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CUSTOMER SATISFACTION AND FIRM PROFITS IN MONOPOLIES: A STUDY OF UTILITIES

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Abstract

There is a growing body of evidence that customer satisfaction is predictive of firms' future financial performance. However, studies of this relationship have been limited to competitive markets and monopolistic markets have been largely ignored. In this study, we explore the large and important utilities market and exploit its unique regulatory requirements that generate detailed and reliable operating and accounting data to examine the overall relationship between customer satisfaction and utility profit, and establish the causal mechanisms involved. Using data from U.S. public utility firms we show that even when customer satisfaction does not affect future revenues, it does positively predict future profitability by reducing utility firm operating costs. More specifically, we find that higher satisfaction reduces the costs of utility firm distribution, customer service, and sales and general administration expenses. These findings and additional post-hoc evidence we present are consistent with customer satisfaction generating efficiency-enhancing benefits for utility firms via lowering the direct and employee engagement costs of dealing with dissatisfied customers and generating greater trust and cooperation from customers. This study has important implications for both managers and regulators, and provides important new insights for market-based asset theory and regulatory economic theory.

Keywords: Customer Satisfaction; Firm Performance; Public Utilities; Operating Costs; Firm Efficiency.

INTRODUCTION

In competitive markets, the positive effect of customer satisfaction on firm performance has been well documented (e.g., Aksoy et al. 2008; Anderson, Fornell, and Mazvancheryl 2004; Anderson and Mansi 2009). Satisfying customers is therefore a key goal for firms in such markets (e.g., Gruca and Rego 2005; Morgan and Rego 2006). However, little is known about satisfaction's effects in monopolistic markets such as utilities where customer choices are limited. As a result, utility managers are unsure how much to invest in satisfying customers—if anything at all since most customers have no alternative supplier choices (e.g., PWC 2015; Strategy& 2014). For example, in exploratory interviews a utility's COO commented: *"Utility executives don't know whether and how much payoff they may expect from investments in increasing customer satisfaction."* Similarly, a utility CEO suggested: *"I think that increasing my customers' satisfaction is the right thing to do, but I don't know how much to spend in doing so because the returns I should expect are not clear."* This issue is also of interest to regulators who in the absence of competition are responsible for protecting utility customers. Whether or not customer satisfaction should be a part of regulator efforts to incent and monitor utilities is a debated question, with the answer depending on whether utilities otherwise have economic incentives to satisfy their customers (e.g., Makholm 2018; McNamara and Winter 2013; Tirole 2015).

The effect of customer satisfaction in utility markets is also theoretically interesting. Such "natural monopolies" are economically important suppliers of continuously delivered offerings that are difficult for customers to do without (e.g., power, water) in which geographic franchise arrangements make competition practically difficult (Borenstein and Bushnell 2015; Mergent 2016). As a result, these markets are usually regulated to protect customers (Posner 1999).
With limited choices, the customer satisfaction-firm performance relationship may be expected to be different than in unregulated competitive markets. However, the theoretical literature in

economics and marketing offer differing viewpoints. Regulatory economics theory suggests that providing anything more than minimal customer satisfaction is a "discretionary" expense that reduces utility profits (e.g., Crew and Kleindorfer 2002; Karlsen and Pettyfer 2011). In contrast, market-based asset theory in marketing posits that satisfied customers are a relational asset that help increase firm profits and shareholder value (e.g., Srivastava, Shervani, and Fahey 1998)—but does not consider whether and how this may work in monopolistic regulated market settings.

This study addresses this important and theoretically interesting question and offers several contributions. First, using data covering the U.S. public utility industry for the period 2001-2017, we find robust evidence that customer satisfaction is significantly positively related to utility firms' future profits. This has important implications for utility managers and shareholders. Our results show utility managers that customer satisfaction is a key business metric that should be tracked, and a valuable intangible asset which they should invest in enhancing to maximize profits. Furthermore, shareholders should welcome utility investments in improving customer satisfaction. Our results also have implications for marketing theory as it suggests that market-based asset theory—which underpins most explanations for the satisfaction-firm performance relationship—can be extended to such regulated markets. To-date, researchers have either assumed that customer satisfaction is unimportant in regulated monopolistic markets, or excluded them from their theorizing and empirical studies as being idiosyncratic.

Second, this study's findings reveal that the mechanism for the satisfaction-profit relationship observed in utility markets is through decreasing firms' operating costs in serving their customers. In addition, we find evidence consistent with the underlying reasons for this effect of satisfaction on operating costs being via reduced direct and indirect costs to deal with customer complaints and cost savings from firm introduced changes and technologies that benefit from greater customer trust and goodwill. Our study supports the recent findings of Lim, Tuli, and Grewal (2020) in offering evidence of lower operating costs as an important efficiency-enhancing benefit of satisfying customers. It also suggests additional cost-reducing mechanisms that should be explored in studies of how satisfaction contributes to firm performance in other types of markets.

Third, our findings also have implications for economic theory and utility regulators. For regulatory economic theory, our findings suggest a new mechanism by which utility firm and customer incentives may be aligned. Specifically, we show that as currently regulated via control of price-setting and setting minimum quality levels utilities have a cost-based incentive to satisfy their customers. This suggests that utility investments in providing customer satisfaction are rational and profit maximizing rather than “discretionary”. For policy-makers, our findings that customer satisfaction does not lead to increased profits via higher rates or greater demand suggests current regulatory controls are effective. In addition, since we control for both price (rates) and quality (outages) in our analyses—and show a negative effect of customer satisfaction on utility firm operating costs beyond that explained by these two variables—our findings suggest regulators should view investments in customer satisfaction as recoverable costs.

In the next section, we first present conceptual arguments regarding the mechanisms by which satisfaction may be linked with firm profits and explore how each of these may (or may not) work in a regulated utility market. We then describe the data set assembled, detail how we empirically test the relationships of interest, and present and discuss the results. Finally, we outline the limitations of the study, consider its implications for marketing and economic theory, and provide actionable recommendations for both managers and public policy-makers.

CONCEPTUAL FRAMEWORK AND INDUSTRY CONTEXT

Market-based asset (MBA) theory has been the primary theory lens applied in studying the customer satisfaction-firm performance relationship. From this perspective, satisfaction indicates the health of a firm's customer relationships—a relational asset that generates future cash flows by: (i) increasing cash inflows via allowing higher price premiums, lower customer churn, enhanced customer responsiveness to new products and marketing programs, and stronger brand equity and word-of-mouth attracting new customers; and, (ii) reducing cash outflows directly by lowering the cost of sales and service, and reducing required working capital and fixed investments, and indirectly by reducing cash flow volatility which lowers the firm's cost of capital (Srivastava, Shervani, and Fahey 1998). Thus, customer satisfaction is theorized to affect a firm's future profits via its ability to both increase firm revenue and reduce firm costs.

Studies in competitive markets, reveal some empirical support for theorized revenue-enhancing links at the customer- (e.g., Homburg, Koschate, and Hoyer 2005; Wangenheim and Bayón 2007) and firm-levels (e.g., Fornell et al. 1996; Morgan and Rego 2006). On the cost-reducing side, while some attention has been paid to the efficiency with which satisfaction is created (e.g., Anderson, Fornell, and Rust 1997; Mittal et al. 2005), only recently has evidence emerged concerning the satisfaction-cost linkage (Lim, Tuli, and Grewal 2020). However, since the firm-level effects of customer satisfaction have not previously been explored in non-competitive markets, and MBA theory does not distinguish between different kinds of markets in its core propositions, it is unclear how the theorized revenue and cost mechanisms may work (if at all) in regulated utility markets.

We therefore begin with the general case developed in MBA theorizing, and explore how each of the suggested routes by which satisfaction may affect firm-level outcomes may or may not be different in regulated utility markets. As shown in Figure 1, the literature suggests four routes linking higher customer satisfaction with firm profits: (i) by increasing customer demand for the firm's offerings; (ii) by reducing customer price sensitivity and allowing the firm to sell its output at higher prices; (iii) by reducing the fixed costs required to produce and deliver the firm's offerings; and (iv) by reducing the variable operating costs to market, deliver, and service the firm's offerings. While all four of these routes may be viable in competitive settings, this is unlikely to be the case in regulated public utility markets for a number of reasons.

[INSERT FIGURE 1 ABOUT HERE]

First, utility customers share a basic need for power that is independent of the supplier's performance. Thus, a customer's unit demand is not likely to be directly affected by their satisfaction with their utility supplier—customers are unlikely to consume more power as a result of being more satisfied or vice versa. Furthermore, because geographic franchise arrangements make competition practically difficult, most utility markets offer only one choice of supplier (Posner 1999). This may not be much of a "choice" for most consumers since they face high switching costs with respect to substitutes (i.e. "going off the grid") as evidenced by the very small number in the U.S. that have done so (EIA 2017).[1] Thus, dissatisfied customers are unlikely to either defect or to significantly reduce their consumption (e.g., Morey and Kirsch 2016; PWC 2015). In addition, a utility's customers are determined solely by their geographic location i.e. a utility only gains new customers when they move into that utility's service area. Thus, even though satisfied customers may be more likely to engage in positive word-of-mouth, non-customers have no ability to switch their utility provider in response.[1] However, utilities do have regulatory incentives to encourage customers to conserve energy, and engage in "Demand

[1] While substitute technologies have improved over time and their costs fallen, Energy Information Agency (EIA) data on net metering indicates that in 2017 0.1% of residential customers produce their own power, and less than 1 million people use any supplementary alternative energy source (https://www.eia.gov/electricity/data/eia861m/).
[1] Some so called "Choice" States have experimented with some limited retail utility provider choice. We exclude these from our main sample but include them in later robustness and generalizability assessments.

Side Management" (DSM) programs designed to this end (Loughran and Kulick 2004). If satisfied customers are more responsive to such programs it is possible that satisfaction may be associated with lowered unit demand. We therefore examine this possibility in our analyses.

A utility may also have strategic reasons for seeking to increase customer satisfaction. For example, utilities can (with regulator approval) also operate in unregulated markets (e.g., selling back-up generators, providing home security services, etc.), and might therefore invest in customer satisfaction in order to provide opportunities and returns in their unregulated businesses (e.g., Braeutigam and Panzar 1989).[2] We therefore control for any such effects in our analyses. In addition, while switching barriers are still high, over time the availability of substitutes for utility service has been increasing and their relative cost decreasing. Thus, a forward-looking utility may seek to enhance customer satisfaction to reduce incentives for customers to explore substitutes, and for potential substitute providers to view the utility's customers as a "disruption" opportunity (e.g., Holmes, Levine, and Schmitz 2012). However, while increasing customer satisfaction may have such positive longer-term defensive payoffs, there is no theory or evidence to suggest that these will materially increase either short-term demand or profits. Nonetheless, we allow for this possibility empirically by examining the effect of satisfaction on demand.

