Energy Economics 72 (2018) 365–375

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneeco

Consumer electricity and gas prices across Australian capital cities: Structural breaks, effects of policy reforms and interstate differences☆

Abbas Valadkhani [a], Jeremy Nguyen [a,*], Russell Smyth [b]

[a] Swinburne Business School, Swinburne University of Technology, Victoria 3122, Australia
[b] Department of Economics, Monash University, Victoria 3800, Australia

ARTICLE INFO

Article history:
Received 19 October 2017
Received in revised form 25 February 2018
Accepted 23 April 2018
Available online 25 April 2018

JEL classification:
D4
L5
Q41
Q48
Q50

Keywords:
Electricity price
Gas price
Consumer energy prices
Structural break
Australia

ABSTRACT

We detect, and analyze, the most significant structural changes in the quarterly growth rate of consumer electricity and gas prices in Australia and estimate their corresponding seasonal effects. To do so, we apply the general modelling framework of the Bai-Perron breaking regression to all available quarterly data for capital cities, individually, and Australia as a whole (1989Q3–2017Q2). Retail energy prices in most Australian states were deregulated in the 2000s. We find that increases in average quarterly growth rates of electricity and gas prices consistently occurred in the third (September) quarter, and find very few instances of increases in any other quarters of the year. In the post-deregulation period, price increases are significantly higher than in the pre-deregulation era. Results for some capital cities are stark: in Perth, third-quarter growth in electricity prices has been five times higher after the structural break. In Australia, as a whole, third-quarter growth in gas prices has been three times higher after the structural break. We discuss several possible explanations for energy price rises in the period since deregulation.

1. Introduction

High, and rising, energy costs have been a major concern of Australian consumers in recent years. Household electricity prices have nearly doubled over the past decade (Wood et al., 2017). Australian household electricity prices are now among the highest in the world. In a comparison of 91 countries, states and provinces, four of the top six household electricity prices were in Australian states (Mountain, 2012). Gas prices have also surged in recent years. Between 2006 and 2015, residential gas price increases ranged from 23% in Victoria to 74% in Tasmania (Department of Industry, Innovation and Science, 2016) with a further spike in 2017. An expected shortfall in gas for 2018 and 2019 led Prime Minister Malcolm Turnbull, in June 2017, to threaten that the Australian government would restrict gas exports in an attempt to lower power prices (Yaxley, 2017). This option was only taken off the table when, in September 2017, the three major gas companies—Origin, Santos and Shell—agreed to provide enough gas to meet the shortfall (Peatling et al., 2017). Paradoxically, such rapid rises in energy prices have continued despite the fact that Australia is sufficiently energy-rich to be a significant exporter of energy on world markets. As the Chair of the Australian Competition and Consumer Commission (ACCC)—the Australian regulator—has stated, "energy affordability has gone from being a source of economic advantage for Australia to the opposite" (Sims, 2017).

A further irony is that these price increases occurred *after* the industry underwent major deregulation reforms. The intention behind the deregulation of Australia's energy markets had been to *lower* prices (Hilmer et al., 1993). As an independent review commissioned by the Victorian State Government concludes, recent high prices were "not the outcome that Victorian consumers anticipated from the competitive market and … there is evidence of market failure that has led to this result" (Thwaites et al., 2017). Amidst intense political debate and public discussion regarding electricity markets, the Treasurer, Scott Morrison, instructed the ACCC to launch an inquiry into retail electricity prices, with the final report being due in June 2018.

Despite being an issue of enormous policy significance, there has not been any systematic research into trends in Australian consumer energy prices and the effect of deregulation. We contribute to the literature in the following important ways. First, we use objective statistical criteria, and sequential algorithms, to identify possible structural breaks in retail energy prices, thus allowing the breaks to be determined endogenously

☆ We thank two anonymous referees, whose useful feedback considerably improved an earlier version of this article. The usual caveat applies.
* Corresponding author.
E-mail address: jdnguyen@swin.edu.au (J. Nguyen).

https://doi.org/10.1016/j.eneco.2018.04.038
0140-9883/

by the data (Bai and Perron, 2003), rather than relying on subjective methods to select the relevant dates. As such, this is the first study to perform endogenous structural break tests on Australian consumer energy prices. Second, we utilise results from the break tests as input data into an analysis of the effects of deregulation on electricity and gas prices—specifically, by comparing the extent of price increases in the periods before and after deregulation. Third, we track significant spikes in consumer electricity and gas prices across all Australian capital cities, especially in the post-deregulation period, to identify sub-national markets in which price rises have been substantially out-of-step with the others. Our results shed light on coordinated pricing tactics in both electricity and gas markets across capital cities and provide a location-specific and evidenced-based justification for the current, on-going, government inquiry into retail electricity markets.

We contribute to at least two strands of literature. The first are a small number of studies that have ascertained the timing, and considered the relevance, of structural breaks in non-renewable energy prices. For example, Lee et al. (2010) study structural breaks in the daily oil price using the Bai and Perron (2003) method. More recently, Sun and Shi (2015) document structural breaks in weekly crude oil and petroleum prices over the period January 1986 to March 2014 using the Perron and Yabu (2009) method. Similarly, Noguera (2013) documents structural breaks in monthly oil prices over the period January 1861 to August 2011 using the Perron and Yabu (2009) and Kejriwal and Perron (2010) methods. We extend this literature to consider the timing of structural breaks in electricity and gas prices and use these break dates to examine the effect of energy market deregulation in the specific case of Australia. More generally, we differ from these studies in that we use the timing of the structural breaks to specifically examine the effect of energy market deregulation on movement in energy prices.

