Have Customers Benefited from Electricity Retail Competition?

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  - The markup rate determined in the market place may be higher than the regulated rate of return.
- This paper empirically estimates the net policy impact on retail prices.

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- Wholesale competition: 1992 Federal Energy Act and the following FERC orders.
  - Competition in electricity generation, facilitated by open access regulation of the transmission grid.
- Retail competition: State legislations, regulatory rulings, and/or court orders.
  - Competition in retail services, facilitated by open access regulation of the distribution network.

Related literature

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- Growing literature on the impact of wholesale competition
  - Generation cost savings: Kleit and Terrell (2001), Febrizio *et al.* (2007), Zhang (2007), Barmacck *et al.* (2007)
  - Market power: Borenstein and Bushnell (1999), Borenstein *et al.* (2002), Wolak (2003)

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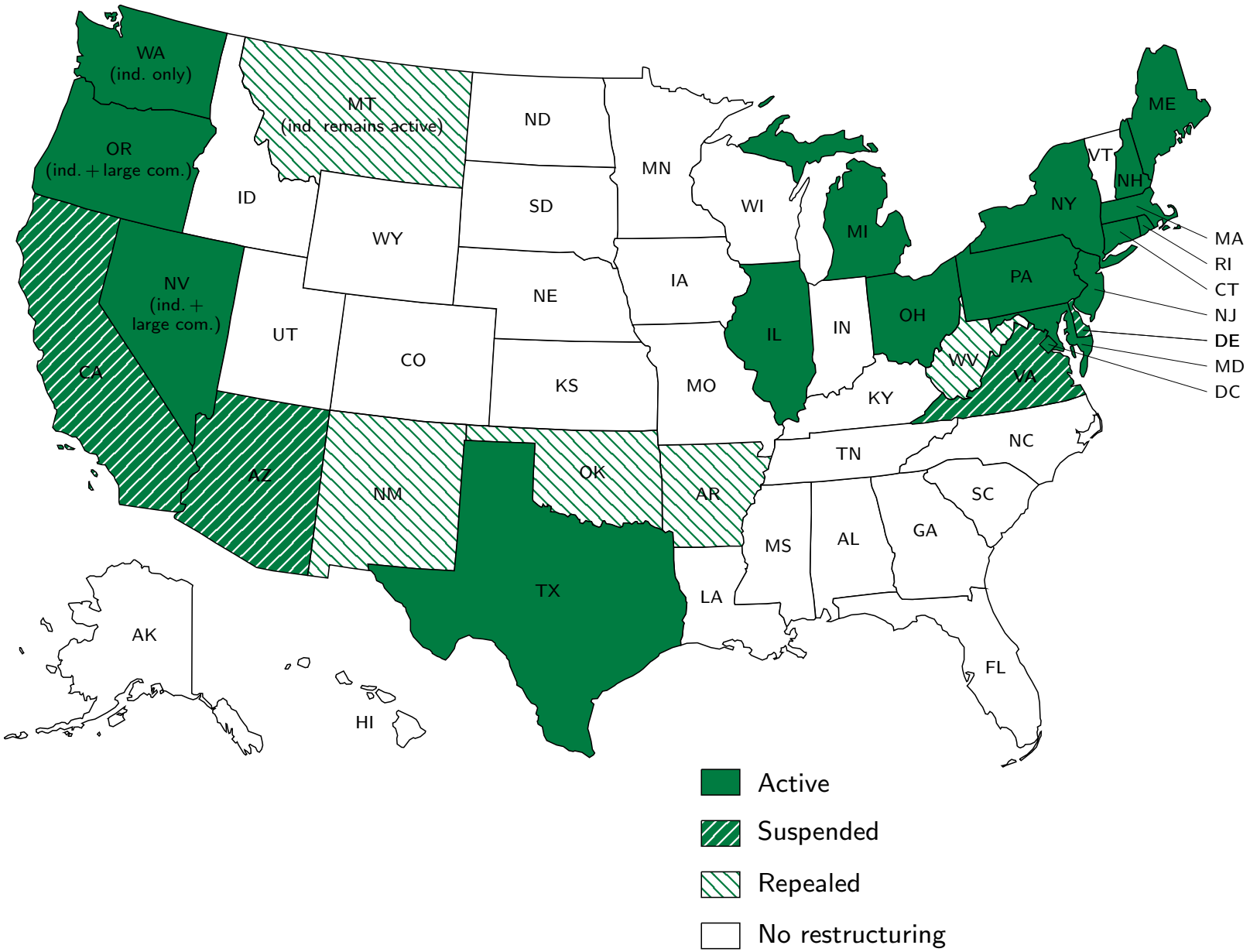
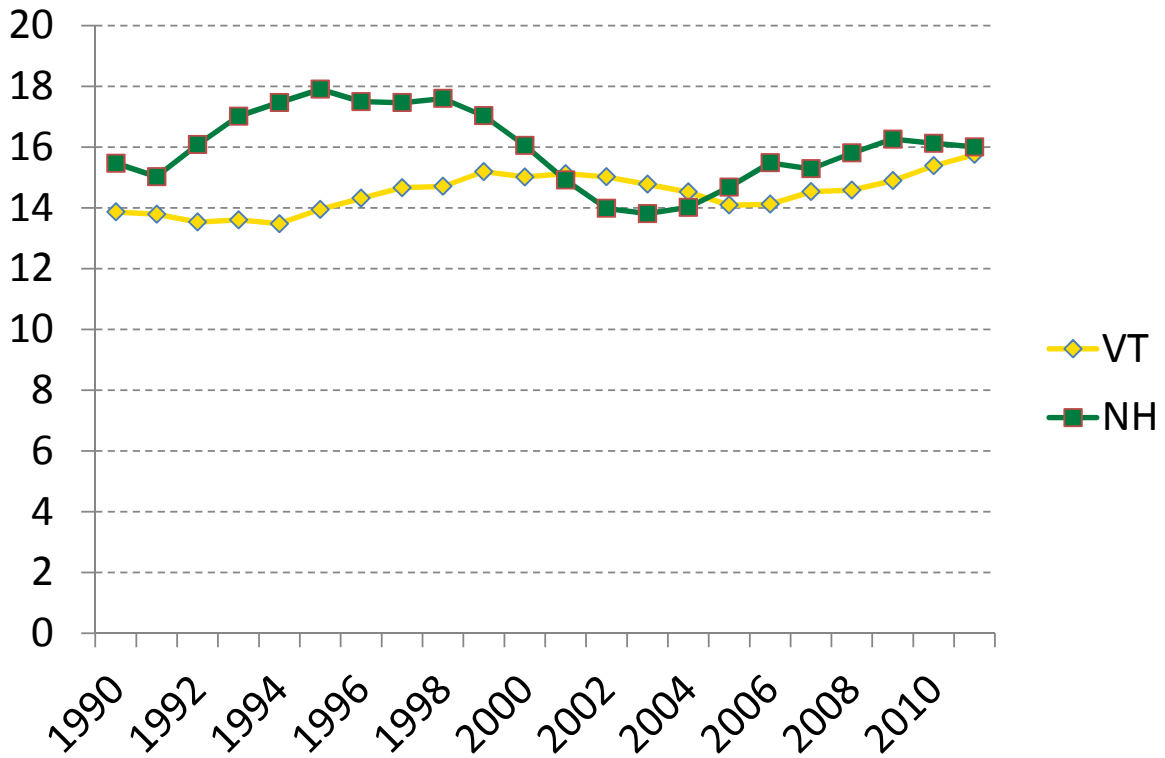
  - Market power: Borenstein and Bushnell (1999), Borenstein *et al.* (2002), Wolak (2003)
- Little concensus so far on the impact of retail competition on electricity prices
  - Apt (2005), Fagan (2006), Jaskow (2006)
  - Swadley and Yücel (2011)