Second, consumer protection in the absence of competition is provided by regulators. Regulators achieve this by setting the prices per unit (rates) that utilities can charge customers, establishing and monitoring minimum quality standards to ensure customer access to reliable service, and providing incentives for firms to increase efficiency (e.g., Laffont and Tirole 1994; Makholm 2018). Thus, regulators do not set (or cap) utility dollar profits. Rather, they determine

[2] These are excluded in regulator's determination of the utility firm's revenue requirement and rates but are included in the firm's accounting statements of revenues and net income. We focus only on revenues, costs, and profits from each firm's utility operations in our analyses, and control for their non-utility profits.

the revenue requirements for the utility that will deliver a "reasonable" rate of return on the required capital investments, and allow them to recover unavoidable costs incurred in providing customer access to service subject to meeting required certain objective quality levels and efficiency improvement targets (Joskow 2013; Vogelsang 2002) [See Web Appendix A8 for further details]. When establishing the revenue requirement, regulators determine the price (rate) the utility is allowed to charge customers for each unit of power to deliver this—and take no account of customer satisfaction in doing so.[3] Thus, even if satisfied utility customers were less price sensitive, a utility cannot raise its prices to exploit this revenue opportunity.

With many of the "demand-side" benefits of satisfying customers likely to be either diminished or effectively unavailable in regulated public utility markets, any relationship with utility profits may be more likely to flow through the "cost-side" route.[4] In the U.S., regulators require access to each utility firm's costs to identify "unavoidable" costs to deliver reliable service, set utility prices, and set and monitor progress against mandated efficiency targets. To enable this, a federal agency (the Energy Information Administration) is tasked with auditing and collecting utility cost data in a standardized way at a more granular level than in most other industries. This granular and comparable utility cost data is also publicly available, providing the opportunity to study the potential effects of satisfaction on utility firm costs in detail.

In terms of the cost-side of the satisfaction-profit relationship, utility markets are characterized by component commonality (the major cost-drivers for the deliverable product or service are similar), and substantial production and distribution complexity. Under such

[3] To allow for the possibility that a utility's customer satisfaction could conceivably informally affect regulator decision-making during "rate case" negotiations regarding rates of return and allowable costs, we include utility unit prices in our analyses of potential satisfaction-profit mechanisms.
[4] Utilities have strong incentives to reduce costs as regulators set efficiency targets and monitor cost performance, with substantial penalties and review costs for failures to meet targets (e.g., Makholm 2018; PWC 2015).

circumstances customer satisfaction is unlikely to have any significant effect in reducing a number of utility firm costs of production—particularly since unit demand is less likely to be significantly affected by customer satisfaction than in competitive markets. Therefore, utility firm costs involved in producing power are unlikely to be affected by customer satisfaction. To ensure this expectation is correct, we also check this relationship in our analyses.

However, customer satisfaction may impact operating costs that a utility firm incurs in serving customers. Since the conceptual literature on potential linkages between customer satisfaction and firm costs is relatively undeveloped, we supplemented this with insights from a number of exploratory interviews with senior industry executives, and a focus group with industry managers and employees. Specifically, using a snowball sampling approach we interviewed five utility CEOs and one COO, one VP of a satisfaction-tracking service for the industry, and the President of a leading utility industry association. The focus group comprised fifteen managers and employees of different utilities that were attending a leading industry event. These allowed us to qualitatively explore potential reasons why a number of different operating costs for utilities may conceivably be lower for firms with higher customer satisfaction. Combined with insights from the extant conceptual literature, these suggest that customer satisfaction may impact utility operating costs via two key mechanisms.

First, studies in competitive industries show that higher customer satisfaction leads to reductions in customer complaints (Fornell et al. 1996). This effect has also been observed by utility managers that we interviewed. The cost of quality literature posits that increasing customer satisfaction reduces firm costs involved in dealing with "non-quality" such as field service and handling and managing complaints (e.g., Huff, Fornell, and Anderson 1996). In the utility case, interviewed managers suggested that this may translate into a lower volume of customer service calls and “walk-ins” to service centers and thus lower the cost of dealing with customers, which should reduce firms’ customer service expenditures.

Both utility managers and employees suggested that higher levels of customer satisfaction also mean that customer-facing employees deal with fewer unhappy customers. This may result in indirect cost savings via productivity benefits resulting from greater employee satisfaction and engagement (e.g., Koys 2001; Schmit and Allscheid 1995). Additionally, it was suggested that fewer employee interactions with irate and complaining customers may also lead to lower employee stress, which in turn both reduces absenteeism and lowers healthcare costs. Higher levels of customer satisfaction may also improve employee satisfaction and decrease employee turnover, further lowering employee costs and raising productivity.

Second, higher satisfaction also leads to greater customer trust in—and goodwill towards—the utility (e.g., Garbarino and Johnson 1999). Our interviews suggest that this may produce cost savings in a number of areas. For example, regulators obligate utilities to provide service, and in most cases they cannot discontinue service for a customer without lengthy and expensive legal recourse—and this usually results in a bad debt. Higher customer satisfaction has been linked with reduced bad debt in the academic literature (e.g., Pike and Cheng 2001). The utility trade press also suggests that satisfied customers are more likely to pay their bills and to do so on time, both lowering bad debt and accelerating cash inflows (e.g., Sharam 2007).

Increased trust and goodwill arising from satisfaction may also lead to faster and greater acceptance of firm introduced changes in product/services (Ernst 2002), some of which could deliver cost benefits to utilities. For example, DSM is key to enabling utilities to realize substantial cost savings and they encourage customers to limit their demand by sharing data on their consumption and providing energy efficiency services (Loughran and Kulick 2004). They also ask customers to allow them to install and operate peak demand limiters to help balance power load, reduce outages, and lower distribution costs. Customers with goodwill towards the utility are more likely to follow their energy consumption advice, accept demand limiters, and trust the firm to manage their consumption when required (MacGill and Smith 2017). They are also more likely to use online self-service customer service technologies and paperless billing systems introduced by the firm which can lower costs to serve. Goodwill is also useful to utilities in enabling them to gain access to customers' property in order to maintain and upgrade utility equipment. While utilities may have legal rights of way to important equipment in many cases, our interviews suggested that customers can still slow their efforts to access such equipment. In addition, access and permission to trim trees and vegetation on customers' property affects utilities' ability to engage in planned maintenance and thereby reduce overall distribution costs.

Overall, as depicted in Figure1 the literature and fieldwork therefore suggests that while all routes should be empirically examined, customer satisfaction is most likely to be linked with utility firm profits via an effect on operating costs.

DATA

Data covering U.S. public utility firms are used to test the relationships described. We used the American Customer Satisfaction Index (ACSI) as our sampling frame as this been the primary data source used in studying customer satisfaction-firm performance relationships in competitive markets. We collected firm-level customer satisfaction data for all publicly-traded U.S. utility companies for the years 2001 through 2017. The ACSI customer satisfaction score is a latent variable for each firm/year (see Fornell et al. 1996). These data were matched with additional customer, firm, industry, and market data, collected from the Energy Information Administration (EIA), Federal Energy Regulatory Commission (FERC), and COMPUSTAT databases.

Examining the relationships of interest also requires data on utility firm profits and its components: rates (unit prices); unit sales volume (demand); and costs. We obtain data for each of these variables from the EIA database. The EIA collects utility firm operating reports and subjects them to a rigorous data quality assurance program that includes over 800 computerized checks as well as routine audits by EIA staff, providing a high degree of accuracy, consistent line of business definitions, and standardized accounting procedures. For each utility firm, the EIA data are also reported by State (since some utilities serve customers in more than one State) and customer type (residential, commercial, and industrial). Since the ACSI does not survey business-to-business (B2B) customers, we included only EIA data items for residential customers in constructing the measures used in our empirical analyses.

Profits: the difference between net operating revenue (data item UOPEREUCO) and net operating expense (data item UOPEXE) for the utility's regulated energy business (all non-regulated diversified business is excluded), using EIA data items for residential customers only.

Rates: EIA provides data on average rates charged per unit of power sold to residential customers, by each utility firm for each year (data item UAVGAREB) reported as cents/Kwh.

Sales Volume: EIA provides data on each utility's unit demand volume (data item USALEEUC) to capture the number of units (Kwh) sold to residential customers.

Utility Costs: all costs incurred in serving residential customers (i.e. total utility expenses attributable to serving residential customer accounts). The EIA collects data on all costs incurred by public utilities. Based on insights from our interviews and focus group and following the logic detailed in our conceptual development we classify these costs into two mutually exclusive categories: Satisfaction Varying Operating Costs (SVOC) i.e. those that may be affected by customer satisfaction and All Other Costs (that should not be affected by satisfaction). Any cost items not reported separately for different types of utility customers are converted to represent residential customer-related costs by using the ratio of residential-to-total customers served.

Satisfaction Varying Operating Costs (SVOC):

Customer Service Expenses: Total operating expenses incurred in customer service, accounting, and collection activities for residential customers (data item UOPECA). This includes costs incurred in: (a) customer records and collection expenses; (b) meter reading expenses; (c) miscellaneous customer accounts expenses; and (d) supervision expenses. Increases in customer satisfaction are likely to reduce such overall customer service expenses.

Salaries: The firm's total salaries and wages paid to permanent employees (data item USW). Increases in customer satisfaction may lead to improved employee engagement and productivity, which may reduce the utility's salaries expense in serving residential customers.

Bad Debt: Total expenses associated with bad debt due to uncollectible customer accounts (data item UOPECNC). Higher customer satisfaction may decrease bad debt expense.

Sales and General Expenses: Expenses incurred with regard to office rent and administration, property insurance, pensions and benefits, and other general expenses including: advertising; miscellaneous general expenses; office supplies and expenses; part-time employee salaries; outside services employed; and, regulatory commission expenses (data item UOPEAG). Some of these costs may decrease with customer satisfaction, via customers' improved acceptance of firm introduced new technologies that reduce customer-facing office requirements.

Distribution Costs: Total expenses associated with the operational costs incurred in utility power distribution (data item UOPED) to residential customers. Overall, we expect that these costs may decrease with customer satisfaction via improved customer acceptance and use of new technologies and greater access to plant and equipment on residential customers' property.

Following the classification and description of the costs listed above, and the theoretical rationale discussed earlier, we calculate an overall SVOC measure by aggregating all five of these operating expenses that may be customer satisfaction dependent (i.e. Customer Service Expenses, Salaries, Bad Debt, Sales and General Expenses, and Distribution Costs). We use this SVOC measure to test our operating cost-related path linking satisfaction with profits.

All Other Costs:

Costs of Production: Total expenses associated with the purchase, generation, and maintenance of the company's energy supply (data items UEPPEXP and UGPPEXP).

Fuel Costs: Total cost of fuel used to produce electricity or gas (data item UFCOSTT).

Maintenance Costs: Contract labor, materials and other direct and indirect expenses incurred for preserving the operating efficiency or physical condition of utility plant used for electric power (or gas) production, transmission and distribution of energy and administrative and general operations. For gas companies, this also includes maintenance of storage plant (data items UMEE for electricity, and UMEGW for gas utilities).

