The productivity challenge for European regions

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with Roberto Ganau

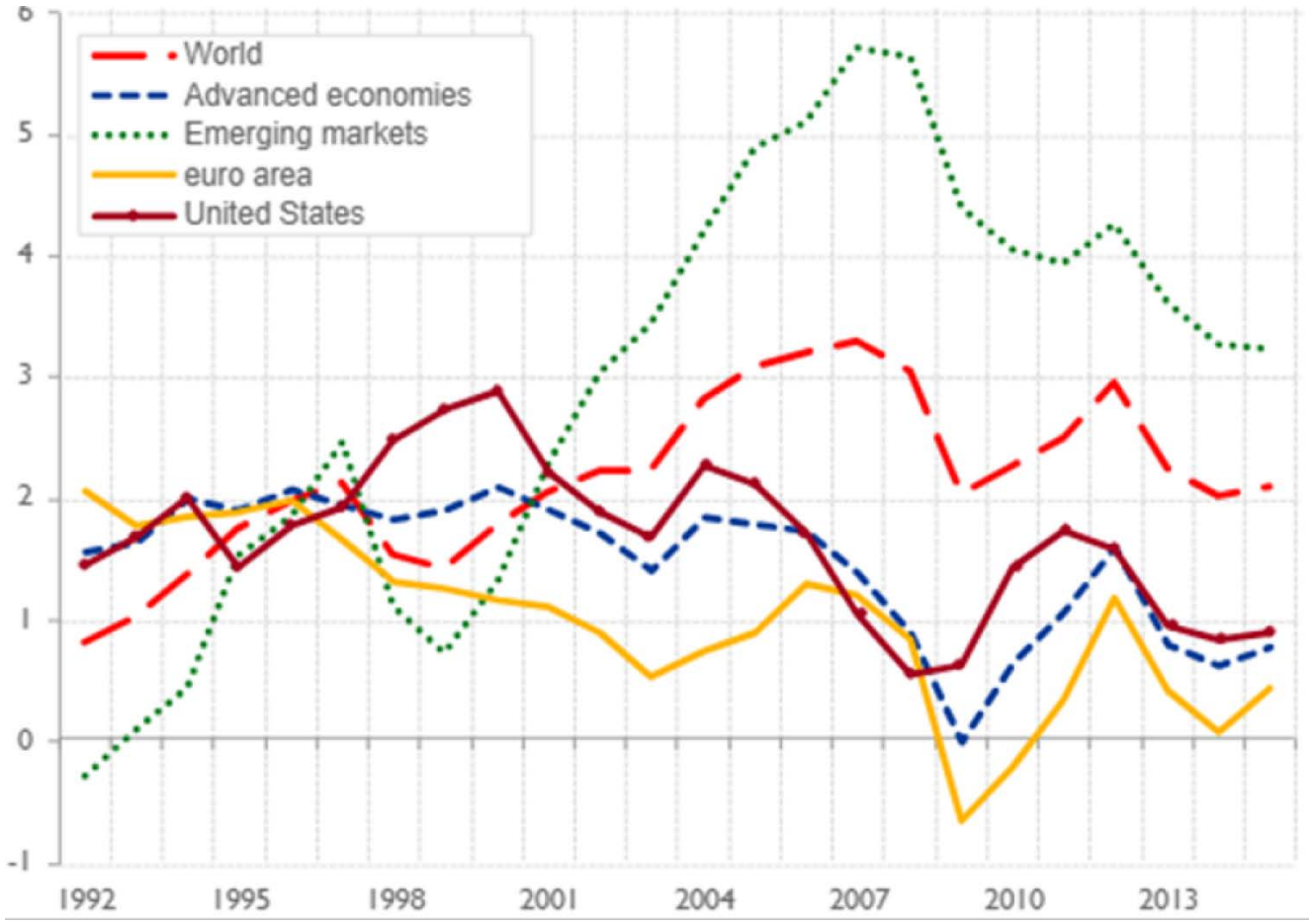
The productivity challenge:

Jobs and incomes in the dawning era of intelligent robots

Brussels, 19 November 2018

The productivity challenge

The challenge

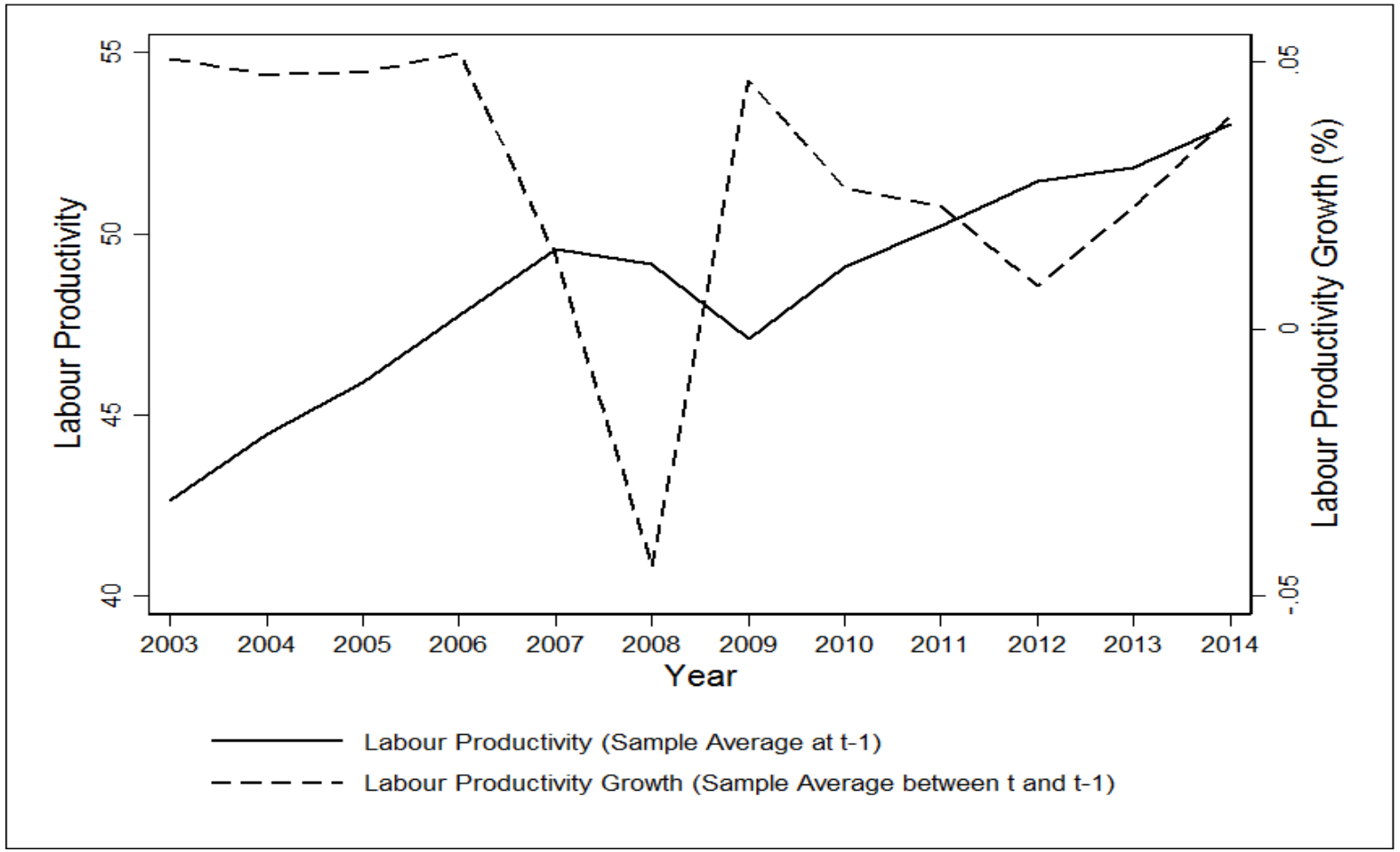


Mario Draghi, 2016, https://www.ecb.europa.eu/press/key/date/2016/html/sp161130_1.en.html

Institutions and the productivity challenge

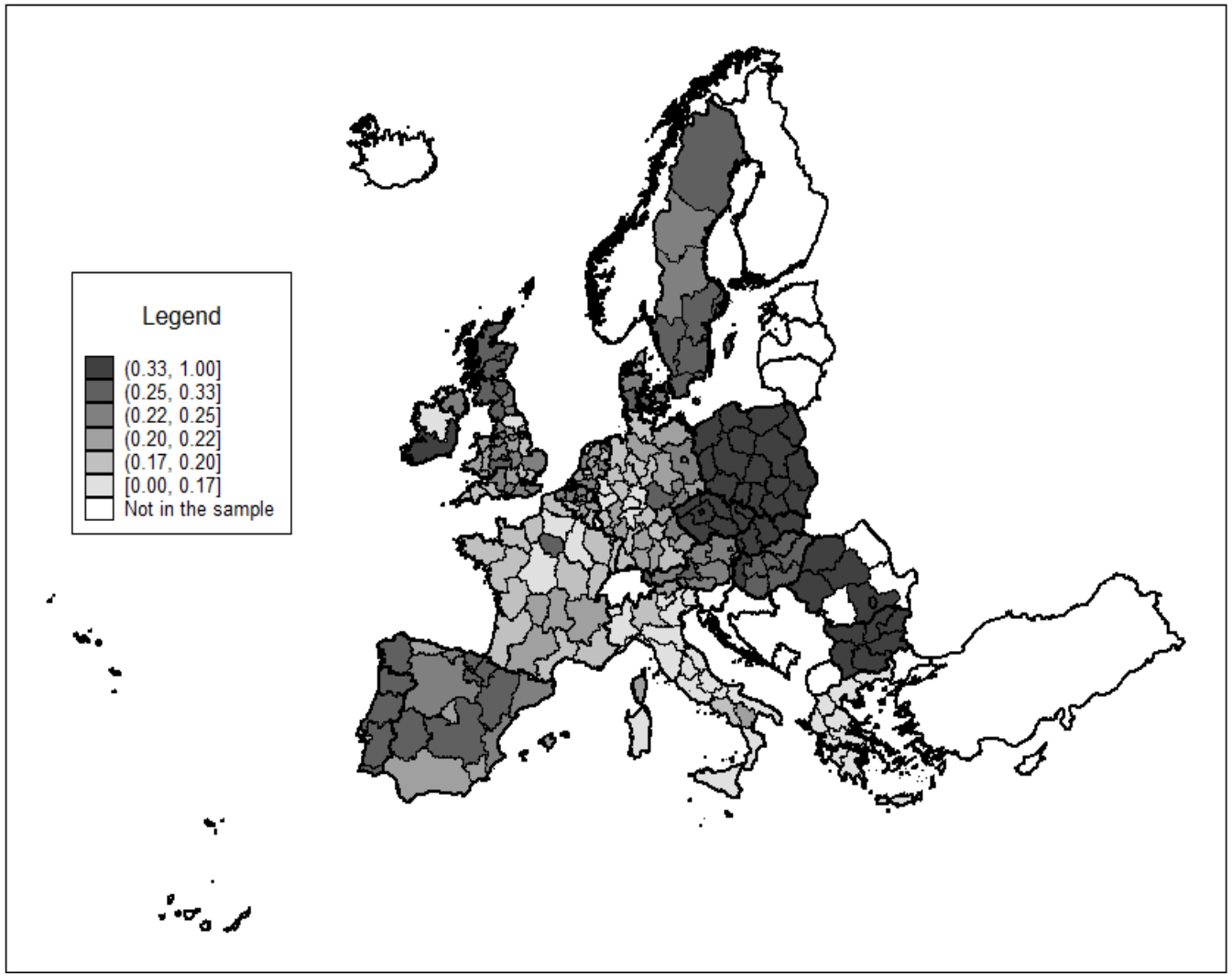
- Productivity growth in Europe is well below that of other areas of the world
- And has been declining since at least the 1990s
- Structural factors (e.g. ageing, lack of labour market reforms) stunt productivity growth
- Unlocking institutional problems may be a solution to the challenge

