Institutional quality, environmental policy and productivity in EU

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Motivation (i)

- The EC has established at the end of 2014 the toughest climate change target of any region in the world: greenhouse gas emission has to be cut by 40% and 27% of total energy production has to be from renewable sources before 2030.

- The EU is well on track towards meeting its targets for cutting greenhouse gas emissions both under its own internal target in the Europe 2020 Strategy and under the Kyoto Protocol's second commitment period (2013-2020).

- What is the effect of tight environmental legislation on competitiveness?

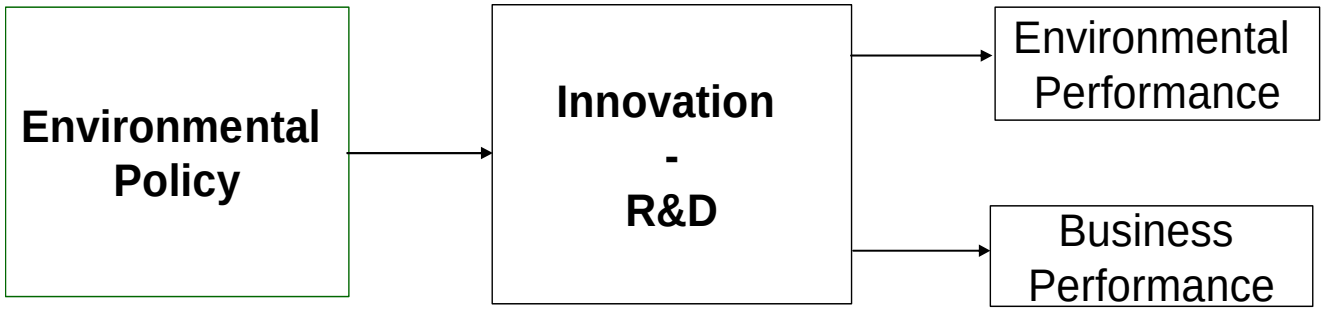
Motivation (ii)

- The conventional perception about environmental protection is that it imposes additional costs on firms, which may reduce their global competitiveness with negative effects on growth and employment.

- But Porter and Van der Linde (1995) found that more stringent environmental policies can stimulate innovations that may over-compensate for the costs of complying with these policies.

- The Porter hypothesis suggests that "*clean air*" and competition are not incompatible since properly designed environmental regulation can stimulate innovation which in turn will increase competitiveness.

The «Porter hypothesis»



Three variants of the PH (Jaffe et al, 2005):

- "*weak*": environmental regulation will stimulate certain kinds of environmental innovations, although there is no claim that the direction or rate of this increased innovation is socially beneficial.

- "*narrow*": flexible environmental policy regimes give firms greater incentive to innovate than prescriptive regulations, such as technology-based standards.

- "*strong*": more stringent environmental policy may induce innovation that may compensate (or more than compensate) for the cost of complying with it.

Motivation (iii)

- Pollution is a negative environmental externality, while innovation is a positive externality.
- Therefore, without a public intervention to manage these two market failures, firms pollute too much and innovate too little compared with the social optimum.
- As such, investments and thus, innovation to develop “green” technology are likely to be below the social optimum because, for them, the two market failures are mutually reinforcing. (Jaffe et al 2014).
- Thus the big challenge for the policymakers is to stimulate environmental innovation to enhance productivity growth in a credible framework.
    - As environment is often described as a collective good, the problem of maintaining a sustainable environment (tight environmental regulation) can be interpreted as a problem of collective action due to the conflict between individuals (firms) and collective rationality (institutions).

Literature (i)

- This paper relates to at least two different strands of literature: one related to the “Porter hypothesis” and the other on the influence of institutional quality and trust on environmental policy.

- Empirical investigation of the consequences of environmental regulation on productivity at the macroeconomic level is rather scant, heterogeneous and mostly developed in the context of international trade (Lanjouw and Mody, 1996; Popp, 2006; De Vries and Withagen, 2005).

