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International Benchmarking of Electricity Transmission by Regulators: Theory and Practice

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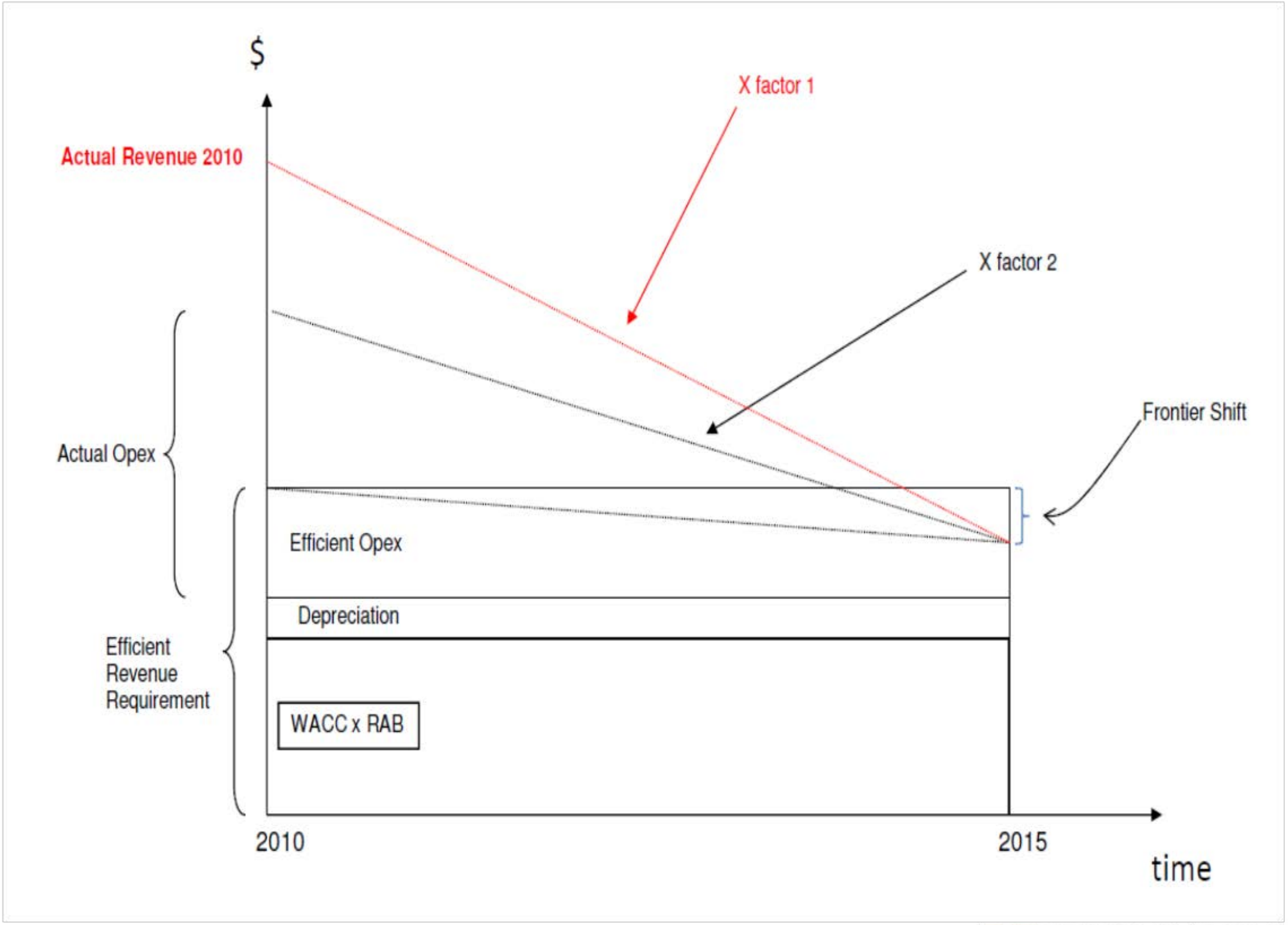
Outline

- What is benchmarking trying to do within regulation
- Previous literature on transmission benchmarking
- Difficulties of collecting and comparing data on transmission companies
- Methodological issues
- What should be done in the future
- What do regulators do and think – a survey

WHAT IS THE ROLE OF BENCHMARKING IN REGULATION?