Labour productivity (growth) dynamics



Note: Yearly averages for 248 NUTS-2 regions in the sample, with t=2003,…,2015.

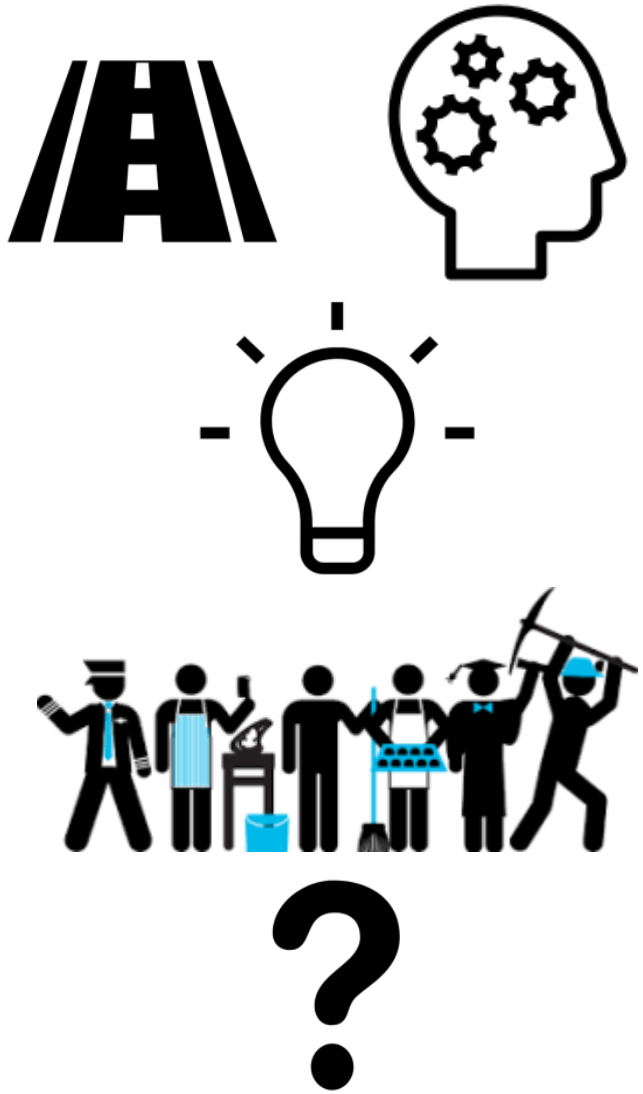
Regional labour productivity growth



Note: Time averages over the 2003-2015 period. Values are standardised in the interval [0,1]. Darker areas denote higher values of the index.

