

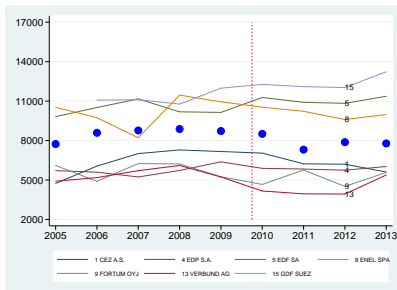
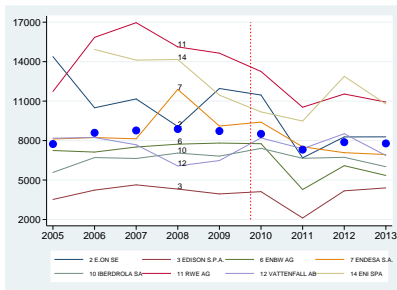
Cross-border M&As and eco-environmental performance of European energy utilities

Evgenii Monastyrenko

Paris School of Economics - Paris 1 Panthéon Sorbonne University

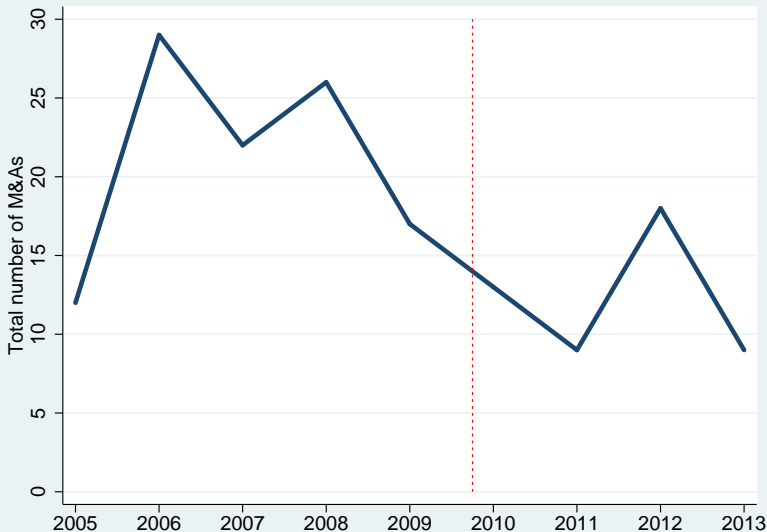
FIW 2015

Performance of EU energy sector



- TFP predicted following Levinsohn and Petrin (2003)
 - ▶ Freely variable inputs: total installed capacities and TOPEX
 - ▶ Intermediate input: amount of power generated

M&As in EU energy sector



Research question

- How do cross-border M&As affect eco-environmental performance of EU energy utilities?
 - ▶ Acquirers vs Vendors
 - ▶ Cross-border vs Domestic

Why electricity?

- ① The sector is strongly involved in M&As
 - ▶ Share in global amount of takeovers was 6.3% in 2001 (Pryor, 2001)
 - ▶ Second place by number of deals in 2010 (Schmid et al., 2012)
- ② Electricity is essential for functioning of quasi-totality of manufacturing and service activities
- ③ Electricity as a good is homogenous
 - ▶ This property eases monitoring and ensures comparability of multinationals

Why Europe?

- ① Third, after Asia and North America, most important market of electricity
- ② In 2013 hosted 19.1% of global installed capacities and 16.4% of total energy generation
- ③ High share in global worldwide energy intakes:
 - ▶ In 2011 around 24% of global power deals
 - ▶ In 2012 and 2013 EU took first place among world regions with 35% and 36%
- ④ Resent liberalization
 - ▶ Surge of M&As as a response
 - ▶ Later stages of common market's creation were driven by international mergers

Advance upon M&A literature on electricity industry

- Most previous studies:
 - ▶ shareholder wealth outcomes
 - ▶ U.S. electricity market
 - ▶ case study method
- Main references:
 - ▶ Bagdadioglu et al. (2007) predicted efficiency gains resulting from consolidation of Turkish energy utilities
 - ▶ Becker-Blease et al. (2008) revealed post-merger losses in stock prices and operating performances of U.S. power utilities
 - ▶ Kwoka and Pollitt (2010): targeted U.S. energy firms over-perform prior to mergers; combined utilities significantly under-perform
- This study is the second one (after Berry, 2000) accounting for cross-border energy deals
- Two-stage Data envelopment analysis applied for non-financial industry