Electricity retail markets restructuring status, 2011



Average prices paid by residential customers: VT v. NH



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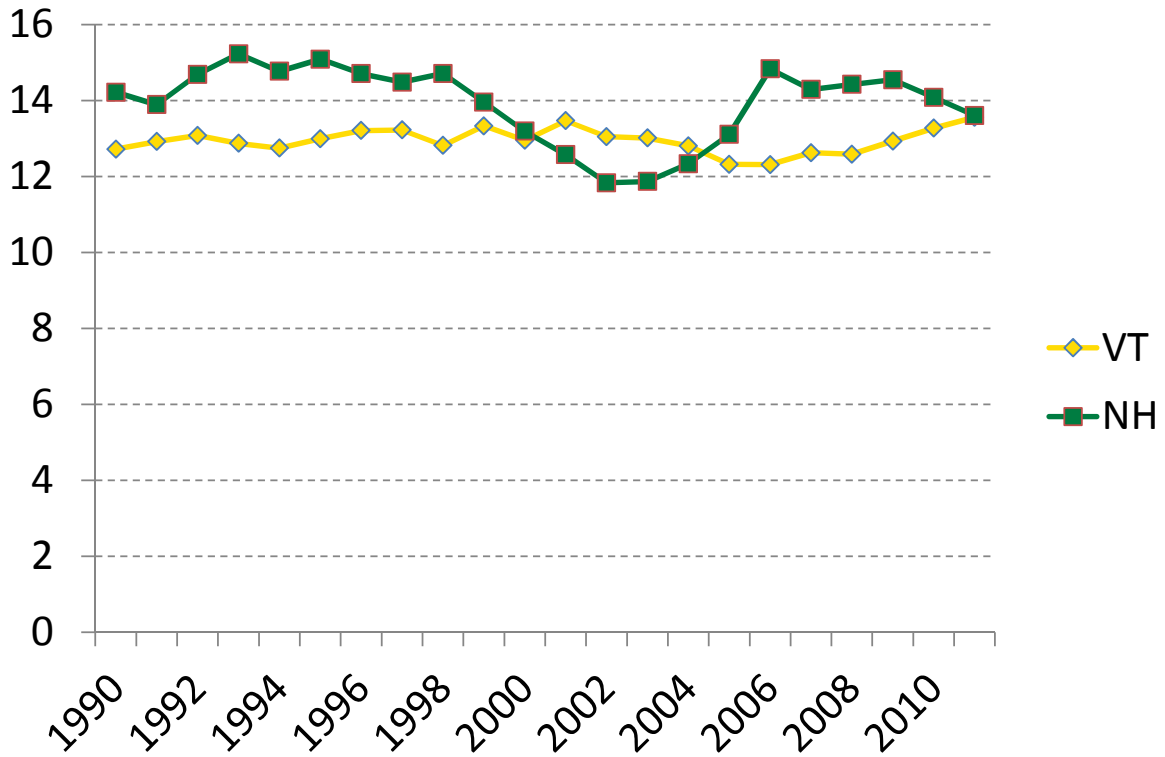

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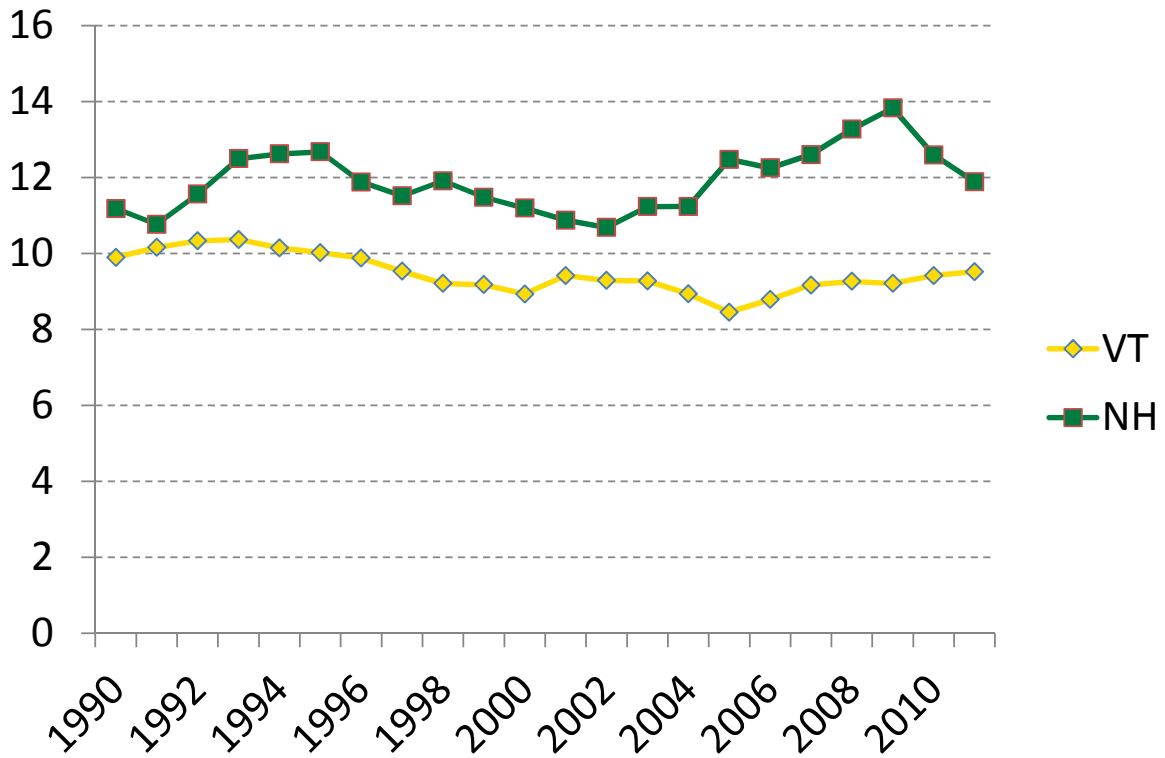
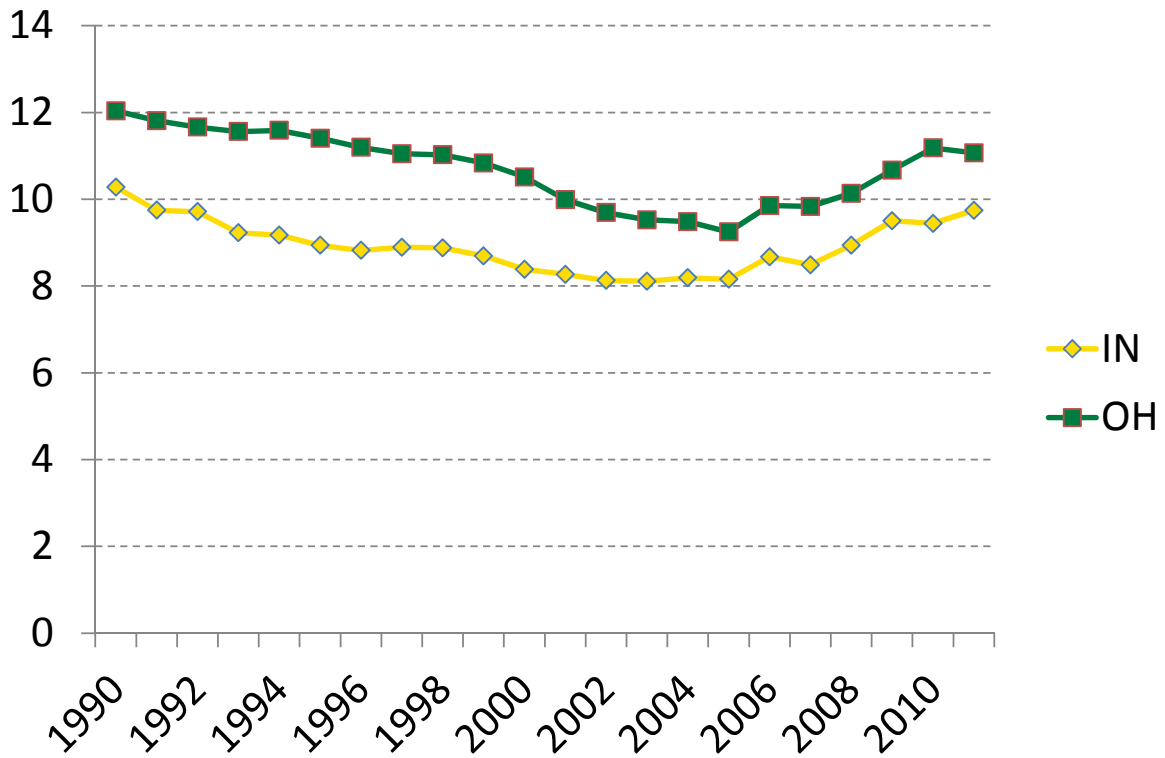