Depreciation Costs: Charges made against income to provide for distributing the cost of depreciable electric plant, less estimated net salvage over the estimated useful life of the asset (data items UXDPE for electric, and UXDPGW for gas utilities).

We also include several firm-level and customer-level controls in our empirical models.

Firm-Level Controls

Utility Type Index: Indicates the % of revenue from sales of *electricity* vs. *gas* that a utility reports to the EIA. Since electricity or gas are different products (sold at different margins), the type of utility supplied to customers may influence overall firm profits.

Firm Size: We use the firm's reported total assets obtained from COMPUSTAT (item AT) as an indicator of firm size. Larger firms may experience greater efficiencies of scale, potentially leading to differences in operating costs and profitability.

Diversification: We use COMPUSTAT segment data to calculate firm diversification, operationalized as the proportion of the utility firm's total revenue obtained from operations in non-utility markets (Johnson, Hoskisson, and Hitt 1993). This is included as a control to account for utilities that may seek to satisfy their regulated market customers as a way of encouraging cross-buying from them in different unregulated markets. We only include profits, costs and demand from utility firms' regulated businesses in our empirical models.

Outages: To control for variance attributable to quality, we use FERC data on the impact of power outages on residential customers served. For each firm, we calculate an annual outage index consisting of the number of outages per firm-year, the total number of residential customers affected by outages, and the duration of outages. Outages may reduce both satisfaction and firm profits (costs are incurred for repairs and revenue is lost during an outage).

Rates: To control for any potential variance attributable to price, we include rates as a control for the cost-based model.

Customer-Level Controls

Demographics: We control for the demographic profile of residential customer population served (i.e., age, gender, ethnicity and household income) as demographics can affect utility consumption (and thus revenue) (e.g., Brounen, Kok, and Quigley 2012) and influence customer satisfaction (e.g., Smith, Bolton, and Wagner 1999). Demographic data was gathered from the U.S. Census Bureau database. For utilities with operations in multiple States, the demographic data was weighted by the firm's proportion of residential revenues from each State.

The ACSI collects customer satisfaction data annually for utility firms during January through December. These data are released annually by the ACSI in the following March, which are matched with current year annual data reported by the EIA and FREC databases, released at the end of November (describing utility firms' data for the previous calendar and fiscal year). We assemble the measures described above by pooling data across these multiple sources, which we match to the financial-accounting data from the COMPUSTAT database. As all investor-owned utilities in our database have December fiscal year ends, the ACSI, EIA, FREC and COMPUSTAT data are aligned chronologically. After compiling and merging data from the sources described above, and following the elimination of firms for which three or fewer years of consecutive data is available and those operating in "Choice States", our database contains 478 firm-year observations, representing 38 investor owned (i.e., public) utilities over 18 years, from 2000 through 2017. Table 1 summarizes descriptive statistics and correlations for the main variables of interest. Appendix 1 provides formal definitions and operationalizations for all measures used in our empirical analyses and subsequent robustness checks.

[INSERT TABLE 1 & APPENDIX 1 HERE]

METHODOLOGY

Our sample is a moderately unbalanced panel, which allows us to control for unobserved heterogeneity but is susceptible to other econometric concerns (e.g., autocorrelation and heteroskedasticity). To deal with these concerns we use a fixed-effects (FE) correction supplemented with year fixed effects to address unobserved heterogeneity, as suggested by the Hausman test. We also use heteroskedasticity and autocorrelation-consistent (HAC) standard errors, which yield unbiased and efficient t-statistics (Stock and Watson 2008) and accommodates for moderately unbalanced panels (Wooldridge 2010).

Endogeneity is also a concern in such data sets and can influence estimates via simultaneity, reverse causality, and omitted variable bias (presence of endogenous regressors), creating identification challenges that need to be addressed. First, in addition to controlling for unobserved heterogeneity, the inclusion of year fixed effects also control for exogenous shocks such as business cycles (Lim, Tuli, and Grewal 2020), which can influence both firm profits and customer satisfaction and therefore are potential sources of endogeneity. Similarly, the inclusion of firm fixed effects allows us to alleviate concerns with respect to time-invariant omitted variables such as corporate culture (Germann, Ebbes and Grewal 2015), which are also potential sources of endogeneity. Simultaneity may also be a potential source of endogeneity in testing the relationship between customer satisfaction and utility profits because some of the dependent variables may be "hard-wired" from an accounting perspective (i.e., unit sales, costs and rates are positively correlated)—raising concerns about codependence of the error terms. We address these concerns by jointly estimating all model specifications whose error terms may be correlated as a system of equations, while allowing the error term on each equation to covary.[5] Lastly, we address potential firm-specific omitted variable endogeneity by including a set of rich firm-level time-variant covariates (Wooldridge 2010).

The remaining endogeneity concerns are addressed as follows. We mitigate potential reverse causality—current period profits could be reinvested to enhance customer satisfaction, in which case current period profits could be an omitted variable—by temporally separating the dependent variable from its predictors, which are lagged one time period. Additionally, despite the corrections listed above, it is not possible to argue that we include all potential predictors of both profits and satisfaction in our models. For example, there remain other potential time-variant omitted variables such as firm-level management ability—which may influence both firm profits (Anderson, Chandy, and Zia 2018; Bloom and Van Reenen 2007) and customer

[5] We use conditional mixed-process models to estimate the simultaneous equations. This jointly estimates a recursive set of equations that mix different model specifications, while still enabling use of instruments, and controlling for potential simultaneity endogeneity by allowing each equation's error terms to correlate.

satisfaction (Wirtz and Zeithaml 2018). Since reverse causality can also be constructed as a variation of omitted variable bias, where the omitted variable varies over time (Wooldridge 2010), we therefore use a standard two-stage least squares (2SLS) approach with an appropriate instrumental variable as our identification strategy. Absent natural experiments or policy interventions, this approach allows the demonstration and estimation of a causal effect since valid instruments affect the outcome only via a specific treatment (i.e., approximating randomized control trials). We use average satisfaction with local Cable TV providers serving each utility's customers as our instrument since as detailed below it is both relevant (i.e. conceptually correlates with the utility customer satisfaction variable that is endogenous) and valid (i.e. satisfies the exclusion restriction).

First, in terms of relevance, customer satisfaction formation is a disconfirmation process based on customers' expectations of a product or service (Oliver 2014). Woodruff et al. (1983) theorize that customers have a distribution of relevant experiences that provide them with norms on which they base performance expectations for a focal provider—including experiences with both "similar brands" and "similar products." Aligned with this it has been shown that customer expectations of—and via (dis)confirmation satisfaction with—one provider are influenced by their experiences with other suppliers (e.g., Cadotte, Woodruff, and Jenkins 1987; Keiningham et al. 2014), and that peers with similar characteristics have greater influence (e.g., Woodruff, Cadotte, and Jenkins 1983). However, these studies are of competing suppliers and products within the same category while in our natural monopoly context, customers' experiences with other utilities is usually very limited (many have only experienced their current utility). Thus, we follow Woodruff et al.'s (1983) logic that customers draw on experiences with other similar providers to inform their expectations, and thereby influence their satisfaction with utility service but extend the identification of "similar providers" beyond the power utility category.

To identify the most relevant non-power utility "similar providers" we draw on the psychology literature which shows that consumer learning about categories is facilitated by the similarity between objects, with similarity judgments involving an alignment process in which features are placed in correspondence (e.g., Lassaline and Murphy 1998). In the marketing literature, this has been shown in terms of how consumers make comparisons from other categories and draw inferences and judgments about "really new" products for which there are no direct referents (e.g., Gregan-Paxton and Moreau 2001; Moreau, Markman, and Lehmann (2001). Thus, we reason that consumers are likely to use features characteristic of a utility (e.g., no choice of provider, supplying an always available on-demand at home service, monthly billing cycles, etc.) as a lens to identify the most relevant similar providers, and draw on their experiences with such similar suppliers to inform what they may expect from their utility.

Of the types of firms that most consumers have experiences with, we propose that Cable TV providers are likely to be more similar to utilities than suppliers from other categories and thereby both more salient and easier to learn from in consumers' expectation formation. We tested this proposition by surveying a random sample of 170 U.S. consumers served by regulated monopoly power utilities, asking them to score a randomized list of different suppliers from other categories on their similarity with their electric utility with respect to how services are provided and how suppliers interact with them. As shown in Web Appendix A9, Cable TV providers were rated as the most similar firms to utilities, with a mean of over 6.5 (out of 10). This clearly suggests the salience of Cable TV providers as reference points for utility consumers in evaluating their supplier and supports the relevance of our proposed instrument.[6]

[6] The criteria on which they are viewed as being similar to a utility also supports our logic (see Web Appendix A9).

Second, satisfying the exclusion restriction implies that the proposed instrument is not only correlated with the endogenous utility customer satisfaction variable but also that it does not correlate with the dependent variable of interest (utility firm profits and its components) (Wooldridge 2010). While customers' utility expectations (and hence satisfaction) are likely to be influenced by their experiences with similar providers of other services such Cable TV, these experiences should not otherwise directly impact utility firms' profitability. Furthermore, conversations with industry executives indicate that utility firms do not benchmark their satisfaction against any adjacent industries. Finally, customers' Cable TV satisfaction is unlikely to be correlated with any of the potential omitted variables identified earlier—i.e., individual utility firms' current period profits, corporate culture, and management ability. Consequently, the proposed instrumental variable meets the exclusion condition.

To measure the proposed instrument, for each Utility firm-year we construct a weighted (by customer share) average of customer satisfaction of Cable TV operators in the State(s) served by the Utility. For utilities serving more than one State, the average for each State was weighted by the proportion of the Utility's revenue from each State (for details see Appendix 1). Empirically, we find that in line with our reasoning the proposed instrument is significantly correlated with utility satisfaction (-0.27, $p < 0.001$) but not with utility profitability (0.03, $p = 0.863$). In addition, changes in satisfaction with Cable TV providers are likely to have a negative effect on consumer's expectations from utility providers such that increases in satisfaction with the former raises expectations from the latter. As customer satisfaction is a function of consumer expectations, the higher expectations due to increases in customer satisfaction with Cable TV are likely to result in a negative effect on customer satisfaction with utilities. Empirically, we observe this phenomena and find that *changes* in cable TV satisfaction are significantly correlated with *changes* in utility satisfaction (-0.54, $p < 0.001$).

