Price Discrimination, Search, and Negotiation in an Oligopoly: A Field Experiment in Retail Electricity*

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Abstract

In many concentrated markets, firms publicly post prices and privately negotiate discounts with consumers. Yet despite the prevalence of such price posting and negotiation, empirical research into firms' conduct and market efficiency in such settings is severely limited by a general lack of access to sensitive consumer–firm specific negotiated price data. We develop a field experimental approach to overcoming this challenge, specifically via an audit study that can uncover negotiated prices, as well as disentangle the mechanisms that generate dispersion in them.

We implement our field experiment in the context of a retail electricity market where firms compete for customers. We create a call center staffed by actors that call real call centers to obtain negotiated prices for fictitious customers with experimentally–assigned combinations of customer characteristics and informedness about prices. Combining these experimental data with firms' publicly-available posted prices, we show how posted prices only tell part of the story about how market power manifests itself. Firms are willing to reduce their profit margins by 30% for customers who call in and negotiate rates. Offline search leads to larger discounts than online search. The best deals are obtained by informed callers who provide the lowest reference prices. Holding price informedness and other customer characteristics fixed, firms are less willing to negotiate lower prices with new customers in the market than with existing clients of rival firms.

Finally, motivated by consumer advocacy concerns that income-tested government subsidies are being in part captured by firms in the market, we look for and find no evidence of explicit price discrimination based on government-subsidy status. Based on our experiment, we conclude that the incomplete pass-through of government subsidies for vulnerable customers recently documented by the industry's federal anti-trust authority can be attributed to lower likelihood to search.

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1 Introduction

In many important industries in which firms have market power, prices are negotiated between consumers and firms. Prominent examples in IO include banking, healthcare, telecommunications, and energy markets, however negotiated prices characterize pricing in many other settings including private schools and retirement communities. In these markets, it is not uncommon for firms to publicly post prices and privately negotiate discounts with consumers. As a result, search frictions and negotiation are key determinants of retail price dispersion. Moreover, if firms price discriminate based on willingness and ability to search and negotiate, the distributional welfare impacts of market power depend on the willingness and ability of different consumers groups to engage in these activities.

Despite its prevalence, there is surprisingly little research into price posting, negotiation, and price discrimination in search markets. This is partly due to the fact that firm-consumer specific negotiated price data are sensitive and generally unavailable. Early research on price dispersion and market power (e.g., Sorensen 2000, Brown and Goolsbee 2002) focuses on dispersion in posted prices and abstracts from negotiated prices. Recently, Allen, Clark, and Houde (2018) gain access to consumer-specific mortgage contract data from Canada and provide a structural analysis of search frictions, negotiation, and branding as sources of price dispersion and market power in retail banking. Hastings, Hortaçsu, and Syverson (2017) similarly exploit administrative data to provide a structural analysis of search, branding, and market power in the context of Mexico's privatization of social security.

While these studies provide new frameworks for the analysis of market power and its sources, their applicability is limited to the extent that researchers face significant barriers to accessing firm-consumer specific negotiated price data.[1] In this paper, we propose a field experimental approach to recovering such negotiated price data. It is based on audit studies, which have an extensive history for studying labor market discrimination (Bertrand and

[1] Relatedly, Backus, Blake, Larsen, and Tadelis (2018) examine bilateral bargaining over prices using data on sequences of price offers between buyers and sellers on eBay. However, they abstract from market power and interdependencies in bargaining processes across oligopolistic sellers, which is a focus of our study.

Duflo 2017). Our innovation is to bring the audit study approach to IO for studying price discrimination, search frictions, and negotiation as sources of price dispersion and market power. In this way, we emphasize audit studies as an empirical tool for studying the oligopoly problem more generally.

Our audit study approach complements previous structural analyses in two important ways. We explicitly design our field experiment to disentangle different mechanisms that affect price negotiations. In our study, we primarily focus on search frictions as a key mechanism for determining negotiated price outcomes between firms and consumers. Moreover, the simplicity of our approach makes it readily accessible to policymakers for more accurately measuring price dispersion and market power, and identifying their sources.

We conduct our experiment in a competitive retail electricity market.[2] This context is well-suited for several reasons. First, the product is homogeneous, which allows us to abstract from product differentiation in identifying the role of search frictions in creating retail price dispersion (Wildenbeest 2011; Koulayev 2014). Second, retail electricity markets are local, and the entire population of firms offering posted and negotiated prices is identifiable. We can therefore recover the entire distribution of posted and negotiated prices across firms.[3] Finally, there are no explicit switching costs from changing retailers, which allows us to avoid complications associated with disentangling search frictions and switching costs (Handel 2013).

Electricity is also a highly policy-relevant context. It is an essential service whose use creates pollution externalities, for which there is prior evidence of retail market power (Guilietti, Wildenbeest, and Waterson 2014; Hortaçsu, Madanizadeh, and Puller 2017). Indeed, in

[2]In many countries, including the US, UK, Australia and across Europe, there is retail competition and price dispersion in electricity markets (Hortaçsu, Madanizadeh, and Puller 2017).

[3]In contrast, previous audit studies on price negotiation, where the focus is on how reference prices for negotiation and gender influences bargaining outcomes, involve competitive markets where data on the entire distribution of posted and negotiated prices is not available. See, for example, Busse, Israeli, and Zettelmeyer (2017) (car repairs), Castillo, Petrie, Torero, and Vesterlund (2013) (taxis), Gneezy, List, and Price (2012) (wheelchairs, new cars), List (2004) (sports cards), and Ayres and Siegelman (1995) (used cars). Also, we focus on a market that entails regular quarterly transactions (electricity bills), whereas previous studies study contexts with more infrequent transactions for durable goods or collectables.

the specific market we study of Victoria, Australia, there are concurrent state and national inquiries into market power (ACCC 2018; Thwaites et al. 2017). These inquiries respond to questions about whether retail competition in electricity should be abandoned in favor of regulated monopoly. Our study informs these debates over market design by quantifying the degree to which price negotiation in competitive retail markets dissipates monopoly rents, which has previously gone unmeasured.

Finally, our experiment is partly motivated by consumer advocacy concerns about incomplete pass-through of government subsidies to low-income consumers. Electricity represents a significant portion of expenditures for low-income consumers and high bills can exacerbate cycles of debt and poverty (Johnston 2016). A number of governments worldwide therefore subsidize rates for low-income consumers. Examples include social tariffs in France, Low Income Home Energy Assistance Program (LIHEAP) and linked eligibility utility-sponsored programs in the US like the National Grid's Energy Affordability Program, and the Warm Home Discount in Great Britain (The Brattle Group 2018).

There is a large literature in economics on the extent to which the benefits of subsidies pass-through to consumers, including in markets with imperfect competition (Weyl and Fabinger (2013)).[4] When subsidies are targeted ("tagged") and suppliers have market power, perhaps due to search costs, it can be profitable to charge subsidy recipients higher base rates (Akerlof (1978)). There is recent empirical evidence of this practice. Collinson and Ganong (2015) show that a dollar increase in the price ceiling of Housing Choice Vouchers led landlords to raise tenant rents by 13 to 20 cents. And Turner (2017) shows that universities

[4]Typically product-based purchase subsidies are available to all local purchasers of the product. For example, Lade and Bushnell (2016) find that only half to three-quarters of the subsidy for the purchase of ethanol-based fuels is passed-through to consumers. Rodgers (2018) finds that 50 cents of every dollar of the US Child and Dependent Care Credit is captured by providers in the form of higher prices and wages. Cabral et al. (2018) find evidence of incomplete pass-through of government subsidies to private Medicare Advantage plans, with pass-through rates are substantially higher at 74% in the most competitive market as opposed to 13% in the least competitive market. This result echos the heterogeneous tax incidence of fuel prices found by Stolper (2016) when comparing petrol markets with different levels of local competition. There is also empirical evidence of incomplete pass-through of purchase subsidies in individually-negotiated prices. Busse et al. (2006) find that auto dealers increase negotiated rates not only when customers benefit from dealer cash promotions but also under customer cash promotions. Gulati et al. (2017) find that dealer margins rise by $138 for every $1,000 increase in the subsidy for hybrid electric vehicles in Canada.

reduce their individual aid packages by 19 cents for every dollar of federal need-based Pell Grant that a student receives. In each of these cases, supplier responses undermine the effectiveness of the subsidy. Muehlegger and Rapson (2018) nonetheless show that incomplete subsidy pass-through is not inevitable: a program to subsidize the purchase of hybrid electric and electric vehicles among low income households in California, that involved extensive monitoring of sale prices by regulators and screening of eligible suppliers, did not lead to price discrimination based on subsidy-status.

Our experiment is set up in a way that allows us to determine whether recipients of electricity purchase subsidies are being explicitly charged higher base rates. Observing higher prices for subsidy recipients in aggregate data is not conclusive because subsidy recipients could be more costly to serve or less likely to search. Gulati et al. (2017) provide a simple theoretical framework that explains why, when bargaining is costly to consumers, subsidy-status may also in itself lower the amount of search and negotiation that takes place. By exogenously varying each customer characteristic independently, and collecting prices for combinations of characteristics that may be infrequently observed in practice, our experimental design allows us to disambiguate these different factors. To the extent that price dispersion is driven by search costs, there are low-cost strategies available to governments to reduce search costs that could yield efficiencies in the design of electricity concession payments. Our experiment helps inform this policy question by revealing the value of information for consumers in searching for and negotiating retail electricity contracts.

