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ABSTRACT

What anti-corruption policy can learn from theories of sector regulation*

This paper reviews the theories of corruption in regulated sectors to further understand the impact of corruption and the ways in which it can be reduced. The aim is to draw out the policy implications of the different theoretical approaches and to examine the support that can be garnered for such policies from empirical evidence and practice. We then attempt to draw out some of the broader lessons that can be learnt for anti-corruption policy in general.

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I. Introduction

Corruption in regulated industries has been a problem "forever", or at least for as long as regulation has existed. Most regulated industries involve large costly investments and long maintenance and operational contracts. Two obvious sources of financial rents. Many also deal with politically sensitive sectors in which price control or creative tariff structures are easy to implement and employment opportunities abound, obviously strong sources of political rent. These are probably the core sources of corruption in these industries.

Historically, the core problem was thought to be uncontrolled and unaccountable self regulation or to the active use of the regulation of these industries by politicians or dictators to create politically motivated jobs which increase costs without improving service, to artificially inflate costs to generate easy to capture rents to finance political activities, or simply to feed their private accounts in some foreign western bank. An extreme example, not too distant, but not to close either to avoid the risks of an overreaction by some politician, is offered by President Doe's management of Liberia's assets in the early 1980s. [1] The example has most of the ingredients of what most of us think of when we discuss corrupt regulated industries. It also shows that the way we think about corruption today is simply an adaptation of how we had to think about it until 20 or 30 years ago. The rules have changed, but the sad game itself has not.

Many management positions of Liberia's major utilities (and many of the ministries) were staffed with friends, family, or, political and financial allies of the head of state or of some strong minister. Many low skill jobs which contributed to the overstaffing of these industries were created as favours to friends or relatives. Self regulation of an industry is what allowed the corruption of public utilities and major transport infrastructures to leverage or payback favours in that country. This story is obviously not only representative of Liberia. Similar stories could have been written for developed or developing countries, thirty years ago, …or today. Anyone reading this paper is likely to be able to come up with an example in their own country in which regulated public services were recently associated with favours inflating costs, jobs or private bank accounts, whether in many European countries (anecdotes easily come to mind for Belgium, France, Italy or Spain), in the US, in Argentina or in the Philippines. Liberia's story is not too different from stories that could be told for a majority of countries on this planet 1, 10 or 100 years ago. Liberia's story may simply have been more extreme as it was symptomatic of the limits that can be reached in a state that eventually collapsed.

[1] One of the two authors worked on, and partially in, Liberia from 1982 to 1985 and had the opportunity to contribute to public expenditure reviews and macroeconomic fiscal assessments of the country. Hence, the use of this anecdote based on first hand experience.

The scale of the problem may indeed have been the real issue in Liberia and it eventually led to the need for the international community to intervene in the management of the public sector. The failed management of a key regulatory instrument may provide the best illustration. Some readers may remember that Liberia has long been known for making it easy for any shipper to have a Liberian flag. That flag was a favourite among shippers because it implied safety regulatory requirements which were low enough to imply low maintenance costs and high enough to reassure the international community. This attracted shipping companies from all over the world who would simply have to travel to Monrovia, the capital city to pay their dues. At the end of the 1970s , the annual revenue from the flag regulation was over 24 million dollars—about 10% of the public sector income or 3% f GDP. Easing the compliance efforts was thus an easy way of raising revenue. President Doe, who has just taken over the presidency through a coup understood this well. But this did not show up in Liberia's fiscal revenue figures. This is because within 2 years of Mr.Doe's coup, the flag revenue had dropped to a third of that amount. An investigation conducted by the US state department suggested that the shippers were requested to pay the flag fee in cash and the Minister of Finance would go and collect the cash personally at the harbour. This gives a first order magnitude of the cost of two forms of corruption in a single regulated industry.

This is the kind of extreme situation that made it easy to argue for a shift from self regulation to independent regulation of industries that required regulation. The move towards more independent regulation started in the early 1990s around the world, following the British lead in the early 1980s. Unfortunately, as discussed below, the evidence suggests that independence from political interference and from other forms of corruption is hard to achieve. It is indeed not too early to report that this reform has not yet managed to deal with the corruption problem. Recent surveys of evidence of corruption in infrastructure (Kenny (2009b) and Transparency International (2008) suggests that regulation continues to be associated with corruption, in both developed and developing countries. Moreover, in regulated industries in developing countries, there are enough high profile events to show that corruption will often involved foreign companies financed by their own development agencies but more interested in closing deals than in contributing to the development of state capacity in the host country..

So if corruption in regulated industries is still a problem despite the efforts to reform regulation, what has changed? The real change in the last 10 years or so may be that corrupt regulatory practices are increasingly well recognised as a major problem. Less than 10 years ago, it was closer to a dirty little secret everyone knew but no one wanted to talk about. For the poorest countries, this was a socially costly secret as has the potential to undermine any progress in expanding access to basic infrastructure. According to the Transparency International Global Corruption index, one person in three has had a direct experience of corruption in the utilities sector. Moreover, grand corruption has been shown to significantly affect governments' decisions to carry out reforms in the sector which have the potential to fundamentally

improve performance.[2] All the details on the secret are not out yet. National politics, geo-politics and just greed continue to keep the mouth of most people working in the sector shut on the details.[3] But enough is know on where incentives are going wrong. The real challenge is to minimize these wrong incentives, knowing that not all of them can be dealt with within the sector. This is where regulation has been helping in the last few years. It has allowed a better understanding of the perversity of many of the incentives and has suggested solutions.

This paper reviews the theories of corruption in regulated sectors to further understand the impact of corruption and the ways in which it can be reduced. The aim is to draw out the policy implications of the different theoretical approaches and to examine the support that can be garnered for such policies from empirical evidence and practice. We then attempt to draw out some of the broader lessons that can be learnt for anti-corruption policy in general.

In recent years, there has been in explosion in the number of articles studying corruption, including many surveys.[4] However, relatively little exists examining the problem in a sector specific way – exceptions include Dal Bó (2006), Boehm (2007) and Kenny (2009b). This paper differs from other articles in focusing on the institutional tools that regulatory theory indicates policy makers have at their disposal to reduce corruption. It therefore takes a more policy orientated view than the survey of regulatory capture provided by Dal Bó (2006), as well as considering a somewhat broader definition of corruption.

The paper is divided into five sections. We begin in Section I by discussing the various types of corruption in regulated industries, focusing on those that are more specific to the sector. The section considers the principal ways that corruption has been modelled in the theoretical literature in economics. Section II follows by discussing broadly the potential problems that corruption might cause, as well as potential positive effects, looking at both theoretical and empirical work. We then continue in Section III by discussing the various potential solutions suggested in the literature to either reduce corruption or mitigate its effects. We consider three main areas where decisions over policy and institutions can affect corruption: In choosing a market structure, in designing a regulatory structure and in shaping regulators' careers. Section IV looks for evidence for or against these policy suggestions in the

