EUSERS SUMMER SCHOOL

Performance and Governance of Services of General Interest.

Critical perspectives on Energy, Telecommunications, Transport and Water Reforms in the EU

June, 27th – July 1st 2016

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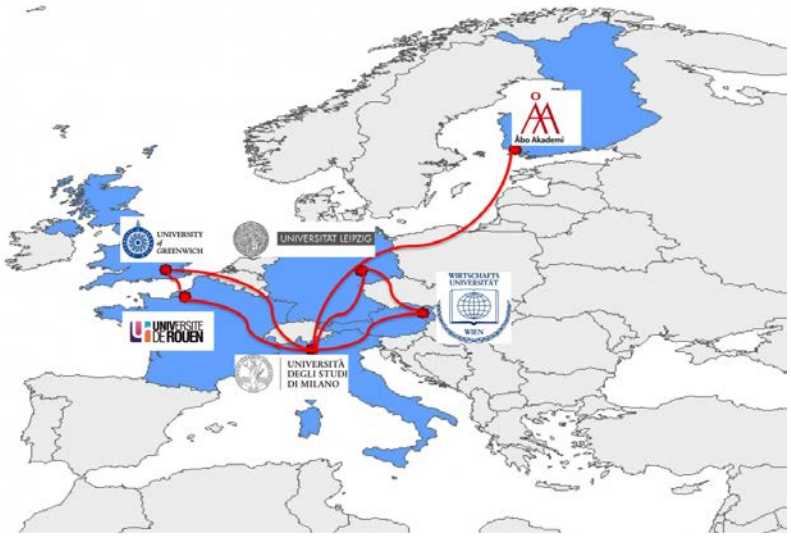

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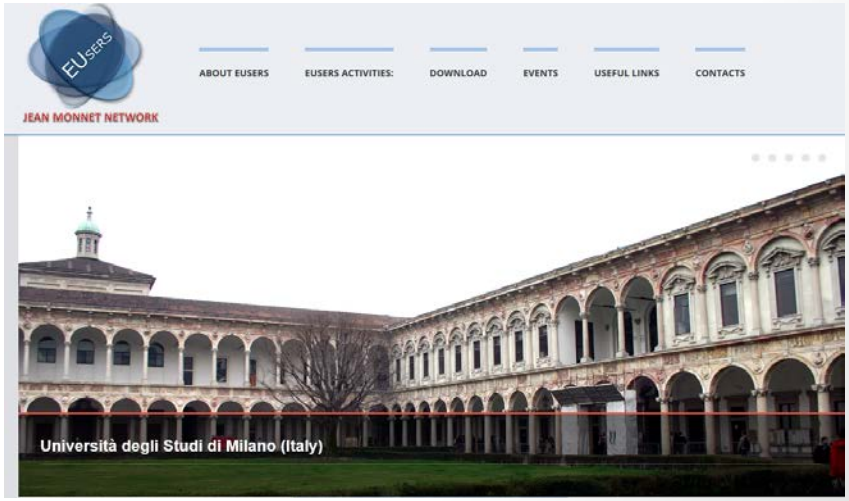

Evaluating reforms of network industries in the EU: Methodological issues

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Objective of the School

- Provide a conceptual frame for an empirical quantitative evaluation of policy reforms
- The reform paradigm that will be discussed includes privatization, unbundling, regulation and liberalization.
- The sectors that will be considered in the School include:
- Electricity
- Natural gas
- Telecoms
- Railways
- Local public transport
- Water







Structure of the lecture

- Concept: policy framework reforms
- Network industries
- History
- EU reforms in the last two decades
- Stylized facts
- Empirical strategy: tracking the reforms
- Case study: electricity
- Case study: gas
- Conclusions

Conceptual frame

Applied welfare economics of policy reforms**.** **But what a policy reform is ?**

First meaning: the change of a “signal”;

The Ramsey (1927), Samuelson (1951), Diamond-Mirrlees (1971), Dréze-Stern (1987), Guesnerie (1998) tradition.

A signal is any variable directly affecting the behaviour and welfare of an agent.

A.C. Pigou
1877-1959

F.P. Ramsey
1903-1930

If W (s) is a social welfare function and s is a signal,
the theory of reform revolves around the estimation of
marginal social values dW(s)/ds (around the optimum or in the gradient perspective)

For example Ahmad and Stern (1984) summari
study of reform of indirect taxation in India:

"Given a set of value judgements,
an initial state, and a model of the economy,
one can ask whether some feasible tax change
would increase welfare.

We do this by defining the marginal cost in terms of welfare of raising an extra rupee from the *i*th good… We illustrate the concepts and results using data from the Indian economy for 1979–1980. Directions of tax reform for a number of specific social welfare functions and for Pareto improvements are presented."

Positive analysis of a policy reform, ‘political economy’ questions, such as:

“Are social-democratic governments against privatization?”, “To what extent regulators are independent in less developed economies?”, “Is government debt causing or hindering liberalization policies?”, and so on.

The core of the normative perspective, however, is the objective analysis of social welfare effects of such reforms:

“Is privatization beneficial to the poor?” “Does market opening to foreign investment disrupt the income of small farmers?”

Our context: the change of an institutional setting that should be evaluated, neither captured by a microeconomic or macroeconomic variable.

Examples are privatization of public enterprises, unbundling in network industries, or the promotion of competition in a formerly monopolistic market.

These changes will be embodied in **legislation**, through several bills or regulatory decisions, which are more or less closely linked together by common objectives of a general nature.

The reform in this wider meaning is in fact a mechanism aimed at promoting a cascade of several punctual changes in a certain desired direction.

This is a POLICY FRAMEWORK REFORM

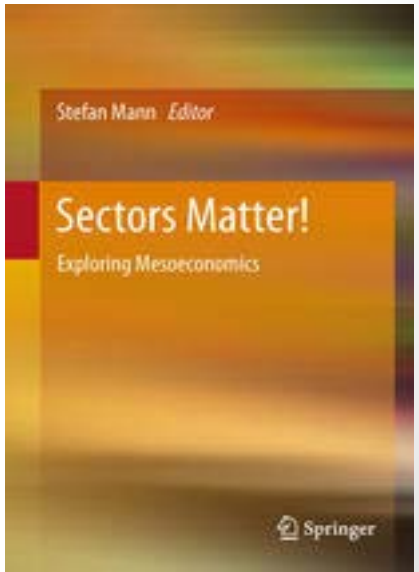
Less than a paradigm change

More than a signal change

- Microeconomic signal reforms: the rate of an indirect tax, the level of a price-cap on tariffs of utilities, the number of years of compulsory primary education, the permitted level of carbon emissions.

- Macroeconomic policy reforms: change in the level or growth of GDP and/or other variables after changes in some economic policy tools, e.g. level of public investment or debt, tax revenues, etc. (Implicit welfare analysis).

- "Mesoeconomic" policy framework reforms PFR:
- the change of an institutional arrangement
- at industry level



- While a change of a signal requires just some ingenuity to appropriately defining the unit of measurement of the appropriate variable (a tax rate, a QALY, a public service tariff, number of passenger/ Km provided, etc.) the empirics of PFR needs creating artificial indicator variables, for which usually no natural units of account exist.
- Several types of errors may occur in measuring PFR:
- Conceptual errors in defining the relevant reform dimensions
- Errors in **discretization** of continuous variables
- Errors in defining metrics and orderings
- Measurement errors deriving from misinterpretation of the information
- Scoring aggregation errors.
- After the policy variable of interest, the other crucial ingredient in the evaluation of reforms is the identification of the dependent (outcome) variable(s). The choice, which actually specifies the research question, should be firmly based on the analyst's perception of the relevant social welfare function (SWF).

This is a way the topic is discussed for example by Parker and Kirkpatrick (2012) in their review of the literature:

"OECD member countries have been engaged with regulatory reform and improving regulatory processes. For a decade or more, in the expectation that there will be significant improvements in *economic welfare outcomes*.

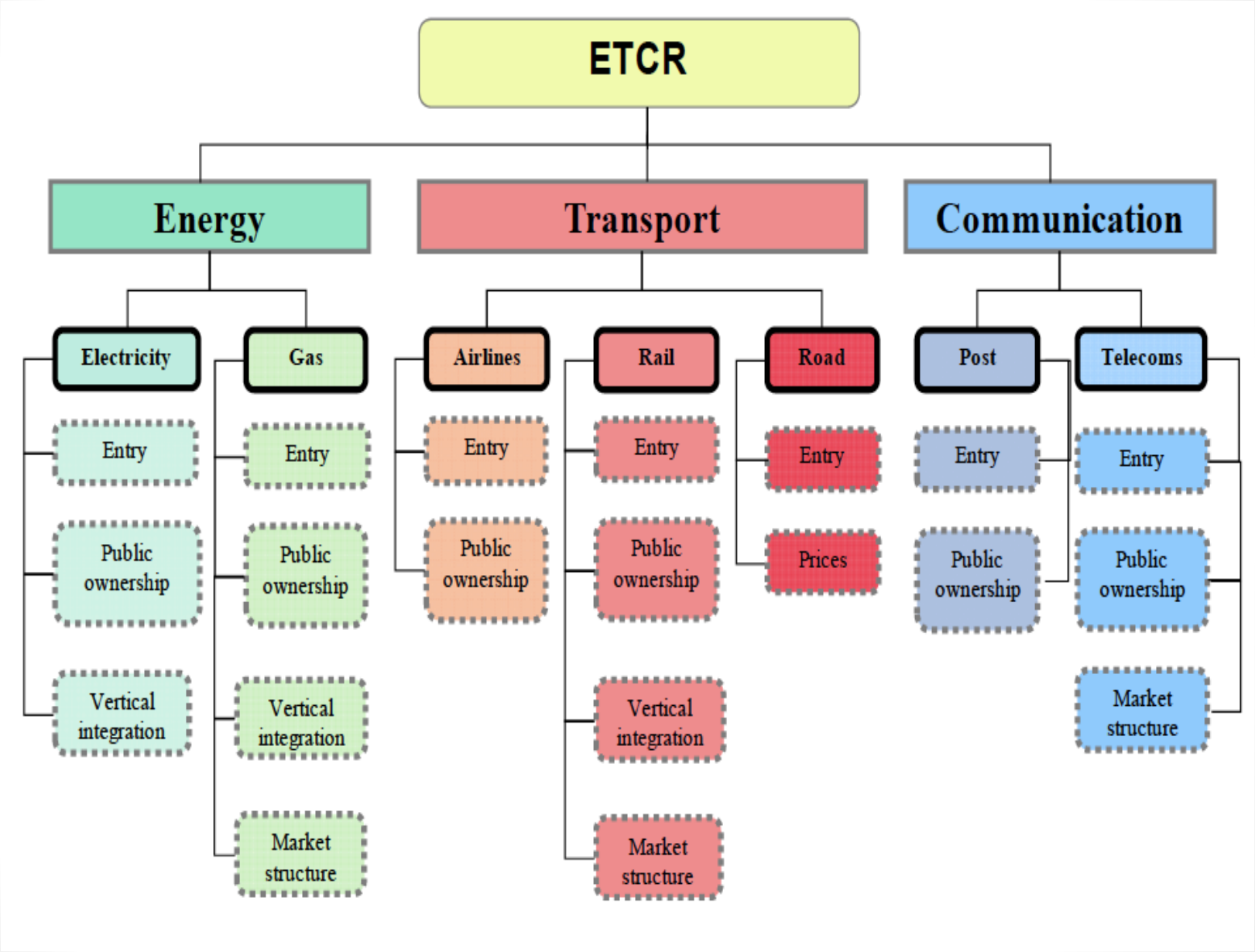
But in the absence of clarity about how and why the changes should lead to improvements, policy failures are likely.

The critical public policy challenge is to ensure that the expected economic benefits from regulatory changes are both achieved and outweigh any economic costs imposed.

This requires firm evidence on how different policies perform.

Evidence on the outcomes of regulatory policies should help policymakers design regulatory measures that work better".