Preview of Results

Our field experiment is structured as an audit study that obtains price quotes from electricity companies for fictitious customers with randomly–allocated combinations of characteristics. Our experiment sees actors engage in scripted phone conversations with electricity retailer call center personnel, revealing over the course of each conversation randomly–assigned customer characteristics and informedness of competitors' prices.

These experimental phone calls yield a dataset of negotiated retail prices that we match to online posted prices from the retailers' websites. Combining the posted and negotiated price data, we are able to estimate the extent to ignorance over rivals' prices explain variation in posted and negotiated retail prices.

Our experiment delivers a number of new insights into the interconnected impacts of price discrimination, search, and negotiation on retail prices. Quantitatively, we document a substantial, 30% reduction in profit margins, from 8 to 11 percent mark-ups over costs, if consumers threaten to switch retailers and engage in price negotiation using low, yet credible, reference prices.[5] These baseline results are revealing of a market with discriminatory pricing whereby firms post high prices that are paid by unengaged consumers, while engaged consumers engaged in price negotiation realize large price discounts. Being able to observe the entire distribution of posted and negotiated prices from our experiment is fundamental to obtaining these results.

We further document two novel empirical results for empirical research on retail price search.[6] First, we experimentally vary whether a consumer is new to the market, or is an existing consumer looking to switch retailers. We find firms offer significantly higher prices to new consumers and are far less willing to negotiate with them. In other words, we find that perceived consumer experience in the market is an important factor that firms condition when engaging in price discrimination.

Second, we exploit the fact that we have an identifiable finite number of firms in our market and experimentally vary where in a sequential price search process consumers are when negotiating prices. With a strong caveat on statistical significance, we find some evidence that firms' prices depend on where consumers are in a sequential search process. Condi-

[5] As we discuss in detail below, we exploit recently–published in–depth inquiries from multiple government agencies into market power in the retail electricity market. These reports exploit proprietary consumer-firm specific pricing data, as well as firms' customer-specific cost data, to provide estimates of average mark-ups for the entire market, as well as for different sub-groups of consumers. We make use of these figures to provide relevant context for our experimental findings.

[6] See Baye, Morgan, and Scholten (2006) or Ellison (2016) for overviews of the empirical literature on retail price search and price dispersion.

tional on consumer characteristics and their reference prices, we find larger price discounts are offered to consumers who have previously search for prices at fewer firms. Intuitively, firms offer larger pre-emptive price discounts to consumers with less search experience and hence who have higher reservation values of continued search from a larger remaining pool of companies. Such pre-emptive pricing in a price negotiation process is consistent with the structural model put forth by Allen, Clark, and Houde (2018). In this way, our experimental results supports emerging structural econometric frameworks for examining market power in markets with search and price negotiation.

Finally, conditional on likelihood to search and willingness to accept direct-debit or pay-on-time plans, we find no evidence of price discrimination based on a customer's government subsidy status. Incomplete pass-through of government subsidies for vulnerable customers appears to be due to lower likelihood of search and lower willingness to accept direct-debit or pay-on-time plans.

This paper is structured as follows. In Sections 2 and 3 we describe the industry and our experiment. Section 4 describes the asymmetric pricing strategies followed by the different types of firms. Section 5 describes how negotiated prices vary with customer characteristics. We conclude in Section 6.

2 Industry

Our research context is the electricity market of the Australian state of Victoria.[7] The market is split into four parts: generation, transmission, distribution, and retail. Generators compete every 5-minutes in uniform price auctions that determine the marginal wholesale cost of generating electricity. Distributors are regulated monopolists who own the electricity grid's the wires and poles, and manage geographically-distinct electricity transmission and distribution networks. Competing retailers pay network fees upstream to buy electricity

[7] According to the 2016 Census, Victoria has a population of 6.3 million people, 4.4 million of which live in the state capital of Melbourne.

from distributors. They in turn supply electricity downstream to end users, both residential and commercial.

In the retail market, there are 17 firms during our 2016 study period: 3 large, 3 medium, and 11 small.[8] These groups of retailers respectively have market shares of 60%, 28% and 12%.[9] The "Large 3" retailers, AGL, Origin, and Energy Australia, are vertically integrated and compete in both the generation and retail markets. This market structure is relatively mature as retail competition was introduced in 2009. Prior to then, retail electricity prices were regulated by the state government.

2.1 Retail pricing

As in many electricity markets, retail electricity prices in Victoria typically consist of a two-part tariff: a fixed daily charge irrespective of electricity used, and a variable per kWh charge. At an average of AUD \$1/day fixed and 27 cents/kWh variable, prices in Victoria are slightly higher than those typically offered in the United States, and lower than those available in Europe. Some retail pricing contracts involve increasing block tariffs, flat variable charges, and time of use variable charges by time of day and day of week. Our experimental design abstracts from increasing block tariffs by focusing on average energy usage levels. We focus on the prices most commonly-offered in the market: contracts with flat variable charges.

Customer rates can be categorized into three sets of prices: *default contracts*, *posted prices*, and *negotiated prices*.[10] If customers never adopt a posted price contract, or fail to renegotiate a posted price contract after it expires, they are switched to a default contract. Some posted price contracts never expire; others last one or two years. The government

[8] All figures referenced in the discussion institutional detail that follows in Sections 2.1 and 2.2 are drawn from four major industry reports into the retail market from the Australian Competition and Consumer Commission (ACCC 2018), Australian Energy Regulator (AER 2017), Australian Energy Market Commission (AEMC 2017), and a state-level retail electricity market review by the Victorian Government (Thwaites et al. 2017). Data on prices, costs, and margins are drawn from either ACCC (2018) or AEMC (2017), who both have access to highly proprietary detail firm-consumer specific data on contracts and costs of service from all firms in the market for their investigations into retail electricity markets.

[9] Table A.1 in the Appendix presents individual retailers and their market shares.

[10] In Victoria, default contracts are referred to as "standing offers" whereas posted prices and negotiated prices are called "market offers".

requires that every retailer offer default contracts in order to ensure that customers always have a valid contract irrespective of their level of engagement as a shopper in the retail market.

Posted prices are more competitive than default contracts. Customers can obtain these contracts by signing up online or calling their current retailer or competitor. Posted prices are often expressed as a discount relative to that retailer's current default contract. A retailer typically offers multiple posted prices at any given time, with variation in the ratio of fixed to variable charges, discounts for direct debit or on time payments, green power commitments, or one-time sign-up discounts or other promotions.

Finally there are negotiated prices. Some customers are on contracts that are negotiated by trade associations for the benefit of their members. Others are on contracts negotiated directly by customers, either when contacted by rival retailers or third-party resellers, or when customers initiate contact by calling retailer call centers. Prior to this paper, there was only anecdotal evidence to the potential gains from calling up and negotiating rates in this market. Online price comparison tools only compile data about default contracts and posted prices. Aggregate industry statistics either don't account for negotiated discounts at all, or do not distinguish between posted price contracts obtained at different times and negotiated price contracts. This is, in part, the measurement problem our field experiment below helps to resolve.

The state government also subsidizes electricity costs for a subset of households through concession payments. Consumers qualify for such payments by having low incomes, being a pensioner with a moderate to low income, or being a veteran.[11] Eligible consumers are required to contact and provide their concession card details to their retailer in order to benefit from concession rebates. The annual Victorian concession is set at 17.5 per cent of electricity usage and service costs after retailer discounts and solar credits have been applied.

[11]Specifically, an individual who resides in Victoria, Australia is eligible to apply for annual electricity concession if they own one of the following cards: Pensioner Concession Card, Health Care Card or Veterans' Affairs Gold Card.

The concession does not apply to the first $171.60 of the annual bill. Concession rebates are calculated by retailers and deducted directly from the total nominal costs on each bill. Consumers observe the nominal cost, concession amount and the net payable amount.

2.2 Demand

Victorian households consume an average of 3600 kWh of energy per year. This costs them $1457 in electricity bills annually on average, representing about 3% of total disposable income.[12] Among the bottom 20% of income earners, electricity bills represent a significantly larger portion – approximately 10% – of income, which is in part why the state government provides concession payments to these groups.

Apart from electricity consumption, consumer search and retailer switching is a key aspect of demand. Each year, 26% of customers switch retailers. There is, however, considerable inertia with electricity contracts, which has in part lead to an incumbency advantage for the "Large 3" retailers, as evidenced by their large market shares. Using proprietary data from all retailers' customer account databases, which include customer prices, costs, and turnover, ACCC (2018) documents that among the Large 3, 30% of consumers on posted price contracts have been with their retailer for more than 2 years, while 75% of consumers on default contracts had not switched retailers in more than 2 years. Among all other retailers these figures are just 18% and 20%, respectively, highlighting a much lower degree of inertia for the mid-sized and small retailers.

Retailers attempt to overcome this inertia by engaging in door-to-door selling and telemarketing, as well as online and cable advertising, all of which encourage customers to switch from their current retailer.[13] Leveraging retailers' internal cost data, ACCC (2018) estimates that 8% of a consumers' total bill typically is spent on customer billing, marketing, and assistance costs. Moreover, it has been well–documented that the combination of relatively

[12]This compares, for example, to 16% and 18% of disposable income on average being spent on food and housing, respectively.

[13]Marketing and consumer switching intensity is most intense around January and July each year, as this is when upstream electricity distributors update their network charges, and retailers update their prices.

complex electricity pricing contracts and constant marketing campaigns leave customers generally confused and creates large search costs that limits customer engagement.[14] To help combat this, the state and national government both offer online price comparator websites to help customers compare electricity pricing contracts in making switching decisions.[15]

What fraction of customers end up on higher-priced default contracts and lower-priced posted contracts as a result of this switching behavior? Again leveraging proprietary data from the retailers, ACCC (2018) reveals that 6% of customers in the state end up on default contracts. Hardship customers are twice as likely to be on default contracts, compared to non-hardship customers.