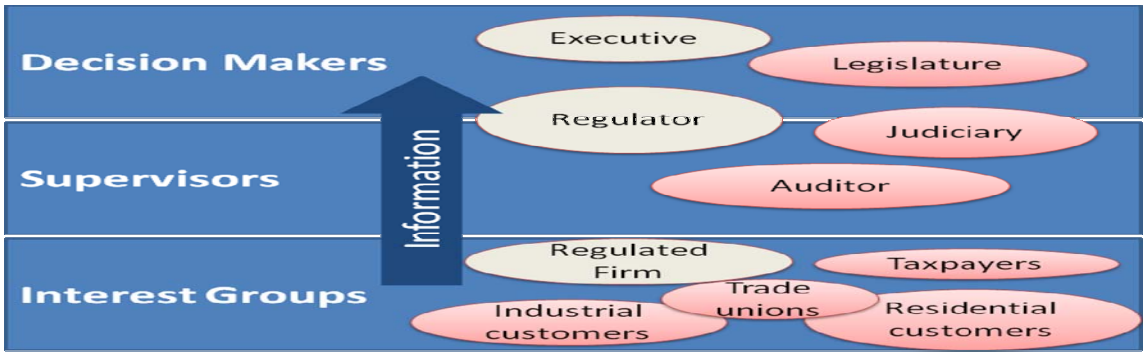
[2] See, for example, Boehm and Polanco (2003), Bjorvatn and Søreide (2005) and Li, Qiang, and Xu (2005).
[3] It is easy to underestimate the importance of geo politics in this business. Traditional colonial powers continue to try to obtain contracts in the regulated industries of their former colonies. The correlation between the flags of the foreign companies wining contracts for regulated industries and the flags of the former colonial powers may be stronger for some countries than for others, but the average is high. Obviously, this distribution of markets takes place in very subtle ways. Cultural similarities in preferences for ways of doing business inherited from colonial times are often credited for this correlation. Markets for favours abound in the allocation of these markets despite the efforts to improve procurement for these large business contracts. Indirect evidence of foul play only appears occasionally when against the tide, some former colonial power supports a country with a suspect human right record in a vote at the UN at about the same time a major contract needs to be signed. The "raison d'Etat" is very much alive in the allocation of large contracts which include many of the contracts in regulated industries. Competition from China, India and Korea have recently started to weaken the effectiveness of a geo-political management of commercial contracts.
[4] See, for example, Bardhan (1997) and Aidt (2003).

empirical work on regulated sectors, whilst Section V considers their implementation in practice. Finally, we conclude with suggestions of lessons that may feed into the more general corruption debate.

II. Types of corruption in regulated industries

As illustrated by the Liberian example, corruption in regulated industries takes a variety of forms – favouritism, fraud, cronyism, patronage, embezzlement, regulatory capture, cash bribes or even extortion are all examples.[5] Conceptually, it is essential to recognize that these corrupt transactions may take place between different sets of actors. They can involve different groups of public officials, public and private agents or users and service providers. However, in this paper we focus mainly on corruption between government agents and interest groups (including the regulated firm) at the regulatory level. This is not to say that corruption between public officials or between a firm and its users is less important, but rather that here sector specific theories have relatively little to add to more general discussions of anti-corruption. The types of corruption covered in this paper therefore strongly overlap with what is often described as `regulatory capture', which we define here to be the manipulation of government agencies regulating network industries by special interests.

Figure 1 below summarizes the main different possible actors, categorising them into three groups: Interest groups, supervisors and decision makers. The interest group most commonly of concern is the regulated firm itself, since the main purpose of the regulator is generally to control the firm's actions. However, other groups may also wish to manipulate the regulatory agency. Trade unions may desire more labour than is optimal for society, whilst taxpayers may desire a smaller than optimal network expansion if public subsidies are required. Different customer groups – e.g. residential or industrial – are likely to have competing interests about the relative prices they pay.



[5] Corruption in regulation can be seen as one of several ways institutional weaknesses cause problems in infrastructure in developing countries. For discussions of more general problems of institutional weakness, focusing on the pioneering work of Jean-Jacques Laffont, see Laffont (2005) and Estache and Wren-Lewis (2009).

In Figure 1, government actors have been split into two groups – supervisors and decision makers. In this model, supervisors do not directly decide upon regulatory policy, but instead just transmit information from the interest groups (particularly the regulated firm) to the decision makers. Decision makers, on the other hand, are in charge of policies such as the type of regulation, the prices a firm is allowed to charge and any subsidies that may exist. Auditors are therefore supervisors, whilst the executive and legislature are clearly decision makers who do not gather information directly. Other actors – in particular, the regulator itself – may play a dual role, both collecting information and making decisions. However, within the regulatory agency itself, these roles are likely to be split.

Categorising actors in this way allows us to distinguish between two sorts of corruption. The first essentially ignores or abstracts from the supervisor category and concentrates on the direct influence of interest groups on decision makers. We label this form of corruption the *capture of decisions***.** This would, for example, include the regulated firm bribing the regulator to set a higher price in any rate review or to not enforce a particular regulatory statute. We then label the second type of corruption as *capture of information*. This, for example, would include the regulated firm bribing an auditor to hide the fact that it was in truth making a larger profit than it claimed.

This division can approximately be mapped to the division between two different ways of modelling regulatory capture. The capture of decisions is generally the focus of traditional `capture theory' or `interest group theory'. This was originally developed by Stigler (1971) who argued that regulation would in fact be developed in the interests of the regulated firm. This theory was then extended by, amongst others, Posner (1974), Peltzman (1976), Becker (1983) who argued that there was likely to be a range of interest groups each with competing interests. Levine and Forrence (1990) provide a survey of this literature and others. This theory then stressed that regulatory policy was likely to be determined by the relative power of the interest groups involved, which in turn might be determined by things such as the size of each group. This style of model therefore relates to more recent models such as those by Bernheim and Whinston (1986) and Grossman and Helpman (1994, 1996) who apply similar ideas to the influence of special interest groups on politics more generally. Typically, these models do not explicitly consider the relationships among actors within the governmental process, nor the mechanisms by which the acts of regulators are made to conform to the desires of organized subgroups. Whether influence occurs through corrupt means generally is therefore generally abstracted from.

The second modelling approach has emphasised the importance of asymmetric information in determining corruption. This approach takes a principal-agent framework and specifically considers the relationship between some kind of supervisor and its principal, where the supervisor may have access to information

that the principal does not. A pioneering model in this field is that of Laffont and Tirole (1991, 1993), which considers the case where a supervising agency may receive information about the firm's cost structure that it can then hide from a decision maker. The firm then has an incentive to bribe the agency into not passing on this information in order for it to receive an information rent. In the model, the supervising agency is motivated by private payoffs, and therefore will take the bribe if the principal does not offer a suitable incentive scheme. The key difference between this approach and the former is that information asymmetries between the supervising agency and the decision maker offer the potential for capture, even if the decision maker themselves is benevolent. This style of model can be adapted in a variety of ways. Other interest groups besides the firm may also have an incentive to prevent information being revealed to the decision maker, such as environmentalists (Laffont and Tirole (1991, 1993)) or taxpayers (Estache, Laffont, and Zhang (2006)). We might also consider different actors in the role of principal and agent – for example, they might both be members of the same regulatory agency. Furthermore, we can relax the extent to which the principal is non-benevolent, such as in Spiller (1990).

Since the distinction between the capture of decisions and the capture of information has been most pronounced in the literature, we will focus mostly on this distinction in our following discussion of implications and potential solutions. Nonetheless, there are other ways in which we can categorise different types of corruption that will help us to understand the breadth of potential mechanisms and the limitations of solutions. One such categorisation is the distinction between *ex ante* and *ex post* corruption. In ex ante corruption, the interest group's objective is to influence the design of regulation or laws. For example, an incumbent firm may attempt to block a reform that would introduce competition. Ex post corruption on the other hand happens within the existing legal framework – for example, the distortion of cost information to gain a better rate. Hellman, Jones, and Kaufmann (2003) show that whether a firm attempts to capture ex ante or ex post depends on characteristics such as their political connections.

It is also useful to note that capture occurs in both *legal* and *illegal* ways. Legal capture includes lobbying as well as more subtle forms of capture such as using the career concerns of regulators. Illegal capture consists not only of bribery, but also the use of favours or coercion. Dal Bó (2006) discusses the various instruments used in capture in more detail, whilst Dal Bó and Di Tella (2003) examine the differences between capture by threat and by bribery. Clearly legal capture may not be considered corruption, but frequently the line between the two may be thin. Awareness of the existence of both legal and illegal forms of capture is important when considering policy in order to ensure that one type is not simply replaced by another.

Finally, it is useful to distinguish between *direct* and *indirect* capture. From our definition, we are considering capture to be the `manipulation of government

agencies', but the interest group has the option of manipulating the agency themselves or via an alternative power. For example, Holburn and Vanden Bergh (2004) develop a model showing how, in certain circumstances; it is optimal for firms to attempt to capture authorities who hold power over a regulatory agency, rather than the agency itself. If they are successful, these authorities may then be able to exert sufficient pressure on the agency that it does not need to be captured directly.

