Regulatory behaviour under threat of court reversal

Magnus Söderberg a, Flavio Menezes b and Miguel Santolino c

a CERNA, Mines ParisTech, 60 Boulevard St Michel, 75006 Paris, FRANCE.
Tel: +33 (0)1 4051 9091; Fax: +33 (0)1 4051 9145; E-mail: magnus.soderberg@mines-paristech.fr

b School of Economics, University of Queensland, St Lucia, Qld 4072, AUSTRALIA.
Email: f.menezes@uq.edu.au

c Riskcenter-IREA, Department of Econometrics, University of Barcelona, Avda. Diagonal, 690, 08034
Barcelona, SPAIN. E-mail: msantolino@ub.edu

25 November 2012

ABSTRACT
This paper investigates the review processes when customers have complained about conditions proposed by a monopolistic firm. This is accomplished by first developing a theoretical model that considers two possible types of regulators: one who only cares about her career and one who cares about both her career and consumer surplus. When the regulator is only concerned with her career, it is predicted that, under certain conditions, a larger number of decisions will be overturned by the appellate court in more complex cases than in less complex cases. The model also predicts that when the regulator cares about both her career and consumer surplus, less complex cases will be associated with more appeals by regulated firms, but fewer decisions will be overturned and prices will be lower. As the complexity of cases increases, the model predicts a switch to more appeals by consumers, more decisions being overturned and higher prices on average. Our empirical analysis based on 409 customer complaints from the Swedish electricity market largely confirms these theory predictions. As an empirical innovation we suggest that the level of bureaucratic effort is measured as the positive disturbance term in a stochastic frontier model.

Key words: regulation, effort, complexity

JEL Classifications: K41, C34
1. INTRODUCTION

The global reform of network industries (e.g. electricity, gas, telecommunications and rail) in the last few decades of the 20th century was characterised by an unbundling of the competitive and natural monopoly components of these industries. While new markets emerged in competitive segments, such as gas production and electricity generation, the natural monopoly segments of these industries were reregulated. This process was followed by large privatisation efforts and corporatisation of publicly owned enterprises. Importantly, price setting in the newly reregulated sectors by an independent regulator replaced an opaque system where prices were set by the government and sometimes by the government-owned institutions providing the service. These changes led to outcomes in network industries becoming increasingly reliant on regulatory and bureaucratic decisions. As a result, the two primary tasks performed by regulators today are rate reviews (i.e., price setting) and the resolution of customer complaints.

Previous studies on regulatory outcomes have almost exclusively focused on rate reviews, often by state regulators in the US where the regulated firms (but not the customers) can appeal the regulators’ decisions. The focus on rate reviews ignores an important aspect of how regulators influence market behaviour through complaint management. This may be a serious omission, since rate reviews and customer complaints have fundamentally different implications and in contrast to rate reviews, both the consumer and the firm can often appeal the outcome of a dispute. More specifically, the relative stakes involved for firms and customers are different for rate reviews and complaints. A small adjustment of the rates will have a substantial effect on the firm’s financial status, whereas it will affect the average customer’s budget only marginally. The opposite situation applies for many customer complaints. This suggests that regulators’ incentives and preferences may vary depending on whether they undertake a rate review or handle a customer’s complaint.

---

1 A simple indication of this is the rapid increase in the number of regulatory agencies witnessed in recent years. See Jordana et al. (2011) for details.

2 Note that the ‘regulator’ is defined broadly here. Sometimes rate reviews and customer complaints are handled by different agencies. E.g. in Australia, Germany, Spain and the U.K., the electricity regulator deals with rate reviews and Ombudsmen with complaints. In the Scandinavian countries and in the US the electricity regulator deals with both tasks. However, this difference is irrelevant for the analyses in this paper as long as regulatory dispute resolutions can be appealed.

3 Examples of studies based on US data include DeFigueiredo and Edwards (2007), Davis and Muehlegger (2010), and Knittel (2003). With the increasingly availability of data elsewhere, there is a new body of literature evaluating regulatory decisions outside the US. See, for example, Breunig and Menezes (2012) and Breunig, Hornby, Menezes and Stacey (2006) for Australia, Silva (2011) for Brazil, and Smyth and Söderberg (2010) for Sweden.
In this vein, Prendergast (2007) shows that when a bureaucratic mistake is causing relative harm to consumers (such as when the consumer’s stake is higher), bureaucrats will adopt pro-consumer preferences. In a situation in which a mistake results in relative benefit to the consumer, the bureaucrat will instead adopt more pro-firm preferences. This reasoning suggests that regulators responsible for reviews (complaints) might have preferences that are relatively pro-firm (pro-consumer).4

The regulator’s objectives and decision making are key considerations in our approach and we emphasis two specific features. First, we consider regulatory effort to be endogenous. One of the fundamental premises of the principal-agent literature is that there is a complex relationship between the choice of effort, the cost of effort and outcomes.5 While this is well established in the theoretical literature, previous empirical investigations of regulatory behaviour have assumed that the choice of effort is exogenous. In this paper, we take advantage of a unique and rich dataset representing customer disputes in the Swedish electricity market to incorporate an innovative measure of regulatory effort in explaining regulatory decisions. More specifically, we use a stochastic frontier methodology where we interpret the strictly positive disturbance term as a measure of effort. This analytical framework allows us to disentangle the unobserved level of effort from other unobserved factors and to determine what exogenous factors have an influence on effort.

The second feature of our approach is the consideration of the regulator’s objective(s). In addition to the pigovian notion that bureaucrats work in the best interest of the public, economic theory has suggested alternative motivations for the regulator, such as to maximise the size of the agency (Niskanen, 1971) or the possibility that they are captured by an interest group (Stigler, 1971).6 The more contemporary literature suggests that both legal and bureaucratic decisions can be explained by decision makers’ willingness to avoid errors (Daughety and Reinganum, 1999; Heiner, 1986; Leaver, 2009; Shavell, 2006) and that bureaucrats are influenced by their own or some higher level institution’s ideological preferences, such as that of an appointing or legislative institution (see Hauge

---

4 Smyth and Söderberg (2010) found that the Swedish electricity regulator generally had pro-consumer preferences when it resolved customer complaints.
5 See, for example, the seminal work of Laffont and Martimort (2002) for a broad exploration of the principal-agent literature and Laffont and Tirole (1993) for its application in the context of rate setting.
6 In this tradition, Ross (1984) develops a model where the regulator maximises a weighted combination of producer and consumer surplus. Valentini (2006) extends this model by relaxing the assumption of a perfectly informed regulator when utilities are subject to price-caps. Macher and Mayo (2012) have recently extended the capture theory by linking the degree of firm influence to wider firm, industry and country specific characteristics.
et al., 2012; Guerriero, 2006; Innes and Mitra, 2011, Menezes and Roessler, 2010). These views have been justified by the desire of individuals to keep their jobs, advance in their career or, more generally, protect their reputation (Hilton, 1972; Berry, 1984; Leaver, 2009; Levy, 2005; Eckert, 1981).

We build on these two features by constructing a model in which both customers and utilities can appeal regulatory decisions. In our benchmark model, we assume that regulators only care about their careers. This implies that they will make decisions in order to minimise the likelihood that any mistakes will be exposed. The possibility of regulatory mistakes being explicitly exposed to review is a novel feature of our analysis and follows from the setting we invoke, where both the customers and the regulated firms can appeal the regulator’s decisions. We then consider a second type of regulator, who cares about both error minimisation and consumer surplus.

