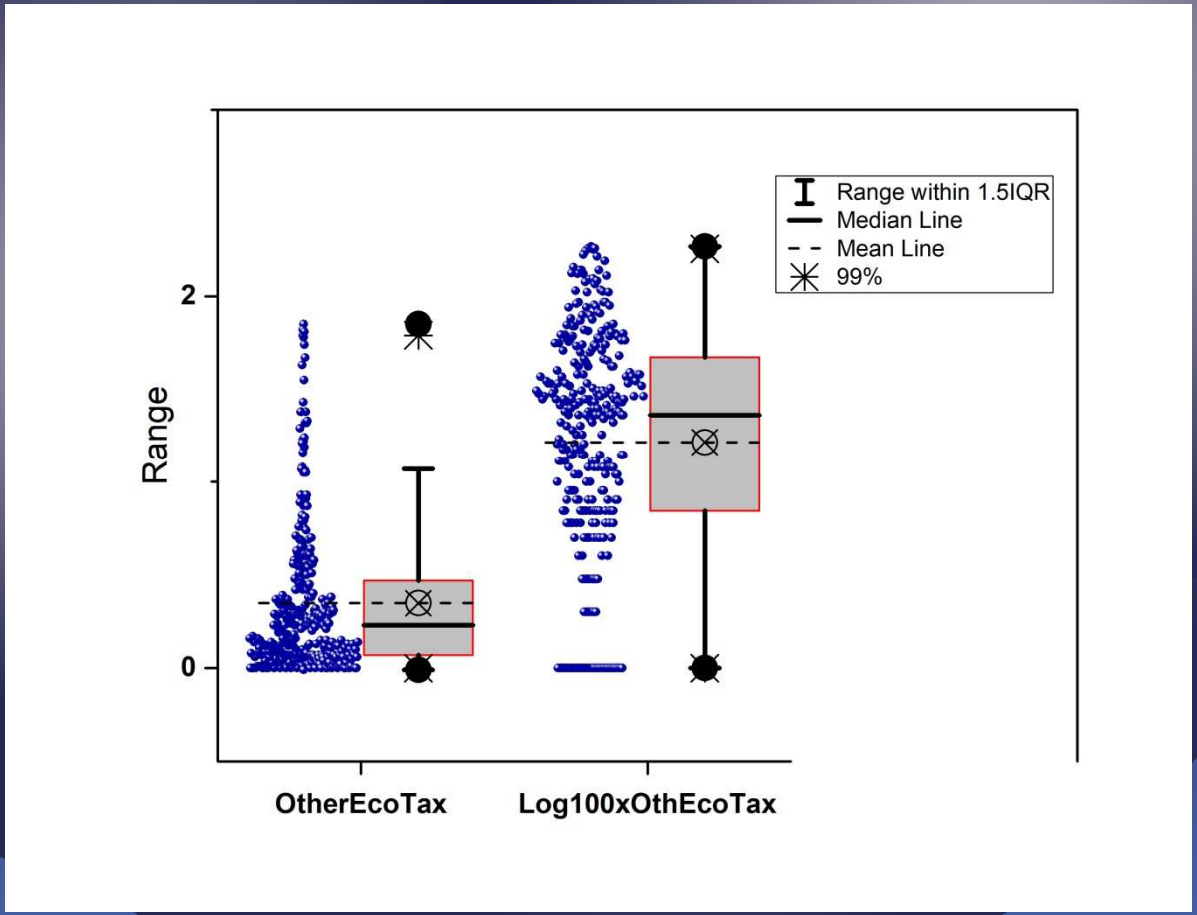

Total environmental tax revenue
2015 in %
A diverse share of environmental taxes
12
10
8
6
4
2
0
EU-28
Croatia
Slovenia
Greece
Bulgaria
Latvia
Malta
Cyprus
Netherlands
Romania
Denmark
Poland
Estonia
Ireland
Italy
United Kingdom
Portugal
Hungary
Finland
Lithuania
Czech Republic
Spain
Austria
Slovakia
Sweden
Germany
Luxembourg
France
Belgium
Serbia
Norway
Iceland
Share of total revenue from taxes and social contributions
Relative to GDP