- In a very recent paper, Albrizio et al (2014) look at the effects of environmental stringency policy changes on productivity growth in the OECD countries.

- The effect and importance of institutional quality for environmental sustainability has been discussed in many empirical and theoretical papers (i.e. Pellegrini 2006, Etsy et al 2005)

Aim and assumptions

- We investigate empirically the mechanisms trough which the quality of Institutions affects the effectiveness of public policies in enhancing productivity and innovation.

- Our main assumption is that the quality of Institutions might work as catalysts to strengthen the effect of environmental policy on firms' productivity and propensity to innovate.

    - institutional quality can be a solution for solving collective action problems and make the environmental policy more effective (Gärling et. al. 2002).
    - environmental policy might improve productivity fostering technological innovation.

What is new?

- We investigate the impact of environmental policy stringency indicators on productivity and innovation adopting a cross-country perspective.

- Country level studies are more suitable for international policy-making compared to industry or firm level studies as they usually provide very context-specific conclusions.

- We test the PH looking at the impact of both “command and control” and “market based” environmental policy instruments on productivity and innovation (ICT and R&D).

- To the best of our knowledge, this is the first analysis investigating the interplay between environmental regulation and institutional quality in determining the economics performance of regulated countries.

The data (i)

- Our analysis covers 10 EU countries (Austria, Belgium, Germany,, Spain, Finland, France, Italy, The Netherlands, Sweden, UK) over the period 1995-2008. Annual data are from OECD and EUKLEMS.

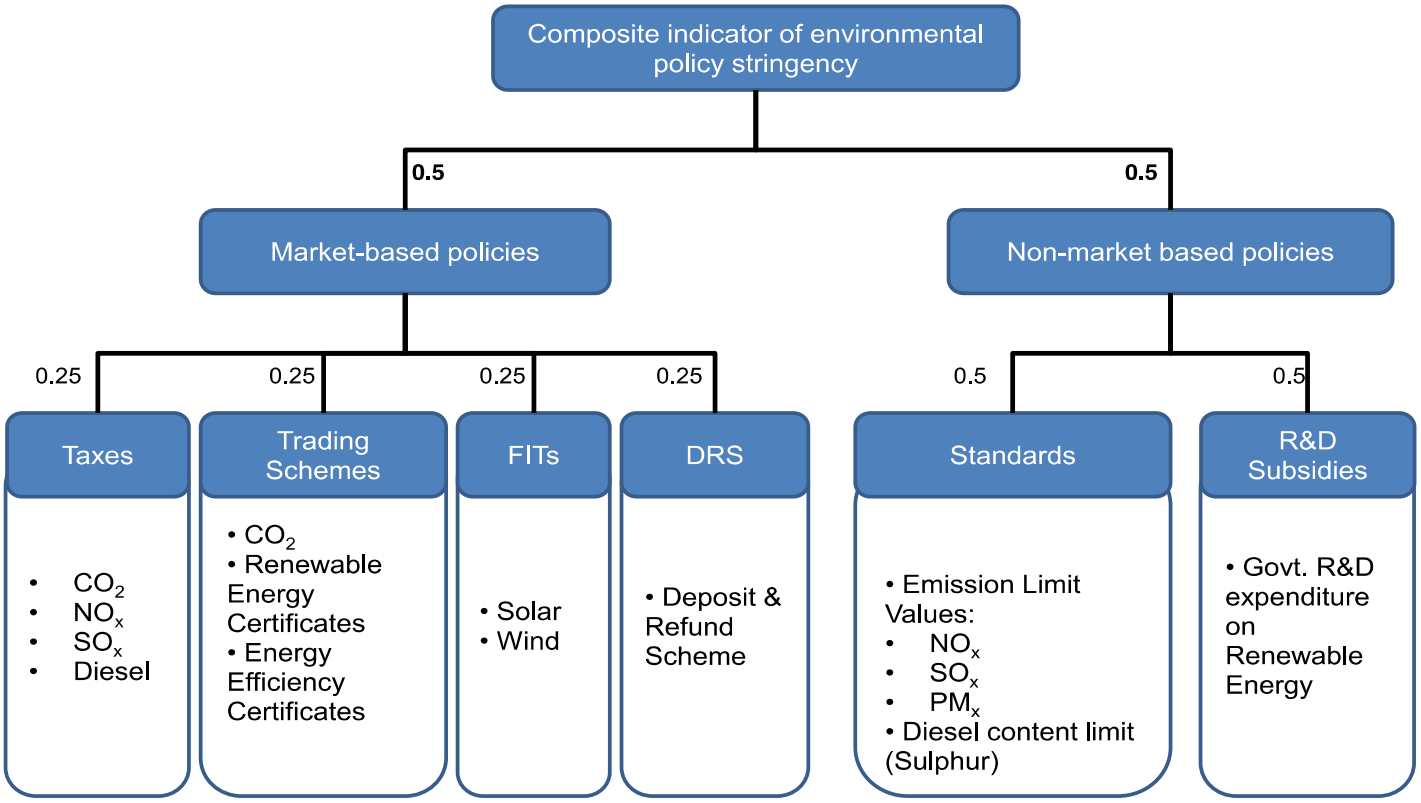
- As for environmental policy indicators we use the new Environmental Policy Stringency (EPS) index, developed for the OECD countries by Botta and Koźluk (2014).