Factors behind changes in productivity

Drivers of productivity



The model

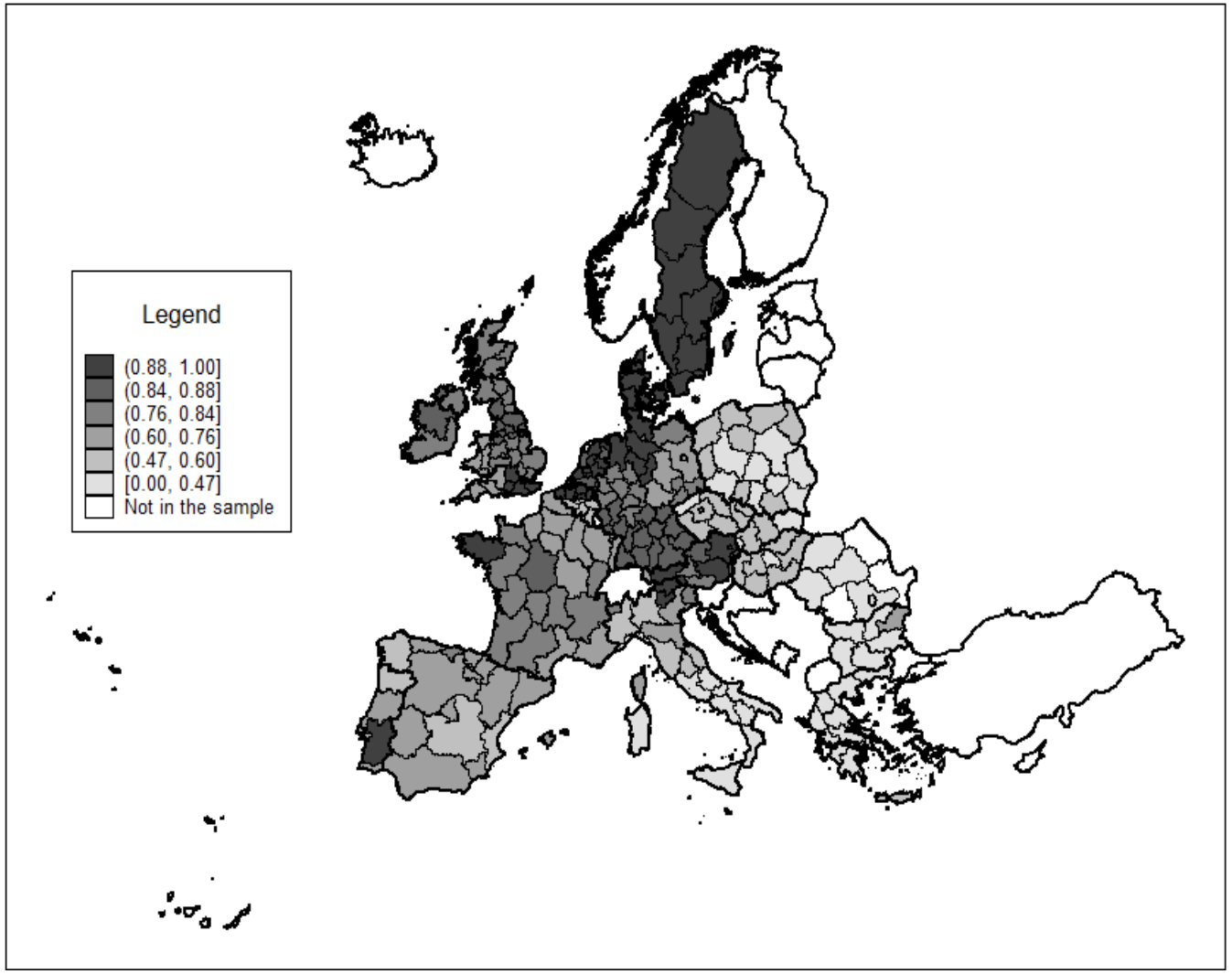
$$\Delta LP_{r,t} = \beta \log\left(LP_{r,t-1}\right) + \gamma \log\left[K_{r,t-1}/\left(1 - K_{r,t-1}\right)\right] + \delta \log\left(\Delta Population_{r,t-1} + TC + DR\right) + \zeta \log\left[HC_{r,t-1}/\left(1 - HC_{r,t-1}\right)\right] + \theta \log\left(Innovation_{r,t-1}\right) + \vartheta \text{Institutional Quality}_{\text{r,t}-1} + \nu_r + \xi_t + \varepsilon_{r,t}$$

- $\Delta LP_{r,t} = \log\left(LP_{r,t}\right) - \log\left(LP_{r,t-1}\right)$ **denotes annual regional labour productivity growth;**
- $K\_(r, t-1)$ **represents physical capital (Gross fixed capital formation);**
- $HC_{r,t-1}$ **is human capital (share of population 25-64 with higher education);**
- $Innovation_{r,t-1}$ **controls for region's innovative capacity (patent applications);**
- $Institutional\ Quality_{r,-1t}$ **captures the quality of regional institutions;**
- ν_r, ξ_t **and** $\varepsilon_{r,t}$ **represent region and time fixed effects and the error term.**

Data and period of analysis

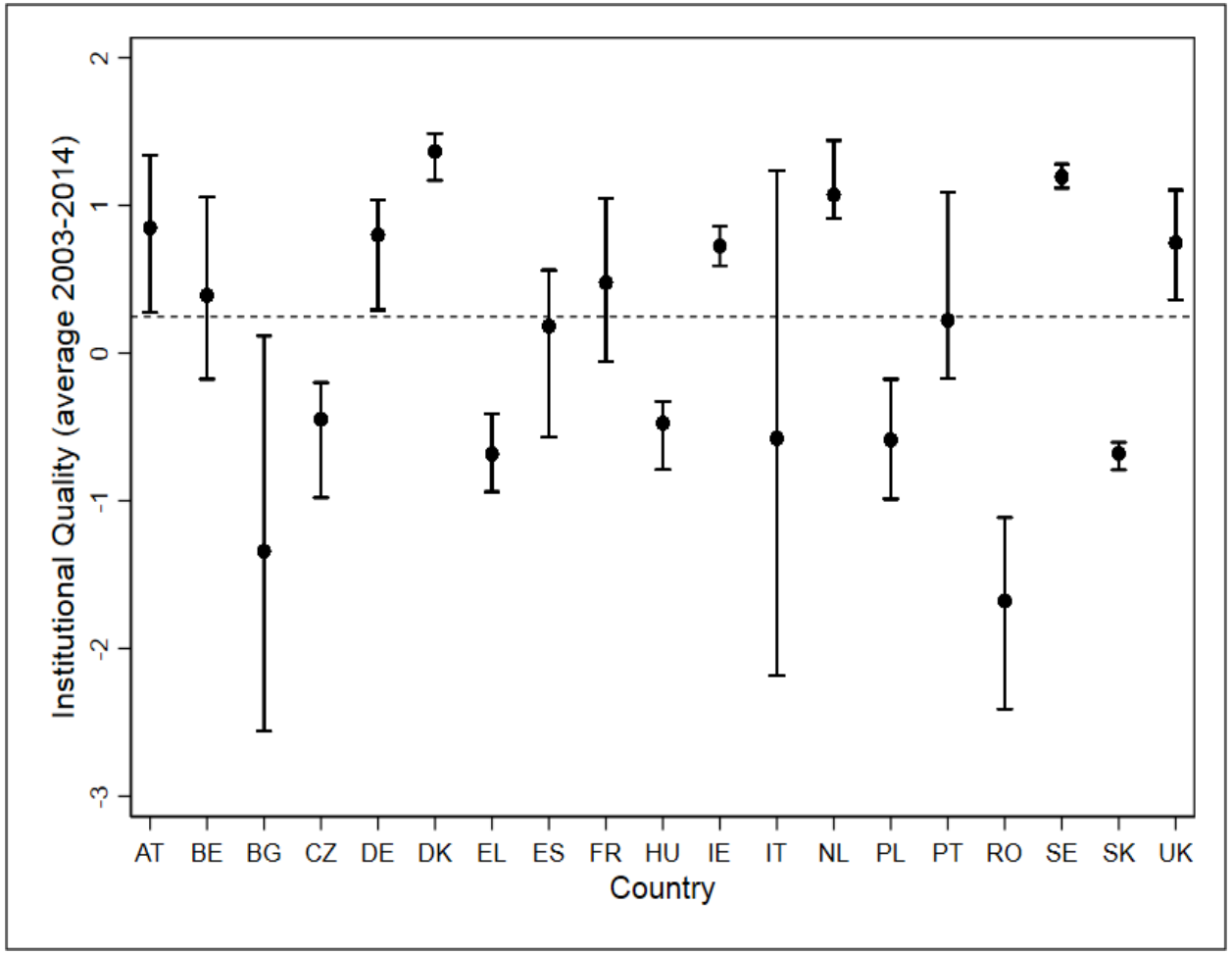
- **Analysis for 248 NUTs 2 regions in 19 countries**
  - Covering 95.65% of the GVA, 93.74% of the employment, and 93.47% of the population of the EU-28
- **For the period between 2003-2015**