2.3 Margins

Lacking data on negotiated prices and firms' costs of supply has, historically, made it difficult to estimate retail margins in the market. However, through its unique access to customer-level contract data and firm cost data, ACCC (2018) estimates that Victorian retailers earn an 11% profit margin on average.[16] In dollar terms, this implies that $160 of a customer's $1457 annual before-tax electricity bill is retail profit. Moreover, historical data obtained by the ACCC reveals that these nominal per-consumer annual margins have fallen by just $4 (in 2015-16 dollars) since 2007-08, the year before the retail market was deregulated. Market power has persisted in the industry over time despite the introduction of retail competition. Indeed, between 2007 and 2016, annual per consumer profits in real terms have risen from $123 to $163, which represents a 33% increase.

[14] See ACCC (2018), AEMC (2017) and Thwaites et al. (2017). This issue of consumer inertia in retailer choice in retail electricity markets is not unique to our setting. Guilietti, Wildenbeest, and Waterson (2014) and Hortaçsu, Madanizadeh, and Puller (2017) similarly document significant search frictions and inertia in U.K. and U.S. retail electricity markets.

[15] Energy Made Easy is the national website (https://www.energymadeeasy.gov.au/) while Victorian Energy Compare is the state-run website (https://compare.energy.vic.gov.au/).

[16] As described in the ACCC report, all margin figures correspond to earnings before interest, taxes, depreciation and amortization (EBITDA).

2.4 Summary

Summarizing our discussion of institutional detail, the market is homogeneous product market with asymmetric retailers and three dominant firms. There is significant inertia among consumers in retailer choice, and they face potentially confusing non-linear two-part tariffs when searching for lower prices. Such deals exist if customers are willing to search and negotiate, as industry reports based on proprietary data are revealing of significant retail price dispersion. This dispersion arises as firms offer posted price contracts whereby they discount variable per-kWh prices relative to the variable per-kWh prices in default contracts. These latter contracts, in effect, serve as an upper bound on retail prices. The main policy issues in the market are twofold: (1) rising margins over time since the market was deregulated in 2009; and (2) low-income consumers paying higher prices, potentially as a result of not being engaged in retail price search and negotiation.

3 The Experiment

In this section, we describe a field experiment designed to the quantify degree of price dispersion and its underlying sources. The experiment generates a publicly–available dataset that acts as counterpart to the highly proprietary administrative data on consumer-firm specific contracts used by ACCC (2018) for its anti-trust investigation. We first describe our experiment, which is an audit study whereby fictitious electricity customers under different experimental conditions call retailers to negotiate prices. Having described the experiment, we describe our dataset which consists of experimental price data and retail electricity contract data that we scraped from electricity retailers' websites.

3.1 Design

Our fictitious electricity customers were actors who we recruited from an online acting recruitment website in Melbourne. We held a casting call at the University of Melbourne where

we interviewed actors using hypothetical bargaining scripts. In total, we hired 18 different actors for the experiment, 9 of which were female.

All successful recruits participated in a four-hour training session where we informed them about the study and the structure of the retail electricity market in Victoria. We also had the actors practice negotiating electricity contracts with each other whereby one acted as the electricity retailer and the other was the customer. We finished training by having actors engage in pilot negotiations with actual electricity retailers using different bargaining scripts. In practice, negotiating retail prices with retailers amounted to our actors calling front-line employees at retailers' call centers who were the first point of contact for customers.

We developed 28 fictitious customers. Each customer is a combination of one of 4 characteristics: new arrival vs. client of rival firm, subsidy-recipient or not, reference price (high or low), and source of reference price (called 1, called 4, price comparator website, friend). We span the entire space of possible combinations, using two different reference prices for all but the easily-verifiable price comparator website.

We called every retailer with every customer combination. We randomly assigned actors to the 28 by 12 = 336 customer-retailer treatments. Our intention was for each actor to call each retailer no more than once. Given some actor attrition near the end of the calling period, we reassigned a few actors to call centers that they had previously called. There was no indication that any actor landed on the same call centre employee in any of the repeated calls.

We obtained residential addresses for our fictitious customers from an online website of homes available for rent. We separately randomly allocated addresses to customers within each retailer, so no retailer would be called twice with the same address.[17]

The calls took place in private offices in the University of Melbourne's Faculty of Business

[17]Our full sample of calls has 395 calls because we initially planned to also vary home postcode (high vs low-income) across all customer-retailer combinations. When we realized that phone calls were often stretching to the full time allotted, we decided to switch from duplicating addresses to randomizing them. Because we randomized the order of calls, duplicate treatments took place (with distinct addresses and callers) and are included in the final sample. Standard errors are clustered at the retailer level.

and Economics over the course of the third week of March 2017 between 9am and 4pm. The actors were provided with disposable SIM cards that they inserted into their own cell phones. Using cell phones enabled us to disable caller IDs.

Armed with a bargaining script, the caller dialed each designated retailer on speaker phone. A silent research assistant sitting next to them took duplicate notes on information revealed through the course of the call to ensure data quality.[18] The study's authors also participated silently in many calls to further ensure quality control and uniformity across calls. After each call, the actor and research assistant compared notes to finalize data collected from the call.

As with previous audit studies, our experiment involved deception: retailers' call center employees were not told that were participating in a study of retail price search and negotiation. Our actors were also briefed on the broader study context. To minimize the burden on call center staff, we limited all calls to 20 minutes, and we encouraged actors to publicize good deals to friends and family after the experiment was run.

Standardizing Customer Characteristics

There are many sources of electricity customer heterogeneity that we normalize to allow us to focus on the influence of search on retail price negotiations. In particular, we had actors represent customers with a two-bedroom rental apartment with an average monthly energy usage of 300 kWh/month. This corresponds to the average usage for a two-person consumer in Melbourne.

Home addresses for our fictitious customers were selected from 2-bedroom units available on a large online rental listing website.[19] All home addresses were chosen from the catchment of a single electricity distribution network, United Energy (www.unitedenergy.com.au/).

[18] Calls were not recorded as required by human ethics.

[19] During our pilot calls, we learned that customers addresses were required to establish credibility with call center personnel to initiate negotiations. The addresses also allowed us to also collect data on potentially perceived weekly rent, keeping in mind that the rent posted on the rental website does not specific contracted rent, which could be higher or lower than posted rent.

This guaranteed that electricity network charges would be identical across all customers. We chose the United distribution network as their catchment area has the widest range of postcode-level consumer income according to the Australian Bureau of Statistics.

Our fictitious customers were exclusively interested in electricity accounts without gas. Moreover, our customers were not interested in green power plans nor time-of-day plans, which are relatively rare in the Victorian market. We also picked a uniform single rate electricity meter type, the most common meter type, for all customers.

Our customers negotiated rates for a one-year contract. If asked, our callers explained that they had a one-year renewable lease. Finally, when we provide a reference price, we correctly associate the price with the same retailer(s), regardless of whether it is "high" or "low" reference price. We now provide specifics on our bargaining protocols.

Experimental Conditions

Each call consisted of two stages. In the first stage of the call (*Call-In Initial Contract*) actors revealed their randomly–allocated address, subsidy status (e.g., experimental conditions *concession* or *not concession*), and whether they are moving into a new address in Melbourne or are a customer of a rival retailer in Melbourne looking to switch (e.g., conditions *new customer* or *switcher*). We picked the same rival for all of the switcher calls, who was not part of the experiment. The rival we picked displays its rates in proprietary units that make price comparisons very difficult. The choice of rival allowed our callers to easily deflect any questions about current rates.

Having provided this information, callers then wrote down the initial daily fixed charge and per kWh variable charge (or more simply, "price") offered by the retailer. We encouraged all actors to negotiate using total annual bills to facilitate comparison. The actors clarified any details regarding the offer, including what rates would be with or without discounts for direct-debit, pay-on-time, and paperless bills. We collected data on prices for each of these options, where available.

In the second stage of each call (*Negotiated Final Contract*), actors reveal a reference price and how they obtained it. The reference price comes from one of four randomly-allocated sources: (1) an online state-run price-comparator website (https://compare.energy.vic.gov.au/); (2) previous call to one other company; (3) previous call to four other companies; (4) a friend. Below, we denote these information source-based conditions *called 1 rival*, *called 4 rivals*, *price comparator*, and *friend*. When the price came from previously-called companies, the name(s) of the companies were held fixed. Callers negotiated based on two reference price levels: a high and low price (e.g., conditions *high price* or *low price*). The "high" price was the lowest price obtained from the government-run online price-comparator website.[20] The "low" price was the lowest rate that we were able to negotiate over the phone, from that same company, during the pilot.

3.2 Data

Our dataset of retail prices contains default contract rates and posted price data from the field, and negotiated price data from our experiment. We obtained default rates and posted prices by scraping retail contracts from individual retailer websites. Each price quote is composed of a daily fixed charge and a per kWh variable charge, and any connection fees or special discounts. To normalize rates across retailers, we calculate a total annual bill based on average use of 300 kWh/month. Connection fees and discounts are included in the total annual bill estimate. All prices presented are before a 10% value-added-tax (VAT). Our callers were trained to confirm whether each quoted negotiated rate included or did not include VAT.

Summary Statistics

Summary statistics from our raw price data are presented in Table 1. They reveal substantial price dispersion: variable rates range from 40 to 14 cents per kWh, while daily electricity

[20] We checked each day of the experiment and confirm this price did not change.