We argue that a regulator’s type is determined by the amount of experience they have in resolving disputes. When the regulator first starts resolving disputes, we assume that they only care about their careers. This assumption rests on the view that when regulators have relatively limited experience, reversals are more likely to be explained by a lack of knowledge and/or ability compared to when the regulators are more experienced. Hence, this view implies that experienced regulators enjoy more freedom in their decision making activities. As a consequence, we claim that experienced regulators will pursue a mixture of objectives, including both error minimisation and consumer surplus. The regulator’s focus on consumer surplus (rather than, for example, total welfare) is motivated by Prendergast’s (2007) model of bureaucratic bias. Regulators’ tendency to develop stronger pro-consumer preferences as their experience increases has been confirmed empirically by Garside et al. (forthcoming) in the context of UK competition law.

The possibility of a mistake arises from the existence of asymmetric information; the regulated firm knows its true cost, but the regulator only knows the distribution from which the cost is generated. The regulator can discover the firm’s true cost by exerting costly effort. Once the regulator has chosen their level of effort, they then decide what price to set. At this stage, both the customer and the firm may appeal to an administrative court under different scenarios. For example, a regulated firm will not

---

7 Candeub and Brown (2008) find that regulators’ idiosyncratic preferences are more determinative than ideological preferences.
8 A regulator who makes mistakes will find it more difficult to be reappointed or to secure career progressions.
9 In Section 3.1.1 we provide support for a link between experience and type of objective(s) using descriptive statistics. This descriptive finding uses our theoretical result that a combination of objectives (error minimisation and consumer surplus) leads to higher reversal rate.
appeal when a high price is set, and similarly, a consumer will not appeal when a low price is set but may appeal otherwise. Finally, we assume that the court uncovers the firm’s true cost. This is of course an oversimplification but results will hold true as long as the court has a sufficiently high probability of uncovering the firm’s true cost.

This theoretical framework allows us to make a number of testable predictions that will depend on the regulator’s preferences. Specifically, when the regulator is only concerned about her career, we show that, under certain conditions, a larger number of decisions will be overturned by the court when cases are more complex (i.e., cases requiring more effort from the regulator to make the ‘right’ decision) than in situations in which the case is less complex. We also show that when the regulator cares about both her career and consumer surplus, less complex cases will be associated with more appeals by regulated firms, but fewer decisions will be overturned and prices will be lower. As the complexity of the case increases, we predict a switch to more appeals by consumers, more decisions being overturned and higher prices on average. Moreover, regulators who care about both their careers and consumer surplus will exert less effort when cases become more complex. This emerges as, in equilibrium, parties recognise the link between complexity, choice of effort and outcomes. These theoretical predictions are generally confirmed in our empirical analysis.

The framework outlined above is related to that of Leaver (2009), who argues that regulators genuinely try to make good decisions but that they also care about their reputation and want to avoid being caught making mistakes. However, a pro-consumer regulator is unlikely to emerge in this model, since a regulatory mistake can only be detected by the firm and a rate increase has a much higher effect on the firm’s budget than on the average customer’s budget; naturally, the regulator will tend to ensure they err on the side of the firm. Accordingly, Leaver (2009) finds that regulated firms receive undue favours. The assumption that the regulator cares about its reputation is similar to our model, but the conditions under which the regulator operates are distinct. Moreover, our theoretical predictions are distinct from Leaver’s (2009), as we elaborate in Section 2.

Our model can additionally be related to judicial decision models or, more specifically, to models based on first-stage trial/district court judges subject to the threat of review by an appellate court. Shavell (2004, 1995) emphasises that first-stage judges want to avoid having their decisions reversed and that they can increase the accuracy of their decisions by exerting more effort. In our model, the focus is on how the regulator’s decision and their choice of effort is influenced by the possibility of appeal when there exists different regulatory objectives.
The paper proceeds as follows. Section 2 presents a simple model that highlights the role of regulatory preferences in identifying the interrelations between effort, the cost of effort and the decision outcome. Section 3 describes the regulatory setting in the Swedish electricity sector. Section 4 contains our empirical investigation and Section 5 concludes.

2. A THEORY OF REGULATORY BEHAVIOUR UNDER COURT ENFORCEMENT

We assume there are two types of firms (utilities) that differ based on unitised costs: high cost \( c_H \) and low cost \( c_L \). The fraction of \( c_H \) firms in the population is equal to \( q \), whereas the fraction of \( c_L \) firms is equal to \( 1 - q \). We assume the following sequence of events. A utility sets the price to charge the consumer either at \( c_L \) or at \( c_H \). If the price is set to \( c_H \), we assume that the consumer complains to the regulator,\(^{10}\) otherwise there are no further developments. Consumer demand is equal to 1 at a price less than or equal to \( c_H \), and 0 otherwise.

When the regulator receives a complaint, it has to determine a regulated price, \( p^R \). We assume that the regulator does not know the utility’s true cost, but they can find out the true cost by exerting some effort. Denote effort by \( E = \{0, \varepsilon\} \). If the regulator exerts effort \( \varepsilon > 0 \), they fully learn the true cost of the firm. Let the cost of effort be given by \( C(E) = \varepsilon \). By exerting 0 effort, the regulator assumes that any low cost utility will pretend to be a high cost. More precisely, if the regulator exerts 0 effort, then all they know is that the utility’s true cost is \( c_H \) with probability \( q \).

Once the regulator has chosen their level of effort, they then decide what price to set. We assume that when they set \( p^R = c_H \), the consumer appeals to the court with probability \( \gamma \), and when the regulator sets \( p^R = c_L \), a high cost utility appeals to the court with probability \( \delta \), where \( \delta < \gamma \).\(^{11}\) It should be

\(^{10}\) Note that we could assume the decision is probabilistic, but it will simply complicate matters without providing any additional insight.

\(^{11}\) This assumption captures the notion that while the interaction of the consumer with the court is a one-off, the regulated company’s relationship with the court and the regulator is more complex, because it takes the form of a repeated game. Frequent appeals might tarnish a regulated company’s reputation—especially if the outcome of the appeal is unfavourable. This naturally results in regulated firms being more cautious when deciding to appeal. There are also costs associated with appealing and, in reality, there is some uncertainty about the court’s decision that is not considered in this model. This relationship is also expected based on Priest and Klein (1984),
noted that while there are no explicit appeal costs imposed on either consumers or the utility in the model, the fact that both $\delta$ and $\gamma$ can take values less than 1 could conceivably capture such costs. Finally, and as indicated earlier, we assume that the court will uncover the true cost of the utility.

2.1 Benchmark model

Initially, we consider a regulator who is self-interested; that is, their only concern is that the court does not overturn their decision. We argue that this self-interest arises from their career concerns (later we will introduce a regulator who also cares about consumer surplus). Here, we assume that the utility of the regulator when a decision is not overturned by the court is $U > 0$, and when their decision is overturned, their utility is equal to $-\Gamma < 0$. Proposition 1 summarises the regulator’s decision in this setting.

**Proposition 1.** Suppose

$$\frac{q}{1-q} > \frac{\gamma}{\delta}. \quad (1)$$

That is, the ‘hazard rate’ is greater than the ratio of the probability of appeal by the consumer to that of the utility. Then for sufficiently high cost of effort, or more specifically, if $\varepsilon > \gamma(1-q)[U + \Gamma]$, the regulator always chooses 0 level of effort and sets $p^R = c_H$. If $\varepsilon < \gamma(1-q)[U + \Gamma]$, then the regulator always chooses $p^R = c_L$ and $E = \varepsilon$.

