UPP UNDERSTANDING PRIVATISATION POLICY: POLITICAL ECONOMY AND WELFARE EFFECTS

The welfare effects of utility reforms: the European consumer

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Objective of the Milan project

- Empirical analysis of the welfare impact on consumers of privatisation, liberalisation and regulation of public utilities in the EU 15 with special reference to services such as gas, electricity and telecommunications.

Research motivation

- Over the last twenty years EU Member States have embarked on a wide range of reforms of public services, previously fully or partly nationalized (electricity, gas, telecommunications, water, railways, other public transport modes, postal services, etc.)
- Since early 1980s, divestiture of public ownership in SGI, and large-scale privatization policies across Europe.
- The EU is neutral about ownership, but strongly supports liberalization of network industries.
- The EU made compulsory the disintegration of several network industries, as an instrument to liberalization policies,
- A New Paradigm emerged: privatization, liberalization and vertical disintegration are seen as germane policies.

Research motivation

- The overall trend is clear and widespread, but its timing and implementation shows considerable variations across the 15 EU Members States & new member countries.
- Moreover the outcome of the reforms is still under scrutiny.
- Supporters of the New Paradigm have little doubts about the net social benefits of the reform process, but criticism on it is far from being overwhelmed by evidence.
- The last word on the outcome of the reforms rests ultimately on empirical analysis.

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Welfare effects of privatization

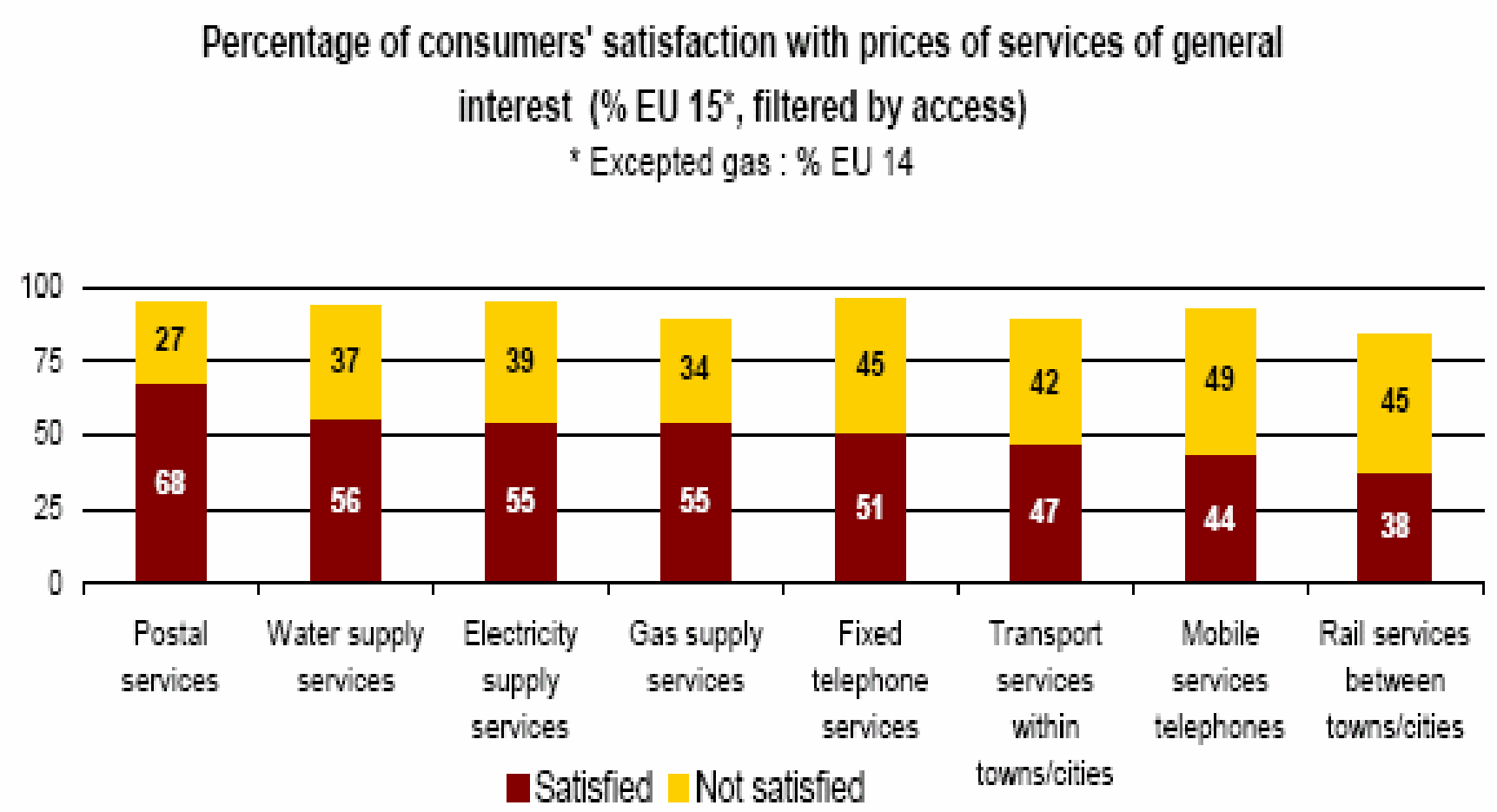
- Analysis of the change in consumers' welfare "with" and "without" privatizations by means of the tools of applied welfare economics.
- Similar analysis for other regulatory reforms.
- Prices, access, quality.
- Eurostat, IEA, ITU Data.

From measurable welfare to happiness (i.e. subjective welfare)

- Evaluation of the level of consumer satisfaction with Services of General Interest
- This is not a substitute, but a complement to standard welfare analysis
- Eurobarometer Data

- Eurobarometer questions:
  - In general, would you say that access to mobile telephone services is easy or difficult for you?
    - Also for fixed telephone, electricity, gas, water, transport, postal services?
  - In general, would you say that the price you pay for the mobile telephone services you use is fair or unfair?
    - Also for fixed telephone, electricity, gas, water, transport, postal services?
  - Analogous questions with quality and condition of contract, information received by providers

Consumers' satisfaction with prices of SGI



Framework of the analysis

- One strategy to preserve some micro information is to adopt an empirical shortcut:
- instead of (or as a complement to) relying on revealed preference through the estimation of individual compensated demand functions (or their proxies) we can turn to stated preferences, i.e. subjective well-being measures.
- SGIs are sufficiently important to influence perceptions of well being.
- While such perceptions can be wrong, they are of course based on the information set available to the respondent, plus an idiosyncratic bias.
- Happiness economics relates overall subjective well being to macroeconomic issues. Here we focus on satisfaction on specific, albeit important consumption items.

A natural experiment about SGI?

- To sum up: we regard the implementation of reforms of services of general interest in the EU as a natural experiment with heterogeneous population.
- Each Member States moves along a common policy trend, the privatization-vertical disintegration-liberalization paradigm, as determined by the 'Brussels Consensus', a mixture of legislation and of commonly shared beliefs.
- There are however strong variations across time and countries in the implementation process.
- We wish to exploit this variability to evaluate the welfare impact of the program.

Illustrative example

- We construct some dichotomous indices of satisfaction.
- The consumer price satisfaction index is equal to 1 if the respondent says that the price paid for an SGI is fair, and is recorded equal to 0 otherwise (unfair, excessive).
- The consumer quality satisfaction index is equal to 1 if the respondent says that the quality of an SGI is very good, and is equal to 0 if the answer is fairly good, fairly bad or very bad.
- Other possibilities (ordered probit, OLS, etc)

Index of satisfaction

	Telephone	
	Price	Quality
not satisfied	40.1%	60.3%
satisfied	59.9%	39.7%

	Gas	
	Price	Quality
not satisfied	34.5%	61.6%
satisfied	65.5%	38.4%

	Electricity	
	Price	Quality
not satisfied	38.2%	56.8%
satisfied	61.8%	43.2%

Standard probit model

- Latent model of satisfaction:

$$S^* = \mathbf{x}\boldsymbol{\beta} + e$$

- One can only observe:

$$S = 1[S^* > 0]$$

- Probit model:

$$\Pr(S = 1 \mid \mathbf{x}) = \Pr(S^* > 0 \mid \mathbf{x}) = \Pr(e > -\mathbf{x}\boldsymbol{\beta} \mid \mathbf{x}) = 1 - \Phi(-\mathbf{x}\boldsymbol{\beta}) = \Phi(\mathbf{x}\boldsymbol{\beta})$$

- Average partial effects:

$$APE_j = \beta_j \frac{1}{n} \sum_{i=1}^{n} \phi(\mathbf{x}^i \boldsymbol{\beta})$$

Covariates

- Individual characteristics (including sex, age, marital status, age when finished education, occupation, political views, contribution to household income, and household income, respondent's cooperation as assessed by interviewer)
- Country fixed-effects,
- Year dummies,
- Some country-level macroeconomic variables (population density, GDP per capita, GDP growth rate, employment growth rate, Gini index)
- Some regulatory indicators of entry regulation, public ownership, market structure and vertical integration.

Descriptive statistics of regulatory variables for the EU 15

	Obs	Mean	Std. Dev.	Min	Max
		Market structure			
Telephone	43	3.21	1.06	1.4	5.1
Gas	45	4.73	1.23	1	6
		Public ownership			
Telephone	45	2.15	1.92	0	6
Electricity	43	3.14	1.99	0	6
Gas	45	2.93	2.15	0	6
		Vertical integration			
Electricity	43	2.20	1.80	0	6
Gas	45	4.13	1.22	0.9	6
		Entry regulation			
Telephone	44	0.30	0.97	0	4
Electricity	42	1.55	1.72	0	6
Gas	45	2.95	2.10	0	6

Source: our calculations on REGREF (Conway and Nicoletti, 2006)

Individual heterogeneity

- Explains very little of satisfaction variability with *quality* of SGI
- Explains more of satisfaction variability with *price* of SGI
- Very different results as compared with Latinobarometro (Checchi, Florio, and Carrera 2006): socio-economic status is not as important in the EU for most services customer satisfaction

Individual characteristics & satisfaction

- Female is about 1% more likely to be less satisfied with prices
- The older the respondent, the smaller is the satisfaction with prices.
- People who finished education at later age are more likely to be satisfied with prices. This remains so even after controlling for income quartiles.
- Students are consistently more likely to be satisfied for all SGI, house persons are more likely to be satisfied with gas and electricity prices and unemployed are less likely to be satisfied about tel & elect. prices than self-employed people.
- More polarized respondents tend to be less satisfied about prices.
- The lower the collaboration of respondents, the more likely tend to be the individual dissatisfaction for prices of different SGI.

Income and satisfaction

- Household income quartile available only for 2000 and 2002.
- Income quartile coefficients are significant for the probability of satisfaction of telephone and electricity prices, showing that more purchasing power tend to increase satisfaction.
- For gas prices and quality of all SGI considered, the coefficients are not significantly different from zero, although they are mostly positive.

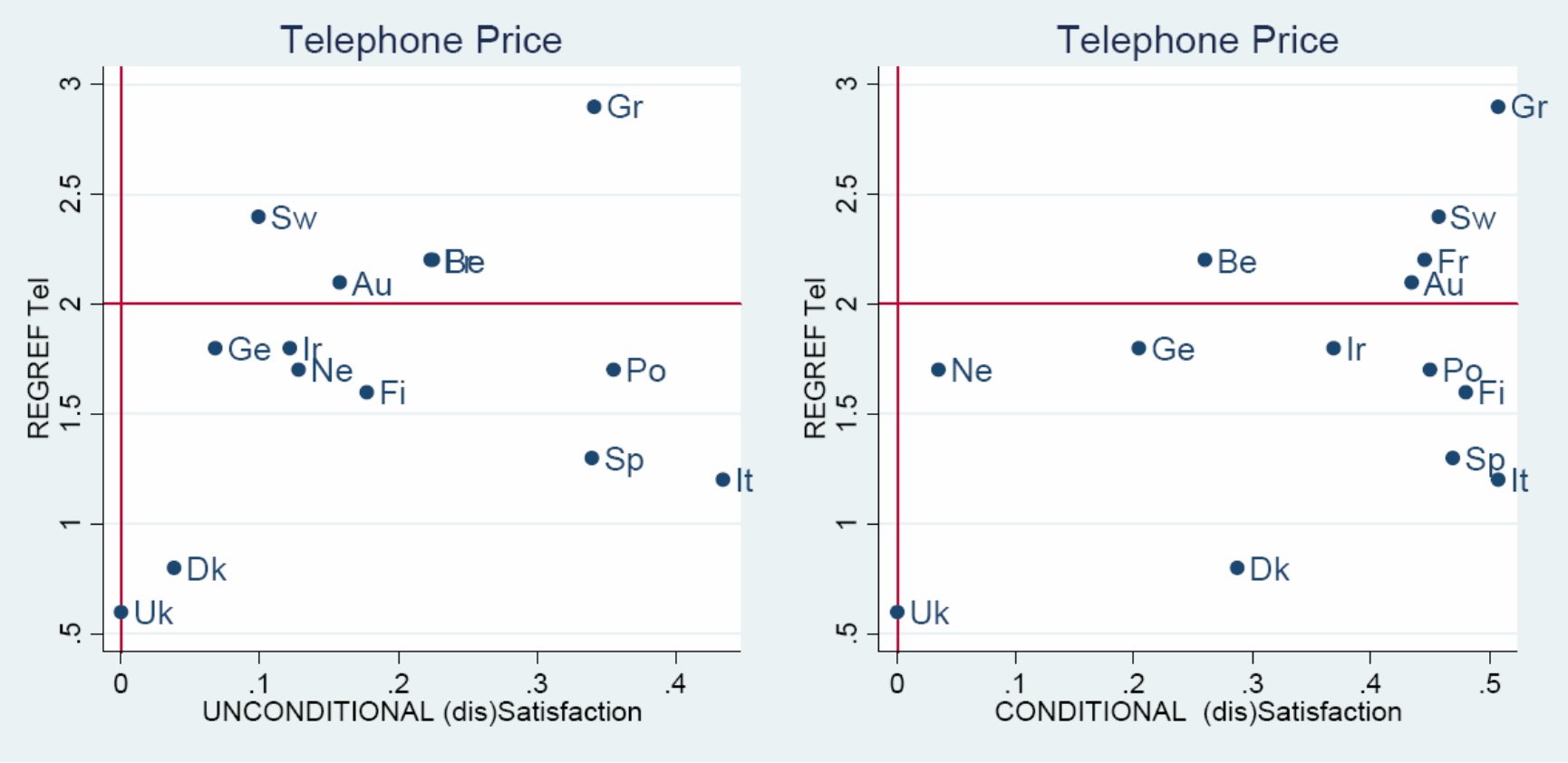
Macro-economic controls

- The higher is the population density, and the employment growth rate the more likely seems to be consumer satisfaction.
- Similarly for GDP growth rate (with the exception of electricity prices).
- Per capita GDP and the Gini inequality index instead, do not provide a clear message for all services.

Most relevant variables

- Country fixed-effects
- Year dummies:
  - satisfaction more likely in the last year considered with respect to year 2000.
  - for instance, in 2000 respondents were over 20% more likely to declare satisfaction with respect to telephone prices, about 10% more likely to declare satisfaction with respect to gas and electricity prices, and about 5-10% with respect to gas quality.

Is there a positive (SW<--> NE) rel'p b/w reform and satisfaction?



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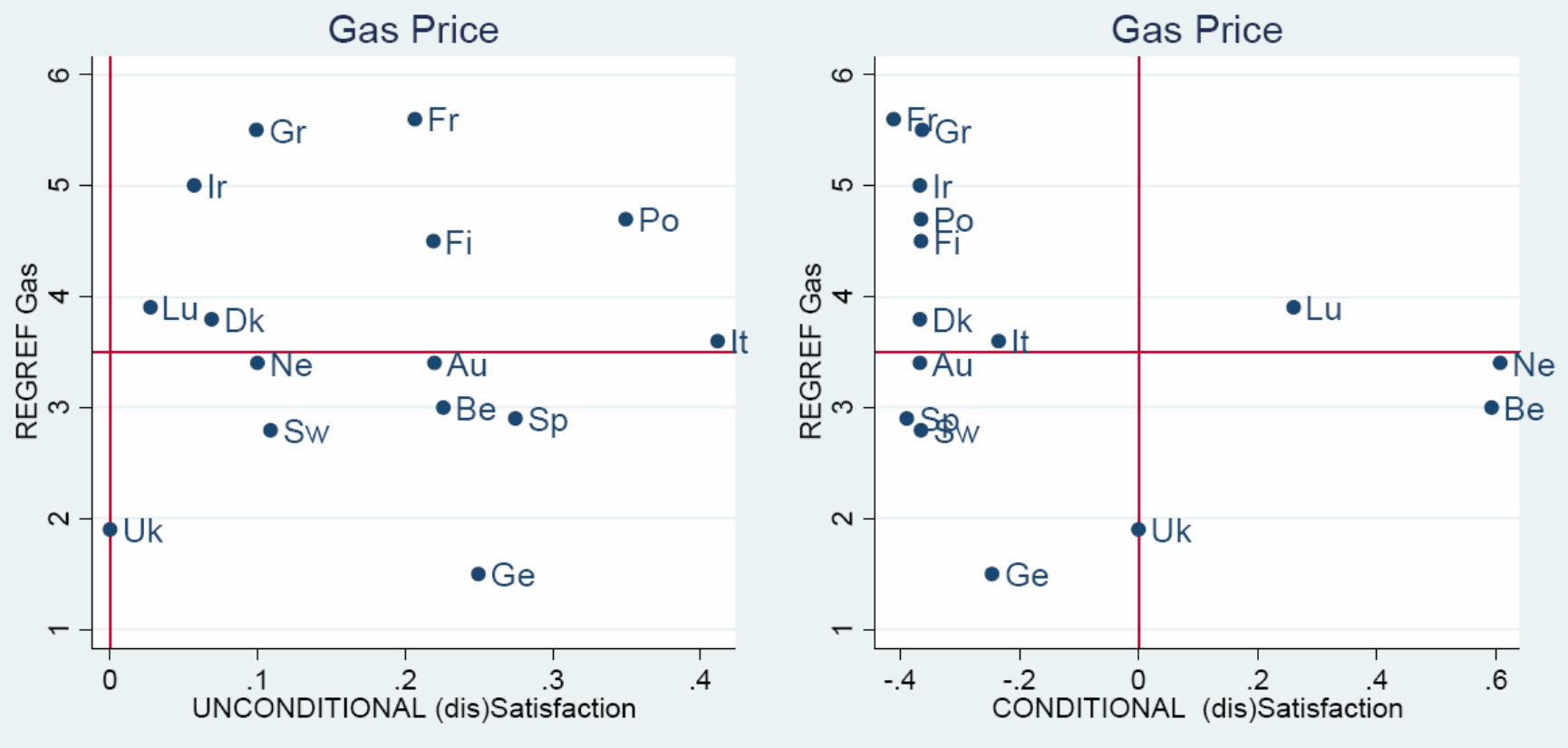

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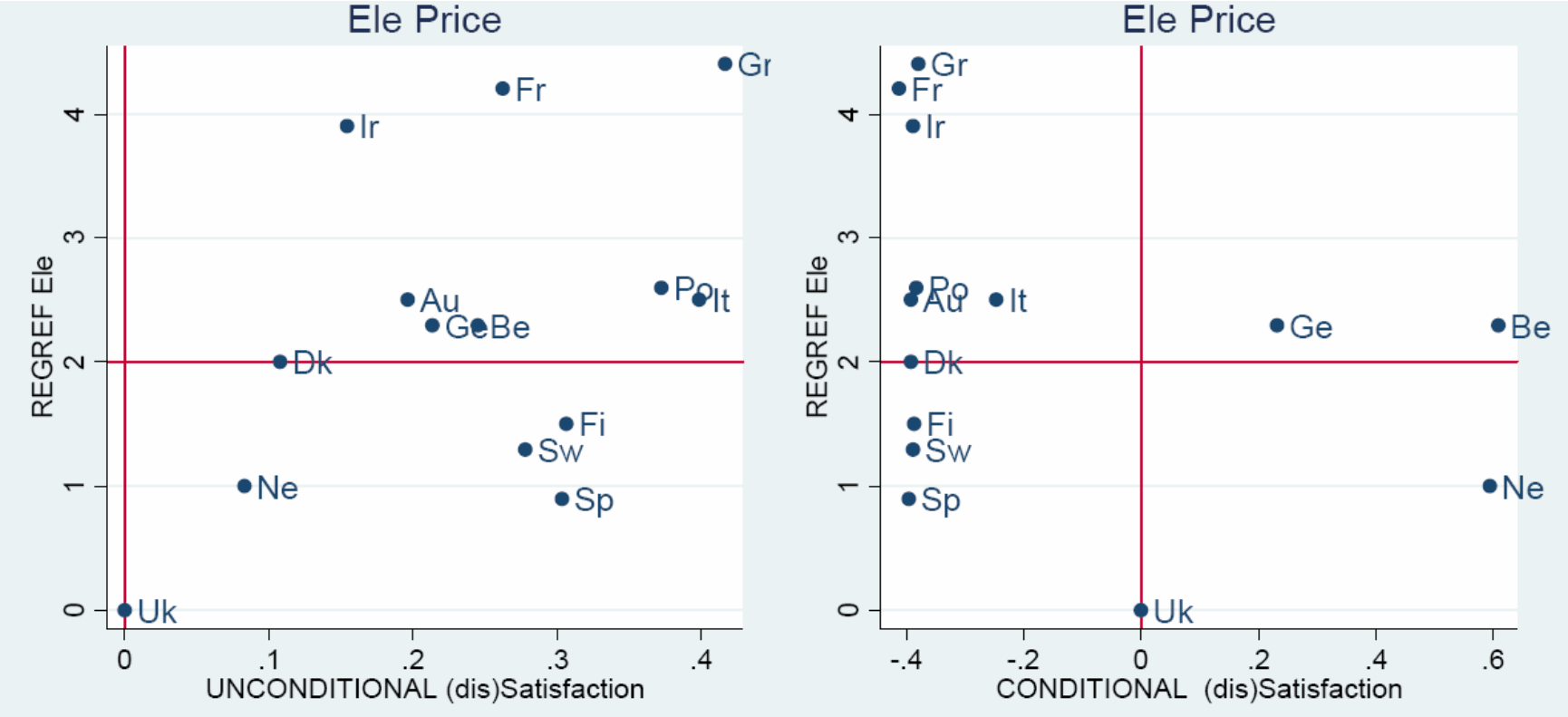


Telecom

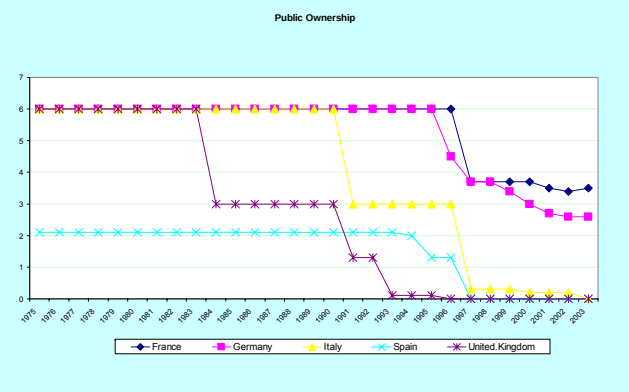
The investigation concerns the 15 EU Countries for the period 1975-2005, although, due to missing values, the effective sample approximately reduces to the last 15 years.

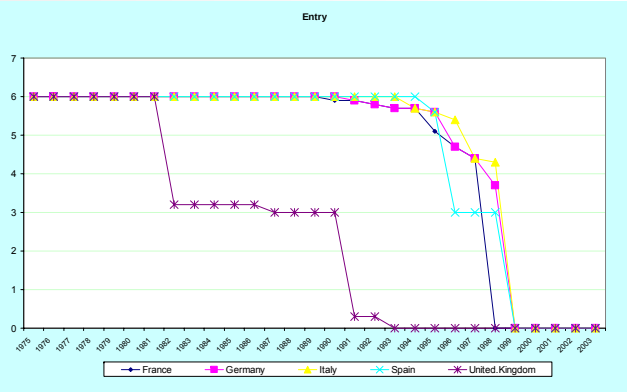
Almost all the information concerning the telecommunication sector comes from the ITU World Telecommunication Indicators (2006) dataset.

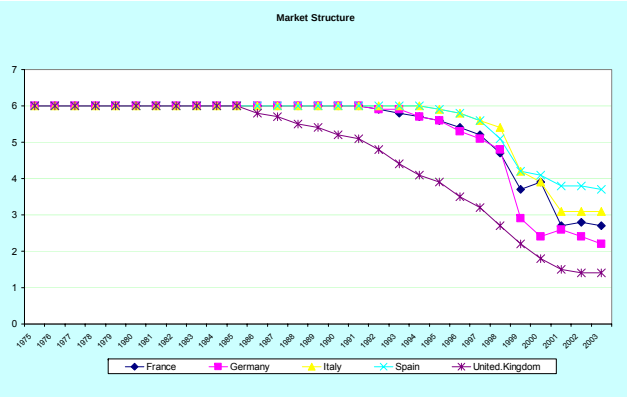
The indicator we use to describe the dynamics of prices is the price of a 3-minute fixed telephone local call (peak rate).

Short time series for local, national and international calls prices are however available from the Eurostat dataset, and have been used in the consumers' satisfaction analysis.

Telecom: REGREF Policy Indicators (OECD)







The trend has been, since the beginning of the 1990s, towards a marked reduction of public ownership, a less integrated industry structure and a less regulated access to the market.

Telecom: Productivity and Prices

The empirical analysis consists in the specification and estimation of equations for prices, subscriptions, connection charges, and productivity. Each of these equations includes, among the explanatory variables, aggregate or detailed measures of the level of market opening of the sector.

The model is:

$$P_{it} = c + R_{it}'\beta + X_{it}'\gamma + \varepsilon_{it}$$

where P_{it} is a measure of prices (or productivity) for country i at time t, R_{it} the vector of regulatory variables for country i at time t, which includes entry regulation, public ownership and market structure, and X_{it} a matrix of control variables.

Telecom empirical analysis: Prices

Table 4: Price equation estimates

Dep.Var.: D.fixed local price (log)	P1	P1a	P2	P2a	P2b
D.telecom liberalization indicator	0.087	0.081***			
	0.162	0.000			
D.entry regulation			0.017	0.013	0.012
			0.69	0.081	0.104
D.public ownership			0.046	0.006	0.004
			0.378	0.498	0.713
D.market structure			0.032	0.133***	0.124***
			0.708	0.000	0.000
LD.fixed local price (log)	0.835***	0.042**	0.833***	0.044**	0.039*
	0.000	0.009	0.000	0.006	0.019
L2D.fixed local price (log)	0.031	0.031*	0.034	0.019	0.025
	0.684	0.012	0.663	0.124	0.054
D.productivity (log)		-0.967***		-0.988***	-0.979***
		0.000		0.000	0.000
D.telecom inv st line (log)		-0.028		-0.004	0.008
		0.311		0.898	0.782
D.mob subscribers st line (log)		0.036***			0.035***
		0.000			0.000
D.isdn channels st lines (log)		0.004*		0.000	0.002
		0.016		0.879	0.315
D.tel lines st pop (log)		0.410*			0.286
		0.011			0.095
D.density (log)		-5.798***		-7.330***	-6.154***
		0.000		0.000	0.000
D.pc_gdp		0.816***		1.190***	0.668***
		0.000		0.000	0.000
Constant	0.044	0.002	0.045	0.033***	0.026**
	0.086	0.835	0.09	0.000	0.006
N	173	155	173	156	155

* p<0.05, ** p<0.01, *** p<0.001

st line and *st pop* stay for standardized by main telephone lines and by population, respectively

Telecom empirical analysis: Main results

- The main drivers of pushing downwards prices of local calls for fixed telephony are productivity, population density, and market shares of new entrants. GDP change tends to increase prices, through a demand effect. Ownership and entry regulation do not play a statistically significant role.
- Connections charges are decreased by technological progress, and marginally by market shares of new entrants, while the number of main telephone lines, perhaps surprisingly, increase them. There exists also a negative relation between prices and connection charges. Ownership and entry regulation are again not significant.
- Regulatory variables and ownership do not influence subscription rates, that respond only to local calls prices, with the expected negative sign.
- Productivity is not influenced by any of the three OECD regulatory indicators, and it seems influenced only by its past trend, pointing to technological factors.

Telecom empirical analysis: Consumers' satisfaction

Table 8: Price and Quality satisfaction: main estimation results from the probit model.

	Marginal effects: Price		Marginal effects: Quality	
	A	B	C	D
Regulation variables				
Public ownership	-0.007	-0.040***	-0.003	0.003
Market structure	0.017	0.100***	0.002	0.002
Entry regulation	0.027***	0.016	-0.007	-0.006
Price variables				
lparice local		-0.419***		-0.117
lprice national		-0.351***		-0.007
lprice international		-0.128		-0.021
ltel subscription		0.131		0.197***
Dlprice local		0.079		0.154***
Dlprice national		0.000		-0.034
Dlprice international		0.000		0.008
Dltel subscription		0.000		-0.187**
Individual characteristics	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes
Year dummies				
year=2002	-0.026	0.002	-0.016	0.016
year=2004	0.191***	0.020	-0.016	-0.059
Country fixed effects				
Austria	-0.304	0.403***	0.087	0.057***
Belgium	-0.375**	-0.597***	-0.715***	-0.965***
Denmark	-0.261	0.405***	0.082	0.049
Finland	-0.308	0.401**	0.081	0.065***
France	-0.364	0.289	0.209***	0.087
Germany	-0.219***	-0.164	0.003	-0.143
Greece	-0.494**	0.392***	0.094	-0.918***
Ireland	-0.263	0.401**	0.078	0.062***
Italy	-0.570***	-0.636**	0.084	-0.998***
Luxemburg				
Netherlands	-0.380	-0.590***	-0.888***	-0.978***
Portugal	-0.482**	0.388***	0.087	-0.948***
Spain	-0.490**	0.371***	0.155**	-0.725
Sweden	-0.269	0.409***	0.093	0.071***
Constant	2.087	-10.943**	-4.052	-21.855***
Observations	38479	35831	38847	36180
Pseudo-R2	0.081	0.078	0.051	0.044
Log-Likelihood	-23054720	-21358410	-8027321	-8016795

Robust p values in brackets - * significant at 10%; ** significant at 5%; *** significant at 1%

Telecom : Summing up

We have tested the role played by the OECD regulatory indicators in explaining consumers prices and satisfaction in the EU 15.

- Ownership change, from public to private, plays no role in explaining prices of local calls, connection charges and subscription rates, productivity, and perceived quality. Small positive impact on consumers' perception of the price they pay.

==> one key item of the standard reform paradigm, privatization, is far from being supported by the empirical analysis

- The market share of entrants seems to play a more positive role, but the result is not very strong.

==> we conclude that up to now it would be less than prudent to state that in the EU 15 the reform experiment is supported by clear evidence

Gas: Looking for regulatory reform effects on retail natural gas prices

- Estimation of panel data models where net-of-tax gas prices are a function of regulatory indicators:
  - vertical integration
  - public ownership
  - entry regulation
  - market structure.
- Main problem:
  - quality of without taxes price information: many differences within the same source IEA-OECD, and between different sources (IEA vs Eurostat)
- Exploratory analysis by means of fixed-effect and first differences estimators with time dummies

Gas: The empirical model for price analysis

- We estimated the following dynamic model

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

- All variables in logs, to directly get elasticities
- Country effects, to get rid of specific unobservables (*i.e. access to pipelines with different import prices*).
- Time dummies to account for common shocks on consumer prices, oil prices, cold winters, etc.
- ρ parameter: captures the correlation between current and lagged price levels,
  - no need to interpret it as a structural parameter (its estimate subsumes the combined effect of true state dependence and correlation over time due to unob. heter.)

Gas: Main empirical evidence

1. Estimates based on the IEA price time series

- Statistically significant negative effect of vertical integration on prices, robust to:
  - Different methods
  - Different time span
  - Different specifications

2. Estimates based on Eurostat price information

- Support the previous evidence for:
  - sign and significance of vertical integration
  - decreasing returns from "disintegration"
- Partly detect a positive relationship between privatization of the ownership and price increase

Gas: Simplified welfare evaluation of reforms which took place in EU states

- The REGREF indicator of vertical integration was equal to 5.1 in 1994 and to 3.5 in 2003.
- From the elasticity formula in logs: $\Delta \ln p = \eta_{p,R_i} \Delta \ln R_i$
- From which (for any ex ante price p^0).
- $$\Delta p = \exp\left[\ln p^0 + \eta_{p,R_i} \Delta \ln R_i\right] - p^0$$

- $\eta_{p,R_i} = 0.15$, ΔRi = -1.6 ⟶ ΔPi = -0.37 € per Gj

with respect to the average price of 6,83 € per Gj in 1994 (equal to –5.5%).

- Average consumption in Gj between 1994 and 2003:

  4,422,360,000.

- Hence the estimated welfare gain expressed in 1994 € is:
  - $\Delta W = -\left(-0.37 * 4{,}422{,}360{,}000\right) \approx 1{,}658$ million € overall
  - About 4.7 Euros in per capita terms

Gas main results: five specifications explored

- Models with regulatory variables: results not robust to exclusion of price variables:
  - Insignificant role of gas prices (*imprecise aggregation of different individual prices into a single national one?*)
  - A few regulatory indicators with a significant coefficient:
    - public ownership: the lower public share in the gas industry, the lower consumer's satisfaction.
    - Market structure: the higher the market share of the incumbent), the higher consumer's satisfaction.
- Average partial effects estimates:
  - 1 additional point in public ownership and market structure indicators increases the probability of having a satisfied gas user across the EU by 16% and 7%

Gas: Summing up

- The assessment of the effects of regulatory reforms in network industries may benefit from analyses where intra-sector indicators are considered
- empirical analysis of price dynamics does not offer support to the view that privatization per se decreases prices
- Vertical disintegration seems to push down prices but
  - there are no increasing returns (negative quadratic component)
  - is the related REGREF appropriate?
- If unbundling is the key reform, average per capita effect is likely to be extremely small (4.7 euros)

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.

Electricity: The new paradigm

The **new paradigm** (supported for example by the OECD, and WB for LDCs) is usually simplified as suggesting three parallel reforms:

1. *privatization* (sale of existing publicly owned firms and licensing of private entrants),
2. *unbundling* (associated with incentive regulation of the networks, third-party-access, establishing and independent regulator)
3. *liberalization* (i.e. allowing entry and competition in generation and retail).

However…

- many items are not strongly correlated, can be implemented under a variety of industry structures and government interventions, thus the degrees of freedom in the reform design are higher than sometimes is suggested.

- Without empirical testing, however, some of the tenets of the reform paradigm are questionable

Electricity: approach

Our empirical approach is to take advantage of the diversity in European electricity reform patterns and to control for a number of potential explanatory variables to predict two simple performance indicators:

1. **prices of electricity** for households (source:IEA),
2. **satisfaction of consumers** with prices they pay and quality of service provided (source: Eurobarometer).

Electricity: Summary statistics of some relevant variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Household price (Kw/h in nat. curr.)	408	0.24	0.33	0.07	1.60
Energy sources					
Source Hydro. (GWh/Tj)	394	18274.31	21007.10	0.00	73668.00
Source Comb. Fuel (GWh/Tj)	394	69179.42	88650.60	29.00	349166.00
Imports (GWh/Tj)	394	9479.15	10940.37	0.00	51519.00
Energy Distribution Loss (GWh)	394	9255.65	9624.75	24.00	34185.00
Macro-economic variables					
Population (Milions)	406	24.95	25.52	0.36	82.52
GDP (nat. curr. Billions)	406	478.29	493.49	5.09	2148.89
Residential Consumption (GWh)	394	36373.66	40740.92	394.00	146744.00
Cost variables					
Cost Comb. Oil (nat.curr./TOE)	287	154.39	46.99	67.09	400.57
Cost Coal (nat.curr./TOE)	266	96.71	37.30	47.41	258.82
Cost Gas (nat.curr./TOE)	196	155.70	42.64	71.87	324.26

Source: Our calculations on IEA (2006)

Electricity: The REGREF data

- Variables from the OECD's REGREF dataset are:
  - "**public ownership**", which measures the public ownership of each SGI and is coded from 0 (private ownership) to 6 (public ownership),
  - "**vertical integration**", which is an indicator of vertical separation in different industries and is coded from 0 (ownership separation) to 6 (integration),
  - "**entry regulation**", which is a weighted average of legal conditions of entry in a market and is coded from 0 (free entry) to 6 (franchised to one firm).

Explaining electricity price dynamics

- p_{it} *is* the log of household electricity prices for country *i* at time *t*
- R_{it} *is* the vector of regulatory variables for country *i* at time *t*, which includes vertical integration, public ownership and entry regulation
- *t is* the deterministic time trend
- *X* a set of controls including production costs.

$$p_{it} = c + p_{i(t-1)}'\lambda + R_{it}'\beta + X_{it}'\phi + \alpha_i + t\gamma + \varepsilon_{it}$$

Electricity: Arellano Bond estimation

Dependent variable is log net (of tax) price of electricity for households

	Arellando and Bond estimation			
	(A)	(B)	(C)	(D)
D.log net price (-1)	0.858***	0.874***	0.889***	0.753***
D.Vertical Integr.	0.003	0.007	0.005	-0.008
D.Public Ownership	-0.003	-0.004	-0.004	0.007
D.Entry Regulation	-0.003	0.000	0.003	0.011
D.Source Hydro. (log GWh/Tj)		0.002	0.001	-0.009
D.Source Comb. Fuel (log GWh/Tj)		0.027	0.039*	0.044*
D.Imports (log GWh/Tj)		0.026**	0.028**	0.037***
D.Energy Distribution Loss (log GWh)		-0.037	0.010	-0.029
D.GDP (log Nat.Curr. B.)		0.004	0.010	-0.161***
D.Residential Consumption (log GWh)			-0.178***	0.003
D.Cost Comb. Oil (log Nat.Curr./TOE)				0.049*
D.Cost Coal (log Nat.Curr./TOE)				0.056**
D.Population (log M.)		0.716	0.734	-0.295
D.Cost Gas (log Nat.Curr./TOE)				0.107***
Constant	-0.001	-0.003	0.001	0.009***
Obs.	325	297	297	123

Source: Our calculations on IEA (2006)
Note: D. stands for first difference.

Consumer's satisfaction with electricity prices

- Dataset: Eurobarometer (waves 2000, 2002, 2004)
- Consumer satisfaction is dichotomized:
  - Satisfied about prices paid is considered *fair*
  - Satisfied about quality consumer is *very satisfied*

APE of consumers' satisfaction with electricity prices

	Electricity: Price (A)	Electricity: Price (B)	Electricity: Price (C)
Regulatory variables			
Public Ownership: Ele		0.026***	0.027***
Vertical Intergration: Ele		0.013***	0.012*
Entry Regulation: Ele		0.021***	0.040***
Price variables			
Price (in local currency per Wh)	-0.444		-1.334**
First difference of Price (loc. curr. per Wh)	0.000		0.000
CPI	-0.008**		0.012***
Year dummies			
year 2002	-0.001	-0.003	0.040
year 2004	0.148***	0.120***	0.080**
Individual characteristics	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes

APE of consumers' satisfaction with electricity quality

	Electricity: Quality (A)	Electricity: Quality (B)
Regulatory variables		
Public Ownership: Ele		0.019***
Vertical Intergration: Ele		0.006
Entry Regulation: Ele		0.024***
Price variables		
Price (in local currency per Wh)	1.618***	
First difference of Price (loc. curr. per Wh)	0.000	
CPI	-0.020***	
Year dummies		
year 2002	0.022	0.038
year 2004	0.148***	0.043*
Individual characteristics	Yes	Yes
Macroeconomic controls	Yes	Yes

Electricity: Summing up

1. panel estimation of prices tend to reject the prediction that privatization per se leads to lower electricity prices, after controlling for other reforms, and other industry and country-specific variables;
2. customer satisfaction for prices is correlated to observed prices, confirming that perceptions by consumers are broadly consistent with the objective evidence
3. customer satisfaction about prices and quality of services is higher with public ownership than under private ownership.

Conclusion

- No evidence that a unique reform paradigm is dominant in terms of welfare changes across EU15.
- If you have very strong prior beliefs that the paradigm must work, you may object that:
  1. the data do not capture adequately the benefits of reforms,
  2. the indexes supplied by the OECD's REGREF database do not capture all the subtle dynamics involved.
  3. One can also think that in some countries it is too early to draw conclusions.