In order to get a sense of how the results of the various models of corruption in the economic academic literature can be derived formally, it may be useful to present a simple formal model that incorporates both forms of corruption.[6] The simplest model needs to focus on a regulated monopolist. Assume that this monopolist produces a quantity q of a good for domestic consumption, say water or electricity for instance. The production cost can be represented by the function $C(q) = (\beta - e)q - F$, where β is a firm-specific characteristic representing its underlying cost, e is an effort level that decreases the marginal cost and F is a fixed cost.[7] β represents costs that are outside of the firm's control, such as factor prices (the price of the main fuel for electricity—say coal or oil-- or of the price of some chemical for a water provider). It can also represent a technology (is the factory of an old or a new vintage?).

The simplest way of modeling the options is to consider a binary model whereby the firm is either low-cost, $\beta = \underline{\beta}$ (occurring with probability v) or high-cost, $\beta = \overline{\beta}$ (occurring with probability $1-v$). e is the part of the marginal cost that is controllable by the firm directly. For example, the manager may be able to reduce costs by purchasing from the cheapest supplier or by reducing mistakes. Exerting an effort level of e causes the firm a disutility of $\psi(e)$ $(\psi' > 0, \psi'' > 0, \psi''' \geq 0)$.

The monopoly's revenue from sales is qp, where p is the price level. In addition to this revenue, the monopoly receives a transfer from the government—which is interesting to model explicitly as it can be used to assess the cost to taxpayers of excess production costs allowed by corruption.[8] This transfer takes the form of a lump sum, t, which may be positive or negative. The monopoly's welfare is then $U = qp - (\beta - e)q - F - \psi(e) + t$. We will also describe U as the `rent' the firm receives from being the monopoly supplier. The monopoly has a participation constraint such that, after β is revealed, its welfare must be no less than 0, i.e.

(1) $\underline{U} \geq 0$

(2) $\overline{U} \geq 0$

where $\underline{U}$ is the firm's utility when $\beta = \underline{\beta}$, and $\overline{U}$ that when $\beta = \overline{\beta}$. We similarly define $\underline{e}$, $\overline{e}$, $\underline{p}$, $\overline{p}$, $\underline{q}$, $\overline{q}$, $\underline{\alpha}$, $\overline{\alpha}$ $\underline{t}$ and $\overline{t}$ and as the effort levels, price levels, quantities produced, fraction of costs reimbursed and transfers made in these respective cases.

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[6] A longer discussion of this model and of its possible analycal uses to derive partial results is provided in Estache and Wren-Lewis (2010)

[7] See Laffont and Tirole (1993), Armstrong, Cowan and Vickers (1994) and Armstrong and Sappington (2007) for detailed expositions of models in this style.

[8] See Laffont and Tirole (1993, p.145-155) for details of how the model changes when transfers are removed. Generally, when prices must be used to generate the revenue here provided by transfers there will be a loss of efficiency. This may however be mitigated if the firm can use two-part tariffs rather than linear prices.

Consumers' gross surplus from consuming a quantity q of the good is

(3) $S(q) = \int_0^q P(q')dq'$

where $P(q)$ is the inverse demand function ($S' > 0$, $S'' < 0$). Consumers also pay taxes to fund the transfer to the monopoly. Raising an amount t in taxes costs consumers $(1+\lambda)t$, where $\lambda > 0$ is the opportunity cost of public funds. Hence consumers' net surplus is $V = S(q) - qp - (1+\lambda)t$. Consumers are welfare maximizing, and hence, by differentiating equation (3) and setting the differential to zero, we can see that in equilibrium we have $p = P(q) = S'(q)$. In other words, demand is determined such that price is equal to the marginal benefit. We assume that both p and q are public, and that the government sets one of these variables directly. The other is then determined by the consumer market.

We assume here that F is common knowledge—i.e. the government or the consumers know it because the results of an audit on this cost have been made public-- so that there is no risk of corruption on that front—and this may be a strong assumption in the context of regulated industries which require large investments and hence large fixed costs, but it is a common assumption in the literature. We also assume that the government can observe marginal cost $c = \beta - e$--and this an equally strong assumption.

The contract between the government and the firm can therefore specify the price the firm should sell at, the marginal cost level it should obtain and the transfer from the government to the firm. What is really relevant for the discussion of this paper is that this simple model shows that why the literature tends to derive some of its key results from the assumption that no-one but the firm know the components of this cost – i.e. the government does not observe the two variables that drive that cost: β and e. These two variables will have to be the focus of the regulator and be central to the final cost consumers will have to pay or taxpayers will have to subsidize. Their assessment is needed to be able to assess the cost of corruption for instance.

The job of assessing the composition of cost accrues to the regulator. This regulator is separated from the government to reflect the modern approach to the management of regulation. More specific the specific job of this independent regulator is to reduce the asymmetry of information by learning the value of β. The regulator is endowed with an information technology that obtains a private signal r that may give information about the firm's cost. In practice, this means for instance that regulators can rely on some type of benchmarking or details cost accounting that could allow them to approximate the true cost of the firm but the benchmarking may be imperfect or the cost accounting incomplete. With probability ξ the firm's cost is revealed to the regulator ($r = \beta$) and with probability $1-\xi$ they receive no information ($r = \varnothing$).

To be able to model any undesirable interaction between the operator and the regulator, the signals the regulator receives, have to be assumed to be `hard' information. This means that the regulator cannot report that the firm is of a particular type unless it has received a signal revealing this to be true. The possibility of an undesirable interaction between the operator and the regulator is the result of the possibility that the regulator can hide information and report to the government that the cost could not be figured out (i.e. the signal is $\varnothing$) even if this was not the case.

In other words, the signal can be hidden by the regulator but it cannot be faked—which is useful to model the potential benefit of in depth audits of the performance of a regulator.

We can now formally introduce the two forms of corruption into this simple model, *the capture of decision* and *the capture of information.* Since the government can be captured either way, it has been modelled as a non-benevolent government. This can be done by assuming that the government aims to maximize the following social welfare function:

(4) $W = \gamma U + V$

where $1+\lambda > \gamma > 1$,[9] with γ representing the *capture of decisions.* As the decision maker, the government can directly distort the decision of consumers and providers and care less about the distortion caused by taxes to pay for the firm's rent.

To introduce the *capture of information,* the model assumes that the firm observes both the regulator's signal and their report to the government. The firm can corrupt the information process by contracting on the regulator's report and make dependent transfers. Transfers between the regulator and the firm are costly because they are illegal, i.e. there may be costs undertaken to hide the transfer or a penalty if the parties are caught. Hence for any bribe given by the firm the regulator only enjoys a fraction k of the bribe, where $k \in (0,1)$. k here represents the ease with which bribes can be made, i.e. a higher value of k means that there are fewer costs involved.

This very simple model allowed us to show the two main ways in which corruption has been modelled. It has also allowed us to point the key variables that have generally been used to document the important perverse incentives that lead corruption to interfere with efficiency or with the distribution of rents generated in regulated industries. The model also give the basic intuition to discuss how corruption, in the two main forms identified here, might affect outcomes that we are concerned about.

III. What are the implications of corruption?

Anecdotal evidence on the unfairness and the inefficiency of corruption interfering with the provision of regulated public services abounds. This ignores the frustration and unhappiness it carries with it. The relative importance of these distortions in the fair allocation of resources and its intensity can be anticipated from a wide range of theoretical models. This section considers the implications of corruption that emerge from the economic modelling of corrupt regulation, the crux of why corruption in regulated industries is of such concern. First, we study the potential implications of corruption that arise from the various ways the theoretical models have accounted for these two main types of corruption. These implications can also be categorised into two groups of effects: redistribution of rents and changes to efficiency. We then consider how these two broad effects will manifest themselves in practice, and examine evidence for this in the empirical literature.