Quality of government



Note: Time averages over the 2003-2015 period. Values are standardised in the interval [0,1]. Darker areas denote higher values of the index.

Within country differences in QoG



Notes: The non-standardised yearly institutional quality index ($IQI_{r,t-1}$) is averaged over the period 2003-2014.

Analysis

Two-way FE estimates

Dependent Variable	$\Delta LP_{r,t}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\log(LP_{r,t-1})$	-0.215****	-0.226****	-0.225****	-0.228****	-0.247****	-0.248****	-0.248****	-0.249****	-0.236****
	(0.010)	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)	(0.012)	(0.015)
$\log[K_{r,t-1}/(1-K_{r,t-1})]$	…	0.040****	0.040****	0.040****	…	0.031****	0.031****	0.031****	0.105****
		(0.006)	(0.006)	(0.006)		(0.005)	(0.005)	(0.005)	(0.022)
$\log(\Delta Population_{r,t-1} + TC + DR)$	…	-0.002	-0.002	-0.002	…	-0.006	-0.006	-0.005	-0.005
		(0.006)	(0.006)	(0.006)		(0.006)	(0.006)	(0.006)	(0.006)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})]$	…	…	-0.016**	-0.017**	…	…	-0.014*	-0.015*	-0.061***
			(0.008)	(0.008)			(0.008)	(0.008)	(0.021)
$\log(Innovation_{r,t-1})$	…	…	…	0.002	…	…	…	0.002	-0.006
				(0.002)				(0.002)	(0.007)
Institutional $Quality_{r,t-1}$	…	…	…	…	0.256****	0.196****	0.194****	0.192****	0.062
					(0.039)	(0.039)	(0.038)	(0.039)	(0.074)
$\log[K_{r,t-1}/(1-K_{r,t-1})] \times$ Institutional $Quality_{r,t-1}$	…	…	…	…	…	…	…	…	-0.126****
									(0.032)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})] \times$ Institutional $Quality_{r,t-1}$	…	…	…	…	…	…	…	…	0.072***
									(0.025)
$\log(Innovation_{r,t-1}) \times$ Institutional $Quality_{r,t-1}$	…	…	…	…	…	…	…	…	0.016
									(0.010)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	2,976	2,976	2,976	2,976	2,976	2,976	2,976	2,976	2,976
No. of Regions	248	248	248	248	248	248	248	248	248
Model F Statistic [p-value]	502.21 [0.000]	248.06 [0.000]	188.44 [0.000]	156.94 [0.000]	237.99 [0.000]	163.29 [0.000]	134.32 [0.000]	117.34 [0.000]	65.82 [0.000]
Average Marginal Effect of Institutional $Quality_{r,t-1}$	…	…	…	…	…	…	…	…	0.202****
									(0.039)

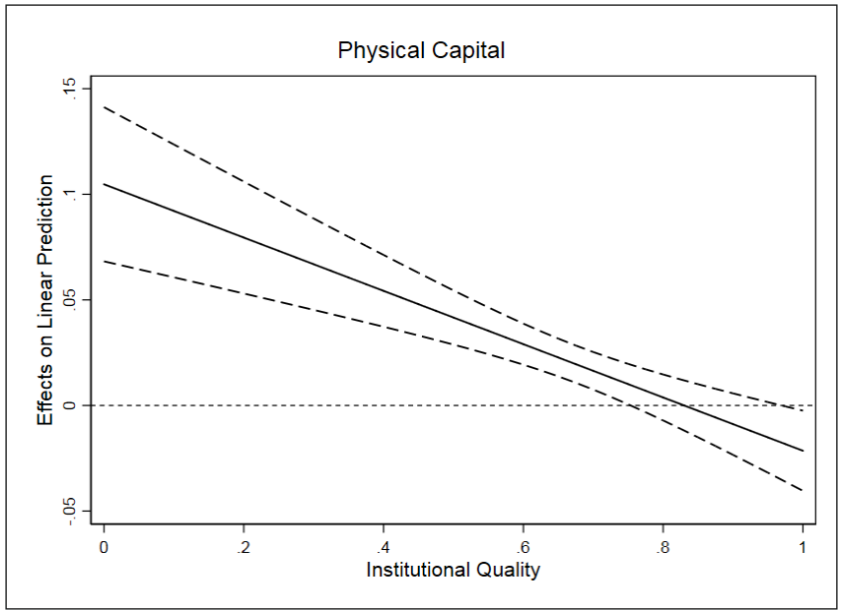
Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$. Robust standard errors in parentheses.