Table 1: Summary Statistics

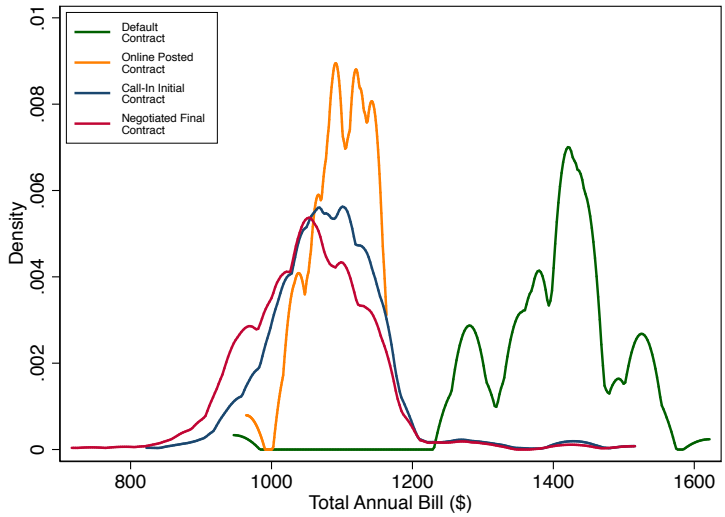
	Mean	Std Dev	Min	Max	N
Cents per kWh					
Default Contract	28.31	1.57	25.34	30.95	12
Online Posted Contract	27.35	2.63	20.69	29.63	12
Online Posted Contract, Direct Debit Only	20.51	1.74	18.19	24.55	12
Call-In Initial Contract	26.84	3.22	17.15	39.57	395
Negotiated Final Contract	23.39	4.38	13.98	39.57	395
Reference Price High	19.24				
Reference Price Low	17.85				
Cents per day					
Default Contract	107.90	15.35	84.7	130.46	12
Online Posted Contract	107.47	14.29	81.31	130.46	12
Online Posted Contract, Direct Debit Only	101.49	17.49	64.23	130.46	12
Call-In Initial Contract	107.64	14.69	73.92	148.45	395
Negotiated Final Contract	103.41	17.53	54.70	140.00	395
Reference price high	78.40				
Reference price low	70.50				

charges, which is the sum of daily fixed charges plus variable charges assuming 300 kWh/day consumption, range from $1.40 to 55 cents per day. Discounting is also notable from the summary statistics. Default contracts on average are 28.31 cents per kWh, falling to 27.35 cents per kWh for prices posted on firms' websites, then to 26.60 cents per kWh for initial prices offered during our experimental negotiations over phone, and then finally to 23.06 cents per kWh after stage two of our negotiations. That is, negotiating rates reduces prices 18.5% discount on average relative to default contracts.

Figure 1 graphically presents the distribution of annual electricity costs implied from our prices dataset assuming 300 kWh energy consumption month. Here, we can see that annual bills from posted prices are centered near $1400 per year, whereas online posted market contracts and call-in initial offers are centered around $1150 per year. The distribution of negotiated final contracts is shifted further to the left and is centered around $1050 per year, with a notable mass of prices to the left of $1000 per year which is not presented in the online market contracts nor the call-in initial offers.

The discounting in Figure 1 visually confirms significant price dispersion across the dif-

Figure 1: Distribution of Annual Energy Costs Associated with Default, Posted, Call-In, and Negotiated Contracts



Notes: *Default Contract* is the firm-specific default contract with an associated price ceiling that a consumer goes onto if they do not renew their current contract or search for a new one. *Online Posted Contract* is the contract based on the best rates posted on each firm's website. *Call-In Initial Contract* is the contract received by a customer moving into the market calling to connect service. *Negotiated Final Contract* is the final contract received after customer reveals reference price and intensity of search.

ferent groups of pricing contracts, as well as within these groups. On average, in our data there is a 21% reduction in prices when moving from default contracts to posted prices or stage 1 call-in offers. Moreover, posted prices appear to be the starting point within which firms start negotiating with consumers over the phone. Once consumers move past this initial price in stage 1 of the call, they are able to obtain an additional 9% discount off of their annual electricity bills. Below, we use regressions to formally estimate the degree of discounting between posted and negotiated prices.

4 Price Posting and Private Negotiation

In this section we present our experimental analysis of price posting and negotiation in the market. Here, we focus on the magnitude of discounts potentially available through negoti-

ation. Importantly, in the context of an oligopoly, we further investigate firm heterogeneity in price posting and private price negotiation that is revealed by our experiment.

4.1 Baseline Results

Motivated by Figure 1, we construct a baseline set of results that quantify the degree of discounting between default, posted, call-in, and negotiated contracts. To do so we regress the log of the total annual bill for potential customer i from retailer j, Bill_{ij}, calculated assuming total annual use of 3600 kWh, on the way the associated prices were obtained:

$$\begin{aligned}\log(\text{Bill}_{ij}) =& \beta_0 \text{Posted}_j + \beta_1 \text{Call-In}_j + \beta_2 \text{Negotiate}_j \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \rho_l + \delta_t + \epsilon_{ij} \end{aligned} \tag{1}$$

where Posted_j is the best price posted on retailer j's website. The omitted category is the default contract, also obtained from each retailer's website. Dummies for the two stages of the call: initial (Call-In_j) and call stage 2: post-negotiation (Negotiate_j) represent the two rates collected during the call. Our regression also includes actor, retailer, and date-of-call fixed effects: α_k, ρ_l, and δ_t. We also include the cumulative number of calls made by each actor by the time of that call and its square, $Ncall$ and $Ncall^2$, to account for any actor-experience effects on negotiated offers. Standard errors are clustered at the retailer-contract type level.

Table 2 presents the results. The sample we run this regression with includes two sets of observations for each phone call (call-in and negotiation stages) as well as default contracts and posted prices for each retailer. In column (1) all bill reductions are shown relative to the default contract, which is the excluded category. The regressions in column (2) and all subsequent regressions in the paper drop the default contracts from the sample and specify posted prices as the excluded category. Bill reductions from our experimental negotiations within phone calls are then shown relative to posted prices.

Table 2: Discounting Between Posted, Call-In, and Negotiated Contracts

	All Contracts (1)	Excluding Default Contracts (2)
Posted	-0.243***	
	(0.016)	
Call-In	-0.258***	-0.015*
	(0.016)	(0.008)
Negotiated	-0.284***	-0.041***
	(0.017)	(0.010)
R-Squared	0.810	0.496
Observations	1672	1248

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered to allow for abitrary covariance at the firm and contract type level. All regressions include actor, date, firm, and the number of calls made by an actor to date and its square. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$

Quantifying the magnitude of discounting across contracts, we see that posted prices are on average 24.3% lower than default contracts. By calling in to obtain a price quote, consumers receive an additional 1.5% discount in their rates relative to the best available contracts online. Should they negotiate on the call, the discount nearly triples to 4.1%.

Economic Magnitudes

All of these reductions are statistically-different from zero, but are they large? Recall from our discussion of institutional detail above, ACCC (2018) estimates that the average annual bill in Victoria is $1457 with a retail margin of 11%. From the Lerner Index, this implies an annual cost to serve of $1297 per consumer. Conservatively applying our estimates of negotiation effects from switchers off of online market contracts, a 4.1% bill reduction yields average annual bill of $1397. This implies a reduction in profit margin from negotiation among switchers in the market to 8%. In other words, retail profit margins decrease from 11 to 8 percentage points (pps), or by 27%, when consumers call in and negotiate rates. In

this sense, the estimated impact of price negotiation on margins is economically large.

4.2 Firm Heterogeneity

Given the oligopoly market structure, from the outset we investigate whether firms adopt symmetric or asymmetric strategies with how they engage in public price posting and private price negotiation. For our analysis, we categorize firms as belonging to three categories: *Large* if a firm has more than one million customers (AGL, Energy Australia, Origin), *Mid-Sized* if a firm has between one million and two hundred thousand customers (Alinta, Lumo, Red Energy, Simply Energy), and *Small* if a firm has less than one hundred thousand customers (the remaining 9 fringe firms in the sample).

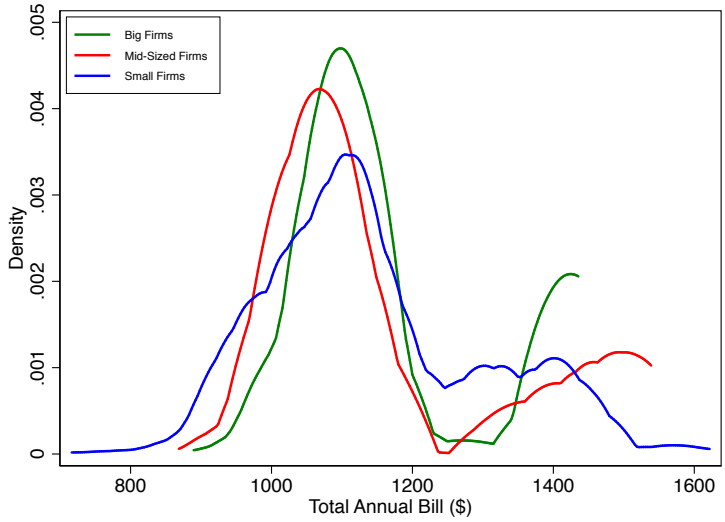
These classifications are based on customer number estimates from ACCC (2018). Such classification keeps with how the market structure is interpreted in practice, with emphasis put on the "Large 3 firms" who, as mentioned above, were in the market before deregulation, and who have a 60% market share. The mid-sized and small groups have 28% and 12% collective market shares, respectively.[21]

Figure 2 provides our first piece of visual evidence regarding differences in firms' pricing strategies. For each firm, we see a bi-modal distribution, where the right-most mass corresponds to the default contracts, while the larger masses correspond to posted, call-in, and negotiated contracts. What is surprising about the graph is that the distributions are not clearly ordered by large, mid-sized, and small. For instance, ignoring the default contracts, we find that the median annual energy cost for the large, mid-sized, and small firms is \$1108, \$1074, and \$1109. We do see, however, the small-firms have the largest amount of left-most mass in the distribution with substantial discounting involving annual bills of less than \$900.

