UNIVERSITY OF ALBERTA
FACULTY OF ARTS
Department of Economics

Working Paper No. 2017-06

The Effect of Default Rates on Retail Competition and Pricing Decisions of Competitive Retailers: The Case of Alberta

David P. Brown
University of Alberta

Andrew Eckert
University of Alberta

August 2017

The Effect of Default Rates on Retail Competition and Pricing Decisions of Competitive Retailers: The Case of Alberta

by

David P. Brown[†] and Andrew Eckert[‡]

Abstract

We investigate the impacts of default regulated products and their design on the development of competitive retail markets and retailers' pricing decisions. We analyze this question in the context of Alberta's competitive retail electricity market, using data on the prices and characteristics of both regulated and unregulated retail products from July 2006 to March 2017. Our analysis consists of a descriptive discussion of the evolution of market structure in the industry, followed by an econometric analysis of the effect of default prices on unregulated retail prices. We find that as the default product moved from being a long-term stable product, to one based on short-term forward market prices, the number of products and competitors increased substantially. This suggests that the change in the default product was successful at facilitating the development of a competitive retail market. However, our econometric analysis of the pricing of unregulated contracts suggests that competitive retailers may continue to exercise market power by adjusting prices upward in response to short-term changes in the regulated rate, even after controlling for changes in the costs of providing retail products.

Keywords: Electricity, Retail Markets, Market Power, Regulation, Default Rates
JEL Codes: D43, L51, L94, Q40

August 2017

† Department of Economics, University of Alberta, Edmonton, Alberta T6G 2H4 Canada (dpbrown@ualberta.ca).

‡ Department of Economics, University of Alberta, Edmonton, Alberta T6G 2H4 Canada (aeckert@ualberta.ca).

1 Introduction

A key feature of electricity market restructuring worldwide has been the introduction of competition at the wholesale level. However, an often more controversial issue has been whether and how to introduce competition in electricity retailing. While many jurisdictions have opted to allow retail competition, others have maintained a regulated retail provider.[1] The role and design of retail choice has received renewed attention, as concerns of market power increase and markets adjust to facilitate increased integration of distributed energy resources (DERs) such as roof-top solar and electric vehicles. For example, after eighteen years of retail choice, New York regulators have made moves to eliminate retail competition over concerns of market power (NYPSC, 2016). Alternatively, California is investigating the role of expanded retail choice to expedite the entry of DERs (CPUC, 2017).

Jurisdictions that introduce retail competition often establish a default regulated electricity product to protect consumers from market power, from which consumers can choose to switch to an unregulated offering. The existence of default regulated products during the transition to a competitive retail market poses difficult regulatory and market design questions. In particular, in choosing the rate structure and specific product offerings of the regulated provider, regulators must balance two conflicting goals: providing for a timely transition to competition, while at the same time protecting consumers from price hikes and volatility associated with market power. While regulated default products were meant to be temporary, the products often are offered long after retail competition has been introduced, raising concerns that it may impede competition (Tschamler, 2006; Blumsack and Perekhodtsev, 2009).

Despite the central role of regulated default products in competitive retail markets, there is limited evidence on the effects of these products on retail competition. Certain studies have assessed the evolution of retail competition through a description of market structure; see for example McFetridge (2012) for the case of Alberta, IPA (2015) for a discussion of the European Union, and AMEC (2015) and Willems and Mulder (2016) for assessments in the Australia and Dutch markets, respectively. Unfortunately, the usefulness of descriptive market structure analyses to understand the effect of a regulated default product on competition is limited. In part, this is because of the standard concerns regarding inferring market power from market structure. As well, a finding that market structure is suggestive of considerable market power is not informative regarding the role of the default product; if concentration is high, can this be attributed to the price or characteristics of the default product?

There exists an econometric literature examining the determination of retail electricity prices.

[1]Retail competition has been introduced in numerous jurisdictions worldwide including Australia, Korea, New Zealand, Alberta Canada, Norway, and fourteen US States (e.g., Texas, New York, Pennsylvania) (Morey and Kirsch, 2016).

Many of these studies infer market power or other distortions from the response of prices to costs[2] and the relative importance of cost and demand factors.[3] Most relevant to the current study are papers examining the interaction between retail electricity prices of different providers in the UK, including Giulietti et al. (2009), Giulietti et al. (2014), and Waddams Price and Zhu (2016).[4]

While important, these studies leave important gaps in our understanding of the evolution of retail competition. First, to our knowledge there have been no econometric studies of the effect of regulated default products on pricing and competition in the unregulated side of the market. As well, a difficulty with studies that examine the time-series relationship between incumbent and entrant prices is that such an association could in fact be picking up cost effects. Finally, retail electricity prices typically exhibit substantial rigidity, remaining constant for months at a time. While price rigidity and stickiness has been recognized and incorporated into studies of retail pricing in other industries, this is not the case for the literature on electricity markets.

The objective of this paper is to consider the relationship between unregulated and default RRO prices in a manner that addresses these concerns. Our analysis is conducted in the context of Alberta, which introduced retail competition in 2001, alongside a regulated default retail product (the Regulated Rate Option, or RRO) that remains available today with the majority of residential consumers enrolled. The design of the RRO changed from one that is based on long-term forward contracts and provided substantial price stability, to one that is more volatile and based on short-term forward market prices (MSA, 2017a). Our focus is on understanding the effects of the RRO and its design on market development and the pricing dynamics of unregulated fixed-priced retail products.

The data used in this paper consists of prices and characteristics of regulated and unregulated retail electricity products in Alberta from July 2006 to March 2017, along with data on the prices of forward contracts. Our analysis takes place in two stages. First, we provide a descriptive discussion of the evolution of retail market structure over our sample period, and how it is related to specific events in the industry including the restructuring of the RRO to being based on short-term forward prices. We follow this with an econometric analysis of the relationship between the RRO and unregulated retail pricing, to examine whether and how the RRO affects competition in the unregulated retail market. Specifically, we wish to determine whether RRO prices affect unregulated retail pricing once costs (in the form of forward wholesale costs) are controlled for. If so, this suggests that the existence

[2] See Johnsen and Olsen (2008) for an analysis of asymmetry response in Nordic countries, Ofgem (2011) for the United Kingdom, Mirza and Bergland (2012) for Norway, Willems and Mulder (2016) for the Netherlands, and Heim (2016) for Germany. With the exception of Willems and Mulder (2016), these studies find some evidence of an asymmetric response.

[3] See Salies and Waddams Price (2004) and Von der Fehr and Hanson (2010), for example.

[4] As well, there exists a small literature using panel data for the U.S. to assess the effect of introducing retail competition on retail electricity prices. Recent examples include Su (2015) and Ros (2017).

of the RRO is affecting the evolution of the retail market, and that there continues to be market power concerns. Our analysis will incorporate the pronounced degree of price stickiness in the industry, by focusing on how RRO pricing affects the timing of unregulated retail product price changes.

Our descriptive measures of retail market structure development show that the number of products and firms increased substantially in the time period after the default product transitioned to being based on short-term forward market prices. However, residential consumers on unregulated products remain concentrated with the three largest firms, and as a result our market structure analysis is inconclusive regarding whether the unregulated market is impacted by the pricing of the RRO, and whether the RRO continues to play an important role. Our econometric analysis of pricing indicates that changes in prices of the default product impact competitive retailers' price change decisions, even after controlling for changes in the cost of retailing. However, for at least one of the competitive retailers, this relation appears to be between unregulated prices and RRO price volatility as opposed to RRO price levels. This result is robust to the consideration of numerous other drivers such as increased risk of retailing, entry of large competitors, and more flexible responses to cost shocks.

Increased short-term volatility in the RRO increases consumers' demand to switch to a more stable competitive fixed-price product. A subsequent increase in the price of unregulated products could reflect a profit-maximizing response to this increased demand by firms possessing market power. These results demonstrate that regulators may face a trade-off in the design of the default rate. A transition to a shorter-term, more volatile, default rate can facilitate entry of competitive retailers as they provide risk-hedging services to risk-averse consumers. However, if competitive retailers are able to exercise a high degree of market power on consumers who switch to products with more-stable prices, prices may increase and the benefits to consumers is reduced.

Finally, our paper makes a useful contribution to the literature on price rigidity and stickiness. Although retail electricity prices in many jurisdictions exhibit a high degree of price rigidity, to our knowledge our paper is the first to incorporate this explicitly into the econometric approach, by examining the conditions under which an electricity retailer adjusts its energy rate, and how this decision is affected by the RRO.

The rest of the paper will proceed as follows. Section 2 provides a basic overview of retail markets and default products. Section 3 provides a detailed review of retailing in Alberta, with a focus on changes to the RRO and the development of retail competition. The basic theoretical framework for our analysis is given in Section 4, while Section 5 presents our empirical methodology. The data are described in Section 6, and results are given in Section 7. Section 8 concludes.

2 Retail Markets and Default Rates

Electricity provision in restructured markets proceeds through distinct vertical sectors. Electricity is generated and sold through a wholesale market (a power pool). The electricity passes through transmission and distribution to final consumers. Electricity retailers are the final step of the distribution chain. Retailers do not take physical distribution of the product, and need not be involved with generation, transmission, or distribution. Rather, retailers act as the interface between these stages of the distribution chain and the final consumer. Retailers provide customer care and billing services, and offer consumers different contracts regarding how they pay for the electricity they consume.

While electricity is a homogeneous product, a competitive retail electricity market can be viewed as offering differentiated products, based on the terms of the contracts offered to consumers (Hortascu et al., 2017). In many markets, consumers can choose between contracts whose prices are floating (varying with the spot market price) or fixed over different time horizons (e.g., one to five years in Alberta). Retailers offering fixed rate contracts in effect offer different packages of insurance against wholesale electricity price variation, and include a risk premium in their rates for the price and volumetric risk they face for offering fixed-price long-term contracts (Eakins and Faruqui, 2000).[5]

Restructured markets that have transitioned to a deregulated retail market have frequently done so through the provision of a temporary regulated default product (Kwoka, 2008; Blumsack and Perekhodtsev, 2009). Different approaches to designing and pricing the default product, in order to encourage switching to competitive products, have been taken.[6] In Texas, after the initial phases of retail competition, regulators set default prices at high levels to entice unregulated suppliers to compete over consumers. These "price-to-beat" rates eventually expired and the market operates with no regulated default rates (although there are mandated providers of last resort) (PUCT, 2015; Hortascu et al., 2017). Other jurisdictions have adopted a model of wholesale price pass-through to set default rates (Tschamler, 2006). This policy is intended to encourage risk-averse consumers to switch to unregulated retailers offering fixed-priced products. The benefits of imposing wholesale price pass-through as the default rate has been questioned in the literature (Littlechild, 2003).