Average prices paid by residential customers: IN v. OH



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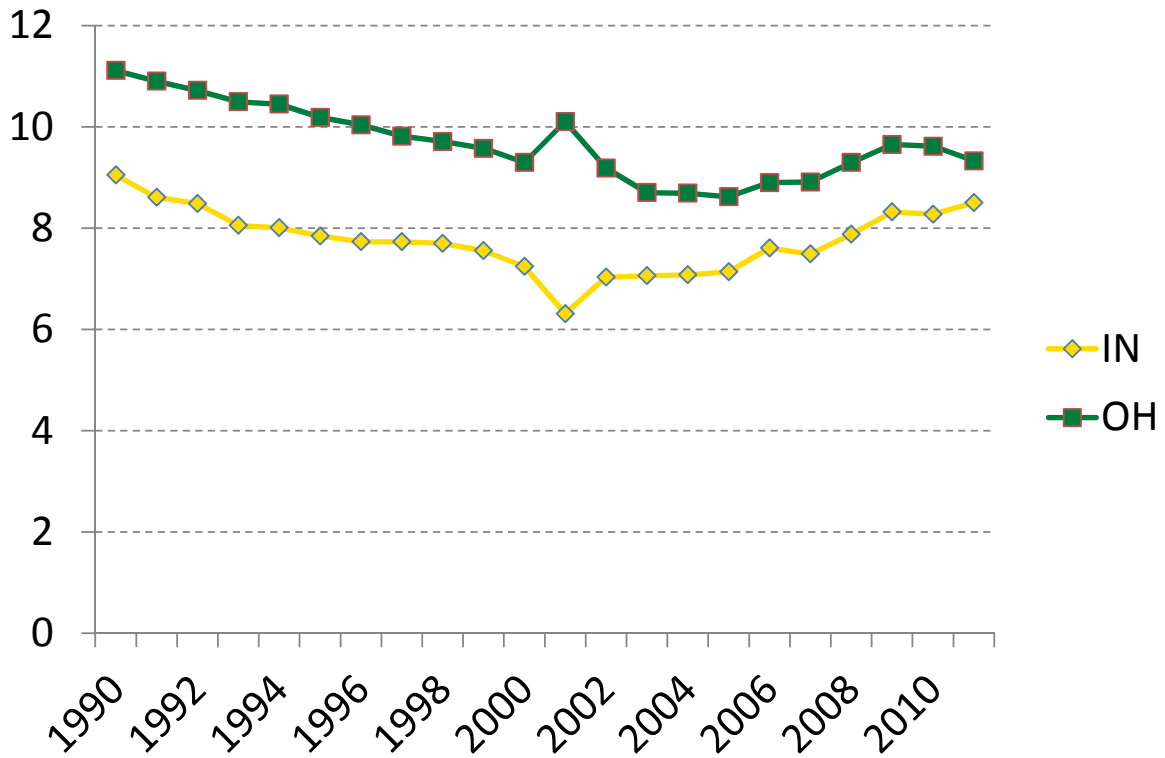

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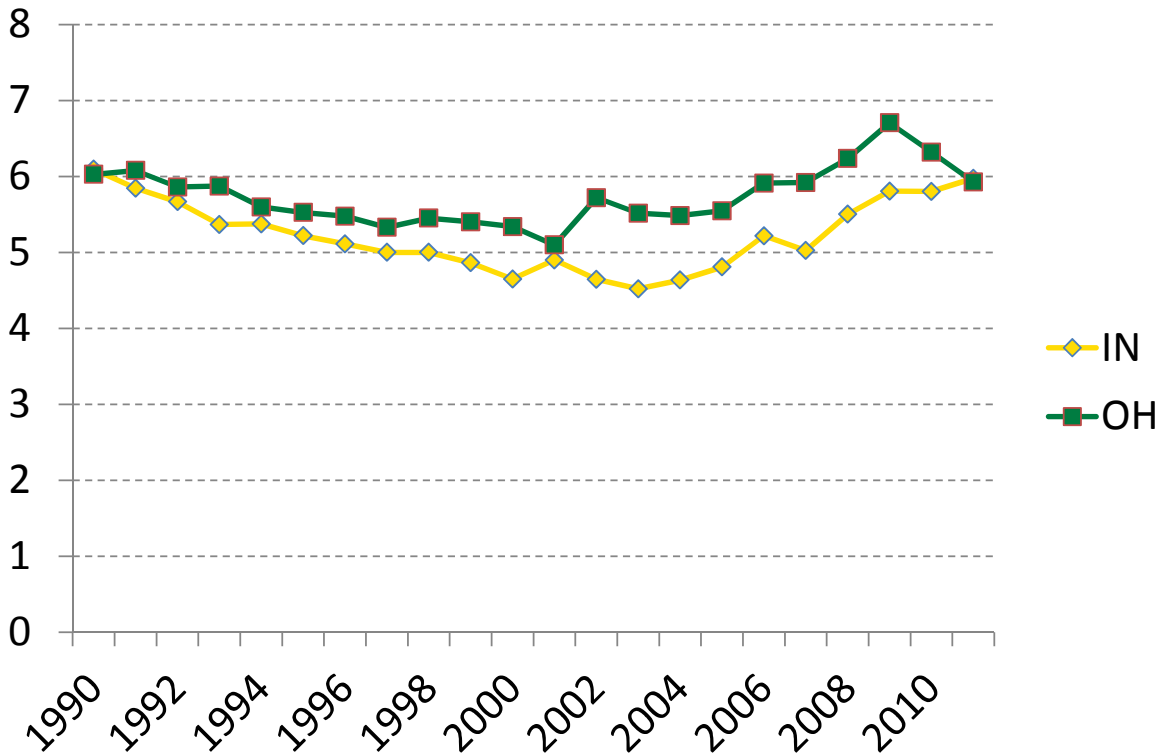