[9] If $1+\lambda < \gamma$ then the model becomes uninteresting as the government simply transfers all of consumers wealth to the firm through taxation.

It is reasonable to start with the redistributional effects of corruption since the redistribution of the surplus towards the party that's doing the capturing is the main goal of that party. In these models, redistribution from corruption implies winners and losers as expected. In the case of the regulated firm, for example, this could be an increase in producer surplus that comes through higher prices at the cost of reduced consumer surplus. In many models, the losers are the taxpayers who end up paying for the subsidies governments have to pay to make sure that distortions to the producer and consumer surplus are minimized.

A redistribution of surplus occurs in all models of regulatory capture and in all the types discussed in the previous section. For instance, in an interest-group model of capture, the firm may persuade the government agency not to carry out a rate review that would result in a lower regulated price. In a principal-agent model of capture, the firm wishes for the supervisor to hide cost information in order to generate an `information rent' for the firm. The fact that the firm now has information that the regulator does not means that the regulator has to provide a transfer of funds to the firm in order to incentivise the revelation of this information.

Other interest groups besides the firm that use corruption are also seeking a redistribution of surplus. If a particular group of consumers capture the regulator (e.g. industrial consumers), they may seek a change in the cross-subsidy regime that benefits them (e.g. higher residential prices and lower industrial prices). Alternatively, consumers that are already connected to the network may seek to prevent further network expansion if such expansion would involve a transfer away from the connected to subsidise the unconnected (see Estache, Laffont, and Zhang (2006) for more details). Since regulated network industries are often full of opportunities for cross-subsidies or transfers, there is great potential for this redistribution of surplus to take place in a number of ways.

We can thus be sure that a redistribution of surplus would take place following any successful instance of corruption in regulation. In some cases, this may be the only implication. If the surplus being redistributed is a relatively unimportant economic rent then there is a possibility that capture will simply result in some efficient transfer from one group to another. For example, if one firm wins a contract instead of an alternative identical firm simply because it has bribed the regulator, then the only consequence of this capture may be the gain of one firms' shareholders over another. If this were the case generally, economists might be relatively unconcerned about corruption, or at least it would be more appropriately considered within a more general framework. Judging whether or not regulatory capture was bad in this case would involve making some judgement over the optimality for social welfare of such a redistribution of income. For example, we could imagine that capture might be good a thing if the capturing interest group was generally under-represented in polity. However, most instances of corruption are likely to imply more than an efficient transfer of surplus, and in addition are likely to impact the overall efficiency of the sector being regulated.

The second important potential impact of corruption in regulation is on economic efficiency. This may happen in a number of ways. Most observers would assume that corruption will deteriorate efficiency. A number of models, however, documents instances in which corruption in regulation may in fact improve efficiency.

One commonly cited way in which capture may increase efficiency is through helping to mitigate problems of commitment where the optimal policy is time inconsistent. For instance, Evans, Levine and Trillas (2008) show that, when the government cannot commit to allow the firm a sufficient return on investment, capture can improve efficiency. Commitment problems are avoided if direct lobbying of the decision-making executive is allowed, or by devolving decision making to a sufficiently `pro-industry' regulator. One way in which a regulator may be made sufficiently `pro-industry' is through their openness to capture. More generally, capture might mitigate inefficiencies that arise elsewhere in the regulatory process, such as through the election of politicians (see Besley and Coate (1998) for example for a discussion of such inefficiencies).

Overall, however, models of regulatory capture have generally focused on instances where corruption, or the potential for corruption, decreases efficiency. This generally occurs in three possible ways: the direct distortion of prices, the cost of corruption itself and the anti-corruption measures taken.

The nature of regulatory capture means that the redistribution of surpluses that occur does not typically take the form of direct lump sum transfers. This is either because the regulator does not have the power to make such transfers (perhaps precisely because this would increase the effect of capture) or because such transfers would expose the otherwise covert capture. As a result, the redistribution of rent that occurs will often result in the distortion of various prices away from their optimal values. For example, in the simplest case of monopoly regulation, a firm that captures the regulator will seek a higher price than desired by society, resulting in under-consumption. In another case, where consumer groups capture in order to change the cross-subsidy regime, this will frequently be through changes in relative prices. We would therefore expect to see over-consumption by the group that captures and under-consumption by other groups. Finally, in the case where surplus is transferred from the government to a firm or interest group, the transfer itself may not be distortionary. However, since the government pays for the transfer out of taxation that is itself distortionary, this leads to inefficiency.

A further source of inefficiency arises from the costs of capture itself. This occurs in both legal and illegal capture. In legal capture, costs might include over-spending on election campaigns or the allocation of jobs to inferior candidates. When capture is illegal, time and money will be spent on keeping any transfers covert or enforcing damaging threats. As Tullock (1967) showed, these costs may be high, since the large surpluses present in network industries justify a large amount being spent on trying to obtain the rents. When opportunities for capture

abound, managers will spend more time attempting to capture than improving their firms' performance, as illustrated in the model of Dal Bó and Rossi (2007).

A final cause of inefficiency is changes in policy designed to prevent or mitigate the damages arising from capture. This is demonstrated clearly in the models of information capture of Laffont and Tirole (1991) and Estache, Laffont and Zhang (2006). In these models, capture is costly to prevent, since the regulator has to be given a sizeable incentive not to be captured. These costs are directly related to the gain that an interest group receives through capture. There is thus an incentive for the principal to reduce these potential gains, even if doing so is costly for other reasons. Hence it may be optimal to offer a lower-powered incentive regime that does not sufficiently reward effort if this also decreases the information rent a firm can obtain through feigning inefficiency.

Overall therefore, corruption in regulation - or the threat of such corruption – is likely to cause both a redistribution of surplus and increased costs overall. In practice in network industries, there are three main ways in which we are likely to observe such effects: Increased prices (for at least some groups), increased subsidies (for at least some groups) and decreased quality (for at least some groups). These effects may occur directly, or through decisions over potential reforms that interest groups attempt to influence. For example, a monopoly may capture a regulator in order to prevent the liberalisation of the sector, which in turn would have resulted in lower prices.

Empirical evidence of the effect of corruption on outcomes is extremely limited by the difficulty in measuring the extent to which corruption has occurred. Kenny (2009) discusses a range of attempts to measure corruption in infrastructure and finds generally that the data available is relatively poor. One way to measure the extent of corruption is through surveying people's perceptions of corruption. However, as shown by Olken, (2009), there is a risk that perceptions of corruption are systematically biased, and in particular the most damaging forms of corruption go unperceived.

Nonetheless, a lack of alternative data sources means that papers studying the effect of corruption on regulated sectors have frequently used a measure of perceived corruption, particularly in cross country work. Estache and Kouassi (2002), for example, find that water utilities operating in more corrupt countries are less efficient. Similarly, looking at electricity distribution firms in Latin America, Dal Bó and Rossi (2007) show that firms are less efficient when national rates of corruption are higher. Wren-Lewis (2010) also finds such a result using similar data, and gives evidence suggesting this inefficiency is transmitted into higher prices. Estache, Goicoechea and Trujillo (2009) also finds that high national perceived corruption levels have a range of possible negative effects, at times leading to lower quality or higher prices

National corruption levels also appear to have effects on regulated sectors beyond straightforward performance measures. Guasch and Straub (2009) find evidence that corruption increases the likelihood of renegotiation happening at the initiative of firms, while limiting those at the initiative of governments. They hypothesise that these results are consistent with the theory that corrupt governments are able to strike ex ante deal for illegal payments with potential concessionaires, and that since these governments have already managed to get their rent ex-ante, they may be less eager to renegotiate ex post. Looking at electricity unbundling within the old EU states, van Koten and Ortmann (2008) find that it is less likely to occur in more corrupt countries. They argue this is because here the incumbent is more likely to be able to capture the decision making process.