Numerous jurisdictions utilize a model where the default energy rate is set via a competitive auction or via direct bilateral agreements where the default service provider competitively procures supply from generators or from a forward market. Subsequently, the default rate is set with different degrees of stability (e.g., monthly, six month fixed-price, annual fixed-price, multi-year fixed prices).

[5] As well, retailers offer "green" products and dual fuel electricity/natural gas combined products, under which the retailing services for both products are provided by a single firm through a single bill.

[6] See Tschamler (2006) and Blumsack and Perekhodtsev (2009) for detailed summaries of the different regulated (default service) pricing methods utilized and their experience in numerous jurisdictions.

This type of procurement arises in New Jersey (Loxley and Salant, 2004), Rhode Island (RIPUC, 2011), Alberta (MSA, 2014), and Massachusetts (EEA, 2017), for example. These models have been supported because of their ability to reflect expected future wholesale power costs, provide stable price offerings to consumers, and act as a price-ceiling for unregulated retailers. However, offering stable default contracts that internalize the price and volumetric risks of retailing would likely reduce unregulated retailers' abilities to compete for consumers (Tschamler, 2006).

Default rates continue to play a central role in competitive retail markets. In numerous jurisdictions, consumers have to actively opt-out of the default rate. A large number of consumers have chosen to remain on the default contracts, even in settings where the competitive contracts can come at a substantial discount (Competition and Markets Authority, 2016).

3 Electricity Retailing in Alberta

In this section, we first provide a brief overview of the RRO, and its pricing methodology. We then consider the structure of the retail electricity market and how it has adjusted since restructuring, as a first step towards evaluating the impact of the RRO on unregulated retail prices and competition.

3.1 Overview of the RRO

Electricity market restructuring in Alberta began in the late 1990s, with wholesale and retail market competition being in place by 2001.[7] Retail competition was introduced in Alberta alongside the Regulated Rate Option (RRO), which was intended as a temporary measure to aid in transitioning the market towards full retail competition (Alberta Department of Energy, 2010). The RRO remains available to residential, farm, and commercial and industrial consumers with annual consumption less than 250 MWh. There are no exit fees for canceling RRO service.[8] The RRO is provided by different retail providers according to distribution region. Three providers (ENMAX, EPCOR, and Direct Energy) in four distribution regions account for approximately 96% of all RRO customers in Alberta (MSA, 2015). RRO prices are determined monthly, and are announced in advance of the month; RRO consumers face a constant price per KWh for all hours in a month, as well as a monthly fixed charge.[9]

The methodologies for determining RRO prices are approved by the Alberta Utilities Commission, and have changed over time. Initially, the pricing plans (the Energy Price Setting Plans, or EPSPs) of the major RRO providers were based on long-term hedging contracts, so that consumers faced retail prices that exhibited limited volatility. However, beginning in 2006, RRO providers were required to

[7]See Olmstead and Ayres (2014) for further discussion on market restructuring in Alberta.
[8]Some competitive retailers impose exit fees if consumers end their contracts before the end of the contract term.
[9]See MSA (2014, 2015, 2017a) for a detailed description of how the RRO rates are determined.

transition towards procuring their forecasted demand through monthly forward contracts purchased shortly before each month and setting the RRO energy prices based on the associated costs.[10,11] By July 2010, the RRO price for a month was determined entirely by the forward price for that month during the preceding 45 days, plus risk and other margins (MSA, 2017a). As noted by the MSA (2011, p 29), "the new EPSPs are based strictly upon the monthly forward hedge, the idea being that the consumer that prefers more price stability should consider signing with a competitive retailer." The 45 day pricing period was extended to 120 days in 2013 in order to reduce RRO price volatility.

3.2 Qualitative Market Structure Assessment

Before proceeding to our econometric analysis of pricing, we describe the structure of the retail market, how it has evolved over time and how these changes correspond to the changes in the RRO outlined above. This discussion provides preliminary evidence on whether and how the competitive market is impacted by the RRO, and on the extent of competition that has emerged in the unregulated market. In this discussion, we utilize data on competitive retail prices and product offerings from Alberta's Utilities Consumer Advocate (UCA) for the period January 2006 to March 2017.[12] In addition, we obtained data on the number of consumers on the RRO and market shares for the major firms' competitive products from Alberta's MSA from January 2012 to December 2016. Throughout, we focus on pricing and products for residential consumers.

We consider the extent of switching by consumers from default products to competitive offerings as a first indicator of the success of retail market restructuring. While the majority of residential consumers remain on the default RRO, the percentage of residential sites on competitive contracts has grown. According to data from the MSA, by January 2012, 32% of residential sites in Alberta had switched away from the RRO; this percentage had increased to 47% by December 2016.[13]

While almost half of residential sites have switched to unregulated contracts, a remaining question concerns concentration, and the extent to which these customers are being served by a small number of unregulated firms.[14] Figure 1 presents the number of competitive retail firms and its evolution over

[10] Firms can sign forward contracts in advance of the wholesale spot market. These contracts can take the form of financial or physical agreements to supply an amount of electricity at a specified price. In Alberta, standardized forward products are traded over the Natural Gas Exchange (MSA, 2010). See Appendix A for additional details on forward contracting.

[11] Because ENMAX is vertically integrated with generation, its EPSPs have allowed it to self-supply its RRO requirements, with pricing based on appropriate forward price indices.

[12] Historical data on marginal prices can be found at: https://ucahelps.alberta.ca/rates.aspx.

[13] In numerous jurisdictions with retail competition, the majority of consumers remain on default retail rates. For example, 66% of consumers remain on default "standard variable tariffs" in the UK retail market (Ofgem, 2016) and 64% remain on the default rate in Pennsylvania (Fitzpatrick, 2016).

[14] Data for a detailed assessment of entry conditions were unavailable. A qualitative assessment of entry barriers can be found for example in McFetridge (2012, p. 35), who concludes that while entry barriers are low, "it is reasonable to assume that there would be significant new retail entry in the event that the RRO is eliminated."

time. It appears that the number of competitive firms has grown dramatically, particularly since the transition of the RRO to prices based on short-term hedging was completed mid-2010. Two particular entry events are of note during our sample period. In June 2014, EPCOR, which provides distribution services and offers the RRO for its distribution region, entered the unregulated market through the launch of ENCOR by EPCOR. ATCO, which owns generation and competes in the wholesale electricity market, entered the deregulated retail market in February 2016.

Figure 1: Number of Retailers Offering Products, July 2006 - March 2017

The increase in the number of firms observed in Figure 1 does not appear to coincide with a large reduction in market concentration. Table 1 presents quarterly snapshots of the percentage of residential sites on the RRO, and on unregulated contracts with the three largest competitive providers and a fringe of over 30 small competitive retailers. The final column computes the percentage of households not on the RRO that are with the three biggest firms (CR3). As illustrated in Table 1, the three major firms (ENMAX, Direct Energy, and Just Energy) serve 97% to 99% percent of households on competitive retail contracts from 2012 to 2015, with ENMAX alone providing retail services to 54% to 58% of these households.

Table 1: Alberta Retail Market Shares, by Residential Site Counts, 2012-2015

Date	RRO	ENMAX	Direct Energy	Just Energy	Fringe	CR3
Jan-2012	68.36%	17.49%	9.14%	4.76%	0.25%	99.21%
Jan-2013	61.77%	21.19%	11.15%	5.61%	0.28%	99.26%
Jan-2014	58.34%	22.98%	11.45%	6.78%	0.45%	98.93%
Jan-2015	56.41%	23.50%	11.17%	7.79%	1.13%	97.40%

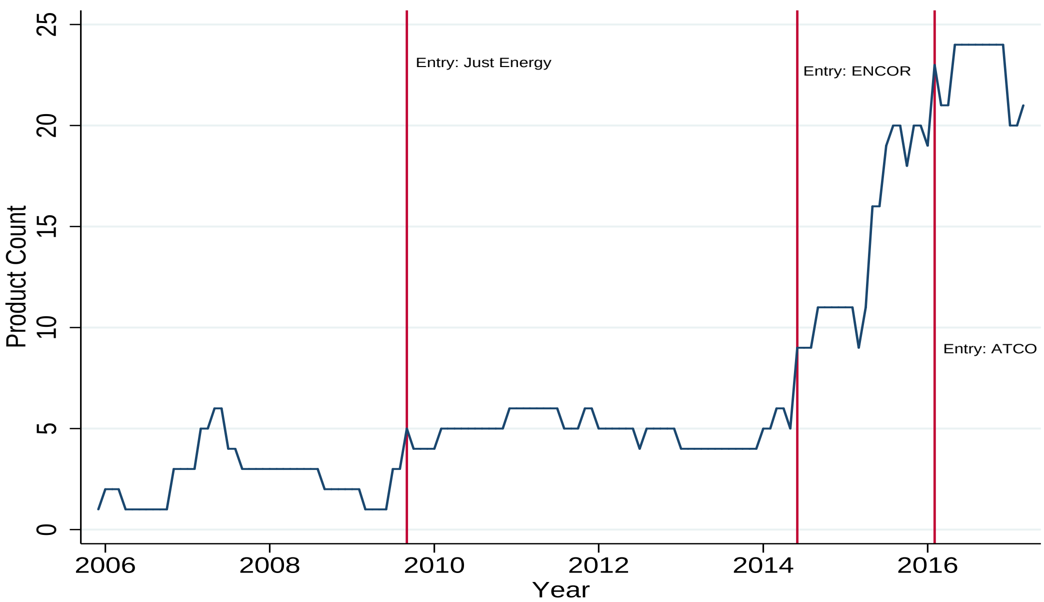
Notes: CR3 denotes the concentration ratio of the three largest unregulated firms. Source: Alberta MSA.

Another consideration in evaluating the evolution of the market is the increase in product offerings.

