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Performance ambientale ed effetti settoriali nelle regioni italiane

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Outline

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  - Drivers for regional environmental performances
- Methods
- Innovation and environmental spillovers
  - Role
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Research questions

- **Environmental performances, the role of:**
  - regional productive structures
  - (sectoral) efficiency
  - sectoral labour productivity
  - sectoral technological innovation
  - technological/innovation spillovers
  - environmental regulation
  - environmental spillovers
  - environmental prices

- **Geo-framework:**
  - Italian regions (20)

Methods

- **Shift-Share analysis (2005, 20 regions, 24 sectors, 10 pollutants)**
  - to decompose the source of change of the emission intensity (EM/VA) into:
    - regional specific productive structures/specializations (the *share*)
    - the efficiency feature (the *shift* between regional and national efficiency)
    - a covariance effect between the previous two

- **Modelling emission intensity (cross-section 2005, 19 regions, 11 sectors, GHG, ACID)**
  - Emission-demand model to identify inn. and env. drivers
  - Environmental spillovers
  - Technological/innovation spillovers (patents based indicator)

Modelling emission intensity

$$e_k^r = (A + \beta_1) + \underset{-}{\beta_2} \ln Y_k^r + \underset{+}{\beta_3} es_k^r + \underset{-}{\beta_4} t_k^r + \underset{-}{\beta_5} ts_k^r + \underset{-}{\beta_6} p_k^r + \varepsilon_k^r$$

where:

- ekr, pollutant emissions for k-sector in the r-region scaled with region/sector value added
- $(A+\beta_1)$, region and sector specific effects
- Ykr, labour productivity
- eskr, environmental spillovers
- tkr, internal (regional) technology
- tskr, innovation spillovers
- pkr, monetary value of environmental externalities
- εkr, error term

Emissions' intensities

- **Data**
  - Italian regional NAMEA data, 2005 (Istat, 2009)
    - 20 regions
    - 24 productive sectors
    - environmental pressures, 10 pollutants (direct emissions)
      - GHG (CO_2, N_2O, CH_4)
      - ACID (NO_x, SO_x, NH_3)
    - economic data (ValAd, HouEx, FullTimeEJ)
  - Electricity consumption by sector (TERNA)
    - Indirect emissions (considered in the model)

Table 3 – CO_2 and SO_X emission intensity (kg x 1M€ of value added, increasing order)

Region	CO_2	Region	SO_X
Trentino Alto Adige	136	Trentino Alto Adige	39
Campania	141	Valle d'Aosta	45
Valle d'Aosta	153	Abruzzo	69
Piedmonte	185	Campania	78
Lazio	204	Lombardy	99
Marche	206	Lazio	101
Lombardy	209	Marche	108
Abruzzo	258	Piedmonte	108
Veneto	267	Calabria	123
Emilia Romagna	270	Basilicata	224
Tuscany	278	Emilia Romagna	226
Italy	301	Molise	276
Calabria	307	Veneto	300
Umbria	342	Italy	315
Friuli Venezia Giulia	353	Tuscany	349
Basilicata	430	Umbria	373
Liguria	472	Friuli Venezia Giulia	539
Sicily	547	Puglia	859
Molise	689	Liguria	886
Sardinia	824	Sicily	1,347
Puglia	971	Sardinia	1,530

Spillovers

- environmental policy acts as a centrifugal force
  - increasing compliance costs reduce the convenience to localize ind activities in that region
- tech. learning and knowledge spilloves have a centripetal force
  - fostering agglomeration patterns (Kyriakopoulou and Xepapadeas, 2009)
- environmental regulation will increase compliance costs only for polluting activities
  - a stringent regulatory framework plays also a centripetal force (fostering indirectly an agglomeration pattern of cleaner productions) (Popp, 2002)
- env. regulation and tech. innovation strategies may act coherently towards an agglomeration effect of high-tech less polluting activities

Innovation spillovers

- The role of regional innovation (technological) spillovers
  - Domestic (internal) effect (*t*)
  - Inter-regional intra-sector effect (*ts*)
- Measure
  - Sectoral innovation intensities: patents (wo specific env. purposes) to VA ratios
  - Five years average (2000-04) for patents by sector (proxy of the innovation stock at sectoral level)
  - Geographical distances and economic structure similarity matter
  - Localization economies associated with the concentration of a particular sector in the (neighbouring) regions
- Data
  - Patents (REGPAT-Eurostat from OECD PATSTAT)
    - *ad hoc* codification of IPC codes according to NACE (manufacturing) codes

Innovation spillovers (measure)