Upon further inspection of our data, we discovered that asking whether firms offer a discount at all between different contracts is revealing about heterogeneity in firms' pricing. To investigate this, in panels (a)-(c) of Figure 2 we plot the distribution of within-firm

[21] As per the study's ethics application, we are not allow to comment on firm-specific pricing beyond these three classification groups.

Figure 2: Distribution of Annual Energy Costs Across Firm Types, Pooling Contracts



Notes: *Large Firms* are AGL, Energy Australia, and Origin; *Mid-Sized Firms* are Alinta, Lumo, Red Energy, Simply Energy; *Small Firms* are the remaining 9 fringe firms in the sample.

discounts when going from default to online posted contracts (panel a), online posted to call-in contracts (panel b), and call-in to negotiated contracts (panel c).[22]

In panel (a) we find that the mid-sized firms systematically offer lower discounted online rates relative to their regulated default rates compared to the large and small firms. Panel (b) shows a substantial mass at 0 for all firms, which implies that there is virtually no discounting between online posted rates and call-in initial rates. This implies that in general firms start negotiations with individual consumers on the phone based upon their best online-posted rates.

Finally, in panel (c) we find significant mass at 0 as well for all three firm types, which implies that the firms often simply refuse to negotiate further beyond the initial price they offer when consumers call-in. Interestingly, we again see an important source of heterogeneity with mid-sized firms: whereas small and large firms refuse to negotiate further in roughly

[22]To understand these figures, first recall that for a given call in our experiment, there are four contracts: default, posted, call-in, and negotiated. For a given call, we compute the discount in annual energy costs from going from default $\rightarrow$ posted, posted $\rightarrow$ call-in, and call-in $\rightarrow$ negotiated. Panels (a)-(c) 2 plots the distributions of these within-call discounts for each of the three firm types.

50% of calls, mid-sized firms refuse to negotiate further in nearly 80% of calls.

Quantifying Firm-Specific Discounts and Willingness to Discount

To quantify firms' differential willingness to discount and the magnitude of their discounts across different contracts, we estimate the following two regressions:

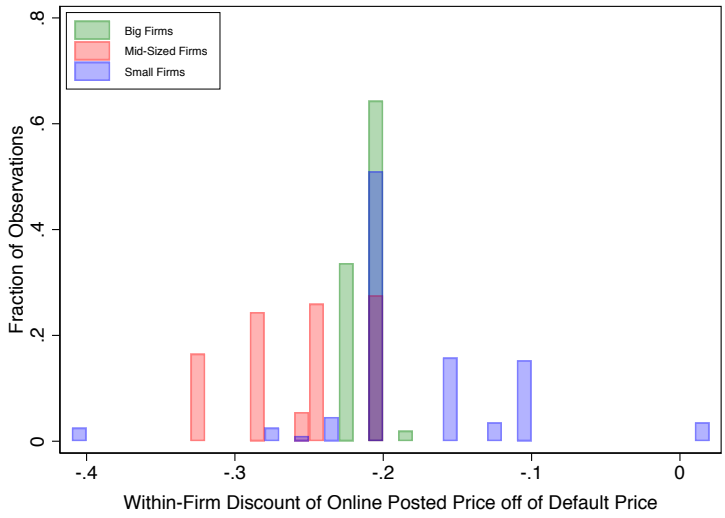
$$1\{\text{Disc}_{ij}^{a,b} < 0\} = \delta_1 \text{Large}_j + \delta_2 \text{Mid-Size}_j + \delta_3 \text{Small}_j + \gamma_1 Ncall_k + \delta_2 Ncall_k^2 + \alpha_k + \delta_t + \varepsilon_{ij} \tag{2}$$

$$\text{Disc}_{ij}^{a,b} = \beta_1 \text{Large}_j + \beta_2 \text{Mid-Size}_j + \beta_3 \text{Small}_j + \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \delta_t + \varepsilon_{ij} \tag{3}$$

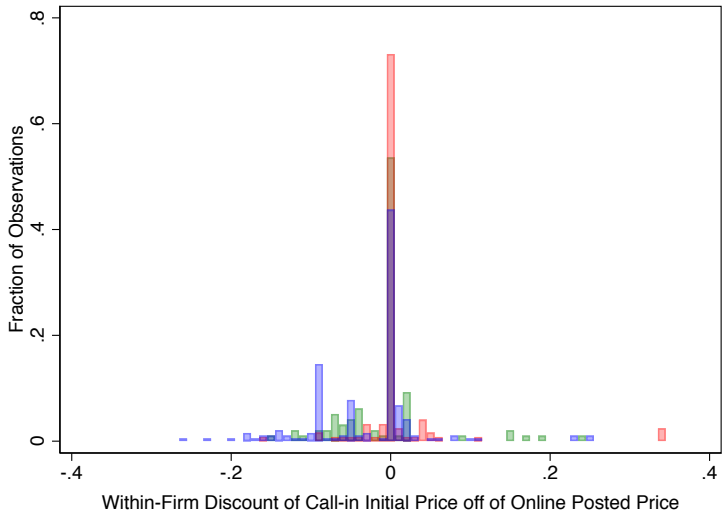
where $\text{Disc}_{ij}^{a,b}$ is the discount going from contract $a \to b$ for caller i with firm j, and $1\{\text{Disc}_{ij}^{a,b} < 0\}$ is a dummy variable equalling one if a non-zero discount is offered. The key regressors are Large_j, Mid-Size_j and Small_j, which are dummies equalling one if firm j is in the group of large, mid-sized or small firms, respectively. All other controls are identical to those in (1) above, however we do not include a constant nor firm fixed effects to make the interpretation of our estimates of $\delta_1, \delta_2, \delta_3, \beta_1, \beta_2, \beta_3$ in (2) and (3) straightforward.

Figure 3: Distribution of Within-Firm Discounts Across Contracts, by Firm Type

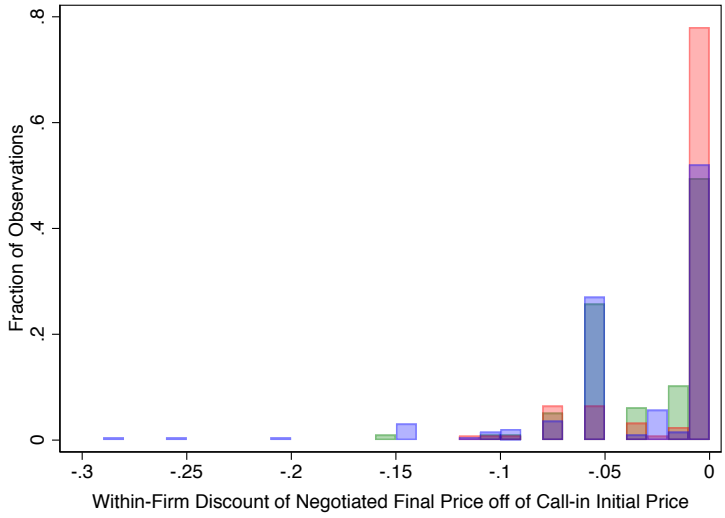
(a) Discounting Going from Default → Online Posted Contract



(b) Discounting Going from Online Posted → Call-In Contract



(c) Discounting Going from Call-In → Negotiated Contract



Notes: *Large Firms* are AGL, Energy Australia, and Origin; *Mid-Sized Firms* are Alinta, Lumo, Red Energy, Simply Energy; *Small Firms* are the remaining 9 fringe firms in the sample.

Table 3: Probability a Firm Gives a Non-Zero Discount Between Contracts

	Gives Discount on Posted Relative to Default Contract (1)	Gives Discount on Call-In Relative to Posted Contract (2)	Gives Discount on Negotiated Relative to Call-In Contract (3)
Large Firm	1.000	0.299***	0.526***
	(.)	(0.021)	(0.100)
Mid-Sized Firm	1.000***	0.130**	0.252***
	(0.000)	(0.048)	(0.060)
Small Firm	0.964***	0.391***	0.490***
	(0.038)	(0.130)	(0.110)
R-Squared	0.984	0.329	0.454
Observations	424	412	412

Notes: Dependent variable is a dummy equalling one if for a given call in the sample, there is a non-zero within firm discount is offered when going from either Default → Posted, Call-In → Posted, or Posted → Negotiated electricity contracts, assuming 300 kWh/month usage. Standard errors are clustered at the firm and quote type level. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$

Tables 3 and 4 present the regression results. As the graphs suggested, in column (1) of the former table we see that firms are almost always give discounts in posted contracts. Comparing call-in to posted contracts in column (2), we see that while large and small firms offer non-zero price differences in 39% and 30% of calls, mid-size firms only offer non-zero price differences in 13% of calls. Column (3) reveals the most interesting heterogeneity: as large and small firms engage in negotiation in 53% and 49% of calls, while mid-sized firms only negotiate in 25% of calls.