Other papers abstract from corruption and consider the effect of capture through the potential influence of interest groups. Considering cross-country differences in regulatory reforms in telecommunications , Li, Qiang and Xu (2005) find support for the interest-group theory of capture in showing that reforms are more likely when `pro-reform' interest groups are large and less likely when incumbents have strong incentives to oppose the reform. They also find that democracy appears to facilitate this interest group effect. Similarly, Knittel (2006) finds that regulation of the electricity industry in the US occurred earlier, where interest groups benefiting from such regulation were strongest. Duso (2005) uses price differentials to proxy for capture, and then finds that capture significantly reduces the probability of a cellular market being regulated in precisely those markets where regulation would lead to a reduction in general prices.

Overall therefore, theory suggests that corruption and the threat of corruption are likely to be significantly damaging for a number of reasons. Though the empirical evidence is severely limited in its ability to measure corruption and capture, it does provide evidence to support this view. It is therefore appropriate to ask the question of `what can policy makers do to reduce corruption and its effects?'. In the next section, we consider a range of solutions suggested by the theoretical literature.

IV. Anti-corruption policies in regulated industries: Theory

Having established the potential risks of corruption in regulated industries, let us now turn to consider potential solutions that derive from the theoretical literature. Since regulated industries are the focus of this paper, we consider only solutions that are sector-specific. Clearly it may also be useful to pursue broader policies that affect the economy and government more generally, such as improving public sector governance or increasing penalties for corruption, but this is not within the scope of the paper. We divide this section into three subsections that each deal with a different area of policy related to network industry regulation. First, we consider how decisions about the market structure, such as whether to privatise or liberalise the market, may affect capture. Second, we explore alternative regulatory structures. This includes decisions over the number of regulatory agencies and the level of

government at which regulation takes place. Third, we examine how policies relating to regulators' careers, such as their term length, may affect capture.

A. Industrial structure

One major reform that has significantly changed the structure of network industries in many countries over the last three decades has been the privatisation of incumbent monopolies. Although reducing corruption was generally not the primary aim of such reforms, it has been argued that this may be a positive secondary effect.[10] In the model presented by Boycko, Shleifer and Vishny (1996) privatisation may reduce the effect of corruption and hence improves efficiency. However, this work concerns capture by interest groups other than the firm – notably labour unions – and assumes that the government itself is captured. Privatisation therefore decreases the effect of capture by making it more difficult for the corrupt government to influence the firms' decisions. Shleifer and Vishny (1994) then extend this idea by arguing that privatisation is likely to only be successful in reducing corrupt politicians' influence if the firm is profitable enough not to depend on subsidies. Of course, if we do not believe that the government is captured by damaging interest groups, then it is not so clear that distancing the government from the firm will be mitigating the effect of capture. In particular, these models do not consider potential capture by the regulated firm, which is generally the focus of the capture literature.

Martimort and Straub (2009) take a different angle to investigate the impact of privatisation on corruption. They use a model of informational capture and consider privatisation to be the prohibition of transfers between the government and the firm. They then argue that the effect of corruption depends on the firm's ownership. If the firm is publically owned, the threat of capture results in a greater public subsidy funded through taxation, whilst a privately owned firm gains profit instead through higher prices. The relative cost of capture therefore depends on how distortionary taxes are relative to higher prices. Taking the model one step further, they argue that privatisation will therefore make capture more transparent, since higher prices are easier to link to the firm's actions than increased taxation. This transparency may aid in the prevention of capture. However, if we instead consider the relative power of interest groups, it may be that a large electorate is relatively powerless to prevent such capture compared to a ministry of finance that wishes to stem the loss of funds.

Another common recent reform of industrial structure that has often accompanied privatisation is the liberalisation of the market to allow new entrants to compete with the incumbent. An interest group theory of capture would suggest that such a reform is likely to reduce corruption since firms find coordinating on capture more difficult in a less concentrated market (see, for example, Olson (1965)). Since

[10] It is worth noting that corruption is also likely to impact upon a governments' decision to privatise - {Laffont, 1999 #107} and {Bjorvatn, 2005 #742}, for instance, both provide models examining how corruption might influence the decision over whether to privatise.

each firm only gains a fraction of the total benefit of a price rise, then, as the number of firms increase, the incentive for each individual firm to capture decreases. However, this argument clearly only applies to corruption that will result in benefits for all firms in the market. The flip side is that incentives for the incumbent to capture may now increase if it needs the regulator's help to beat the competition.

Models of information capture would also tend to suggest that liberalisation is likely to have positive effects. On one side, competition may decrease the need for the regulator to amass information if competition provides an alternative downward pressure on prices. To the extent that information retrieval is still required, a greater number of firms in the market may provide alternative information sources. Laffont and Meleu (1999) show that such additional information is likely to reduce the damage caused by information. However, they also note that such a reduced dependence may not in fact reduce the prevalence of capture. Instead, since the government may see capture as less problematic, it may choose to spend less on preventing capture occurring.

Overall therefore, neither privatisation nor liberalisation is likely to be a panacea when it comes to reducing the risk of corruption. The effect of privatisation on capture is ambiguous. If one is concerned about interest groups besides the firm capturing regulation, then privatisation may succeed in improving efficiency. However, if one is concerned about potential capture by the firm, then the effect of capture is likely to vary. The theoretical support for liberalisation as an anti-corruption device is probably less ambiguous, which may help to explain why we would also expect incumbent firms to use corruption to prevent such a reform occurring at all!

B. Regulatory structure

Models of information capture focus on the key role of supervisors who collect cost information from the firm. Laffont and Martimort (1999) show that increasing the number of supervisors is one way of reducing corruption in these models.[11] This relies on the assumption that each supervisor is aware of the signal that the other receives but they cannot collude amongst themselves.[12] In this model, capture remains a problem if only one of the supervisors receives information from the firm, but is removed as a threat when both supervisors receive information. This is because, if both regulators receive informative signals, each will anticipate that the other will reveal it, and hence any collusion would be ineffective. Estache and Martimort (2000) argue additionally that, if different supervisors are instead not aware of the information the other receives, separation is still likely to reduce capture. Since each supervisor is now only partially informed, their ability to extract

[11] This can be seen as an example of the general principle that competition amongst bureaucrats decreases corruption, as discussed in Rose-Ackerman (1978) and Wilson (1980), amongst other places.
[12] See Laffont and Meleu (1999) for an analysis of the case where regulatory agents can collude between themselves.

bribes from the firm is reduced. In practice, this insight could be applied on a number of levels. It may work through the creation of two separate agencies, or perhaps less costly through the involvement of a government body besides the regulator, such as the judiciary. At a more micro-level, it may simply suggest that individual supervisors within the regulatory agency work in pairs rather than independently.

Increasing the number of supervisors may well go along with increasing the number of decision makers. This would be the case if, for example, separation was achieved through dividing roles between agencies. This may also decrease capture if we believe that it is more costly to capture two decision makers than to capture one. On the other hand, Estache, and Martimort (2000) argue that, when different principals are affected by the activities of the regulator, the latter can play one principal off against the other. The bureaucrat may then become less accountable with each principle unable to constrain its actions. Whether or not the existence of multiple principals is a curse or blessing for accountability depends on the regulatory process and structures in place.[13] For example, one way to increase accountability is to expose the regulatory bureaucrat by making available private information on the effectiveness of the bureaucrat's behavior. Simple institutional rules like the public release of regulatory information may allow this kind of information sharing between multiple principals

In sum, the current theoretical literature appears to generally favour increasing the number of actors when it comes to reducing the risk of capture. Of course, increasing the number of actors will certainly impact a number of other aspects of regulation, as discussed in Estache and Martimort (2000). Indeed, Laffont and Meleu (2001) argue that it is in precisely the circumstances where separation's role in capture reduction is most important that the costs are highest.

One particular way that has been suggested to increase the number of actors is to create consumer advocates that are involved in the regulatory process (see, for example, Ugaz (2003)). This aligns closely with the interest group theory of capture, since it may help to improve the power of consumers. By increasing the power of this particular interest group, which typically is seen as the victim of corruption, the relative power of other groups – in particular, the regulated firm – will decrease.