Research results

Descriptive statistics for X1, X2 and X3



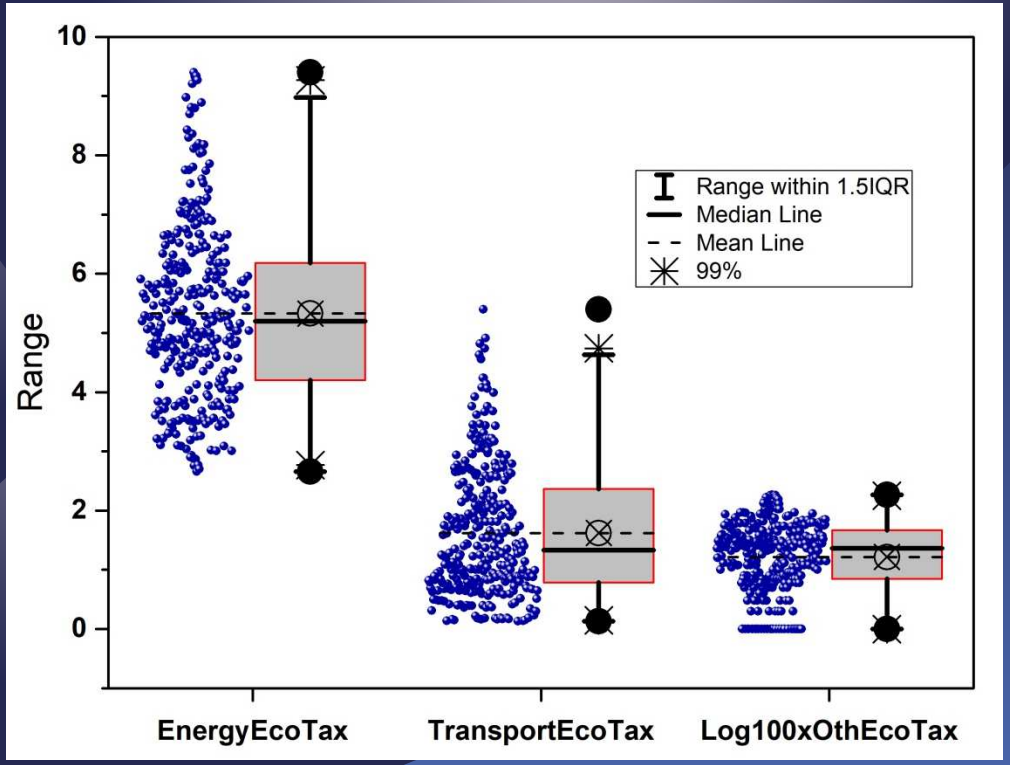
*Descriptive statistics for X3 before and after logarithmic transformation (X vs. Log(100*X))*



Descriptive statistics for X1, X2, X3

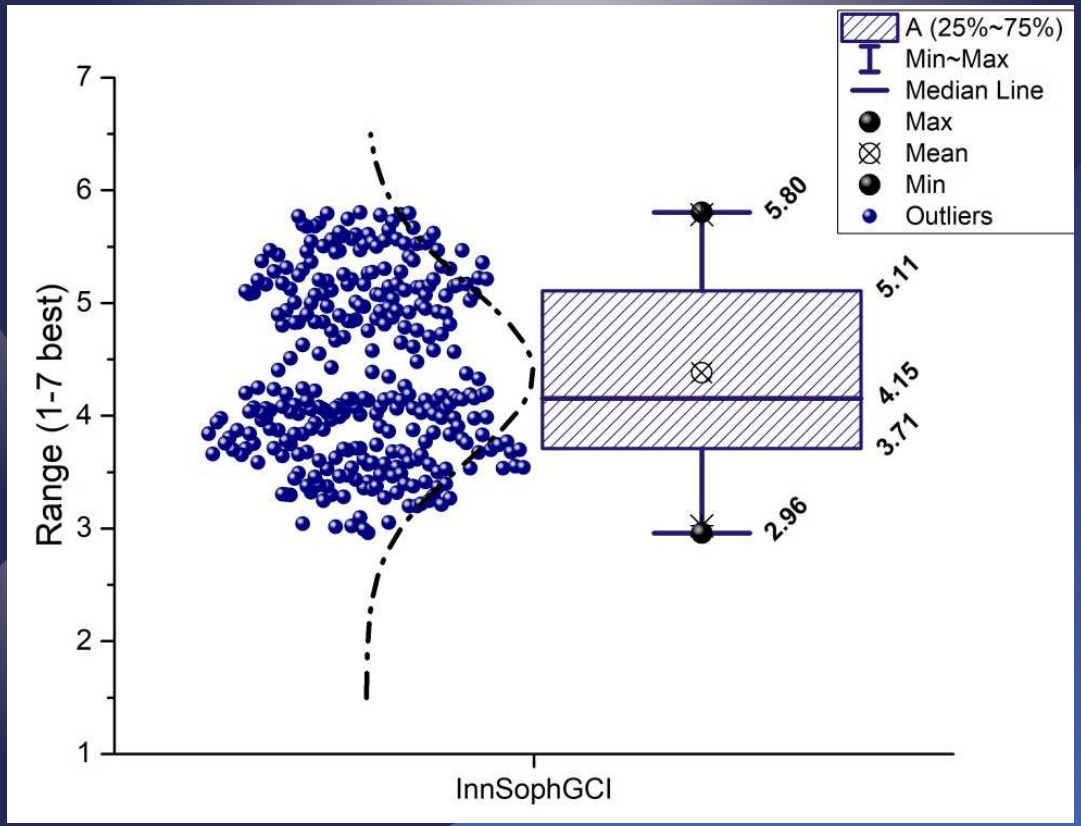
Variable	Obs	Mean	Std. Dev.	Min	Max
X1-EnergyEcoTax	320	5.35	1.48	2.66	9.40
X1-TransportE~x	320	1.62	1.09	0.13	5.40
X1-Log100xOth~x	320	1.22	0.62	0.00	2.27

Multicollinearity	X1	X2
X1- EnergyEcoTax	1	
X2- TransportE~x	-0.34	1
X3- OtherEcoTax	0.19	0.17



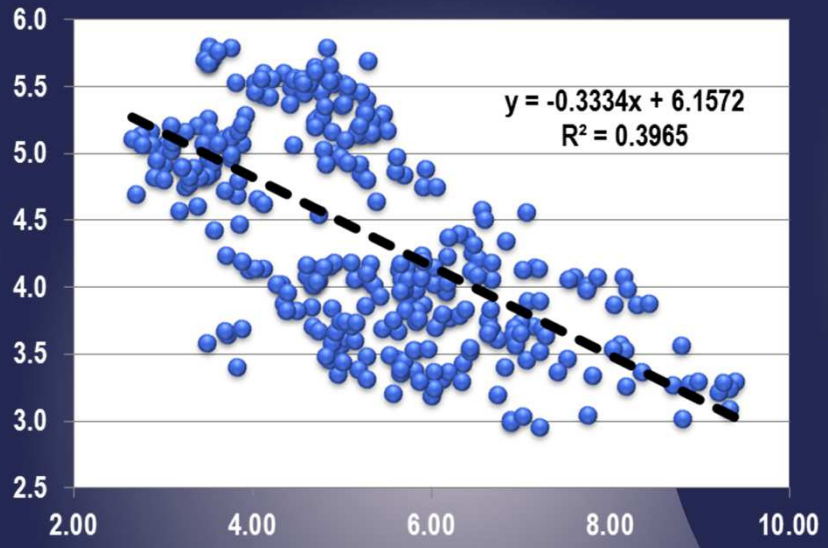
Descriptive statistics for Y – GCI Innovation and sofistication (1-7 best)