**Proof.** See Appendix 1.

Condition (1) is plausible since we show in Section 3 that $\frac{q}{1-q}$ (i.e. the share of high cost firms) can be considered large in our empirical setting. The following corollary follows in a straightforward manner from Proposition 1 and provides some novel propositions that will later be tested using our data on regulatory and court decisions from the Swedish electricity market.

since consumers have higher stakes than utilities. This assumption is about the probability of appeal given a particular regulatory decision, whereas the summary data described in Table 1 is unconditional on the decisions. This assumption is borne out by the data as described in Table 5 in Section 4.4 (at least for medium and high levels of effort).
Corollary 2. When a regulator is only concerned about her career and (1) holds, for a sufficiently high cost of effort (i.e., in more complex cases), Proposition 1 implies that more decisions will be overturned by the court than in the case of less complex cases.

2.2 An alternative objective for the regulator

We now consider an alternative type of regulator who cares about both their career and the level of consumer surplus. In this setting, consumer surplus is simply equal to the difference between the consumer’s valuation and the cost of service provision. Proposition 3 establishes that, with this type of regulator, we should observe more appeals by the regulated firm and a larger number of overturned decisions. In addition, such a regulator will choose a lower regulated price than a regulator who cares only about their career.

Proposition 3. Suppose that

\[
\bar{U} > \Gamma + \frac{(1-q)(1-\gamma)(c_H - c_L)}{-(1-q)\gamma + \delta q}.
\]

Then, under the assumptions of the model, a low cost of effort will be associated with more appeals by the regulated firms but less decisions being overturned and lower prices. Conversely, as the cost of effort increases, we predict a switch to more appeals by consumers, more decisions being overturned and higher prices on average.

Proof. See Appendix 1.

Condition (2) is likely to hold when the disutility cost for the regulator is low and when the probability that utilities appeal is high. Proposition 3 suggests that as the cost of effort increases (for example, in more complicated cases), the regulator switches to 0 effort and sets \( p^R = c_H \). Thus, we predict that less complex cases will be associated with more appeals by regulated firms but less decisions being overturned and lower prices. Conversely, as the complexity of the case increases, we predict a switch to more appeals by consumers, more decisions being overturned and higher prices on average. The following corollary follows in a straightforward manner from this analysis.
Corollary 4. Suppose $\overline{U} < \frac{1-\delta}{\delta} (c_H - c_L) - \Gamma$ and condition (2) are both satisfied. Then, whenever positive effort is exerted, the regulator sets $p^R = c_L$ independently of the realisation of costs. This will lead to the court overturning the regulator’s decision upon an appeal by the regulated firm, but no appeals will be made by consumers. It is more likely that $\overline{U} < \frac{1-\delta}{\delta} (c_H - c_L) - \Gamma$ and condition (2) are both satisfied when the disutility cost of reversal is low.

3. CUSTOMER COMPLAINTS IN THE SWEDISH ELECTRICITY SECTOR

In the Swedish electricity distribution sector, customers can file complaints to the regulator regarding the contract conditions determined by local monopolistic utilities. Based on its investigations, the regulator either confirms the conditions in full or withholds a proportion of the utility’s ‘benefits’—for example, the price when the contract concerns a monetary transfer. Either the customer or the utility can appeal the regulator’s decision to the County Administrative Court (the ‘court’). The court then decides whether to confirm the amount determined by the regulator, or to change it in favour of the appealing agent. Here, we focus solely on connection disputes that arise when customers complain about the price quoted by utilities for establishing a new connection to the existing network. Focusing on one type of dispute reduces the need to consider case type heterogeneity.12

In this setting, the regulator is the individual who is responsible for making the final decision about the amount the utility is allowed to charge the customer. This individual is a civil servant employed by the Swedish Energy Markets Inspectorate (EMI) and appointed by the Director General (DG) to resolve disputes. There are several individuals that can serve as regulators at any given point in time, and Smyth and Söderberg (2010) found that regulators that decide against consumers face a higher probability of being replaced.13 This is consistent with the arguments presented in Section 2, where we argued that regulators are inclined to develop a pro-consumer attitude when resolving disputes. It should also be noted that, while the DG is appointed by the national parliament, they have no official party or ideological affiliation and, likewise, there are no clear ideological influences in appointing or replacing the regulators. This suggests that an ideological dimension in the regulator’s decision making may not be central in the cases we consider. This is in contrast to Hauge et al. (2012),

---

12 In this study, we distinguish between two different connection types: 1) connection of mobile antennas and 2) connection of residential/industry properties.

13 Smyth and Söderberg (2010) studied what factors influence the DG’s decisions to replace regulators when resolving disputes.
Guerriero (2006) and Innes and Mitra (2011) who examine in detail the effect of the regulator’s ideological preferences on decisions.

3.1 Data

We use information on decisions related to connection disputes made by the regulator from 2002 to 2009, providing a total of 409 observations. The majority of the decisions were made during 2007 to 2009, with only 29 decisions being made between 2002 and 2006. The regulator withheld a proportion of the utilities’ claims in as many as 81 per cent of the complaints raised by customers. The average ratio between the amount awarded by the regulator \( (p^R) \), and the utility’s claim \( (p^U) \) is 0.708, indicating a noticeable effect being made by the regulator. Table 1 shows that customers have appealed 23 per cent of the regulator’s decisions, while utilities have appealed 38 per cent, resulting in well over half of the regulator’s decisions being appealed to the court. Not only do utilities appeal more, they also appear to be more successful in court, with 26 per cent of their appeals being reversed in their favour. The corresponding number for customers is 16 per cent. When customers appeal, the court sets its average amount to \( P^C = 0.96P^R \), and when the utilities appeal, it sets its average price to \( P^C = 1.09P^R \).

<table>
<thead>
<tr>
<th></th>
<th>Share of all regulatory decisions appealed</th>
<th>Prob. court changes regulator’s decision conditioned on appeal</th>
<th>Ratio of court’s and regulator’s amounts conditioned on appeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appeals made by customers</td>
<td>0.227</td>
<td>0.161</td>
<td>0.959</td>
</tr>
<tr>
<td>Appeals made by utilities</td>
<td>0.384</td>
<td>0.261</td>
<td>1.093</td>
</tr>
<tr>
<td>All appeals</td>
<td>0.611</td>
<td>0.224</td>
<td>1.043</td>
</tr>
</tbody>
</table>

Sample: 409 complaints filed by customers.

3.1.1 Regulator types

A key claim in this paper is that regulators who are relatively inexperienced only care about error minimisation, whereas more experienced regulators care about both error minimisation and consumer surplus. One of the predictions found in Section 2 is that when regulators become more experienced and start caring about both errors and consumer surplus, the court will reverse a larger share of their decisions.

---

14 Excluding those 29 decisions does not change any of the qualitative conclusions presented in this paper.

15 This data does not contradict our assumption that the probability of appeal by high cost utilities is lower than the probability of appeal by consumers who respond to a high price. The data simply reflects that the real-world probability of appeal by all firms is greater than the probability of appeal by all consumers.
decisions. To scrutinise this claim empirically, it is necessary to have some prior knowledge of when a regulator can be considered ‘experienced’. The simplest approach would be to assume a linear relationship between experience and the number of decisions made (or a similar variable, like time since first decisions). However, the assumption that experience increases at a constant rate is strong and, in addition, our theoretical model is based on comparing two distinct states: regulators that are inexperienced and those that are well experienced. Graphical representations of the relationship between the share of court reversal and the number of decisions made by the regulator can provide an indication as to whether the relationship is in fact positive, as we claim in our theoretical model, and help guide the empirical classification of regulators by type.