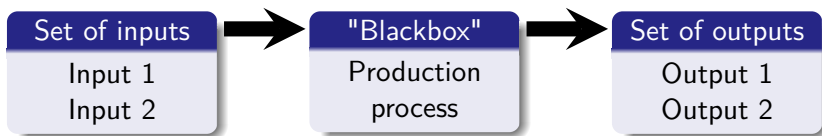
Data

- 15 biggest European electricity producers
 - ▶ 53.2% of total production capacities and 62.3% of aggregate electricity generation (2013)
- Panel data covering 2005-2013
 - ▶ energy intakes in 2004 for reference
- There are 165 M&As in the sample
 - ▶ 98 cross-border (59.4%)
 - ▶ 103 acquisitions (62.4%)
- Strict definition of “energy merger”:
 - ▶ Fully completed
 - ▶ In t $< 50\%$ shares and in $t+1$ $\geq 50\%$ shares
 - ▶ Targets operate in closely related sectors: electric services (SIC 4911), natural gas transmission (SIC 4922), and natural gas transmission and distribution (SIC 4923)

First stage: Data envelopment analysis

How does it work?

- Nonparametric method that constructs the best practice frontier based on observed combinations of inputs and outputs



- Calculated performance scores belong to unity interval $(0;1]$ and reflect the position relative to most efficient firms

Advantages over stochastic methods

- 1 Exact functional form of production technology is not required
- 2 Physical amounts of inputs and outputs are evaluated instead of their (hardly accessible) prices

First stage: Data envelopment analysis

- Output-oriented model

- ▶ DMUs (firms) treat amounts of inputs as given
- ▶ maximization of final production (electricity) and minimization of undesirable output (CO2 emissions)

Variable	Definition	Data sources
DEA inputs		
Capacity	Total installed capacities involved in electricity generation (MW)	Enerdata and corporate reports
TOPEX	Total operational expenditures of energy production (M€)	Thomson One
DEA outputs		
PowerGen	Physical amount of generated electricity (TWh)	Enerdata and corporate reports
Emissions	CO2 emissions (gCO2 per kWh)	Enerdata, corporate reports and PricewaterhouseCoopers (2013)

Notes: Table represents definitions and sources of employed variables. * indicates cases where own computations were undertaken basing on the initial data.

- Undesirable measure model of Seiford and Zhu (2002)

- ▶ Window analysis (window=9 years) based on the principle of moving averages (Charnes et al., 1994b; Yue, 1992)

First stage: Data envelopment analysis

Firm name	Headquarter location	2005	2006	2007	2008	2009	2010	2011	2012	2013
CEZ A.S.	Prague, Czech Republic	.946	.8873	.9947	.9137	.8668	.8675	.87	.8364	.8283
E.ON SE	Dusseldorf, Germany	.8736	.968	.8165	.8479	.8162	.8013	.7772	.7738	.7956
EDISON S.P.A.	Milan, Italy	.8475	.8451	.816	.7893	.6436	.6478	.5857	.568	.5057
EDP S.A.	Lisbon, Portugal	.6684	.6774	.5944	.5305	.5306	.5441	.5199	.5135	.5356
EDF SA	Paris, France	1	1	.9921	.9756	.9758	.9949	1	.9724	.9838
ENBW AG	Karlsruhe, Germany	1	.9659	.9442	.8232	.7894	.8716	.8457	.8401	.8074
ENDESA S.A.	Madrid, Spain	.8097	.8202	.763	.7475	.6889	.6514	.6876	.7117	.665
ENEL SPA	Rome, Italy	.5504	.5271	.5275	.6123	.5691	.6185	.6098	.6089	.5849
FORTUM OYJ	Espoo, Finland	.9651	.9641	.9913	.9058	.8665	.9204	.9057	.9237	.8267
IBERDROLA SA	Bilbao, Spain	1	1	1	.9514	.9469	.9707	.9979	.9896	.9258
RWE AG	Essen, Germany	.8337	.852	.9774	.8269	.8325	.8719	.7987	.803	.8227
VATTENFALL AB	Stockholm, Sweden	.6047	.6233	.5927	.6498	.6523	.6947	.6347	.5924	.6095
VERBUND AG	Vienna, Austria	.9663	.9811	.9244	.9465	.7334	.8344	.8048	.8404	.8503
ENI SPA	Rome, Italy	1	.9602	.9763	.9439	.8279	.885	.8893	.9689	.9421
GDF SUEZ	Courbevoie, France	.8264	.693	.6875	.7083	.7503	.7243	.667	.706	.8307

Notes: Table reports calculated DEA performance scores.