The **Relative specialization index (RSI)**:

$$RSI_k^r = \frac{t_k^r}{\sum_{k=1}^{n} t_k^r} \Bigg/ \frac{t_k^{IT}}{\sum_{k=1}^{n} t_k^{IT}}$$

where t_k^r is the five-years average of patents to valued added ratios for each *k-th* sector and *r-th* region, while t_{ITk} is the same measure at the national level, as $t_{ITk} = \sum_{r=1}^{q} t_k^r$

The **bilateral innovation spillovers** (ts_k^{rs}) for each *k-th* sector from the *s-th* Region to the *r-th* Region un-weighted by the geographical distance are expressed as:

$$ts_k^{rs} = \left(\frac{\left| RSI_k^r - RSI_k^s \right|}{\sqrt{RSI_k^r + RSI_k^s}} \right)^{-1} \cdot t_k^s \qquad \forall s \neq r$$

The resulting (*20* x *20*) matrix of spillovers for each *k-th* sector (with a vector of 0 in the diagonal dimension $\forall s = r$)

Innovation spillovers (spatial weights)

- Several alternative criteria to transform geo-distances into spatial weights
  - Binary contiguity concept (D_1): assumes interregional spillovers take place only between direct neighbours (comon border)

$$D_1 ts_k^r = \sum_{s=1, s \neq r}^{n} \left(ts_k^{rs} w_{rs} \right)$$ with $w_{rs} = 1$ only if s neighbouring r

  - k-nearest neighbours (D_2): thresold distance, 300km
  - inverse distances (D_3): the intensity of influences between any two regions diminishes continuosly with increasing distances

Environmental spillovers

- Expected positive sign (*es*)
  - agglomerative forces producing concentration of dirty activities into circumscribed geo-areas
- The role of extra regional environmental regulation on regional environmental performance
  - emissions produced by neighbouring Regions may represent the role of economic agglomeration phenomena in explaining environmental performances (Gray and Shadbegian, 2007)
- Measure
  - Emission intensity of the surrounding regions
  - environmental spillovers as the sum of sectoral emissions per unit of value added from the other regions (eks) valid for $\forall s \neq r$ weighted by distances D_1, D_2, D_3

Environmental prices

- Proxied by
  - The stringency of the environmental regulatory framework
    - the incidence of environmental regulation on average regional income (Costantini and Crespi 2008)
    - Public expenditure 4env.protection may be considered as a proxy of the (regional) WTP of citizens to preserve natural environment
- Measure(s)
  - 3 alternative public expenditure measures
    - Current exp. 4environmental protection activities
    - Capital exp. 4environmental protection activities
    - R&D exp. 4environmental protection activities
- Data
  - Expenditures 4environmental protection activities (Istat, 2007)
  - by region

Diagnostic checks

- Spatial dependence
  - LM lag and LM error tests
- Potential endogeneity of regional innovation
  - Hausman test

