

Markets with Power

Competitive benchmark model of the Australian National Electricity Market

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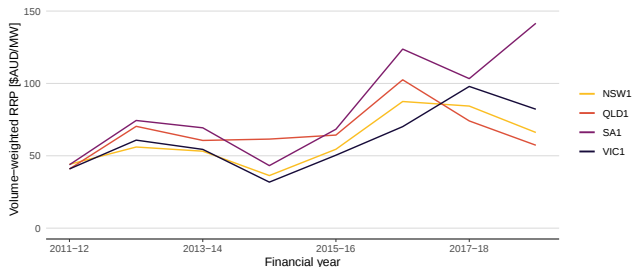
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Motivation

Motivation I

- Persistent rise in prices without corresponding increase in coal prices (AER, 2020).
- Pre-2017, prices averaged \$53 AUD/MWh.
- Post-2016, prices increased to \$94 AUD/MWh.



Motivation II

- These outcomes precipitated three federal inquiries on the effectiveness of Australia's market design and competition policy (Finkel et al., 2017; ACCC, 2018, 2019a,b).
- Price increases were attributed to a variety of factors:
 - Tightening supply-demand balance
 - Coal supply disruptions
 - Increasing gas prices
 - High market concentration

Overview

- **Aim**

- Following Borenstein et al. (2002), we assess the degree to which price increases can be attributable to the markups in generator bids.
- We interpret markups as a reflection of market power.

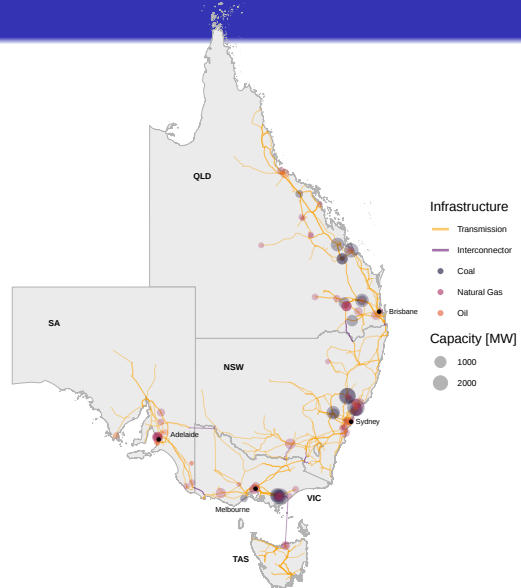
- **Questions**

- ① Has market power significantly contributed to higher electricity prices in Eastern Australia?
- ② Is market power heterogeneous across regions and time periods?

Background

Australian NEM

- The market is split into five regions:
 - New South Wales (NSW)
 - Queensland (QLD)
 - South Australia (SA)
 - Tasmania (TAS)
 - Victoria (VIC)
- The NEM is an energy-only, zonal, real-time electricity market.



Market structure

- The NEM has been concentrated since its inception and thereafter experienced significant consolidation.
- CR_3 by capacity
 - NEM < 50%
 - NSW = 77%
 - QLD = 64%
 - VIC = 70%
 - SA = 68%
- High regional concentration is an artifact of the NEM's commissioning → separate markets with limited trade.

Table: Capacity by region in 2019

Firm	NSW	QLD	VIC	SA	TAS	Total
AGL Energy	5,403	677	3,626	1,792	0	11,498
Snowy Hydro	5,149	0	3,015	281	0	8,445
Origin Energy	4,093	1,578	629	1,016	0	7,315
EnergyAustralia	2,435	93	2,775	351	0	5,654
CS Energy	0	4,251	0	0	0	4,251
Stanwell Corp.	96	4,155	0	0	0	4,251
Hydro Tasmania	0	0	94	100	1,543	1,737
Engie	78	0	0	1,117	0	1,194
Other	3,180	4,678	3,206	1,097	0	12,160
Total	20,433	15,431	13,344	5,754	1,543	56,506

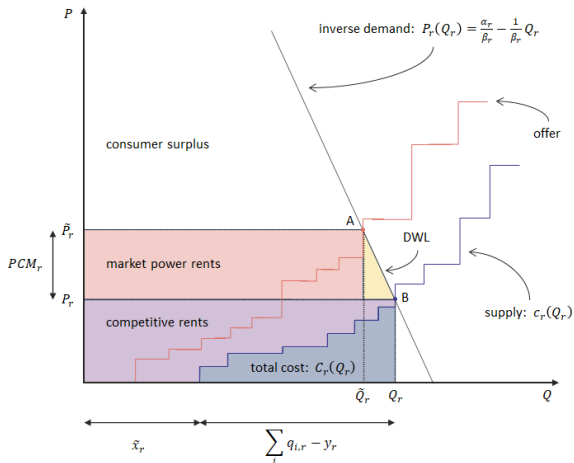
Note: All values in MW.