Furthermore, the cross-sectional variance in the proposed instrument is substantial and represents about 83% of the total variance in the instrument, alleviating granularity concerns (Angrist 2014). Additionally, as noted in the findings section, the first-stage R^2 and Partial R^2 F tests, the Anderson under identification LM statistic, and the Cragg-Donald Wald F-statistic are all consistent with a strong and relevant instrument. Therefore, average satisfaction with local providers of Cable TV services provides a relevant, valid, and strong instrument and an appropriate identification strategy to address omitted variable bias, and establish causal direction in examining the relationship between utility firm satisfaction and profitability.[7]

Finally, we checked for remaining estimation concerns including normality, presence of influential observations, and multicollinearity, and conclude that our data does not materially suffer from any of these shortcomings. The resulting estimates from our proposed model specifications are therefore unbiased and efficient. To test the association between customer satisfaction and profitability, we adopt the following base model specification:

$$Profit_{i,t+1} = \alpha_{0i} + \alpha_1.Satisfaction_{i,t} + \alpha_2.Rates_{i,t} + \alpha_3.Firm\ Size_{i,t} + \alpha_4.Diversification_{i,t} + \quad \textbf{(Eq.1A)}$$
$$+ \alpha_5.Utility\ Type\ Index_{i,t} + \alpha_6.Outage\ Index_{i,t} +$$
$$+ \Sigma\alpha_{7\text{-}12}.Demographic\ Controls_{i,t} + Year\ Dummies_{t+1} + \varepsilon_{i,t+1}$$

where *i* stands for firm and *t* for time (year), α_{0i} is the time-invariant fixed effect that captures unobserved firm-specific heterogeneity in future profits (e.g., supplier and labor relations), and $\varepsilon_{i,t+1}$ is the random error representing all unobserved influences on future profitability. We also include all controls described earlier. Lastly, we include a vector of mutually exclusive year dummies, to control for time-fixed effects.

[7] Since causality bias and omitted variable bias are both forms of endogeneity bias, they share the same solution.

As described above, we address causality and omitted variable endogeneity using average satisfaction with local Cable TV services as an instrument for customer satisfaction (i.e., first-stage estimates for the 2SLS FE-HAC second-stage model specification summarized in Eq.1A), using the following model specification:

$$Satisfaction_{i,t} = \beta_{0i} + \beta_1.Cable\ TV\ Satisfaction_{i,t} + \beta_2.Rates_{i,t} + \beta_3.Firm\ Size_{i,t} + \beta_4.Diversification_{i,t} + \beta_5.Utility\ Type\ Index_{i,t} + \beta_6.Outage\ Index_{i,t} + \Sigma\beta_{7\text{-}12}.Demographic\ Controls_{i,t} + \eta_{i,t} \quad \textbf{(Eq.1B)}$$

where all variables and subscripts are as noted earlier, β_{0i} represents a fixed effect that captures firm-specific heterogeneity in satisfaction, and Cable TV Satisfaction is the average customer satisfaction score for providers serving each utility's customers, weighted by their share of the customers in the State(s) served so it matches each utility firm coverage as closely as possible. Equations 1A and 1B are estimated simultaneously as a system, with Equation 1B (i.e., first-stage model) used to estimate $\widehat{Satisfaction}_{i,t}$, which is then used as the instrumental variable in Equation1A (i.e., second-stage model) for $Satisfaction_{i,t}$. By construction, the proposed instrument is uncorrelated with the error term $\varepsilon_{i,t+1}$. Table 2 summarizes the first and second stage estimates for the proposed base model specification.

Next, we follow an identical approach to estimate the effect of utility customer satisfaction on profits, and its two primary components—revenues and costs. As noted earlier, because revenues and costs are hard-wired, to address simultaneity concerns, we jointly estimate revenues and costs as a system of equations, while allowing the error term on each equation to covary. Both equations are estimated using fixed-effects heteroskedasticity and autocorrelation consistent standard errors (FE-HAC) and include identical controls to those used for the profit equation. We employ the same identification strategy used for the profit equation, and instrument utility firm customer satisfaction using average satisfaction with local providers of Cable TV services, to estimate the following system of equations:

$$Revenues_{i,t+1} = \alpha_{0i} + \alpha_1.Satisfaction_{i,t} + \alpha_2.Rates_{i,t} + \alpha_3.Firm\ Size_{i,t} + \qquad \textbf{(Eq.2A)}$$
$$+ \alpha_4.Diversification_{i,t} + \alpha_5.Utility\ Type\ Index_{i,t} + \alpha_6.Outage\ Index_{i,t} +$$
$$+ \Sigma\alpha_{7\text{-}12}.Demographic\ Controls_{i,t} +$$
$$+ Year\ Dummies_{t+1} + \varepsilon_{i,t+1}$$

$$Costs_{i,t+1} = \beta_{0i} + \beta_1.Satisfaction_{i,t} + \beta_2.Rates_{i,t} + \beta_3.Firm\ Size_{i,t} + \qquad \textbf{(Eq.2B)}$$
$$+ \beta_4.Diversification_{i,t} + \beta_5.Utility\ Type\ Index_{i,t} + \beta_6.Outage\ Index_{i,t} +$$
$$+ \Sigma\beta_{7\text{-}12}.Demographic\ Controls_{i,t} +$$
$$+ Year\ Dummies_{t+1} + \phi_{i,t+1}$$

where all variables and notation are as described above, and α_{0i} and β_{0i} *are* the time-invariant unobservable firm-fixed effects, and $\varepsilon_{i,t+1}$ and $\phi_{i,t+1}$ are random errors representing all unobserved influences on future revenues and costs, respectively, and are allowed to covary. Table 2 summarizes the estimates for the revenues and costs equations.

Finally, in order to test the association between customer satisfaction and utility operating costs we utilize an identical FE-HAC standard errors estimation, while decomposing utility profits into its most granular components: Revenues (i.e., unit sales volume and rates), and Costs (i.e., SVOC and all other costs), using the variables $Unit\ Sales_{i,t+1}$, $Rates_{i,t+1}$, $SVOC_{i,t+1}$ and $Other\ Costs_{i,t+1}$, respectively, as dependent variables. Similar to the previous analyses, we allow the error terms in all equations to covary to address simultaneity concerns and use average satisfaction with local providers of Cable TV services to instrument utility firm's customer satisfaction. The proposed system of equations estimated is summarized below[8]:

$$Dependent_{(k)i,t+1} = \alpha_{(k)0i} + \alpha_{(k)1}.Satisfaction_{i,t} + \alpha_{(k)2}.Firm\ Size_{i,t} + \alpha_{(k)3}.Diversification_{i,t} \qquad \textbf{(Eq.3k)}$$
$$+ \alpha_{(k)4}.Utility\ Type\ Index_{i,t} + \alpha_{(k)5}.Outage\ Index_{i,t} +$$

[8] Since rates is the dependent variable in the second equation, it needs to be excluded as a regressor from each equation in the system of equations, including the first-stage equation. Subsequent estimation of the Unit Sales, SVOC and Other Costs equations, including rates as a regressor, yield findings identical to those reported in Table 3.

$$+ \Sigma\alpha_{(k)6\text{-}11}.Demographic\ Controls_{i,t} +$$
$$+ Year\ Dummies_{(k)t+1} + \varepsilon_{(k)i,t+1}$$

where all variables and notation are as described above, and the $Dependent_{(k)}$ variable is in turn $Unit\ Sales_{i,t+1}$, $Rates_{i,t+1}$, $SVOC_{i,t+1}$ and $Other\ Costs_{i,t+1}$, and the *(k)* subscript identifies estimates specific to each equation. Table 3 summarizes estimates for these granular analyses.

[INSERT TABLES 2 & 3 HERE]

FINDINGS

Tables 2, 3 and 4 summarize the main empirical model testing results. Table 2 summarizes the overall effect of satisfaction on utility firm profitability using average cable TV satisfaction as an instrumental variable for utility satisfaction. Table 2 Eq. 1B first stage estimates support our identification strategy as average local cable TV provider customer satisfaction predicts utility satisfaction and is a strong and valid instrument, allowing us to demonstrate and estimate the causal relationship between customer satisfaction and utility firm profits. Specifically, the first stage R^2 is 38.78% and the F statistic ($F = 177.23$, $p < 0.001$) is significant and larger than the average effective cut-off of 10 (Andrews, Stock, and Sun 2019). Additionally, the Anderson under-identification LM test ($\chi^2 = 25.68$, $p < 0.001$), and the Cragg-Donald Wald test ($\chi^2 = 28.31$, $p < 0.001$ vs. Stock Yogo 10% Critical F Value = 16.38) confirm instrument strength. Additionally, the second stage R^2 is 79.05% and the Wald test ($\chi^2 = 453.89$, $p < 0.001$) confirm the overall goodness of fit of the model. The estimated model reveals that the effect of customer satisfaction on utility firm profit is positive and significant ($\beta = 114.63$, $p < 0.05$).

In terms of the mechanism by which customer satisfaction may be linked with utility firm profits, Table 2 confirms the expectation that in a regulated utility context customer satisfaction has no impact on utility firms' future revenues ($\beta = 70.21$, $p > 0.10$) but does negatively predict future costs ($\beta = -32.35$, $p < 0.01$). Table 3 shows more granular results decomposing utility firm revenues into unit sales and rates and firm costs into operating costs likely to be affected by customer satisfaction vs. "other" costs as separate dependent variables. As expected, Table 3 reveals an insignificant relationship between current period satisfaction and following period unit sales ($\beta = 37.76$, $p > 0.10$). In line with regulatory policy, we also find that current period customer satisfaction has no significant effect on future period rates ($\beta = 5.71$, $p > 0.10$). Additionally, the insignificant coefficient for current customer satisfaction on future "other" costs ($\beta = -0.20$, $p > 0.10$) supports our arguments regarding the types of costs that may be unlikely to be affected by satisfaction. However, Table 3 reveals that the effect of a utility firm's current customer satisfaction on its future operating costs (SVOC) is negative and significant ($\beta = -28.93$, $p < 0.001$), providing additional support for our conceptual arguments.

Overall, the empirical analyses reveal a strong preponderance of evidence supporting the conceptual model proposition that customer satisfaction predicts future utility firm profits, and does so not by allowing higher rates, affecting unit demand, or lowering other costs, but by reducing utilities' operating cost to serve customers. Thus, our results show that the only path through which customer satisfaction affects future profits in the utility industry is via lowering operating costs. Since satisfying customers is not costless, our results indicate that for utilities the increased efficiency benefits of customer satisfaction outweigh the costs of providing it.

To provide additional insight into some of the underlying routes by which satisfaction may lead to lower operating costs, we examined supplementary data for the utility firms in our sample. The rationale proposed earlier suggests that customer satisfaction reduces operating costs and enhances employee productivity via lowering customer complaints and service calls and enhancing customer trust and goodwill. To provide insight on some of these potential mechanisms, we first obtained customer complaint data for a subset of 30 firms for 3 years, yielding 90 firm-year observations. In this sub-sample, we find a correlation of -0.30 ($p < 0.05$) between customer satisfaction and complaints, and a correlation of 0.18 ($p < 0.09$) between complaints and these firms' SVOC—both consistent with this aspect of the proposed satisfaction cost-reduction mechanism. Second, we assessed enhanced employee productivity as a mechanism on all 478 firm-year observations, using a stochastic frontier estimation approach (with number of employees as the input and total units of gas/electricity generated as the output) to calibrate employee productivity. These analyses are also consistent with our rationale, revealing that customer satisfaction is a significant positive predictor of utility employee productivity ($\beta = 1.61$, $p < 0.05$). See Appendix 2 for additional details.