Second stage: Fractional outcome regression

- Quasi-Poisson approach of Papke and Wooldridge (2008) accounting for fractional nature of performance scores
- Bernoulli log-likelihood model is estimated with generalized estimating equation (GEE) method
 - ▶ Link functions: logit (common for two-stage DEA) and probit
- Exchangeable correlation matrix:
 - ▶ performance scores are equally correlated within utilities (between years), but no correlation allowed between them
 - ▶ performances of two different firms in different moments of time are unlikely to be correlated
- Semi-robust standard errors (Newson, 2000; Hardin and Hilbe, 2001) are clustered on firm-level:
 - ▶ Robust to mis-specification of the covariance structure
 - ▶ Robust to mis-specification of conditional mean Y given X in models with logit link function

Second stage: Fractional outcome regression

$$\begin{aligned}
 DEAscores_{it} = & \alpha_0 + \alpha_k M\&A_{dummies}_{it} + \beta_1 TwoMergers_{it} + \beta_2 GenToSales_{it} + \beta_3 RnDExp/Y_{it} + \\
 & + \gamma_1 K/S_{it} + \gamma_2 K/S_{it}^2 + \gamma_3 I/K_{it} + \gamma_4 Y/S_{it} + \gamma_5 Leverage_{it} + \gamma_6 CurrentRatio_{it} + \\
 & + \gamma_7 TotalAssets_{it} + \gamma_8 TotalAssets_{it}^2 + \sum_{2005}^{2013} \delta_t Year_t + \varepsilon_{it}
 \end{aligned}$$

Variable	Definition	Data sources
Nonfinancial controls		
TwoMergers	Dummy that is equal to one if firm has been involved in M&As both in the period of interest and one year before	SDC Platinum*
GenToSales	The share of distribution output generated by firm itself	Enerdata and corporate reports*
RnDExp/Y	The ratio of research and development expenditures to operating income	BvD Orbis, Thomson One*
Financial controls		
K/S	The ratio of long term tangible assets (property, plant, and equipment) to net sales	Thomson One*
Y/S	The ratio of operating income to net sales	Thomson One*
I/K	The ratio of capital expenditures to tangible long term assets (property, plant, and equipment)	Thomson One*
Leverage	Financial leverage computed as the ratio of total liabilities to shareholders' equity	Thomson One*
Current ratio	The ratio of current assets to current liabilities	BvD Orbis
TotalAssets	Total amount of assets owned by the utility	Thomson One*

Notes: Table represents definitions and sources of employed variables. * indicates cases where own computations were undertaken basing on the initial data.

Summarized regression results

Variables of interest	Period of completion		
	t-2	t-1	t
Merger	+	+	_/***
CB merger			_/**
Dom. merger	+/**		_/***
Buyer	+		_/**
CB buyer	+/**		_/**
Dom. buyer			_/***
Seller			
CB seller		+/**	+/+
Dom. seller	+/**		_/***
N	120	135	135

Notes: Table represents results of assessing M&A dummies of interest over three periods. If a coefficient is statistically significant, its sign is reported. *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

Zoom on acquisitions

	(1) Logit	(2) Probit	(3) Logit	(4) Probit	(5) Logit	(6) Probit
Dom. buyer t	-0.25*** (0.082)	-0.15*** (0.047)				
Dom. buyer t-1			-0.0057 (0.083)	-0.0073 (0.044)		
Dom. buyer t-2					0.15 (0.11)	0.082 (0.060)
TwoMergers	-0.090 (0.061)	-0.049 (0.032)	-0.13 (0.081)	-0.067 (0.042)	-0.099 (0.089)	-0.048 (0.051)
GenToSales	1.41*** (0.33)	0.79*** (0.21)	1.43*** (0.43)	0.76*** (0.26)	1.56*** (0.44)	0.84*** (0.26)
RnDExp/Y	1.45 (0.89)	0.74 (0.54)	1.42 (1.05)	0.70 (0.62)	1.56 (1.00)	0.78 (0.58)
K/S	-0.32 (0.31)	-0.20 (0.22)	-0.32 (0.35)	-0.18 (0.23)	-0.50 (0.45)	-0.33 (0.26)
K/S square	0.17* (0.094)	0.097 (0.063)	0.18 (0.11)	0.095 (0.071)	0.22 (0.13)	0.13* (0.079)
I/K	-1.35 (0.85)	-0.74 (0.46)	-1.26 (1.01)	-0.66 (0.54)	-1.07 (0.93)	-0.60 (0.51)
Y/S	-0.91 (0.87)	-0.67 (0.49)	-0.88 (1.09)	-0.66 (0.62)	-0.90 (0.96)	-0.64 (0.54)
Leverage	-0.053* (0.032)	-0.024 (0.020)	-0.048 (0.036)	-0.018 (0.024)	-0.071** (0.030)	-0.035* (0.020)
CurrentRatio	-0.047 (0.12)	-0.025 (0.071)	-0.031 (0.13)	-0.0099 (0.072)	-0.069 (0.14)	-0.037 (0.079)
TotalAssets	0.0089** (0.0035)	0.0046** (0.0020)	0.011*** (0.0037)	0.0056** (0.0022)	0.0075 (0.0054)	0.0035 (0.0032)
TotalAssets sq	-0.000022* (0.000012)	-0.000011 (0.0000066)	-0.000030** (0.000014)	-0.000014** (0.0000070)	-0.000020 (0.000019)	-0.0000085 (0.000010)
Constant	1.09** (0.46)	0.69*** (0.26)	1.06* (0.56)	0.66** (0.32)	1.16* (0.67)	0.77* (0.40)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	135	135	135	135	120	120

