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Department of Economics

The Ideal Competitive Electricity Market. A simulation model for Italy.

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2nd AIEE ENERGY SYMPOSIUM; November 2-4 2017 Rome



Outline

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Introduction

The paper provides an empirical measurement of the deadweight loss of welfare and the market inefficiency through the market power analysis of both demand and the supply side in the Italian wholesale electricity market.



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Theoretical Background & Empirical Strategy

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- **Literature**

Optimizing bidding behavior Model to measure the unilateral market power of strategic players using the residual demand / supply arc elasticity:

Cramton (2004), Wolak (2003), Bigerna & Bollino (2016).

- **Cournot model with competitive fringe:**

Agents belonging to the fringe maximize their profit with the competitive bid.



Optimal Bidding Behavior: Supply side

- $q_{ih} = \arg \max \pi_{ih}(q_{ih}) = p_h(Q^*_{-ih}, q_{ih})q_{ih} - C_i(q_{ih})$

Mark-up and Residual Demand Elasticity

$$> [p_h - \partial C / \partial q_{ih}] / p_h = 1 / \varepsilon DR_{ih}$$

Optimal Bidding Behavior: Demand side

- $q_{ih} = \arg \max \pi_{ih}(q_{ih}) = z x_i - p_{ih}(Q^*_{-ih}, q_{ih})$

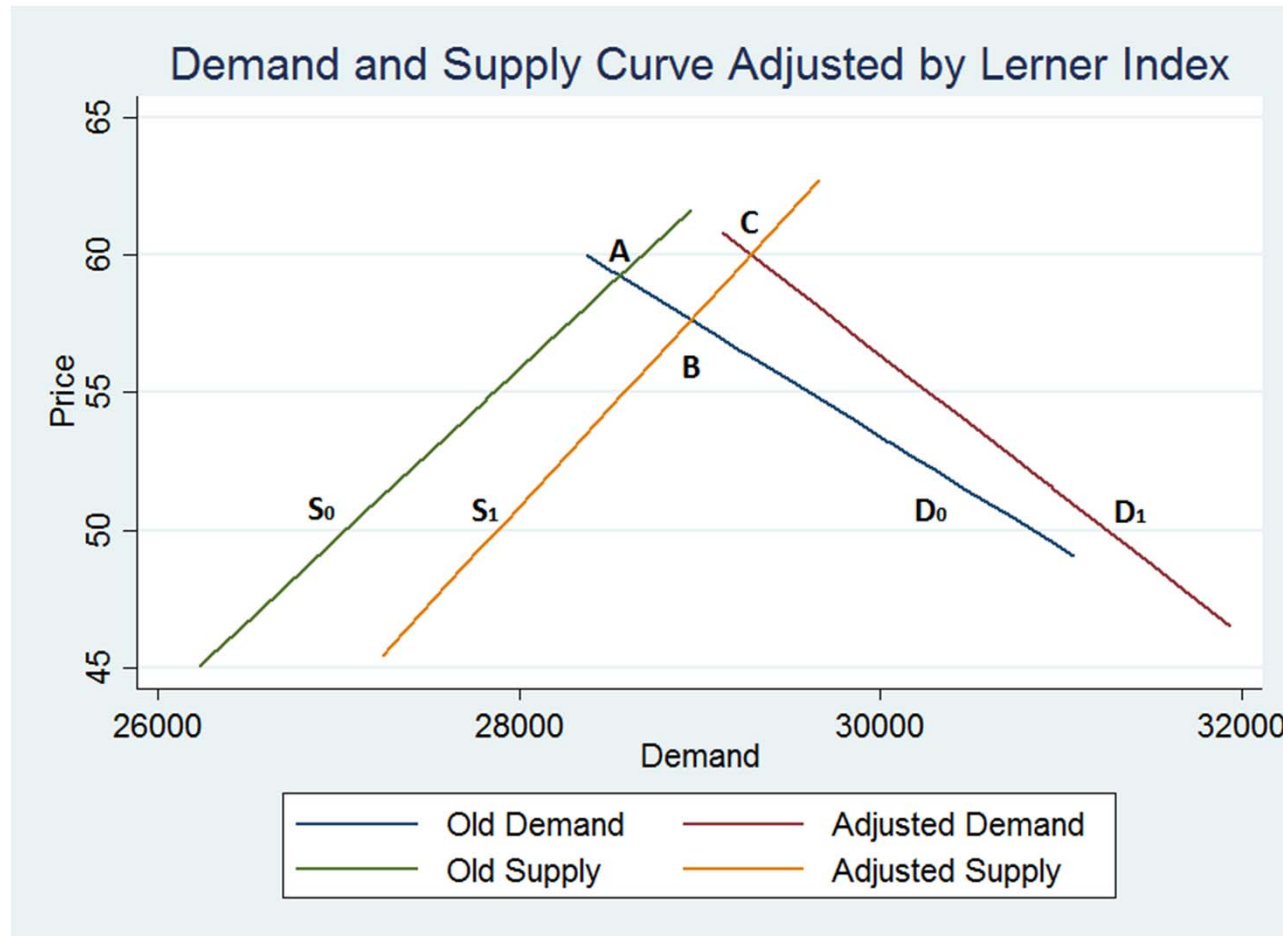
Mark-down and Residual Supply Elasticity