Tables 4 highlights the magnitude of within-call discounts across all contracts in the data (columns (1)-(3)), and among the subset of contracts where a non-zero discount is offered (columns (4)-(6). The story the emerges that of asymmetric pricing: mid-sized firms offer more heavily discounted posted online prices relative to default prices (a 26.3% discount) relative to large and small firms (21.6% and 17.9% discounts) in columns (1) and (4). However, in column (3) we find mid-size firms on average offer small or no discounts from call-ins and negotiations, while we find large and small firms offer 2.6 and 3.2 percent

Table 4: Within-Firm Discounting Between Contracts

	Discounting with All Contracts			Discounting Conditional on a Non-Zero Discount Being Offered		
	Default - Posted % Discount	Call-In - Posted % Discount	Call-In - Negotiated % Discount	Default - Posted % Discount	Call-In - Posted % Discount	Call-In - Negotiated % Discount
	(1)	(2)	(3)	(4)	(5)	(6)
Large Firm	-0.216***	-0.007	-0.026***	-0.216***	-0.064***	-0.049***
	(0.006)	(0.004)	(0.004)	(0.006)	(0.009)	(0.005)
Mid-Sized Firm	-0.263***	0.007***	-0.013***	-0.263***	-0.046***	-0.051***
	(0.020)	(0.002)	(0.003)	(0.020)	(0.008)	(0.006)
Small Firm	-0.179***	-0.028	-0.032***	-0.186***	-0.095***	-0.065***
	(0.018)	(0.016)	(0.009)	(0.020)	(0.015)	(0.006)
R-Squared	0.944	0.075	0.326	0.958	0.781	0.707
Observations	424	412	412	417	120	176

Notes: Dependent variable is a dummy equalling one if for a given call in the sample, there is a non-zero within firm discount is offered when going from either Default → Posted, Call-In → Posted, or Posted → Negotiated electricity contracts, assuming 300 kWh/month usage. Standard errors are clustered at the firm and quote type level. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$

discounts on negotiated prices relative to call-in prices.[23]

Finally, focusing on columns (5) and (6) of Tables 4, we do see that while firms exhibit a non-negligible propensity to offer no discounts on call-in contracts relative to posted contracts, and negotiated relative to call-in contracts, that conditional on offering a discount, firms are willing to offer substantial deals. Call-in discounts range from 6.4% to 9.5% in column (5), and negotiated discounts range from 4.9% to 6.5% in column (6). These figures make it clear that the smaller firms are indeed potentially the most aggressive firms in terms of discounting, when they are willing to do so. They also reveal that while the mid-size firms only engage in negotiation 25% of the time, when they do, they are willing to discount.

In light of these findings, the question that begs to be asked is when are firms willing to engage in price negotiation? We answer this question in the following sections when we study firms' discounting behavior with our experimentally–varied customer types.

[23] All of the differences in coefficients between mid-sized firms and the small and large firms in columns (1), (3), and (4) of Table 4 are statistically significant at the 5% level.

Before moving on, we finish our analysis of firm heterogeneity in price posting and negotiation by augmenting our baseline regression model from (1) above to allow for firm heterogeneity:

$$\begin{aligned}\log(\text{Bill}_{ij}) =& \beta_0 + \beta_1 \text{Call-In}_j + \beta_2 \text{Negotiate}_j + \beta_3 \text{Mid-Sized}_j + \beta_4 \text{Negotiate}_j \\ &+ \beta_5 \text{Call-In}_j \times \text{Mid-Sized}_j + \beta_6 \text{Negotiate}_j \times \text{Mid-Sized}_j \\ &+ \beta_7 \text{Call-In}_j \times \text{Small}_j + \beta_8 \text{Negotiate}_j \times \text{Small}_j \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \delta_t + \epsilon_{ij} \end{aligned} \tag{4}$$

This regression allows us to see what the impact of heterogeneous pricing strategies among the different firms on total annual bills. Here, the large firms form our base group, and we again do not include firm fixed effects to simplify interpretation of the coefficients on the firm group dummy variables.

Table 5 presents the results, where we reproduce the baseline regression estimates in columns (1) and (3) for comparison. Focusing on the column (4) results, we find that mid-sized firms offer posted contracts that are 4.3% lower relative to large firms. Small firms, in contrast, do not offer discounted posted contract. The "Call-In" coefficients show that none of the firm groups offer a statistically significant or economically meaningful discount on call-in contracts relative to online posted contracts.

The "Negotiated" contracts show that the large firms offer a 3.6% discount relative to posted online contracts, again revealing these firms' willingness to offer deals to customers who are willing to negotiate. Small firms negotiate even more aggressively, offering a 6.4% discount in negotiations which is statistically significant at the 5% level. In contrast, the mid-sized firms offer only a 0.8% discount off of posted prices which is statistically insignificant at the 5% level.

Table 5: Firm Heterogeneity in Discounting Between Contracts

	All Contracts		Excluding Default Contracts	
	(1)	(2)	(3)	(4)
Mid-Sized Firm		0.018		-0.043**
		(0.023)		(0.020)
Small Firm		-0.059***		-0.016
		(0.021)		(0.018)
Posted	-0.243***	-0.245***		
	(0.018)	(0.010)		
Posted X Mid-Sized Firm		-0.061**		
		(0.030)		
Posted X Small Firm		0.044		
		(0.027)		
Call-In	-0.258***	-0.255***	-0.015	-0.010
	(0.020)	(0.012)	(0.017)	(0.014)
Call-In X Mid-Sized Firm		-0.046		0.015
		(0.032)		(0.030)
Call-In X Small Firm		0.022		-0.022
		(0.033)		(0.032)
Negotiated	-0.284***	-0.281***	-0.041**	-0.036**
	(0.022)	(0.013)	(0.019)	(0.015)
Negotiated X Mid-Sized Firm		-0.033		0.028
		(0.034)		(0.032)
Negotiated X Small Firm		0.016		-0.028
		(0.039)		(0.037)
R-Squared	0.723	0.751	0.061	0.109
Observations	1672	1672	1248	1248

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered at the firm and quote type level. All regressions include actor, date, and the number of calls made by an actor to date and its square. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$

5 Negotiation, Search, and Price Discrimination

In this section, we examine how our experimental conditions regarding consumers' types influence negotiation outcomes. Recalling our treatments, we consider the roles of new versus switching customers, reference prices, information sources, and concession status and demand-side factors that influence consumer-firm price negotiation. Given the central role of firm heterogeneity in price posting and negotiation in the market, throughout we also examine how different firm types respond to these different demand-side factors in negotiations.

5.1 New and Switching Customers

Recall that ss part of our experiment, customers immediately reveal to a firm whether they are new to the market and looking to sign up to a firm, or if they are in the market and switching firms. To examine the role of new versus switching customers plays in the market, we adapt our baseline regression to:

$$\begin{aligned}\log(\text{Bill}_{ij}) =& \beta_0 + \beta_1 \text{Call-In}_j + \beta_2 \text{Negotiate}_j \\ &+ \beta_3 \text{Call-In}_j \times \text{Switcher}_i + \beta_4 \text{Negotiate}_j \times \text{Switcher}_i \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \rho_l + \delta_t + \epsilon_{ij} \end{aligned} \tag{5}$$

where Switcher_i equals one if caller i is experimentally assigned to the switching customer treatment. The coefficients β_3 and β_4 thus allows to see if discounting is different among switchers relative to new customers. All other aspects of the regression are identical to our base regression. In estimation, for this regression and the remainder of the paper we exclude the default contracts from our sample and focus on discounting behavior from calling in and negotiating relative to online posted prices. To investigate firm heterogeneity in how firms respond to switchers and new customers, we also estimate (5) among big, mid-sized, and

Table 6: Discounting Among New Consumers and Switchers

	All Firms (1)	Large Firms (2)	Mid-Sized Firms (3)	Small Firms (4)
Call-In	-0.009	0.003	0.014**	-0.032*
	(0.009)	(0.007)	(0.005)	(0.016)
Call-In X Switcher	-0.013	-0.026	-0.019*	0.003
	(0.008)	(0.018)	(0.010)	(0.014)
Negotiated	-0.033***	-0.018*	0.002	-0.064***
	(0.011)	(0.009)	(0.007)	(0.021)
Negotiated X Switcher	-0.018*	-0.040*	-0.022*	-0.001
	(0.010)	(0.018)	(0.012)	(0.016)
R-Squared	0.500	0.287	0.448	0.584
Observations	1248	295	373	580

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered at the firm and quote type level. All regressions include actor, firm, date, and the number of calls made by an actor to date and its square. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$

small firms.

Table 6 presents our results. Our pooled estimates in column (1) reveal that new customers realize a 3.3% discount from negotiation, while switchers have a 5.1% discount which is statistically significantly different. In short, firms exercise more market power over new customers relative to existing ones, which potentially reflects their belief that new customers are at an informational disadvantage or face costs of becoming informed about prices that can be exploited.

We also find interesting heterogeneity in how firms respond to switchers. Both large and mid-sized firms focus their discounts on switchers, offering them additional 4.0% and 2.2% discounts in negotiations relative to new customers. In this way, the larger firms are more selective with whom they are willing to negotiation with in the market. Mid-sized firms are particularly selective in that they do not engage in price negotiations with new customers at all as evidenced by the small 0.002 coefficient in column (3). In contrast, the smaller firms

offer a 6.4% negotiated price discount to attract a potential customer, irrespective if whether they are new to the market or an existing customer.

Given these substantive differences in pricing toward switchers and new customers in the market, for the remainder of our analysis of demand-side factors that affect negotiations, we carry through splitting the sample also by new customers and switchers in our regressions.