Concept: policy framework reforms



Modelling the relation between reforms and outcomes

The basic model PFR empirical evaluation takes often the generic form

$$Y = f(R, D, S, Z)$$

- Y is the outcome dependent variable,
- R is a set of indicator variables which are *proxies for the policy framework*,
- D are demand-side controls,
- S are supply-side controls
- Z are additional controls, including for example time and fixed effects, individual characteristics (firm-level or consumer-level).

Static Panel Models

(either estimated with Fixed-Effects or Random Effects) a generic form is:

$p_{it}=c+\mu_i+\delta_t+R_{it}'\beta+X_{it}'\gamma+\varepsilon_{it}$

with $i = 1,\ldots,I$ *and* $t=1,\ldots,T$

Dynamic Panel Models

These models differ from the previous one because it is explicitly acknowledged that because of stickiness of the outcome variables (for example because of contractual forms preventing short term adjustments) the lagged dependent variable should be considered a covariate. The estimation technique is often GMM (which in turn can take different forms, an issue not considered here). A generic format is:

$p_{it}=c+\mu_i+\delta_t+\vartheta p_{it-1}+R_{it}'\beta+X_{it}'\gamma+\varepsilon_{it}$

First-order auto regressive (AR(1))

can play a role in this arena, where the error term takes a form such that:

$p_{it}=\mu_i+R_{it}'\beta+X_{it}'\gamma+\varepsilon_{it}$

with

$\varepsilon_{it}=\rho\varepsilon_{it-1}+u_{it}$

Estimating the impact of regulation on consumers' satisfaction/unsatisfaction (LDV)

Static Probit Model:

- $y_{it}^* = c+\mu_i+\delta_t+R_{it}'\beta+X_{it}'\gamma+\varepsilon_{it}$ (Latent variable model)
- $y_{it}=1$ if $y_{it}^*>0$; and 0 otherwise
- $Pr(y_{it}=1, R_{it}, X_{it})=\emptyset(c+\mu_i+\delta_t+R_{it}'\beta+X_{it}'\gamma)$

Dynamic Probit Model:

- $Pr(y_{it}=1 , R_{it}, X_{it}, y_{it-1})=\emptyset(c+\mu_i+\delta_t+R_{it}'\beta+X_{it}'\gamma+\rho y_{it}-1)$

where:

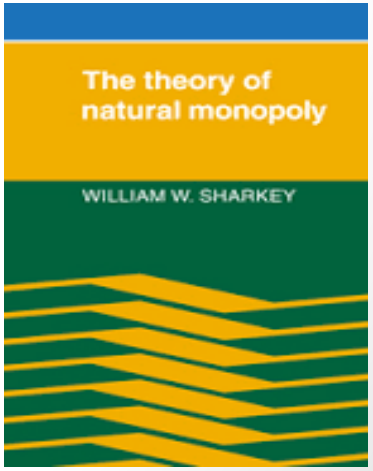
- $\emptyset$=standard normal cumulative density function
- y_{it}^*= exact level of individual satisfaction/deprivation/etc…
- y_{it}= observed level of individual satisfaction/deprivation
- y_{it-1}=lagged observed level of individual satisfaction/deprivation
- μ_i=country F.E.
- δ_t=time F.E. (or: δ_t=time trend)
- β and γ=vectors of parameters to be estimated
- R_{it}= set of regulatory and industry structure indicators
- X_{it}=set of control variables (accounting for macroeconomic conditions, individual characteristics, utility prices, etc.)
- ε_{it}=error term

Network Industries

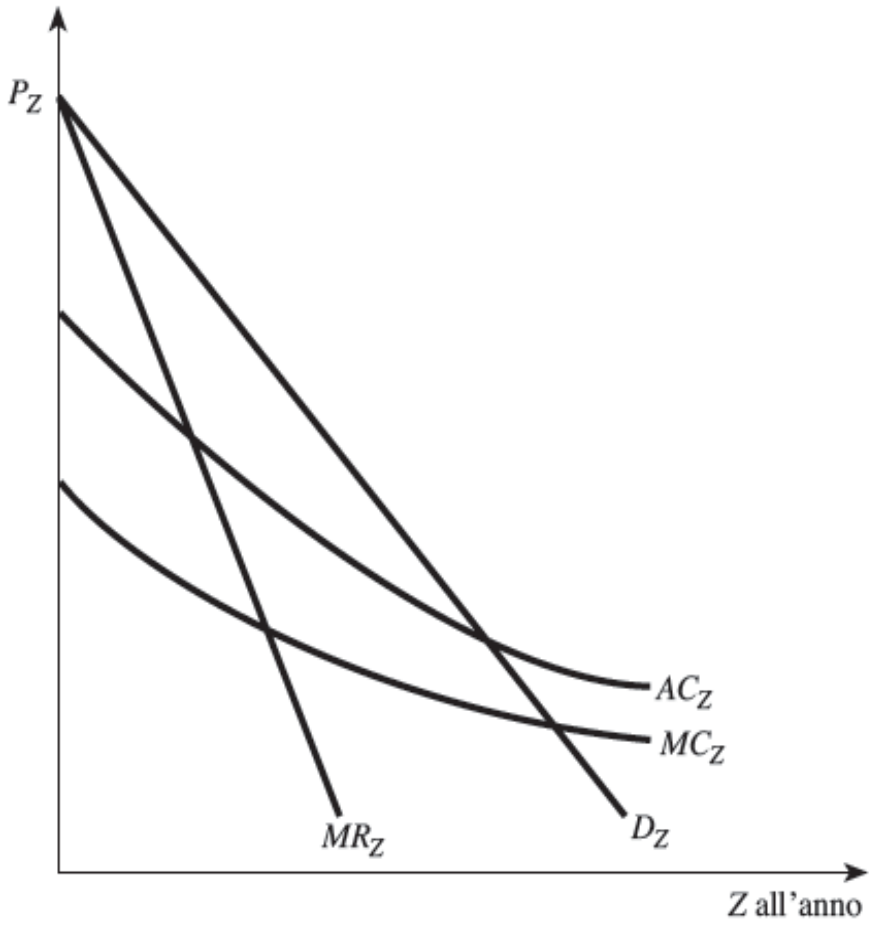
- The key feature of these industries is that they include both a major fixed-cost component, the network, under increasing returns to scale, and several potentially competitive upstream or downstream operations.
- This feature leads to **natural monopoly** for the network services, and potential market dominance of the vertically integrated network's owner.
- Most network services were initially

delivered by privately invested firms

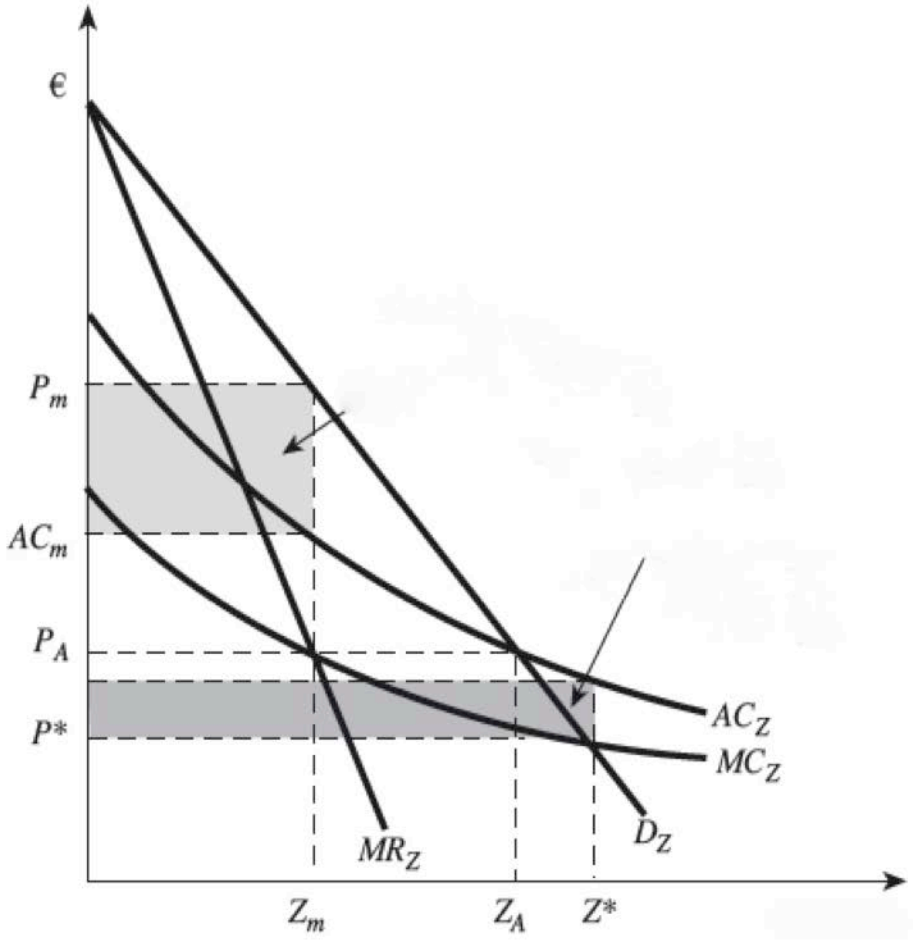
(late XIX Century and first decades 1900s)



Natural monopoly



Natural monopoly



History

- Wide disappointment with earlier private monopolies or oligopolies, often sheltered by various forms of concessions (legal monopoly+natural monopoly)
- Most European governments in the XX century, often after the Great Depression, took control of industries plagued by collusion, underinvestment, and price discrimination.
- Wide variability across countries because of different geopolitical (including military) and internal cohesion issues

- Millward, R. (2013). The State and Business in the Major Powers: An Economic History 1815-1939. Routledge.
- Millward, R. (2005). Private and Public Enterprise in Europe: Energy, telecommunications and transport, 1830-1990. Cambridge University Press.

- Tariffs under government supervision were strictly regulated and included cross-subsidies for some segments of the residential users (low-income, rural or other disadvantaged areas, etc.).

- After World War II, service provision and investment in the networks under public ownership increased significantly in many countries, particularly energy and telecoms.

The starting of the privatization wave

- In the 1970s, however, several nationalised SGEI in Europe were under budgetary stress, and widely perceived as inefficient.
- The United Kingdom, in the mid 1980s, was the front-runner of reform, while, among the EU member states, France was often regarded as a country adverse to move away from public monopoly.

The typical EU reform

EU legislation has adopted some but not all the ingredients of the UK reforms.

A typical 'European-style' reform package has four main dimensions:

- divestiture of public ownership;
- unbundling of the network from service operations;
- price regulation by an independent office (usually in the form of price capping);
- lifting of restrictions to market entry and eventually full liberalisation.