To understand which specific operating costs are reduced by enhanced customer satisfaction we also decomposed the operating costs (SVOC) variable into its five components and examined the relationship between satisfaction and each of these costs, using an identification strategy identical to that described earlier. These analyses are summarized in Table 4, and reveal that while the effect of satisfaction is negative for all five operating cost types, it is only statistically significant for three of these costs: distribution costs ($\beta = -7.89$, $p < 0.001$), sales and general expenses ($\beta = -13.54$, $p < 0.01$), and customer service costs ($\beta = -30.19$, $p < 0.001$). The absence of a significant effect of satisfaction on the costs of full-time employee salaries[9] suggests that the productivity gains detailed in Appendix 2 may be the result of enhanced employee engagement and freeing up customer-facing employees to engage in productive tasks that may otherwise not be undertaken, rather than lower full-time employee numbers. The reduced distribution costs and sales and general expenses associated with higher satisfaction are consistent with the earlier arguments linking customer satisfaction with greater

[9] Part-time employee costs are counted by EIA as part of Sales and General Expenses, with which we observe a significant negative relationship with satisfaction—but the part-time employee cost item is not separately reported.

trust and cooperation from customers.

[INSERT TABLE 4 & APPENDIX 2 HERE]

Robustness Checks and Generalizability Assessment

To further establish the robustness of our empirical results, we conducted three additional analyses. First, we rule out the possibility that our results are significantly affected by differences across state-level regulatory regimes. This is a potential concern since the customer satisfaction data in our sample is aggregated to the firm-level, but some utility firms operate across states and therefore can face multiple regulating authorities. Statistically, any such biases or inefficiencies in our analyses should be minimized by the inclusion of firm and year fixed effects in the estimated models. However, to fully rule out such any such effects, we re-estimated the models summarized in Tables 3 and 4 using State-level data from J.D. Power, covering 76 utilities for the period 2012-2017, for a total of 449 firm-year observations. As shown in Appendix 3, the estimates replicate the original findings on the effect of satisfaction on utility firm profits, and provide additional evidence substantiating reduced operating costs as the primary mechanism for the observed relationship.

Second, we rule out the possibility that the effects observed are driven by utility firms' previous investments in customer satisfaction. Our executive interviews and industry reports suggest that the three most important drivers of utility customers' satisfaction are outages, prices, and customer service (e.g., McNamara and Winter 2013; Sullivan et al. 1996). Utility firms may choose to invest in each of these major satisfaction drivers in order to maintain or enhance their performance. Being unable to secure data on the investment costs associated with improving each of these major drivers of their customers' satisfaction—and given that such investments take some time to pay off—we explored the satisfaction-profit relationship using longer time period measures of satisfaction and profits, revealing a more precise effect of satisfaction on profits, net of such investments' costs (amortization) and cumulative effect on satisfaction. Discussions with executives suggested that the longest reasonable lag between making such investments and observing customer satisfaction results was three years. We therefore re-estimated our empirical models using (i) 3-year average satisfaction and profits; and (ii) weighted average (using 25%, 50% and 25% as weights for prior, current, and future year, respectively) satisfaction and profits, using average local Cable TV provider satisfaction to instrument the alternative measures of customer satisfaction. We found that the substantive results remain the same (see Web Appendix Table A1 for details).

Third, while random treatment is the gold-standard to establish causality, no utility firm is likely to allow researchers to manipulate their customers' satisfaction. A next-best approach to demonstrate causality is to identify and leverage a natural or quasi-natural experiment that exogenously impacts utility customer satisfaction. Following this logic, if higher customer satisfaction causes higher utility firm profits by reducing operating costs, then any exogenously determined customer satisfaction should also impact the utility firms' profits and operating costs. From this perspective, it is well-known in the utility industry that some of the variation in customer satisfaction is unrelated to the utility's efforts in delivering quality and efficiency and is instead determined by the demographic make-up of the firm's served customer base (Zarakas, Hanser, and Diep 2013). This is consistent with prior research in other industry contexts (e.g., Mittal and Kamakura 2001). Thus, some proportion of a utility's customer satisfaction is exogenous and cannot be controlled by the firm. Following the logic of our causal rationale, such exogenously determined satisfaction should also predict utility firm profits and operating costs.

We examine the effect of this exogenously determined satisfaction on utility firm profits and operating costs using U.S. Census demographic data to calibrate the exogenous demographic make-up of each utility firm's geographic service area (i.e., served customer base). Specifically, we regress satisfaction on five key demographic variables (income, education, gender, age and race), to estimate the customer satisfaction attributable to the demographic make-up of each utility's served customer base and control for year-fixed effects. By construction, this measure is exogenous to all other variables in our empirical analyses. Next, we re-estimated the firm profits and SVOC model specifications, replacing the original customer satisfaction variable—similar to the 2SLS FE-HAC approach described earlier—with the exogenous demographic-predicted satisfaction. As shown in Appendix 4, we find that although the effect sizes are smaller than those estimated in previous analyses, the effect of this exogenously determined satisfaction on profits remains positive and significant ($\beta = 9.90$, $p < 0.001$), and on operating costs remains negative and significant ($\beta = -9.01$, $p < 0.01$). Since, this exogenously determined customer satisfaction cannot be explained by any firm-related unobserved variable (e.g., management quality, prior investments in technology and equipment that may drive satisfaction, costs, and profits) or by any of the observed variables included in our empirical analyses, and because it temporally precedes the utility firm's observed profits and operating costs, it provides strong evidence for the proposed causal satisfaction-cost-profit relationship.

[INSERT APPENDIX 3 & 4 HERE]

We also conducted sensitivity analyses on our results (see Web Appendix Tables A2 through A5). First, we used ROA in place of profit as an alternate accounting performance measure and results remain essentially identical. Second, we substituted utility firms' total operating costs (i.e., SVOC) with the average operating costs per residential customer as the dependent variable and results remain consistent. We also computed and used the average cost-to-serve all customers using the total combined number of residential, commercial, and industrial customers as the dependent variable and results remained substantively unchanged. Third, to address any concern of potentially biased parameter estimates from a complete case analysis (and to benefit from increased power) we also created an imputed dataset (estimating the values of missing variables) using the multivariate normal model (Little and Rubin 1987). This expanded our data set to a balanced panel of 45 utilities and 582 firm-year observations. We found the substantive results to be unchanged when estimated on the larger imputed dataset.

Having established the robustness of our estimates, we used a post-hoc test to examine the generalizability of our findings. As noted earlier, our sampling framework includes only utility firms operating in “No Choice” States (i.e., regulated monopolies where each customer has only one utility provider in their geographic service area). In our post-hoc analyses, we also include utility firms operating in “Choice States”—U.S. states which have adopted programs that allow consumers to buy from competing retail power suppliers. The augmented sampling framework includes an additional 7 utility firms (for a total of 104 firm-year observations), which we use to estimate differences in the proposed satisfaction-profit effect size, via a dummy indicator that distinguishes between No Choice and Choice States (i.e., dummy indicator, and interaction between satisfaction and the dummy indicator). Our substantive results remain unchanged and we find the interaction coefficient to be non-significant ($\beta = 1.02$, $p > 0.10$), indicating that the effect of satisfaction on utility firm’s profits is positive, significant, and invariant across No Choice and Choice States. Thus, our results are robust to including Choice State utility firms, which is to be expected, since operating costs—the mechanism linking customer satisfaction with profits—are likely to be relatively unaffected by competition.

DISCUSSION AND IMPLICATIONS

In a sample of U.S. public utilities over a long time series our analyses reveal a significant and robust positive relationship between customer satisfaction and firm profits. Consistent with our expectations given the characteristics of the utility industry, our results confirm that satisfaction does not impact utility profits via either rates (prices per unit) or demand (unit sales volume) but provide unambiguous evidence that it does so by reducing utility operating costs. Subsequent analyses of operating cost components and utility complaint and productivity data provide evidence consistent with this efficiency-enhancing benefit of satisfaction being a result of cost savings and employee benefits from dealing with fewer unhappy customers, and greater customer cooperation from enhanced customer goodwill toward and trust in the firm.

Overall, this research contributes to theory in two main ways. First, our findings extend the scope of MBA theory. To-date MBA theory has not considered regulated market settings—which is also true of the broader customer satisfaction literature. Indeed prior research either assumes that customer satisfaction does not matter in such markets (e.g., Jacobson and Mizik 2009) or excludes them as being too idiosyncratic (e.g., Anderson, Fornell, and Mazvancheryl 2004; Morgan and Rego 2006). We provide evidence that MBA theory can be usefully extended to non-competitive settings. Thus, to the extent that satisfaction is an indicator of a firm's customer relationships, we show that this can be a valuable asset even when customers' behavioral loyalty is practically guaranteed. This opens up a theoretically and managerially interesting set of economically important and often high customer-dependency industries to which application of MBA theory can be extended. In addition, the cause of the satisfaction-profit relationship we uncover—reducing the firm's operating costs—is not one that has been conceptually well-developed, and has received little empirically attention. Our results suggest that the largely unexplored efficiency-enhancing benefits of MBAs may be considerable.

Second, we contribute to regulatory economics theory which presumes a misalignment of natural monopoly firm incentives with the interest of their customers leading to such markets being regulated via price-setting, quality standards, and efficiency improvement controls (e.g., Bös 2014; Raith 2003). Our results indicate that as currently regulated via such controls there is still a cost-based incentive for public utilities to deliver and improve their customers' satisfaction. This contributes to regulatory economics theory by identifying an important new mechanism—customer satisfaction reducing utility firm operating costs and thereby enhancing their profits—by which incentives between natural monopolies and their customers are aligned even in the absence of competition. This study also offers strong evidence that current regulatory economic theory assumptions that providing higher service quality raises utility system costs are incorrect, which may change the economic models on which controls selected by regulatory system designers are based (e.g., Perez-Arriaga, Jenkins, and Battle 2017; Tirole 2015).

This research also offers new insights for managers, policy-makers, and regulators. From a managerial perspective, utility managers are uncertain as to whether they should be investing in satisfying their customers, and if so, what the returns may be. Our study clearly indicates that if they are not doing so already, utility managers need to track their customers' satisfaction. They should also set targets for customer satisfaction improvement and invest in strategies designed to accomplish this goal. Our results suggest that doing so will lead to efficiency improvements as a result of lower customer service, distribution, and selling and general administrative costs and ultimately to enhanced profitability. For the average utility in our sample, a one unit (on the 1-100 point ACSI scale) improvement in customer satisfaction may be expected to reduce operating costs by $29 million overall, with contributions of customer service, distribution, and selling and general administrative costs to lowered costs of $3, $8, and $13 million per year, respectively.[10] Given the need for utility firms to reach regulator mandated efficiency goals and the costs and penalties of failing to do so (Makholm 2018), these benefits from customer satisfaction investments should also be calibrated. This will help utility managers budget for investments in customer satisfaction improvement appropriately.