Regulated Revenue over a price control period



Best practice (f.Lovell, 2006)

- DEA / SDEA / COLS / SFA
- Large / high quality dataset
- Panel data
- Consistency with engineering / well behaved
- Bootstrapping / confidence interval
- Consistency with non-frontier methods
- Quality / environmental / input price variables
- Value added in efficiency analysis

THE PREVIOUS LITERATURE ON ELECTRICITY TRANSMISSION BENCHMARKING

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Table 1 – Academic Studies of Transmission

	Dataset	*Inputs (I), Outputs (O), Environmental (E) Variables*	*Methodology*	*Hypothesis Tested*	*Results and average efficiency (AE)*
Pollitt (1995)	129 US utilities in 1990	I: Number of employees, circuit km*KV, energy losses O: energy delivered, maximum demand, route km	DEA	Public and Private utilities different	Public and private utilities equally efficient AE: 0.80
Nemoto and Goto (2006)	9 Transmission-Distribution Japanese utilities 1991-98	O: weight sales I: No of employees, capital expenditure	SFA	Evolution of firm efficiencies over time	Time invariant efficiency = 0.78-0.94
Von Geymueller (2007)	7 EU utilities, 1999-2005	I: Employees O: Domestic Demand Quasi-fixed input: Transformer capacity	DEA	Significant difference if some capital inputs assumed fixed	Dynamic models better than static. AE: 0.75-1.00
Von Geymueller (2009)	50 US utilities 2000-2006	I: materials and supplies costs, labour costs O: transmission of electricity for others Quasi-fixed inputs: transmission miles, transformer capacity	DEA	Significant difference if some capital inputs assumed fixed	Dynamic models better than static. AE: 0.7-0.85
Llorca, Orea and Pollitt (2012)	59 US utilities 2001-09	I: Opex, Totex O: Peak load, electricity delivered, total energy E: including weather and vertical integration	SFA-TFE with latent class	Presence of different classes	Different classes significant, AE: 0.8-0.85.

ACCC (2012) notes 22 DEA and 16 SFA studies, all of which are on energy distribution.

Sumicsid (2009) looks at 22 European TSOs from 2003-06 using DEA (NDRS).

DATA ISSUES IN ELECTRICITY TRANSMISSION

Data issues in transmission

- What is being compared?
- Which price indices should be used?
- Shared costs, local taxes and capitalisation policies
- Which inputs, outputs and environmental variables?
- Degrees of freedom a problem, thus Sumicsid (2009) produce a measure of normalized grid size based on combining 1200 variables. This illustrates the extreme nature of the aggregation assumptions required to making frontier benchmarking tractable.

Table 2 – Possible outputs and Environmental variables in electricity transmission

Variable (s)	Output variable	Environmental variable	Input variable	Degree of company control
Length transmission network	X		X (sometimes used as input)	Virtually none in short run
maximum demand and load density (average utilisation)	X			Some via load management
demand growth in units sent out and growth of route length	X			Virtually none in short run
network density (e.g. long or short lines from generation sources to load centres)		X		None
flow patterns (amount of wheeled energy), interconnection with other systems		X		Some in long run via increased interconnection
whether lines are uni- or bi-directional and the topology of network (whether security standards are n-1 or n-2)		X		None in short run
availability/reliability requirements		X		Often imposed by regulation
extent of tree cutting requirements		X		Partially under company control
terrain (e.g. how mountainous the service area is)		X		None
weather effects of peak wind strength, temperature at time of peak demand		X		None in short run, could re-site some assets in long run
requirements for the provision of ancillary services		X		None
number of circuits and substations, voltage levels of transmission lines, amount of underground lines,		X		None in short run, network can only be reconfigured in long run

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FRONTIER EFFICIENCY TECHNIQUES

Frontier Efficiency and Electricity Transmission

- Parametric and non-parametric approaches have their strengths and weaknesses.
- SFA is less useful to regulators. ‘True’ panel models and Latent class models promising but in infancy.
- A strong argument for DEA (see Nillesen and Pollitt, 2010 and Frontier Economics, 2010, who recommend to Ofgem for electricity transmission).
- More data helps, however frontier efficiency is limited by the current performance of sample firms.
- Norm or reference network model approach has been severely criticised as a tool for use in independent regulation (e.g. by Jamasb and Pollitt, 2008).
- Frontier techniques offer no guidance as to how quickly any measured efficiency gap can be eliminated
- Need to consistently use one method.