While a variety of contracts are available in Alberta, the most common unregulated retail products are long-term fixed price contracts. MSA (2015) reports that as of November 2015, 64% of residential sites not on the RRO were on dual fuel contracts with fixed electricity rates; an unspecified percentage of households were on fixed-price electricity-only contracts. Contract lengths range from one year to five years. Variable price contracts that pass through the pool price are available, but have low uptake.

To consider the evolution of product proliferation, Figure 2 presents the number of fixed rate products offered by the large firms in Alberta's energy industry: ENMAX, Direct Energy, Just Energy, ATCO, and ENCOR.[15] Figure 2 demonstrates that while the number of available products has increased, this increase does not seem to correspond to the change in RRO pricing in mid-2010, but rather is associated with the entry of new major firms.

Figure 2: Number of Fixed-Price Products of Major firms, July 2006 - March 2017

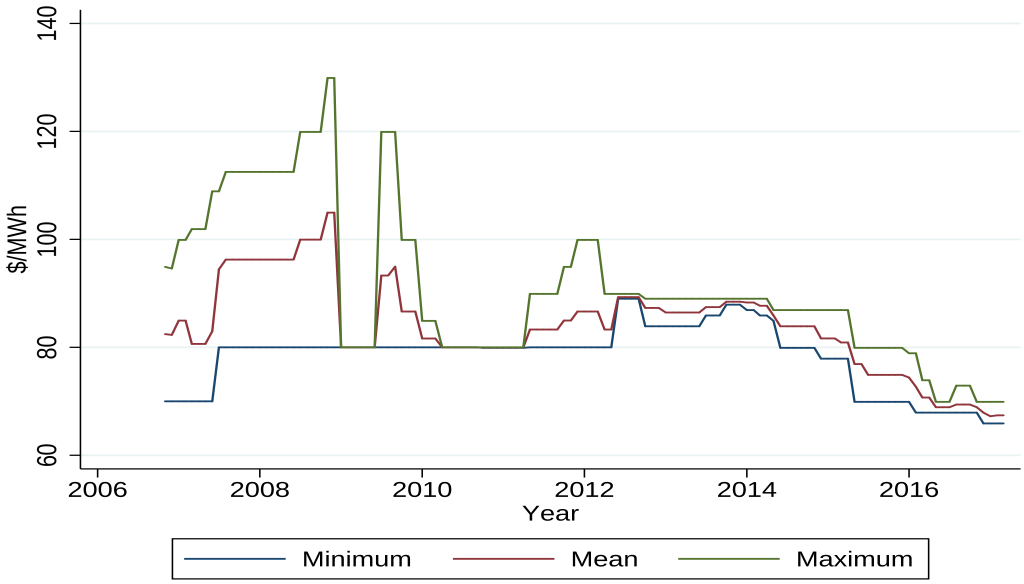


Finally, it has been suggested that increased competition in retail electricity markets would be accompanied by reduced price dispersion.[16] In general, while there is some evidence of a reduction in price dispersion since the beginning of the sample, price dispersion has persisted. This is illustrated in Figure 3, which shows the minimum, mean, and maximum prices of five year fixed-price contracts, from July 2006 to March 2017.[17] Figure 3 illustrates that there was a large degree of price dispersion prior to 2010; notably, over this period there were only two firms offering five year fixed-price contracts (Just Energy and ENMAX).[18] Since the end of the RRO procurement transition period in 2010, dispersion

[15]Fringe firms are excluded because of their small market share and limited presence in Alberta's electricity market.
[16]See for example Giulietti et al. (2010, 2014).
[17]We focus here on the five year fixed-price product because it is the most commonly offered fixed-price product during our sample period. Similar qualitative conclusions hold for other fixed-price products.
[18]Periodically during our sample period, there was only a single firm offering the five year fixed-price product. Therefore, as can be seen in Figure 3, the minimum, maximum, and mean five-year product price are identical in this setting.

has been lower and generally decreasing. This is consistent with an increase in competition since 2010.

Figure 3: Minimum, Maximum, and Mean Prices for Five Year Fixed-Price Products



To summarize, the evolution of Alberta's retail electricity market is characterized by: (i) a gradual switching of consumers from the RRO; (ii) a large increase of new unregulated firms starting in 2011; (iii) continued high concentration, with almost all consumers who have switched from the RRO being with one of the three largest firms; (iv) an increase in consumer choice; and (v) some evidence that price dispersion has been reduced but not eliminated, particularly beginning in 2010. Together, these results suggest that the change to the structure of the RRO have affected the evolution of the market, particularly regarding the number of firms and price dispersion. However, market concentration remains high, and increases in product differentiation appear related to the entry of particular firms.

While these observations are important, these results are descriptive in nature, and do not address the pricing of unregulated products. In the remainder of the paper, we develop an econometric methodology to examine retail pricing and how it is affected by the RRO. In particular, due to a large degree of price rigidity observed in the data, we investigate if changes in the default RRO price impacts the timing and direction of price changes of the major retailers' unregulated products.

4 Theoretical Framework

Before proceeding to our econometric model it is useful to first discuss the basic theoretical framework behind our analysis. While electricity is a homogeneous product, retailers often attempt to differentiate their retail product via differences in service quality, green labeling, marketing, and the degree of price stability (Morey and Kirsch, 2016; Willems and Mulder, 2016; Hortascu et al., 2017). Therefore, the simplest setting through which to understand the relationship between RRO prices and prices of deregulated products is a static differentiated products Bertrand model.

In such a setting, unregulated retail products such as fixed-rate contracts are considered to be imperfect substitutes to the RRO. As a result, holding costs constant, the equilibrium prices of the unregulated retailers are increasing in expected RRO prices (which are exogenously set by regulation), since higher expected RRO prices stimulate demand for the unregulated products. The degree of association between the equilibrium unregulated prices and the RRO price depends on how closely they are viewed as substitutes. Further, changes to the stability of the RRO could be expected to reduce the attractiveness of the RRO to risk-averse consumers and increase the level of demand for the unregulated products.

Note that the demand for unregulated products depends on consumers' expectations of RRO prices. Understanding how consumer expectations are formed can be critical for understanding the association between RRO and unregulated prices. For example, if consumers view a positive short-term shock to the RRO as representing a permanent increase, the effect on unregulated prices will be increased.[19]

The relationship between RRO prices and unregulated prices is further complicated by the recognized existence of search or switching costs. See for example Hortacsu et al. (2017) for empirical evidence for Texas and Guilietti et al (2014) for the United Kingdom. While there have been attempts to incorporate these considerations into theoretical models of electricity retailing (Green, 2000; Sturluson, 2005; Giulietti et al., 2014), to our knowledge clear results regarding the relationship between unregulated rates and those of a regulated default provider have not been derived. However, intuition from the literature on search frictions and switching costs suggests that the effect of an increase in RRO rates on unregulated rates may be ambiguous. For example, an increase in the RRO rate that causes increased search and switching by RRO customers may induce unregulated retailers to lower their prices, in order to compete for and lock in these customers. As a result, the association between RRO rates and unregulated rates is an empirical question.

Finally, it is important to recognize that RRO rates are constructed from the prices of short-term forward contracts. A correlation between unregulated fixed-price retail rates and the RRO rates could reflect changes in the costs of providing unregulated retail products, rather than a response of unregulated rates to the demand effects of changes to the RRO. While the former would be expected in a competitive setting, the latter is suggestive of market power on the part of unregulated firms (assuming constant marginal costs). Therefore, in the empirical analysis that follows we will be careful to control for the costs associated with forward contracting to cover the retail obligations of

[19]MSA (2014) notes that switching rates from the RRO to unregulated products are increasing in one-month lagged RRO prices, suggesting that consumers may switch to competitive products after positive short-term RRO price shocks.

providing a long-term fixed-price unregulated retail product.[20]

5 Empirical Methodology

In this paper we focus on the timing and direction of price changes due to the large degree of price rigidity observed in the major firms' competitive retail products. There is a large literature that examines the timing of price adjustments in oligopolies.[21] Empirical approaches include logit and probit models of the probability of a price change (Cecchetti, 1986), ordered probit models of the direction of price changes (Hausman and Lo, 1992), as well as the Autoregressive Conditional Heteroskedasticity model developed by Hamilton and Jorda (2002).[22]

We utilize an ordered probit model to capture the dynamics of price changes. Let t index the first day of each month. For each firm i in period t, whether a price decrease, increase, or no change is observed from the first day of the previous month depends on a latent variable y^*_{it}:

$$y^*_{it} = \beta_0 + \beta_1 (P_{it-1} - c_{it-1}) + \beta_2 \Delta RRO_t + \beta_3 \Delta c_t + \sum_{j=1}^{4} \delta_j Quarter_{jt} + \gamma \tau_t + \epsilon_{it} \tag{1}$$

where $(P_{it-1} - c_{it-1})$ reflects firm i's retail price margin in period $t-1$; ΔRRO_t represents the change in the RRO price; Δc_t represents the change in the underlying costs of providing the retail product; $Quarter_{jt}$ reflects quarter dummies; and τ_t reflects a time trend. The error term ϵ_{it} is assumed to be distributed as standard normal. y^*_{it} captures in a reduced-form the extent to which the current price exceeds or is less than the firm's ideal price.[23] Higher values of y^*_{it} correspond to greater increased profits from a price increase, while lower values indicate greater incentive for decreases.

The latent variable y^*_{it} is not observed. Instead, we observe the variable y_{it}, where:

$$y_{it} = \begin{cases} -1 & \text{if} \quad y^*_{it} \leq \alpha_1 \\ 0 & \text{if} \quad \alpha_1 < y^*_{it} \leq \alpha_2 \\ 1 & \text{if} \quad \alpha_2 < y^*_{it}. \end{cases} \tag{2}$$

That is, y_{it} is the ordered dependent variable that takes on the value 0 if there is no price change, 1 if there is a price increase, and -1 if there is a price decrease by firm i from $t-1$ to t. Given the assumption of normality of the error term in the latent variable equation, our model becomes an

[20]See Appendix A for a detailed discussion of the costs of providing a long-term fixed-price retail product.

[21]See Douglas and Herrera (2010) for an overview of this literature. The literature has considered pricing in a range of industries, including magazines (Cecchetti, 1986), automobile insurance (Dahlby, 1992), gasoline (Davis and Hamilton, 2004; Douglas and Herrera, 2010, 2014) and saltine crackers (Slade 1995, 1999).