- The EPS is a composite indicator based on the aggregation of quantitative and qualitative information on selected environmental policy instruments into one comparable, country-specific proxy of environmental policy stringency. The EPS covers 24 OECD countries over the period 1990-2012.

- Data for Institutional quality, control of corruption, regulatory quality, voice and accountability, government effectiveness and political stability are taken from the World Bank Worldwide Governance Indicators.

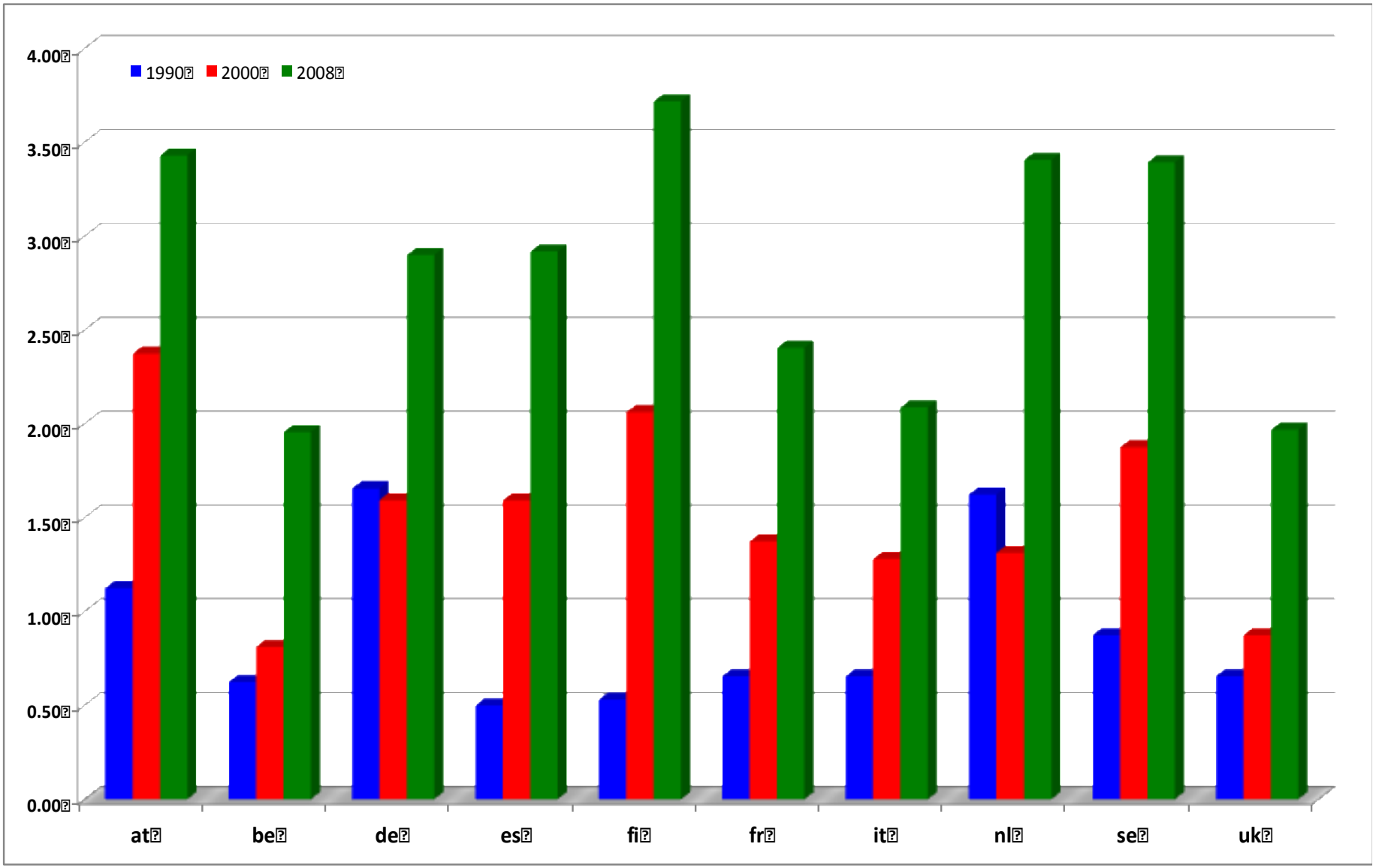
EPS indicator

Figure 1. Structure of the Environmental Policy Stringency (EPS) indicator



Source: Botta and Koźluk (2014)

EPS across sample countries: 1990-2008



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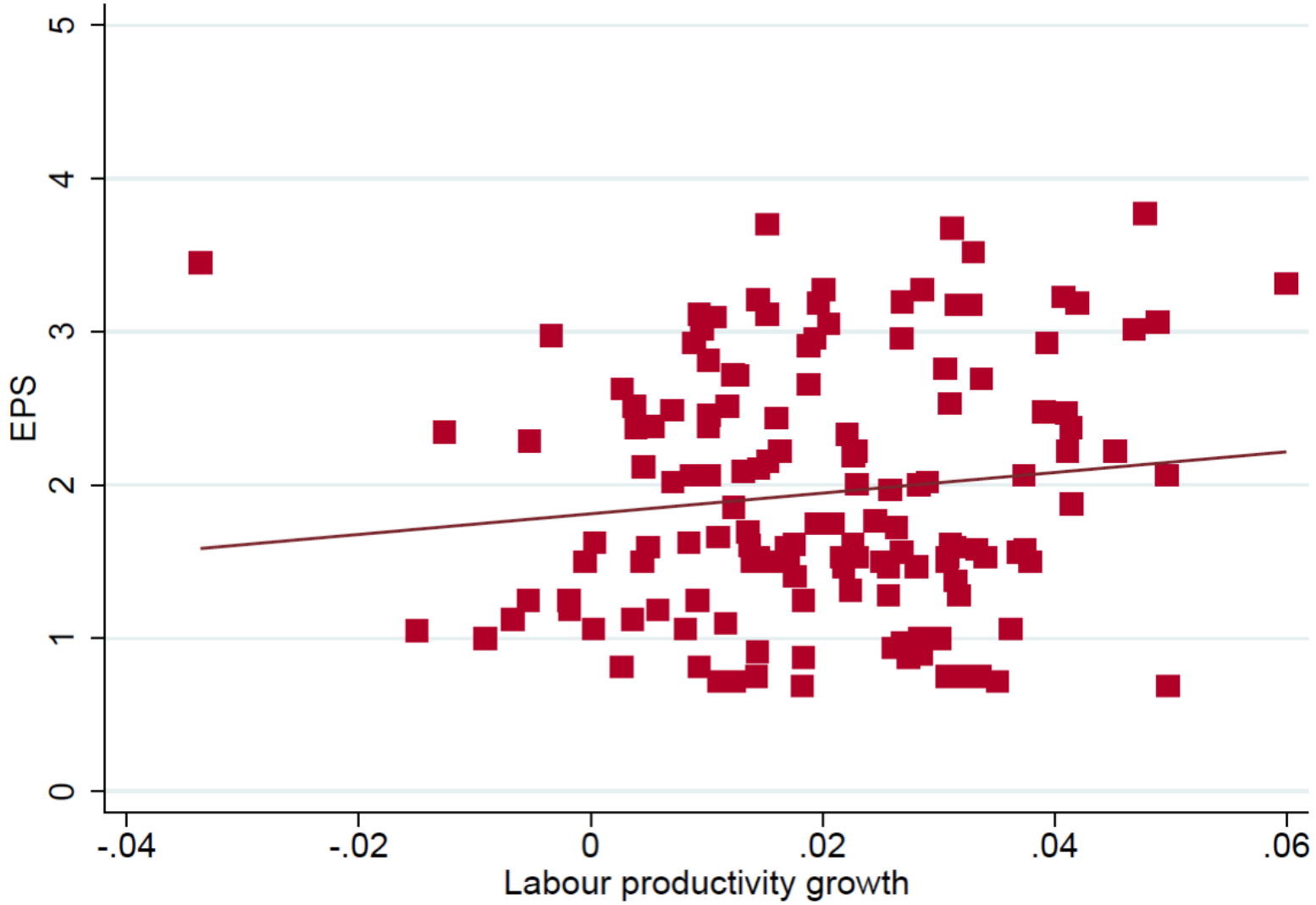
EPS and labor productivity growth: 1995 - 2008