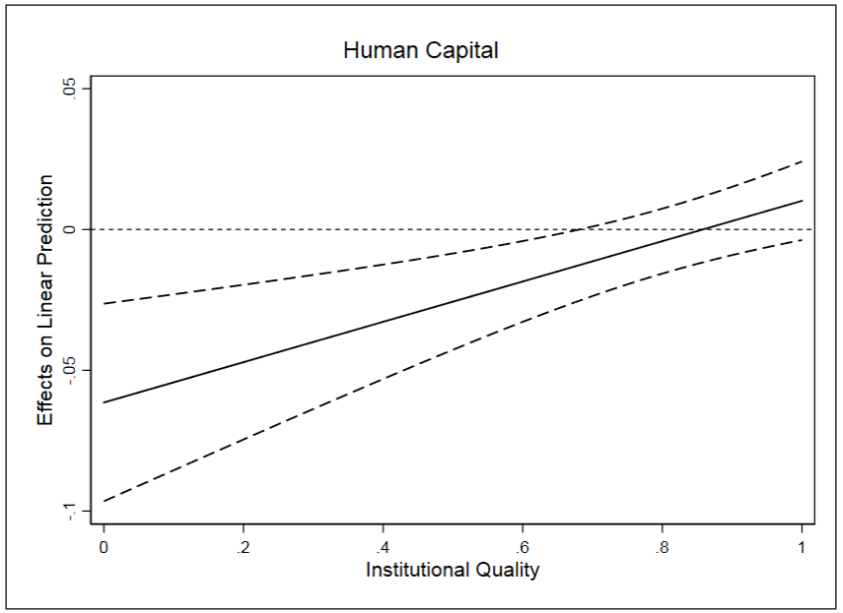
- Convergence in productivity
- Productivity growth positively associated with investment in physical capital
- But not with human capital

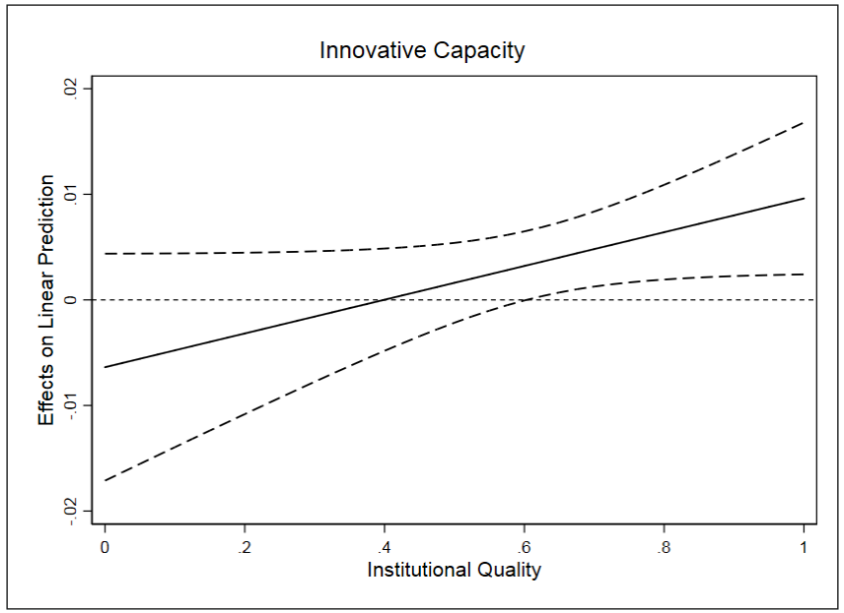
QoG positively associated with productivity growth Unit change in QoG leads to a 19.2% increase in productivity

The returns of human capital for productivity are massively conditioned by local QoG

The indirect effects of QoG on productivity







Local QoG decreases the returns of physical capital, but increases those of human capital and innovation