The efficiency gains available from enhancing satisfaction via greater customer trust and goodwill leading to greater acceptance of new technologies introduced by utilities suggested by our results also provides a timely insight for managers. Utilities are currently working on numerous efficiency-enhancing technology initiatives that will require consumer help to introduce and leverage including: advanced meters that allow use of differential rates; smart grids allowing better load balancing; and net metering allowing consumers to contribute energy and storage to the grid (MacGill and Smith 2017). If greater customer satisfaction enhances both consumer willingness to allow utilities to introduce such technologies and subsequent consumer use of them, then utility satisfaction improvement programs should be managed and aligned with their technology initiatives as well as their efficiency programs.

This study also has implications for policy-makers and regulators. The results indicate that—at least as currently regulated—greater satisfaction of utility customers not only ensures consumer welfare by improving utility provider efficiency but also increases the future profitability of the utility. This suggests that incentives between utilities and their customers are aligned in U.S. regulated public utility markets. It is also important to policy-makers charged with protecting consumers that we confirm that increasing customer satisfaction does not enhance the firm's ability to persuade regulators to raise prices or customers to increase demand. For policy-makers these are clearly important findings for those they regulate (utilities), those

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[10] While the samples are different and contain different firm sizes with varying cost breakdowns, this overall dollar amount is comparable to that reported by Lim et al. (2020) with respect to average "cost of convenience" savings.

they seek to protect (consumers), and those they answer to (legislators).

For regulators, information asymmetry and the cost/availability of data used in regulation are key considerations in regulatory system design (Tirole 2015). Ideal incentives drive utilities to behave in ways that benefit customers without raising costs (Makholm 2018; Tirole 2015). Our results show that customer satisfaction—which by definition benefits customers—also allows utilities to reduce costs and enhance efficiency. It is also relatively cheap for utilities to measure. This suggests regulators should both allow investments in customer satisfaction to be recoverable and add customer satisfaction to the mix of regulatory controls applied and require the collection and reporting of satisfaction data. Satisfaction measurement and reporting can easily be standardized (using exemplars such as the ACSI), which will aid benchmarking across utilities. This may also help regulators in their moves towards performance-based regulation where satisfaction may capture drivers of service quality that are not captured in currently used objective driver measures (e.g., service uptime and interruptions).

LIMITATIONS AND FUTURE RESEARCH

A number of limitations should be kept in mind when considering the results of this study, which also present opportunities for future research. First, ACSI surveys measure the satisfaction of consumers but not business customers, thus we could not explore the effects of the satisfaction of utility business customers. Subsequent robustness tests in which we included operating cost to serve business customers as an additional control in our analyses did not change our results. Furthermore, utility firm profits from residential customers is extremely highly correlated with their overall profits (0.96) in our data, suggesting that the managerial implications of our study hold for utility firms. However, whether and how business customer satisfaction and firm profits and operating costs may be connected remains an interesting area for future research.

Second, with detailed and verified cost-data, the utility industry provides a unique context to allow the exploration of the efficiency-enhancing effect of customer satisfaction. We find similar effects when Choice State utilities are included in our generalization testing, and Lim et al.'s (2020) recent findings suggest that these effects generalize within the ACSI sectors. Our results suggest that the efficiency-enhancing benefits of customer satisfaction may arise via reduced customer complaints and employee productivity gains, and enhanced customer trust and goodwill while Lim et al. (2020) identify reduced costs of selling in competitive markets. Clearly, further research is required to more directly examine each of these efficiency-enhancing mechanisms. It is also likely that there are boundary conditions to each mechanism and potentially even trade-offs between them. For example, when customization is an important determinant of perceived quality, does enhancing customer satisfaction reduce rather than improve productivity even if it reduces complaints? Similarly, in "high touch" contexts where customer service requirements are high, do the increased costs of providing satisfaction outweigh the lower costs of dealing with unhappy customers? Exploring such boundary conditions would provide new insights for managers considering strategies for improving customer satisfaction.

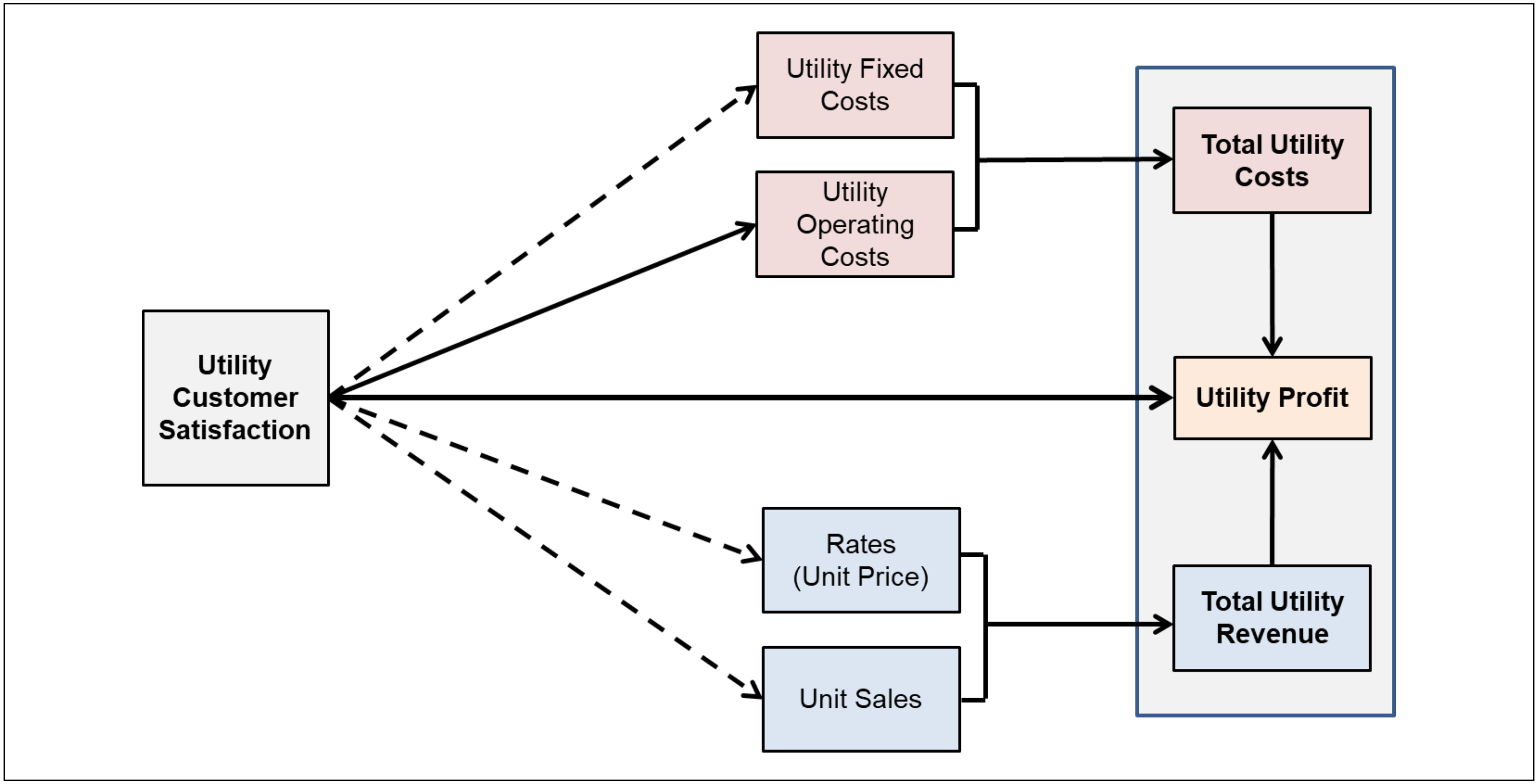
In addition, this study also identifies important new avenues for future research. First, this research reveals the efficiency-enhancing benefit of customer satisfaction as the driver of the relationship between satisfaction and utility firms' profits. This supports Lim et al.'s (2020) recent findings in competitive consumer markets. How economically significant are such efficiency benefits relative to revenue-enhancing benefits under different levels of competition? Do efficiency-enhancing benefits also exist for other MBAs such as brands? Answering these questions may enable managers to more fully account for all of the economic benefits of MBAs to the firm, reducing the likelihood of firm under-investment.

Second, regulatory economics and policy approaches to consumer welfare in natural monopolies focus on price and objective quality. Our results reveal a utility firm-customer interest alignment via customer satisfaction that does not operate through quality (outages) or prices (rates) in regulated public utility markets. How might insights and resulting policy change in other areas if consumer welfare is examined with a focus on subjective customer satisfaction outcomes in addition to price and objective quality? For example, since regulatory mechanisms in uncompetitive markets are costly for governments and firms, could regulatory regimes be lighter (and cheaper) if customer satisfaction were added to the consumer welfare indicators used and could this lead to lower costs and prices without reducing quality?

CONCLUSION

Researchers studying customer satisfaction's impact on firm performance have focused almost exclusively on competitive markets, implicitly—and sometime explicitly—assuming that it is irrelevant in non-competitive markets. Our study of the U.S. utility industry shows that customer satisfaction is a valuable asset even in a regulated monopolistic market. Results revealing customer satisfaction's role in driving firm profits by reducing operating costs also highlight the largely neglected efficiency-enhancing benefit of satisfaction in such markets. Post-hoc analyses are consistent with this efficiency-enhancing effect arising from reducing customer complaints and increasing customer trust and goodwill in ways that lower costs to serve customers and enhance employee productivity. In addition to the new insights provided into where and how satisfaction contributes to firm performance, these results have important implications for utility managers, regulatory economic theory, and regulators.