5.2 Reference Prices

Reference prices are expected to have a large impact on negotiations. To study their impact, we estimate regression models of the following form:

$$\begin{aligned}\log(\text{Bill}_{ij}) =&\beta_0 + \beta_1 \text{Call-In}_j + \beta_2 \text{Negotiate}_j + \beta_3 \text{Negotiate}_j \times \text{LowRef}_i \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \rho_l + \delta_t + \epsilon_{ij} \end{aligned} \tag{6}$$

where LowRef_i equals one if a caller negotiates with a low-cost reference contract. We again present results based on pooled estimates of (6), and where we estimate it based on subsamples across different firm types, and among new customers and switchers.

Our results in Table 7 yield a number of new insights. In the top panel, our pooled estimates show that new customers can realize negotiated price discounts only if they are informed about a low reference price. In this case, they receive a 2.6% discount as opposed to receiving no discount without a low reference price. The coefficient estimates in columns (3) and (4) show that this result is mainly driven the mid-sized and smaller firms.

The bottom panel of the table reveals the exact opposite result for switchers: they receive a 4.3% negotiated price discount regardless of whether they negotiate with high or low reference prices. The firm-specific results again reveal heterogeneity whereby the large and mid-sized firms are more willing to tailor how they negotiate depending on a switcher's reference price. Indeed, they are willing to offer 1.7% and 1.3% additional discounts among switchers with low reference prices. in contrast, smaller firms are less discriminatory with re-

Table 7: Discounting and the Role of Reference Prices

New Customers	All Firms (1)	Large Firms (2)	Mid-Sized Firms (3)	Small Firms (4)
Call-In	-0.013	0.003	0.014	-0.036
	(0.019)	(0.013)	(0.029)	(0.033)
Negotiated	-0.024	-0.013	0.019	-0.056
	(0.023)	(0.018)	(0.036)	(0.042)
Negotiated X Low Reference	-0.026**	-0.008	-0.037	-0.025
	(0.012)	(0.007)	(0.025)	(0.020)
R-Squared	0.044	0.022	0.015	0.100
Observations	707	168	199	340
Switchers				
Call-In	-0.018**	-0.025**	-0.005	-0.024
	(0.008)	(0.010)	(0.004)	(0.016)
Negotiated	-0.043***	-0.052***	-0.014**	-0.061**
	(0.011)	(0.010)	(0.005)	(0.023)
Negotiated X Low Reference	-0.009	-0.017*	-0.013*	0.005
	(0.007)	(0.009)	(0.006)	(0.016)
R-Squared	0.486	0.428	0.636	0.516
Observations	541	127	174	240

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered at the firm and quote type level. All regressions include actor, firm, date, and the number of calls made by an actor to date and its square. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$

spect to reference prices among switching customers; they receive a 6.1% discount regardless of their reference price.

5.3 Information Source

Does the source of price information matter for negotiations? We now investigate whether our conditions for having called 1 firm, 3 firms, obtained a price from a government-run search platform, or having asked a friend about their prices matters, conditional on citing either a

low or high price in negotiations. To investigate such heterogeneous negotiation outcomes, we run analogous regressions to our baseline regression in (1) above, but include appropriate interactions to allow for differential negotiation outcomes as a function information source:

$$\begin{aligned}\log(\text{Bill}_{ij}) =& \beta_0 + \beta_1 \text{Call-In}_j + \beta_2 \text{Negotiate}_j + \beta_3 \text{Negotiate}_j \times \text{Call 1 Rival}_i \\ &+ \beta_4 \text{Negotiate}_j \times \text{Call 3 Rivals}_i + \beta_5 \text{Negotiate}_j \times \text{Platform}_i \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \rho_l + \delta_t + \epsilon_{ij} \end{aligned} \tag{7}$$

The omitted category is "Talked to friend". Now, the $\beta_3 - \beta_6$ coefficients describe how information sources affect negotiation outcomes.

Table 8 presents our results. In general, we find that information sources play a much less pronounced role in generating dispersion in negotiated prices. However, there are some interesting exceptions. In the top panel of the table in column (2), we see that the larger firms are willing to give incremental 5.6% and 9.9% price discounts to new customers who claim their information is drawn from having searched rival firms previously and obtained their information from the government's search platform. The result suggests that claiming credible information sources among new customers for whom the firms potentially face more uncertainty matters for their willingness to negotiate. The direction of these effects among mid-sized firms in column (3) is similarly negative, though the coefficients are statistically insignificant.

The bottom part of the table similarly shows that information sources are largely irrelevant for negotiation outcomes among switchers. The most notable result in the bottom part of the table in our view comes from comparing the pooled estimates for having called one versus three rivals. Testing the equality of these coefficient estimates (e.g., 0.009 vs 0.017), we find a statistically significant difference at the 5% level which provides evidence in favor of our pre-emptive pricing hypothesis among switching customers in the sequential search environment that we examine. Looking across columns (2)-(4), we see that this difference in

Table 8: Discounting and the Role of Information Sources

New Customers	All Firms (1)	Large Firms (2)	Mid-Sized Firms (3)	Small Firms (4)
Call-In	-0.013	0.003	0.013**	-0.036**
	(0.009)	(0.003)	(0.005)	(0.017)
Negotiated	-0.029*	0.005	0.011	-0.069**
	(0.015)	(0.005)	(0.015)	(0.025)
Negotiated X Called 1 Rival	-0.008	-0.019**	-0.033	0.009
	(0.011)	(0.007)	(0.020)	(0.016)
Negotiated X Called 3 Rivals	-0.014	-0.035**	-0.008	-0.006
	(0.013)	(0.013)	(0.042)	(0.015)
Negotiated X Search Platform	-0.014	-0.078***	0.015	0.001
	(0.021)	(0.018)	(0.055)	(0.014)
R-Squared	0.524	0.270	0.401	0.629
Observations	707	168	199	340
Switchers				
Call-In	-0.018**	-0.025**	-0.005	-0.024
	(0.008)	(0.010)	(0.004)	(0.016)
Negotiated	-0.051***	-0.068***	-0.025**	-0.059***
	(0.010)	(0.011)	(0.010)	(0.018)
Negotiated X Called 1 Rival	0.004	0.010	0.012	-0.017
	(0.015)	(0.032)	(0.011)	(0.017)
Negotiated X Called 3 Rivals	0.011*	0.019**	0.009	0.012**
	(0.006)	(0.008)	(0.013)	(0.005)
Negotiated X Search Platform	0.002	0.009	-0.009	0.013
	(0.015)	(0.017)	(0.026)	(0.030)
R-Squared	0.484	0.416	0.631	0.520
Observations	541	127	174	240

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered at the firm and quote type level. All regressions include actor, firm, date, and the number of calls made by an actor to date and its square. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$

the coefficients is driven by both the large and small firms.

5.4 Discriminating on Concession Status

Our last experimental condition of interest is concession status. Do firms price differentially simply because a customer receives a concession? To study this, we update our regression equation as follows:

$$\begin{aligned}\log(\text{Bill}_{ij}) =& \beta_0 + \beta_1 \text{Call-In}_j + \beta_2 \text{Call-In}_j \times \text{Conc}_i \\ &+ \beta_3 \text{Negotiate}_j + \beta_4 \text{Negotiate}_j \times \text{Conc}_i \\ &+ \gamma_1 Ncall_k + \gamma_2 Ncall_k^2 + \alpha_k + \rho_l + \delta_t + \epsilon_{ij} \end{aligned} \tag{8}$$

where Conc_i is our dummy for concession status. We are able to consider heterogeneous impacts of concession status with both call-in intial prices and negotiated final prices because we reveal concession at the start of the call. The key issue for anti-trust policy is whether the coefficients on β_2 or β_4 are positive, which would imply firms are increasing their prices because and individual's concession status, which would lead to incomplete subsidy passthrough.

Despite public concern of the issue, our results in Table 9 yield virtually no evidence of price discrimination based on concession status. The only exception we can find is discriminatory pricing among small firms with new customers, where a non-concession customer receives a 7.7% negotiated price discount, whereas a concession customer realizes a 5.8% discount, a difference that is statistically significant at the 10% level. But overall, there does not appear to be systematic price discrimination along this policy dimension.

Table 9: Discounting and Concession Status

New Customers	All Firms (1)	Large Firms (2)	Mid-Sized Firms (3)	Small Firms (4)
Call-In	-0.012	0.013**	0.015	-0.040**
	(0.011)	(0.005)	(0.015)	(0.018)
Call-In X Concession	-0.001	-0.019	-0.005	0.008
	(0.009)	(0.011)	(0.027)	(0.011)
Negotiated	-0.039***	-0.006	0.000	-0.077***
	(0.014)	(0.012)	(0.017)	(0.023)
Negotiated X Concession	0.006	-0.023	0.002	0.019*
	(0.010)	(0.015)	(0.025)	(0.011)
R-Squared	0.523	0.237	0.389	0.634
Observations	707	168	199	340
Switchers				
Call-In	-0.016	-0.041**	-0.000	-0.015
	(0.017)	(0.016)	(0.029)	(0.030)
Call-In X Concession	-0.003	0.028	-0.008	-0.018
	(0.010)	(0.016)	(0.011)	(0.013)
Negotiated	-0.043**	-0.069***	-0.011	-0.053
	(0.018)	(0.012)	(0.032)	(0.031)
Negotiated X Concession	-0.007	0.016	-0.016	-0.012
	(0.010)	(0.022)	(0.016)	(0.009)
R-Squared	0.084	0.177	0.019	0.097
Observations	541	127	174	240

Notes: Dependent variable is logarithm of total annual electricity bill assuming 300 kWh/month usage. In column (1) the omitted category is the firm's default contract. Column (2) drops the default contracts and presents call-in and negotiated price discounts relative to the online posted price. Standard errors are clustered at the firm and quote type level. All regressions include actor, firm, date, and the number of calls made by an actor to date and its square. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$

6 Conclusion

An emerging body of empirical research in IO is revealing the value of administrative data on consumer-firm specific prices for examining market power and retail price dispersion and their underlying causes: price discrimination, search frictions, and negotiation. While this research is providing new frameworks to inform our understanding of the issues in

oligopolistic pricing, their general applicability is potentially limited due to the sensitive nature of the administrative data that these frameworks require.