HT and two-step IV HT (second stage) estimates

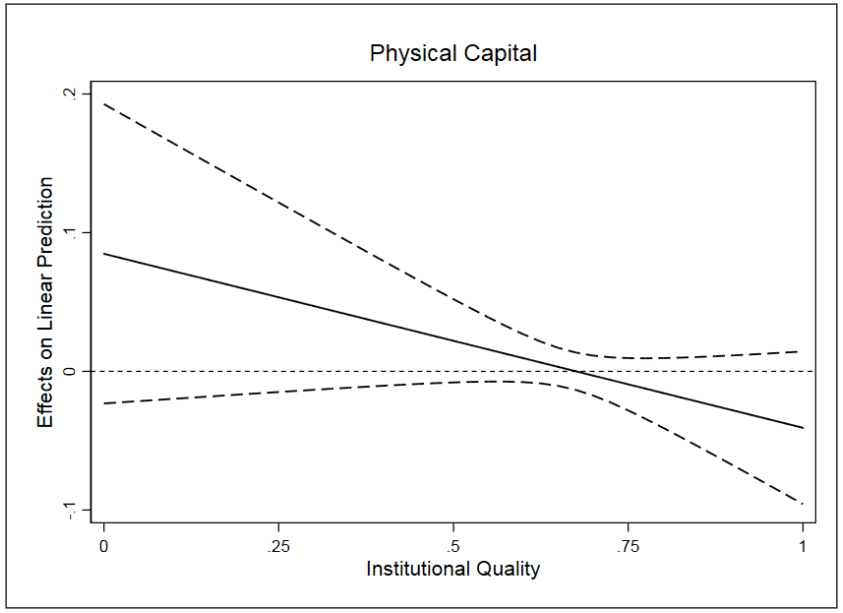
Dependent Variable	$\Delta LP_{r,t}$			
Estimation Method	HT		Two-step IV HT	
	(1)	(2)	(3)	(4)
$\log(LP_{r,t-1})$	-0.249****	-0.236****	-0.286****	-0.218****
	(0.012)	(0.015)	(0.022)	(0.022)
$\log[K_{r,t-1}/(1-K_{r,t-1})]$	0.031****	0.105****	0.016*	0.085
	(0.005)	(0.022)	(0.008)	(0.066)
$\log(\Delta Population_{r,t-1}+TC+DR)$	-0.005	-0.005	-0.012	-0.006
	(0.006)	(0.006)	(0.008)	(0.008)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})]$	-0.015*	-0.061***	-0.012	-0.071
	(0.008)	(0.021)	(0.008)	(0.073)
$\log(Innovation_{r,t-1})$	0.002	-0.006	0.001	-0.026
	(0.002)	(0.007)	(0.002)	(0.018)
$Institutional\ Quality_{r,t-1}$	0.192****	0.062	0.520****	0.218
	(0.039)	(0.075)	(0.133)	(0.364)
$\log[K_{r,t-1}/(1-K_{r,t-1})] \times Institutional\ Quality_{r,t-1}$	…	-0.126****	…	-0.125
		(0.032)		(0.098)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})] \times Institutional\ Quality_{r,t-1}$	…	0.072***	…	0.139
		(0.025)		(0.101)
$\log(Innovation_{r,t-1}) \times Institutional\ Quality_{r,t-1}$	…	0.016	…	0.052*
		(0.010)		(0.030)
Country Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
No. of Observations	2,976	2,976	2,976	2,976
No. of Regions	248	248	248	248
Model χ^2 Statistic [p-value]	1,375.22 [0.000]	1,626.46 [0.000]	1,384.59 [0.000]	1,493.99 [0.000]
First Stage χ^2 Statistic on IV for [p-value]:				
$Institutional\ Quality_{r,t-1}$	…	…	16.99 [0.000]	48.43 [0.000]
$\log[K_{r,t-1}/(1-K_{r,t-1})] \times Institutional\ Quality_{r,t-1}$	…	…	…	58.55 [0.000]
$\log[HC_{r,t-1}/(1-HC_{r,t-1})] \times Institutional\ Quality_{r,t-1}$	…	…	…	51.67 [0.000]
$\log(Innovation_{r,t-1}) \times Institutional\ Quality_{r,t-1}$	…	…	…	64.51 [0.000]
Average Marginal Effect of $Institutional\ Quality_{r,t-1}$	…	0.202****	…	0.412****
		(0.039)		(0.100)

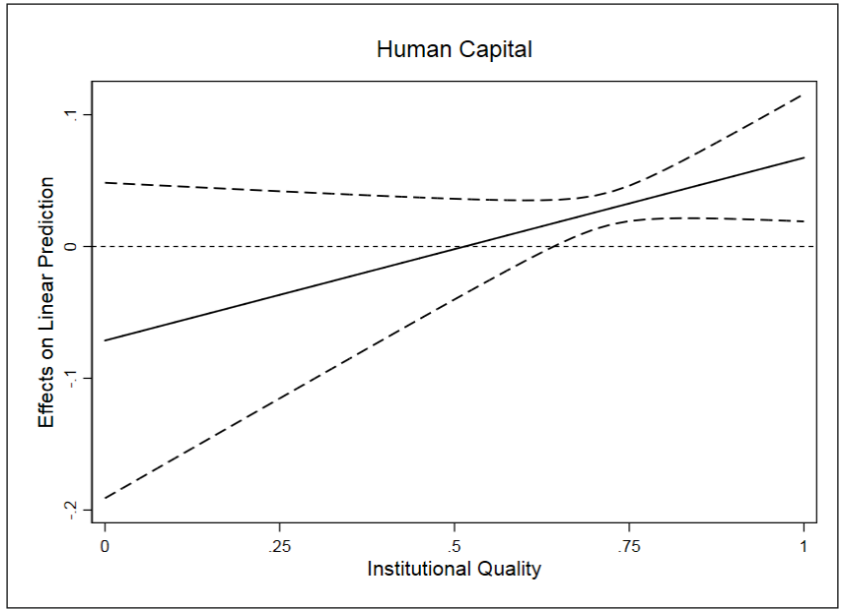
Coefficients broadly confirm the results of the FE analysis