Whilst this theory is in principal sound, two potential problems arise. First, from an interest group perspective, there remains a concern that the consumer advocates themselves act in a corrupt manner. Second, Laffont and Tirole (1993) argue that if one takes an information perspective, consumer groups will be of no help unless they can provide an additional information source and hence act as an alternative `supervisor'. These concerns should therefore be borne in mind when designing consumer advocates by ensuring representation and given the advocates enough resources to enhance their ability to gather information.

[13] See McCubbins, Noll and Weigngast (1987), Spulber and besanko (1992) and Dixit (2003) for discussions on how the interaction of multiple actors in government is influenced by processes and structures.

An alternative way to change the regulatory structure is through decentralisation. The relationship between corruption and broader questions of decentralisation has received a significant amount of attention in the literature (see, for example, Bardhan and Mookherjee (2000); Bardhan (2002)). Clearly, corruption in regulation can be viewed as a particular aspect of this relationship. From an interest group perspective, the proposed advantage is that regulation at a more local level is likely to be more accountable. In other words, consumer groups and/or local taxpayers are likely to be able to organise themselves more effectively to influence the regulator's decisions. However, the flipside from an interest group perspective is that local firms and other groups might also find capture to be easier at a local level. For example, Boehm (2006} argues that regulation at the local level is likely to lead to more frequent interactions, encouraging capture.

Models focused on informational capture are also ambiguous as to the effect of decentralisation on capture (see Laffont and Meleu (2001) for an overview). Laffont and Pouyet (2004) show that, when decentralisation induces competition between regulators, this competition may reduce their discretion and hence their potential to be captured. On the other hand, Besfamille (2004) shows that a local government may have an incentive to collude with a local firm against the national government if this results in greater subsidies heading to the local area. In China, for example, local governments have been known to collude with small-scale inefficient coal power plants in order to prevent them being shut-down by the central government. This is because the local government has an incentive to keep power plants in their region open as they provide jobs and tax revenue, which aid the local officials' personal objectives such as promotion.[14]

Considering jointly these various contributions, it seems that economic theory presents no clear view about the effect of decentralisation on capture. One idea that may be worth further research is the extent to which the positives of both decentralised and centralised regulation could be brought out using a hierarchy involving both levels of government. This might also be a mechanism by which to increase the number of actors involved in regulation, and hence reduce capture through the mechanism discussed above.

A final decision that needs to be made when deciding upon the regulatory structure is the degree to which the regulatory agency should be independent from the government. Generally, the emphasis of policy advisors has been to push for greater regulatory independence in the belief that this will decrease political interference and hence improve the ability of the government to commit (see, for example, Thatcher (2002)). However, a regulator that is less constrained by government may be more open to collusion with the firm. In light of this argument, it is worth studying some of the empirical work on independent regulation more closely. We may, for example, expect to see greater investment under a captured

[14] See Laffont (2005, pp.22-24) for further details.

independent regulator, alongside excessive returns. In this case, it should be noted that evidence that independent regulation increases investment is not necessarily evidence that it is welfare enhancing.[15]

Independence may however not increase collusion if the limited accountability of the government means that capture of politicians or the executive is a greater threat than regulatory capture. Furthermore, in considering the trade-offs that independence brings, it is worth distinguishing between different components of independence. For example, making the regulator's workings transparent to the government and citizens is likely to reduce the risk of capture, whilst making it transparent the firm may facilitate capture.[16]

Related to the discussion of the degree of independence is the amount of discretion a regulator should hold. Clearly, the greater discretion the regulator is allowed, the greater the potential for capture. Hiriart and Martimort (2009) show that a greater degree of capture (i.e. pro-industry bias) calls for a smaller amount of discretion to be given to the regulator. Overall therefore, whilst increasing independence by no means necessarily increases capture, policy makers need to be aware that granting too much discretion carries such a risk.

C. Regulatory Careers

The final policy area is the design of the careers of regulators. A first aspect of this is the manner in which the regulators are appointment. One idea that has been suggested is to elect regulators directly, rather than having them appointed. In the models of Besley and Coate (2003) and Guerriero (2006), regulators that are directly elected are more responsive to consumers' demands for the regulated sector since this is the sole issue of concern in these elections. If the direct election of the regulator is infeasible or potentially damaging, one alternative is for the appointment to be made jointly between the executive and legislature. In an interest group theory of capture, joint appointment has the advantage of involving more than one actor and therefore diluting the power of any particular interest group.

Once a regulator has been appointed, a further policy variable is the length of the term for which an individual regulator is appointed for. An important work in the study of the regulatory life-cycle is that of Martimort (1999) who develops the information based model of capture of Laffont and Tirole (1991) one step further by considering the contract between the `capturer' and the `captured'. In particular, the paper notes that since agreements between the capturing firm and the regulator are likely to be illegal, they cannot be explicit contracts that are externally enforced.

[15] Faure-Grimaud and Martimort (2003) provide a theoretical model where the principle makes this trade off between commitment and capture when deciding upon independence.
[16] As difference between IRAs and CBs / Competition authorities is that for latter there is public scrutiny by international comparison and an industry of commentators.

Instead, such contracts are implicit, and hence depend on the fact that relationships between the regulator and the firm are repeated over time. The threat of capture is therefore positively correlated with the frequency of these interactions and the duration of time over which they are expected to last. It can therefore be argued that reducing the regulator's term length decreases the potential for collusive implicit contracts between the firm and the regulator to be maintained.

Based on a similar model, Faure-Grimaud and Martimort (2003) give a different argument for why shorter term lengths may reduce capture. They work on the assumption that the cost of bribes are likely to increase in a convex manner at any given time, which seems reasonable when we consider that giving small amounts of cash under the table will go relatively unnoticed, but larger transfers will require more time and effort spent on making the transaction covert. Moreover, they also argue that the benefits to the firm of capture are likely to change over time – for example, during a potential rate review it may be particularly valuable to the firm for the regulator not to reveal any information it has on the firm's cost structure. Given these two assumptions, the firm would like to spread out its bribes over time in order to reduce the total cost. However, if term limits are short, this will not be possible, since a given regulator may only hold the post during a period where capture is particularly valuable. In this way, decreasing term limits may increase the total cost to the firm of capturing the regulator.

A second aspect of regulatory careers that has been studied in the literature is the `revolving door' that exists between jobs in regulation and jobs with interest groups, particularly the regulated firm. Since the skills required to work for a regulator are often similar to those required to work for a regulated firm, the movement of people between the two bodies is natural. Unfortunately, it also offers the potential for capture by enabling the firm very easily to reward regulators for `good behaviour'. This is particularly valuable in situations where other sorts of corruption such as bribery are more difficult, since the value to the regulator of a well paid career in a firm may be very sizable. To reduce this route for capture, restrictions can be placed on who regulators can work for after leaving the agency, although such rules are likely to be ineffective when the regulated firm is part of a large multi-sector consortium. An alternative is to appoint a different type of person to the agency, such as career civil servants, academics or those close to the end of their career, since these actors are less likely to seek employment in the firm afterwards.

More work may be required before it can be conclusively argued that closing the `revolving door' is necessarily worth the costs involved in lost skills. Moreover, Che (1995) and Salant (1995) argue that keeping the revolving door open may offer other benefits, such as increasing commitment and incentives for regulator's to signal their skill through efficient regulation. Overall, however, it seems likely that closing the revolving door will most-likely reduce corruption.

V. Anti-corruption policies in regulated industries: evidence on effectiveness

The previous section outlined a number of ways in which theory suggests corruption or its impact may be reduced in regulated sectors. In this section, we survey the relevant empirical literature to look for evidence that supports or conflicts with these theoretical results. However, s discussed in Section II, the difficulty in measuring corruption means that direct evidence is hard to come by, and hence for many policies there is little empirical evidence.