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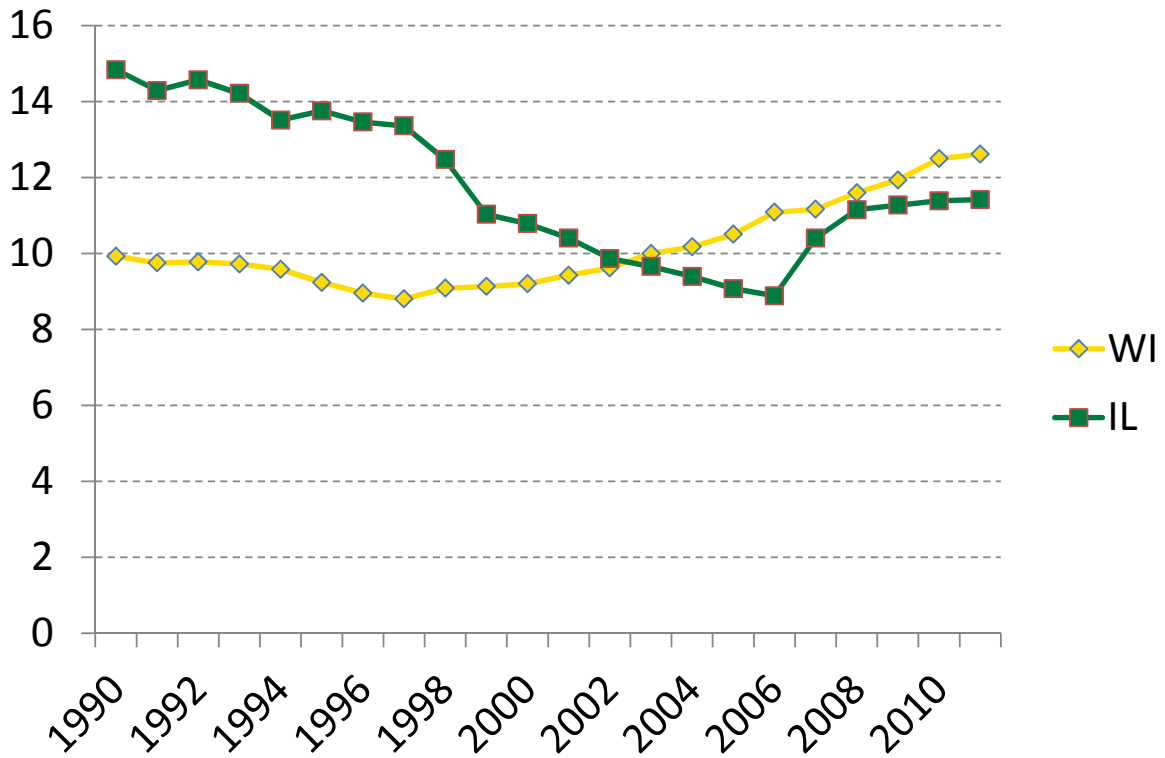

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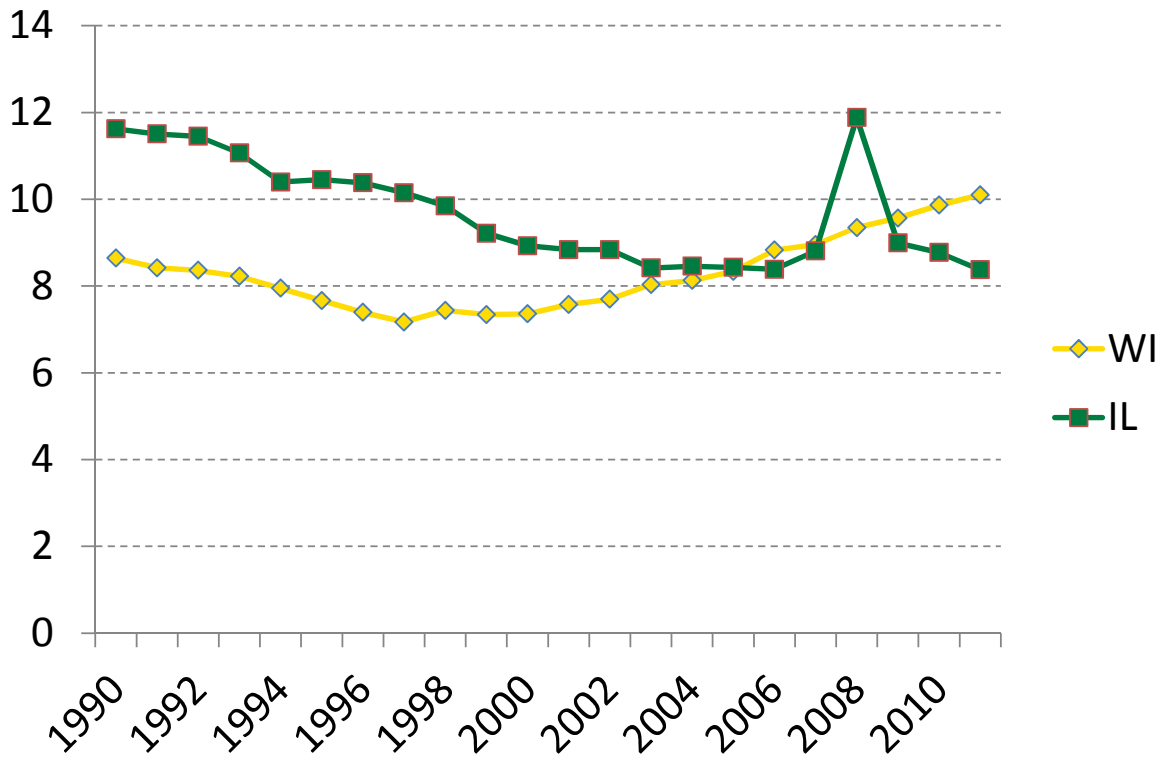