FIGURE 1
CUSTOMER SATISFACTION PATHWAYS TO UTILITY FIRM PROFITS



Note: *Solid arrows from customer satisfaction indicate likely relationships, dotted arrows indicate less likely possible relationships in a utility context, but all routes to profitability are empirically examined.*

TABLE 1
DESCRIPTIVE STATISTICS AND CORRELATIONS (N=478)

VARIABLE	MEAN	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. *Customer Satisfaction*$_{(t)}$	*73.54*	*4.84*	*1.000*																	
2. *Net Profit*$_{(t)}$	*710.67*	*933.32*	*.075*	*1.000*																
3. *Net Profit*$_{(t+1)}$	*788.28*	*930.90*	*.120*	*.708*	*1.000*															
4. *Sales Revenue*$_{(t)}$	*5030.10*	*865.11*	*.048*	*.379*	*.249*	*1.000*														
5. *Unit Sales Volume*$_{(t)}$	*39.39*	*57.13*	*.017*	*.664*	*.300*	*.897*	*1.000*													
6. *SVOC*$_{(t)}$	*1206.70*	*685.50*	*-.144*	*.149*	*.124*	*.399*	*.498*	*1.000*												
7. *Other Costs*$_{(t)}$	*3501.60*	*1149.71*	*.113*	*.255*	*.157*	*.439*	*.335*	*.647*	*1.000*											
8. *Diversification*$_{(t)}$	*10.97*	*13.38*	*.181*	*-.027*	*-.020*	*-.092*	*-.101*	*-.309*	*-.330*	*1.000*										
9. *Rates*$_{(t)}$	*11.09*	*3.79*	*.093*	*.340*	*.309*	*.160*	*.018*	*.065*	*.029*	*-.138*	*1.000*									
10. *Firm Size*$_{(t)}$	*27414.14*	*14583.10*	*.129*	*.422*	*.352*	*.018*	*.075*	*.605*	*.639*	*-.189*	*.046*	*1.000*								
11. *Outage Index*$_{(t)}$	*2713.11*	*6459.98*	*-.122*	*.189*	*.178*	*.010*	*.010*	*.243*	*.160*	*-.017*	*-.067*	*.183*	*1.000*							
12. *Utility Type Index*$_{(t)}$	*0.17*	*0.38*	*.019*	*.029*	*.027*	*.190*	*.168*	*-.269*	*-.361*	*.029*	*-.617*	*-.029*	*-.044*	*1.000*						
13. *% Caucasian*$_{(t)}$	*75.37*	*9.59*	*.134*	*-.049*	*-.041*	*-.079*	*-.030*	*-.010*	*-.020*	*-.019*	*.018*	*-.022*	*-.025*	*-.004*	*1.000*					
14. *% African American*$_{(t)}$	*13.13*	*7.07*	*-.015*	*.004*	*-.001*	*.038*	*-.240*	*-.222*	*.015*	*.184*	*-.092*	*.044*	*.239*	*-.012*	*-.512*	*1.000*				
15. *Income*$_{(t)}$	*44908.46*	*6141.13*	*-.063*	*.229*	*.280*	*.228*	*.199*	*.341*	*.380*	*.015*	*.099*	*.382*	*.182*	*-.008*	*-.120*	*-.181*	*1.000*			
16. *Education*$_{(t)}$	*25.84*	*5.01*	*-.237*	*.158*	*.147*	*.109*	*.190*	*.030*	*.222*	*.049*	*-.120*	*.209*	*.201*	*-.003*	*-.461*	*-.118*	*.630*	*1.000*		
17. *Gender*$_{(t)}$	*48.88*	*0.59*	*-.105*	*.029*	*.029*	*.019*	*.048*	*.052*	*.026*	*.012*	*.030*	*.029*	*.002*	*.004*	*-.080*	*-.450*	*.291*	*-.097*	*1.000*	
18. *Age*$_{(t)}$	*35.59*	*2.38*	*.125*	*.205*	*.209*	*.159*	*-.131*	*-.301*	*.189*	*-.089*	*.157*	*.180*	*.071*	*.007*	*.090*	*.060*	*.409*	*.190*	*-.028*	*1.000*

Note: *Correlation coefficients larger than |.118| are significant at the p<0.01 level, while those greater than |.090| are significant at the p<0.05 level.*

TABLE 2
EFFECT OF CUSTOMER SATISFACTION ON UTILITY FIRM PROFIT, REVENUES AND COSTS
LOCAL CABLE TV PROVIDERS SATISFACTION AS INSTRUMENT FOR UTILITY SATISFACTION

UNSTANDARDIZED ESTIMATES	***Eq.1A*** ***Profit*** $_{(t+1)}$ ***(Second Stage)***	***Eq.1B*** ***Utility Satisfaction*** $_{(t)}$ ***(First Stage)***	***Eq.2A*** ***Revenues*** $_{(t+1)}$ ***(Second Stage)***	***Eq.2B*** ***Costs*** $_{(t+1)}$ ***(Second Stage)***
MAIN EFFECTS				
$\widehat{Satisfaction}_{(t)}$	*116.04* *		*70.21*	*-32.35* **
	(45.22)		*(102.11)*	*(12.49)*
Cable TV Satisfaction $_{(t)}$		*-0.21* *		
		(0.09)		
CONTROLS				
Rates $_{(t)}$	*81.22* *	*-0.12* *	*5.32* *	*-5.07*
	(32.04)	*(0.06)*	*(2.33)*	*(2.85)*
Firm Size $_{(t)}$	*0.05* ***	*0.19*	*0.43* ***	*0.31* ***
	(0.01)	*(0.16)*	*(0.04)*	*(0.08)*
Diversification $_{(t)}$	*13.10*	*0.08* ***	*12.63* **	*-4.01*
	(5.18)	*(0.02)*	*(4.87)*	*(3.39)*
Utility Type Index $_{(t)}$	*-8.01* **	*0.62*	*2.54*	*-5.90* ***
	(2.77)	*(0.51)*	*(2.97)*	*(1.39)*
Outage Index $_{(t)}$	*-0.01*	*-0.04* ***	*-0.16*	*0.34*
	(0.01)	*(0.00)*	*(0.010)*	*(0.56)*
% Caucasian $_{(t)}$	*0.07*	*0.78**	*0.80*	*-0.35*
	(0.11)	*(0.39)*	*(0.51)*	*(0.40)*
% African American $_{(t)}$	*0.17*	*-0.63* ***	*0.75*	*-0.70*
	(0.13)	*(0.12)*	*(0.55)*	*(0.52)*
Income $_{(t)}$	*-0.02*	*-0.02*	*0.01*	*0.01*
	(0.03)	*(0.03)*	*(0.01)*	*(0.01)*
Education $_{(t)}$	*2.14*	*0.26* ***	*9.95*	*0.26*
	(2.69)	*(0.06)*	*(11.12)*	*(0.43)*
Gender $_{(t)}$	*0.47* **	*0.19*	*0.25*	*-0.14*
	(0.15)	*(0.17)*	*(0.54)*	*(0.19)*
Age $_{(t)}$	*29.66*	*0.23* **	*20.09*	*-10.81*
	(35.33)	*(0.07)*	*(18.91)*	*(15.04)*
TESTS				
First Stage				
Shea Partial R^2		*7.63%*		
Adjusted R^2		*38.78%*		
$F_{(12,489)}$		*177.23* ***		
Anderson LM statistic		*25.68* ***		
Cragg-Donald Wald $F_{(1,489)}$		*28.31* ***		
Stock Yogo Critical F		*10% 16.38*		
		20% 6.86		
		25% 5.79		
Second Stage				
Wald χ^2	*453.89* ***		*Likelihood Ratio* χ^2	
Pseudo- R^2	*79.05%*		*490.40* ***	

Notes: *** *significant at p<0.001;* ** *significant at p<0.01;* * *significant at p<0.05. Standard errors in parentheses. Simultaneous estimation of equations 1A and 1B, and equations 2A, 2B and 1B via two-stage least square (2SLS) with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. Year dummies included.*

TABLE 3
EFFECT OF CUSTOMER SATISFACTION ON UTILITY REVENUES AND COSTS COMPONENTS
LOCAL CABLE TV PROVIDERS SATISFACTION AS INSTRUMENT FOR UTILITY SATISFACTION

UNSTANDARDIZED ESTIMATES	***REVENUES***		***COSTS***	
	Eq.3A ***Unit Sales$_{(t+1)}$***	***Eq.3B*** ***Rates$_{(t+1)}$***	***Eq.3C*** ***SVOC$_{(t+1)}$***	***Eq.3D*** ***Other Costs$_{(t+1)}$***
MAIN EFFECTS				
$\widehat{Satisfaction}_{(t)}$	*37.76*	*5.71*	*-28.93****	*-0.20*
	(47.31)	*(3.14)*	*(5.33)*	*(0.16)*
CONTROLS				
Firm Size$_{(t)}$	*0.02****	*0.02***	*0.03****	*0.05****
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
Diversification$_{(t)}$	*-0.13*	*0.05*	*-0.48*	*0.03*
	(0.19)	*(0.03)*	*(0.83)*	*(0.03)*
Utility Type Index$_{(t)}$	*-0.01*	*0.03*	*1.01*	*-1.92*
	(0.05)	*(0.04)*	*(0.60)*	*(1.10)*
Outage Index$_{(t)}$	*-0.01***	*0.01*	*0.01**	*0.02*
	(0.00)	*(0.01)*	*(0.00)*	*(0.02)*
% Caucasian$_{(t)}$	*0.19*	*0.13*	*-0.26*	*0.50*
	(0.17)	*(0.09)*	*(0.31)*	*(0.31)*
% African American$_{(t)}$	*0.52*	*0.03*	*-0.26*	*0.10*
	(0.41)	*(0.02)*	*(0.30)*	*(0.12)*
Income$_{(t)}$	*-0.01*	*0.09*	*-0.06****	*-0.01***
	(0.01)	*(0.07)*	*(0.01)*	*(0.00)*
Education$_{(t)}$	*-0.89*	*0.03*	*-7.20***	*-4.32****
	(0.54)	*(0.03)*	*(2.21)*	*(1.03)*
Gender$_{(t)}$	*5.77*	*0.11*	*-0.07*	*0.87*
	(7.53)	*(0.09)*	*(0.06)*	*(0.80)*
Age$_{(t)}$	*2.01***	*-0.04*	*-20.28*	*7.19*
	(0.76)	*(0.03)*	*(22.10)*	*(9.54)*
TESTS				
Likelihood Ratio χ^2	*523.65****			

Notes: **** significant at p<0.001; ** significant at p<0.01; * significant at p<0.05. Standard errors in parentheses. Simultaneous estimation of equations 3A, 3B, 3C, 3D and 1B (not shown and excluding Rates$_{(t)}$) via 2SLS with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. Year dummies included.*

TABLE 4
EFFECTS OF CUSTOMER SATISFACTION ON UTILITY OPERATING COSTS COMPONENTS
LOCAL CABLE TV PROVIDERS SATISFACTION AS INSTRUMENT FOR UTILITY SATISFACTION