A. Industrial structure

Focusing on petty corruption, Clarke and Xu (2004) investigate whether bribes paid to utility firms in Eastern Europe and central Asia are affected by the ownership or level of competition in the sector. They find that enterprises pay fewer bribes to utilities in countries where the relevant sector is competitive and firms have been privatised, suggesting these reforms are successful in reducing these reforms. However, Kenny (2009) points out that we should be careful in drawing conclusions from a study that measures just one aspect of corruption. H`e points out that, in Jakarta, petty corruption was very low when the water sector was in private hands. However, prices paid by consumers were very high, possibly as a result of corruption at a higher level that facilitated a cartel, and hence consumers may well have been better off with more petty corruption with a public firm.

Looking at an earlier period in the former Soviet Union and eastern Europe, Kaufmann and Siegelbaum (1997) consider both corruption in the privatisation process and the effect of privatisation on long-term corruption. They argue that most likely corruption would be worse without privatisation, but that the type of privatisation matters significantly. They find that privatisation is most effective at reducing corruption when links with the state are severed completely and rapidly – a policy which is likely to be difficult in regulated industries. Moreover, they find that management-employee buyouts tend to be associated with the worst levels of corruption after privatisation has occurred.

Other studies attempt to infer a relationship between privatisation and corruption by considering measurements of corruption at a national level. {Dal Bó and Rossi (2007) and Wren-Lewis (2010) consider the effect of corruption on the efficiency of electricity distribution firms in Latin America, finding a significant negative effect. Whilst Dal Bó and Rossi (2007) find no robust interaction between corruption and ownership, Wren-Lewis (2010) finds private firms appear to be more insulated from the effect of corruption. However, this result is not robust to instrumenting for ownership and may be partly driven by private firms appearing to invest less in corrupt environments. These results are therefore consistent with Estache, Goiceoechea and Trujillo (2009), who shows that the interaction between

privatisation and corruption is not a straightforward one. Finally, {Martimort and Straub (2009) find that in Latin America dissatisfaction with privatisation is highest when levels and changes in corruption are high, supporting their theoretical result discussed earlier that privatisation may increase the visibility of corruption.

Overall therefore, the evidence is consistent with the theoretical work in that competition appears to reduce corruption (although here the evidence is very limited) whilst the effect of privatisation is unclear. Moreover, there appears to be evidence that the privatisation process may change the effects of corruption, such that some measures of performance or corruption improve whilst others worsen.

B. Regulatory structure

One of the theoretical recommendations of the previous section was that an increase in the number of actors involved in supervising and making decisions may decrease the effect of corruption. Unfortunately, as far as we are aware no work has attempted to test this proposition empirically. A related result is that of Seim and Soreide (2009), who find that corruption is correlated across countries with bureaucratic complexity, and hence argue that (particularly in poorer countries) simpler procedures are likely to be less conducive to corruption. Pursuing a different thread, Holburn and Spiller (2002) tests for the effectiveness of consumer advocates in US electricity regulation. He finds evidence that the creation of consumer advocates has benefited consumers, but only industrial ones. This lends weight to the earlier interest-group based theory, since it appears that consumer advocates benefit those who are likely to find organising most straightforward. Similarly, Henisz and Zelner (2006) use cross-country panel data to show that a more powerful industry lobby reduces investment in SOEs generating electricity, and argue this is evidence that inefficient `white elephants' are prevented.

Looking at decentralisation, some evidence supporting its positive effect against capture can be found in Boyes and McDoweel (1989). He finds that elections for regulators are only effective at reducing consumer prices in US electricity when held at a sufficiently decentralised level. However, Anand n (2008) finds decentralisation doesn't help reduce petty corruption in the water sector in India, with results suggesting that more bribes are paid by consumers when the sector is managed at decentralised level.

Looking at the effect of the creation of an independent regulator, Wren-Lewis (2010} finds it appears to significantly reduce the negative effect of corruption on efficiency and prices in the electricity distribution sector in Latin America. {Estache, 2009 #787} also finds some evidence for a positive interaction affect between regulation and corruption, though the results are mixed.

Overall therefore there is evidence that there is a significant interaction between corruption and the regulatory structure, but the relationship is not straightforward. As with questions of industrial structure therefore, more detailed

empirical work will be necessary to find support for the theoretical suggestions of the previous section.

C. Regulatory careers

Relative to the policy areas considered above, the effect of elections for regulators has been relatively well researched. Looking at residential electricity prices, Besley and Coate (2003) and Guerriero (2006) both find empirical support for the hypothesis that elections help to reduce capture by the firm. Smart (1994} finds a similar result for telecoms prices in the US. In addition, Atkinson and Nowell (1994) finds that elected regulators set the regulatory lag closer to the social optimal and Guerriero (2006) finds that the election of judges also tends to result in reduced electricity prices. This result is not universal - Boyes, and McDowell (1989) finds that elections are only effective when carried out at a relatively local level, whilst Kwoka (2002) finds that only industrial prices are reduced. However, there is little to suggest that election of regulators increases capture, suggesting it is an anti-corruption policy with relatively strong empirical support. Furthermore, Smart (1994) finds that telecoms rates in the US are lower when regulators are appointed jointly by the executive and legislature, so long as the two are controlled by different political parties.

Looking at the effect of term limits, Leaver (2009) studies their effect on prices in the US electricity sector. She finds that longer term limits appear to lead to reduced prices for consumers, which goes against the theoretical prediction above that longer term limits should facilitate corruption. She explains this by building a model where regulators are concerned about gaining future employment and hence preserving their reputation. This career concern increases as regulators near the end of their term, and hence regulators are less keen to challenge the firms they regulate for fear that they might be exposed as being wrong. This can be interpreted in `capture' in the loose sense of the word if we consider that one of the tools firms have at their disposal to exert power over regulators is through damaging their reputation. Taking a different approach, Dnes and Seaton (1999) find no evidence for a `life-cycle' effect related to capture either way in an event study of electricity regulation in the UK. Hence, overall, the empirical jury is still out when it comes to the way term lengths should be adjusted to reduce regulatory capture.

Empirical work on the existence of a `revolving door' effect is minimal and inconclusive. Cohen (1986), for example, shows that regulators do become more favourable to the firm they regulate in the year before they become employed there, but not before this. This importance of the proximity to the end of one's term is also found in Leaver (2009), suggesting that careers in industry may act as an incentive only when the prospect of a change in employment is imminent.

VI. Anti-corruption policies in regulated industries: Practice

Before concluding, it may be useful to mention some of the real world challenges in trying to deal with corruption in a very pragmatic way. Between 2005 and 2010, every major international development agency has issued guidelines.[17] Many governments in developed countries, starting with the US, the UK and various Nordic countries have their own national guidelines. Most guidelines follow the red flag approach which gets auditors to identify unusual details in the way business is being done. All agree that the main corruption issues arise from a lack of transparency, limited access to information, and lack of accountability and control.

Most of the advice to reduce these problems focuses on the procurement phase and on institutional dimensions of the organization of institutions that drive the incentives. Most of this advice can be traced to many of the theoretical debates They are part of the real life solutions. They are necessary but they are not sufficient. It is somewhat surprising that the sector experts that work on these guidelines tend to omit the details of the choices of regulatory tools that make transparency and hence accountability possible. Regulation is about details. In most businesses, whether regulated or not, the details can be picked up in sound business accounting data. Many developing countries have poor accounting systems, many developed countries leave too much room for creativity to accountants. For instance, provisions for losses are widely used to smooth profits over time. This has the dual benefit of cutting tax liabilities but also to inflate costs that can then be passed on to regulated tariffs when convenient. Similarly, internal transfer pricing through subcontracting can be used to cut taxes and increases costs to be reflected in tariffs. Few guidelines however do into the details of regulation. Exceptions can be found among British, Australian or Dutch regulators in developed countries and in Brazil, Colombia, Mali or Morocco for developing countries. In those countries specific regulatory accounting guidelines are demanded from the regulated utilities to minimize the incentives to be too creative in the accounting of these industries. [18] Not everything is perfect and it can lead to conflicts as was the case in Mali for instance where a private operator preferred to pull out once they considered that the regulator was too inquisitive. [19]