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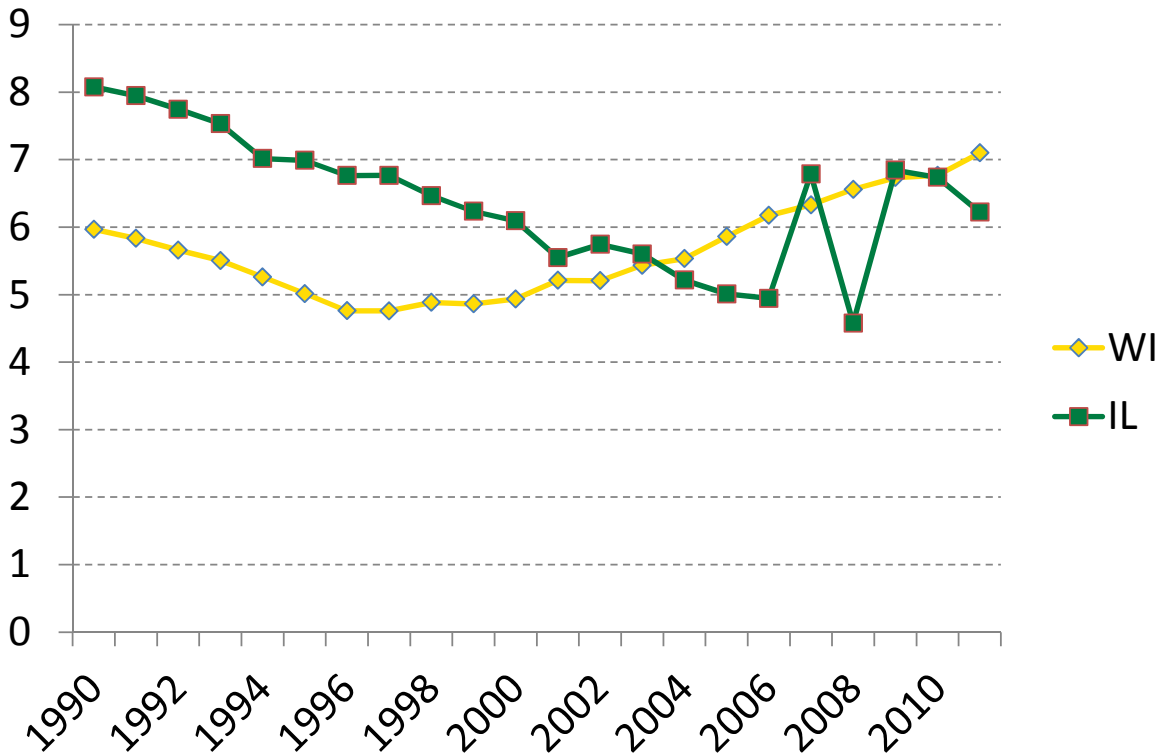

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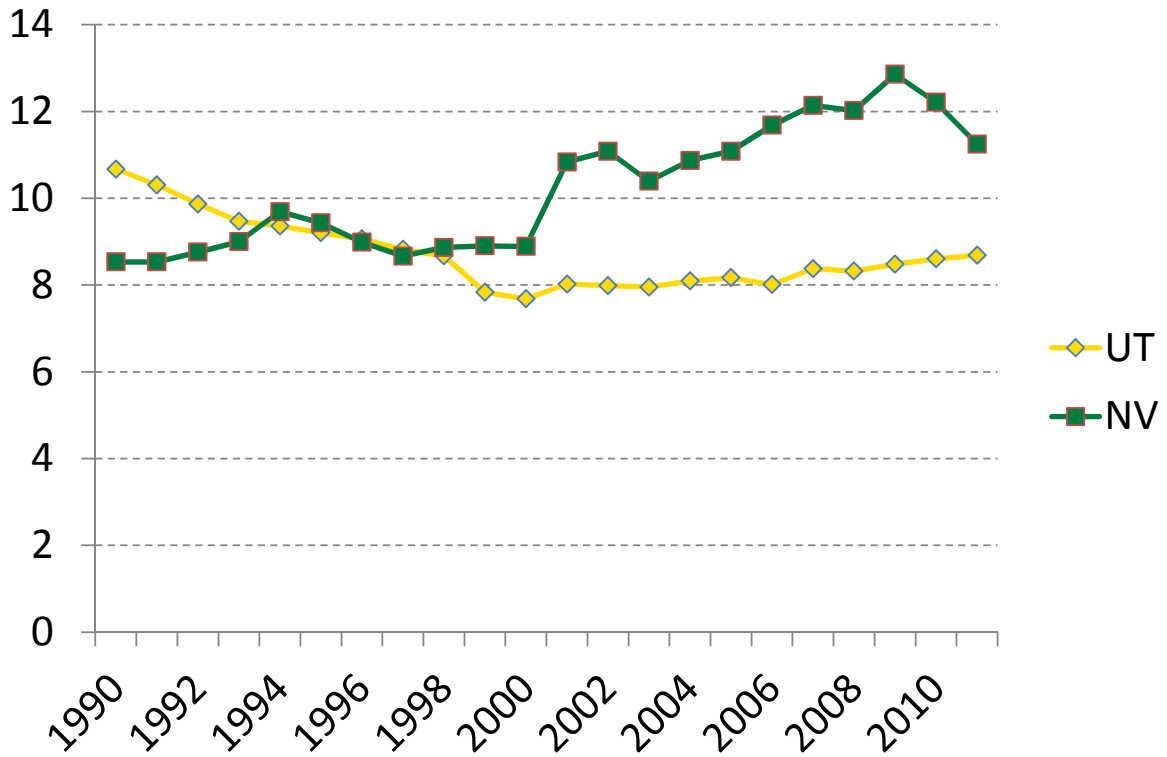

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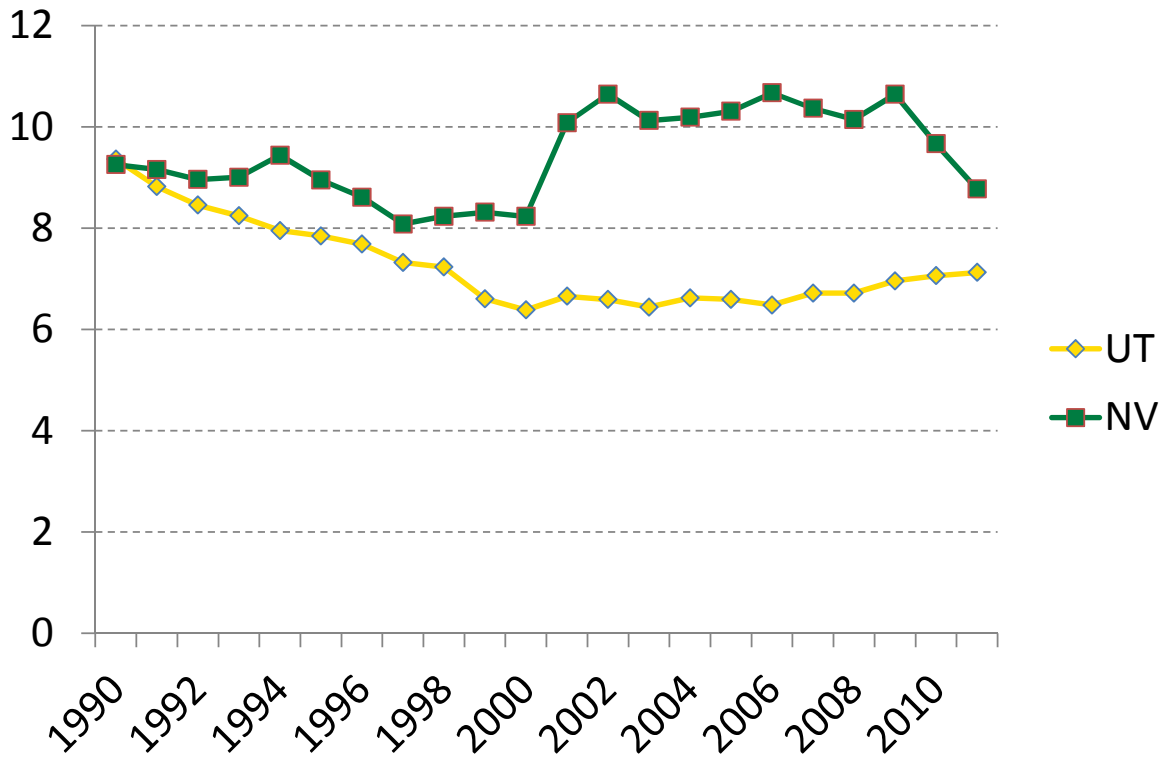