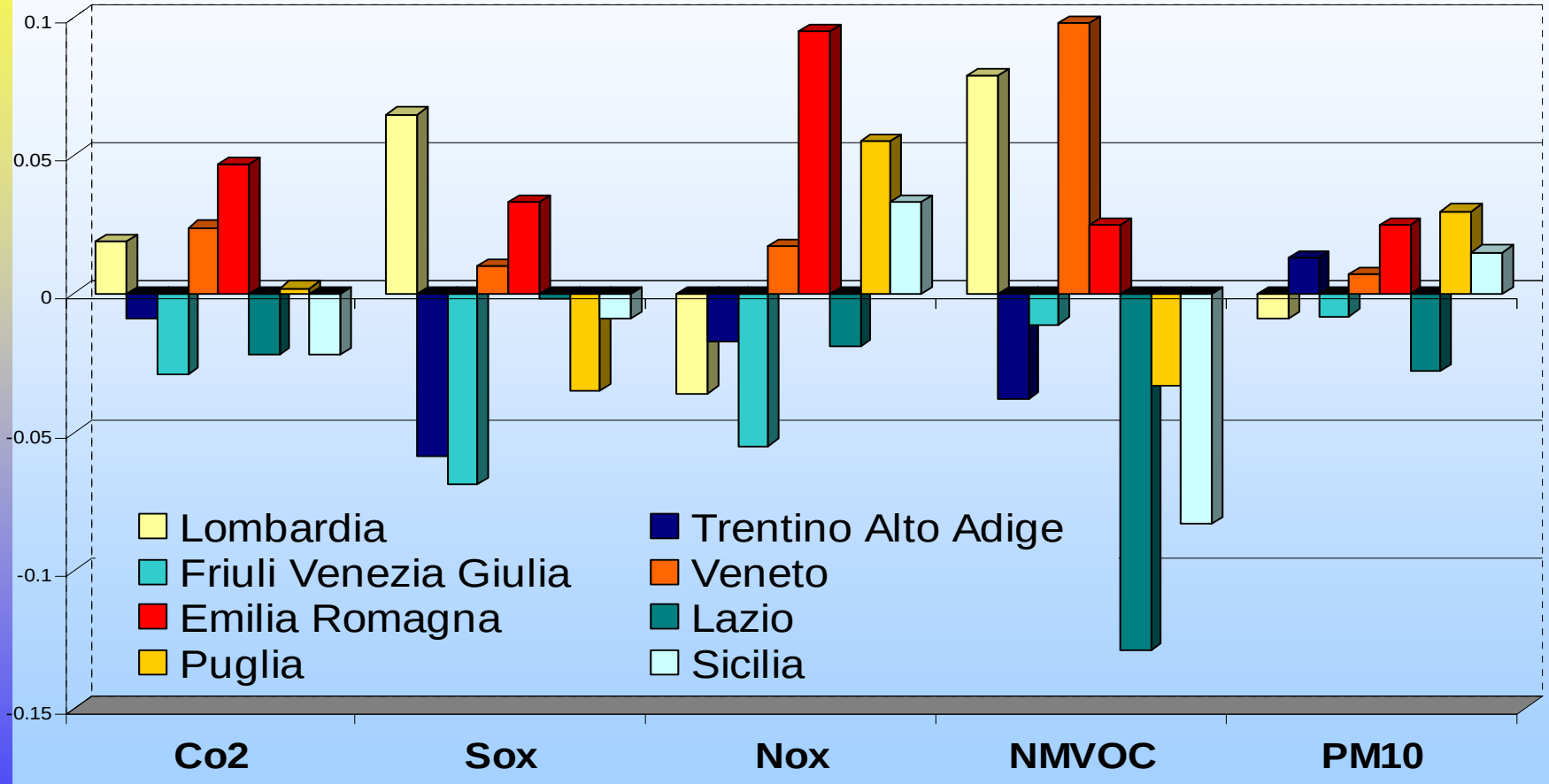
Empirical evidence (i)

i. Shift-Share analysis (only direct emissions)

- **industry mix effect (other things being equal):**
  - industrial regional specialization matters
  - more industrialized N regions are (obv.) penalized

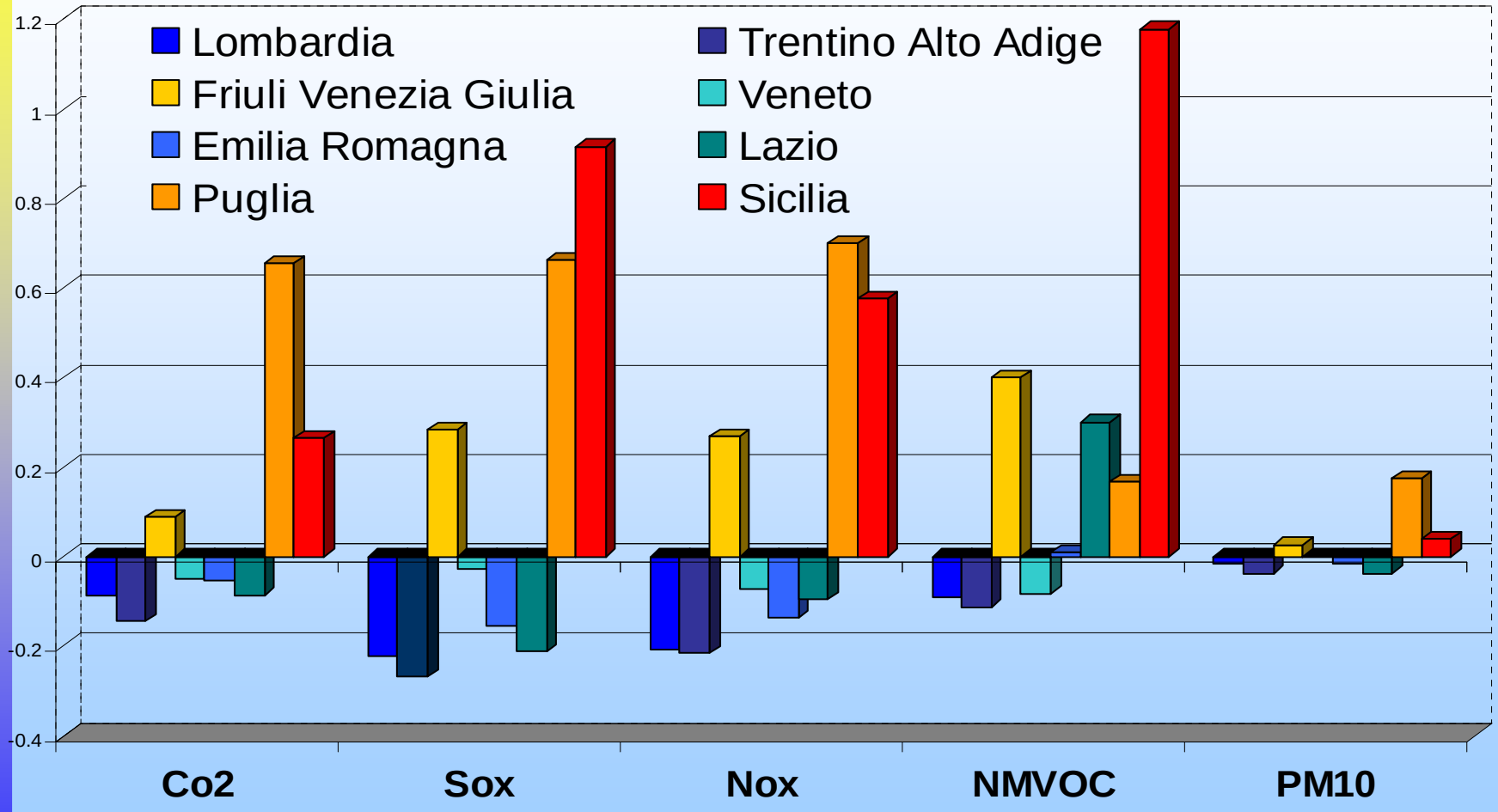
- **efficiency effect (given an homogeneous industry mix across regions):**
  - NW regions perform well
  - some N regions perform bad (es. FVG)