THE FUTURE OF INTERNATIONAL BENCHMARKING OF ELECTRICITY TRANSMISSION

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Is benchmarking a short term phenomenon?

- As Agrell and Bogetoft (2010, p.6-7) point out the ‘effectiveness [of the current regulatory system] depends on the tasks and externalities it is supposed to control, past performance is only representative of future success insofar as these are of equivalent nature’.

Does benchmarking introduce unwelcome distortions?

- Rating Agency Moody's do include a weight on regulatory benchmarking risk (see Moody's, 2009). No evidence of an actual downgrade as a result of a regulatory benchmarking exercise (see Oxera, 2010).
- S+Ps suggest downgrading following: 'Robin Hood' tax on Italian network companies in 2009 and renaging of Spanish government on rate of return for new investments for Spanish network companies.
- Sanyal and Bulan (2011) measure regulatory risk as passage of reform acts and the presence of incentive based regulation. Together these regulatory risk factors reduce leverage by 15% (though not only PBR).
- Interestingly, Morana and Sawkins (2000) show that the reverse is true for water companies in England and Wales: that a predictable regulatory regime leads to reduced equity betas over time.
- Schaeffler and Weber (2010) find that 21 regulatory authorities use a CAPM approach to calculate the weighted average cost of capital (WACC) in spite of the flaws in the CAPM methodology.
- Kobialka and Rammerstorfer (2009) find evidence of a lack of persistence of regulatory risk impacts for German utilities.

Is there a longer run regulatory solution?

- More use of procurement tendering ?
- Negotiated settlements ?
- A longer price review period ?
- More incentivised outputs ?

- Simpler incentive regimes such as those under performance based rate making in the US might deliver the same sort of incentives as CPI-X while reducing the reliance on fairly unreliable estimates of relative efficiency and work well in controlling the total costs of existing transmission systems.

A simpler regulatory regime?

- Jamasb and Pollitt (2001) note Southern California Edison over the period 1996-2001. Prices were capped at the previous level in 1996, then X factors specified for 1997-2001 (X_{1997}=1.2%, X_{1998}=1.4%, $X_{1999-2001}$=1.6%). However prices could be adjusted according to the profitability of the regulated business according to a profit sharing arrangement around a target rate of return, such that for -/+50 basis points (bps) around the target, shareholders receive all profits/losses; for -/+50 to 300 bps, shareholders share of the excess profits/losses rises from 25 to 100%; while for -/+300 to 600 bps, shareholders receive all the gains/losses; however at greater than +/- 600 bps, a price (rate) review is triggered.

USE OF EFFICIENCY ANALYSIS BY REGULATORS

Benchmarking survey – overview

- May to July 2012
- Mixture of open and closed questions
  - Choice of benchmarking techniques
  - Benchmarking analysis process
- Electricity and gas network regulators
  - Responses from 25 / 48 national regulators
  - Europe, Australasia, Latin America

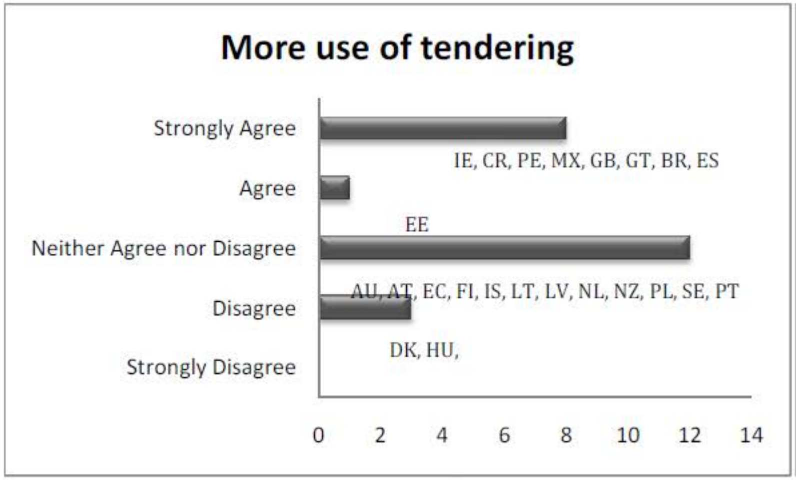
Use of benchmarking techniques?

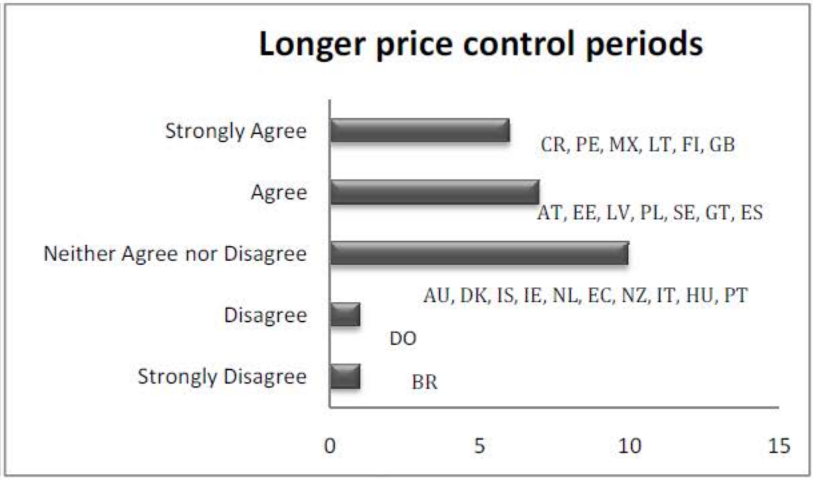
- 13 out of 25 use some form of benchmarking to regulate their electricity transmission companies.
- Of these 13, only four refer to the use of frontier benchmarking (Netherlands, Portugal, Brazil and Finland). The others mainly use either unit cost approaches (e.g. Great Britain, Ireland, Australia, Dominican Republic, Peru) or reference network analysis (Ireland and Latvia).
- The most frequently cited reason for not using benchmarking techniques up to this point is the limited number of transmission operators and associated lack of comparators.
- 9 regulators have review periods greater than 3 years in length. 7 of these regulators also use benchmarking techniques.

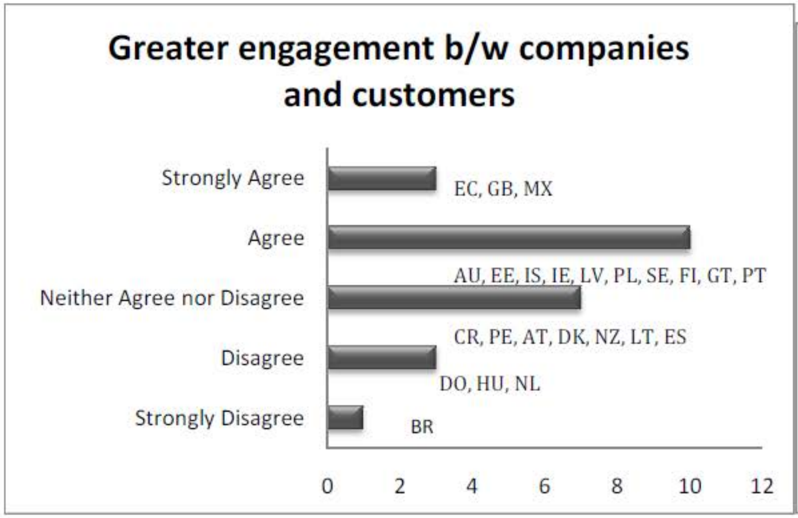
Benchmarking analysis process?

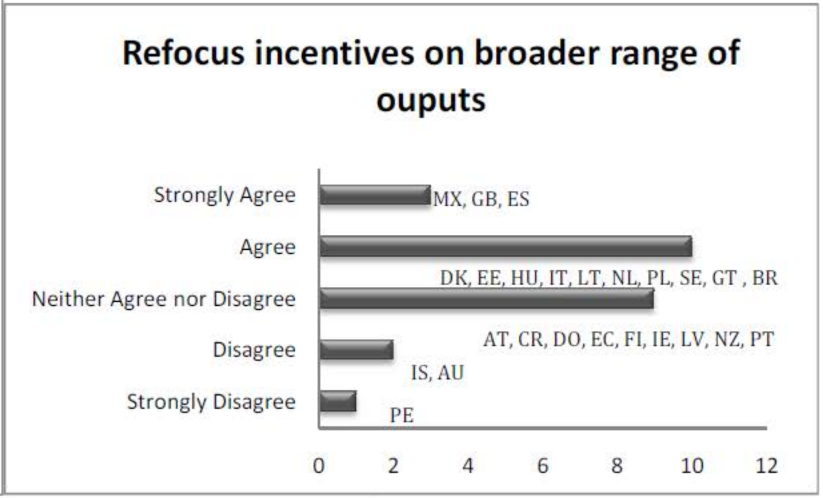
- Only 3 of the 13 regulators use the results indirectly, i.e. as the basis for negotiation (Great Britain, Portugal and Peru). Finland only applies the results of their negotiation-based method to regulation.
- 6 of the regulators that use benchmarking techniques make some sort of adjustment for uncertainty (Ireland, Latvia, Netherlands, Portugal, Australia and Brazil).
- Environmental factors have been incorporated into the analysis by 7 regulators (Great Britain, Latvia, Netherlands, Portugal, Brazil, Guatemala and Australia).
- 5 of the respondents use international data (Ireland, Latvia, Portugal, Guatemala and the Netherlands) and 5 use panel data (Great Britain, Brazil, Guatemala, Latvia and Portugal). Comparability issues are a concern around use of international data.

Useful changes?









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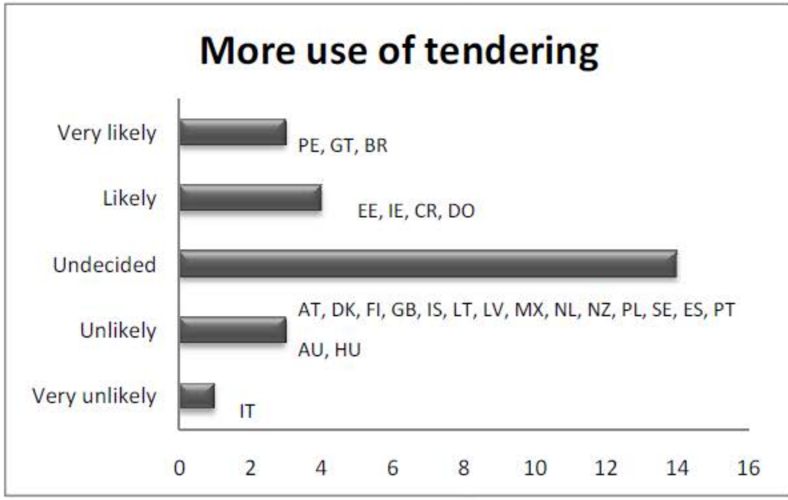
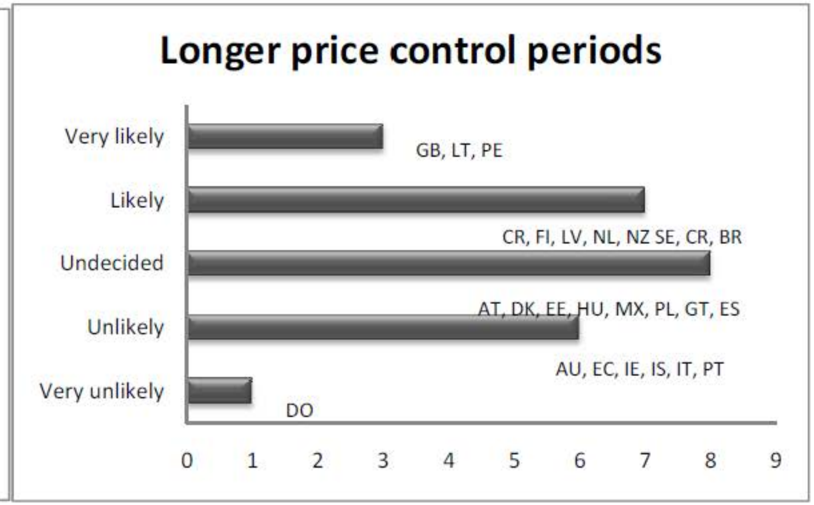
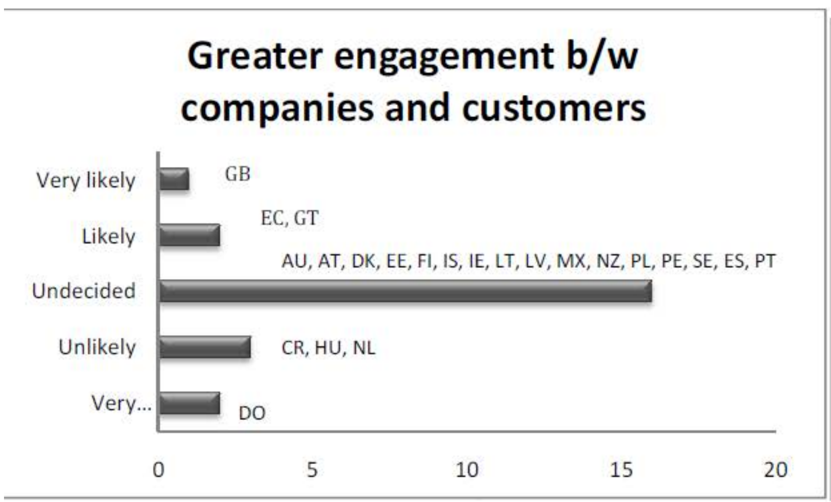
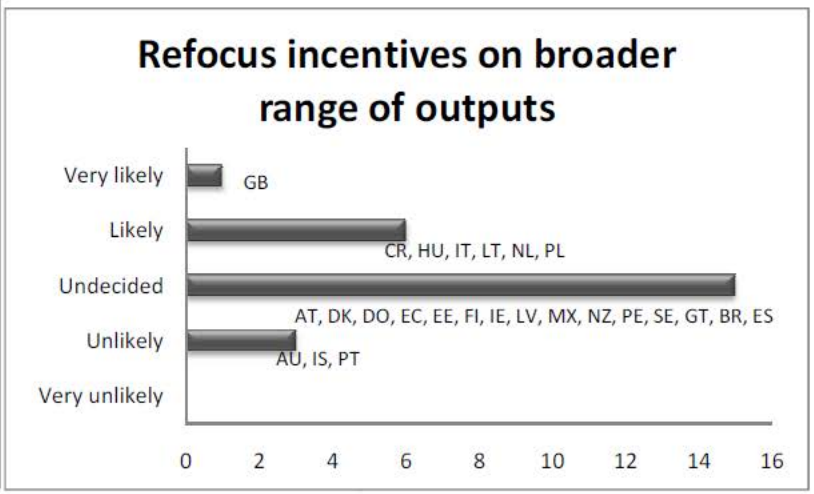
Changes likely?