Figure 1a shows the share of regulatory decisions reversed by the court as a function of the total number of decisions made by each of the nine regulators during the sample period. The relationship does indeed appear to be positive and non-linear with a structure break around 50 decisions. One regulator has conducted substantially more decisions than all other regulators (over 300 decisions, which can be compared to approximately 75 decisions for the regulator with the second highest amount). While the functional form of the relationship appears to be sensitive to whether this regulator is included or not, the relationship is always positive. Apart from this outlier, Figure 1a suffers from not being able to separate experience from regulator fixed effects. In Figure 1b, we plot the same relationship but examine the share of regulatory decisions being reversed when the regulators have made 1 to 25 decisions, 26 to 50 decisions, and so on, up until 200, where we use 50 classes (201 to 250 and 251 to 300). Keeping in mind that all observations above 75 decisions have been generated by one individual, Figure 1b also shows a positive relationship with a structural break around 100 decisions.

In order to avoid a classification based on the behaviour of one regulator, we set the threshold between ‘inexperience’ and ‘experience’ at 50 decisions. Hence, we define a regulator who only cares about her career as someone who has been responsible for less than 50 decisions. This means that two regulators will be included in the sub-sample where the regulator cares about both her career and consumer surplus. In the empirical section, we indicate whether the regulator is inexperienced with the dummy variable Career. We include a sensitivity analysis with respect to the definition of Career in Table A2 in the Appendix. There it can be observed that the signs of the relevant coefficients are identical when a regulator becomes experienced when she has made any number of decisions between 50 and 150. Hence, our results are not particularly sensitive to how Career is defined.
3.1.2 Utility types

In Proposition 1 we assume that \( q \), i.e. the share of high cost utilities, is ‘large’. Descriptive statistics for the full population of utilities in 2007 shows that the vast majority of utilities have costs that are substantially higher than the lowest cost utilities. For example, Figure 2a shows that the cost per kWh is about twice as high for the average utility compared to the lowest cost utility. A similar cost distribution emerges in Figure 2b where cost per customer is investigated. Hence, these investigations show that \( q \) can be considered large and thus, that condition (1) is plausible.
3.1.3 Case complexity

Another core variable in this study is case complexity. Similar to effort, complexity is unobserved. Kaheny et al. (2008) used the number of document pages of the decision to represent complexity. The obvious issues with using this as a proxy are that different writers use different writing styles and background information included in judicial decisions is sometimes merely copied from earlier cases. Clermont and Eisenberg (2002) use review time as a proxy for complexity, but as we show in this study, there are several factors unrelated to complexity that have a significant effect on review time. Hence, both these measures appear to be questionable proxies and raise endogeneity concerns. Instead, we propose using the number of precedents (Cplex) to represent case complexity. A precedent is defined as a case decided by the court in the past that is of the same type as the present case. That means that when the court has made a decision regarding a dispute about the connection of a residential/industry property, the regulator has to consider one more precedent in all its subsequent decisions of that type. As the number of precedents is clearly exogenous in relation to the present case, and since all precedents must be considered by the regulator and the court, it provides a more straightforward econometric solution and it is a more objective measure of case complexity than both the number of pages and review time. Similar to Fon and Parisi (2006), we expect a rich availability of precedents to increase complexity since there is a large degree of outcome diversity in the precedent cases.

Information about each case is drawn from the case files that have been provided by the Swedish EMI. Additional information was collected from annual regulatory statistics (also collected from the EMI) and firms’ annual reports. Descriptive statistics for all variables are given in Table A1 in Appendix 2.

4. EVIDENCE

In Section 4.1, we estimate regulatory effort and determine its functional properties. Section 4.2 investigates the decisions of both customers and utilities to appeal the regulator’s decisions. Section 4.3 provides the court’s response functions conditioned on appeals. Finally, Section 4.4 summarises the empirical findings and investigates how consistent these are with the theoretical predictions presented in Section 2.
4.1 Regulatory effort

Effort $E_i$ exerted by the regulator in case $i$ is naturally unobserved. However, as a starting point, we suggest that more $E_i$ requires longer review time ($RevT_i$). Other factors that may affect review time include workload, case complexity, customer and utility types, regulator’s experience and ability and government directives. Workload will be affected by the amount of resources available to the regulator’s, but all types of resources (e.g. financial, staff) are unobserved. Thus, to circumvent this endogeneity problem, we replace workload with a variable representing the number of days since the Swedish electricity market was deregulated ($Days$) and a dummy for cases representing connection of mobile antennas ($Antenna$). Workload has increased steadily during the period of deregulation, while the connection of mobile antennas is more readily reviewed due to a relatively high degree of standardisation. An indicator variable ($CustC$) is included that takes the value 1 when the customer is a corporation. The generally held opinion among regulators is that corporations provide higher quality input to cases than that of private individuals. Finally, the variable $NoDec$, which represents total number of decisions made by the responsible regulator, is included to control for more experienced regulators conducting faster reviews. Regulators’ abilities and government directives (as well as other annual effects) are controlled for by including regulator and year fixed effects. We place these additional (non-core) variables in the vector $X$ and formulate the function as

$$RevT_i = f(X_i, a) E_i \exp(v_i),$$

where $f(\cdot)$ is a multiplicative function and $v_i$ is random noise. Taking the natural logarithm yields

$$RevT_i^T = \alpha_0 + X_i^T a + E_i^T + v_i,$$

where superscript $T$ denotes a natural logarithmic transformation. Ordinary least squares (OLS) is not an appropriate method to estimate the unknown parameters, because the random term mixes $E_i^T$ and $v_i$. However, when distributional assumptions are imposed on both $E_i^T$ and $v_i$, they can be econometrically disentangled from each other. Here we assume that $E_i^T$ and $v_i$ are independent where $v_i$ is normally distributed with mean equal to 0 and variance $\sigma_v^2$ and $E_i^T$ is exponentially

---

16 This has also been suggested by Prendergast (2003).
17 The Swedish electricity market was deregulated on 1 January 1996.
18 We also evaluated the model with workload included as a regressor (calculated as the number of decisions made during the previous 12 months), and found the same qualitative results.
distributed with variance $\sigma^2_{E_{i,t}}$. The implication of this distributional assumption is that the regulator always exerts positive effort, and that low values of effort are more likely than high values. Since the mean and standard deviation are identical for the exponential distribution, one can interpret an increase in $\sigma^2_{E_{i,t}}$ as an increase in $E_{i,t}^T$. We define $\sigma^2_{E_{i,t}}$ to be a function of the regulator’s objective ($Career$), case complexity ($Cplex$) and other exogenous shocks ($W$):

$$\sigma^2_{E_{i,t}} = \exp(\beta_0 + \beta_1 Career_i + \beta_2 Cplex_i + \beta_3 Career_i \times Cplex_i + W_i^k).$$  \hspace{1cm} (4)

The inclusion of $Cplex$ follows from our theoretical prediction. The interaction between $Career$ and $Cplex$ allows us to investigate whether regulators with different objectives respond differently to complexity. As $Cplex$ is included in both (3) and (4), there is a risk that the estimated parameters will appear implausible; for example, by being incorrectly signed. However, multicollinearity problems were not detected. When we exclude $Cplex$ in either (3) or (4), we only observe marginal adjustments to the mean and standard error of the $Cplex$-parameter in the other model.

In $W$, we include behavioural aspects of the regulatory process that may affect $E$, such as learning and negotiating power. Similar to (3) we include $Days$ and $Antenna$. Broadly, $Days$ captures the development of the regulatory process. We also include an indicator variable, $ThreeL$, which takes the value 1 when the utility is one of the three largest. When customers are corporations ($CustC$) rather than private persons, they have more negotiating power and they have the ability to provide higher quality information to the regulator. Finally, regulator fixed effects are included.

