

Testing for Market Integration in the Australian National Electricity Market

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The 1990s witnessed a remarkable global experiment with the introduction of market-based reforms and the restructuring of the electricity sector. Australia established the National Electricity Market (NEM) on 13 December 1998 as a consequence of the restructuring and liberalisation of its electricity supply industry (ESI). One of the foremost objectives of wholesale electricity market reform in Australia, consistent with the electricity market reforms objectives in the European Union (EU), was to deepen competition in wholesale electricity trade and facilitate the fuller integration of the separate regional electricity markets into an efficient and integrated NEM. However, direct empirical evidence, based on econometric methods, as to whether the separate regional electricity markets in the NEM are fully integrated and well-functioning is missing. Empirical evidence on the role of direct interconnections and regional price linkages in achieving fuller integration of regional electricity markets into a NEM is also missing in the Australian context.

This study aims to clarify to what extent the objective of creating an integrated NEM has been achieved since its establishment. Second, this paper adds to the limited number of studies analysing electricity market integration in island economies where the benefits of an integrated market are generally challenging because cross-border interconnections have, to date, been infeasible. Third, the empirical evidence on market integration can provide a significant additional input into the on-going policy debate concerning transmission investment strategies and network regulation arrangements across Australia. Furthermore, the impact of growing large scale trade of wholesale renewable power on the market integration outcomes of 'energy-only' markets has largely remained unexplored in the literature (Tangeras, 2015).

We study market integration by obtaining a fuller understanding of the direct daily electricity spot pricing relationships (price convergence /divergence) between the interconnected regional electricity markets in the NEM. Price convergence (divergence) shows how strongly prices are related (unrelated) across similar markets and cointegration analyses can detect if the prices share a common long-run equilibrium (Johansen, 1995). However, cointegration is not very appropriate for studying a relatively new market that has an emergent connective structure and poised for the large scale uptake of wholesale renewable power. So, we also apply the Kalman filter methodology based on a state-space model that allows us to estimate time-varying coefficients (Kalman, 1960). A time-varying filtered coefficient indicates how strong pricing relationships are among the markets considered and gives us a guide to the level and development of market integration.

We find that the market integration coefficient is lowest between Tasmania and Victoria. Tasmania only actively started participating in the NEM in 2006 while the dominant electricity generation technologies also differ in these two states. The wholesale price divergence gaps between Tasmania and Victoria is decreasing over-time, especially after 2011. The market integration coefficients between New South Wales and Queensland and between New South Wales and Victoria do not show signs of significant increase in market integration. Market integration seems to be the highest between South Australia and Victoria in the NEM. Hence, integrating of the separate regional electricity markets into the NEM has not yet been universally achieved since its establishment based on the systematic testing for market integration conceptualised under '*the law of one price*' as defined by Cournot (1971).

Our findings suggest that convergence in generation and network ownership, coupled with harmonisation of network regulation and regulatory institutional framework, will be increasingly important factors in improving wholesale market integration across all energy-only markets as they experience an increase in the share of renewable energy. The findings from this study can also be a first step in recognising the network constrained regions due to lack of adequate interconnections in the NEM and followed up by a possible network augmentation based on net market benefits assessment. The lack of international interconnections places greater global importance on domestic wholesale market design, underlying internal market rules, network regulation and regulatory institutional arrangements in promoting wholesale competition across isolated electricity markets like the NEM. Hence, achieving an integrated market for electricity in the EU is challenging considering the lack of adequate interconnections and inconsistency in existing wholesale market design and rules across the EU countries facing an increasing share of wholesale renewable energy.

References:

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