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Econometric strategy (i)

We start from a standard production function augmented with environmental policy, institutional quality and trust indicators to check for the direct impact of these factors on productivity growth:

$$DlnY = \alpha_1 + \alpha_2 DlnX + \alpha_3 Z_1 + \alpha_4 Z_2 \, e \qquad (1)$$

Where:

Y is labor productivity (*LP)*,
X is a set of controls including measures of innovation and capital stock and Z_1 is a vector including measures of environmental regulation and Z_2 are institutional quality indicators.

If $\alpha 3$ is positive then our assumption (WPH holds) is supported. As for $\alpha 4$ we have no a priori on the sign but we assume that well designed environmental policies and institutional quality should positively affect productivity growth.

Econometric strategy (ii)

To check for the growth impact of the synergies between environmental policies and institutional quality we augment equation (1) with the interaction between institutional quality and environmental policy stringency indicators. Equation (2) is as follows:

$$\Delta \ln Y = \alpha_1 + \alpha_2 \Delta \ln X + \alpha_3 Z_1 + \alpha_4 Z_2 + \alpha_5 Z_1 * Z_2 + \varepsilon \qquad (2)$$

If α_5 is positive then countries with tighter environmental regulation and better institutions experience faster productivity growth.

Econometric strategy (iii)

- Finally, we test whether environmental regulation and institutional quality have a positive direct impact on the accumulation of technological and innovation capital.

- Thus we investigate the correlations between a set of environmental stringency and institutional quality proxies and two measures of technological and innovation capital stock K^i (i.e. ICT, R&D) in equation below.

$$D\ln K^i = \alpha_1 + \alpha_2 \ln Z_1 + \alpha_3 Z_2 \, e \qquad (3)$$

- if α_2 is positive and significant we can take the results as an “indirect” test of PH.