Yet, more transparent accounting guidelines can significantly help diffuse the fights around pricing for monopoly infrastructure services. To move toward more realistic regulatory targets, it is essential to ensure that the information base grows and that the ability of regulators to process it improves. Getting it right—with well-

[17] The OECD, the UN, the Word Bank and the various regional development agencies have each issued guidelines on how to deal with corruption in general but also in some of the sectors regulated

[18] For a useful overview of best practice, see Grroom, Schirf-Rapti and Rodriguez-Pardina (2008)

[19] See Schilrf-Rapti (2005) who points to the cultural differences between a French operator functioning as in France where regulation is more political than technical and a regulator trying to introduce accountability starndard to the tariffs setting process closer to the British tradition. Schlrf-Rapti also points out the inconsistency in the technical assistance received by the regulator. Some of the support was funded by the French development agency with one message, relayed by some of the French staff of other donors. The regulator was also being advised by other sources closer to the anglo-saxon view of regulation.

conceived rules, data, and methodologies—helps to avoid time-consuming regulatory disputes and contract renegotiations. It also reduces the risks of regulatory capture by the new private operator, and assess who gains and who loses from utility privatization. Getting it wrong can cause the operators to operate and invest inefficiently, raise its cost of capital, and ultimately increase tariffs to be paid by users or subsidized by taxpayers.

More generally, the point made here is that one of the main lessons from the developments in the theory of regulation of the last 40 years now is that information matters. A lot of the theory tries to come up with ways of minimizing the consequences of information asymmetries, taking a rather modest view of the scope of action available to actually cut information asymmetries rather than having to deal with them. In business, information is about accounting. The use of information is about the modelling of cost and demand and how their interactions can and should be used to assess the average tariff that will ensure that the returns on assets generated by average tariffs are not over a reasonable threshold, typically an approximation of the cost of capital. This is a way to be fair to all actors, operators, users and taxpayers. And when cost information is not available, it can be approximated by regulators facing operators unwilling to provide that information. Performance benchmarking is becoming more and more precise and in many countries, it is used in regulated industries to shift the burden of providing evidence on the true costs on to producers. Benchmarking also allows other actors to assess the extent to which the regulator is delivering on its commitments, is incompetent or shows signs of capture.

In a nutshell, in practice, the simple idea is to reduce the information assymetries so that costs are minimized, that there are no favours, no tolerance for insufficient efforts. This goes beyond the broad decisions on market structure, it deals with the strict measurement of performance. It simply deals with sound a combination of sound cost accounting and benchmarking. These are not very exciting activities for economists, but they can do a lot to protect the interest of users and taxpayers when the risks of capture are serious. These risks are serious for most regulated industries. And not just in developing countries. Halliburton, Enron, Bouygues or Siemens are all very big names which have encountered their share of problems with the law for abuses in regulated industries, as domestic actors in their own countries or as foreign investors around the world.

VII. Conclusions and lessons for general anti-corruption policy

This paper has shown that economic theory suggests a range of solutions that aim to deal with the risks presented by corruption in regulated industries. From reviewing these solutions, we can see that each policy aims to do one of two things: Reduce the power of threatening interest groups to corrupt decision makers or

reduce the ability of regulatory agents to exploit the information asymmetry between them and their principals.

The first of these two objectives arises from the `interest-group' theory of capture which argues that regulatory capture is determined by the relative power of rival interest groups. According to this theory, capture can be reduced by decreasing the power of the groups most likely to capture and increasing the power of the groups that suffer from capture. Liberalisation serves to decrease the power of the regulated industry by splitting it up, whilst closing the revolving door decreases the power regulated firms have over current employees of the regulator. More generally, increasing the number of regulators and requiring their appointment to be made by two separate powers dilutes the effect of any interest group that has power over a single actor. Consumer advocates and the election of regulators then aim to increase the power of consumers and taxpayers, who are generally the victims of capture. Other policies may then either reduce or increase the risk of capture. Decentralisation is likely to increase the power of both local consumers and other local interest groups, and hence the overall effect will be context dependent. Similarly, privatization and increasing regulatory independence have ambiguous effects. If an interest group holds power over politicians, then distancing them from control of the firm is likely to reduce the effect of capture. On the other hand, if we are worried about the firm corrupting government agencies, then distancing this process from relatively accountable politicians may increase the probability of corruption.

The second objective, which focuses on decreasing an agent's ability to exploit information asymmetries, comes out of the theory of corruption revolving around a principal-agent model. This theory tells us that one way capture can be reduced is through the reduction in information asymmetries, which may be brought about through liberalisation if competition is achieved. Increasing the number of regulators may also be useful since it reduces the ability of any individual regulator to hide information – an activity that may be made easier if the regulator is given greater independence. The theory also suggests that shortening the term length of regulators and closing the `revolving door' may reduce the ability of the firm to make credible implicit contracts with the regulatory agent, and in doing so decrease the risks of capture. Finally, according to this theory, the effect of privatisation on the costs of capture will depend on the relative distortions of higher prices compared to higher taxes.

The paper has also shown that many regulators in the real world are sill trying to reduce information asymmetries at the same time as they are working on minimizing the risks associated with the asymmetries. Academic research could claim credit for some of these solutions at least since benchmarking dates back to original research by Schleifer (1985) on yardstick competition. But the accumulated stock of knowledge from the practice of regulation can share that credit as regulators have learned quite a bit from these benchmarking approaches how to reduce the risk

of excess costs, whatever their sources. The real challenge is to get politicians to allow regulators to develop those tools and this is still a challenge in many countries, whether rich or poor, indicating that political interference with optimal regulation is still a rather common issue.

To conclude, it may be useful to summarize the lessons to be learned dfrom these theories for anti-corruption policy more generally. First, theories of corruption in regulated industries give us a good example of when the cost of corruption is not equal to its frequency. In the model of corruption through asymmetric information, extra information may mean governments choose to spend less on preventing corruption precisely because it is less damaging. Hence, when anti-corruption policy is endogenous, we expect corruption to occur more often when it is less damaging. Similarly, the interest group theory of capture argues that it is the power of interest groups to capture that results in damaging distortions. In this case, reducing an interest group's power to influence the regulatory process legally will reduce capture, even though corruption may increase as the interest group seeks alternative means to influence. Furthermore, regulated sectors provide a good example of where the perception of corruption may not be correlated with the cost of corruption. In particular, corruption is more likely to be observed if it results in higher prices, yet it may well be that anti-corruption policies are most valuable when the costs are extracted from less-well observed government transfers.

Second, theories of corruption in regulated industries also point to a trade-off that may have implications for anti-corruption policy more generally. In many of the countries where corruption is most problematic, contract enforcement and the ability of the government to commit is also very limited.[20] In these contexts, commitment may come through repeated interactions and implicit contracts rather than explicit ones. This has implications for anti-corruption policy, since many of the policies discussed above that may reduce corruption also may reduce commitment. This trade-off is present because the existence of repeated interactions and implicit contracts are precisely those factors that are necessary for corruption. When designing anti-corruption policy therefore, it may be important to either simultaneously work on alternative ways to increase commitment or focus on strategies that improve both, such as improving the power of the judiciary.

Finally, work on corruption in regulated industries alludes to a relationship that is likely to be of concern for anti-corruption policy throughout government. Corruption takes place at a variety of different levels, and these different types of corruption may either be complements or substitutes. For example, when politicians take bribes to favour firm's interests, the model of informational capture discussed above shows that they are likely to spend less on preventing the corruption of regulatory agencies – hence here the two forms of corruption are complementary.

[20] For more discussion of problems of limited commitment in regulation in developing countries, see Estache, and Wren-Lewis (2010)

On the other hand, we have seen that if a private firm corrupts the regulator in such a way to allow higher regulated prices, this may reduce the incentive to demand small bribes at the point of service delivery – hence here the two forms of corruption are substitutes. Since reducing one side of complementary corruption is likely to be more effective overall than reducing one part of substitutable corruption, understanding the relationships between different forms of corruption is clearly crucial for anti-corruption policy.

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