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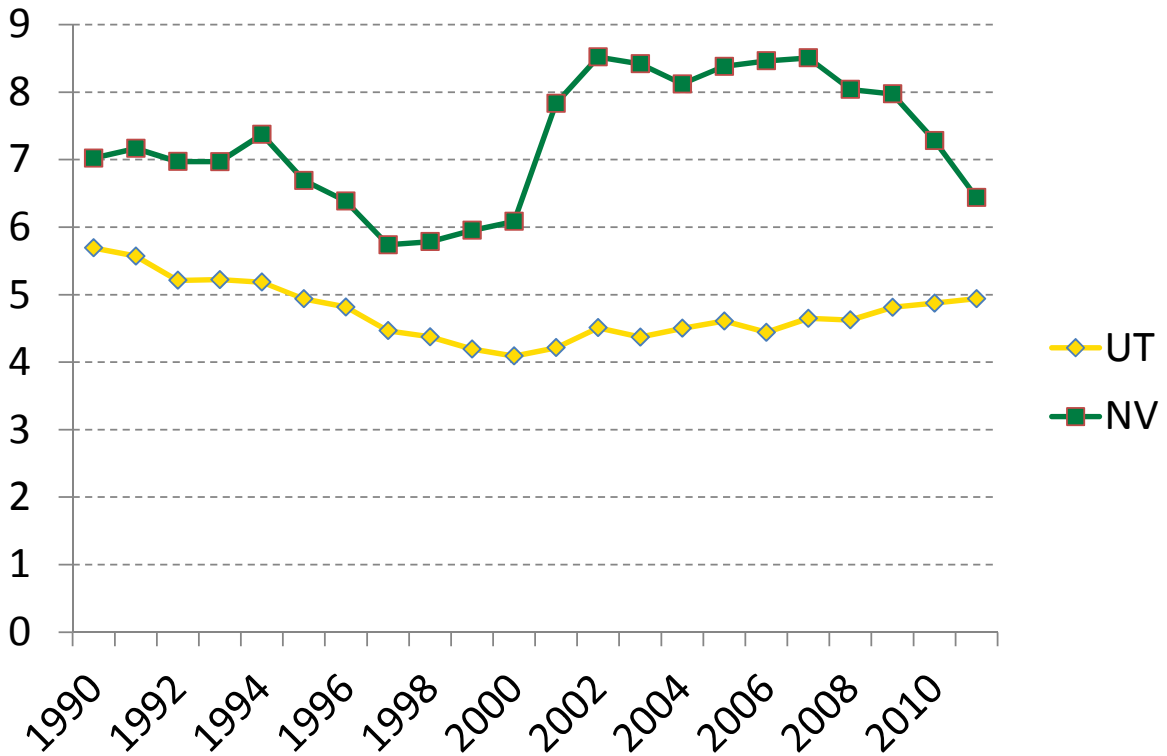

Uniform policy impact

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- y_{st} is the average electricity retail price for state s in year t in real term (2009 dollar)
- α_s and β_t are state and year fixed effects
- R_{st} is the restructuring status for state s in year t, and γ is the parameter of interest
- X_{st} are supply and demand control variables
- ε_{st} is the residue term

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- The entire period of retail competition is divided into a transitional and a post-transitional period
- The transitional period represents a hybrid regulatory regime of both incipient retail competition and direct price controls
- R_{st}^{SR} is a dummy for the transitional period since restructuring, so γ^{SR} measures the short run policy impact
- R_{st}^{LR} is a dummy for the post-transitional period, so γ^{LR} is the long run policy impact of retail competition

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- The restructuring decision is not random but endogenous
  - Indeed the high-price states were more likely to pursue restructuring.
  - With state fixed effects, self selection based on the "level difference" is readily accounted for in the model
  - On the other hand, self selection based on "slope difference" will lead to biased results

Pre-treatment price patterns

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- We focus on the time period before any states implemented any restructuring policies (pre-treatment).
- We compare the price patterns between the group of states that later pursued retail competition ($g_s = 1$) and the group that did not ($g_s = 0$).
- Any level difference, ϕ, can be readily accounted for in later DID analysis with state fixed effects α_s.
- Significant slope difference, δ, would raise concerns about potential bias in DID estimates.

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- Broken down into three customer segments: residential, commercial, and industrial.
  - Calculate the average price for each segment respectively to minimize the impact of composition changes.
- For each segment, total sales further divided between full services and restructured services.
  - Calculate the effective penetration rate of restructured services.

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- The entire restructuring period can be divided into the transitional period and post-transitional period using 3-year or 5-year window.
- Alternative data-based measure: effective penetration rates.

Number of restructuring states by year

Year	Residential	Commercial	Industrial	Full retail choice
1990–1996	0	0	0	0
1997	1	1	1	0
1998	5	5	6	3
1999	7	9	10	4
2000	11	12	13	7
2001	15	17	19	13
2002	17	19	21	16
2003	17	19	21	16
2004	17	19	21	17
2005	16	18	20	16
2006	16	18	20	16
2007	15	17	19	15
2008	14	16	18	14
2009	14	16	18	14
2010	14	16	18	14
2011	14	16	18	14
Total observations	**193**	**218**	**243**	**179**

Alternative measures of restructuring status

Year	Residential	Commercial	Industrial	Full retail choice
Observations in transitional/post-transitional period				
First 3 years	54	60	66	54
After first 3 years	139	158	177	125
First 5 years	89	99	109	87
After first 5 years	104	119	134	92
Observations with effective retail competition				
Revenue penetration $\geq 1\%$	104	193	230	n.a.
Revenue penetration $\geq 5\%$	56	161	201	n.a.
Revenue penetration $\geq 10\%$	35	130	172	n.a.
Quantity penetration $\geq 1\%$	103	194	237	n.a.
Quantity penetration $\geq 5\%$	56	160	207	n.a.
Quantity penetration $\geq 10\%$	35	138	160	n.a.