The joint estimation of (3) and (4) is displayed in Table 2. Panel (a) displays the results of the full specifications. Panel (b) shows a reduced specification that only includes parameters that were significant at the 10 per cent level after stepwise elimination.

---

19 Alternative distributional assumptions (e.g. half-normal and truncated normal) did not converge.
20 While not resulting in biased estimates, multicollinearity can generate parameters that are wrongly signed (Farrar and Glauber, 1967).
21 The Swedish electricity distribution sector consists of three dominating utilities that distributed 49 per cent of the total electricity on the local networks in 2009 (based on annual regulatory statistics collected by the Swedish EMI).
Table 2. Estimation output for equations (3) and (4).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Eq. (3)</th>
<th>Eq. (4)</th>
<th>Eq. (3)</th>
<th>Eq. (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
</tr>
<tr>
<td><strong>Days</strong></td>
<td>-0.6958 (1.5909)</td>
<td>21.147** (9.1046)</td>
<td>18.208*** (6.0560)</td>
<td></td>
</tr>
<tr>
<td><strong>Antenna</strong></td>
<td>2.7341*** (0.1236)</td>
<td>-9.8469*** (2.0677)</td>
<td>2.7742*** (0.0742)</td>
<td>-10.322*** (4.2196)</td>
</tr>
<tr>
<td><strong>Career</strong></td>
<td>2.8564 (3.3499)</td>
<td>0.3590*** (0.0679)</td>
<td>1.6035** (0.8382)</td>
<td></td>
</tr>
<tr>
<td><strong>Cplex</strong></td>
<td>0.3489*** (0.1164)</td>
<td>-1.2354** (0.5385)</td>
<td>0.3590*** (0.0679)</td>
<td>-1.0536** (0.4644)</td>
</tr>
<tr>
<td><strong>Career×Cplex</strong></td>
<td>-0.2634 (1.0261)</td>
<td>0.2329 (0.4217)</td>
<td>0.2329 (0.4217)</td>
<td></td>
</tr>
<tr>
<td><strong>ThreeL</strong></td>
<td>0.0206 (0.1045)</td>
<td>1.1312 (0.7913)</td>
<td>1.1312 (0.7913)</td>
<td></td>
</tr>
<tr>
<td><strong>CustC</strong></td>
<td>0.0252 (0.0180)</td>
<td>0.2329 (0.4217)</td>
<td>0.2329 (0.4217)</td>
<td></td>
</tr>
<tr>
<td><strong>NoDec</strong></td>
<td>11.261 (12.225)</td>
<td>-171.24** (74.210)</td>
<td>5.8862*** (0.1510)</td>
<td>-147.01*** (48.921)</td>
</tr>
<tr>
<td>Regulator fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sigma (v)</td>
<td>0.1393*** (0.0077)</td>
<td>0.1400*** (0.0074)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-36.292</td>
<td>-38.851</td>
<td>-38.851</td>
<td></td>
</tr>
<tr>
<td>No. obs.</td>
<td>409</td>
<td>409</td>
<td>409</td>
<td>409</td>
</tr>
</tbody>
</table>

*p<0.10, **p<0.05, ***p<0.01.

Both Panels (a) and (b) in Table 2 show that the coefficient associated with Cplex is negative and significant at the 5 per cent level in (4), implying that increased case complexity reduces effort when the regulator cares about both her career and consumer surplus.\(^{22}\) Hence, although our theoretical prediction that increased complexity can reduce effort may seem unintuitive, we find strong empirical support for this. We use the predicted values of effort, \(\hat{E}_i^T\), from panel (b) in our subsequent analyses of appeals and the court’s response to appeals.\(^{23}\)

### 4.2 Appeals

We set the binary variable \(A^k\) to indicate whether the regulator’s decision is appealed, where \(k\) is \(Cu\) when an appeal is made by a customer, and \(Ut\) when made by a utility. In Section 2, we claimed that when a regulator only cares about her career and when she exerts high effort, it is more likely that the

\(^{22}\) The net effect of case complexity for regulators who only care about error minimisation is also negative, but it is not significant at any reasonable level.

\(^{23}\) See Stata Manual v. 11, p. 503, for details on how \(\hat{E}_i^T\) is estimated.
customer appeals. We also established that when a regulator cares both about her career and consumer surplus, the probability of an appeal will be a function of effort. Thus, $A^k$ will be a function of $E$, Career and the interaction between them:

$$A^k_i = \gamma^k_0 + \gamma^k_1 \hat{E}_i^k + \gamma^k_2 \text{Career}_i + \gamma^k_3 \hat{E}_i^k \times \text{Career}_i + \mathbf{Z}_i \mathbf{\pi}^k + u_i^k. \quad (5)$$

In the $\mathbf{Z}$ vector, we include variables representing the regulator’s judgement and litigants’ relative cost of litigation. To capture the deviation between the regulator’s assessment and a utility’s initial claim, we create a variable by taking the ratio between the amount awarded by the regulator, $P^R$, and the amount charged by the utility, $P^U$. Taking $\frac{P^R}{P^U}$ eliminates the influence of any basic cost drivers, such as transformers and the amount of power, for which the regulator has long since established templates that to a large extent are accepted by the utilities. One would expect customers to be more inclined to appeal for high levels of $\frac{P^R}{P^U}$, whereas the opposite holds for the utilities.24 A dummy variable representing customers that are corporations (CustC) is added, since it has been claimed that corporations have a lower opportunity cost of litigation than private persons (Söderberg, 2008). Similarly, the largest utilities have more legal resources than those that are smaller. Thus, we include a dummy variable that captures when the utility is one of the three largest (ThreeL). Year and regulatory fixed effects are not included, since they cause the model to be over-specified. We estimate (5) using both linear probability and probit models. Separate results are presented for when customers and utilities appeal in Table 3.

One general conclusion from the output presented in Table 3 is that the linear probability and probit models give comparable results but the log likelihood values for the probit models are higher. Based on this, we use the probit estimates when we compare our theoretical predictions to the empirical evidence in Section 4.4.

24 Correlation between $\frac{P^R}{P^U}$ and $u$ was tested using ‘number of customers affected by the connection’ and ‘low voltage line length’ as instruments. No endogeneity problems were detected.
Table 3. Estimation output of customers’ and utilities’ decisions to appeal.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Customers’ appeals</th>
<th>Utilities’ appeals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS Mean (S.E.)</td>
<td>OLS Mean (S.E.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{E}^T )</td>
<td>-0.0064 (0.0037)</td>
<td>0.0025 (0.0064)</td>
</tr>
<tr>
<td>Career</td>
<td>-0.0250 (0.0330)</td>
<td>-0.0120 (0.0401)</td>
</tr>
<tr>
<td>( \hat{E}^T \times \text{Career} ) &amp; 0.0100 (0.0025) *** &amp; -0.0061 (0.0056) ***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| \( \beta^{CP} / \beta^{RP} \) & 0.4866 (0.0674) *** & -0.6593 (0.0541) ***
| CustC         | 0.2464 (0.0231) *** & 0.1804 (0.0506) **
| ThreeL        | -0.1579 (0.0387) *** & 0.0204 (0.0349) **
| Days          | 9.6E-6 (8.5E-5) *** & -2.7E-4 (5.1E-5) ***
| Constant      | -0.2035 (0.3541)   & 1.8835 (0.2275) ***

Sargan P>\chi^2
R^2
Log likelihood
No. obs.