$$> [z \partial f_i / \partial q_{ih} - p_h] / p_h = 1 / \varepsilon SR_{ih}$$



Operational strategy

- Correction of the bid accounting for the mark-up/down.
- Construction of the new the supply/demand curves from the new ascending/descending order
- Derivation of the new competitive market equilibrium, from the intersection of the two curves.
- Computation of Welfare Loss through the comparison of the current equilibrium with the simulated competitive counterfactual.





The original historical equilibrium SMP, at point A

Remove only the supply strategic behavior, supply function shift from S_0 to S_1 , equilibrium SMP at point B.

Also remove the demand strategic behavior, demand curve shift from D_0 to D_1 , equilibrium SMP at point C



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Data



- Years: 2013-2014
- Single and two market configuration(Sicily-Mainland) (Frequency: 65%-62% of total)
- Unit plant bids of both suppliers and wholesalers
 - to recover the empirical distribution of the best response conditional on the competitors' best bids
 - to identify the best response of each strategic agents
 - to derive the measure of unilateral market power



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Preliminary results

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	Old Equilibrium Price	$\Delta 1\%$	$\Delta 2\%$	$\Delta \text{Tot}\%$
2013	63.62	-5.88	1.49	-4.58
2014	52.51	-3.16	1.17	-2.01
Tot	58.065	-4.52	1.33	-3.29
	Old Equilibrium Quantity	$\Delta 1\%$	$\Delta 2\%$	$\Delta \text{Tot}\%$
2013	31863.25	0.59	0.37	0.96
2014	30945.39	0.25	0.33	0.59
Tot	31404.32	0.42	0.35	0.77



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	Old Social Welfare Mil.	$\Delta 1\%$	$\Delta 2\%$	$\Delta \text{Tot}\%$
2013	8.87	0.19	0.36	0.55
2014	8.53	0.07	0.31	0.39
Tot	8.70	0.13	0.33	0.46
	Old Consumer Welfare Share	$\Delta 1\%$	$\Delta 2\%$	$\Delta \text{Tot}\%$
2013	79.88	1.74	-0.37	1.36
2014	82.84	0.73	-0.26	0.47
Tot	81.36	1.23	-0.31	0.92
	Old Producer Welfare Share	$\Delta 1\%$	$\Delta 2\%$	$\Delta \text{Tot}\%$
2013	20.12	-6.69	1.64	-5.5
2014	17.16	-3.59	1.06	-2.56
Tot	18.64	-5.14	1.35	-4.03



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		2013			
		Old Social Welfar	Δ1%	Δ2%	ΔTot%
		Mil.			
Peak		8.85	0.18	0.38	0.56
Off-Peak		8.77	0.2	0.37	0.57
		Old Consumer Surplus	Δ1%	Δ2%	ΔTot%
		%			
Peak		79.51	1.67	-0.41	1.25
Off-Peak		79.9	1.83	-0.37	1.45
		Old Producer Suplus	Δ1%	Δ2%	ΔTot%
		%			
Peak		20.5	-6.54	1.72	-5.27
Off-Peak		20.1	-6.83	1.73	-5.61
		2014			
		Old Social Welfar	Δ1%	Δ2%	ΔTot%
		Mil.			
Peak		8.57	0.07	0.28	0.35
Off-Peak		8.48	0.08	0.32	0.4
		Old Consumer Surplus	Δ1%	Δ2%	ΔTot%
		%			
Peak		83.49	0.67	-0.23	0.44
Off-Peak		82.45	0.77	-0.27	0.5
		Old Producer Suplus	Δ1%	Δ2%	ΔTot%
		%			
Peak		16.51	-3.38	1	-2.42
Off-Peak		17.55	-3.74	1.08	-2.68



- **Welfare loss** due to market power lies between the 0.39% (in 2013) and the 0.55% (in 2014).
- Removing oligopolistic market power slightly increases the **wholesalers' shares** (between the 0.7% and 1.7%); changes in consumers' surplus are even more marginal when we neutralize the oligopsonistic market (around 0.33%).
- **Producers' surplus** undergoes major changes, decreasing by 5.5% in 2013 and by 2.56% in 2014. Removing oligopolistic market power leads the suppliers' shares to deeply shrink between the 3.59% and the 6.69%. Ridding of the oligopsonistic market power increases the producers' welfare share between the 1.06% and the 1.64%.

shift



Conclusions

If the Antitrust Authority and Energy Authority do not take action:

Market power is here to stay

It's better to burn out

Than to fade away

Market power can never die

There's more to the picture

Than meets the eye.

(Neil Young, 1979)