Summary Statistics

Variable			Mean	Std. Dev.	Min.	Max.
Total revenue	($mil.)	Residential	2,181	2,549	90	16,649
		Commercial	1,781	2,379	97	16,251
		Industrial	1,045	1,099	11	9,301
Restructured revenue	($mil.)	Residential	32	152	0	1,644
		Commercial	162	668	0	7,228
		Industrial	74	267	0	3,247
Total sales	(GWh)	Residential	23,385	23,641	1,480	145,654
		Commercial	20,889	22,234	1,450	128,214
		Industrial	19,672	18,916	216	108,300
Restructured sales	(GWh)	Residential	233	1,072	0	14,763
		Commercial	1,438	5,244	0	47,974
		Industrial	989	3,582	0	43,102

Summary Statistics

Variable			Mean	Std. Dev.	Min.	Max.
Average price	(¢/kWh)	Residential	10.92	3.17	6.27	33.61
		Commercial	9.56	2.86	5.17	31.37
		Industrial	6.88	2.69	3.17	27.52
Summer generation capacity	(GW)	Coal	6.13	6.01	0	23.51
		Natural gas	5.31	9.82	0	73.22
		Oil	1.25	2.18	0	14.80
		Nuclear	1.95	2.49	0	12.61
		Hydro	1.53	3.39	0	21.58
		Other	0.92	1.62	0	11.57
		All sources	17.10	16.31	0.56	109.18
Personal income	($bil.)		197	239	12	1,623

Pre-treatment analysis

	Residential				Commercial				Industrial			
Average price	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$I(g_s = 1)$	1.618	1.418	2.252	1.932	0.939	0.818	1.321	1.163	0.850	0.914	1.363	1.451
	(0.63)**	(0.59)**	(0.77)***	(0.71)***	(0.57)	(0.55)	(0.69)*	(0.65)*	(0.55)	(0.53)*	(0.65)**	(0.62)**
$t \cdot I(g_s = 1)$		0.067		0.108		0.041		0.053		−0.021		−0.030
		(0.06)		(0.07)		(0.04)		(0.05)		(0.04)		(0.04)
Real income	1.251	1.244	1.000	0.987	0.978	0.974	0.805	0.799	0.709	0.711	0.530	0.534
	(0.33)***	(0.33)***	(0.36)***	(0.37)**	(0.38)**	(0.39)**	(0.41)*	(0.41)*	(0.33)**	(0.33)**	(0.36)	(0.36)
Coal	−0.264	−0.264	−0.237	−0.236	−0.219	−0.219	−0.202	0.202	−0.218	−0.218	−0.202	−0.202
	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***
Natural gas	−0.083	−0.083	−0.069	−0.068	−0.063	−0.063	−0.052	−0.051	−0.057	−0.057	−0.045	−0.045
	(0.03)***	(0.03)***	(0.02)***	(0.02)***	(0.03)**	(0.03)*	(0.03)*	(0.03)*	(0.03)**	(0.03)**	(0.02)**	(0.02)**
Oil	−0.021	−0.018	0.004	0.009	−0.024	−0.023	−0.007	−0.004	0.002	0.001	0.007	0.006
	(0.13)	(0.13)	(0.11)	(0.11)	(0.15)	(0.16)	(0.14)	(0.14)	(0.10)	(0.10)	(0.09)	(0.09)
Nuclear	0.168	0.168	0.118	0.117	0.108	0.108	0.081	0.081	0.079	0.079	0.038	0.038
	(0.08)**	(0.08)**	(0.07)	(0.07)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	(0.08)
Hydro	−0.352	−0.351	−0.314	−0.312	−0.300	−0.300	−0.279	−0.279	−0.320	−0.320	−0.324	−0.324
	(0.07)***	(0.07)***	(0.06)***	(0.06)***	(0.08)***	(0.08)***	(0.07)***	(0.07)***	(0.06)***	(0.06)***	(0.06)***	(0.06)***
Other	−0.453	−0.450	−0.348	−0.342	−0.190	−0.188	−0.113	−0.110	−0.119	−0.120	−0.028	−0.029
	(0.24)*	(0.24)*	(0.27)	(0.28)	(0.29)	(0.29)	(0.31)	(0.31)	(0.27)	(0.27)	(0.30)	(0.30)
N	357	357	322	322	357	357	322	322	357	357	322	322
R^2	0.561	0.562	0.585	0.586	0.471	0.472	0.482	0.483	0.436	0.436	0.467	0.467

Uniform policy impact

	Residential				Commercial				Industrial			
Average price	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Restructured	−0.537	−0.560	−0.635	−0.714	−0.012	0.002	−0.058	−0.060	0.197	0.218	0.146	0.262
	(0.30)*	(0.26)**	(0.27)**	(0.29)**	(0.28)	(0.24)	(0.24)	(0.28)	(0.26)	(0.21)	(0.22)	(0.23)
Real income	0.039	0.046	−0.014	0.263	0.233	0.235	0.193	0.611	0.235	0.227	0.224	0.432
	(0.14)	(0.15)	(0.13)	(0.23)	(0.16)	(0.17)	(0.15)	(0.21)***	(0.11)**	(0.11)**	(0.11)**	(0.22)*
Coal	−0.309	−0.293	−0.308	−0.235	−0.075	−0.057	−0.073	0.009	−0.139	−0.130	−0.125	−0.080
	(0.15)**	(0.14)**	(0.14)**	(0.14)	(0.14)	(0.12)	(0.12)	(0.13)	(0.11)	(0.09)	(0.09)	(0.09)
Natural gas	−0.039	−0.004	−0.002	−0.005	−0.057	−0.024	−0.022	−0.036	−0.049	−0.012	−0.011	−0.013
	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)	(0.03)
Oil	0.122	0.044	0.049	0.086	0.151	0.082	0.078	0.126	0.241	0.173	0.168	0.213
	(0.14)	(0.12)	(0.13)	(0.13)	(0.14)	(0.11)	(0.11)	(0.11)	(0.15)	(0.12)	(0.13)	(0.13)
Nuclear	0.057	0.064	0.075	0.032	−0.195	−0.178	−0.172	−0.230	−0.203	−0.172	−0.184	−0.201
	(0.45)	(0.51)	(0.51)	(0.55)	(0.23)	(0.26)	(0.26)	(0.30)	(0.23)	(0.24)	(0.24)	(0.28)
Hydro	0.238	0.222	0.248	0.143	0.404	0.379	0.370	0.213	0.371	0.299	0.294	0.266
	(0.25)	(0.29)	(0.26)	(0.27)	(0.31)	(0.33)	(0.32)	(0.31)	(0.33)	(0.31)	(0.31)	(0.33)
Other	−0.001	0.061	0.065	−0.012	−0.133	−0.075	−0.069	−0.164	−0.104	−0.057	−0.063	−0.106
	(0.15)	(0.11)	(0.11)	(0.11)	(0.12)	(0.08)	(0.08)	(0.08)**	(0.11)	(0.07)	(0.07)	(0.08)
N	1,122	1,056	946	858	1,122	1,056	946	858	1,122	1,056	946	858
R^2	0.892	0.918	0.922	0.924	0.885	0.911	0.916	0.922	0.859	0.905	0.909	0.916