Shift-Share: productive specialization component



the smaller the indicator the better is the environmental performance

Shift-Share: efficiency component



the smaller the indicator the better is the environmental performance

Empirical evidence (ii)

ii. Econometric model for emission intensity

- labour productivity gains associated with env. efficiency gains
- env. efficiency spillovers play a role for GHG emissions
  - within 2 spatial regimes D_1 and D_2

- internal innovation plays a limited role
- tech interregional spillovers play a role
  - within 2 spatial regimes D_1 and D_2

- evidence for spatial dependence (GHG emissions)
- no evidence for spatial dependence (ACID emissions)

Drivers for environmental performances (GHG) (Spatially lagged models)

	(1)	(2)	(3)
Labour productivity	-0.676***	-0.665***	-0.650***
Environ. Spillovers	0.171***	0.183***	0.185***
Internal Innovation	-0.030*	-0.029*	-0.022
Techn. Reg. Spillovers	-0.057**	-0.060**	-0.055**
Env. Reg. Current Exp.	-0.086		
Env. Reg. Capital Exp.		-0.054	
Env. Reg. R&D Exp.			-0.035
Energy Intensity	0.647***	0.644***	0.639***
Dirty Sectors dummy	1.223***	1.215***	1.206***
Constant	3.740***	3.712***	3.428***
Spatial Lag	-0.113***	-0.119***	-0.116***
No obs.	209	209	209
Adj R-sq	0.76	0.76	0.76
Log L	-199.19	-199.58	-199.27
Breusch-Pagan test	74.07	61.84	50.46
LR test	4.38	4.98	4.65

Drivers for environmental performances (ACID) (OLS with regional dummies)

	(1)	(2)	(3)
Labour productivity	-1.323***	-1.343***	-1.356***
Environ. Spillovers	0.060	0.050	0.043
Internal Innovation	-0.035	-0.037*	-0.036*
Techn. Reg. Spillovers	-0.109***	-0.107***	-0.106***
Env. Reg. Current Exp.	0.009		
Env. Reg. Capital Exp.		-0.022	
Env. Reg. R&D Exp.			-0.042
Energy Intensity	0.439***	0.443***	0.447***
Dirty Sectors dummy	2.346***	2.374***	2.393***
Constant	3.857***	3.968***	3.768***
Geographical dummies	Yes	Yes	Yes
No obs.	209	209	209
Adj R-sq	0.74	0.74	0.74
F-stat	50.38	50.40	50.84

Conclusions

- **Labour productivity, innovation efforts and region-specific regulatory framework matter**
- **North vs South different performances**
- **within N and S different performances**

- **existence of agglomeration effect at the sectoral level**
  - higher conc. of polluting firms adopting dirtier prod. processes

- **centripetal forces associated to inn.spillovers among regions**
  - a first influence of the tech adopted in the production processes
  - limit to distance: 300km

Conclusions

- **4global pollutants (GHG):**
  - the agglomerative impact associated to env. efficiency externalities overwhelm the clustering effect due to general inn. spillovers
  - more collective action is necessary

- **4localized pollutants (ACID):**
  - the opposite occurs
  - a geo-circumscribed collective action is effective

Grazie

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