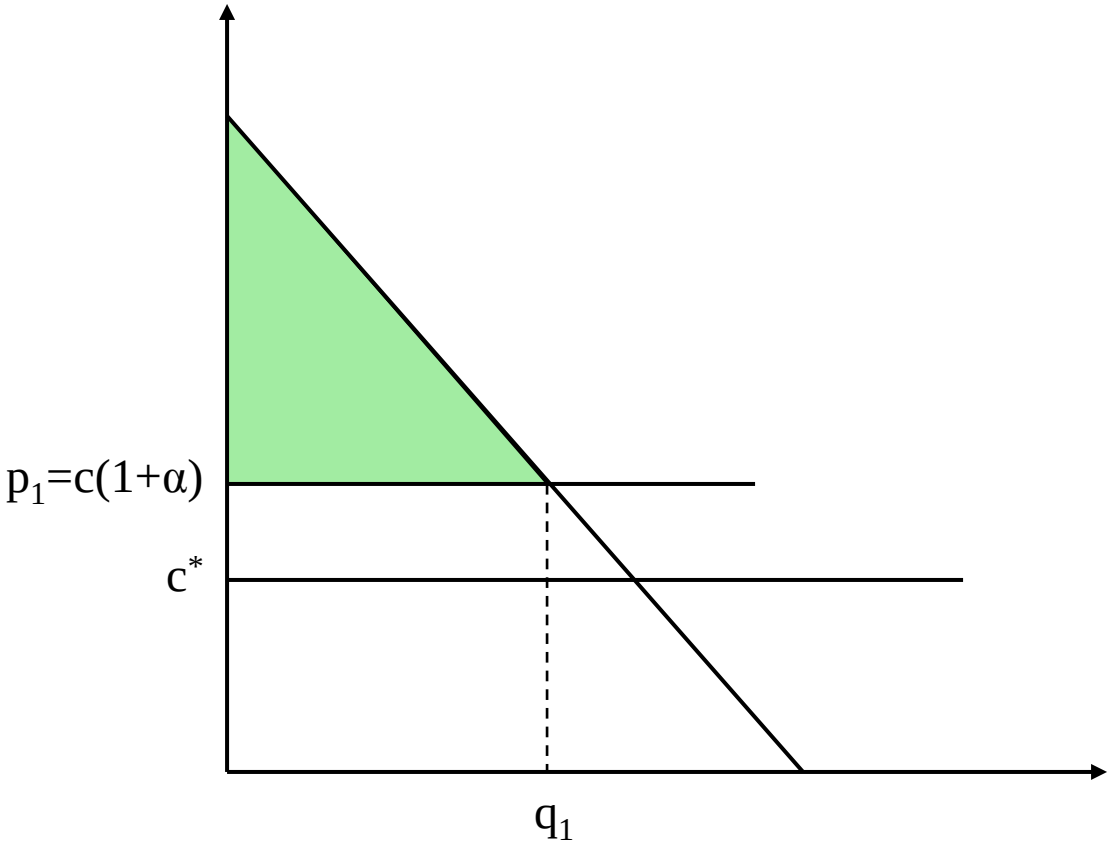
The typical EU reform

- The EU institutions have been in general strongly supportive of the reforms. While neutral on public ownership divestiture, the EC has proposed over the years a number of important directives on transport, telecom, energy, and other SGEI that push the Member States towards a homogenous pattern of regulatory legislation.
- A new paradigm (and legislation) has emerged.

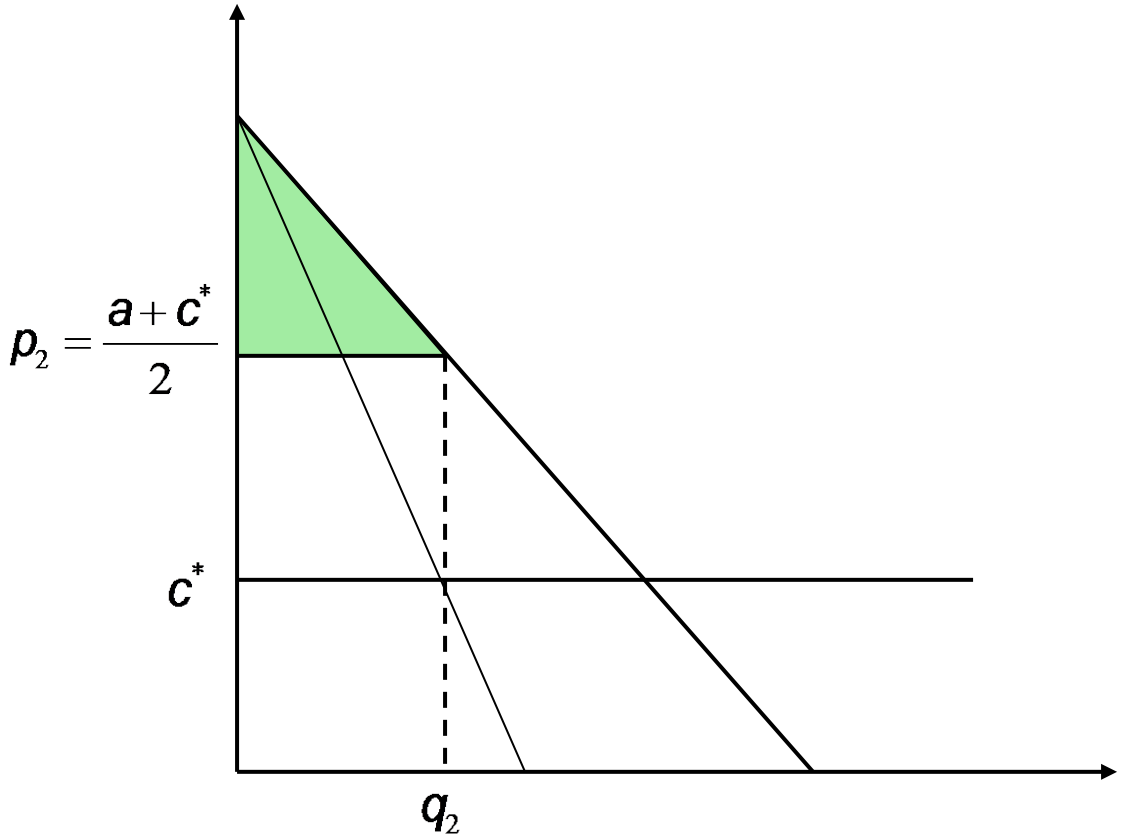
The paradigm: three pillars

- The first pillar of the paradigm: Privatization
- The second pillar: Unbundling
- The third pillar: (regulated) Market opening