Differential policy impact

	Residential				Commercial				Industrial			
Average price	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
A. Use 3-year transitional window												
Transitional	−0.855	−0.930	−0.964	−1.125	−0.348	−0.359	−0.378	−0.380	−0.094	−0.120	−0.136	0.002
	(0.20)***	(0.19)***	(0.19)***	(0.21)***	(0.26)	(0.27)	(0.27)	(0.34)	(0.24)	(0.24)	(0.25)	(0.30)
Post-transitional	−0.365	−0.357	−0.451	−0.504	0.166	0.194	0.117	0.105	0.355	0.404	0.304	0.405
	(0.40)	(0.34)	(0.35)	(0.38)	(0.35)	(0.29)	(0.29)	(0.31)	(0.33)	(0.24)	(0.25)	(0.26)*
Difference	0.490	0.573	0.512	0.620	0.515	0.553	0.495	0.486	0.449	0.524	0.440	0.404
	(0.32)	(0.30)*	(0.30)*	(0.32)*	(0.32)	(0.30)*	(0.30)	(0.32)	(0.31)	(0.26)**	(0.27)	(0.29)
B. Use 5-year transitional window												
Transitional	−0.941	−1.009	−1.053	−1.213	−0.307	−0.314	−0.346	−0.346	0.013	−0.068	−0.131	−0.005
	(0.23)***	(0.21)***	(0.21)***	(0.23)***	(0.25)	(0.24)	(0.24)	(0.31)	(0.25)	(0.23)	(0.24)	(0.28)
Post-transitional	−0.071	−0.033	−0.141	−0.192	0.314	0.354	0.266	0.242	0.403	0.542	0.467	0.566
	(0.47)	(0.42)	(0.42)	(0.46)	(0.41)	(0.34)	(0.34)	(0.36)	(0.37)	(0.28)*	(0.30)	(0.31)*
Difference	0.870	0.976	0.912	1.021	0.621	0.669	0.611	0.589	0.390	0.610	0.599	0.571
	(0.39)**	(0.37)**	(0.37)**	(0.40)**	(0.37)*	(0.33)**	(0.33)*	(0.35)	(0.34)	(0.30)*	(0.32)*	(0.35)
C. Use linear trend in restructured period												
Restructured	−1.142	−1.277	−1.302	−1.530	−0.407	−0.486	−0.500	−0.487	−0.010	−0.232	−0.283	−0.180
	(0.25)***	(0.23)***	(0.24)***	(0.27)***	(0.28)	(0.29)*	(0.29)*	(0.38)	(0.30)	(0.27)	(0.27)	(0.36)
Year since restructuring	0.113	0.134	0.125	0.143	0.073	0.090	0.082	0.075	0.038	0.083	0.080	0.081
	(0.06)*	(0.05)**	(0.05)**	(0.06)**	(0.06)	(0.05)*	(0.05)	(0.05)	(0.05)	(0.04)*	(0.05)*	(0.05)

Fill retail choice

	Residential				Commercial				Industrial			
Average price	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
A. Uniform policy impact for the entire restructuring period												
Restructured	−0.517	−0.538	−0.618	−0.664	−0.147	−0.176	−0.243	−0.297	0.071	0.011	0.001	0.050
	(0.31)	(0.27)*	(0.28)**	(0.30)**	(0.27)	(0.23)	(0.24)	(0.24)	(0.27)	(0.22)	(0.23)	(0.24)
B. Differential policy impact using the 3-year transitional window												
Transitional	−0.910	−0.993	−1.028	−1.128	−0.573	−0.631	−0.664	−0.684	−0.414	−0.499	−0.478	−0.426
	(0.20)***	(0.18)***	(0.18)***	(0.22)***	(0.19)***	(0.18)***	(0.18)***	(0.22)***	(0.18)**	(0.17)***	(0.18)***	(0.19)**
Post-transitional	−0.275	−0.250	−0.352	−0.420	0.116	0.112	0.028	−0.094	0.370	0.334	0.311	0.300
	(0.43)	(0.38)	(0.39)	(0.40)	(0.39)	(0.34)	(0.34)	(0.34)	(0.38)	(0.30)	(0.31)	(0.32)
Difference	0.635	0.743	0.676	0.708	0.689	0.743	0.692	0.590	0.785	0.833	0.789	0.726
	(0.35)*	(0.33)**	(0.32)**	(0.34)**	(0.37)*	(0.34)**	(0.34)**	(0.35)	(0.34)**	(0.26)***	(0.26)***	(0.26)***
C. Differential policy impact using the 5-year transitional window												
Transitional	−0.966	−1.034	−1.082	−1.190	−0.533	−0.575	−0.618	−0.670	−0.282	−0.417	−0.404	−0.397
	(0.24)***	(0.21)***	(0.22)***	(0.25)***	(0.20)**	(0.20)***	(0.20)***	(0.24)***	(0.22)	(0.19)**	(0.20)**	(0.23)*
Post-transitional	0.077	0.136	0.020	−0.086	0.363	0.366	0.270	0.112	0.537	0.593	0.558	0.541
	(0.51)	(0.46)	(0.47)	(0.48)	(0.46)	(0.39)	(0.39)	(0.38)	(0.41)	(0.34)*	(0.34)	(0.34)
Difference	1.043	1.170	1.101	1.104	0.896	0.941	0.888	0.783	0.820	1.010	0.962	0.938
	(0.43)**	(0.41)***	(0.41)**	(0.42)**	(0.40)**	(0.35)**	(0.35)**	(0.36)**	(0.33)**	(0.28)***	(0.29)***	(0.28)**

Effective penetration

	Residential				Commercial				Industrial			
Average price	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
A. Restructured sales quantity penetration, one-year lag												
Penetration rate $\geq 1\%$	0.036	0.283	0.228	0.036	0.162	0.287	0.117	−0.090	0.361	0.417	0.328	0.213
	(0.44)	(0.45)	(0.45)	(0.51)	(0.36)	(0.30)	(0.30)	(0.31)	(0.33)	(0.23)*	(0.23)	(0.23)
Penetration rate $\geq 5\%$	0.318	0.577	0.529	0.510	0.333	0.432	0.319	0.176	0.481	0.537	0.453	0.283
	(0.48)	(0.52)	(0.51)	(0.52)	(0.38)	(0.34)	(0.36)	(0.37)	(0.35)	(0.26)**	(0.26)*	(0.25)
Penetration rate $\geq 10\%$	−0.336	−0.113	−0.168	−0.191	0.462	0.563	0.487	0.186	0.639	0.688	0.595	0.449
	(0.29)	(0.29)	(0.28)	(0.29)	(0.36)	(0.32)*	(0.33)	(0.33)	(0.34)*	(0.26)**	(0.27)**	(0.26)*
B. Restructured sales revenue penetration, one-year lag												
Penetration rate $\geq 1\%$	0.194	0.290	0.230	0.010	0.162	0.288	0.116	−0.094	0.359	0.429	0.338	0.226
	(0.48)	(0.47)	(0.47)	(0.53)	(0.36)	(0.31)	(0.32)	(0.31)	(0.34)	(0.23)*	(0.24)	(0.23)
Penetration rate $\geq 5\%$	0.238	0.484	0.431	0.408	0.310	0.406	0.286	0.137	0.486	0.555	0.466	0.336
	(0.49)	(0.54)	(0.53)	(0.54)	(0.38)	(0.34)	(0.36)	(0.37)	(0.35)	(0.25)**	(0.26)*	(0.25)
Penetration rate $\geq 10\%$	−0.336	−0.113	−0.168	−0.191	0.395	0.509	0.431	0.162	0.633	0.688	0.596	0.465
	(0.29)	(0.29)	(0.28)	(0.29)	(0.37)	(0.33)	(0.34)	(0.33)	(0.34)*	(0.25)***	(0.26)**	(0.25)*

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Thank you!