The second strand of studies to which we contribute are studies of electricity or gas prices in Australia. One set of such studies—often studies commissioned by government or non-government organizations—has documented price increases in a descriptive fashion and offered suggestions for providing relief to consumers (see e.g., Mountain, 2012; Thwaites et al., 2017; Wood et al., 2017). Apergis and Lau (2015) examine whether wholesale electricity prices in Australia are converging, using panel stationarity tests. Apergis et al. (2017) and Worthington et al. (2005) examine the extent to which electricity markets in Australia are interconnected and the transmission of price volatility across markets. Simshauser and Whish-Wilson (2017) examine the effects of price discrimination in retail electricity markets. Other studies have focused on the effect of specific policy changes on energy prices. For example, Nelson et al. (2010, 2012) examine the effect of climate change initiatives in Australia on energy prices. We extend this literature to endogenously locate structural breaks in trends in Australian consumer energy prices and consider the effect that the deregulation of the energy sector has had on those prices.

Several policy reports and inquiries into energy prices in Australia have noted that Australian retail electricity prices have risen significantly since the Global Financial Crisis (GFC) or the immediate aftermath (ACCC, 2017; Thwaites et al., 2017; Wood et al., 2017). We go beyond these studies in that they calculate the average price increase from specific events or policy changes, while we formally locate the exact associated structural break due to reforms.

We find that the break dates for quarterly growth in electricity prices are mainly centred around the turn of the millennium or during the GFC, while most of the break dates for quarterly growth in gas prices are around 2000. We find that the third quarter (the September quarter) is the period in which most energy price rises occur and that price rises in the third quarter are even greater in the period since energy market deregulation. We attribute this finding to the prevalence of temporal price discrimination, given that the third quarter in Australia encompasses the winter months, in which the demand for energy for heating is highly inelastic.

2. Deregulation and consumer prices in energy industries

There has been a trend toward deregulation, and privatization, of energy markets around the world (see e.g. Pollitt, 2004; Giulietti et al., 2010; Borenstein and Bushnell, 2015). In many countries in which this has occurred, the expectation was that privatization and separation of electricity transmission from generation, distribution and marketing would promote competition, increase efficiency and lower prices to consumers (Aune et al., 2004; Ajayi et al., 2017).

In practice, the effects of regulatory reforms on consumer prices have turned out, on multiple occasions, to differ from expectations. Although New Zealand did experience decreases in production costs (Filippini and Wetzel, 2014) with a commensurate improvement in the quality of services and reduction in the frequency and duration of outages (Nepal et al., 2016), consumer prices actually *rose* rather than fell (Nillesen and Pollitt, 2011). In Turkey, residential electricity tariffs increased by more than 50% in 2008 following deregulation (Zhang, 2015). In a study for the US state of California, Razeghi et al. (2017) find no evidence of reduced consumer prices as a result of energy deregulation. More generally, Borenstein and Bushnell (2015) conclude that following the 1990s wave of reform in the US, consumer prices rose in states that had deregulated (and also in states that remained regulated), and that price increases in deregulated states tended to be *larger* than in regulated states during the initial years of the reform period. Similarly, Brau et al. (2010) find limited evidence of benefits for consumers from reforms in the natural gas industry across 15 European Union countries.

Before the mid-1990s, in Australia, energy was provided by government owned monopolies, which were vertically integrated (providing four components: generation, transmission, distribution and retail services). Jurisdictional barriers to entry at the state level prevented entrants to each of the sub-national markets (Australian Energy Market Commission, 2016). In 1995, Australia introduced sweeping microeconomic reforms in the guise of the National Competition Policy (NCP), following recommendations from an independent committee of inquiry (the Hilmer Report), which reported in 1993 (Hilmer et al., 1993). One of the key recommendations of the Hilmer Report was to restructure public monopolies, including energy utilities, in order to facilitate competition (Hilmer et al., 1993).

Competition was introduced to components of energy provision that were "contestable", i.e. have no clear justification for monopoly. High infrastructure costs lead to natural monopolies for the network components (transmission and distribution), but under the reforms, generation and retail were unbundled, and competition encouraged (Wood et al., 2017). Retail reforms typically proceeded in two major stages: (1) full retail contestability (FRC) and (2) deregulation of prices. In the first stage, barriers to entry and competition in energy retail markets were removed, although prices remain regulated. The second stage involved removal of price controls. The implementation of the two stages across states and territories is summarized in Table 1.

During 2009–2010, the federal government proposed, but was unable to secure passage of, a carbon pollution reduction scheme (CPRS). The political uncertainty regarding this emission trading scheme has been offered as one reason why energy providers

Table 1
Timing of major reforms in retail energy markets across Australian jurisdictions.
Source: based on Fig. 2.1 of Australian Energy Market Commission (2016).

States	Electricity market		Natural gas market	
	FRC	Price deregulation	FRC	Price deregulation
Australian Capital Territory	2003	–	2002	2002
New South Wales	2002	2014	2002	–
Queensland	2007	–	2007	2007
South Australia	2003	2013	2004	2013
Tasmania	2014	–	2007	2007
Victoria	2002	2009	2002	2009

Note: FRC = Full Retail Contestability.