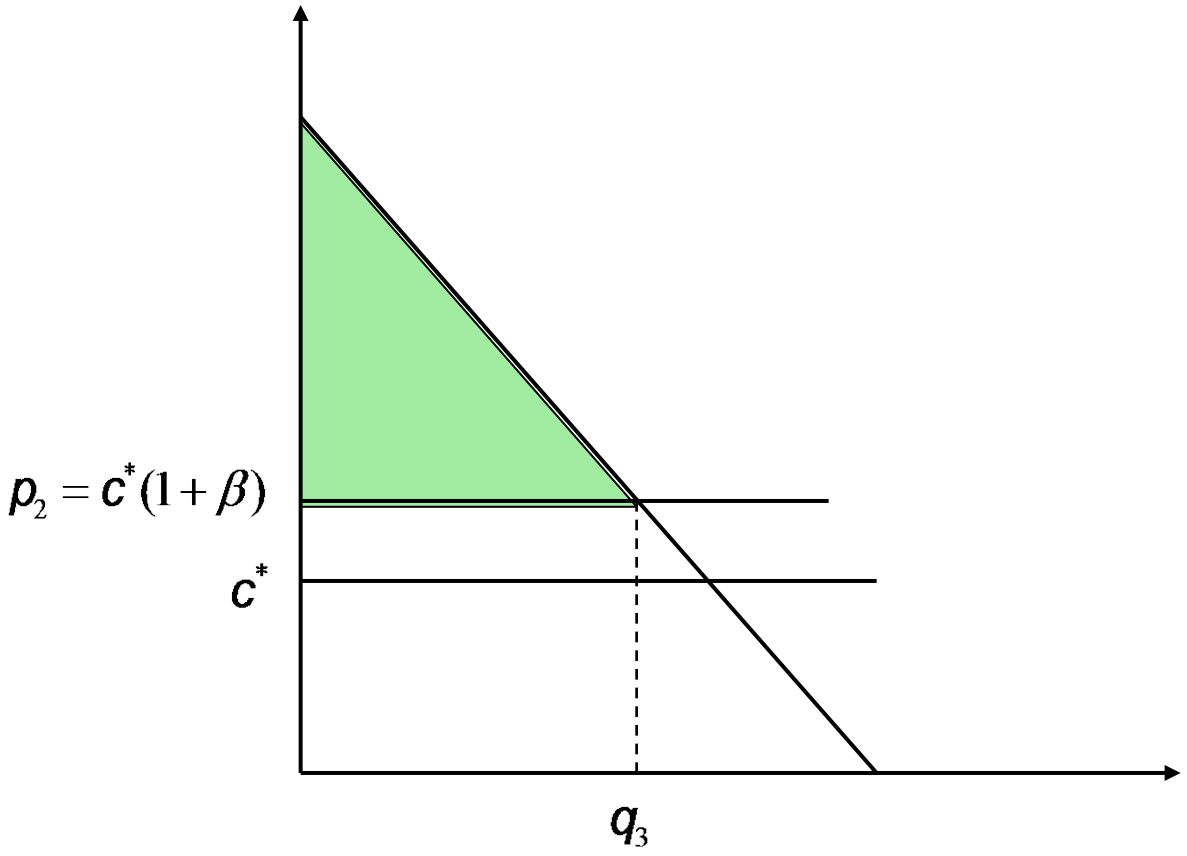
Public Monopoly



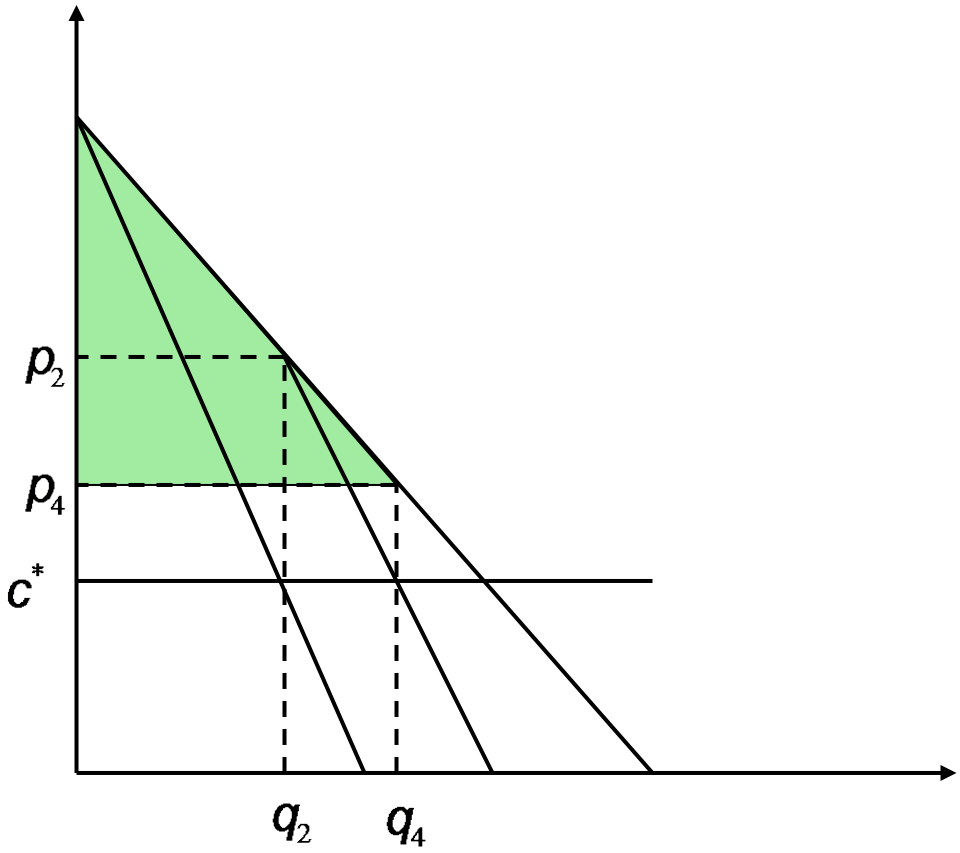
Private Monopoly, unregulated



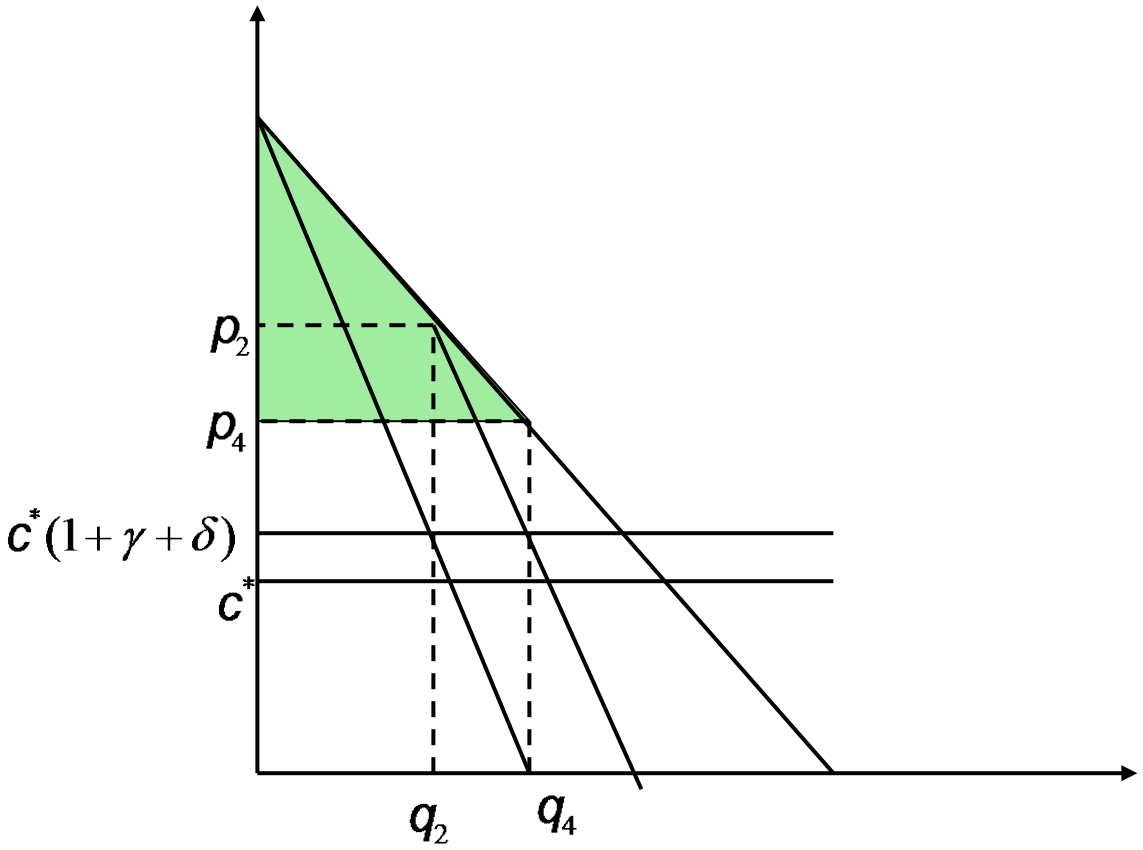
Private Monopoly, with a Price-Cap



Duopoly without costs of unbundling



Duopoly with costs of unbundling



Oligopoly 1/4

- After unbundling of the network, the regulator can offer a license to any new entrant
- *n* is the number of providers
- No price regulation
- Network service costs covered by the taxpayer

Oligopoly 2/4

- Profit maximization for each provider:

$$p_5 = \frac{c_n}{1 - \left(\sigma_n / \varepsilon \right)}$$

p_5 = price with free entry

c_n = marginal cost

ε = demand elasticity to price

$\sigma_n = \frac{q_n}{q}$ = share of the demand covered by the entrant

$\left| \left(\frac{\varepsilon}{\sigma_n} \right) \right|$ = elasticity of firm's demand

Oligopoly 3/4

Marginal Cost c_n

- Inefficiency of unbundling: ϕ

$$\Rightarrow c_n = c^* \left[1 + \phi(n)\right]$$

- Market liberalization in network industries in poorly interconnected regional markets seems to result in oligopoly
- Under oligopoly, prices can be higher than under a vertically integrated public monopoly

Oligopoly 4/4

Example: Regional gas supply oligopoly with five competitors.

$|0.8|$ = industry demand elasticity in the equilibrium point

$\phi(5) = 0.05$

$\Rightarrow p_5 = c^* \left(1.05/0.75\right) = 1.40c^*$

This implies that the vertically integrated monopoly had to be affected by $\alpha > 40\%$ or regulatory slack $\beta > 40\%$ to deliver higher prices than the unregulated oligopoly

The natural (quasi) experiment approach

- We treat this story as a natural experiment in policy reform, to study its welfare effects on users.
- We consider the EU15 (low reliability of data from NMS, shorter time series, very different institutions up to 1990s)
- Government-owned providers in energy were not loss makers, hence their prices covered costs, and comparison with pricing of private firms is more sensible.

Empirical strategy: tracking the reforms

	OWNERSHIP OF THE INCUMBENT OPERATOR	OWNERSHIP UNBUNDLING OF THE NETWORK	MARKET ENTRY AND COMPETITION
INTEGRATED PUBLIC MONOPOLY	PUBLIC	NO	NO
INTEGRATED PUBLIC MONOPOLY WITH NETWORK ACCESS	PUBLIC	NO → Accounting; Legal / Functional separation	Public Competitors; YES → Private Competitors; Mixed
UNBUNDLED PUBLIC INCUMBENT	PUBLIC	YES → Private Network; Public Network	Public Competitors; YES → Private Competitors; Mixed
INTEGRATED PRIVATE MONOPOLY	PRIVATE	NO	NO
INTEGRATED PRIVATE INCUMBENT WITH NETWORK ACCESS	PRIVATE	NO → Accounting; Legal / Functional separation	Public Competitors; YES → Private Competitors; Mixed
UNBUNDLED PRIVATE INCUMBENT	PRIVATE	YES → Private Network; Public Network	Public Competitors; YES → Private Competitors; Mixed

Empirical strategy 1/2

- Take advantage of cross-country variability of the reform pattern and trends, and to consider the reform pattern as a quasi-experiment.
- Under the quasi-experiment approach, one outcome variable is selected, e.g. productivity, investment, or prices, users satisfaction, and – after considering country or industry-specific control variables – a set of predictions about the impact of reforms is tested.
- causality issues, if not impact at least correlations

Empirical strategy 2/2

- This presentation focuses first on consumer prices. After all, we think that the main justification of a regulatory reform in SGEI should lie in the potential benefits for final users.
- Under very general assumptions consumer surplus changes are inversely related to price changes, thus focussing on consumer prices is a sensible shortcut for welfare analysis.

Prices and welfare

- It can be showed that the Marshallian surplus is an average of the Laysperes and Paasche price indices (see Waddams Price & Hancock, 1998; Florio 2004). We assume that privatized companies produce *normal goods*
- For a linear Marshallian demand and its compensated and equivalent counterparts, at privatisation, time 1, we observe quantity x_1 and a price p_1. At time 2, we observe quantity x_2 and price p_2.
- The compensated demand intersects the Marshallian demand at point x_1, p_1. It takes value x_3 at p_2 where $x_2>x_3>x_1$ because the slope of the compensated demand is greater than the Marshallian demand.
- The 'equivalent demand' intersects the Marshallian demand at point p_2,x_2 and takes the value x_4 at p_1, and $x_2>x_4>x_3>x_1$.
- The Marshallian welfare changes caused by price change is:

$$M = x_1(p_1 - p_2) + (p_1 - p_2)(x_2 - x_1) / 2$$

$$M= (p_1 - p_2)\ (x_2 + x_1) / 2$$

Empirical strategy: tracking the reforms

- We do not need to know actual prices and quantities; we just need expenditures at privatisation (or liberalisation) and at the final year, and the price index p_2 / p_1.
- Alternatively, if we select a middle year when

$$x^* = (x_1 + x_2) / 2$$

- we can directly infer the Marshallian welfare change as

$$M = E^*(p_1 - p_2) / p^*,$$

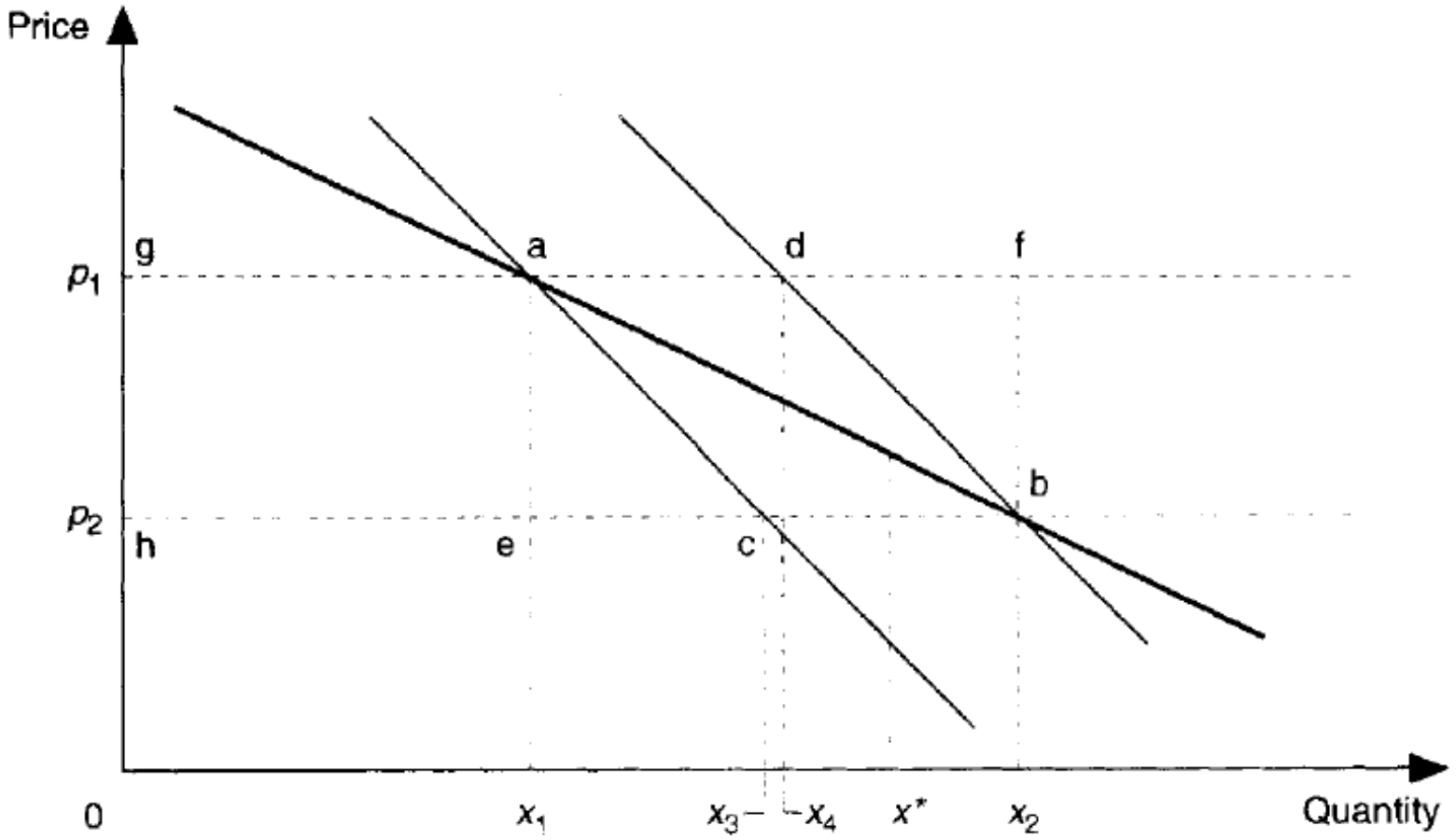
where we need one midway expenditure data and two price indexes p_1 / p^* and p_2 / p^*.

- We can be confident that this measure is between EV and CV, when the assumption of linear demand holds and substitution effects are negligible (as they might be for low elasticity of demand).
- We can then calculate the ratio between M and the income of the consumer for different percentiles, and give a welfare weight to each consumer type

Empirical strategy: tracking the reforms

- The Laysperes and Paasche compensated and equivalent variations are respectively:
  - $L=x_1(p_1 - p_2)$
  - $P=x_2(p_1 - p_2)$
  - $CVL= (p_1 - p_2) (x_1 + x_3) / 2$
  - $CVP= (p_1 - p_2) (x_2 + x_4) / 2$
- Since $x_1 > x_3 > x_4 > x_2$, It follows that $L<CV<<M<EV<P$ (see Waddams Price & Hancock 1998 for a simple graphical representation).
- We define now
  - $E_1 = x_1 p_1$
- and
  - $E_2 = x_2 p_2$
- then
  - $M=(E_1 - E_2 + p_1 x_2 - p_2 x_1) / 2$
- or
  - $M=\{E_1 (1 - p_2/ p_1) + E2 (p_1 / p_2 - 1)\} / 2$
- note that
  - $P = E_2 (p_1/ p_2 - 1)$
  - $L= E_1 (1 - p_2/ p_1)$
- Thus we can also write the Marshallian measures as an average of Paasche and Laysperes welfare measures:
  - $M= (L + P) / 2$

Prices as welfare indicators



Main research questions 1/2

- Hence, we can split our research question in two:
  1. Are average consumer prices lower (after controlling for non-reform related factors) in countries that implemented the reforms?
  2. Are individual consumers happier with the price they pay in the latter countries?
- If the answer is 'yes' to both questions, the reform is on a promising track, because it is at the same time supported by objective evidence and it enjoys public support.

Main research questions 2/2

- If prices are low, but perceptions are less positive, reformers should carefully consider why people are unhappy.

- If there is no evidence that prices are lower and that people are happier in countries that adopted the reforms, something is going wrong.

The main data set

- Consider actual price changes, as recorded by Eurostat (most data start in 1991). These are country-average data.
- Perceived price fairness by (individual) users, as recorded by Eurobarometro, a large EU sponsored survey, for which four waves and around 60,000 data points are available.
- Other data set are also used including the International Energy Agency (IEA, for electricity and gas), the International Telecommunication Union (ITU, for telecoms), the World Development Indicator (WDI).

Empirical strategy: tracking the reforms

ELECTRICITY	*Original OECD coding*			*Our coding*	
	Country scores 0-6		*Sector indic.*	*Binary variable 0-1*	
	Question weights	Weights by theme	Our label	Coding	Our label
PUBLIC OWNERSHIP:					
What is the ownership structure of the largest companies in the generation, transmission, distribution, and supply segments of the electricity industry? (ERpo1)	1/3	1/3	**ER**	1 if ownership is public	**ERpo_d**
ENTRY REGULATION:					
How are the terms and conditions of third party access (TPA) to the electricity transmission grid determined? (ERen1)	1/3	1/3		1 if wholesale market for elect. is not liberlised & consumption threshold is larger than 1MWatts	**ERen_d**
Is there a liberalised wholesale market for electricity (a wholesale pool)? (ERen2)	1/3				
What is the minimum consumption threshold that consumers must exceed in order to be able to choose their electricity supplier ? (ERen3)	1/3				
VERTICAL INTEGRATION:					
What is the degree of vertical separation between the transmission and generation segments of the electricity industry? (ERvi1)	1/2	1/3		1 if overall degree of vertical integration in the industry is mixed or integrated.	**ERvi_d**
What is the overall degree of vertical integration in the electricity industry? (ERvi2)	1/2				

Source: OECD coding taken from Conway and Nicoletti (2006).

Empirical strategy: tracking the reforms

GAS	*Original OECD coding*			*Our coding*	
	Country scores 0-6		*Sector indic.*	*Binary variable 0-1*	
	Question weights	Weights by theme	Our label	Coding (zero otherwise)	Our label
PUBLIC OWNERSHIP:					
What percentage of shares in the largest firm in the gas production/import sector are owned by government?	1/3	1/4	GR	1 if 100% of ownership of shares in all segments of the industry is public	GRpo_d
What percentage of shares in the largest firm in the gas transmission sector are owned by government?					
What percentage of shares in the largest firm in the gas distribution sector are owned by government?	1/3				
ENTRY REGULATION:					
How are the terms and conditions of third party access (TPA) to the gas transmission grid determined?	1/3	1/4		1 if no third party access, no consumers' choice in the retail market, and restrictions operate in all markets.	GRen_d
What percentage of the retail market is open to consumer choice?	1/3				
Do national, state or provincial laws or other regulations restrict the number of competitors allowed to operate a business in at least some markets in the sector: gas production/import	1/3				
MARKET STRUCTURE:					
What is the market share of the largest company in the gas production/import industry?	1/3	1/4		1 if market share in all segments of the industry is larger than 90%	GRms_d
What is the market share of the largest company in the gas transmission industry?	1/3				
What is the market share of the largest company in the gas supply industry?	1/3				
VERTICAL INTEGRATION:					
What is the degree of vertical separation between gas production/import and the other segments of the industry?	1/3	1/4		1 if the industry is integrated in all segments	GRvi_d
What is the degree of vertical separation between gas supply and the other segments of the industry?	1/3				
Is gas distribution vertically separate from gas supply?	1/3				

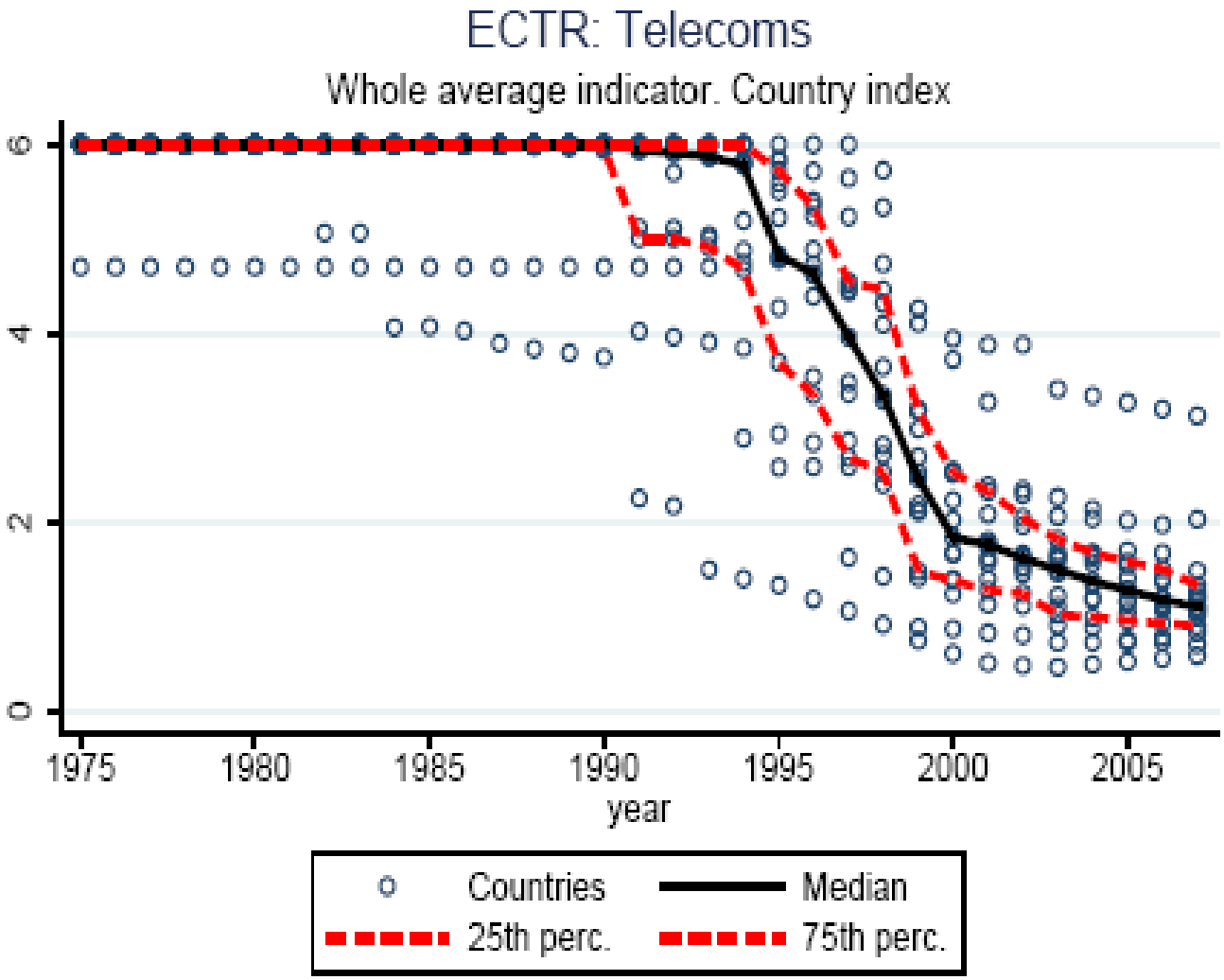
Source: OECD coding taken from Conway and Nicoletti (2006).

Empirical strategy: tracking the reforms

TELECOM	*Original OECD coding* — *Country scores 0-6* — Question weights	Weights by theme	*Sector indic.* — Our label	*Our coding* — *Binary variable 0-1* — Coding (zero otherwise)	Our label
PUBLIC OWNERSHIP:					
What percentage of shares in the PTO are owned by government?	1-wm	1/3	TR	1 if 100% of shares in the PTO are owned by government	TRpo_d
What percentage of shares in the largest firm in the mobile telecommunications sector are owned by government?	wm				
ENTRY REGULATION:					
What are the legal conditions of entry into the trunk telephony market?	1/4*wt*(1-wm)	1/3	TR	1 if legal condition of entry into the trunk tel. market is franchised to	TRen_d
What are the legal conditions of entry into the international market?	1/4*(1-wt)(1-wm)				
What are the legal conditions of entry into the mobile market?	1/2*wm				
MARKET STRUCTURE:					
What is the market share of new entrants in the trunk telephony market?	1/4*wt*(1-wm)	1/3	TR	100-market share of entrants in the trunk telephony market (a)	TRms_d
What is the market share of new entrants in the international telephony market?	1/4*(1-wt)(1-wm)				
What is the market share of new entrants in the mobile market?	1/2*wm				

Source: OECD coding taken from Conway and Nicoletti (2006).

Notes: The weight wm is the OECD-wide revenue share from mobile telephony in total revenue from trunk, international, and mobile. The weight wt is the OECD-wide revenue share of trunk in total revenue from trunk and international telephony. "PTO" stands for "Public telecommunications operator". (a) the variable TRms_d is the only non-binary variable as it is defined as 100 minus the share of new entrants in the trunk telephony market variable, going from zero to 100.


ECTR: Telecoms
Whole average indicator. Country index
0
2
4
6
1975
1980
1985
1990
1995
2000
2005
year
Countries
Median
25th perc.
75th perc.

Empirical strategy: tracking the reforms

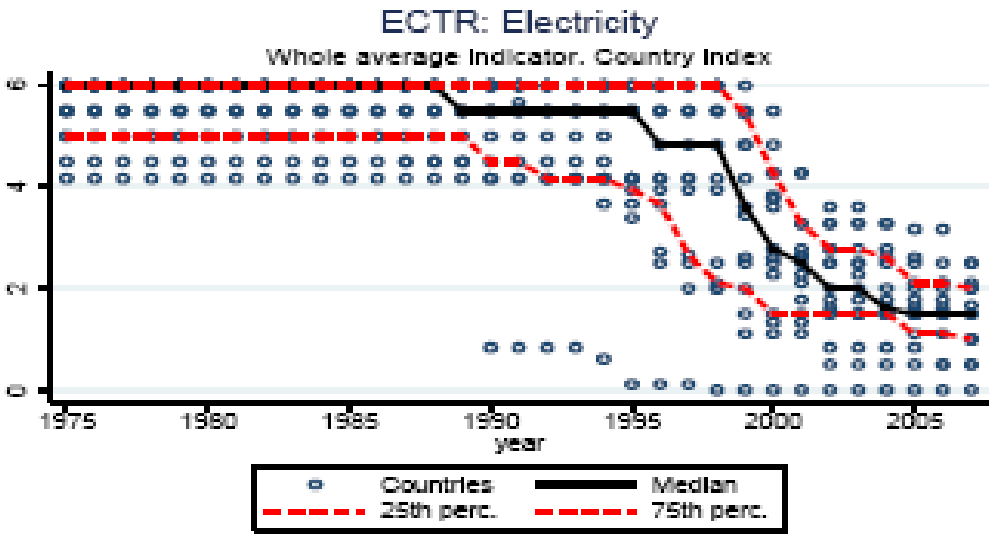
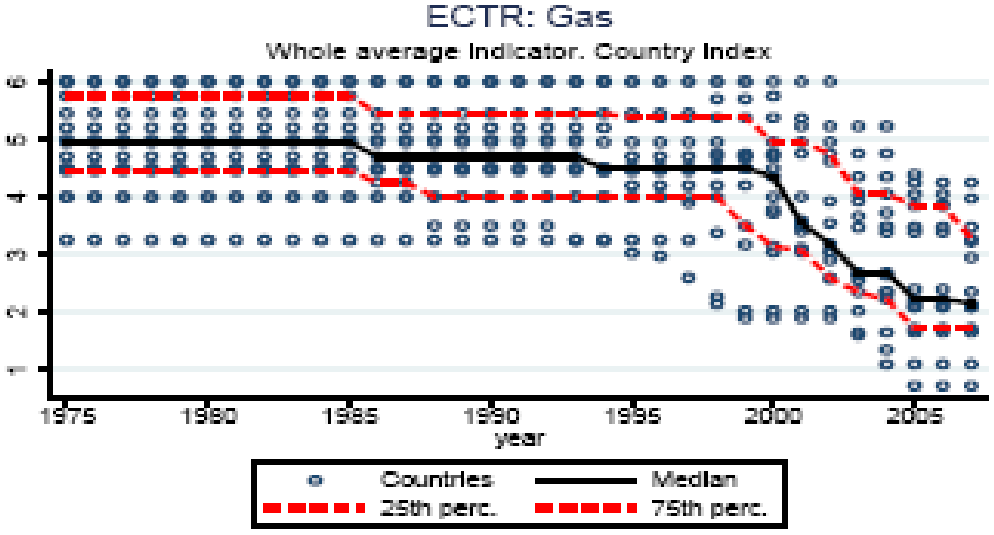
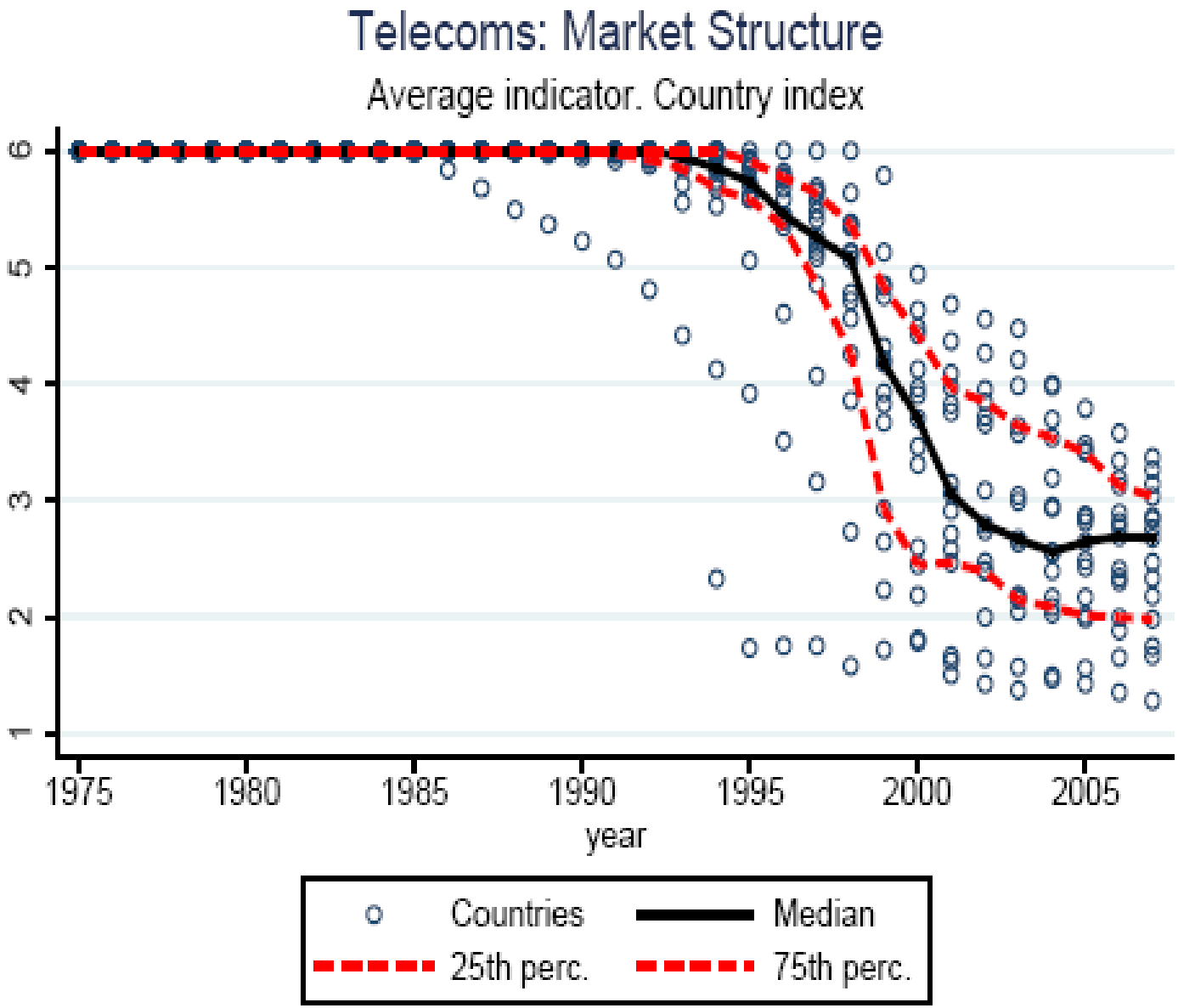


Figure 3:




Telecoms: Market Structure
Average indicator. Country index
1
2
3
4
5
6
1975
1980
1985
1990
1995
2000
2005
year
Countries
Median
25th perc.
75th perc.

Empirical strategy: tracking the reforms

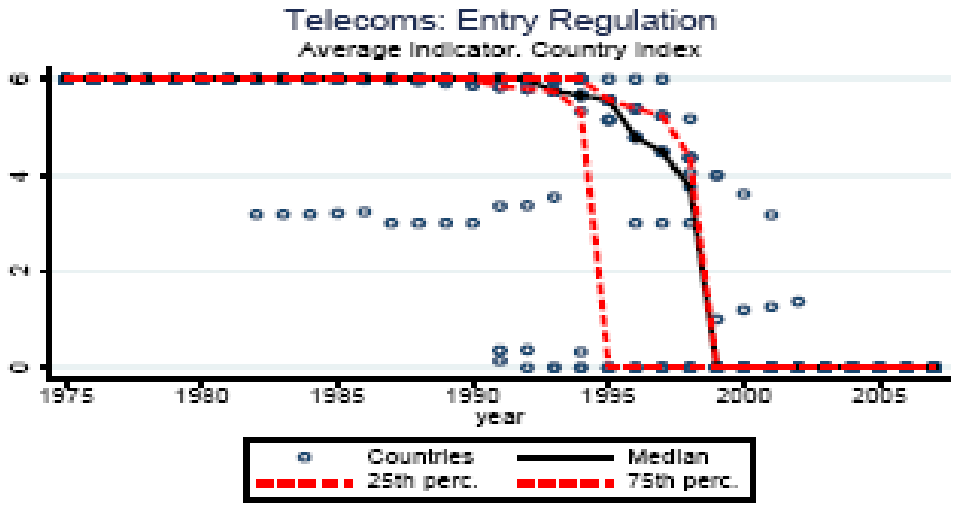
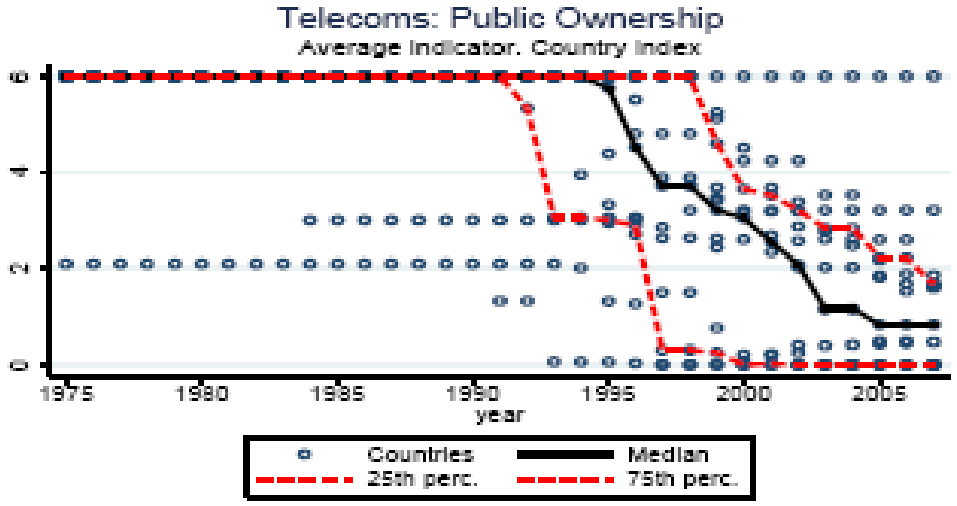


Figure 5:



The electricity industry

The electricity industry can be described as including four different activities:

1. generation,
2. transmission (the high voltage network),
3. distribution (the middle and low voltage network),
4. retail (supply to final consumers).

Only transmission and distribution are natural monopolies, at the national and regional level, because of the high network fixed sunk costs.




Data

The primary source for the average price variables are the International Energy Agency (IEA). The only alternative data source available for a EU15-wide analysis would be the Eurostat, which however is available for a much shorter time series as it starts at best in 1991

The IEA net-of-tax electricity prices for households are expressed in €/unit and present a correlation with household net-of-tax electricity prices

As for the regulatory reform variables, including measures of entry regulation, public ownership, market structure, vertical integration, in varying levels of detail: ETCR data set

Electricity prices.
France, UK, EU15 and NMs, 1990-2011. (kWh)

Source: Bacchiocchi, E. et al. (2015).

Price trends and Public ownership scores for France and UK, EU15, NMs, EU27

		1990	1996	2005	2009	2010	2011
France	Price	0.09	0.11	0.09	0.09	0.09	0.11
	ETCR score	6.00	6.00	4.50	4.50	4.50	4.50
UK	Price	0.08	0.09	0.08	0.14	0.13	0.14
	ETCR score	1.50	0.00	0.00	0.00	0.00	0.00
EU15	Price	0.09	0.10	0.10	0.13	0.13	0.13
	ETCR score	4.60	4.50	3.50	3.40	3.10	2.90
NMS	Price	n.a	0.05	0.08	0.10	0.11	0.11
	ETCR score	6.00	5.75	5.12	4.87	4.87	4.87
EU 27	Price	0.09*	0.09	0.09	0.12	0.12	0.12
	ETCR score	5.22	5.06	4.22	4.06	3.89	3.78

Note: Electricity prices for domestic consumers, Kilowatt/hour, Euro (from 1.1.1999)/ECU (up to 31.12.1998).
*Prices for EU15. Source: Own elaborations on Eurostat and ETCR data (from our updated OECD database since 2007).

Source: Bacchiocchi, E. et al. (2015).

Results

- The following table presents the result of the estimation of various dynamic models for electricity prices. The first column provides a test of the reform as a whole estimating a model where the reform variable is the ETCR sector score ranging from 0 to 6. In the following columns, we use as reform variables the set of dichotomous dummy variables. All models are estimated using GMM
- It is interesting to notice that the lagged dependent variable is highly significant also after inclusion of year fixed-effects, regulatory variables and other controls

Results

- If, instead of the ETCR score, a dummy variable for each of the three dimensions of the electricity industry reform is included, it emerges that only public ownership variable (ERpo_d) presents a consistently significant coefficient, reducing average price by roughly 0.3 (log) points.
- Vertical integration, which is strongly correlated with public ownership, is never statistically significant.
- Entry regulation is significant at the 10% significance level although it is mainly the freedom of choice of providers that drive this effect

Prices and the public ownership indicator are inversely correlated (EU15, 1978-2007).

Public Ownership and household prices (log, net-of-tax) electricity - 1978-2007, EU15

	(1)	(2)	(3)	(4)	(5)
	GMM	GMM	GMM	GMM	GMM
Regulation index	0.003				
	(0.690)				
Public ownership[1]		−0.376***	−0.356***	−0.350***	−0.366***
		(0.000)	(0.000)	(0.000)	(0.000)
Entry regulation[1]		−0.106*			
		(0.072)			
Vertical integration[1]		0.099	0.079	0.037	0.066
		(0.233)	(0.393)	(0.598)	(0.462)
Entry regulation[1]: third party access			−0.043		
			(0.483)		
Entry regulation[1]: liberalized wholesale pool			−0.015		−0.024
			(0.741)		(0.596)
Entry regulation[1]: minimum threshold for consumers' choice			−0.098*	−0.100**	−0.092*
			(0.073)	(0.049)	(0.088)
Average price (period $t-1$)	0.854***	0.414***	0.407***	0.428***	0.414***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total combustible fuels	0.025**	0.016	0.021	0.023	0.021
	(0.011)	(0.517)	(0.408)	(0.354)	(0.409)
Electricity import[2]	0.000	−0.000	−0.000	−0.000	−0.000
	(0.720)	(0.913)	(0.900)	(0.936)	(0.917)
Electricity residential consumtion[2]	−0.022**	0.002	−0.008	−0.007	−0.005
	(0.012)	(0.948)	(0.805)	(0.820)	(0.870)
Per capita GDP[2]	0.016	0.231***	0.215***	0.225***	0.227***
	(0.274)	(0.000)	(0.000)	(0.000)	(0.000)
Year fixed-effects	yes	yes	yes	yes	yes
Constant	−0.292**	−0.676**	−0.683**	−0.612**	−0.647**
	(0.026)	(0.011)	(0.011)	(0.015)	(0.014)
Observations	402	402	402	402	402
Countries	15	15	15	15	15

Standard errors in parentheses. For the regulatory variables see Table 5.A.1. For details, see Fiorio and Florio (2010).
*** p<0.01,** p<0.05,* p<0.1.
[1] Dummy.
[2] Log.

Source: Florio, M. (2013). Table 5.7

Public Ownership and household prices in electricity - 1990-2011, EU27

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: price of electricity							
Overall electricity industry indicator (ER)	0.029***						
	(0.009)						
Dummy variable for public ownership		-0.030	0.006				
		(0.034)	(0.033)				
Dummy variable for vertical integration		0.031		0.073***			
		(0.033)		(0.028)			
Dummy variable for entry regulation		0.092***			0.102***		
		(0.031)			(0.026)		
ER EU15						0.045***	
						(0.009)	
ER NMS						-0.046***	
						(0.014)	
Dummy variable for public ownership EU15							0.019
							(0.043)
Dummy variable for public ownership NMS							-0.100**
							(0.051)
Dummy variable for vertical integration EU15							0.014
							(0.038)
Dummy variable for vertical integration NMS							0.072
							(0.061)
Dummy variable for entry regulation EU15							0.128***
							(0.032)
Dummy variable for entry regulation NMS							-0.172***
							(0.059)
Electricity generated from renewable sources	1.144***	1.145***	1.084***	1.103***	1.117***	1.165***	1.148***
	(0.186)	(0.187)	(0.189)	(0.186)	(0.184)	(0.175)	(0.179)
Distribution losses	7.418**	7.213*	7.877**	7.325*	7.246*	8.012**	7.936**
	(3.764)	(3.749)	(3.813)	(3.783)	(3.741)	(3.548)	(3.585)
Plant load factor	-0.611***	-0.620***	-0.636***	-0.587***	-0.641***	-0.840***	-0.761***
	(0.184)	(0.185)	(0.186)	(0.186)	(0.183)	(0.177)	(0.179)
Energy Intensity of the economy	0.046	0.070	0.032	0.038	0.070	0.098	0.092
	(0.081)	(0.081)	(0.082)	(0.081)	(0.081)	(0.077)	(0.078)
Import share	0.272**	0.285**	0.211*	0.260**	0.267**	-0.077	-0.019
	(0.112)	(0.112)	(0.112)	(0.112)	(0.110)	(0.116)	(0.117)
GDPpc real	0.551***	0.564***	0.435***	0.469***	0.576***	0.513***	0.541***
	(0.114)	(0.114)	(0.110)	(0.109)	(0.113)	(0.108)	(0.110)
COSTcomp	0.042***	0.039***	0.029***	0.035***	0.039***	0.046***	0.040***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Constant	-8.279***	-8.544***	-6.894***	-7.328***	-8.654***	-8.154***	-8.380***
	(1.537)	(1.538)	(1.498)	(1.488)	(1.533)	(1.449)	(1.478)
Observations	420	420	420	420	420	420	420
R-squared	0.498	0.506	0.485	0.494	0.504	0.555	0.555
Number of country	27	27	27	27	27	27	27

Prices and the public ownership indicator in the NMS are inversely correlated (EU27, 1990-2011).

Source: Bacchiocchi et al. (2015).

Dissatisfaction for the provision of the electricity service (Probit)

	(1)	(2)	(3)	(4)	(5)	(6)
Regulation index	0.021	0.019	0.024			
	(0.324)	(0.335)	(0.390)			
Public ownership[1]				−0.035	−0.057*	−0.060**
				(0.303)	(0.062)	(0.035)
Entry regulation[1]				0.129*	0.125*	0.137*
				(0.089)	(0.088)	(0.060)
Vertical integration[1]				0.026	0.032	0.042
				(0.438)	(0.332)	(0.178)
Price for average household (period *t*)		1.828	2.357		2.316**	3.616***
		(0.113)	(0.162)		(0.022)	(0.000)
Price for average household (period *t*−2)			−0.583			−1.342
			(0.666)			(0.143)
Individual characteristics	yes	yes	yes	yes	yes	yes
Macroeconomic variables	yes	yes	yes	yes	yes	yes
Year fixed-effects	yes	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes	yes
Individuals	57,153	57,153	57,153	57,153	57,153	57,153
Log-likelihood	−35,333	−35,306	−35,304	−35,268	−35,227	−35,217
Pseudo R-squared	0.0578	0.0585	0.0586	0.0595	0.0606	0.0609

The public ownership indicator and price dissatisfaction (Eurobarometer, EU15, 2002, 2004, 2006, 2008) are inversely correlated.

Sources: own elaboration on ECTR for regulatory indices (see Table S.A.1), Eurostat for price variables and macroeconomic variables, Eurobarometer for individual variables.
P-values in parentheses.
*** p<0.01,** p<0.05,* p<0.1.
[1] dummy.

Source: Florio, M. (2013).

Measures of quality

"Service quality is an important issue in the electricity distribution and retail sectors. Experience so far shows when a regulator chooses to regulate prices using price or revenue caps, a service level tends to drop. On the other hand, rate of return method could lead to over investments in the network. For this reasons, all types of regulation must be supplemented by some kind of service quality regulation"

(Energy Community Regulatory Board, 2008, p.5)

Two main aspects of quality, which are of interest of regulators:

1. Commercial (connection times, metering, billing, handling of customers' requests) and
2. Technical quality (continuity of supply and voltage quality)

Voltage quality is a complex concept, usually not directly measurable by users.

The continuity dimensions can be summarized by simple indicators, such as the System Average Interruption Frequency Index (SAIFI) or the System Average Interruption Duration (SAIDI)

Quality of service (1)

Ordered logit analysis of consumer satisfaction about Electricity Supply

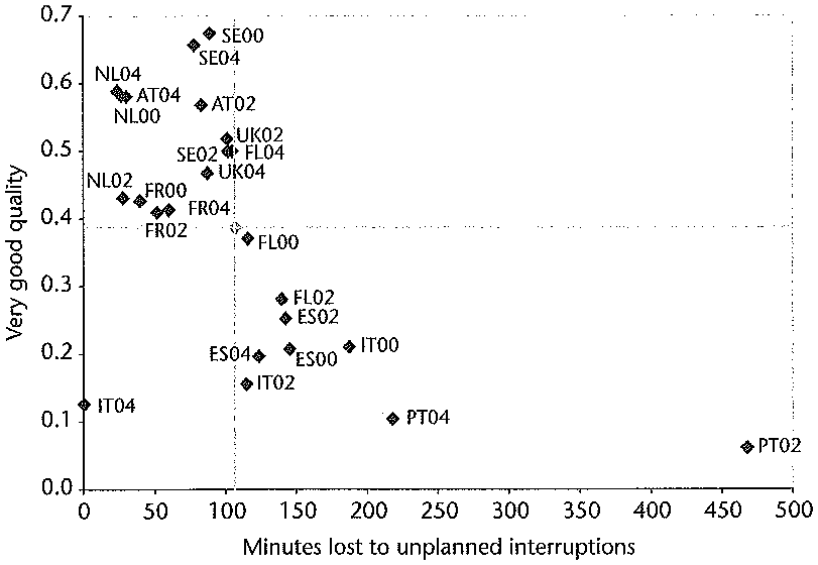
	A	B
Public Ownership	0.133***	0.090***
Entry Regulation	-0.032	-0.103***
Market Structure	0.098***	0.121***
Vertical Integration		
Individual Characteristics	YES	YES
Household income: II quartile		0.077
Household income: III quartile		-0.002
Household income: IV quartile		0.161**
Country fixed-effects	YES	YES
Year fixed-effects	YES	YES
Population density	0.028*	0.023
GDP, per capita	-0.031***	0.001
GDP, growth rate	0.050	0.243***
Employment growth rate	-0.064**	-0.174***
Gini	0.022	0.092
Individuals	42,548	29,344

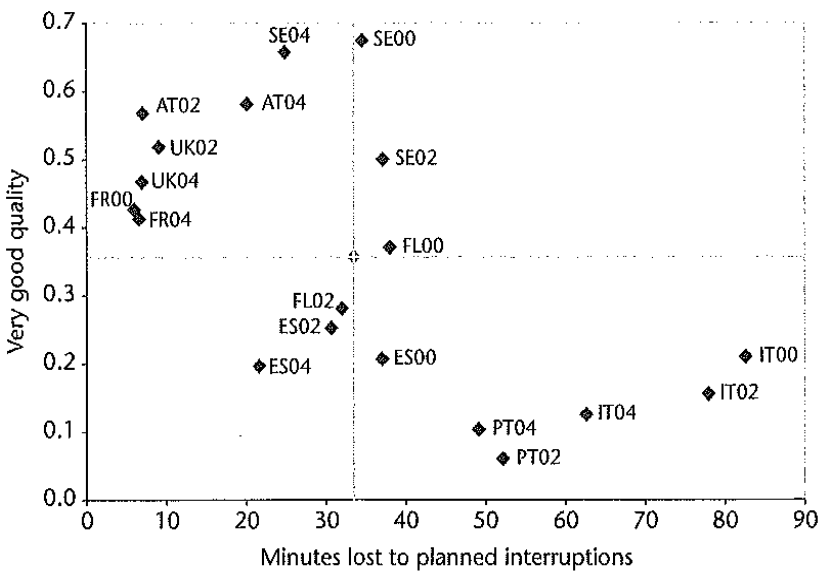
Consumer satisfaction and the public ownership indicator are positively correlated.

Source: Florio, M. (2013).

Quality of service (2)

Correlation between interruption of electricity supply and quality perceptions





Source: Florio, M. (2013).

Quality of service (3)

Pearson Correlation Index between ECTR scores and number and minutes of unplanned interruptions of electricity supply

Pearson Correlation	Unplanned Interruptions		Planned Interruptions	
	Number[1]	Minutes[2]	Number[3]	Minutes[4]
Entry	0.016	0.155	−0.053	0.189
Public ownership	−0.301**	−0.090	−0.137	−0.055
Vertical integration	−0.023	0.015	−0.051	0.088

Source: own elaboration on CEER 2008 data, various years. For regulatory variables see Tables 4.A.1, 5.A.1, 6.A.1.
[1] Number of sample units 96.
[2] Number of sample units 98.
[3] Number of sample units 79.
[4] Number of sample units 85.
** Correlation is significant at the 0.01 level.

Service interruptions and the public ownership indicator are inversely correlated.

Source: Florio, M. (2013).

Distribution of electricity and quality of institutions (1)

Institutional quality by country

Country	*QOG*	*GEE*	*RQE*
Bulgaria	0.059	0.104	0.382
Czech Republic	0.431	0.488	0.583
Estonia	0.310	0.513	0.769
Finland	1.000	0.946	0.915
France	0.565	0.710	0.638
Germany	0.782	0.767	0.788
Hungary	0.410	0.399	0.645
Italy	0.250	0.298	0.517
Netherlands	0.905	0.851	0.923
Poland	0.351	0.270	0.419
Portugal	0.557	0.504	0.626
Romania	0.036	0.028	0.162
Slovakia	0.333	0.376	0.591
Slovenia	0.432	0.492	0.471
Spain	0.580	0.604	0.671
Sweden	0.915	0.930	0.870

Notes

Average values of standardized indicators 2002–09.

Source: QOG, quality of government (International Country Risk Guide); RQE, regulatory quality (WB governance indicators); GEE, government effectiveness (WB governance indicators).

Source: Borghi, E. et al. (2014).

Distribution of electricity and quality of institutions (2)

TFP measure	*All firms*		*Public firms*		*Private firms*		*Difference in mean*
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*P*
Cobb–Douglas	4.93	0.86	4.96	0.77	4.86	1.01	0.018
Translog	2.15	0.57	2.14	0.50	2.17	0.71	0.205
Levinshon and Petrin	6.02	0.98	6.09	0.85	5.87	1.18	0.000

Notes

Two-sample *t* test with unequal variances; H1: difference = mean(private)−mean(public) < 0. For Cobb–Douglas and Levinshon and Petrin: H1: difference = mean(private)−mean(public) < 0; *P*: *Pr*(*T* < *t*): one tailed *P*-value for H1. For Translog: H1: difference = mean(private)−mean(public) > 0; *P*: *Pr*(*T* > *t*): one tailed *P*-value for H.

Source: Amadeus, authors' elaboration.

Source: Borghi, E. et al. (2014).

Total Factor Productivity

Total factor productivity determinants: baseline results

TFP is inversely correlated with public ownership but positively correlated with the interaction of public ownership and quality of institutions.

TABLE 5

Total factor productivity determinants: baseline results

	Base	*QOG*	*GEE*	*RQE*
Dep. variable TFP (Levinshon and Petrin)	*(1)*	*(2)*	*(3)*	*(4)*
Ownership	0.002	−0.410**	−0.401**	−0.517**
	(0.027)	(0.113)	(0.113)	(0.155)
Institutional quality		0.330	−0.239	−0.168
		(0.322)	(0.143)	(0.344)
Ownership * Institutional quality		0.563**	0.552**	0.686**
		(0.139)	(0.140)	(0.192)
Total assets	0.497**	0.504**	0.502**	0.502**
	(0.007)	(0.007)	(0.007)	(0.007)
Capital/labour	−0.200**	−0.202**	−0.201**	−0.201**
	(0.015)	(0.014)	(0.014)	(0.014)
Wage	0.385**	0.395**	0.388**	0.387**
	(0.038)	(0.039)	(0.037)	(0.037)
Regional GDP p.c.	0.125	0.151*	0.141*	0.141*
	(0.068)	(0.070)	(0.070)	(0.071)
Constant	0.202	0.031	0.156	0.167
	(−0.532)	(−0.546)	(−0.550)	(−0.568)
Number of observations	1,968	1,968	1,968	1,968
Adjusted R^2	0.866	0.868	0.868	0.867

Notes: OLS estimation. All specifications include time and country dummies. Omitted country = Bulgaria, omitted year = 2002. *P*-values, associated to robust standard errors, clustered by country and year, in parenthesis. $^{**}P < 0.01$, $^{*}P < 0.05$.
Base: only ownership dummy and other controls; *QOG*: institutional quality = QOG; *GEE*: institutional quality = GEE; *RQE*: institutional quality = RQE. Ownership = 1 if public; = 0 if private.

Source: Borghi, E. et al. (2014).

Empirical Analysis: Gas

- Brau et al. (2010) estimate panel data models regressing the log of net-of-tax natural gas prices for domestic users against the ETCR reform indicators to test for the presence of any statistically significant impact of reforms on the prices paid by European consumers.

Empirical Analysis

- The (log of) natural gas price is highly correlated with its lagged value regardless of the data source used, calling for the estimation of panel models including the lagged dependent variable (dynamic panels) instead of static ones. Let p_{it} be the log yearly household natural gas prices for country i at time t, R_{it} the vector of regulatory variables for country i at time t, Z_{it} a vector of additional controls, and β a vector of time dummies:

$$p_{it} = \rho p_{i,t-1} + R_{it}^{'}\gamma + Z_{it}^{'}\delta + \alpha_i + \beta_t + \varepsilon_{it}$$

Results

- When the estimated models include a series of country-specific controls, most of which are statistically significant, crude oil price – as expected- is positively correlated with natural gas prices. Given this pricing structure for wholesale gas, and the huge swings in oil prices in the period 1991-2003, it is hardly surprising that oil is an important determinant of domestic gas prices in Europe.

However, the focus of Brau et al (2010) is on the effects, if any, of regulatory reforms on prices.

Results

- After controlling for time dummies, Brent oil, and macroeconomic variables, there is some evidence that public ownership is associated with lower prices.

- *This is true with both data sets,* although the p-value is statistically significant at 10% only using the Eurostat data (14% using the IEA data). By contrast, with stricter market regulation, prices increase regardless of the data set used, and the effect is always statistically significant.

Data

- Brau et al. go into further detail by replacing the average scores with the sub-indicators used in the ECTR data for creating the average 0-6 score indicators, with some modifications.

- The public ownership ETCR 0-6 score is replaced by the sub-indicators measuring the percentage of shares owned by the state in the production and in the distribution stage.

Data

- The entry regulation and market structure ETCR 0-6 scores, providing an indication of the liberalisation process, are replaced with the continuous variable indicating the percentage of the retail market open to consumers' choice. Moreover, a dummy variable that is equal one if the market share of the incumbent is below 90% and zero otherwise is also used.

- The vertical integration ETCR 0-6 score is replaced by dummy variables as the sub-indicators are provided as categorical variables (integrated monopoly, legal/accounting separation or ownership separation) and their cardinalization is debatable. In particular, the dummies created are equal to one if there is ownership, legal or accounting separation in the industry and zero otherwise in the production, supply and distribution stages.

GMM estimation of dynamic panels for gas prices

	(1)	(2)	(3)	(4)	(5)
	GMM	GMM	GMM	GMM	GMM
Average price (period *t-1*)	0.712***	0.806***	0.795***	0.797***	0.811***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ECTR score	-0.094**				
	(0.027)				
Public ownership dummy		-0.240***	-0.233**	-0.227**	-0.245***
		(0.007)	(0.015)	(0.017)	(0.008)
Vertical integration dummy		-0.025	-0.016	-0.013	-0.030
		(0.691)	(0.811)	(0.840)	(0.614)
Entry regulation dummy		-0.028			
		(0.726)			
Entry regulation dummy:			0.047		
No third party access			(0.509)		
Entry regulation dummy:			-0.073	-0.043	
No retail market open to consumers			(0.402)	(0.564)	
Restrictions by laws/regul. on n. of competitors			-0.019	-0.005	-0.020
No consumer choice of supplier			(0.900)	(0.974)	(0.890)
Brent oil price	0.025	0.076**	0.082**	0.071*	0.072*
	(0.591)	(0.028)	(0.041)	(0.053)	(0.052)
Year fixed-effects	yes	yes	yes	yes	yes
Constant	0.843**	0.220	0.231	0.268	0.229
	(0.048)	(0.240)	(0.417)	(0.340)	(0.405)
Observations	295	295	295	295	295
Number of countries	11	11	11	11	11

Dep. var.: log average price for gas supply.

Source: Authors' calculations using IEA, WDI source data. IEA data used for price series.

Notes: Robust p-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Year dummies included in all models. GMM results are one-step estimates with heteroskedasticity-consistent standard errors (in parentheses) and test statistics. All continuous variables are in logs.

Source: Florio, M. (2013) Tab. 6.9

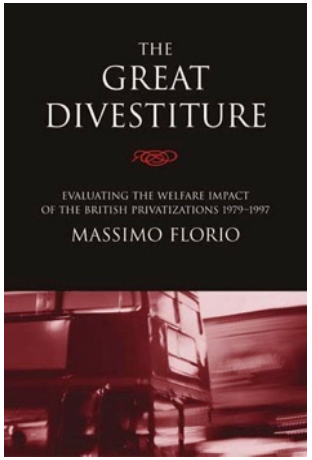
Conclusions

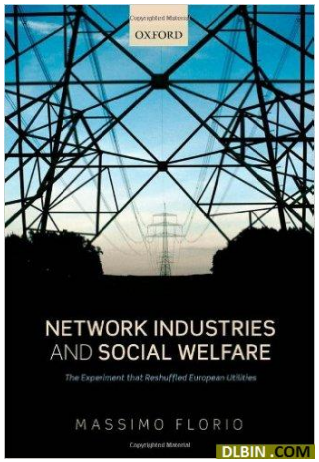
- Prices and the public ownership indicator are inversely correlated (EU15, 1978-2007).
- Prices and the public ownership indicator in the NMS are inversely correlated (EU27, 1990-2011).
- The public ownership indicator and price dissatisfaction (Eurobarometer, EU15, 2002, 2004, 2006, 2008) are inversely correlated.
- Quality satisfaction and the public ownership indicator are positively correlated (EU15).
- Service interruptions (nine EU15 countries, 1999-2007) and the public ownership indicator are inversely correlated.
- TFP (8 EU15 countries vs 8 NMS countries, 2002-2009) is inversely correlated with public ownership but positively correlated with the interaction of public ownership and quality of institutions.

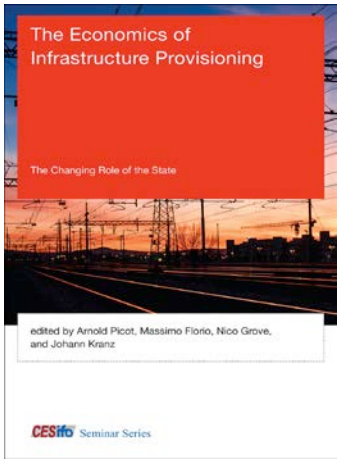
Some Research Questions

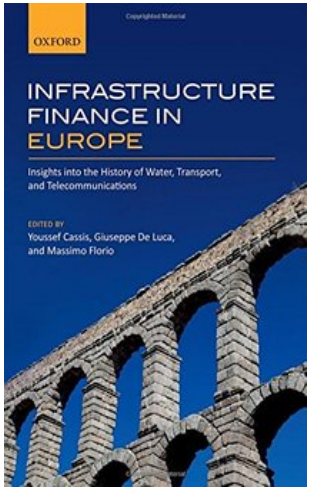
- In network industries the competition paradigm cannot work as elsewhere. Welfare effects of regulated oligopoly?
- Does public ownership in (some) regulated industries, as electricity, act as an implicit price-cap mechanism (theory of mixed-oligopoly)?
- Welfare effects when profitability is inversely correlated to prices for a given cost structure (technology and R&D).
- Productivity should be assessed in physical units of service (as prices enter in added value). Issues of data.
- Quantities and prices should be quality-adjusted.
- Are SOEs better when government is better?
- Without good institutions, both privatization, market regulation and public ownership fail.

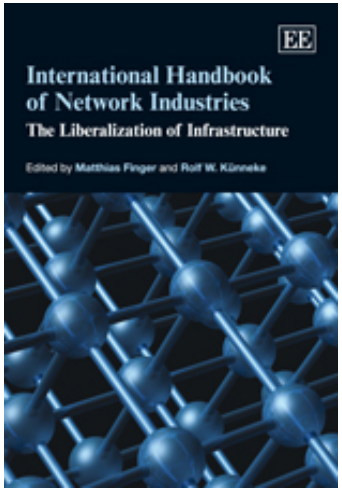
THANK YOU

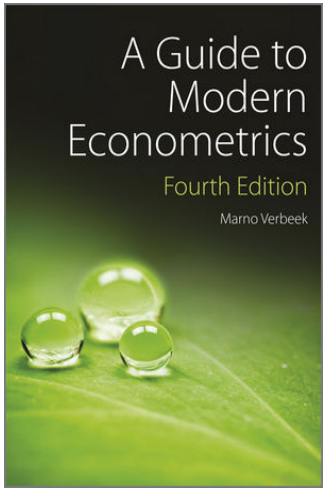












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