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EPS, institutional quality and labor productivity (i)

VARIABLES	(1)	(2)	(3)	(4)	(5)
DlnH_k_nonict	0.470***	0.515***	0.554***	0.540***	0.480***
	(0.094)	(0.091)	(0.096)	(0.093)	(0.094)
DlnH_k_ict	0.058*	0.067**	0.059*	0.062*	0.088***
	(0.034)	(0.032)	(0.034)	(0.033)	(0.032)
eps_mb		0.008***	0.007***	0.008***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)
eps_nmb		0.000	0.001	0.001	-0.000
		(0.004)	(0.004)	(0.004)	(0.004)
corruption	0.027***	0.027***			
	(0.009)	(0.008)			
factlim	-0.001	0.001	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
eps_fs	0.010**				
	(0.004)				
goveff			0.022***		
			(0.006)		
voiceacc				0.034***	
				(0.009)	
regqual					-0.006
					(0.011)
Observations	99	99	99	99	99

Standard errors in parentheses

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

EPS, institutional quality and labor productivity (ii)

VARIABLES	(1)	(2)	(3)
DlnH_k_nonict	0.526***	0.562***	0.594***
	(0.086)	(0.087)	(0.091)
DlnH_k_ict	0.073**	0.068**	0.066**
	(0.032)	(0.032)	(0.032)
eps_mb	0.002	-0.013*	-0.012**
	(0.004)	(0.008)	(0.006)
corruption	0.021**		
	(0.009)		
corruption_eps_mb	**0.008***		
	(0.005)		
goveff		-0.025	
		(0.017)	
goveff_eps_mb		**0.033*****	
		(0.011)	
voiceacc			-0.025*
			(0.015)
voiceacc_eps_mb			**0.037*****
			(0.010)
Observations	99	99	99

Standard errors in parentheses

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

R&D, ICT, EPS, institutional quality.

Tab 3 R&D, ICT, EPS and institutional quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	R&D				ICT			
eps_nmb		0.007	0.008	0.008		0.004	0.008	0.007
		(0.006)	(0.006)	(0.006)		(0.010)	(0.010)	(0.010)
eps_mb		-0.002	-0.003	-0.002		-0.003	-0.003	-0.005
		(0.003)	(0.003)	(0.003)		(0.006)	(0.006)	(0.006)
corruption	-0.012	-0.010			0.023	0.023		
	(0.011)	(0.011)			(0.023)	(0.023)		
factlim	-0.005**	-0.005**	-0.005**	-0.005**	0.003	0.002	0.003	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.005)	(0.005)
eps_fs	0.001				0.004			
	(0.007)				(0.011)			
goveff			0.002				0.044***	
			(0.007)				(0.013)	
voiceacc				-0.001				0.044***
				(0.009)				(0.015)
Observations	110	110	110	110	99	99	99	99

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Estimation results (i)

- EPS has a positive and statistically significant impact on labor productivity growth.
- The control for corruption, government efficiency and voice accountability has a positive impact on labour productivity growth.
- Institutional quality enhances the effectiveness of market based environmental policies on labour productivity growth. Thus preliminary results support our main assumption: the quality of Institutions might work as a catalyst to strengthen the effect of environmental policy on firms' productivity and propensity to innovate.
- Further investigation is warranted

Estimation results (ii)

- Finally, we turn to the analysis of the influence of environmental regulation and institutional quality on ICT capital accumulation and R&D expenditure to investigate for the presence of an indirect channel trough which institutional quality might affect productivity growth.

- As for institutional quality government effectiveness and voice accountability have a positive impact only on ICT capital accumulation while the financial factors limiting production have a negative relationships with both R&D and ICT.

- The other qualitative variables have the correct signs but are not statistically significant

Preliminary conclusions (i)

- In this paper we explore how the quality of institutions and environmental stringency affect the effectiveness of public policies in enhancing productivity.

- Our main assumption that institutional quality might work as a catalyst for strengthening the effect of environmental policy on productivity and propensity for innovation can not be rejected.

- Thus empirical evidence seems to support the conjecture that the stringency of environmental policies can be increased without harming economy-wide productivity and that this effect is fostered by higher institutional quality.

- A deeper analysis of the mechanisms through which environmental policy influences productivity and innovativeness has therefore potentially relevant implication to further develope the European environmental policy agenda.

Next steps

- Test TFP instead of LP to get more insights on spillovers
- Test specific environmental policy measures (i.e. ETS, environmental taxes, emission targets)
- Expand the time span (new EUKLEMS data soon available)

Thank you for your attention

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