<table>
<thead>
<tr>
<th>Sargan</th>
<th>0.226</th>
<th>0.240</th>
<th>0.207</th>
<th>0.174</th>
</tr>
</thead>
<tbody>
<tr>
<td>R^2</td>
<td>0.409</td>
<td>0.409</td>
<td>0.409</td>
<td>0.409</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-172.29</td>
<td>-166.67</td>
<td>-238.09</td>
<td>-224.95</td>
</tr>
</tbody>
</table>

* p< 0.10, ** p< 0.05, *** p< 0.01. S.E. clustered over seven regulators. Marginal effects reported for probit and IV-probit, with S.E estimated using the Delta method. Constants were included in main estimation but are not reported when marginal effects are estimated.

4.3 Court’s response to appeals

We use the ratio of the amount awarded by the court (\( P_C \)) and the regulator (\( P_R \)) as our dependent variable. In Section 2, we claimed that the court responds differently depending on whether it is the consumer or the utility that appeals. Thus, the court’s decision is estimated separately for consumer appeals and utility appeals. Moreover, in our theoretical analysis, it is postulated that \( \frac{P_C}{P_R} \) is affected by the regulator’s objective and effort. Hence, just as in (3), we use \( E, Career \) and the interaction between them as our primary variables of interest.

\[
\frac{p^c}{p^r} = \delta_0 + \delta_1 \hat{E}_i + \delta_2 \text{Career}_i + \delta_3 \hat{E}_i \times \text{Career}_i + K_i \theta_k + \varepsilon_i
\]  

(6)

where \( k \in \{Cu, Ur\} \). The vector \( K \) represents general exogenous shocks. Here \( K \) includes Days to control for the development of the regulatory process. Regulator and year fixed effects are excluded to avoid over-specification.
Since (5) and (6) represent sequential stages in the regulatory process, it is possible that \( u_i \) and \( e_i \) are correlated, indicating that the sub-sample used in (6) is non-random. To account for this potential error correlation, we use the two-stage Heckman model (Heckman, 1976) where (5) is used for the selection stage and (6) is the second stage. Results are displayed in Table 4.

### Table 4. Estimation output of court's response.

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLS</th>
<th>Heckman</th>
<th>OLS</th>
<th>Heckman</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
</tr>
<tr>
<td>( \hat{E}_i^T )</td>
<td>0.0057 (0.0035)</td>
<td>0.0048 (0.0078)</td>
<td>0.0267 *** (0.0027)</td>
<td>0.0287 *** (0.0036)</td>
</tr>
<tr>
<td>Career</td>
<td>-0.0103 (0.0205)</td>
<td>-0.0117 (0.0276)</td>
<td>-0.0260 (0.0696)</td>
<td>0.0027 (0.0873)</td>
</tr>
<tr>
<td>( \hat{E}_i^T \times \text{Career} )</td>
<td>-0.0061 (0.0041)</td>
<td>-0.0052 (0.0081)</td>
<td>-0.0173 * (0.0097)</td>
<td>-0.0189 * (0.0103)</td>
</tr>
<tr>
<td>Days</td>
<td>-1.1E-4 (6.7E-5)</td>
<td>-1.1E-4 (6.7E-5)</td>
<td>-4.2E-5 (9.2E-5)</td>
<td>6.5E-5 (1.1E-4)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.4122 *** (0.2803)</td>
<td>1.4152 *** (0.2746)</td>
<td>1.2416 ** (0.3874)</td>
<td>0.9194 ** (0.4467)</td>
</tr>
<tr>
<td>( \rho )</td>
<td></td>
<td>0.0245 (0.2008)</td>
<td></td>
<td>-0.4436 *** (0.0471)</td>
</tr>
<tr>
<td>R^2</td>
<td>0.038</td>
<td></td>
<td>0.026</td>
<td></td>
</tr>
<tr>
<td>No. obs.</td>
<td>93</td>
<td>93</td>
<td>157</td>
<td>157</td>
</tr>
</tbody>
</table>

*p< 0.10, **p< 0.05, ***p< 0.01. S.E. clustered over seven regulators.

First, we note that the correlation \( \rho \) between the error terms in (5) and (6) is significantly different from 0 when utilities appeal, but not when customers appeal. Consequently, we use the OLS estimates when customers appeal and the Heckman outputs when utilities appeal in our comparative analysis.

### 4.4 Consistency between theory and evidence

The appeal behaviour of customers and utilities, and the court’s associated responses, are summarised in Table 5 for instances in which regulators only care about their career, and in Table 6 for cases in which regulators care about both their career and consumer surplus. Results in both tables are categorised for levels of effort ranging from 1 to 125. The sample range for effort is 1 to 113 and the effort level of 125 is, therefore, an out-of-sample prediction.
When regulators only care about their career, we observe that a customer’s probability of making an appeal is 0.22 for the lowest level of effort. As the level of effort increases, the point estimate of customers’ probability to appeal increases to around 0.70, but the associated standard errors go up markedly, making the final effect statistically undeterminable. Utilities appeal with a probability of 0.36 for the lowest level of effort, and the probability decreases to slightly below 0.24 for the highest level of effort. Thus, the estimates suggest that the probability of a utility appeal is negatively related to the value of effort. This indicates that customers are more likely than utilities to appeal for high levels of effort, which is consistent with our theoretical findings.

To investigate how the court responds to an appeal, we tabulate the predictions of $\frac{p_C}{p_R}$ for both customer and utility appeals. If $\frac{p_C}{p_R}$ is not statistically different from 1, we conclude that the court has not reversed the regulator’s decision. To test this, we include the 90 per cent lower and upper confidence interval. When customers appeal, the court only reverses the regulator’s decision when the regulator exerts low and medium levels of effort. Conversely, when utilities appeal, it is very likely that the court reverses the regulator’s decision. The only exception is for the very highest level of effort, where we cannot reject the hypothesis that $p_R = p_C$. However, it should be noted that a value of 125 for effort is out-of-sample. These findings are largely in agreement with our theoretical predictions given in Section 2.

| Effort | Customers’ appeals | | Utilities’ appeals | |
|--------|-------------------|-----------------|-------------------|
|        | $p_C / p_R$ | 90% LCI | 90% UCI | $p_C / p_R$ | 90% LCI | 90% UCI |
|       | (S.E.) |       |        |       |       |        |
| 1      | 0.2197 (0.0295) | 0.9481 | 0.9138 | 0.9824 | 0.3589 (0.0298) | 1.2096 | 1.0509 | 1.3682 |
| 25     | 0.3012 (0.0729) | 0.9374 | 0.8981 | 0.9767 | 0.3345 (0.0588) | 1.4453 | 1.2230 | 1.6676 |
| 50     | 0.3969 (0.1785) | 0.9262 | 0.8727 | 0.9798 | 0.3099 (0.1041) | 1.6909 | 1.1628 | 2.2189 |
| 75     | 0.4985 (0.2876) | 0.9151 | 0.8433 | 0.9869 | 0.2860 (0.1480) | 1.9364 | 1.0899 | 2.7829 |
| 100    | 0.6002 (0.3795) | 0.9039 | 0.8123 | 0.9955 | 0.2631 (0.1883) | 2.1820 | 1.0147 | 3.3493 |
| 125    | 0.6957 (0.4375) | 0.8927 | 0.7805 | 1.0050 | 0.2412 (0.2243) | 2.4276 | 0.9386 | 3.9165 |

Notes: The sample range for effort is from 1 to 113. $p_C / p_R$ values when customers (utilities) appealed based on OLS (Heckman) estimates displayed in Table 4.
When the regulator cares about both her career and consumer surplus, we observe that customers only appeal for very low levels of effort, whereas the utilities appeal with 39 per cent probability when effort is at its lowest and around 70 per cent for the highest levels of effort. The court will reverse appeals from customers when the regulator has exerted low levels of effort, but we cannot reject the hypothesis that the court confirms a decision when high effort was exerted. When utilities appeal, the court will always reverse the regulator’s decision and the magnitude of the adjustment increases for higher levels of effort. All these findings are consistent with our theoretical predictions presented in Section 2.

