The Strategic Use of Regulatory Investment

by Industry Sub-Groups

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In the last ten years, consumer regulation at the federal, state and local levels has burgeoned. Of the eight federal agencies directly concerned with consumer protection, three—the Office of Consumer Affairs, the Consumer Product Safety Commission, and the Consumer Product Information Center—were created in the 1970's. At the same time, the emphasis placed by existing agencies on consumer regulations has increased. These regulations have had, of course, important effects on industry as well as on the consumers they may have intended to serve. Early work investigating the effect of regulation on industry (see, for example, Stigler, 1971), treated firms in the industry as a single coalition—equally affected by the regulation, and therefore equally interested in encouraging or discouraging those regulations. In this paper, I focus on the sub-groups of firms within industries, and in particular examine the way particular regulations may favor one sub-group or another within an industry, and thus alter the competitive balance within that industry.

The argument I will make is two-pronged. First, I will argue that new regulations often impose very different benefits and costs on sub-groups within an industry. Secondly, and this is the more controversial link in the argument, I will argue that sub-groups within an industry often recognize and indeed may promote new regulations which will be to their comparative advantage. In short, regulatory barriers created by firm conduct may be used by sub-groups in the industry as a competitive weapon against other groups.
1. **Industry Sub-Groups**

The argument in this paper depends on the existence of sub-groups within an industry with different interests, as well as on the power of these sub-groups to actively participate in the process by which entry barriers are created. It is only recently that statistical work in industrial organization has begun to pay attention to the problem of industry sub-groups. Traditional statistical work in industrial organization has generally used the industry as its primary unit of observation. The focus in this work has been on the structure of the industry, and on how structural differences across industries create differences in the performance of those industries; details of the sub-structures of industries have been for the most part suppressed. This preoccupation with the industry, which has been noted by Caves and Porter (1978) among others, is most apparent in the empirical work in the field. Almost all of the empirical work on profitability treats industry characteristics as determinative. Firms are assumed to differ only in terms of size; differences in scope, organization, history, motivations and so on were generally suppressed.

In part this emphasis in the literature on the industry was the result of the difficulties of obtaining firm level data. In part, though, the emphasis on inter-industry analysis comes from the view that the structure of the industry determines firm behavior, and performance. This is clearly the presumption in the competitive model. In Caves' classic introduction to industrial organization (1964), for example, it is argued that: "In this environment [the competitive one], the individual firm has no significant freedom of choice." (p.37) Firm differences are suppressed because they are meaningless. Unfortunately, this tendency to underplay the power of firm differences spread to the treatment of non-competitive situations.
The major exception to this treatment of the industry as a homogeneous unit in the older literature was the case study. McKie, in his classic study of cans, for example, emphasizes the differences among can manufacturers not only in their size, but in their scope, type of product produced and policies. (McKie, 1959) McKie argues that there are important differences in the can industry between these firms producing "packers' cans" (fruit and vegetable cans) and "general line cans." These differences are recognized by the industry. Moreover, McKie argues there are differences between these industry segments both in economies to scale and entry conditions. This latter point about the group specificity of entry conditions anticipates quite recent work in economics and business.

Peck in his study of the aluminum industry also highlights differences among firms. (Peck, 1961) First, there are important differences in the structure, conduct and performance of the primary producers of aluminum and the independent fabricators; as in the McKie study there is a sense of sub-groups within the industry. Peck goes further, however, by pointing to differences within the group of primary producers. In the post-war period, the capacity expansion strategies of the three major producers--Kaiser, Reynolds and Alcoa--were quite different, and quite important for the performance of the three companies.

Recent statistical work in industrial organization has begun to investigate these intra-industry differences suggested by earlier case studies. Of the economists, Caves and Porter have been most influential in this new work. Firms within an industry are treated as heterogeneous,
with varying power and interests. This work has taken a good deal from business school literature, which has for a long time emphasized the firm over the industry. Hatten and Schendell argue, for example, "the literature of business policy points towards the idea that different firms compete differently within an industry because they have different resources and skills, possibly different objectives, and because they have managers who view the firms' environments on a personalized or idiosyncratic basis." (Hatten and Schendell, 1977, p.99)

Recent economics literature has focussed on what have been termed strategic sub-groups within an industry. The sub-group here is defined by the commonality of the strategies followed by the members in setting key decision variables--investment levels, R & D, etc. (Hunt, 1975; Caves and Porter, 1977; Porter, 1979.) Not only do sub-groups have different strategies, they are, in part because of these different strategies, differentially protected from the market. In a discussion reminiscent of McKee, Caves and Porter argue:

"...sellers within an industry are likely to differ systematically...so that the industry contains subgroups of firms with differing structural characteristics....Barriers to entry then become specific to the group rather than protecting all firms in the industry equally." (p.250)

Sub-groups in the industry differ, then, both in their conduct and in their final performance.

From this central proposition about the particularity of entry barriers to the group, the empirical literature has taken off to look at the effect that these differences in entry barriers have on the performance of the sub-groups. What are the results of the different strategic choices made by sub-groups within an industry, both in terms of differences in the height of the entry barriers facing potential entrants into that sub-group, and in terms of the performance of that sub-group?
As in the traditional statistical work in industrial organization literature, the primary performance measure used in this new literature is profit levels. Newman (1978) takes a first step in this work by testing the influence of differences in the homogeneity of an industry and its profit levels. Newman argues that the existence of distinct sub-groups within an industry reduces the capacity of that industry to collude, and thus reduces profit within the industry. The evidence supports this hypothesis. Porter (1979) goes one step further and argues that different sub-groups within an industry manifest different structure, conduct—performance relationships. Porter estimates separate profit functions for different sub-groups within a series of industries; his results suggest that there are significant differences in the profitability of various traditional industry entry barriers to different sub-groups of the industry. Industry concentration, advertising and economies to scale all yield profits for the leaders in an industry, but not for the followers. Hatten and Schendell (1977) consider the same problem within a single industry—brewing—and find that brewing firms do indeed display different marketing and manufacturing strategies, and that these different strategies have different pay-offs for the firms.

A recent paper by Porter and Spence pushes this work still further. Porter and Spence investigate differences within a quite traditional industry—the corn wet milling industry—in the capacity of expansion decisions of firms. Firms within the industry differ not only in terms of their size, but in terms of their tenure in the industry, risk-taking behavior and so on. As a result of these differences, firms make
different strategic choices about capacity expansion. The result is a quite variegated industry, both in terms of firm conduct and in terms of firm profits.

Recent work by Nelson and Winter (1979), also emphasizes the importance of differences in the conduct of firms within an industry; the emphasis here, however, is not on the profit performance of the industry and its member firms, but on differences in a wide range of performance measures, including innovation. Through a series of simulation runs, Nelson and Winter consider issues like what happens in an industry when some firms decide to pursue a strategy of imitation of new technologies, while other firms in the same industry aggressively innovate. Once again, the emphasis is on differences among the firms in an industry, and the implications that these differences have for industry and firm performances.

Coincident with this literature on the existence of sub-groups within an industry, there has been new work on the strategic use by firms of entry barriers. The early industrial organization literature characterized entry barriers as being largely outside of the control of firms within an industry; in Salop's terms entry barriers were characterized as being "innocent" (Salop, 1979). In part, this had to do with the focus on economies to scale as the main source of entry barriers, coupled with the view that the technology creating these barriers was largely exogenous to the firm.
The earliest change in the treatment of entry barriers came in the discussion of advertising, where it was recognized that firms could through advertising purposively change product differentiation and thus increase barriers to entry in the industry. More recently, strategic use of research and development as a way to increase the minimum efficient scale of an industry and thus raise entry barriers has been treated (see, for example, Levin, SEJ, 1978). Salop (1979) discusses the recent literature on the use of both innovation and advertising as strategic entry deterrence. The connection between the literature on group-specific entry barriers and the strategic use of entry barriers is clear. As long as entry barriers were thought of as largely technological and independent of firm conduct, it was hard to see sub-groups in the industry actively manipulating these barriers. Once barriers to entry are seen to come in part from firm conduct, the potential for using these barriers as competitive weapons becomes clearer.

2. The Use of Regulation to Erect Mobility Barriers

Systematic treatment of the central role of industry in fashioning its own regulation by government was first provided by Stigler (1971), and later developed and refined by Peltzman (1976). In contrast to the old theory which emphasized the market failure/public interest source for regulation, Stigler argued that economic regulations were designed not to correct a resource misallocation but rather to transfer wealth; in most cases, the intent was to transfer wealth to politically powerful producers' groups. (Stigler, 1971) The industry in this work, both in
the theoretical discussion and in the empirical examples, was treated as a single coalition—with essentially the same interests. The game, then, was to use regulation as a barrier to entry against possible new competitors, and to exploit as fully as possible the existing market power of the industry. Empirical support for this view has been mixed.

If we take the Caves, Porter idea of sub-groups within industries seriously, it becomes apparent that this characterization of the link between industry and the regulatory process is too simple. Regulations do not typically affect all firms within an industry in the same way. This point is well-known (and indeed a subject of concern) in the area of pollution regulations. Leone (1977), for example, argues that water pollution requirements in the metal finishing industry raise the minimum efficient scale in that industry by a factor of five. This clearly affects both entry conditions into the industry, and the profitability of existing large versus small existing firms. This suggests that there may be some private advantage to be gained from manipulating these regulations.

Indeed I would argue that government regulation is at least as potent a weapon as either advertising or investment and innovation in the fight among firms for market share. As long as there is some initial difference among firms in the industry, one can imagine sub-groups in that industry pushing for regulations which increase the rate of return to their peculiar characteristics over the characteristics of their rivals. Even if we observe a new regulation which helps all existing firms at the expense of potential entrants, some groups in the industry may derive a comparative advantage from this regulation. In the long run this may improve the firm's profits as well as enlarging its market share.
The observation that firms within an industry may differ sufficiently that their interests concerning a particular regulation are not always convergent has also been made by Stigler in his discussion of the free rider problem. (Stigler, 1974) In that piece, however, Stigler focuses on the possibility that different kinds of firms may enter a coalition in an attempt to fashion a regulation which will simultaneously serve all of the firms in that coalition; regulatory investments are cooperative even in the face of firm diversity. In this paper, I focus instead on regulatory rivalry produced by firm diversity.

In the case of rivalrous regulatory investments, the firm may encourage passage of a regulation which reduces industry demand or increases industry costs. The firm may encourage such regulations because they differentially damage its rivals, and thus rearrange market shares at the same time they reduce the total market. To go one step further, the firm may even encourage a regulation which lowers its short-term profits if that regulation simultaneously reduces the ability of its rivals to effectively compete. In this case, there are some links between the discussion of rivalrous regulatory investment and the limit pricing literature. In the limit pricing discussion, the firm may find it profitable in the long run to set a low price in order to prevent entry and protect its long-run position. Regulatory investments may be used similarly. Of course the regulation case is a bit more complicated since regulations may themselves affect barriers to entry.

There are three general conditions which must be met before one would expect any rivalrous regulatory investments by firms to occur. First, the industry must contain sub-groups. That is, firms within the industry
must be differentiated. This differentiation can be created either by firms producing different product mixes, or through differences in size, technology, levels of integration or whatever. These differences create the possibility that a regulation can create a comparative advantage for some firms in the industry, and lead to a shifting of market shares within the industry.

The second requirement for rivalrous regulatory investments to occur is that there be some reasonably strong interdependence among the firms in the industry. That is, we must be dealing with sub-groups in an industry, and not with truly separate industries. The essence of rivalrous investments is that a firm will try to exploit the differential effect of a regulation on itself versus its rivals; this differential effect is only important if firms are interdependent. Once again, this interdependence can be either on the demand side or on the supply side. Firms produce goods which are substitutes for each other, or affect each other's costs.

Finally, if firms are to engage in strategic regulatory behavior there must be some actual or potential barriers to entry to the industry, and some barriers to mobility within the industry. Without barriers, any quasi-rents created by the firm's regulatory intervention will be dissipated. Barriers protect the return associated with the change induced by the regulation. This case is similar to the case of limit pricing. Without some entry barriers, neither limit pricing nor rivalrous investments are profitable strategies.
If an industry meets these three requirements, then there is at least some potential for rivalrous regulatory investments to occur. Firms with different bundles of specific capital and hence different operating strategies can try to influence the regulatory process to increase the pay-off to the particular strategies they have adopted. In the discussion which follows, I sketch out the specific factors which will lead to a situation in which some firms in an industry gain from a regulation, while others lose, creating the potential for rivalrous investments. I consider regulations affecting both supply and demand conditions facing the firm.

Demand differentiation: sub-groups produce different but substitutable products

In order to make the problem simpler, I will work with an industry with two firms and linear demand functions. The demand system can be derived from a quadratic utility function (see Dixit, 1979). We have:

\[
\begin{align*}
(1) & \quad P_1 = a_1 - b_1Q_1 - VQ_2 \\
(2) & \quad P_2 = a_2 - b_2Q_2 - VQ_1 \\
(3) & \quad c_1 = c_1Q_1 \\
(4) & \quad c_2 = c_2Q_2 
\end{align*}
\]

Firm 1 produces only good 1, and so faces demand function 1, and firm 2 produces only good 2. "V" is a measure of cross-product substitution. Equality of V's in equations (1) and (2) assures us of symmetry in the cross-product elasticities. This is a one-period model, so that we have not allowed for any entry across product classes.
This is a simple case of a differentiated duopoly. We are interested in the context of this model in considering the effect on firm profits of changes in the demand and cost parameters which might be produced by regulatory action. There are a number of solution concepts which might be applied in solving for an equilibrium in this problem. Perhaps the simplest would be to assume joint profit maximization. But in the context of this problem cooperative behavior of this sort is unrealistic. Given that the firms are differentiated, one firm may gain from a regulation while another loses. Cooperation, or joint profit maximization, thus seems implausible here. Thus either a Cournot or Stackelberg model seems to be more sensible. In the discussion which follows, both Cournot and Stackelberg solutions are used.

The specific results which emerge in this paper obviously depend somewhat on the solution concept used, and on the specifics of the demand and cost functions, but I think the intuition behind the results follows in a more general case. In what follows, I have tried to point out the general results. The model is intended to illustrate one case in which the potential for rivalrous regulatory investments exists, and to allow us to explore the causes of that rivalry.

*If we allow for side payments, joint maximization is perhaps more plausible. But in many situations such payments are impossible.*
The Cournot equilibrium to the simple problem above is

\[
Q_1 = \frac{2B_2(a_1 - c_1) - V(a_2 - c_2)}{4B_1 E_2 - V^2}
\]

\[
Q_2 = \frac{2B_1(a_2 - c_2) - V(a_1 - c_1)}{4E_1 E_2 - V^2}
\]

If we assume instead firm 1 is a Stackelberg leader, the equilibrium becomes

\[
Q_1^S = \frac{2E_2(a_1 - c_1) - V(a_2 - c_2)}{4E_1 E_2 - 2V^2}
\]

\[
Q_2^S = \frac{(2E_1 - \frac{V^2}{2E_2})(a_2 - c_2) - V(a_1 - c_1)}{4E_1 E_2 - 2V^2}
\]

In the context of this model, we can consider the effect on firm's profits of two different broad types of demand-side regulations: a regulation which affects the intercepts of the firm's demand curves, or, alternatively one which affects the cross-good substitution parameter. In Tables 1a and 1b, I have worked through a number of simple numerical examples to illustrate the potential for rivalrous regulatory investments, under assumptions of Stackelberg and Cournot equilibria. In the Stackelberg cases, firm 1 is the dominant firm or the leader in the industry.

The most straightforward case in which rivalrous investments can be expected is the case of a regulation which directly affects only the demand for one of the two goods. For example, we might have a regulation which reveals some adverse information about the characteristics of good 2. One way to think of this regulation is that it reduces $a_2$, or shift the demand curve to the left. Firm 2 obviously will oppose such a regulation.
In this case, however, the industry will not be in agreement. In particular, given the substitution between goods, the reduction in production of $Q_2$ will shift the demand for good 1 to the right; the intercept for good 1 is simply $a_1 - V Q_2$. So firm 1 has some incentive to support an $a_2$ shifting regulation. In Table 1, if we compare rows 1 and 2, we see firm 1's profits increase as a result of the regulation, while 2's fall. This result is symmetrical. That is, firm 2, the smaller, follower firm also has an interest in promoting regulations which decrease $a_1$. Since small firms generally have a smaller influence on the regulatory process than large firms, in what follows I concentrate on the regulatory incentives facing the dominant firm.

As long as goods are substitutes, firms will gain from a shift in $a_2$. However, the size of the gain depends on the particular characteristics of the problem at hand. If we consider the profit of firm 1 at the Stackelberg equilibrium and change $a_2$, we find:

$$d p_1 = - \frac{V Q_1}{2 B_2}$$

This result follows Dixit (1979), who is primarily concerned with analyzing optimal firm behavior with and without entry. First, of course, the larger the shift in $a_2$, the greater the loss to firm 2 and gain to firm 1. The lower is $B_2$, the more elastic the own demand for good 2, the larger the potential gain to firm 1. A more elastic demand implies that any shift in $a_2$ will have a large effect on $Q_2$, and this, of course, benefits firm 1 through the substitution factor. Finally, a large "V," implying strong substitution between goods, increases the potential gain available to firm 1 from firm 2's misfortune. In the extreme, if $V$ is zero (no substitution),
rivalrous investments will not occur. In sum, rivalrous investments are likely in this case if the regulation has a large effect, rival’s demand is price elastic, and cross-good substitution is large.

Consider now a second, more complicated case. In particular, consider a regulation which reduces demand for both good 1 and good 2, but does so unevenly, firm 2 being more heavily affected. In this case, we may or may not have regulatory rivalry, depending on the particular structure of the problem. The effect of reducing \( a_1 \) is to decrease firm 1’s profits. In the case at hand, the effect on profits can be represented as:

\[
\frac{d\bar{r}_1^S}{da_1} = Q_1^S
\]

The firm then in considering whether to support a particular regulation will compare (7) and (8). It is interesting to note that if \( a_1 \) and \( a_2 \) are equally reduced by the regulation, firm 1 will never have an incentive to encourage that regulation, since \( V/E_1 \) must be less than 1. In general, however, one can construct an example in which firm 1 benefits from the regulation, even though the initial effect is to reduce \( a_1 \) as well as \( a_2 \). A simple example is given in row 3 of Table 1a. The logic of this case is easy to see. The fall in \( a_1 \) initially shifts the demand curve facing firm 1 to the left. Similarly, the fall in \( a_2 \) shifts in the demand facing firm 2. If the fall in \( a_2 \) is large relative to that of \( a_1 \); if the demand for \( a_2 \) is relatively elastic and thus the \( a_2 \) shift induces a large fall in \( Q_2 \), and once again if substitution between goods is strong, then the fall in \( a_2 \) may shift the demand for good 1 sufficiently to compensate for the initial reduction in \( a_1 \). In this case, overall industry demand has fallen, but the reallocation of market shares results in a net gain to one of the two firms. Firm 1 is experiencing some loss to "outsiders" via the decrease in market demand while simultaneously gaining at the expense of its internal rival. For firm 1 to gain, the internal substitution effect must be large relative to the own elasticity.
In the previous two cases, I considered regulations which changed the intercept term in the demand curve. A second type of regulation affecting demand is one which changes the degree of substitution between the two goods. A regulation might well, for example, provide information which tells consumers that two products are better substitutes than they previously believed. One way to model this is to consider a change which simply increases \( V \). This is the case considered by Dixit (1979) in his analysis of the effect of product differentiation on entry. Dixit gets a rather curious result, which is of interest here. In the Dixit model, there are some fixed costs of entry so that there is a discontinuity which influences the incentives facing an already established firm. In particular, changes in the parameters of the model will affect firms differently depending on whether they are successfully impeding entry or not. Once entry has occurred, which is the primary case I am considering, increases in \( V \) hurt the firm. If firms are already rivals, the more differentiated their individual products, the better off they are. Indeed both firms in the industry will lose from a simple increase in \( V \). The size of the loss will again depend on the size of the substitution parameter, and the demand elasticity. For the leader firm, the loss in profits from an increase in \( V \) is

\[ \Delta \pi^L = \frac{Q_1 Q_2}{2 \beta_2} \frac{d\pi^L}{dv} \]

If the established firm is preventing entry, an increase in \( V \) (i.e. better substitution) increases profits. As Dixit points out, it is easier to prevent entry as \( V \) increases. So there is a disjunction between the interests of the firm in preventing entry through regulatory intervention and its interests in improving its market position vis-à-vis its rivals.
As Dixit himself indicates, changing $V$ by itself is a somewhat odd way to capture the substitution change, because increases in $V$ effectively shift in the demand curve facing each firm (since each firm's intercept is simply $a_i - VQ_j$). Thus increasing $V$ reduces aggregate demand for the goods. Some reduction in aggregate demand as $V$ increases may be plausible if we believe that product differentiation increases market demand. Reduction by the full $VQ_i$, however, seems implausibly large. One alternative is to consider compensating changes in the intercepts as $V$ changes. The appropriate normalization is not obvious. In row 4 of Tables 1a and 1b I have considered one example of a simultaneous $a_i$, $V$ change. In this case I have dropped the $V$ term, and summed the two demand curves to create a market demand curve. So that we have moved from a case of two goods which are partial substitutes to perfect substitutes. In general, as $V$ increases, the firms' intercepts converge. In this case, changes in substitution can lead to rivalrous investments. In the case of row 4, for example, firm 2, the smaller firm, gains from its new access to the larger more inelastic market previously dominated by firm 1. The shift here is a mix of the changes illustrated earlier. Firms' intercepts change—the smaller firms moving out, and the larger firms shifting in—as $V$ changes. For the small firm (2), the positive $a_2$ effect dominates the $V$ effect; for dominant firm 1, the two effects reinforce each other. The effect of the move to perfect substitution is to shift out the demand curve facing the smaller firm, and shift in that facing the larger firm.
Sub-groups differentiated by cost functions

Government regulations can affect the cost curves of firms, as well as their demand curves. Cost-changing regulations will not necessarily affect all firms within an industry in the same way. This point is well known (and indeed a subject of concern) in the area of pollution regulation. Leone (1977), for example, argues that water pollution requirements in the metal finishing industry raise the minimum efficient scale in that industry by a factor of five. This clearly affects both entry conditions into the industry, and the profitability of existing large versus small firms. A recent study suggests that the costs per dollar of sales of complying with federal pollution control regulations in the automobile industry also decline radically with firm size (cited in Berney, 1979). Berney suggests that the information, and administrative costs of complying with a wide range of government regulations may be relatively higher for smaller firms, given the less slack these firms have in the organizational center (Berney, 1979).

In what follows, I consider rivalrous behavior by firms in manipulating cost changing regulations. As in the earlier section, I provide a few numerical examples to illustrate the various cases.

The simplest case is one in which firms produce substitute products, and differ in technology, and the anticipated regulation adversely affects only one of the firms. The effect of a change in the average costs of the firm is identical to the effect of changes in the firm's demand intercept. In particular, an increase in the costs of firm 2 will in general increase the profits of firm 1. In the case being considered here, the size of this effect is:
The rivalry effect varies with the substitution parameter, the initial cost change, and demand elasticity. Marvel (1977) provides an excellent early example of this situation, in his discussion of the effect of child labor laws on 19th Century British textiles. At the time, textiles were produced in two types of mills: steam-powered and water-powered mills. The former employed few children, the latter many. Marvel interprets the evidence to suggest that child labor laws were passed at the behest of the steam mills to encourage higher costs in their rivals, the water mills.

In the case discussed above, only one firm was influenced by the regulation. A more interesting case occurs when the anticipated regulation raises costs of both firms, but unevenly. An increase in own costs decreases own profits as:

\[
(10) \quad \frac{d r^1_s}{d c_2} = - \frac{VQ^1_1}{2B^2_2}
\]

So, the firm will calculate the effect of a regulation which increases everyone's costs by comparing 10 and 11. This case is illustrated in row 5 of Table 1 for the different goods/different costs case, and in rows 6 and 7 for the same goods/different costs case. As in the demand-side cases, three
factors are critical in setting the groundwork for rivalrous investments: the size of the cost differential, the substitutability between products, and the own elasticity of goods. Indeed, an increase in per unit costs is equivalent in the model to a reduction in the intercept of the demand curve.

In each of the previous examples, I have concentrated on the short-run gains or losses accruing to firms from regulation. There is a long-run story as well. Suppose there are barriers to entry into an industry, but exit is relatively easy. In this case, we know that firms may sometimes pursue unprofitable short-run pricing strategies in order to push rivals out of the industry and enable themselves to raise prices. The same strategy may be used in the area of regulation. In particular, firms may encourage a regulation which in the short-term results in a reduction in profits, if that regulation induces exit by the firm's rivals. If goods are substitutes then the exit of a rival may create sufficient new profits to compensate for the earlier loss. Several factors encourage this situation: high barriers to entry relative to barriers to exit, a large differential firm effect, and strong cross-good substitution.

In short, I would argue that the regulatory process can be used as a powerful strategic weapon by sub-groups within an industry against other sub-groups. Given this, one should analyze new regulations not as the result of a dialectic between consumers and producers, but at least in part as a result of (and a contributor to) the competitive balance within the industry. In the next section of this paper, I consider a case study of an FTC model act and trace its evolution under the influence of various industry groups. This material is intended as a case study in the creation of a new barrier to mobility through the use of a government regulatory agency.
3. Brand Drugs versus Generics: A Case Study

In January, 1979, The Federal Trade Commission proposed a model Drug Product Selection Act (hereafter, the Model Act). This Model Act will be used as a case study to investigate sub-group investment within the industry in the regulatory area. The Model Act is clearly only one of many possible regulations affecting this important industry, but it does reveal quite well the movement of sub-groups within the industry.

In the 1950's and 60's, many states passed anti-substitution laws requiring pharmacists to fill prescriptions with the exact brand-name drug prescribed by the physician. These laws appear to have been passed largely in response to pressure by large drug manufacturers, who argued that these laws were necessary to ensure quality control in the industry. Critics have recently noted that these laws also raised barriers to entry in the industry (FTC, 1979). In the 1970's, a number of states began to repeal these anti-substitution laws by passing generic substitution laws.

The FTC Model Act is intended to act as a model for the assortment of generic substitution laws now existing in the states. In this paper, I will focus on industry's reaction to this Model Act.

As of 1979, all but 13 states permitted pharmacists to engage in some substitution of generic drugs for prescribed brand name drugs.* There are, however, large differences in the form of the various substitution laws. New York, for example, has the most stringent law: pharmacists are required to fill all prescriptions with the cheapest generic equivalent.

*States not allowing substitution were: Alabama, Hawaii, Idaho, Indiana, Louisiana, Mississippi, Nevada, New Hampshire, North Carolina, North Dakota, Oklahoma, Texas, Wyoming.
available. A formulary is provided to pharmacists to inform this process. In other states, for example Alaska, the physician must explicitly consent to generic substitution on the prescription, no formulary is available, and substitution is at the discretion of the pharmacist.

The FTC model is intermediate in its suggestions. Substitution by the pharmacists would be permitted, rather than required. In order to prevent substitution, the prescribing doctor must write "medically necessary" on the prescription; this option encourages more substitution than the procedure used by Alaska or the alternative used by several other states of using reprinted signature lines in the prescription to prevent substitution. Finally, a drug formulary is to be developed indicating drug equivalences.

The reaction of firms in the drug industry to the FTC Model Act has not been uniform. There are 1300 firms in the pharmaceutical industry. In general, the industry is divided into two sub-groups: large firms which specialize in the production of patented brand-name drugs, and generally smaller firms which specialize in generic drugs. The former group, consisting of about 130 firms, account for about 90% of domestic pharmaceutical sales (Pharmaceutical Manufacturers Association Fact Book, 1976). Many firms, however, produce both brand-name and generic drugs, and there is clearly substitution both in consumption and in production in the two drug types. Thus, one would consider the two firm types to be in the same industry using standard industrial organization industry criteria; they are clearly sub-groups in the industry. The Pharmaceutical Manufacturers' Association--an industry trade association--stresses the existence of sub-groups in the industry:
"The U.S. prescription industry is made up of two distinct segments--'innovators' that research and develop new and improved drugs, and 'imitators' (commonly referred to as generic houses) that produce only follow-up copies of the original version of a drug." (PMA Press Release)

Indeed the PMA represents only the large innovative firms; the smaller generic houses have their own trade-association--the National Association of Pharmaceutical Manufacturers.

Since the FTC Model Act is only a suggestion for state action, it is not yet possible to document its effect on sub-groups within the industry. At the present time, almost 90% of all prescriptions are written by brand-name (FTC, 1979, p.4). Approximately 45% of the ethical drug market is no longer protected by patents. (Business Week, Oct. 29, 1979) So, the potential effect of eliminating anti-substitution laws is large. While state substitution laws of one sort or another have been in effect for several years, evidence on these laws is also quite limited. Evidence from California and Florida suggests that the law is, as one would expect, tilting consumption in favor of the output of the smaller generic firms: early evidence indicates that in 60% of the cases the drug substitution laws were used, products of firms other than the 125 large research-oriented firms were used. (FTC, 1979, p. 47) In general, firms other than the 125 large firms control only 5-10% of the market. The generics' share of the market rose from 8% in 1970 to 12% today (Business Week, Nov. 12, 1979).

The record suggests that the large firms recognize the potential effect of the FTC Model Act on the competitive structure of the industry. In a January 9, 1979 statement, C.J. Stetler, past president of the trade association representing the large drug firms, argues "Drug firms that specialize in cheaper drugs and spend nothing on research may temporarily
gain advantages here and there from a market artificially restructured in their favor by government." (emphasis added) Similar comments were made by Eli Lilly, one of the largest firms in the industry:

"Repeal of the anti-substitution laws has regulatory implications when thought of as changing the environment upon which the current institutional structure of the pharmaceutical industry is based." (Comments on the FTC Drug Substitution Inquiry, April 1978)

Large research firms have followed two strategies in response to this environmental change. First, as we observed in the simulation model in Section 2, regulation alters the optimal $B$, $G$ mix. A number of large firms in the industry have begun to increase their production of generic drugs. Indeed, the president of the trade association representing the large drug firms—the Pharmaceutical Manufacturers Association—argued that anti-substitution laws were bad precisely because they would "force" big companies to emphasize generics (Business Week, Nov. 6, 1979). The large firms have thus far been idiosyncratic in their use of this strategy, Eli Lilly, Upjohn and SmithKline have been fairly aggressive in expanding into the generic market; a number of the other majors have still not penetrated this market. In Table 2, I report growth rates and product mix of the several major drug companies I was able to contact. It is interesting to note that the diversified firms have been growing faster than the non-diversified.

The second strategy followed by the large research firms has been to invest in anti-regulatory lobbying. The Pharmaceutical Manufacturers' Association, representing the large drug firms, has been aggressively against the FTC Model Act. The PMA argues that pro-substitution laws will reduce the pay-off to branded drugs—as indeed we observed in the simula-

* B = Branded, G = Generic
tion model--and thus reduce both the incentive for and ability to innovate. The PMA position is put well by Armistead Lee, current president of the PMA, in a letter:

"Those in Government proposing the MAC and substitutions programs are using an Adam Smith model of perfect competition as a measure for maximizing consumer welfare. It is a static model, and it implies that departures from pure competition are contrived by producers through product differentiation based on advertising and promotion, which forces consumers to spend more than they should.

'We, on our side, are using a dynamic model--associated with the name of Schumpeter, even though most who share this philosophy may never have heard of that great economist. We recognize that competition is imperfect. We say that this is inevitable in an environment where one is dealing with a high-technology product, where quality differences are critical, where (admittedly) buyers or their agents are not perfectly informed on price, and where brand loyalties, as in so many other commodity areas, are very important. We would recall Schumpeter's assertion that under perfect competition one could not expect to find innovation."

(Letter from Lee to James Mitchell, May 1979.)

The generic firms have been less vocal, though they too have behaved as we predicted. The smaller drug companies are represented by their own trade association--the National Association of Pharmaceutical Manufacturers (NAPM). The NAPM supported the various states' repeal of anti-substitution laws, and also support the FTC position. In response to a questionnaire which I sent, one of the major generic houses stated the position of this segment of the market:

"There should be a substantial monetary saving if effective substitution laws are passed. ... major companies will devote more time to research in order to maintain a lead in original pharmaceutical products and development."

The positions taken by the brand drug companies versus the generics is similar to one we find in the industrial organization literature on the role of the carrot versus the stick in inducing innovation.
The large drug companies through the PMA have focused their attack on two provisions of the FTC Model Act: the requirement that physicians write "medically necessary" to prevent substitution, and the use of a formulary to guide pharmacists' choices. As indicated earlier, the role of the physician varies in the various state anti-substitution laws. In some states, (Arizona and Delaware, for example) the physician must positively request generic substitution; in other states (for example, Connecticut) and in the FTC version, physicians must actively intervene to prevent substitution. Evidence suggests that the degree of substitution allowed by the physician does vary with the form of the statute. (FTC, 1979, p. 276). The PMA as well as its member firms have sought to make it as easy as possible for the physician to prevent substitution.

The attempt to use the regulatory environment strategically is most clearly seen in the PMA's response to the formularies. A formulary is simply a listing of equivalent drugs; evidence from the states indicates that substitution is increased substantially when the pharmacist is provided with a formulary. (FTC, 1979, p. 282) In the FTC Act, the Food and Drug Administration is primarily responsible for the development of the formulary. The response of the PMA has argued that "all drug products with the same active chemical ingredients do not necessarily have the same therapeutic effect on each patient." (PMA Press Packet, p. 7) The PMA has gone on to argue that the FDA's interpretation of therapeutic equivalence, as embodied in the formularies "represents a radical departure from the past interpretation." (PMA Press Packet, p. 7) To remedy the
problem, the PMA has proposed another change in an FDA regulation. One can view this as an attempt by the PMA to use the regulatory apparatus to reassert the old institutional environment.

The change proposed by the PMA has to do with the testing standards applied to new versus imitative drugs. Under existing FDA rules, all new drugs must hold a New Drug Application (NDA) which requires a set of elaborate (and expensive) tests of the drug in man (in vivo). Copies (chemical equivalents made by other manufacturers after the patent lapses) are required under present rules only to have an Abbreviated New Drug Application (ANDA). In general, unless some problem exists (e.g., documented therapeutic failure), an ANDA does not require tests in man; in vitro (outside body) tests may be used instead. (FTC, 1979, 124-25) These tests are considerably cheaper.

In order to assure the therapeutic equivalence needed for a formulary, the PMA has proposed that "each manufacturer of any multi-source product should meet monograph standards and hold either a full NDA or an ANDA that includes comparative bioavailability in man (in vivo)" (PMA Press Packet, p.8). Should this proposal be accepted, two effects would follow: our confidence in the bioequivalence of drugs on the formulary might be increased; and the testing costs to the generic houses would rise substantially. In short, the PMA has proposed a new regulation which would improve its comparative position vis à vis the encroaching generics. It is a clear case in which one sub-group in the industry is attempting to use the regulatory process to change the
structure of the industry—in this case to reestablish the old structure.*

The PMA has also been active in trying to use regulation to shore up its position on the demand side. In particular, in early discussions of the various anti-substitution laws, the PMA argued that new regulations should be posed requiring that the manufacturer be identified on the package label for each drug product dispensed. (See the "14 factors" advertisement by the PMA that appeared in a variety of magazines.) The PMA firms, in addition to being heavy innovators, are also heavy advertisers relative to the generic houses. (Burack, 1976) Clearly the large advertised firms will gain more from product identification than will the smaller drug houses. This PMA proposal too can be seen as a way to reestablish barriers between the two markets. This change should incidentally have further effects in changing the incentives of drug firms to advertise to consumers to encourage brand identification. The proposal has been accepted as part of the FTC's model code.

* This is not to say the PMA proposal is not a "good" one: this is in part a scientific question. The industry evidence does suggest that products of brand-name firms have a lower incidence of recall due to poor quality than those of the generic houses (Lilly, 1979). FDA Commissioner, Donald Kennedy, testifying before Congress in 1977, reported, however, that the FDA "has found no evidence of consistent differences between the products of large and small firms, or between brand name and generic producers." (FTC report, 1979)
4. Conclusion

In this paper, I have considered the role of the regulatory process in altering the competitive balance within an industry. In particular, I was concerned with the differential effect regulations may have on various sub-groups within an industry, and thus with the possibility that sub-groups may use these regulations to change barriers to mobility within the industry. A proposed FTC Model Act in the drug area was used to illustrate the process.
### Table 2

**Growth Rates of Major Drug Firms**

<table>
<thead>
<tr>
<th>Firm</th>
<th>% Generic</th>
<th>Sales '78/Sales '75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lilly</td>
<td>7.5</td>
<td>1.50</td>
</tr>
<tr>
<td>Merck</td>
<td>0</td>
<td>1.33</td>
</tr>
<tr>
<td>Searle</td>
<td>0</td>
<td>1.38</td>
</tr>
<tr>
<td>SmithKline</td>
<td>10</td>
<td>1.89</td>
</tr>
<tr>
<td>Upjohn</td>
<td>10</td>
<td>1.49</td>
</tr>
<tr>
<td>CIBA Geigy</td>
<td>0</td>
<td>1.26</td>
</tr>
<tr>
<td>Bristol-Myers</td>
<td>0</td>
<td>1.34</td>
</tr>
</tbody>
</table>
Table 1a: Numerical Examples of Regulatory Changes
Stackelberg Leadership Assumed

<table>
<thead>
<tr>
<th>Case</th>
<th>( Q_1 )</th>
<th>( Q_2 )</th>
<th>( P_1 )</th>
<th>( P_2 )</th>
<th>( \pi_1 )</th>
<th>( \pi_2 )</th>
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</thead>
<tbody>
<tr>
<td>(1) Base Case</td>
<td></td>
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<tr>
<td>( P_1 = 120 - 10Q_1 - 2Q_2 )</td>
<td>4.79</td>
<td>3.56</td>
<td>64.98</td>
<td>29.74</td>
<td>215.45</td>
<td>34.67</td>
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<tr>
<td>( P_2 = 50 - 30Q_2 - 2Q_1 )</td>
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<tr>
<td>( C_1 = 20Q_1 )</td>
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</tr>
<tr>
<td>( C_2 = 20Q_2 )</td>
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</tr>
<tr>
<td>(2) Demand for good 2 only falls</td>
<td>5.14</td>
<td>.12</td>
<td>68.36</td>
<td>19.36</td>
<td>248.57</td>
<td>-.08</td>
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<td>( P_2 = 30 - 3Q_2 - 2Q_1 )</td>
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<td></td>
</tr>
<tr>
<td>(3) Demand for both goods falls, firm 2 is hurt more</td>
<td>4.87</td>
<td>.20</td>
<td>65.90</td>
<td>19.66</td>
<td>223.53</td>
<td>-.07</td>
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<td>( P_1 = 115 - 10Q_1 - 2Q_2 )</td>
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<tr>
<td>(4) Goods are perfect substitutes</td>
<td>10</td>
<td>5</td>
<td>31.50</td>
<td>31.50</td>
<td>114.77</td>
<td>57.62</td>
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<tr>
<td>(5) Costs of both goods rise</td>
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<td>65.90</td>
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<td>223.53</td>
<td>-.07</td>
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<td>(6) ( P - 100 - 4(Q_1 + Q_2) )</td>
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<td>5</td>
<td>40</td>
<td>40</td>
<td>200</td>
<td>100</td>
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<td>(7) Same as 6, but costs of firms rise</td>
<td>12.62</td>
<td>.56</td>
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<td>47.28</td>
<td>319.03</td>
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Table 1b: Numerical Examples

Cournot Case

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<th>Case</th>
<th>( Q_1 )</th>
<th>( Q_2 )</th>
<th>( P_1 )</th>
<th>( P_2 )</th>
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<td>( C_1 = 20Q_1 )</td>
<td>4.46</td>
<td>5.15</td>
<td>64.9</td>
<td>25.6</td>
<td>201.19</td>
<td>26.64</td>
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<tr>
<td>(2) Demand for good 2 only falls</td>
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Factors which may Lead to Strategic Use of Regulation by Industry Sub-groups

Prepared by Sharon Oster
Associate Professor, Yale
For the Federal Trade Commission and the Small Business Administration

August 1980
Prepared under contract. L 0633
In two papers written for the FTC and SBA I have tried to develop some theoretical work on the conditions under which rivalrous industry behavior may arise in the regulatory process. In this paper, I summarize the main results of those papers and suggest some guidelines to policy in this area.

I define rivalrous regulatory investments as investments undertaken by firms to alter the regulatory environment to improve the pay-off to their specific capital at the expense of their rivals. Consider the following simple example: We have two sets of firms in an industry, or two sub-groups to use current terms. One group of firms advertises heavily and produces branded products. A second group eschews advertising and brand identification. The government now considers a rule which would increase the price of advertising. This would increase the price of the advertised goods relative to the unadvertised. In general this rule would benefit the non-advertising group of firms as consumers substitute towards the lower-priced unadvertised goods.

In some circumstances group 2 will not only benefit from the rule change but will find it is in its interest to make some regulatory investments to try to increase the probability that this rule will be passed. Some of the conditions which will make such investments attractive are given below.

Conditions favoring rivalrous regulatory investments

1) The industry must contain sub-groups. In other words, firms in the industry must be differentiated. This differentiation can be created either by firms producing different product mixes, or through differences in size, technology, levels of integration or whatever. These
differences create the possibility that a regulation can create a comparative advantage for some firms in the industry, and lead to a shifting of market shares within the industry.

2) If firms are to engage in strategic regulatory behavior there must be some actual or potential barriers to entry to the industry, and some barriers to mobility within the industry. Consider a counter case in which there is free movement within an industry, and return to the earlier example of two sub-groups differentiated by their advertising strategies. If movement across groups is free, then as the relative pay-off to advertising changes as a consequence of the new rule, firms will simply change their advertising strategies. In this case, the original non-advertising firms have no incentive to invest in trying to pass the rule, because they cannot protect the advantage they receive from the rule. In short, without barriers, any quasi-rents created by the firm's regulatory investment will be dissipated. Barriers protect the return associated with the change induced by the regulation. This case is similar to the case of limit pricing discussed in the standard industrial organization literature. Without some entry barriers, neither limit pricing nor rivalrous investments are profitable strategies.

3) All else equal, the greater the potential substitutability between products of firms in the two sub-groups, the greater the potential for rivalrous regulatory investments. In the extreme, if there is no substitution between goods, no rivalrous investment will occur. So, we would not expect rivalrous regulatory investments to occur across disparate industries.
4) In general, the more elastic the demand for a firm's rival's goods, the greater the incentive for the firm to invest in trying to get rules passed which either increase that rival's costs or shift in his demand curve. If rival's demand is elastic, he will respond via a large output change to any new adverse rule. This leaves a new large market available to our investing firm.

The four conditions given above are intended as a practical guide to identifying industries in which sub-group regulatory rivalry is likely. A more rigorous and careful treatment of these conditions is given in the two papers previously submitted.