Through this study, we have developed an audit study to examine price discrimination, search, and negotiation in a retail market. Our simple, yet novel and powerful methodology for examining these issues complement emerging structural approaches based on administrative data. The simplicity of our approach can be immediately implemented by government agencies looking to identify market power and its sources in industries where there is substantial consumer-firm specific heterogeneity in prices, with the aim of developing policy interventions to circumvent market power and promote efficiency such as government-provided online price search platforms.

Our empirical results shed new light on how firms engage in price discrimination based on search frictions. Firms offer higher prices and are less willing to engage in price negotiation with new consumers in markets compared to existing consumers threatening to switch firms. To our knowledge, this distinction between de novo consumers and existing consumers in a market as a source of discriminatory pricing has previously gone undocumented.

We further find that the level of reference prices in negotiations are, perhaps unsurprisingly, important for discounts consumers can achieve through retail price negotiation. Lower reference prices result in lower negotiated prices. Yet, the source of the information for reference prices, whether it comes from sequential search in the market or cheap talk, is irrelevant for negotiated price outcomes.

Moreover, in the sequential search environment that we study, we find evidence that firms are willing to engage in larger pre-emptive price discounts among consumers who are just starting a sequential search process. These results are in line with recent structural models of search and price discrimination (e.g., Allen, Clark and Houde 2018), and thus offer support for their broader use of these frameworks for understanding how firms price discriminate as a function of consumer search frictions.

Finally, our experiment is able to reveal competitive features of a market that were pre-

viously not well–understood. We find no evidence of incomplete passthrough of government subsidies for low–income consumers in price negotiations. We also document a statistically significant and economically large impact of retail price negotiation on market power. In our experimental context, an existing consumer who is negotiating with a low reference price is able to reduce average profit margins by approximately 30%, from a mark-up of 11 to 8 percentage points. That is, the market we study appears to be relatively competitive among the subset of fully engaged shoppers. This further underscores on-going policy measures aimed at overcoming the search frictions consumers face in negotiating prices, which have persisted as an underlying source of market power in the market we study for more than 10 years since the market deregulated.

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Bargaining Script C (Called Around)

You are now about to call **retailer X**. Please note that you have a 20-minute time limit to complete this call. If you run out of time, please conclude the call.

Introduce yourself based on your role description. Please bear in mind that they may ask more questions than the ones on this script and to answer them you should refer to Document A. ***Important: Not all questions will be asked of you. Please do not provide answers not asked of you unless prompted on the script.***

SECTION 1: DO NOT REVEAL SEARCH METHOD

Introduction

RETAILER: Hi, you are calling **retailer X**. My name is (sales agent's name). How can I help you?

YOU: Hi. I want to have electricity connected to my new place. What are your rates?

I'm also eligible for an Energy Concession (*if applicable, else say nothing unless asked)*

Only if asked:

- Moving to Melbourne from interstate
- I'm looking for a one year contract
- We use about 10kWh per day or 300kWh per month

(Note: They may ask if you're interested in signing up online, in which case just say you haven't decided but ask if there's a discount for that. Also ask if discount can be applied over the phone.)

Address

RETAILER: Sure, may I have your address or NMI please?

YOU: We will be moving to **address.**

RETAILER: What's the unit number?

YOU: I can't remember the unit number.

RETAILER: I need to know what type of meter you have.

YOU: The unit has a standard rate meter.

Only if asked:

RETAILER:	Do you have solar panels at your new property?	YOU: No
RETAILER:	Is there a pool at your new property?	YOU: No
RETAILER:	Are you interested in gas as well?	YOU: No
RETAILER:	Green energy?	YOU: No

First Price Quote

RETAILER: OK. We can offer you our **(name of electricity plan)**. It's **XXXXX** cents/kWh along with a **XXXXX** cents/day supply charge.

YOU: Does that include GST?

RETAILER: No, that is ex-GST.

YOU: Is there a discount for direct debit?

RETAILER: That plan already includes a discount for direct debit.

YOU: How much would I have to pay without direct debit?

RETAILER: **XXXXX**% more

YOU: So both the supply and variable charges would be that much more?

RETAILER: **Yes/No**.

YOU: *Confirm all of the following:*

- 12 month contract
- Monthly bills
- Bills sent via email
- No/any penalty or exit fee if I end the contract early?

YOU: Does that price only apply if I pay my bill on time? If I don't, how much would I need to pay?

RETAILER: **Yes/No.** If you don't pay on time, your total bill will be **XXXX**% higher.

YOU: Does my rate increase at the end of my contract?

RETAILER: No. Rates only increase with inflation and when we have to pass on annual increases in network charges.

SECTION 2: REVEAL PRIOR SEARCH METHOD

Second Price Quote

YOU: Is this your best price? I have called **one company/a few other companies** before you and I have been offered a better deal.

RETAILER: Which company is offering you this price?

YOU: **XXXXXXXX**

RETAILER: And what did they offer?

YOU: **XXXXXX** per day and **XXXXXX** per kWh.

RETAILER: *(Retailer either provides lower new price or refuses to lower price)*

YOU: Is this new plan also valid for 12 months? Are there any penalty fees?

YOU: Can I also ask if there is a discount for direct debit payment? This is a pay-on-time price, right? How much would I pay without direct debit/without pay-on-time?
(record any price revisions and new plan details)

SECTION 3: BARGAIN EVEN FURTHER

Final Price Quote

YOU: Is that really the lowest you can go? I was hoping to get a better price because a **friend** of mine told me he pays less than **$850** a year for electricity.

RETAILER: What company does your friend use?

YOU: I don't know.

RETAILER: Do you know his supply and variable charges?

YOU: No.

(please give retailer time to respond and record any price revisions and new plan details)

Ending the Conversation

YOU: Thank you for your help today. I'll talk with my partner and get back to you. Have a good day. Bye.

You should decline any offer to call you back. They are likely to insist, and you should just end the conversation by asking for an ID number that you can quote if you decide to call back later followed by "Thank you for your help today. I'll talk with my partner and get back to you. Have a good day. Bye."

--End of Conversation—

Important:

All conversations must be kept to a maximum of **20 minutes**. The research assistant sitting beside you will notify you at the 15th-minute and 19th-minute mark. At the **second prompt, you should wrap up the conversation**. If you do not manage to complete all the stages of the bargaining script, kindly inform the researcher in-charge.

In the event that this happens, you may end the conversation by saying "Sorry, I'm afraid I need to go now. I have an appointment in a few minutes. Thank you for your help. Bye."

Price Sheet

Name: _____ Date: _____

Company Name: _____ (e.g. Origin)

Please fill in this section before making the phone call:

Variation ID:	_____	**Search Method:**	
Address:	_____	Called One / Called Many / Website / Friend	
	_____		
Concession:	Eligible / Not Eligible	**Price-to-Beat:** _____ Usage	_____ Supply _____ Annual (300kWh/mo)

Price #1 – price obtained after revealing address and/or concession		
Non-direct debit offer	**Direct debit offer**	**Direct Debit discount:**
1. Usage charge (cents **per kWh**, incl. GST):	**1. Usage charge:**	
Pay-on-time/Not pay-on-time	Pay-on-time/Not pay-on-time	
2. Supply charge (cents **per day**, incl. GST):	**2. Supply charge:**	
Pay-on-time/Not pay-on-time	Pay-on-time/Not pay-on-time	
3. Rate if pay-on-time/not pay-on-time:	**3. Rate if pay-on-time/not pay-on-time:**	

Other Discounts and offers (e.g. One-off rebates, movie tickets):

Exit Fee:

Price after 12 months (if different):

Please ensure that the call only proceeds to the next stage after you have acquired the details for the current stage.

Price #2 – price obtained after revealing search method	
Non-direct debit offer **1. Usage charge** (cents **per kWh**, incl. GST): Pay-on-time/Not pay-on-time **2. Supply charge** (cents **per day**, incl. GST): Pay-on-time/Not pay-on-time **3. Rate if pay-on-time/not pay-on-time:**	**Direct debit offer** **1. Usage charge:** Pay-on-time/Not pay-on-time **2. Supply charge:** Pay-on-time/Not pay-on-time **3. Rate if pay-on-time/not pay-on-time:**
Other Discounts and offers (e.g. One-off rebates, movie tickets):	
Exit Fee: Price after 12 months (if different):	

Direct Debit discount:

Price #3 – price obtained after friend's very low price or threatening to search more	
Non-direct debit offer **1. Usage charge** (cents **per kWh**, incl. GST): Pay-on-time/Not pay-on-time **2. Supply charge** (cents **per day**, incl. GST): Pay-on-time/Not pay-on-time **3. Rate if pay-on-time/not pay-on-time:**	**Direct debit offer** **1. Variable charge:** Pay-on-time/Not pay-on-time **2. Supply charge:** Pay-on-time/Not pay-on-time **3. Rate if pay-on-time/not pay-on-time:**
Other Discounts and offers (e.g. One-off rebates, movie tickets):	
Exit Fee: Price after 12 months (if different):	

Direct Debit discount:

Other Notes: