Stranded assets are assets that have lost a large amount of their value and may even be worthless. However, “worthless” and “stranded” are not synonymous. To be considered stranded, assets generally must be assets of a regulated industry and must have lost their value as a result of legislative or regulatory changes. Stranded assets have recently taken on considerable significance in network industries, especially electric utilities. The resulting demands for compensation or recovery of stranded assets have made it one of the major public policy problems that must be addressed by regulators and legislators today. The purpose of this paper is to examine the problem of stranded assets and consider some possible directions that might be taken in addressing the problem. In section 1, we begin by reviewing and defining the problem of stranded assets. In section 2, we comment on a number of approaches to the problem. Some of these might be characterized as variations of network access pricing schemes. In section 3, we develop a simple model to illustrate the problem of stranded asset recovery by various means, including access pricing. Section 4 is by way of summary and implications.

1. Stranded Assets

Before providing our definition of stranded assets, we first review some of the issues. For an asset to be considered stranded, it must incur a significant loss in value. However, losing its value alone does not necessarily make an asset stranded. Some assets become worthless in the normal course of the operation of the market. Their loss in value is attributed to the normal operation of the competitive market. In the competitive market, the entrepreneur faces the consequences of his own actions and, if he cannot meet the standards of the market, pays the price. Take the

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1 The authors would like to thank Shimon Awerbuch, Mark Beyer, Robert Graniere, Sally Johnston, Richard Schuler, Richard Simnett, and Larry Spaccab for helpful comments.
example of an entrepreneur who buys a country house and converts it into a charming hotel and restaurant. Unfortunately, he misjudges the conversion costs and ends up having to sell the property at a loss. The loss should not be considered a stranded asset but rather the necessary consequence of failing to meet the standards of the competitive market. Indeed, losses and the threat of bankruptcy are the principal disciplines imposed in a competitive market to encourage prudent investment on the part of entrepreneurs and investors.

Critical to the determination of whether assets are stranded is whether they have lost a significant portion of their value as a result of legislative, government, or regulatory changes. However, not all losses in asset value resulting from action by government are expected to be compensated. For example, the gas, electric, telephone, and water companies that supplied an automobile assembly plant should not expect to be compensated if the plant is forced to close because it is too expensive to modify it to produce zero-emission vehicles which were mandated by government decree. This kind of loss would be considered part of the normal risks of doing business and is not significantly different from the risks faced by unregulated businesses. Thus, stranded assets arise primarily in regulated industries, but the mere act of losing value as a result of a regulatory change is not sufficient for assets to be considered stranded. For assets to be considered stranded, the loss must be directly related to the actions of the industry regulator or legislation specific to the industry.

Based on the above discussion, we propose the following definition of stranded assets:

Assets are considered stranded when they were prudently acquired but have lost economic value as a direct result of an unforeseeable regulatory or legislative change specific to the industry in question.

We note the following characteristics of a stranded asset:

1. The investment decision to acquire the asset or contract for its use would have to be considered “prudent” in the light of the information available at the time it was made.
2. The loss in value must be the direct result of regulatory or legislative change and not the result, foreseeable or not, of changes in factor or product markets.
3. The change must have been unanticipated when the original investment was made.
4. The change in the economic value of the asset must be evaluated against the prospects for cash flows from use of the asset in the future.

Before proceeding to examine the problem of stranded investments as manifested in regulated industries today, we develop a simple statement of the problem. We summarize the principal aspects of stranded investment symbolically with the following expression:

$$S(y', \theta) = PV[\Pi(x, y, \theta) - \Pi(x, y', \theta)]$$

where

$$S(y', \theta) = \text{Loss in value of the regulated firm's assets at } (y', \theta);$$

$\theta$ is the state of the world, observed after both $x$ and $y$ are chosen; $y$ is the initial regulatory regime, which is expected by the firm to continue; $x(y)$ is the firm's optimal choice of long-run assets, technologies, etc., given $y$; $y'$ is the changed regulatory regime, possibly unanticipated by the firm; $PV(\cdot)$ is net present value; and $\Pi(x, y, \theta)$ is a vector of profits per period over the life of the assets in regulatory regime $y$, when the firm chooses long-run factors $x$ and state of the world $\theta$.

Assuming that $x$ is chosen to maximize expected discounted profits $EPV[\Pi(x, y, \theta)]$, given $y$ and some distribution over $\theta$, it is clear that the change in regulatory regime to $y'$, if unanticipated, will lead to a decline in expected profits. Of course, it may or may not lead to a decline in actual profits, depending on the state of the world $\theta$ which obtains. And this is the nub of the problem of determining stranded assets. The loss in value of assets is state dependent, and the distribution of $\theta$ used to determine $x(y)$ (and therefore expected profit) is known or verifiable only to the firm's owners/managers. How then is a regulator to determine ex post the magnitude of stranded investment?

One approach is to attempt to assess ex post the difference between what the firm would have earned under $y$ and under $y'$ given its actual investments and the state of the world $\theta$ which obtained, with assets being called stranded only if this difference is positive. This amounts to defining stranded investments as $Max(S(y', \theta), 0)$. A little reflection will lead the reader to see that this is a very general definition of "stranded assets." It essentially guarantees to all states of the world complete immunity from downside risk and attributes all negative outcomes to regulatory choice, when in fact some, if not most, downside risk is the result of normal business uncertainty as captured in the uncertainty of the state of the world $\theta$. Thus, under such a regime, favorable changes in the state of the world imply that a regulator can change the regulatory regime without being punished with a claim for compensation. However, there may be an asymmetry for unfavorable changes in the state of the world. If $S(y, \theta) > 0$, that is, the regulated firm shows a loss of value in its assets ex post, the firm may seek to have the regulator compensate it for the entire loss in value, despite the fact that some of the loss arose from the changed state of the world $\theta$ or from the regulated firm's choices $x$. Indeed,

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2 Stranded assets can be in the form of financial assets, such as contracts, as well as physical assets, such as plants or equipment.

3 This is very much in the spirit of Buchanan's (1968) work on the subjectivity of costs. Thus, costs and profits are only known at the time when economic resources are irrevocably committed to a course of action by a decision maker.
it should be clear that full indemnification of the firm against downside risk, if anticipated ex ante, will lead the firm to make exceedingly risky choices, since it will in effect be playing with “house money.”

It is because of this difficulty in the real world of identifying how much of the stranded investment arises from the firm’s own actions and from changes in the state of the world that the issue of stranded assets will be highly contentious and difficult to resolve. As economists, we can provide some analysis of the issues, but the ultimate resolution will be highly judgmental. Before proceeding to a discussion in section 2 of ways of addressing the stranded asset problem, we will provide some background on the stranded asset problem in electric utilities and telecommunications.

Some firms in the electric utility industry, at least prima facie, have a strong case for claiming that they face a problem of stranded assets. For many years, the electric utility industry has been highly regulated not just in terms of traditional rate-of-return regulation but also in terms of environmental regulation and acting as an agent for the state in promoting energy conservation through demand-side management (DSM) and other policies. Government policy has lead the industry to make decisions that have turned out to be very poor and have resulted in assets which now have a very low market value relative to their book value. The prime example is nuclear power. The public has come to think of nuclear power plants as costly white elephants. Under rate-of-return regulation, the public would bear the cost of such mistakes over a long period of time. As the utilities were monopolies with entry blocked by the regulator, the original investment would be recovered slowly over time through long depreciation lives. All this changed beginning in 1978 with the Public Utility Regulatory Policies Act, which made access to the utility network much easier for independent power producers. The process quickened in 1992 with the Energy Policy Act, which further opened up their networks, signaling an end to the traditional guarantee by the regulator to protect the utilities from entry. This presented some utilities with the immediate prospect that they would be unable to recover a large portion of their investment in their nuclear plants and other assets. The rate of capital recovery through depreciation was too slow to allow them to recover the original cost of the assets, as competition could be expected to drive down the prices they could charge for the electricity they generated.

In telecommunications, the effects of competition and technological change started to become apparent in the late 1970s with the entry of resellers and facilities-based competition into the long-distance business. With the divestiture by AT&T of its local exchange business, the process gathered momentum. AT&T and the local exchange carriers (LECs) showed an awareness of the problem and sought relief from regulators who allowed faster capital recovery. However, despite the progress made in bringing about faster capital recovery, there is still a concern on the part of LECs that they may be faced with stranded assets. The

Telecommunications Act of 1996 and the resulting arbitrations to determine the terms under which long-distance companies can enter their markets as resellers and as facilities-based providers has resulted in claims that the LECs face severe problems of stranded assets and under-recovery of capital. There have been claims that the regulators were in breach of what is called “the regulatory contract” or “an implicit regulatory compact.” The regulatory compact or contract refers to the notion that firms would be guaranteed a reasonable rate of return on their assets in return for controlled prices; and prices and price variability would be kept low by regulation and by long depreciation lives and extended capital recovery. With technological change and the entry of competitors with newer technology, however, LECs with a capital recovery deficiency would be unable to recover their capital, since now the market and not the regulator was determining the rate of capital recovery. Unless the regulator permitted them an immediate increase in capital recovery while they still had some residual monopoly power, perhaps by delaying entry, the regulator would be in breach of the regulatory contract because they would not be able to recover their capital. Arguments for such increased capital recovery have had all the elements of the above dilemma in them, including judgments as to whether the investment had been prudently undertaken, whether changes in industry regulation were unanticipated, and whether states of the world which obtained were more or less favorable to the stranded investment argument put forth by the regulated firms.

At first sight, both industries have what looks like a compelling case that the regulator is in breach of the existing regulatory contract. However, these claims need closer examination. In both of these industries, not all of the assets are stranded. In the case of telecommunications, the value of the LECs’ networks have already increased in value since divestiture because of the booming demand for telecommunications brought about by rapid technological change in the industry. The fax machine, the internet, competition in long distance, and the growth of 800 service have benefited the LECs in the form of increased demand for their local exchange networks. New technologies, for example asymmetrical digital subscriber line (ADSL), have made it possible to increase bandwidth of copper wire potentially increasing the value of the LECs networks. In addition, the LECs themselves will be entering the long-distance markets, further increasing the value of parts of their networks. Rapidly growing markets and advancing technology imply that the argument for significant stranded assets in telecommunications is, at least at the present time, a difficult one to make. In terms of our definition, many of the assets in telecommunications would not qualify as stranded because their economic value is growing not declining.

The situation facing the electric utility industry is quite different. The industry

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4 We first analyzed this problem in relation to local exchange carriers. See Crew and Kleindorfer (1992a).

5 A stalwart proponent of this argument on behalf of the LECs has been Robert Harris in testimony in numerous jurisdictions. Crew and Kleindorfer (1992b) describe the regulatory contract and indicate ways in which LECs and regulators can work to maintain its viability. We offered a form of quasi-quo price-cap regulation which, at least in theory, offered the opportunity to make the companies and customers better off.
faces stringent environmental regulation and demand is sluggish. The technological change that is taking place, notably the combustion turbine, seems to work mostly to reduce the value of the assets of existing utilities. However, although the picture in electric utilities is much weaker than in telecommunications, there are instances where some companies—those with low-cost fossil fuel plants or hydro plants—do not have any stranded assets. Indeed, the value of their assets has increased as the markets for their low cost power are opened up. As the example of the United Kingdom shows, moreover, even slow growth markets offer significant potential for earnings through internal and institutional restructuring and the resulting increased flexibility for companies to reduce X-inefficiencies and respond to market opportunities without regulatory intervention. Similarly, companies relying on purchased power may find that the value of their assets has increased if they get increased access to lower cost power as a result of competition. Even companies with heavy investments in nuclear may find that the value of their transmission and distribution systems has increased. They have a natural monopoly in distribution and increased competition will mean increased demand and, therefore, increase the value of their distribution system. Similarly, their transmission network may have bottlenecks from which they can extract high congestion prices. Thus, it is vital to consider not just the loss in value of a utility's generating assets but also the increase in value of its transmission and distribution networks. If the loss in value exceeds the gains, then the net loss in value (if attributable to unforeseeable regulatory action) would be considered stranded investment. It is this net figure that has to be addressed. If the net is positive, we would argue for doing nothing, even though this means that the shareholders have received a windfall. If the net is negative, then the question of what to do becomes an issue to which we will devote the remaining sections of this paper.

These examples from the electricity and telecommunications point to a further difficult problem of determining whether an asset is indeed stranded and the extent of the loss. The problem is that, particularly in network industries, assets do not have value in isolation, but rather their economic value is determined jointly through their use with other assets. The system-wide basis for defining economic value of a group of assets makes the problem of judging changes in value for subsets of these assets particularly thorny. A variety of methods have emerged for dealing with this valuation problem in networks, but none are completely satisfactory, as we will see.

2. Some Approaches to the Problem of Stranded Asset Recovery

In this section, we examine a number of solutions to the problem of stranded asset recovery. We do not claim to be comprehensive in our treatment, but we have attempted to identify the major approaches to stranded asset recovery. They fall into three categories. The first is to open up markets as soon as possible and let competition rip. The implication of such a policy is that the losses, if any, should lie where they fall. In this context, stranded asset recovery is perceived as a misguided or irrelevant concept. Thus, the free market solution implies no provision for stranded asset recovery. The second approach attempts to define estimation methods, including a variety of scenario-based and auction approaches, for identifying, valuing, and recovering stranded assets. The third approach involves a quid pro quo approach derived from a forward-looking market-based approach, which attempts to provide the regulated firm with additional flexibility to generate earnings to recover stranded asset costs while providing assurances that customers will not be disadvantaged. We examine each approach in turn.

Open Markets to Competition and No Provision for Stranded Asset Recovery

Opening up markets immediately to competition is one approach which is proposed and employed on occasions, notably, De Vany (1997) and Michaels (1997). De Vany argues for opening up the market to competition, and Michaels argues that attempts to provide recovery of stranded investment are mistaken. He specifically addresses the situation in the electric power markets in California, which he criticizes as anticompetitive. De Vany argues, inter alia, competition will mean that "[t]here are no stranded assets or customers in an open market because electricity generation assets are no longer specialized to a particular service or set of customers" (1997, 49). Michaels argues that the anti-competitive nature of the California plan will result in not only static but also dynamic inefficiency. Consumers will not see significant price reductions, which will be further delayed by the ability of incumbent utilities to bar entry to competitors with more efficient plants. In addition, he argues that the plan may not benefit investors, the group that are at risk from failure to recover stranded assets. He argues that, although the plan provides over-recovery of stranded assets, it also provides no guarantee that investors will benefit from the full amount of the recovery. He argues that management may appropriate some of the revenues allowed by entering all sorts of regulated ventures rather than returning the funds to the investors.

The DeVany-Michaels approach does not specifically disallow recovery of stranded investment. It sees it as something that a market opened up to competition will resolve. There are instances, however, where stranded investment is explicitly disallowed. This would be the case where a regulatory body judges that the claims by a company to have stranded assets are groundless and disallows them. For example, a company might claim breach of the regulatory contract, and its commission might counter by ruling that there was no breach.


7 In a recent case before the Washington Utilities and Transportation Commission, docket no. UT-951425, Robert Harris claimed a breach of the regulatory contract. However, the matter was effectively deferred, as the Commission was never required to make an explicit ruling on the matter with USWEST Communications, Inc. reaching a settlement with the parties. The settlement, presumably, does not affect the company's right to raise the argument again in the future. Such claims are currently being made in several cases the outcomes of which will be known shortly.
The no-recovery solution is one that has a strong following and one that cannot readily be dismissed. It is attractive in that it avoids inefficiencies of the type Michaels discusses. However, it does raise certain legitimate concerns of a more general nature going beyond just the narrow interests of the companies concerned. If claims for stranded asset recovery are understood to be summarily dismissed in one industry, this may have an adverse impact on investment in other regulated industries. If investment in a regulated industry is seen as something that the regulator can effectively choose through haphazard changes in regulations, then this is an added risk making investment less attractive and requiring significantly higher returns than associated with traditionally regulated industries. The concern is not just with the industry suffering the losses. If the precedent created by this treatment in the eyes of investors is that the regulator and the government are prepared to make changes in policy without any intention of compensating investors for losses, then investment in all regulated industries will be adversely affected.

"Reasonable" Recovery of Stranded Assets

We use the term "reasonable" in this context because we are considering methods of recovery that would rely on the tradition legal and administrative institutions that operate in regulation. These have traditionally been based on a "just" price and "reasonable" return on assets. Claims for stranded assets imply that investors have not achieved the presumed reasonable return on assets. Hence our use of the shorthand and familiar term "reasonable."

The disadvantages of this approach have been stated, for example, by Michaels and are clear from the model in section 1; it is extremely difficult, ex post, to sort out what the actual loss in value is and how much of this is due to unanticipated regulatory actions. However, the benefits of this approach are several. It would use an approach that was familiar to most of the parties. While this may not be the case for prospective entrants to the industry, even here, most potential competitors would understand the importance of the regulatory process before considering entry. The approach would emphasize considerations of fairness and openness and might therefore be more acceptable than some other approaches. It may have lower transaction costs, at least relative to the alternative of litigation. The latter, given the legal resources available to the industry, would result in significant delays and very high transaction costs. In addition, it is unlikely that courts, lacking knowledge of the industry, are likely to come up with a result that is less satisfactory than that which could be reached by means of the administrative and regulatory process.

If the route of "reasonable" recovery is chosen, two main problems have to be resolved. One is the valuation of the stranded assets. The other is the actual compensation mechanism. A number of methods might be feasible for valuing the stranded assets along the lines of the discussion in section 1. One approach may be to auction off the stranded assets, for example, along the lines of Ainspan and Lesser (1996). This would have the advantage of putting a market valuation on the stranded assets which may be preferable to alternative approaches. Having determined the value of the stranded assets, the design of the mechanism to compensate the firm for the loss in value of its assets would have to be resolved. This is the subject of section 3, where we examine some of the problems of various compensation mechanisms by means of a simple model. However, before turning to this issue, we will briefly examine one more alternative.

Price-Cap Regulation: Using a Quid Pro Quo Approach to Stranded Asset Recovery

We first proposed this approach in the context of increasing the rate of capital recovery in the context of the situation facing LECs (Crew and Kleindorfer 1992b). Throughout the 1980s, the LECs had protested that their rates of depreciation were too slow given the rapid technological change that was taking place in telecommunication and given the increasing competition they were expecting to face. We, therefore, proposed an approach to address this issue which had the potential to make both ratepayers and the LECs better off. Our approach involved adjusting the initial price level and the X factor to enable faster capital recovery to take place. There are several variations on the theme. One possibility is a higher price now and a higher X factor. The other is that the company would get higher prices in the initial periods but would face a lower X factor later. The idea was to enable the LECs to gain faster capital recovery immediately in return for guaranteed greater price reductions in the form of a higher X factor. The idea was intended to be attractive to them not only in that they would recover their capital more quickly but also in that the pattern of recovery was reflective of the increasingly competitive situation they were facing. It is fairly straightforward to demonstrate that companies would find such a proposal attractive if demand is growing. Despite the apparent attractions of our proposal, at least to our knowledge, there were no takers. There may have been a number of reasons for this. The LECs continued to prosper and continued to be successful at increasing their rate of capital recovery without "renegotiating" the terms of their regulatory contract. The continued stability and health of their earnings also made it difficult to sell the argument for increased flexibility to their regulators. In addition, perhaps the quid pro quo aspect may have been problematical for the LECs if they were not completely convinced about the increasing intensity of the competition and the robustness of demand growth. For electric utilities today, some variation on this theme might address the problems they face of increasing competition and stranded assets. It seems likely that the attractiveness of such an approach in electric power would be based on opportunities for pricing flexibility and improved productivity under deregulation. This could come about through either a formal quid pro quo
approach embedded in the price cap or through less explicit approaches which provide the regulated firm cash flows through more flexible competitive pricing allowances or other regulatory relief.

One common variant of the negotiated *quid pro quo* regulatory settlement of stranded asset claims which does appear to be used in practice is the delay of regulatory changes to allow for a suitably long period of protected transition, during which the regulated firm clears up its capital recovery deficiency. This and other informal or less explicit approaches are probably the most common approaches to settling the stranded asset problem. Given their relative efficiency in transactions cost terms, they may represent an appropriate balance between the dangers which explicit recognition of stranded assets presents, as argued by Michaels, and the legitimate claims of some regulated firms for stranded asset recovery. However, this under-the-table or more informal approach is likely to work where the magnitude of stranded assets is very large. In these cases, some explicit identification and valuation must be undertaken. Once stranded assets are explicitly recognized, there must also be explicit mechanisms for recovering the losses associated with these assets. We now consider various approaches for implementing “reasonable” recovery of stranded assets.

3. Compensation Mechanisms for Stranded Asset Recovery

In this section, we consider a simple model which allows us to compare various mechanisms for stranded asset recovery. Since the transition in network industries is primarily concerned with promoting competition, we will be especially concerned with the impact of stranded asset recovery on competitive entry.

We assume two classes of economic agents, an incumbent and entrant(s). The incumbent $I$ operates with a technology with (long-run) unit cost of $C_I$. Entrants $E$ operate as a perfectly competitive fringe with a technology with (long-run) unit cost of $C_E$. The incumbent offers a product $X$ which is an imperfect substitute for the entrants' product $Y$. In addition to the cost $C_I$ associated with producing output $X$, the incumbent has additional costs $S$ which may be only imperfectly observed by a regulator and which represent the costs of stranded assets in the sense defined earlier. Whether and how $I$ is compensated for $S$ will have a significant impact on the efficiency of the resulting outcome. We consider three approaches to compensation:

1. Covering $I$’s stranded assets from general tax revenues, e.g., through tax credits to $I$.

2. Taxing $E$ per unit of output to pay for $I$’s stranded assets.

3. Providing no compensation; letting $I$ pay for its own stranded assets.

We follow the standard model for public utility pricing (e.g., Crew and Kleinendorf (1986)). Define willingness to pay WTP for a consumer of type $t$ as $\nu(x, y, t)$, where $x$ is the amount of service provided by the incumbent and $y$ is the amount provided by the competitive fringe (as noted, we assume product differentiation between $x$ and $y$). We represent consumer preferences in the usual quasi-linear form:

$$u(x, y, m, t) = v(x, y, t) + m,$$

where $m$ is the numeraire good and $t \in T$ is the consumer type. Consumer demand in response to prices $P_X$ and $P_Y$ for services $x(t)$ and $y(t)$ will then be the solution to $Max[v(x, y, t) - P_Xx - P_Yy]$. Given these constraints and assumptions, we can use the following notation to represent demand for the various services of interest and the resulting welfare and profit functions:

**Demand for Incumbent’s Services**

$$X(P) = \int_{t \in T} x(P, t) \, dF(t).$$ (1)

**Demand for Competitive Services**

$$Y(P) = \int_{t \in T} y(P, t) \, dF(t).$$ (2)

where $P$ is the price vector $(P_X, P_Y)$ and $dF(t)$ is the number of consumers of type $t$, $T$ being the set of types.

We assume that entrants pay the incumbent a tax per unit of output (or capacity installed, which in the deterministic model here equals output). We denote this tax by $\rho \geq 0$. Since the $Y$ market is competitive, entry will occur until $P_Y = C_Y + \rho$. Incumbent’s profits can, therefore, be represented as

**Incumbent’s Profit**

$$\Pi_I(P) = (P_X - C_X) X(P) + \rho Y(P).$$ (3)

or alternatively, since $P_Y = C_Y + \rho$, as

$$\Pi_I(P) = (P_X - C_X) X(P) + (P_Y - C_Y) Y(P).$$ (4)

We assume that prices are regulated. We will treat the price vector $P = (P_X, P_Y)$ as the decision variable, although the real decision variables are $P_X$ and $\rho$. Consumer surplus $U(P)$ is given by

$$U(P) = \int_{t \in T} [v(x(P, t), y(P, t), t) - P_Xx(P, t) - P_Yy(P, t)] \, dF(t).$$


\[ V(P) = V(P) - P_X X(P) - P_Y Y(P) \]  

(5)

with \( V(P) \) equal to aggregate WTP.

**Welfare**

The traditional welfare function, the sum of consumer and producer surpluses, can be expressed as

\[ W(P) = U(P) + \Pi(P) = V(P) - C_X X(P) - C_Y Y(P). \]  

(6)

We have in mind solving a Ramsey-like problem of determining the optimal compensation arrangement subject to a break-even constraint for \( I \), using revenues from sale of \( X \) as well as any external compensation, through the “competition transition charge” \( p \), I may receive to pay for \( S \). We can now consider the three options of interest for compensating the incumbent for the costs \( S \) of stranded assets.

### 3.1. Guaranteed Stranded Assets Recovery from General Tax Revenues

Consider first the case where \( S \) is paid for from general tax revenues and assume efficient regulation, i.e., \( P_X \) set so that \( I \) just breaks even. If such payments are not anticipated by \( I \) (i.e., they are non-distorting) and if they do not impose a deadweight loss themselves through the general inefficiency of taxation, then the welfare optimal solution results. That is \( P_X = C_X \) and \( P_Y = C_Y \) would result and entry would occur at the efficient level. However, given the likely infeasibility of funding stranded assets by general taxation, we do not consider this option further.

### 3.2. Guaranteed Stranded Assets Recovery by Taxing Entrants

The welfare optimal solution for the option of paying for stranded assets by taxing entrants is the solution to the following problem (note that this is posed in terms of the price vector \( P \) rather than in terms of \( P_X \) and \( \rho \)):

\[
\text{Maximize } W(P) \text{ subject to } \Pi(P) \geq S, P \geq 0.
\]  

(7)

Let \( W^*(S) \) be optimal solution to this problem and denote the optimal solution value by \( W^*(S) = W(P^*(S)) \).

### 3.3. Stranded Assets Recovery Placed on the Incumbent

This option is along the same lines as the Devany-Michaels proposal discussed earlier, where the incumbent pays for \( S \) out of revenues. The welfare optimal solution is the solution to the following problem:

\[
\text{Maximize } W(P) \text{ subject to } \Pi(P) \geq S, P \geq 0, P_Y - C_Y = 0.
\]  

(8)

Let \( W_0(S) \) be optimal solution to this problem and denote the optimal solution value by \( W_0(S) = W(P_0(S)) \). The reader will note immediately that if the same \( S \) is present in both (7) and (8), then \( W^*(S) \geq W_0(S) \), since (8) entails additional constraints (namely the constraint that only price vectors with \( P_Y = C_Y \) are feasible).

This result is just a restatement of the well-known Ramsey result that if a given burden (in this case \( S \)) must be borne by an economy, then welfare is enhanced if additional products are brought in “under the Ramsey umbrella” to pay for the burden.

#### 3.4. Taxing Entrants versus Burden Placed on Incumbent

The key point we wish to make is that raised in the discussion in section 2, namely the incentive effects of guaranteeing I repayment of stranded costs. To make the point in the context of the above two options (taxing entrants or having I pay for \( S \) from its revenues), we wish to analyze the case in which, because of asymmetric information, the regulator cannot determine precisely what the value of stranded assets are with the result that \( I \) is able to negotiate a higher stranded cost settlement \( S' > S \) when entrants are taxed than when \( I \) goes it alone. This assumption seems reasonable in view of the fact that \( I \) will face stronger incentives to economize when paying for \( S' \) from revenues.

We first note that both \( W^*(S) \) and \( W_0(S) \) are decreasing in \( S \). This follows since increasing \( S \) while requiring break-even operations imposes a more stringent break-even constraint on the associated Ramsey problem (so that if \( P(S') \) is feasible in this problem at \( S' \), then \( P(S') \) will certainly be feasible in the problem at \( S < S' \)). Thus, assuming the profit constraint is binding at optimum, it follows for \( S' > S \) that

\[
W^*(S) = U(P^*(S)) + \Pi(P^*(S)) = U(P^*(S)) + S > U(P^*(S')) + S' = W^*(S').
\]  

(9)

In particular, note that if \( I \) can misrepresent stranded cost to be \( S' > S \), where \( S \) is the actual value, then total welfare will decline (since \( W^*(S') < W^*(S) \)) relative to the pricing regime that would obtain if stranded costs were not overestimated. Of course, the incumbent will be better off by misrepresenting \( S \) to be \( S' \), but collecting the additional profits to fund the misrepresentation will cause a deadweight loss in welfare.

We thus have two regimes possible. In one, taxing entrants, the Ramsey advantage of pricing both \( X \) and \( Y \) under the Ramsey rule leads to welfare gains relative to \( I \) going it alone. However, if the incentive effects of taxing entrants leads to a negotiated outcome (i.e., a misrepresentation) of stranded cost, and if this misrepresentation is less when \( I \) goes it alone, then going it alone is the appropriate rule. To make this plain, we note what happens as the misrepresentation \( S' - S \) grows, where \( S' \) is the effective stranded cost when entrants are taxed and \( S \) is the stranded cost when \( I \) goes it alone. When \( S' = S \), we have from the above \( W_0(S) < W^*(S) \), so if no misrepresentation occurs when taxing entrants, then doing so is efficient. However, as \( S' - S \) grows (keeping \( S \) fixed), the welfare associated with the entry taxation regime declines, i.e., \( W^*(S) = U(P^*(S')) + S' \) is decreasing in \( S' \). The result is that for sufficiently large \( S' - S \), having \( I \) go it alone is a preferable regime. We illustrate this result in figure 1.

As the reader will discern, the region where taxation is preferable to the
incumbent’s covering $s$ will depend on all of the parameters of this problem. Clearly, if $s$ is small, if misrepresentation can be prevented, and if entrants have no product or cost advantages (so entry taxation will not have adverse dynamic efficiency effects), then taxation of entrants to pay for stranded assets is likely to be superior, although under the noted circumstances the welfare differences will not be great relative to having $I$ go it alone. The most advantageous case for entry taxation (e.g., using a rule like Efficient Component Pricing) would appear to be when $s$ is large, when there are no product or cost advantages for entrants, and when misrepresentation can be prevented.

These simple results illustrate the interdependence of designing appropriate compensation mechanisms for stranded cost and procedures for determining the magnitude of these costs.

4. Summary and Implications

We have shown that the problem of stranded asset recovery confronts regulators and policy makers with quite serious problems. We have examined a number of proposed and actual solutions to the problem—none of them entirely satisfactory. The biggest dangers in the current situation are that inefficiencies will be perpetuated or increased. Regulators are in a bind. Not to compensate may create inefficiencies in the form of less investment in the future not just in the industry concerned but more generally. However, the decision to compensate is an extremely difficult one. If the regulator decides to compensate, there is the danger of the creation of an entitlement mentality. This could lead to a situation where the regulated firm does not care very much whether it makes bad or very risky decisions, because it expects the regulator to cover its losses. If this continues, it may be very difficult to break out of the entitlement environment and move to a competitive industry.

The policy that is most likely to be followed when sizable stranded assets are involved is the "reasonable" compensation approach. Our analysis in section 3 showed some of the difficulties in implementing this policy. The difficulties arise from a number of sources, including information asymmetries and the effects of asset-value guarantees on incentives. Because of its impact on incentives, this approach is particularly vulnerable to the entitlement mentality. Also, if access pricing or taxes on entrants are used to compensate incumbents for their stranded assets, then further losses in efficiency result, especially in the presence of information asymmetries which allow the incumbent to negotiate compensation requirements in excess of real economic loss in value of the assets in question. Even if the worst excesses can be avoided with this approach, it will still have the immediate effect of impeding entry and causing static and dynamic inefficiencies along the lines argued by Michaels (1997).

It is for such reasons that a negotiated quid pro quo arrangement, for example, in the form of a price-cap regime that allows the recovery of claimed losses in value over time through improved productivity and service innovations by the regulated firm may be attractive. Such a quid pro quo arrangement reduces the transactions costs resulting from the necessity of determining the loss of value which is apparent in the other approaches. It does this by striking a negotiated agreement between the regulator and the regulated firm (which is transparent to other parties as well), rather than attempting to determine a net amount of allowed stranded asset recovery. It has the disadvantage that, because of asymmetric information, it may result in excessive compensation to the industry. A common variant of the negotiated approach which is being implemented is the delay of regulatory changes to allow a continuing period of protected transition for the regulated company to recover its capital. A further variant would be the transition to a price-cap regime in which the parameters of the price-cap regime were negotiated to reflect the needed flexibility for the regulated firm to "earn" its stranded asset recovery. This approach would again have the benefit of reducing transactions cost, promoting a smooth transition to competition, and protecting consumers through the normal operation of price-cap regulation. The increasing popularity of price caps in network industries in transition is no doubt a result of the recognition of these benefits by regulators and regulated firms alike. However, the details of appropriate price-cap regimes in different industries are themselves complex and require considerable judgment in practice.11

References


11 For a review of recent experience with price caps in different industries and national contexts, see Crew and Kleindefor (1996).