Table 6. Appeal and court responses when regulators care about both their career and consumer surplus.

<table>
<thead>
<tr>
<th>Effort</th>
<th>Customers’ appeals</th>
<th>Utilities’ appeals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pred((A_{Cu}^{R}))</td>
<td>90% LCI</td>
</tr>
<tr>
<td>1</td>
<td>0.2375 (0.0205)</td>
<td>0.9645</td>
</tr>
<tr>
<td>25</td>
<td>0.0169 (0.0228)</td>
<td>1.1003</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>1.2417</td>
</tr>
<tr>
<td>75</td>
<td>0</td>
<td>1.3831</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
<td>1.5245</td>
</tr>
<tr>
<td>125</td>
<td>0</td>
<td>1.6660</td>
</tr>
</tbody>
</table>

Notes: The sample range for effort is from 1 to 113. \(P_{Cu}^{C} / P_{R}^{R}\) values when customers (utilities) appealed based on OLS (Heckman) estimates displayed in Table 4. Pred\((A_{Cu}^{R})\) and its S.E. are <1.0E-6 when effort is ≥ 50.

5. CONCLUSIONS

In this paper, we extended the literature on how economic regulators influence agents’ appeals behaviour. We do so by theoretically and empirically investigating regulatory decisions, customers’ and firms’ decisions to appeal the regulators’ decisions and appellate court decisions. We investigate a situation where customers have filled complaints about charges imposed by monopolistic firms. Investigations of customer complaints add to our understanding of regulatory behaviour, since they are fundamentally different to rate reviews, the field that has received most attention in the literature.

Our purpose has been to untangle some of the complex relationships between choice of effort, the cost of effort and regulatory outcomes that the (theoretical) principal-agent literature has claimed characterise the regulatory process. In our investigation, we emphasised two aspects of the regulatory decisions process that have not previous been considered in a study involving both theory and
empirics: 1) regulatory effort is endogenous, since more complex cases increase the cost of effort and 2) that regulators always care about their career (i.e., that they want to minimise errors), but as they become more experienced, they also care about consumer surplus. The unorthodox assumption that a regulator cares about consumer surplus follows from Prendergast’s (2007) claim that when customers have relatively higher stakes, bureaucrats will adopt pro-consumer preferences.

In our theoretical model, we predicted that when the regulator is only concerned about her career, a larger number of decisions will be overturned by the court when cases are more complex than in situations in which the cases are less complex. We also showed that when the regulator cares about both her career and consumer surplus, less complex cases will be associated with more appeals by regulated firms, but fewer decisions will be overturned and prices will be lower. As the case complexity increases, we predicted a switch to more appeals by consumers, more decisions being overturned and higher prices on average. An unintuitive prediction for regulators with mixed objectives is that they will exert less effort when cases become more complex. These theoretical predictions are generally confirmed in our empirical analysis.

In the empirical section, we adopted an innovative approach to estimate effort based on a stochastic frontier model that has two disturbance terms: one that is strictly positive and one symmetrical disturbance with zero mean and constant variance. The frontier in this model represents the length of a regulatory review with zero effort. The strictly positive disturbance term represents effort, and we can determine which factors have an influence on the front as well as the level of effort. We found, for example, that higher case complexity reduces effort when regulators care about both their career and consumer surplus.

In our empirical investigation we also offered an alternative definition of case complexity to that used in the existing literature. We used the number of precedents, rather than number of document pages or review time, which have been used in the past, to proxy for complexity. Our proxy has the advantage of being strictly exogenous and less blurred by other influences. Number of precedents can have general validity as a proxy for complexity but we stress that the directional impact is uncertain as precedents can both increase and decrease complexity.
REFERENCES


Heckman, J. J. (1976), The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimation for such models, Annals of Economic and Social Measurement, Vol. 5, No. 4, pp. 795–798.


Appendix 1

Proof of Proposition 1
First, we calculate the regulator’s expected utility conditional on effort. Then, we determine the optimal level of effort and the associated regulated price. For \( E = \varepsilon \), the regulator fully uncovers the regulated firm’s true cost. In this case, if the regulator uncovers \( c_H \), and sets the regulated price \( p^R \) equal to \( c_H \), then they obtain utility:

\[
U[p^R = c_H | E = \varepsilon, c_H] = \tilde{U} - \varepsilon.
\]

In this case, the consumer appeals to the court with probability \( \gamma \). However, the court does not reverse the regulator’s decision. If instead the regulator sets \( p^R = c_L \), they obtain utility:

\[
U[p^R = c_L | E = \varepsilon, c_H] = \delta(-\Gamma) + (1 - \delta)\tilde{U} - \varepsilon.
\]

In this case, the regulated firm appeals to the court with probability \( \delta \) and the court reverses the decision. Note that \( U[p^R = c_H | E = \varepsilon, c_H] > U[p^R = c_L | E = \varepsilon, c_H] \). If instead, the regulator uncovers \( c_L \), then their utility under the two possible prices is equal to:

\[
U[p^R = c_H | E = \varepsilon, c_L] = \gamma(-\Gamma) + (1 - \gamma)\tilde{U} - \varepsilon
\]

and

\[
U[p^R = c_L | E = \varepsilon, c_L] = \tilde{U} - \varepsilon.
\]

Note that \( U[p^R = c_L | E = \varepsilon, c_L] > U[p^R = c_H | E = \varepsilon, c_L] \).

We now look at the case where the regulator chooses \( E = 0 \) and, as such, does not know the true realised costs and so computes their expected utility as follows:

\[
U[p^R = c_H | E = 0] = q\tilde{U} + (1 - q)\left[\gamma(-\Gamma) + (1 - \gamma)\tilde{U}\right]
\]
and

\[ U[p^R = c_L | E = 0] = (1-q)\bar{U} + q[\delta(-\Gamma) + (1-\delta)\bar{U}] \]

Note that \( U[p^R = c_L | E = 0] > U[p^R = c_H | E = 0] \) if \( \frac{q}{1-q} < \frac{\gamma}{\delta} \).

Finally, note that for \( \frac{q}{1-q} > \frac{\gamma}{\delta} \), the regulator chooses effort \( E = 0 \) if

\[ \bar{U}[q + (1-q)(1-\gamma)] - (1-q)\Gamma > \bar{U} - \varepsilon. \]

That is, the regulator chooses \( E = 0 \) and \( p^R = c_H \) when \( \frac{q}{1-q} > \frac{\gamma}{\delta} \) and

\[ \varepsilon > (1-q)\gamma(\bar{U} + \Gamma). \]

Proof of Proposition 3.