UNSTANDARDIZED ESTIMATES	*SATISFACTION VARYING OPERATING COST*				
	Eq.4A ***Distribution$_{(t+1)}$***	***Eq.4B*** ***SGE$_{(t+1)}$***	***Eq.4C*** ***Bad Debt$_{(t+1)}$***	***Eq.4D*** ***Salary$_{(t+1)}$***	***Eq.4E*** ***Cust.Service$_{(t+1)}$***
MAIN EFFECTS					
$\widehat{Satisfaction}_{(t)}$	-7.89***	-13.54**	-2.26	-37.38	-30.19***
	(1.13)	(4.90)	(8.13)	(50.19)	(2.56)
CONTROLS					
Firm Size$_{(t)}$	0.01**	0.01***	0.01*	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Diversification$_{(t)}$	-1.32***	-1.06***	-0.09	-7.89**	-0.94***
	(0.20)	(0.21)	(0.20)	(2.52)	(0.20)
Utility Type Index$_{(t)}$	2.54	-2.11	-0.07*	-4.00	-3.04
	(4.20)	(4.39)	(0.03)	(3.43)	(6.09)
Outage Index$_{(t)}$	0.01**	0.01	0.01**	0.01**	0.01
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
% Caucasian$_{(t)}$	-1.40**	-0.73**	-0.20***	-11.88**	-0.57**
	(0.51)	(0.24)	(0.03)	(3.72)	(0.20)
% African American$_{(t)}$	-1.64*	-1.17**	-0.03	-9.31***	-2.40**
	(0.78)	(0.38)	(0.02)	(2.06)	(0.87)
Income$_{(t)}$	0.01**	0.01	-0.01***	0.02	-0.01
	(0.00)	(0.01)	(0.00)	(0.02)	(0.02)
Education$_{(t)}$	4.09***	2.30***	-0.23***	11.20	-0.79
	(0.89)	(0.48)	(0.05)	(9.98)	(1.02)
Gender$_{(t)}$	-0.08***	-0.04	-0.09	-0.06	-0.10
	(0.01)	(0.03)	(0.10)	(0.10)	(0.07)
Age$_{(t)}$	-2.81	-1.29	-0.41*	-1.42	-3.25*
	(1.71)	(0.98)	(0.19)	(1.31)	(1.55)
TESTS					
Likelihood Ratio χ^2	1,210.98***				

***Notes**: *** significant at $p<0.001$; ** significant at $p<0.01$; * significant at $p<0.05$. Standard errors in parentheses. Simultaneous estimation of equations 4A, 4B, 4C, 4D, 4E and 1B (not shown and excluding Rates$_{(t)}$) via 2SLS with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. Year dummies included.*

Appendix 1
Variables and Measurement Details

MAIN VARIABLES	*SOURCE/LITERATURE*
Utility Customer Satisfaction Firm-level latent variable capturing customers cumulative satisfaction with their product/service consumption experience from an annual national representative sample of 65,000+ consumers, from 200+ U.S. firms.	*ACSI* *Fornell et al. (1996)*
Profit Net operating income from the utility's regulated business for residential accounts only, measured as the difference between net operating revenue (item UOPEREUCO for electricity firms and UOPRGWR for gas firms) and net operating expense (item UOPEXE for electric firms and UOPEXGW for gas firms).	*EIA*
Satisfaction Varying Operating Costs (SVOC) Total of utility firm's reported total operating expenses incurred in serving residential customer accounts related to (a) Distribution Expenses (b) Customer Service (c) Bad Debt (d) Employee Salaries, and (e) Sales and General Expense Costs (Items UOPED, UOPECENC, USW, UOPECA and UOPEAG)	*EIA* *Turney and Stratton (1992)*
SVOC per Customer Variable operating costs per residential customer was operationalized as the ratio of total variable operating costs (as above) to the number of residential customers served by the utility.	
Other Costs Total of utility firm's reported total operating expenses incurred in serving residential customer accounts related to (a) Fuel Costs (b) Production Costs (c) Depreciation and (d) Maintenance (Items UFCOSTT, UEPPEXP, UXDPE and UMEE)	*EIA*
Unit Sales Volume (in MwH units) The utility firm's reported total unit sales in Mega Watt-hours (item USALEEUC for electricity suppliers) and in million Btu (item USALEGWUC for gas suppliers) for residential customers only. Btu was converted to MwH using the formula 1 Btu = $2.93X10^{-7}$ MwH to obtain equivalent units.	*EIA*
Sales Revenue (in $) The utility firm's reported total revenue from residential customer sales only (item UOPRER).	*EIA*
Rates Average annual rates (prices paid) per unit of power consumed by the utility's residential customers, obtained from Form 826 EIA Survey (item code UAVGAREB).	*EIA*
Local Cable TV Provider Customer Satisfaction Instrument Average satisfaction with all cable providers operating in the State(s) served by the utility using firm-level ACSI measures capturing customer satisfaction with Cable TV service providers, weighted by the Cable TV provider's market penetration in the state(s) in which the utility's customers reside computed as: *Avg. cable TV satisfaction for State x = customer share of cable TV provider 1 * satisfaction of provider 1 + customer share of cable TV company 2 * satisfaction of provider 2 + … + customer share of cable TV company k * satisfaction of provider k + customer share of all other cable TV providers * satisfaction of all other providers.* Where *1* through *k* represent the major cable TV providers operating in that State for a specific year, and all other cable TV providers is the ACSI "All Others" score (an aggregate of customers interviewed who are served by one of the large number of small cable TV providers within the industry) which captures the satisfaction of customers served by all smaller cable TV providers.	*ACSI and Broadcasting and Cable Yearbook.*

APPENDIX 1
VARIABLES AND MEASUREMENT DETAILS (CONTINUED…)

FIRM-LEVEL CONTROLS	***SOURCE/LITERATURE***
Outage Index A multiplied index consisting of the number of residential customers affected by outages per firm-per year as a control variable, the number of outages and the duration of time to service the outage and re-secure power supply all of which were obtained from form OE-417 reported by FERC.	*FERC*
Utility Type Index The percentage revenue that the firm earns from sales of *electricity* vs. *gas*	*EIA*
Diversification Percentage of the firm's total revenue obtained from operations in other (unregulated) industries. The amount of revenue earned by a firm from operating in a segment with a different 4 digit SIC code was captured and the industry group was manually checked to ensure it is unregulated as well as not representing a supplementary operation but a substantially different one. This distinction is important since for example, for a gas supplier, sourcing and transmitting gas would be listed under separate 4 digit SIC codes though they are central to the same service provision.	*COMPUSTAT Segments* *Johnson, Hoskisson, and Hitt (1993)*
Firm Size The firm's reported total assets (item AT).	*COMPUSTAT Fundamentals*

CUSTOMER-LEVEL CONTROLS	***SOURCE/LITERATURE***
Demographic Controls State level demographic data on age, sex, household income, race, and education was obtained from the U.S. Census (U.S. Census Bureau 1990-2010). Since some of the utility firms in our sample operate in regions in multiple States, a weighted average of each demographic variable was used where the weights were assigned in proportion to the revenue earned by the firm in each State. For example, if firm A earned revenue amounts x and y from States X and Y respectively, each demographic from State X would be multiplied by the weight x / (x + y) and each demographic from State Y would be multiplied by the weight y/ (x + y) to generate the composite weighted demographic. The State-level revenue figures were obtained from COMPUSTAT Segments (State).	*US Census* *COMPUSTAT Segments*

APPENDIX 2
EFFECT OF CUSTOMER SATISFACTION ON UTILITY FIRM EMPLOYEE PRODUCTIVITY

UNSTANDARDIZED ESTIMATES	$\textbf{\textit{Productivity}}_{(t+1)}$
MAIN EFFECTS	
$\widehat{Satisfaction}_{(t)}$	*1.61*[*]
	(0.77)
CONTROLS	
Firm Size$_{(t)}$	*0.01*[***]
	(0.00)
Diversification$_{(t)}$	*0.10*
	(0.21)
Utility Type Index$_{(t)}$	*0.13*
	(0.18)
Outage Index$_{(t)}$	*-0.01*
	(0.01)
TESTS	
Wald χ^2	*1,158.30*[***]

Notes: **** significant at p<0.001; ** significant at p<0.01; * significant at p<0.05. Standard errors in parentheses. Simultaneous estimation of Productivity and modified version of 1B equations (not shown) via 2SLS with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. Demographics excluded for parsimony. Year dummies included.*

APPENDIX 3
EFFECT OF CUSTOMER SATISFACTION ON UTILITY PROFIT COMPONENTS
STATE-LEVEL J.D. POWER DATA

UNSTANDARDIZED ESTIMATES	***PROFITS, REVENUES AND COSTS***				
	Profits(t+1)	***Unit Sales (t+1)***	***Rates(t+1)***	***SVOC(t+1)***	***Other Costs(t+1)***
MAIN EFFECTS					
$\widehat{Satisfaction}^{JDPA}_{(t)}$	*3.93****	*-0.71*	*0.05*	*-9.15****	*-2.10*
	(1.14)	*(0.54))*	*(0.08)*	*(1.19)*	*(1.08)*
CONTROLS					
Firm Size(t)	*0.03****	*0.05****	*0.02***	*0.16****	*0.15****
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.03)*
Diversification(t)	*-0.01*	*-0.90***	*0.02*	*-0.15*	*0.05*
	(0.01)	*(0.30)*	*(0.05)*	*(0.71)*	*(0.04)*
Utility Type Index(t)	*-0.78*	*-0.34*	*0.02*	*1.25**	*1.64*
	(0.52)	*(1.23)*	*(0.03)*	*(0.51)*	*(1.62)*
Outage Index(t)	*0.02*	*-0.12***	*-0.01*	*0.13**	*0.04*
	(0.02)	*(0.05)*	*(0.01)*	*(0.06)*	*(0.07)*
TESTS					
Likelihood Ratio χ^2	*472.33****	*1,362.74****			

Notes: **** significant at p<0.001; ** significant at p<0.01; * significant at p<0.05. Standard errors in parentheses. Simultaneous estimation of Profits and modified version of 1B equations (not shown and excluding demographics), and Revenues, Costs and modified version of 1B equations (not show and excluding demographics), via 2SLS with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. J.D. Power data used to address potential state-level differences. Year and state dummies included. Demographics excluded due to collinearity with State dummies.*

APPENDIX 4
EFFECT OF DEMOGRAPHIC-DETERMINED EXOGENOUS SATISFACTION ON UTILITY FIRM PROFITS AND OPERATING COSTS

UNSTANDARDIZED ESTIMATES	***Profit(t+1)***	***SVOC(t+1)***
MAIN EFFECTS		
$\widehat{Satisfaction}^{EXOGENOUS}_{(t)}$	*9.90******	*-9.01****
	(1.02)	*(2.86)*
CONTROLS		
Firm Size(t)	*0.05******	*-0.01**
	(0.00)	*(0.00)*
Rates(t)	*10.24****	*30.14******
	(3.66)	*(5.65)*
Outage Index(t)	*-0.01****	*0.01**
	(0.00)	*(0.01)*
Diversification(t)	*0.67*	*-5.13*
	(1.12)	*(4.00)*
TESTS		
Wald χ^2	*564.31******	*325.14******

Notes: **** significant at p<0.001; ** significant at p<0.01; * significant at p<0.05. Standard errors in parentheses. $Satisfaction_{(t)}^{EXOGENOUS}$ is an alternative instrument, estimated as the variance explained in customer satisfaction by residential customer demographics, in a first-stage model, and used to instrument second-stage equations reported. Simultaneous estimation of Profits and SVOC equations and modified version of 1B equation (not show and excluding demographics), via 2SLS with fixed-effects and heteroskedasticity and autocorrelation consistent (FE-HAC) standard errors. Year dummies included. Demographics used to calibrate the alternative instrument and excluded from Profits and SVOC equations.*

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