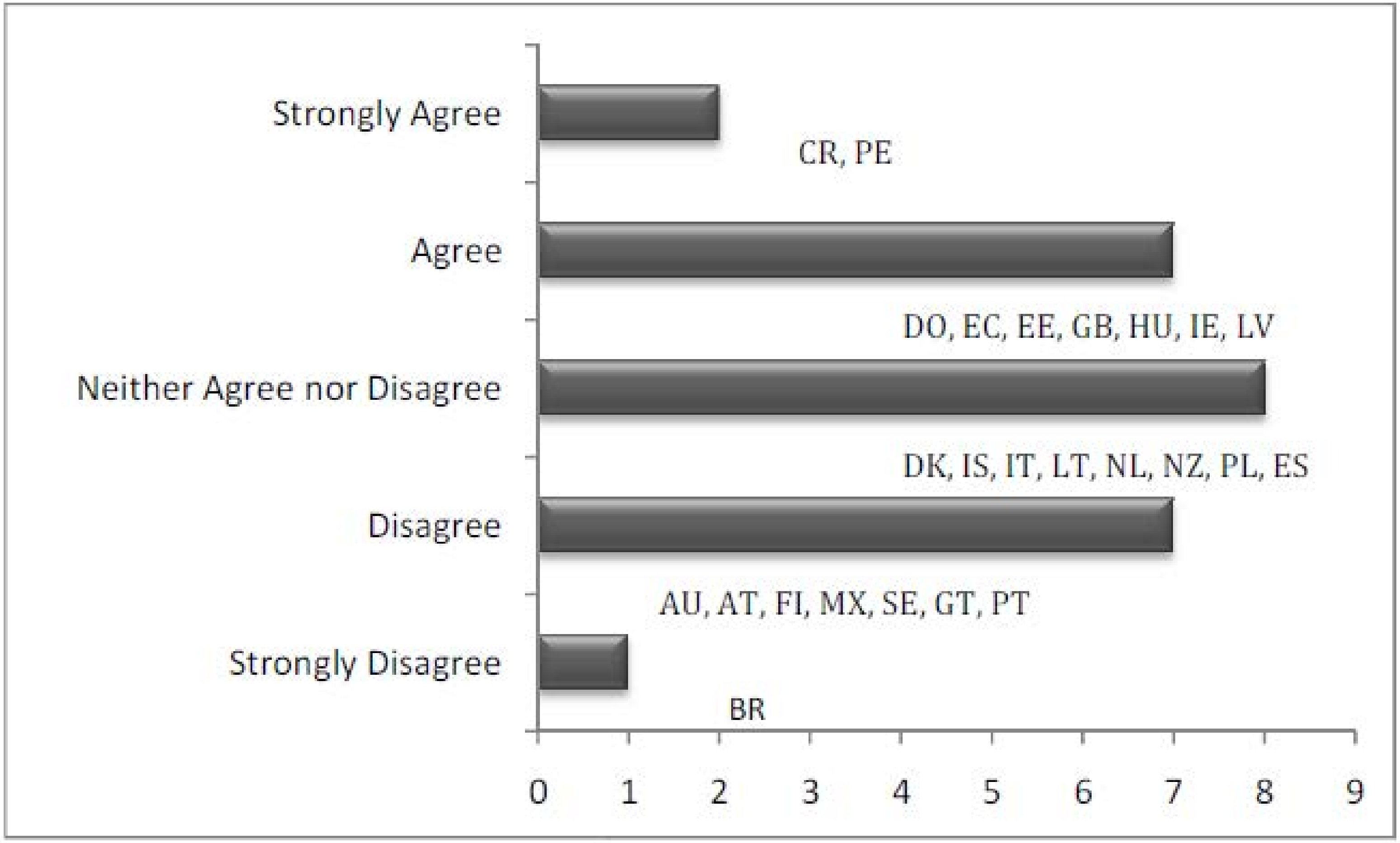




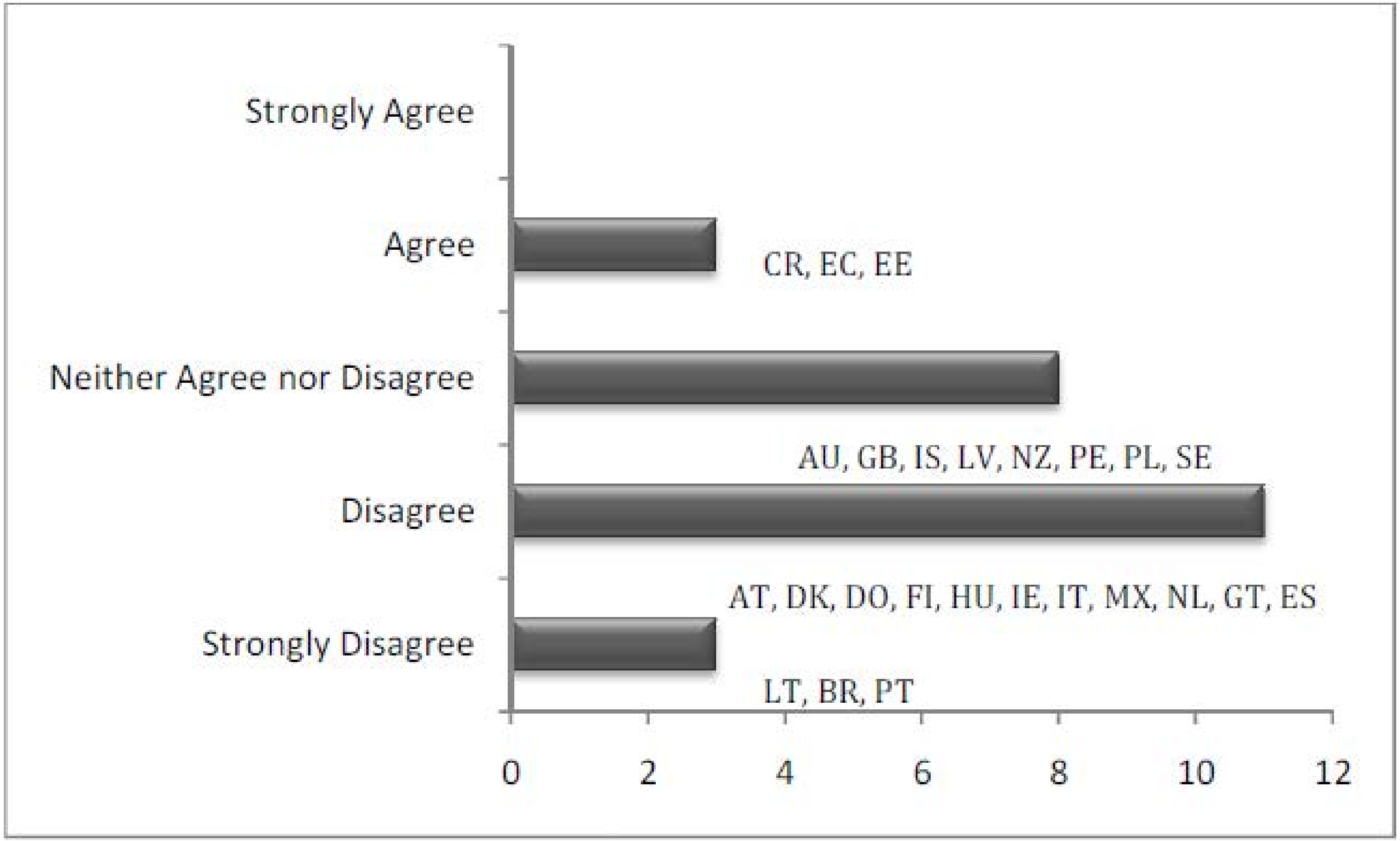




Is benchmarking transmission becoming more difficult?



Benchmarking negatively effects financial rating?



CONCLUSIONS

Conclusions

- Benchmarking has a ***key role in sharing the benefits*** of efficiency improvements with consumers.
- Regulators find electricity ***transmission benchmarking significantly more challenging*** than benchmarking distribution.
- ***New panel data techniques look intellectually promising*** but are in their infancy for regulatory purposes.
- In electricity transmission ***choosing variables is particularly difficult***, because of the large number of potential variables to choose from.
- Failure to apply benchmarking appropriately ***may negatively affect investors' willingness to invest*** in the future.
- While ***few acknowledge that regulatory risk is currently an issue*** in transmission benchmarking, many more concede it might be.
- ***New regulatory approaches are emerging*** and will necessarily involve a reduced role for benchmarking.