Variable	Obs	Mean	Std. Dev.	Min	Max
Y- InnSophGCI	320	4.38	0.78	2.96	5.8

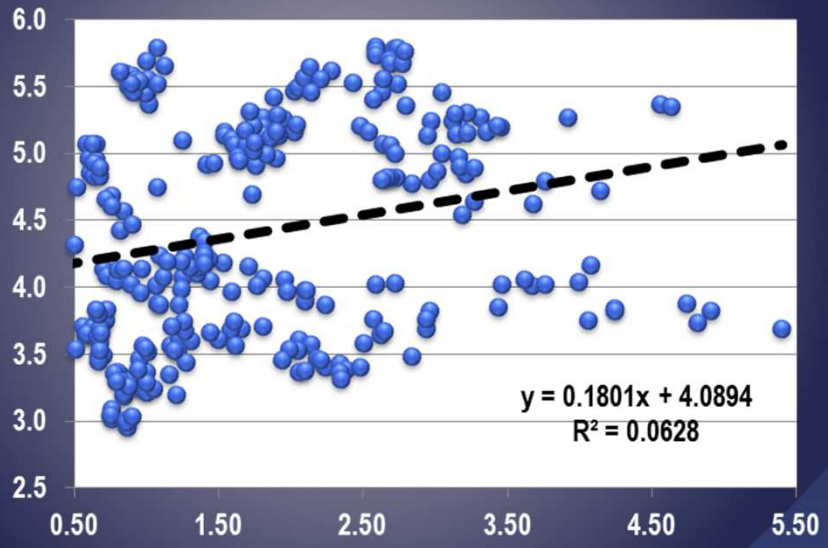


Single regression

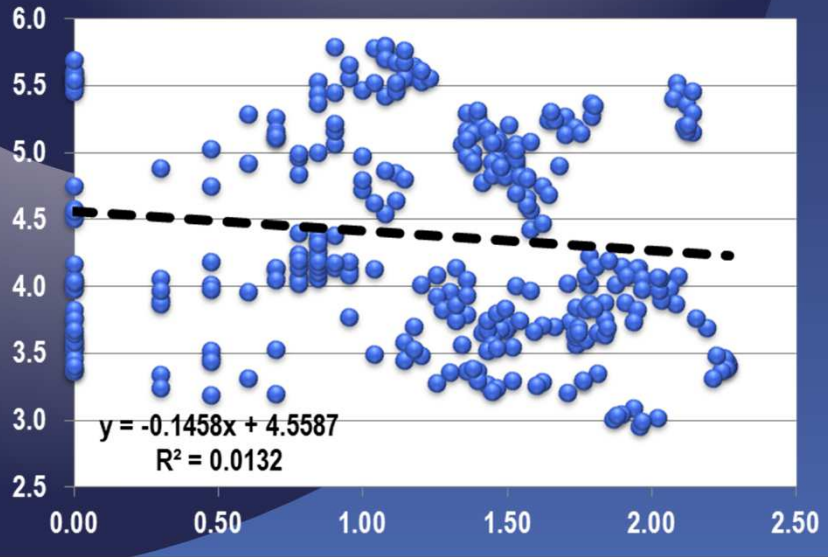
X_1 (Energy environmental taxes) – GCI Innovation and sofistication;



X_2 (Transport environmental taxes) – GCI Innovation and sophistication;



X_3 (Other: pollution, resource…; environmental taxes) – GCI Innovation and sofistication;



Single regression

EU28 + Serbia, Norwey, Iceland

↑ Energy eco taxes **increase** ⇒ **indicate** ↓↓ **stronger** *Innovation& sophistication* **decrese**

↑ Transport eco taxes ⇒ ↑ has no statistical significance *Innovation& sophistication* **increase**

↑ Other: pollution, resource…; eco taxes) ⇒ ↓ has no statistical significance *Innovation& sophistication* **decrese**

Multiple panel data linear regression

Random-effects GLS regression — Number of obs = 320

Group variable: rb — Number of groups = 32

R-sq: within = **0.1135** — Obs per group: min = 10

between = **0.5302** — avg = 10.0

overall = **0.5214** — max = 10

Wald chi2(5) = 73.37

corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

Y - InnSophGCI	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
X1 - EnergyEcoTax	-0.031	0.011	-2.830	0.005	-0.052	-0.031
X2 - TransportEcoTax	0.043	0.021	2.030	0.043	0.001	0.043
X3 - Log100xOthEcoTax	0.091	0.046	1.950	0.051	-0.001	0.091
X4 - DummyEcoCris	-0.074	0.016	-4.550	0.000	-0.106	-0.074
X5 - DummyHistory	-1.079	0.193	-5.580	0.000	-1.458	-1.079
_cons	4.785	0.149	32.070	0.000	4.493	4.785
sigma_u	.516					
sigma_e	.113					
rho	.954	(fraction of variance due to u_i)				

Hausman fixed vs. random test

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
EnergyEcoTax	-.0279188	-.0308781	.0029593	.0006633
TransportE~x	.0514064	.0430829	.0083235	.004253
Log100xOth~x	.0847077	.09053	-.0058223	.0129243
DummyEcoCris	-.074394	-.0742909	-.000103	.