[22]See also the related Autoregressive Conditional Binomial model of Douglas and Herrera (2010, 2014).

[23]Approaches in the literature on price stickiness have included both reduced-form (e.g., Dahbly, 1992), as well as latent variable equations derived from a structural model (Slade, 1995, 1999). Unfortunately, data on product-level quantities or site counts, which would be required for structural analysis, are unavailable.

ordered probit model, estimated using maximum likelihood estimation.

We expect that the higher the retail margin at the start of the month, the more likely prices are to be reduced during the month; that is, higher values of $(P_{it-1} - c_{it-1})$ lead to higher probabilities of price decreases between $t-1$ and t. An increase in the cost of providing the retail product is expected to increase the likelihood of a price increase. Following the discussion in Section 4, the expected impact of changes in the RRO on firms' incentives to increase or decrease its price is ambiguous.

Several alternative specifications are considered as robustness checks. We allow firms to have asymmetric responses to increases and decreases in the RRO price (ΔRRO_t^+ and ΔRRO_t^-) and the underlying cost of its retail products (Δc_t^+ and Δc_t^-). We allow for longer lags on the changes in the underlying costs and the retail margin and control for various measures of recent RRO and wholesale market price volatility. Lastly, we investigate whether firms' pricing change decisions are impacted by the entry of additional large firms near the end of our sample period. In each model specification, we test for the presence of serial correlation and heteroskedasticity.[24]

6 Data

In addition to the data employed in Section 3 above, we require data on residential RRO prices and on forward costs.[25] We obtained data on monthly RRO prices from the Alberta Utilities Commission.[26] Monthly RRO price data were available from July 2006 to March 2017 for each of the four largest RRO regions.[27] Detailed proprietary data on daily forward price settlements were obtained from Alberta's Natural Gas Exchange for the period January 2006 to March 2017.

For our econometric analysis, we focus on the period January 2010 to March 2017 and on the monthly marginal price change decisions of the three major firms: Just Energy, Direct, and ENMAX.[28] Prior to January 2010 there was limited retail competition. As shown in Table 1, during our sample period these three firms are the dominant suppliers of competitive retail products.

We focus our analysis on the marginal price changes of the major firms for their fixed-price competitive retail products. In addition to marginal (per kWh) prices, retailers charge monthly fixed charges. We are unable to analyze monthly fixed charges because of incomplete data availability. However, the monthly fixed charges available in the data exhibit very little variation over time.[29] Competitive

[24] The Autoregressive Conditional Hazard (ACH) models the duration of time between discrete events, with the explicit objective of accounting for serial correlation in price changes (Hamilton and Jorda, 2000). As we discuss in more detail below, we find no evidence of serial correlation.

[25] Due to the short time horizon and the focus on price changes, we employ nominal retail price and cost data. However, real measures of margins and RRO price changes were used in robustness checks, with no noticeable changes to results.

[26] http://www.auc.ab.ca/utility-sector/rates-and-tariffs/Pages/Electricity.aspx.

[27] From January 2012 to December 2016, these four regions contain 96% of residential households (MSA, 2017b).

[28] Our analysis for Direct Energy begins in March 2010. Direct Energy offered no competitive products in January or February 2010.

[29] For example, ENMAX's fixed charge has remained constant at $7.10 per month for our entire sample period.

retailers also offer wholesale price pass-through products. However, few residential consumers choose these competitive products (MSA, 2014, 2015). When the major firms offer multiple products, they systematically change the prices of all of their competitive fixed-price products simultaneously in the same direction. Therefore, we consider a single time-series for each firm.

Competitive retailers often hedge the risks of their retail obligations by purchasing fixed-price contracts from the forward market.[30] A fixed-price forward contract is a commitment by the supplier of the contract to deliver a specified amount of electricity at a fixed-price in a defined future time period (MSA, 2010). We utilize a detailed data set on forward market settlement prices in Alberta's Natural Gas Exchange (NGX) to construct a measure of the cost of a fixed-price product of a given duration. The cost of providing a fixed-price retail product for T months reflects the forward prices signed in advance to meet the retail load obligation over the T months, weighted by forecasted residential load.[31]

The major firms offer one or more fixed-price competitive products. This complicates the construction of the retail margin variable $P_{it-1} - c_{it-1}$. For Just Energy and ENMAX, we focus our analysis on their five-year fixed-price products which are available throughout our sample.[32] We focus on Direct Energy's three year fixed-price product which was offered for the majority of the sample period.[33]

The RRO rates can vary across the four major regions in Alberta. This is driven primarily by differences in the regulated procurement process for the RRO rates in each region (MSA, 2017a). However, there are limited differences in the RRO rates across regions. For example, during our sample period, the correlation in the RRO rates range from 0.977 to 0.992. We construct an RRO index that reflects the RRO prices of each region, weighted by the number of residential households. Our qualitative conclusions are robust to considering RRO rates for each individual region.

Table 2 presents summary statistics for the key variables of interest. ENMAX, Just, and Direct Price Change reflect the discrete ordered dependent variable defined in (2). The average retail price markup ranges from approximately \$28 to \$32, with a large degree of dispersion. Similarly, while the change in RRO prices are centered around zero, they exhibit a sizable degree of variation. Note that because RRO prices reflect monthly forward costs, they exhibit a higher degree of variation than c_t which captures forward costs of a long-term product.

[30] In Alberta, two retailers (ATCO and ENMAX) are vertically integrated with generation facilities. These firms can self-supply their retail requirements. The focus of our analysis is on Direct and Just Energy. In addition, because there is a sizable amount of trading in the forward market, systematic differences between the cost of self-retailing and forward contracting would be eliminated due to the arbitrage opportunities.

[31] See Eakin and Faruqui (2000) and Appendix A for additional details on the estimation of the cost of retailing.

[32] Just Energy also periodically offered a three and four year fixed-price product. However, the prices for these products were (nearly) identical to the five-year product when available. In 2016, ENMAX introduced one and three year fixed-price products. However, there have been zero price adjustments since the introduction of these products.

[33] Direct offered one and two year fixed-price products periodically thought our sample period. When the one and two year products were offered, they were systematically offered at a price that was \$0.005 and \$0.004 per-kWh lower than the three year product, respectively. If the three year product was not offered in a period, we defined Direct's price to equal the one or two year fixed price product, plus \$0.005 or \$0.004 per-kWh.

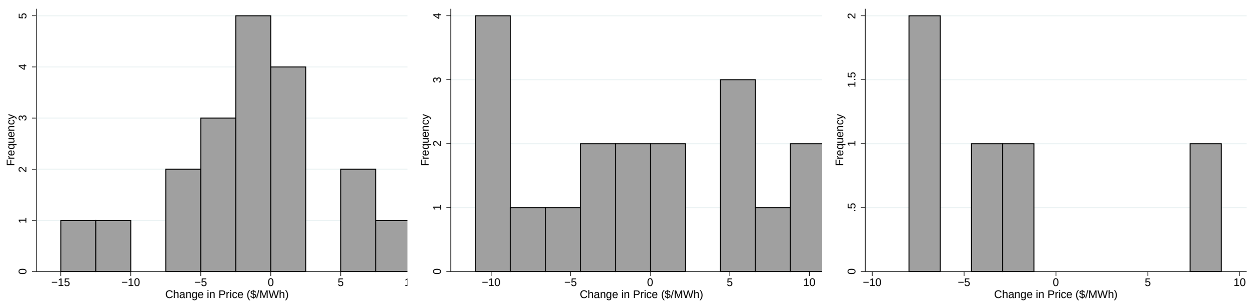
Table 2: Summary Statistics

	Mean	Std Dev	Min	Median	Max
ENMAX Price Change	-0.03	0.24	-1.00	0.00	1.00
Just Price Change	-0.06	0.47	-1.00	0.00	1.00
Direct Price Change	-0.05	0.46	-1.00	0.00	1.00
ENMAX Markup	27.91	8.84	1.30	30.91	40.21
Just Markup	31.59	5.97	14.45	31.60	49.21
Direct Markup	30.56	5.38	15.00	31.85	42.21
Δc_t	-0.20	2.55	-7.14	-0.33	9.10
ΔRRO_t	-0.53	18.03	-57.13	-1.73	46.26

A key feature of retail prices in Alberta (and elsewhere) is a strong degree of price rigidity, with prices changing infrequently. In our sample period, the number of price changes for each firm are 19 for Just Energy, 18 for Direct Energy and only 5 for ENMAX. These represent 22%, 22% and 6% of monthly observations for each firm, respectively. This high degree of price rigidity must be incorporated into our econometric methodology and analysis.

To look at the relative sizes and frequencies of price increases and decreases, Figure 4 presents the distribution and frequency of non-zero price changes for the three major firms. The size of the price changes range between -\$15/MWh to \$10/MWh, with a larger incidence of price reductions. In general we observe more frequent price decreases than increases, corresponding to an overall observed reduction in forward and wholesale prices for electricity during our sample period.

Figure 4: Distribution and Frequency of Price Changes by Firm



(a) Just Energy ($N = 19$) (b) Direct Energy ($N = 18$) (c) ENMAX ($N = 5$)

7 Results

Table 3 presents the symmetric ordered probit model results for each of Direct Energy, Just Energy, and ENMAX.[34] The models for Direct Energy and Just Energy are statistically significant at the 1%

[34]For all specifications, we tested for serial correlation using the generalized residuals (Gourieroux et al. 1987); see the Appendix for details. First-order serial correlation was rejected at standard significance levels in all specifications. To consider the possibility of heteroskedasticity, we estimated heterogeneous choice ordered probit models, modeling the heteroscedastic variance equation as a function of model covariates (Williams, 2010). For two firms we find no evidence of heteroscedasticity, while for the third (Just Energy) we find some evidence of heteroskedasticity depending on the model specification. The results incorporating heteroskedasticity into the ordered probit for Just Energy do not change

level. The estimated model is not statistically significant for ENMAX, likely due to the small number of ENMAX price changes observed in the data (as shown in Figure 4).

For all three firms, the coefficient on the lagged retail price margin is statistically significant and negative. As expected, a reduction in the retail price margin is associated with a higher probability of a price increase. The coefficient on the change in forward costs variable Δc_t is statistically significant for Just Energy with the expected sign, but is not significant for the other two firms. In contrast, ΔRRO_t is significant at 5% for Direct Energy only, suggesting that Direct Energy is more likely to increase its price following an increase in the RRO price, after controlling for changes in forward costs.

Table 3: Symmetric Model Estimates

	Just Energy	Direct Energy	ENMAX
$P_{it-1} - c_{it-1}$	-0.0954***	-0.0922***	-0.1119*
	(0.0335)	(0.0342)	(0.0656)
ΔRRO_t	0.0021	0.0196**	-0.002
	(0.0086)	(0.0088)	(0.0140)
Δc_t	0.1429**	0.02637	-0.0254
	(0.0716)	(0.0672)	(0.1238)
Trend	0.0076	-0.00918	-0.0216
	(0.0067)	(0.0062)	(0.0176)
Quarter Controls	Y	Y	Y
Sample Size	87	83	87
Log-Likelihood	-45.117	-45.485	-16.8028
μ_1	-3.815	-5.33	-7.1858
	(1.0736)	(1.39)	(3.3118)
μ_2	-0.5735	-2.251	-0.8568
	(0.9674)	(1.22)	(1.6499)
χ^2	26.1	19.89	9.67
Prob > χ^2	0.0005	0.0058	0.208
Pseudo-R^2	0.2244	0.1794	0.2235

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

The results in Table 3 indicate statistical significance, but are not informative regarding the marginal effects. Average marginal effects of the key variables of interest are shown in Table 4, which provides the derivatives of the probabilities of a price decrease, no change, or a price increase for both Direct and Just Energy.[35] In addition, we provide several examples to interpret the marginal effects of the key covariates of interest. A one standard deviation decrease in the retail price margin

conclusions regarding statistical significance or magnitudes of effects and are therefore not reported.

[35] Average marginal effects calculate marginal effects at every observation and average these resulting effects. We also computed marginal effects evaluated at representative values of the various covariates. The qualitative conclusions are robust to these alternative marginal effect computations.

(in \$/MWh) from its average value increases the probability of a price increase by 10.6% for Just Energy and 7.2% for Direct Energy, holding all other covariates at their mean values. Similarly, such a decrease in the margin would decrease the probability of a price reduction by 3.1% for Just Energy and 5.4% for Direct Energy. Focusing on the significant marginal effects for Direct Energy, a one standard deviation increase in the change of the RRO price from its average value increases the probability of a price increase by 6.9% and decreases the probability of a price reduction by 2.5%, holding all other covariates at their mean values.

Table 4: Symmetric Model Average Marginal Effects - Direct Energy and Just Energy

	Just Energy			Direct Energy		
	$P(Dec)$	$P(No\ Change)$	$P(Inc)$	$P(Dec)$	$P(No\ Change)$	$P(Inc)$
$P_{it-1} - c_{it-1}$	0.0162***	-0.0058	-0.0104**	0.0171***	-0.0064	-0.0106**
	(0.0055)	(0.0041)	(0.00428)	(0.0065)	(0.0048)	(0.0043)
ΔRRO_t	-0.00035	0.00013	0.00022	-0.0036**	0.0014	0.0023**
	(0.0014)	(0.0005)	(0.0009)	(0.0017)	(0.0011)	(0.0011)
Δc_t	-0.0243**	0.0087	0.01559**	-0.0049	0.0018	0.003
	(0.0125)	(0.0076)	(0.0079)	(0.0125)	(0.00491)	(0.0077)

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

The empirical literature has often found that retail prices respond asymmetrically to cost increases and decreases. Table 5 presents results for the model in which we allow for asymmetric responses to changes in the RRO price and the costs of retailing. In particular, we include ΔRRO_t^+ and ΔRRO_t^-, which equal the first difference of the RRO price when this difference is positive and negative (and zero otherwise), respectively. Similarly, we include Δc_t^+ and Δc_t^- which equals the first difference of the retailing cost measure when this difference is positive and negative (and zero otherwise), respectively.

For all three firms, the lagged retail price margin remains statistically significant and negative. Unlike the symmetric model, for Direct Energy neither RRO term is statistically significant and only increases in the costs of retail is marginally significant, providing some evidence of an asymmetric response to cost shocks. For Just Energy, the story with asymmetry appears to be more nuanced. While the coefficient on ΔRRO_t^+ is statistically significant with the expected sign, the coefficient on RRO price decreases is marginally significant (at 10%) and negative. This suggests that whether Just Energy increases price is positively related to the RRO price volatility. For Just Energy, only decreases in the costs of retailing is marginally significant (and with the expected sign). Finally, for ENMAX we again find no significant effects of the RRO price or changes in forward costs on the probability of price changes. However, the lagged retail margin remains negative and statistically significant.

Table 6 provides the average marginal effects for Direct and Just Energy in the asymmetric model

Table 5: Asymmetric Model Estimates

	Just Energy	Direct Energy	ENMAX
$P_{it-1} - c_{it-1}$	-0.0834**	-0.0971***	-0.1405*
	(0.0355)	(0.0366)	(0.0751)
ΔRRO_t^+	0.0445**	0.0252	-0.0582
	(0.0207)	(0.0191)	(0.0420)
ΔRRO_t^-	-0.0318*	0.0186	0.0355
	(0.0168)	(0.0146)	(0.0324)
Δc_t^+	-0.0068	0.2242*	-0.0802
	(0.1242)	(0.1239)	(0.3170)
Δc_t^-	0.2271*	-0.2091	0.0812
	-0.1196	(0.13)	-0.1952
Trend	0.01232	-0.0081	-0.0339
	(0.0072)	(0.0068)	(0.0228)
Quarter Controls	Y	Y	Y
Sample Size	87	83	87
Log-Likelihood	-41.9707	-42.8714	-15.3331
μ_1	-2.9377	-5.008	-9.8673
	(1.2411)	(1.466)	(4.5109)
μ_2	0.5553	-1.764	-2.8461
	(1.2197)	(1.2886)	(2.4862)
χ^2	32.39	25.12	12.61
Prob > χ^2	0.0002	0.0028	0.1811
Pseudo-R^2	0.2784	0.2266	0.2914

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

specification. In addition, we provide several examples to interpret the marginal effects of the key covariates of interest. A one standard deviation decrease in the retail price margin (in $/MWh) from its average value increases the probability of a price increase by 5.2% for Just Energy and 10.2% for Direct Energy, holding all other covariates at their mean values. Similarly, such a decrease in the margin would decrease the probability of a price reduction by 3.8% for Just Energy and 4.7% for Direct Energy. Focusing on the statistically significant marginal effects for Just Energy, a one standard deviation increase in the change of the RRO price from its average value increases the probability of a price increase by 7.8% and decreases the probability of a price reduction by 5.6%, holding all other covariates at their mean values. Similarly, a one standard deviation decrease in the change of the RRO price from its average value increases the probability of a price increase by 5.8% and a decreases the probability of a price reduction by 9.1%.

Increased short-term RRO price volatility could increase consumers' demand to switch from the

Table 6: Asymmetric Model Average Marginal Effects - Direct Energy and Just Energy

	Just Energy			Direct Energy		
	$P(Dec)$	$P(No\ Change)$	$P(Inc)$	$P(Dec)$	$P(No\ Change)$	$P(Inc)$
$P_{it-1} - c_{it-1}$	0.0138***	-0.0057	-0.0081**	0.0177***	-0.0082	-0.0096**
	(0.0056)	(0.0037)	(0.0038)	(0.0069)	(0.0052)	(0.0041)
ΔRRO_t^+	-0.0074**	0.0031	0.0043**	-0.0046	0.0021	0.0025
	(0.0036)	(0.0024)	(0.0019)	(0.0036)	(0.002)	(0.002)
ΔRRO_t^-	0.0053*	-0.0021	-0.0031*	-0.0034	0.0015	0.0018
	(0.0029)	(0.0018)	(0.0016)	(0.00265)	(0.00141)	(0.0015)
Δc_t^+	0.00112	-0.00047	-0.00065	-0.0411*	0.0189	0.0222*
	(0.0205)	(0.0085)	(0.0121)	(0.0233)	(0.015)	(0.0122)
Δc_t^-	-0.0376**	0.0156	0.022*	0.0383	-0.0175	-0.0206
	(0.019)	(0.0108)	(0.0129)	(0.0237)	(0.0139)	(0.0137)

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

default product to the stable competitive fixed-price products. The positive relationship between RRO volatility and the likelihood of a price increase for Just Energy may reflect a profit-maximizing response to increased demand.[36] While we do not have product-specific switching data, we do observe net monthly switching from the RRO from January 2012 to December 2016. We find a negative correlation between the percentage change in the number of residential consumers on the RRO and the previous month's RRO price level and the absolute change of the RRO price equal to -0.45 and -0.31, respectively. This provides evidence that consumers are more likely to switch from the RRO to competitive products after a period of volatile RRO prices and high short-term RRO prices.[37]

To summarize, these results illustrate that there is a strong negative relationship between the probability that a firm increases its price and the retail price margin. In addition, there is some evidence that short-term changes in the RRO price impacts firm's price change decisions. In the symmetric model, changes in the RRO price increase the probability of a price increase for Direct Energy. In the asymmetric model specification, changes in the RRO price are associated with an increased probability of a price increase for Just Energy, holding all else constant.

7.1 Robustness Checks

In this section, we consider numerous alternative specifications to investigate the robustness of our results. The results from these specifications are presented in Tables 7 to 9. Throughout these extensions, we focus on the more general asymmetric model specification.

First, we investigate if recent wholesale market price volatility is related to price change decisions

[36] In Section 7.1, we control for recent volatility in the wholesale market and RRO prices directly to ensure that this positive relationship is not being driven by increased risks associated with retailing.

[37] MSA (2014) find that consumers are more likely to switch to competitive products after a month of high RRO prices.

of competitive fixed-price products. An increase in wholesale market volatility can increase the risk of providing a retail product because retailers purchase electricity at the prevailing pool price if they have not secured sufficient forward commitments to serve their retail obligations. We compute a variable that equals the variance of the hourly wholesale price of the previous three months (σ^2_{Pool}). The results are presented in column (1) in Tables 7 to 9. Recent pool price volatility is statistically insignificant and has no impact on the key variables of interest.