- ***New approaches will be necessary*** if the ambitious European plans for transmission network expansion are to be, even partially, realised.

List of countries surveyed

		Country	Country code	Survey response
1	*Europe*	Austria	AT	‼
2		Belgium	BE	
3		Bulgaria	BG	
4		Cyprus	CY	
5		Czech Republic	CZ	
6		Denmark	DK	‼
7		Estonia	EE	‼
8		Finland	FI	‼
9		France	FR	
10		Germany	DE	
11		Great Britain	GB	‼
12		Hungary	HU	‼
13		Iceland	IS	‼
14		Ireland	IE	‼
15		Italy	IT	‼
16		Latvia	LV	‼
17		Lithuania	LT	‼
18		Luxembourg	LU	
19		Malta	MT	
20		Netherlands	NL	‼
21		Norway	NO	
22		Poland	PL	‼
23		Portugal	PT	‼
24		Rumania	RO	
25		Slovak Republic	SK	
26		Slovenia	SI	
27		Spain	ES	‼
28		Sweden	SE	‼
29		Turkey	TR	
30	*Australasia*	Australia	AU	‼
31		New Zealand	NZ	‼
32	*Latin America and the Caribbean*	Argentina	AR	
33		Bolivia	BO	
34		Brazil	BR	‼
35		Chile	CL	
36		Colombia	CO	
37		Costa Rica	CR	‼
38		Ecuador	EC	‼
39		El Salvador	SV	
40		Guatemala	GT	‼
41		Honduras	HN	
42		Mexico	MX	‼
43		Nicaragua	NI	
44		Panama	PA	
45		Peru	PE	‼
46		Dominican Republic	DO	‼
47		Uruguay	UY	
48		Venezuela	VE	