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 6.85

Prob>chi2 = 0.1443

https://www.princeton.edu/~otorres/Panel101.pdf

Multiple regression

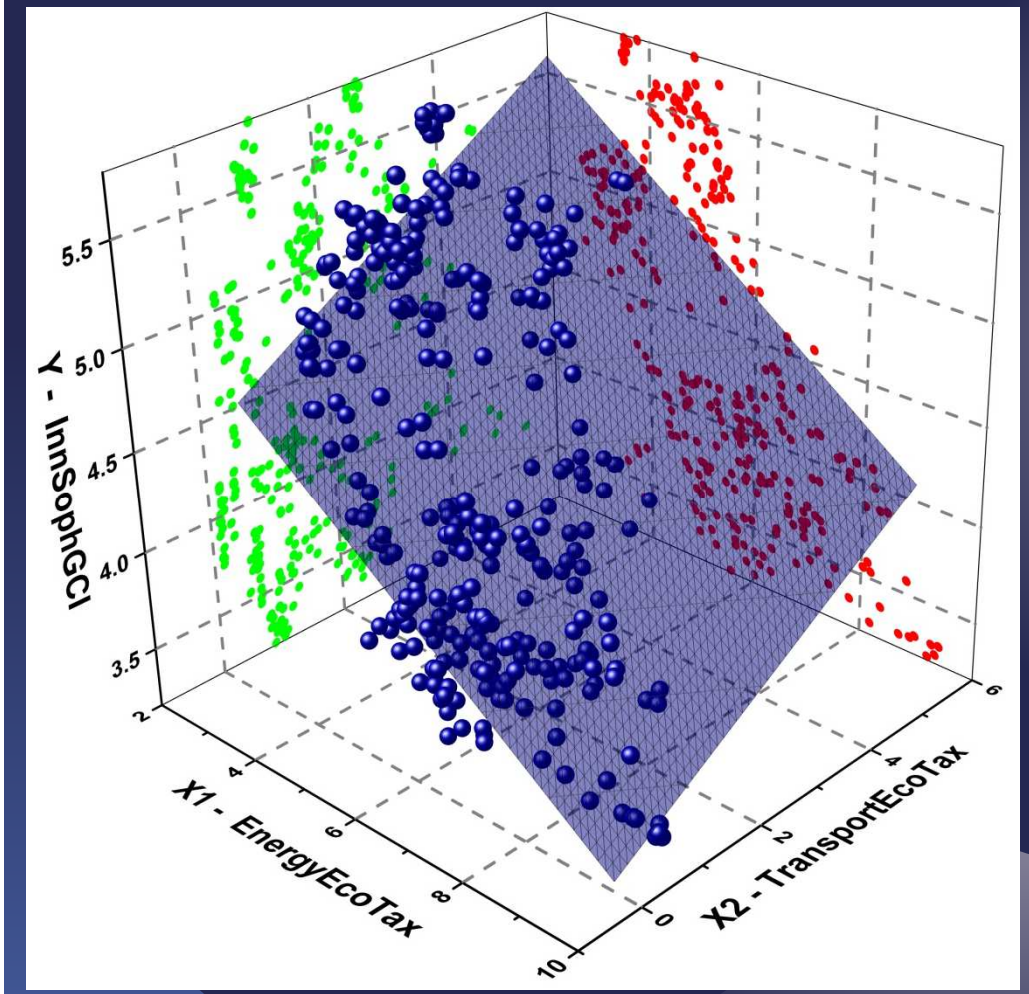
EU28 + Serbia, Norwey, Iceland

↑ Energy eco taxes **increase** ⇒ **indicate** ↓ **less strong** *Innovation& sophistication* **decrese**

↑ Transport eco taxes ⇒ ↑ **less strong** *Innovation& sophistication* **increase**

↑ Other: pollution, resource…; eco taxes) ⇒ ↑↑ **stronger** *Innovation& sophistication* **increase**

3D for X1, X2, Y



The obtained results refer to the conclusion that environmental taxes have statistically significant but contradictory influence of the sub-index **GCI - Innovation and sophistication factors** in European counties during the selected time interval. While **Energy taxes** have a slightly negative influence, the other two independent variables **a) Transport taxes** and **b) Other environmental taxes** (but in transformation log(1 00*X)) have somewhat stronger positive effect on the innovation component of global competitiveness as a dependent variable.

$$Y_{it+1} = -0.031\ X1_{it} + 0.043\ X2_{it} + 0.091\ X3_{it} - 0.074\ X4_{t+1} - 1.079\ X5_{i} + 4.785 + c_i + u_{it}$$

R^2 overall = 0.5214

Conclusion

- The results of research at this stage show that it is possible to generate the initial model for explanation of the effect of environmental taxes on the innovation potential of European countries.
- Nevertheless, this phase is characterised by a relatively small time series as well as a small granulation of the presented environmental taxes as independent variables.
- Results are preliminary and further research is necessary for generalisation of conclusions in accordance with PH.
- The confirmation of this hypothesis can be significant for the creators of economic policies, especially in the light of current ecological and also wider aspirations towards the sustainable development (sustainable development policies in EU).

"The conservation of natural resources is the fundamental problem. Unless we solve that problem it will avail us little to solve all others"

Theodore Roosevelt

The environment is everything that isn't me.

Albert Einstein

Thank you for your attention

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