Market Power

- The NEM relies heavily on effective competition to deliver cost-reflective price outcomes.
- The NEM's design is particularly vulnerable to the exercise of market power:
 - Energy-only design
 - High price cap
 - Bidding up until dispatch
 - Limited inter-regional capacity
- This is before considering other common factors which can exacerbate market power within electricity markets, including: inelastic demand and supply, transmission constraints, and repeated interactions.

Model & Results

Model



Welfare maximization

$$\max_{q_{i,r,t}} W_t = \sum_r \sum_i \left[P_{r,t}(Q_{r,t}) - c_{i,r,t} \right] \cdot q_{i,r,t}$$

$$s.t. \quad 0 \leq q_{i,r,t} \leq \tilde{z}_{i,r,t}$$

flow & balance constraints

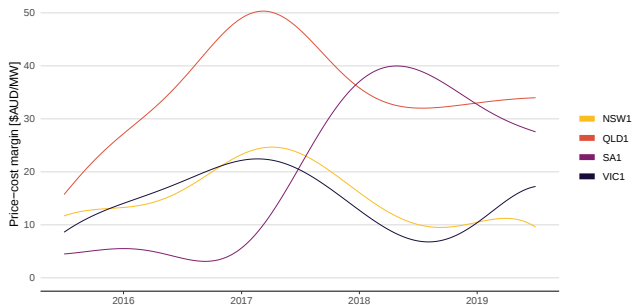
Assumptions

- ① Electricity is a homogeneous commodity.
- ② Non-fossil generation is exogenous.
- ③ Inputs are competitively determined.

Results I

- NSW, QLD and VIC all have high price-cost margins during the 2016-17 financial year and decrease thereafter.
- Despite QLD exhibiting a similar trend to NSW and VIC, its price-cost margin is typically more than double that of the other two regions.
- SA exhibits a different trend, starting from a low value, its price-cost margins dramatically increase during 2017 when all others are decreasing.

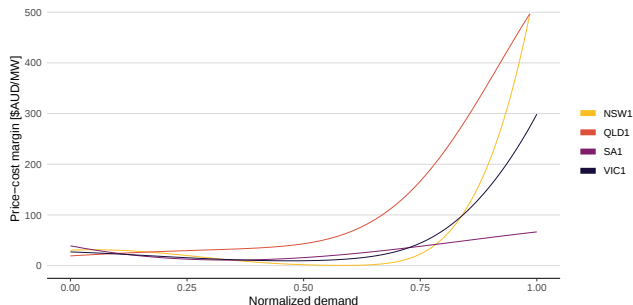
Figure: Daily mean price-cost margins by region



Results II

- Exponential relationship, where margins are much higher at greater levels of demand.
- Margins in QLD begin increasing at lower levels of relative demand than in the other three regions.

Figure: Price-cost margin distributions by region



Summary

Summary

- **Main Takeaways**

- ① From 2015–2019, we attribute 10-50% of price increases to market power depending on the region and time period.
- ② We find significant market power in Queensland and during high demand periods.

- **Extensions**

- Assess how market power and its associated rents changed based on major market events over the past decade.

Thank You!

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References

References I

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Appendices

Capacity by fuel

Table: Capacity by fuel in 2019

Firm	Coal	Gas	Hydro	VRE	Other	Total
AGL Energy	7,295	1,727	678	1,718	80	11,498
Snowy Hydro	0	2,164	6,000	95	186	8,445
Origin Energy	3,000	2,606	240	970	499	7,315
EnergyAustralia	3,000	1,730	0	869	55	5,654
CS Energy	3,681	0	570	0	0	4,251
Stanwell Corporation	3,560	496	161	0	34	4,251
Hydro Tasmania	0	507	822	408	0	1,737
Engie	0	805	0	242	147	1,194
Other	3,955	2,121	140	5,282	662	12,160
Total	24,491	12,156	8,611	9,585	1,664	56,506

Note: All values in MW.