Second, although our ΔRRO_t term captures current RRO price volatility, we also control for past RRO price volatility. We compute the variance of the previous three month RRO prices (σ^2_{RRO}). The results are presented in column (2) in Tables 7 to 9. Similar to the pool price variance, the RRO volatility measure is statistically insignificant and has no impact on the key qualitative conclusions.

Third, we investigate whether the response of retail prices to changes in costs and the RRO have changed as a result of the entry of two large firms in Alberta's energy industry. Specifically, we include two dummy variables ATCO Entry and ENCOR Entry which equal one after the entry of ATCO in February 2016 and ENCOR in June 2014, respectively. The results are presented in column (3) in Tables 7 to 9. The coefficients on the entry dummy variables are not statistically significant, and result in only minor changes to other coefficients.

Fourth, our focus has been on the response of fixed-rate products to changes in the RRO price. However, in an oligopolistic setting, it may be expected that the firms also respond to changes in the prices of their unregulated rivals. To control for this, in column (4) of Tables 7 to 9 we introduce the dummy variables $\Delta P^{Rival,Positive}_{t-1}$ and $\Delta P^{Rival,Negative}_{t-1}$ which equal one if at least one of the firm's major rivals (excluding the fringe) increased or decreased price respectively in the previous month. The coefficients on these dummy variables are not significantly different from zero in any specification, suggesting that a firm's price change is not related to the lagged changes of rivals.[38]

Fifth, we allow for longer lags in the retail markup and asymmetric changes in the costs of retailing measures to allow for more flexible price dynamics.[39] These results are presented in column (5) of Tables 7 to 9. These longer lags are systematically statistically insignificant. The addition of the increased lags changes the magnitude and often eliminates the statistical significance of the first-lagged retail mark up variable ($P_{it-1} - c_{it-1}$). However, this is a result of a high correlation between the first and second lagged values on the retail markup variables, creating multicollinearity problems.[40]

[38] A further possibility is that the firms may respond differently to the price changes of different rivals. We considered alternative specifications in which we included the lagged dependent variables of specific rival firms (just considering Just Energy, Direct Energy, and ENMAX). For Direct Energy, we find a coefficient on the lagged dependent variable for Just Energy that is positive and statistically significant at the 10% level. This provides some suggestion that Direct Energy may respond to Just Energy price changes with a lag. The estimates of other coefficients are largely unaffected.

[39] There is a large literature that aims to explain the presence of observed price stickiness. This literature suggests that firms may respond slowly to cost shocks or changes in the retail price markup (Douglas and Herrera, 2010, 2014).

[40] The correlation between the first and second lagged values of the retail markup measures are 0.81, 0.85, and 0.94 for

Table 7: Alternative Model Specifications: Just Energy

	(1)	(2)	(3)	(4)	(5)
$P_{it-1} - c_{it-1}$	-0.0787**	-0.09856**	-0.10206**	-0.10238**	-0.1755**
	(0.03611)	(0.0394)	(0.04385)	(0.0387)	(0.08248)
$P_{it-2} - c_{it-2}$					0.1307
					(0.09335)
ΔRRO_t^+	0.0397*	0.04472**	0.04145**	0.04141**	0.05431***
	(0.021)	(0.02077)	(0.02064)	(0.0208)	(0.022)
ΔRRO_t^-	-0.0277*	-0.03296**	-0.02827*	-0.0363**	-0.03417*
	(0.0169)	(0.016)	(0.01702)	(0.0173)	(0.01875)
Δc_t^+	-0.02588	-0.02137	-0.01723	-0.0026	-0.1668
	(0.12767)	(0.1248)	(0.1297)	(0.1265)	(0.15229)
Δc_t^-	0.2421**	0.20275*	0.21364*	0.2333*	0.060256
	(0.1207)	(0.12233)	(0.1203)	(0.1217)	(0.1417)
Δc_{t-1}^+					0.17214
					(0.1235)
Δc_{t-1}^-					0.26057*
					(0.14075)
σ^2_{Pool}	0.0000179				
	(0.000015)				
σ^2_{RRO}		-0.0009			
		(0.00098)			
ATCO Entry			-0.71688		
			(0.5945)		
ENCOR Entry			0.07625		
			(0.72227)		
$\Delta P_{t-1}^{Rival,Positive}$				-0.5919	
				(0.6096)	
$\Delta P_{t-1}^{Rival,Negative}$				0.45888	
				(0.42267)	
Trend	0.01429*	0.01138	0.01962	0.0101	0.01015
	(0.00739)	(0.007)	(0.01318)	(0.0075)	(0.0079)
Quarter Controls	Y	Y	Y	Y	Y
Observations	87	87	87	87	87
Log-Likelihood	-41.23	-41.53	-41.215	-40.969	-38.147
μ_1	-2.557	-3.562	-3.0748	-3.7106	-1.971
	(1.29)	(1.420)	(1.7154)	(1.3769)	(1.3461)
μ_2	0.9948	-0.0376	0.42859	-0.0991	1.6832
	(1.27)	(1.36)	(1.6991)	(1.3089)	(1.354)
χ^2	33.87	33.27	33.9	34.39	36.0
Prob > χ^2	0.0002	0.0002	0.0004	0.0003	0.0003
Pseudo-R^2	0.2912	0.286	0.2914	0.2957	0.3206

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

Table 8: Alternative Model Specifications: Direct Energy

	(1)	(2)	(3)	(4)	(5)
$P_{it-1} - c_{it-1}$	-0.1028***	-0.0978***	-0.0968***	-0.0967***	-0.0558
	(0.0374)	(0.0368)	(0.0379)	(0.037)	(0.061)
$P_{it-2} - c_{it-2}$					-0.0395
					(0.0587)
ΔRRO_t^+	0.02268	0.026137	0.02323	0.0227	0.0278
	(0.0193)	(0.0195)	(0.019)	(0.0197)	(0.0196)
ΔRRO_t^-	0.02147	0.01807	0.0186	0.0201	0.0168
	(0.0152)	(0.0147)	(0.0148)	(0.0149)	(0.0154)
Δc_t^+	0.19713	0.22607*	0.24424**	0.2539**	0.2402*
	(0.1279)	(0.1247)	(0.127)	(0.132)	(0.1287)
Δc_t^-	-0.21733	-0.21402	-0.227	-0.2306	-0.2152
	(0.1312)	(0.1318)	(0.135)	(0.142)	(0.138)
Δc_{t-1}^+					-0.093
					(0.1109)
Δc_{t-1}^-					0.1457
					(0.1253)
σ^2_{Pool}	0.0000125				
	(0.000014)				
σ^2_{RRO}		-0.00023			
		(0.00092)			
ATCO Entry			0.5811		
			(.5636)		
ENCOR Entry			-0.8535		
			(0.6372)		
$\Delta P_{t-1}^{Rival,Positive}$				0.47	
				(0.6167)	
$\Delta P_{t-1}^{Rival,Negative}$				-0.56	
				(0.412)	
Trend	-0.0065	-0.00869	0.00065	-0.0059	-0.0074
	(0.007)	(0.0072)	(0.01385)	(0.007)	(0.007)
Quarter Controls	Y	Y	Y	Y	Y
Observations	83	83	83	83	83
Log-Likelihood	-42.491	-42.838	-41.306	-41.401	-41.6003
μ_1	-4.979	-5.0875	-4.437	-4.94	-5.034
	(1.467)	(1.5019)	(1.565)	(1.492)	(1.523)
μ_2	-1.7078	-1.833	-1.123	-1.623	-1.78
	(1.2889)	(1.3177)	(1.4269)	(1.3128)	(1.36)
χ^2	25.88	25.18	28.25	28.06	26.67
Prob > χ^2	0.0039	0.005	0.003	0.0032	0.0086
Pseudo-R^2	0.2334	0.2272	0.2548	0.2531	0.2427

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

Table 9: Alternative Model Specifications: ENMAX

	(1)	(2)	(3)	(4)	(5)
$P_{it-1} - c_{it-1}$	-0.1404*	-0.2345**	-0.1792*	-0.1472**	-0.496
	(0.075)	(0.1013)	(0.0994)	(0.075)	(0.7099)
$P_{it-2} - c_{it-2}$					0.3104
					(0.686)
ΔRRO_t^+	-0.058	-0.0889*	-0.0835	-0.0642	-0.0667
	(0.0419)	(0.0502)	(0.0557)	(0.0439)	(0.0446)
ΔRRO_t^-	0.0355	0.0457	0.0401	0.0364	0.041
	(0.0324)	(0.0336)	(0.0345)	(0.0332)	(0.0352)
Δc_t^+	-0.0946	-0.08245	-0.00515	-0.0459	-0.3523
	(0.2991)	(0.41865)	(0.296)	(0.3289)	(0.795)
Δc_t^-	0.0877	0.0362	0.03958	0.02962	-0.20201
	(0.19852)	(0.22696)	(0.2076)	(0.2083)	(0.7376)
Δc_{t-1}^+					-0.3766
					(0.24314)
Δc_{t-1}^-					-0.05001
					(0.2272)
σ^2_{Pool}	0.000016				
	(0.00003)				
σ^2_{RRO}		-0.0058			
		(0.0049)			
ATCO Entry			-0.5398		
			(1.214)		
ENCOR Entry			-1.5853		
			(1.338)		
$\Delta P_{t-1}^{Rival,Positive}$				-0.2515	
				(0.8455)	
$\Delta P_{t-1}^{Rival,Negative}$				-0.4643	
				(0.642)	
Trend	-0.0271	-0.0554*	0.00467	-0.02867	-0.0419*
	(0.02418)	(0.0291)	(0.0391)	(0.02196)	(0.02461)
Quarter Controls	Y	Y	Y	Y	Y
Observations	87	87	87	87	87
Log-Likelihood	-15.215	-13.388	-14.5062	-15.0385	-13.805
μ_1	-8.798	-15.387	-8.282	-9.752	-12.51
	(4.49)	(6.264)	(4.0053)	(4.28)	(5.1223)
μ_2	-2.071	-6.813	-0.4308	-2.667	-4.46
	(2.6807)	(3.7459)	(2.757)	(2.344)	(2.864)
χ^2	12.84	16.5	14.26	13.2	15.54
Prob > χ^2	0.2325	0.0862	0.2188	0.2805	0.213
Pseudo-R^2	0.2968	0.3812	0.3296	0.305	0.3602

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.

7.2 Post-Adjustment Price Levels

The analysis above suggests that the timing and direction of an unregulated retailer's price changes are primarily related to the distance between the retail price and forward costs. While there is evidence that the RRO price influences the timing of unregulated price changes, for at least one firm this effect seems to be capturing recent RRO price volatility. A natural subsequent question is whether, when a firm adjusts its price, the new price is related to the level of the RRO price once forward costs are controlled for.

Table 10 presents the output from simple linear regressions of retail prices on forward costs, current and lagged monthly RRO prices, quarterly effects, and a trend, limiting the sample to months in which the price changed.[41] Due to the small sample and potential sample selection concerns, these results are at best suggestive. As expected, the results in Table 10 suggests a positive and statistically significant association between post-change unregulated prices and the costs of providing a fixed-price product (c_t). A positive association between both the current and lagged RRO price and the post-change unregulated prices is suggested for both firms with marginal statistical significance, even after controlling for the costs of retailing.

Table 10: Retail Price Level Regressions - Restricted to Months with Price Changes

	Just Energy	Direct Energy
c_t	0.307*	0.561**
	(0.167)	(0.234)
RRO_t	0.126*	0.111*
	(0.063)	(0.0578)
RRO_{t-1}	0.075*	0.113
	(0.04)	(0.068)
Trend	-0.021	-0.035
	(0.022)	(0.056)
Constant	55.74***	40.12***
	(3.72)	(8.36)
Quarter Controls	Y	Y
Observations	19	18
R^2	0.95	0.93

***, **, * denotes statistically significant coefficients at the 1, 5, and 10% levels, respectively.
Robust standard errors in parentheses

8 Conclusions and Policy Implications

A critical question in designing retail electricity markets is the effect of default retail products on the competitive retail market. The empirical literature on the relationship between default retail

Direct Energy, Just Energy, and ENMAX, respectively.

[41] We are unable to include lagged values of our forward cost measure due to the high degree of multicollinearity.

electricity prices and the prices of unregulated providers is limited. To begin to fill this gap, this paper examines the responsiveness of fixed-price unregulated retail products in Alberta to price changes in the Regulated Rate Option (RRO). Specifically, we consider whether RRO prices affect the price change decisions of the major unregulated providers. In addition, we provide a qualitative assessment of Alberta's retail market structure and how it has evolved over time.

Using numerous descriptive measures, we find that the number of firms and product offerings increased substantially after 2010. This coincides with a change in the design of the default regulated product from one that is stable and based on long-term contracts to a shorter-term more variable product. However, the market remains highly concentrated with three major retailers providing over 95% of the unregulated products. Consequently, our descriptive analysis of the retail market structure is inconclusive regarding whether the market has evolved sufficiently to warrant the expiry of the default regulated product.

In an analysis of competitive retailers' pricing decisions, we find evidence that changes in the RRO prices are associated with a higher likelihood of price increases, after controlling for the costs of retailing. This result is consistent with evidence that increased switching from the variable RRO to fixed-price competitive products arises after periods of increased RRO price volatility. Further, this result is consistent with a profit-maximizing response by an unregulated retailer to increased demand for its fixed-price products.

These findings suggest that regulators may face an important trade-off when designing the default regulated rate. While increased price stability of the regulated default rate can provide risk-hedging services to consumers and alleviate concerns of market power, it can also limit the development of the competitive retail market because it impedes competitive retailers' abilities to offer risk-hedging services via fixed-price products. However, if competitive retailers are able to exercise market power over consumers who switch from a variable regulated default rate to fixed-price competitive products, prices may increase and the benefits of retail competition can be eroded.

Future research is needed before drawing final conclusions about the relationship between default regulated rates and competitive retail market pricing and performance. First, additional empirical research is needed in jurisdictions with default regulated products with alternative attributes such as the degree of price stability and procurement methodology. Second, due to the price rigidity observed in our data, we are unable to develop a robust model of unregulated retailers' price-level decisions. Subsequent research should investigate the relationship between default product prices and the unregulated retailers' price-level decisions. A third potential direction for future research is examine the reasons behind the high degree of observed price stickiness, and to consider whether price stickiness is indicative of market power.[42] This research will be important in understanding the implications of price stickiness for the performance of retail markets, and potentially policy decisions.

References

Alberta Department of Energy (2010). Retail Market Review: An Update and Review of Market Metrics.

AMEC (2015). 2015 Retail Competition Review. Australian Energy Market Commission.

Blumsack, S. and D. Perekhodtsev (2009). Electricity Retail Competition and Pricing: An International Review. *International Handbook on the Economics of Energy*, Edward Elgar Publishing.

Cecchetti, S. (1986). "The Frequency of Price Adjustment: A Study of the Newsstand Prices of Magazines," *Journal of Econometrics*, 31: 255-274.

Competition and Markets Authority (2016). Energy Market Investigation: Summary of Final Report.

CPUC (2017). Consumer and Retail Choice, the Role of the Utility, and an Evolving Regulatory Framework. Staff White Paper. California Public Utilities Commission.

Davis, M. and J. Hamilton (2004). "Why are Prices Sticky? The Dynamics of Wholesale Gasoline Prices," *Journal of Money, Credit, and Banking*, 36: 19-37.

Dahlby, B. (1992). "Price Adjustment in an Automobile Insurance Market: A Test of the Sheshinski-Weiss model," *Canadian Journal of Economics*, 25: 564-583.

Douglas, C. and A. Herrera (2010). "Why are Gasoline Prices Sticky? A Test of Alternative Models of Price Adjustment," *Journal of Applied Econometrics*, 25: 903-928.

Douglas, C. and A. Herrera (2014). "Dynamic Pricing and Asymmetries in Retail Gasoline Markets: What Can They Tell Us About Price Stickiness?" *Economics Letters*, 122: 247-252.

Eakin, K. and A. Faruqui (2000). "Pricing Retail Electricity: Making Money Selling a Commodity," in *Pricing in Competitive Electricity Markets,* Eakin and Faruqui, (Eds). Kluwer Academic Publishers.

EEA (2017). Electricity Industry Overview. Energy and Environmental Affairs.

Fitzpatrick, T. (2016). "The Future of Retail Electricity Competition in Pennsylvania," *Public Utilities Fortnightly*, 154(3): 10 - 15.

Giulietti, M., L. Grossi and M. Waterson (2010). "Price Transmission in the UK Electricity market: Was NETA beneficial?" *Energy Economics*, 32:1165-1174.

[42] An overview of different theories of price rigidity can be found for example in Douglas and Herrera (2010).

Giulietti, M., J. Otero and M. Waterson (2009). "Pricing Behaviour Under Competition in the UK Electricity Supply Industry." *Oxford Economic Papers*, 62: 478-503.

Giulietti, M., M. Waterson and M. Wildenbeest (2014). "Estimation of Search Frictions in the British Electricity Market", *Journal of Industrial Economics*, 4: 555-590.

Gourieroux, C., A. Monfort and A. Trognon (1985). "A General Approach to Serial Correlation." *Econometric Theory*, 1: 315-340.

Gourieroux, C., A. Monfort, E. Renault and A. Trognon (1987). "Generalised Residuals." *Journal of Econometrics*, 34: 5-32.

Green, R. (2000). "Retail Competition and Electricity Contracts," Cambridge Working Papers in Economics CWPE 0406.

Hamilton, J. and O. Jorda (2002). "A Model of the Federal Funds Rate Target," *Journal of Political Economy*, 110(5): 1135 - 1167.

Hausman, J. and A. Lo (1992). "An Ordered Probit Analysis of Transaction Stock Prices," *Journal of Financial Economics*, 31(3): 319 - 379.

Heim, S. (2016). "Rockets and Feathers: Asymmetric Pricing and Consumer Search - Evidence from Electricity Retailing," ZEW Discussion Paper no. 16-070.

Hortacsu, A., Madanizadeh, S., and S. Puller (2017). "Power to Choose? An Analysis of Consumer Inertia in the Residential Electricity Market," American Economic Journal: Economic Policy, Forthcoming.

IPA (2015). Ranking the Competitiveness of Retail Electricity and Gas Markets: A Proposed Methodology. Report for the Agency for the Cooperation of Energy Regulators.

Johnsen, T. and O. Olsen (2008). The Relationship Between Wholesale and Retail Electricity Prices to Households in the Nordic Countries. Working paper.

Kwoka, J. (2008). "Restructuring the U.S. Electric Power Sector: A Review of Recent Studies," *Review of Industrial Organization*, 32(3): 165 169.

Littlechild, S. (2003). "Wholesale Spot Price Pass-Through," *Journal of Regulatory Economics*, 23:1, 61 91.

Loxley, C. and D. Salant (2004). "Default Service Auctions," *Journal of Regulatory Economics*, 26(2): 201 229.

McFetridge, D. (2012). "Competition in the Alberta Retail Electricity Power Market," Study Prepared for the Utilities Consumer Advocate.

Mirza, M. and O. Bergland (2012). "Pass-through of Wholesale Price to the End User Retail Price in the Norwegian Electricity Market." *Energy Economics*, 34: 2003-2012.

Morey, M. and L. Kirsch (2016). Retail Choice in Electricity: What Have We Learned in 20 Years? Christensen Associated Energy Consulting.

MSA (2010). An Introduction to Alberta's Financial Electricity Market. Alberta Market Surveillance Administrator.

MSA(2011). Quarterly Report: April - June 2011. Alberta Market Surveillance Administrator.

MSA (2014). State of the Market 2014: The Residential Retail Markets for Electricity and Natural Gas. Alberta Market Surveillance Administrator.

MSA (2015). Retail Market Update 2015: Alberta's Electricity and Natural Gas Retail Markets. Alberta Market Surveillance Administrator.

MSA (2017a). Options for Enhancing the Design of the Regulated Rate Option. Alberta Market Surveillance Administrator.

MSA (2017b). Retail Market Statistics. Alberta Market Surveillance Administrator. Available at: http://www.albertamsa.ca/.

NYPSC (2016). In the Matter of Eligibility Criteria for Energy Services Companies. State of New York Public Service Commission. Case 15 - M - 0127.

Ofgem (2011). Do Energy Bills Respond Faster to Rising Costs than Falling Costs. Discussion Paper.

Ofgem (2016). Retail Energy Markets in 2016. Consumers and Competition.

Olmstead, D. and M. Ayres (2014). "Notes from a Small Market: The Energy-only Market in Alberta," *The Electricity Journal*, 27(4): 102 - 111.

PUCT (2015). Scope of Competition in Electricity Markets in Texas. Report to the 84th Texas Legislature. Public Utility Commission of Texas. Available at: https://www.puc.texas.gov/industry/electric/reports/scope/2015/2015scope_elec.pdf

RIPUC (2011). Re: National Grids Proposed 2011 Standard Offer Supply Procurement Plan and 2011 Renewable Energy Supply Procurement. State of Rhode Island and Providence Plantations Public Utilities Commission. Docket No. 4140.

Ros, A. (2017). "An Econometric Assessment of Electricity Demand in the United States Using Utility-specific Panel Data and the Impact of Retail Comeptition on Prices," *The Energy Journal*, 38(4): 73-99.

Salies, E. and C. Waddams Price (2004). "Charges, Costs, and Market Power: The Deregulated UK Electricity Retail Market," *The Energy Journal*, 25(3): 19 - 35.

Slade, M. (1995). "Product Rivalry with Multiple Strategic Weapons: An Analysis of Price and Advertising Competition," *Journal of Economics and Management Strategy*, 4(3): 445 - 476.

Slade, M. (1999). "Sticky Prices in a Dynamic Oligopoly: An Investigation of (s,S) Thresholds," *International Journal of Industrial Organization*, 17: 477-511.

Sturluson, J. (2005). Price Duopoly in a Default Service Market with Search and Switching Costs. Working Paper.

Su, Xuejuan (2015). "Have Customers Benefited from Electricity Retail Competition?" *Journal of Regulatory Economics*, 47(2): 146 - 182.

Tschamler, T. (2006). Competitive Retail Power Markets and Default Service: The U.S. Experience. In Sioshansi, F. and W. Pfaffenberger (Eds.), Electricity Market Reform: An International Perspective (pp. 529 562). Elsevier Science.

Von der Fehr, N. and P. Hansen (2010). "Electricity Retailing in Norway," *The Energy Journal*, 31(1): 25 - 45.

Waddams Price, C. and M. Zhu (2016). "Non-discrimination Clauses: Their EEffect on British Retail Energy Prices," *The Energy Journal*," 37: 111-132.

Willems, B. and M. Mulder (2016). "Competition in Retail Electricity Markets: An Assessment of Ten Years Dutch Experience" TILEC Discussion Paper No. 2016-011.

Williams, R. (2010). "Fitting Heterogeneous Choice Models with OGLM," *The Stata Journal,* 10: 540-567.

Appendix

A Alberta's Forward Market and Estimating Retailing Costs

We utilize data from Alberta's NGX forward market to estimate the cost of providing a retail product. Competitive retailers forward contract to cover their retail obligations in order to hedge against price risks associated with the wholesale spot market. There are many financial forward products traded over the NGX including flat products that provide a fixed quantity of electricity in every hour of the contract period (e.g., a month) and peak and off-peak products that provide a fixed quantity for peak or off-peak hours only (MSA, 2010).

The vast majority of trades in the NGX are for monthly flat products. From January 2006 to March 2017, over 87% of all trades were for flat products and over 81% of all trades are for products with a monthly duration. We use these monthly flat forward prices to estimate the cost of a retail product. For every day in our sample, we observe flat monthly forward settlement prices for time periods ranging from the next month to several years in advance. For each month in our sample, we take the average of these flat monthly forward settlement prices ranging from one month to sixty months in advance. For a retail product that has a fixed-price for T months starting in period t, the per-unit cost of providing this product equals the sum of the average monthly flat forward settlement prices (p_t^f), weighted by forecasted demand ($\widehat{D}_t$): $c_t = \frac{\sum_{t=1}^{T} p_t^f \widehat{D}_t}{\sum_{t=1}^{T} \widehat{D}_t}$. Using this method, we construct one, two, three, and four year retail product cost measures. These costs measures are highly correlated, with a Pearson's Correlation of 0.95 to 0.997. We utilize the three year retail product cost measure for our primary analysis. However, the results are robust to the use of alternative measures of forward contracting to cover retail obligations. For additional details on the costs of retailing, see Eakins and Faruqui (2000).

B Serial Correlation Tests

To test for serial correlation we first construct the generalized residuals from our estimated ordered probit specification.[43] For simplification, let our latent variable equation be given by:

$$y_{it}^* \;=\; x_{it}'\beta + \epsilon_{it}$$

The generalized residual for firm i in month t is the expectation of ϵ_{it} conditional on the observed outcome y_{it}, given by:

$$\tilde{\epsilon}_{it} = E[\epsilon_{it}|y_{it}, x_{it}; \hat{\beta}, \hat{\alpha}_1, \hat{\alpha}_2].$$

[43]See Gourieroux et al. (1985) and Gourieroux et al. (1987) for the construction of generalized residuals and their use in testing serial correlation. See Hausman and Lo (1992) for an application to an ordered probit model.

For our ordered probit specification this can be written as (see Hausman et al. (1992) for more detail):

$$\tilde{\epsilon}_{it} = \begin{cases} \frac{-\phi(\hat{\alpha}_1 - x'_{it}\hat{\beta})}{\Phi(\hat{\alpha}_1 - x'_{it}\hat{\beta})} & \text{if} \quad y_{it} = -1 \\ \frac{\phi(\hat{\alpha}_1 - x'_{it}\hat{\beta}) - \phi(\hat{\alpha}_2 - x'_{it}\hat{\beta})}{\Phi(\hat{\alpha}_2 - x'_{it}\hat{\beta}) - \Phi(\hat{\alpha}_1 - x'_{it}\hat{\beta})} & \text{if} \quad y_{it} = 0 \\ \frac{\phi(\hat{\alpha}_2 - x'_{it}\hat{\beta})}{1 - \Phi(\hat{\alpha}_2 - x'_{it}\hat{\beta})} & \text{if} \quad y_{it} = 1 \end{cases}$$

where $\hat{\alpha}_1$ and $\hat{\alpha}_2$ are the estimated cutoff from the ordered probit regression.

Following Gourieroux et al. (1985), the test statistic is given by:

$$S_1 = \frac{(\sum_{t=2}^{T} \tilde{\epsilon}_{it}\tilde{\epsilon}_{it-1})^2}{\sum_{t=2}^{T} \tilde{\epsilon}_{it}^2 \tilde{\epsilon}_{it-1}^2}$$

which has a chi-square distribution with one degree of freedom.

Department of Economics, University of Alberta
Working Paper Series

2017-05: Optimal Procurement of Distributed Energy Resources – **Brown, D.,** Sappington, D.
2017-04: The Impact of Schooling Intensity on Student Learning: Evidence from a Quasi-Experiment – Andrietti, V., **Su, X.**
2017-03: The Voting Rights of Ex-Felons and Election Outcomes in the United States – **Klumpp, T.,** Mialon, H., Williams, M.
2017-02: Does the Design of a Fiscal Rule Matter for Welfare? – **Landon, S., Smith, C.**
2017-01: Carbon Pricing with an Output Subsidy under Imperfect Competition: The Case of Alberta's Restructured Electricity Market – **Brown, D., Eckert, A., Eckert, H.**
2016-18: Monetary Policy Tradeoffs Between Financial Stability and Price Stability – **Shukayev, M.,** Ueberfeldt, A.
2016-17: Managing Risk Taking with Interest Rate Policy and Macroprudential Regulations – Cociuba, S., **Shukayev, M.,** Ueberfeldt, A.
2016-16: On the Role of Maximum Demand Charges in the Presence of Distributed Generation Resources – **Brown, D.,** Sappington, D.
2016-15: Implementing Cross-Border Interbank Lending in BoC-GEM-FIN – **Shukayev, M.,** Toktamyssov, A.
2016-14: The Effects of Early Pregnancy on Education, Physical Health and Mental Distress: Evidence from Mexico – **Gunes, P.,** Tsaneva, M.
2016-13: An Equilibrium Selection Theory of Monopolization – **Eckert, A., Klumpp, T., Su, X.**
2016-12: Education Curriculum and Student Achievement: Theory and Evidence – Andrietti, V., **Su, X.**
2016-11: Poverty and Aging – **Marchand, J.,** Smeeding, T.
2016-10: Local Labor Markets and Natural Resources: A Synthesis of the Literature – **Marchand, J.,** Weber, J.
2016-09: Accounting for Firm Exit and Loss of Variety in the Welfare Cost of Regulations – **Andersen, D.**
2016-08: Analyzing the Impact of Electricity Market Structure Changes and Mergers: The Importance of Forward Commitments – **Brown, D., Eckert, A.**
2016-07: Credibility of History-Dependent Monetary Policies and Macroeconomic Instability – Cateau, G., **Shukayev, M.**
2016-06: Electricity Market Mergers with Endogenous Forward Contracting – **Brown, D., Eckert, A.**
2016-05: Thinking about Minimum Wage Increases in Alberta: Theoretically, Empirically, and Regionally – **Marchand, J.**
2016-04: Economic and Socio-Demographic Determinants of Child Nutritional Status in Egypt: A Comprehensive Analysis using Quantile Regression Approach– **Sharaf,M.,** Rashad,A.
2016-03: Regional Inequalities in Child Malnutrition in Egypt, Jordan, and Yemen: A Blinder-Oaxaca Decomposition Analysis – Rashad, A., **Sharaf, M.**
2016-02: Collateralized Borrowing and Risk Taking at Low Interest Rates – Cociuba, S., **Shukayev, M.,** Ueberfeldt, A.
2016-01: Optimal Policies to Promote Efficient Distributed Generation of Electricity – **Brown, D.,** Sappington, D.
2015-18: Departure and Promotion of U.S. Patent Examiners: Do Patent Characteristics Matter? - **Langinier, C.,** Lluis, S.
2015-17: Socioeconomic Inequalities in Infant Mortality in Egypt: Analyzing Trends between 1995 and 2014 – **Sharaf, M.,** Rashad, A.