For \( E = \varepsilon \), we can calculate the regulator’s expected utility when \( c_H \) is realised as follows:

\[ U^{CS}[p^R = c_H | E = \varepsilon, c_H] = \bar{U} - \varepsilon \]

and

\[ U^{CS}[p^R = c_L | E = \varepsilon, c_H] = \delta(-\Gamma) + (1-\delta)(\bar{U} + c_H - c_L) - \varepsilon. \]

Note that \( U^{CS}[p^R = c_H | E = \varepsilon, c_H] > U^{CS}[p^R = c_L | E = \varepsilon, c_H] \) if

\[ \bar{U} > \frac{1-\delta}{\delta} (c_H - c_L) - \Gamma. \]
This inequality holds, for example, whenever the probability that the regulated firm appeals following a regulatory decision where \( p^R = c_L \) is sufficiently close to one. Conversely, the inequality is unlikely to hold if \( \delta \) is small or if the consumer’s surplus is large.

Similarly, if \( c_H \) is realised, then the regulator’s expected utility is given by:

\[
U^{CS} \left[ p^R = c_H \mid E = \varepsilon, c_L \right] = \gamma(-\Gamma + (c_H - c_L)) + (1 - \gamma)(\overline{U}) - \varepsilon.
\]

That is, in this case, the consumer appeals to the court with probability \( \gamma \) and the court overturns the regulator’s decision and the price reduces to \( c_L \). Similarly,

\[
U^{CS} \left[ p^R = c_L \mid E = \varepsilon, c_L \right] = (c_H - c_L) + \overline{U} - \varepsilon.
\]

Note that if the regulator chooses \( E = \varepsilon \), then they will set \( p^R = c_L \) when the utility is of a low cost type.

We now consider the case where \( E = 0 \) and compute the regulator’s expected utility as follows:

\[
U^{CS} \left[ p^R = c_H \mid E = 0 \right] = q\overline{U} + (1 - q)[\gamma(-\Gamma + (c_H - c_L)) + (1 - \gamma)\overline{U}]
\]

and

\[
U^{CS} \left[ p^R = c_L \mid E = 0 \right] = q[\delta(-\Gamma) + (1 - \delta)\overline{U}] + (1 - q)[\overline{U} + (c_H - c_L)].
\]

When \( E = 0 \), the regulator sets \( p^R = c_H \) whenever

\[
\overline{U} > \Gamma + \frac{(1 - q)(1 - \gamma)(c_H - c_L)}{-(1 - q)\gamma + \delta q} \quad (A1)
\]
and noting that the denominator is positive as long as \( \frac{q}{1-q} \geq \frac{\gamma}{\delta} \). Finally, whenever (A1) is satisfied, the regulator will choose effort \( \varepsilon \) (and \( p^R = c_L \)) over 0 effort (and \( p^R = c_H \)) whenever

\[
(e_H - c_L) + U - \varepsilon > qU + (1 - q)\left[\gamma(-\Gamma + (e_H - c_L)) + (1 - \gamma)U\right]
\]

or

\[
\varepsilon < (e_H - c_L)((1 - q)\gamma - 1) + q\gamma U + (1 - q)\gamma(-\Gamma).
\]
## Appendix 2.

### Table A1. Descriptive statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>RevT</td>
<td>Number of days between the regulator receiving the complaint and the decision.</td>
<td>557.97</td>
<td>351.13</td>
<td>34</td>
<td>2196</td>
</tr>
<tr>
<td>Days</td>
<td>Number of days since the electricity market was deregulated. Deregulation occurred 1st January 1996.</td>
<td>4.279</td>
<td>323.6</td>
<td>2.346</td>
<td>4.929</td>
</tr>
<tr>
<td>Antenna</td>
<td>Indicator for when case concerns connection of mobile antenna.</td>
<td>0.5721</td>
<td>0.4954</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cplex</td>
<td>Number of precedents.</td>
<td>56.423</td>
<td>58.954</td>
<td>0</td>
<td>187</td>
</tr>
<tr>
<td>ThreeL</td>
<td>Indicator for when utility is one of three largest (Vattenfall, E.On, Fortum).</td>
<td>0.5501</td>
<td>0.4981</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>CustC</td>
<td>Indicator for when customer is corporation.</td>
<td>0.5892</td>
<td>0.4926</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>NoDec</td>
<td>Number of decisions made by regulator.</td>
<td>114.30</td>
<td>95.678</td>
<td>1</td>
<td>306</td>
</tr>
<tr>
<td>TE</td>
<td>Effort (jointly estimated by eqs. (3) and (4)).</td>
<td>2.3711</td>
<td>6.5801</td>
<td>1.0057</td>
<td>113.38</td>
</tr>
<tr>
<td>Career</td>
<td>Indicator for when regulator has made less than 50 decisions, i.e. when regulator only cares about her career.</td>
<td>0.3839</td>
<td>0.4869</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>pU</td>
<td>Amount claimed by utility (SEK).</td>
<td>116 383</td>
<td>286 316</td>
<td>11 826</td>
<td>5 500 000</td>
</tr>
<tr>
<td>pR</td>
<td>Amount awarded by regulator (SEK).</td>
<td>78 029</td>
<td>190 020</td>
<td>3 664</td>
<td>3 600 000</td>
</tr>
<tr>
<td>pC</td>
<td>Amount awarded by court (SEK).</td>
<td>90 766</td>
<td>236 514</td>
<td>12 865</td>
<td>3 600 000</td>
</tr>
</tbody>
</table>

All variables have 409 observations, except CP, which has 251. Descriptive statistics for CuA and UtA is provided in Table 1.

### Table A2. Sensitivity analysis for the definition of ‘experienced’ regulator.

<table>
<thead>
<tr>
<th>Definition of experienced regulator</th>
<th>Eq (4), using specification displayed in panel (b) in Table 2</th>
<th>Eq (5), customers’ appeals</th>
<th>Eq (5), utilities’ appeals</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;25 decisions</td>
<td>β₁ (S.E.) = 0.4456 (0.5123)</td>
<td>γ₁ (S.E.) = 0.0017 (0.0039)</td>
<td>γ₂ (S.E.) = 0.3885 (0.2408)</td>
</tr>
<tr>
<td>&gt;50 decisions</td>
<td>β₁ (S.E.) = 1.6035 (0.8382)</td>
<td>γ₁ (S.E.) = -0.8571 (0.4644)</td>
<td>γ₂ (S.E.) = -0.3211 (0.218)</td>
</tr>
<tr>
<td>&gt;75 decisions</td>
<td>β₁ (S.E.) = 0.6713 (0.6503)</td>
<td>γ₁ (S.E.) = -0.1536 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0168 (0.251)</td>
</tr>
<tr>
<td>&gt;100 decisions</td>
<td>β₁ (S.E.) = 0.5775 (0.6052)</td>
<td>γ₁ (S.E.) = -0.0133 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0375 (0.251)</td>
</tr>
<tr>
<td>&gt;125 decisions</td>
<td>β₁ (S.E.) = 0.6798 (0.6021)</td>
<td>γ₁ (S.E.) = -0.0140 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0375 (0.251)</td>
</tr>
<tr>
<td>&gt;150 decisions</td>
<td>β₁ (S.E.) = 0.6494 (0.6021)</td>
<td>γ₁ (S.E.) = -0.0160 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0694 (0.251)</td>
</tr>
<tr>
<td>&gt;175 decisions</td>
<td>β₁ (S.E.) = 0.3738 (0.6042)</td>
<td>γ₁ (S.E.) = -0.7417 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0921 (0.251)</td>
</tr>
<tr>
<td>&gt;200 decisions</td>
<td>β₁ (S.E.) = 0.1305 (0.6126)</td>
<td>γ₁ (S.E.) = -0.8304 (0.4644)</td>
<td>γ₂ (S.E.) = -0.0381 (0.251)</td>
</tr>
</tbody>
</table>

All variables have 409 observations, except pC, which has 251. Descriptive statistics for A_C and A_U is provided in Table 1.