Notes: Table reports detailed estimations of population-averaged GEE model. Dependent variable is DEA performance score. Semirobust standard errors clustered on firm-level are reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

	(1) Logit	(2) Probit	(3) Logit	(4) Probit	(5) Logit	(6) Probit
CB buyer t	-0.16** (0.080)	-0.10** (0.045)				
CB buyer t-1			0.031 (0.049)	0.014 (0.027)		
CB buyer t-2					0.14** (0.065)	0.078** (0.035)
TwoMergers	-0.065 (0.083)	-0.030 (0.045)	-0.15** (0.068)	-0.076** (0.036)	-0.10 (0.081)	-0.053 (0.047)
GenToSales	1.27*** (0.40)	0.69*** (0.24)	1.46*** (0.42)	0.78*** (0.26)	1.46*** (0.39)	0.79*** (0.25)
RnDExp/Y	1.22 (0.94)	0.60 (0.58)	1.46 (0.98)	0.71 (0.59)	1.67* (1.00)	0.83 (0.59)
K/S	-0.11 (0.30)	-0.064 (0.21)	-0.32 (0.34)	-0.19 (0.23)	-0.43 (0.36)	-0.28 (0.23)
K/S square	0.12 (0.095)	0.063 (0.065)	0.18* (0.10)	0.095 (0.069)	0.17 (0.11)	0.10 (0.069)
I/K	-0.97 (0.91)	-0.52 (0.50)	-1.31 (1.03)	-0.69 (0.55)	-0.85 (0.95)	-0.49 (0.52)
Y/S	-0.89 (0.86)	-0.69 (0.48)	-0.83 (0.99)	-0.65 (0.54)	-0.58 (1.01)	-0.46 (0.57)
Leverage	-0.051 (0.039)	-0.024 (0.025)	-0.048 (0.036)	-0.018 (0.024)	-0.091** (0.035)	-0.048** (0.022)
CurrentRatio	0.031 (0.11)	0.027 (0.063)	-0.035 (0.13)	-0.011 (0.071)	-0.021 (0.14)	-0.013 (0.080)
TotalAssets	0.0093** (0.0037)	0.0047** (0.0022)	0.011*** (0.0037)	0.0056** (0.0022)	0.0090* (0.0051)	0.0044 (0.0031)
TotalAssets sq	-0.000023 (0.000014)	-0.000011 (0.0000077)	-0.000030** (0.000014)	-0.000014** (0.0000070)	-0.000026 (0.000017)	-0.000012 (0.0000095)
Constant	0.92* (0.48)	0.59** (0.28)	1.05* (0.55)	0.66** (0.31)	1.08* (0.62)	0.74** (0.37)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	135	135	135	135	120	120

Notes: Table reports detailed estimations of population-averaged GEE model. Dependent variable is DEA performance score. Semirobust standard errors clustered on firm-level are reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

Concluding remarks

Policy implications

- Expanding strategy should be based on international acquisitions, which are performance-enhancing in long-term
- Best selling strategy depends on desirable timing of expected benefit:
 - ▶ Immediate efficiency benefits, which are obtained by cross-border sellers, don't sustain over time
 - ▶ Domestic sellers gain in long run, despite short-term losses, which could be caused by local competitive pressure

Summary of intuition

- “Grabbing of lemons”: targets are typically under-performing entities
 - ▶ Acquirers need to deal with incoming inefficiency
- “Lemons” in long run evolve to “cherries” (Blonigen, Fontagné, Sly and Toubal, 2014)