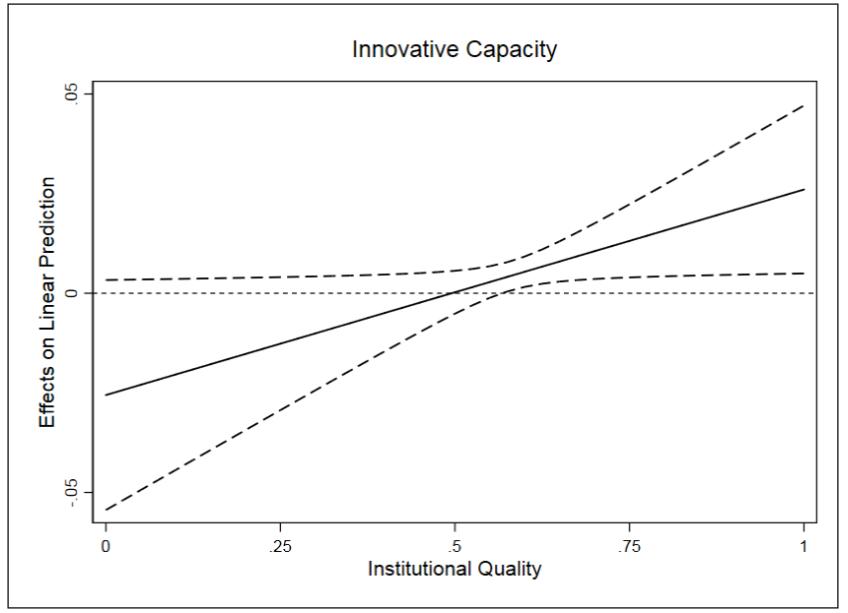
Human capital becomes insignificant once the endogeneity of QoG is controlled for

The impact of QoG increases: a unit increase in QoG leads to an estimated 52% increase in labour productivity growth

The indirect effects of QoG on productivity (IV)







The marginal effects remain broadly similar as in the FE estimations

Different QoG pillars

Dependent Variable	$\Delta LP_{r,t}$				
	(1)	(2)	(3)	(4)	(5)
$\log(LP_{r,t-1})$	-0.228****	-0.237****	-0.241****	-0.243****	-0.246****
	(0.011)	(0.011)	(0.012)	(0.013)	(0.014)
$\log[K_{r,t-1}/(1-K_{r,t-1})]$	0.040****	0.035****	0.033****	0.030****	0.027****
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
$\log(\Delta Population_{r,t-1} + TC +$	-0.002	-0.004	-0.006	-0.004	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})]$	-0.017**	-0.018**	-0.015*	-0.016*	-0.016*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$\log(Innovation_{r,t-1})$	0.002	0.002	0.003	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Government Effectiveness$_{r,t-1}$	0.002	…	…	…	-0.052**
	(0.025)				(0.025)
Rule of Law$_{r,t-1}$	…	0.138****	…	…	-0.019
		(0.039)			(0.045)
Voice and Accountability$_{r,t-1}$	…	…	0.166****	…	0.126****
			(0.028)		(0.023)
Control of Corruption$_{r,t-1}$				0.171****	0.154****
				(0.032)	(0.035)
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
No. of Observations	2,976	2,976	2,976	2,976	2,976
No. of Regions	248	248	248	248	248
Model F Statistic [p-value]	132.75 [0.000]	126.73 [0.000]	119.43 [0.000]	108.78 [0.000]	71.28 [0.000]

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$. Robust standard errors in parentheses.

All QoG pillars, bar government effectiveness, matter for labour productivity growth (Corruption having the strongest effect)

What about improvements in QoG?

Dependent Variable	$\Delta LP_{r,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(LP_{r,t-1})$	-0.230****	-0.224****	-0.229****	-0.228****	-0.227****	-0.225****
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
$\log[K_{r,t-1}/(1-K_{r,t-1})]$	0.038****	0.040****	0.037****	0.040****	0.040****	0.038****
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\log(\Delta Population_{r,t-1}+$	0.003	0.001	0.001	-0.001	-0.002	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\log[HC_{r,t-1}/(1-HC_{r,t-1})]$	-0.019**	-0.018**	-0.017**	-0.016**	-0.019**	-0.020**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$\log(Innovation_{r,t-1})$	0.002	0.002	0.002	0.002	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔInstitutional Quality$_{r,t}$	0.144****	...	...	...	...	...
	(0.041)					
ΔGovernment Effectiveness$_{r,t}$	...	0.037	...	...	...	0.026
		(0.026)				(0.021)
ΔRule of Law$_{r,t}$	...	...	0.181****	...	...	0.115****
			(0.030)			(0.031)
ΔVoice and Accountability$_{r,t}$	...	...	...	0.065**	...	0.051**
				(0.027)		(0.022)
ΔControl of Corruption$_{r,t}$	...	...	...	...	0.060****	0.052****
					(0.013)	(0.010)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	2,976	2,976	2,976	2,976	2,976	2,976
No. of Regions	248	248	248	248	248	248
Model F Statistic [p-value]	140.44 [0.000]	135.17 [0.000]	126.73 [0.000]	129.36 [0.000]	129.65 [0.000]	90.23 [0.000]

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$. Robust standard errors in parentheses.

When considering improvements in QoG, regions that manage to improve their QoG the most experience the greatest rises in productivity

This applies, fundamentally to improvements in rule of law, voice and accountability, and corruption

Conclusions

Facing the regional productivity challenge

- **Regions in Europe are facing, in different degrees, the productivity challenge limiting growth in Europe**
  - The challenge is greatest in many regions hitting the middle-income trap
- **One of the main challenges for European regions is that they are not making the most of their human capital and innovation potential**
- **And institutions are at the heart of this problem**
  - ***Directly:*** As a barrier to changes in productivity
  - ***Indirectly:*** As a factor that inhibits the returns of investments in human capital and innovation
- **Lack of transparency and accountability and corruption as main culprits**

The productivity challenge for European regions

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