Contestable Markets And the Theory of Industry Structure

Baumol Panzar Willig

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William J. Baumol
Princeton and New York Universities

John C. Panzar
Bell Laboratories

Robert D. Willig
Princeton University

with contributions by
Elizabeth E. Bailey
Dietrich Fischer
Herman C. Quirmbach

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THE YALE LAW JOURNAL COMPANY AND FRED B. ROTHMAN & COMPANY For W.J. Baumol, "Quasi Permanence of Price Reductions: A Policy for Prevention of Predatory Pricing," *The Yale Law Journal*, **89**, November 1979, pp. 1–26.

Preface

We wish to emphasize two points in the Preface: the essential simplicity of the ideas described in this book, despite the complexity of some of its more technical arguments, and the many persons, other than the immediate authors, who have made fundamental contributions to the development of these ideas.

The simplicity of our ideas is strongly suggested by their unpretentious beginnings and practical conclusions. Many of our more abstruse results—for example, that on the sustainability of Ramsey prices under natural monopoly and that on intertemporal unsustainability in the presence of scale economies in construction—were first arrived at intuitively. As Elizabeth Bailey describes so well in her Foreword, the proofs of many of our theorems, such as those on the bounds upon the cost-minimizing number of firms or the role of trans-ray convexity in subadditivity of costs in multiproduct activities, were first outlined in simple diagrams. Moreover, as can be seen clearly in the introductory chapters (1 and 2) and in the policy chapters (12 and 16), the basic ideas of the analysis are themselves simple—straightforward enough for applied economists who are wary of abstruse formal analysis and practical enough for noneconomists who are concerned with the design and execution of policy relating to industry structure and conduct.

Acknowledgment of an author's debts to others has become a virtual cliché offered automatically as mere routine. Consequently, it is very difficult to distinguish the case in which the obligations are really deep and fundamental. But our book *is* such an exception. In this case, the construction of a new theoretical analysis was very much a group undertaking—an interactive process that was a constant source of pleasure and excitement to its participants. There were three centers of this creative activity—New York University, Bell Laboratories, and Princeton University.

Gerald Faulhaber and Edward Zajac, who first studied the implications of prices that involve no cross subsidy and showed that the Ramsey solution need not be included among them, carried out pioneering investigations at Bell Laboratories. Later, in his dissertation written at Princeton University, Faulhaber presented an innovative analysis of the single-product case demonstrating the crucial role of subadditivity for natural monopoly.

Systematic work on the general subject in terms of the multiproduct industry began soon after this in the Economics Department of New York University. This work was conducted under a National Science Foundation grant for the study of the economics of the dissemination of scientific and technical information. Here the principal contributors included Yale Braunstein, Janusz Ordover, and Dietrich Fischer. Braunstein designed and carried out ground-breaking work on the empirical estimation and testing issues that emerged from the analysis. Ordover began investigation of the existence of sustainable Ramsey optima. Fischer made particularly crucial contributions, solving technical problems and contributing valuable ideas which made him coauthor of several of the articles that later were transmuted into chapters of the book.

More recently, others have made fundamental contributions to the subject. Thijs ten Raa has written a dissertation (New York University, 1980) on the sustainability of oligopoly. This rigorous work has cleared up many issues and provided a number of crucial results, including some difficult existence proofs and a useful new fixed-point theorem. Bill Sharkey, a frequent contributor to this literature since its inception, has completed a monograph on natural monopoly (Sharkey, 1982). His book provides both institutional background and a thorough game-theoretic treatment yielding important new insights, especially in the study of unsustainable monopoly and oligopoly markets.

Herman Quirmbach, a graduate student at Princeton University, staged a breakthrough in the analysis of the effects of variations in input prices, a subject with which we had struggled earlier, but with rather limited success. He is the author of much of the material in Chapter 6 and contributed to our analysis of the case of flat-bottomed average cost curves.

Because Elizabeth Bailey, Dietrich Fischer, and Herman Quirmbach have written materials that constitute vital portions of this book, the presence of their names on the title page is only a modest acknowledgment of our deep appreciation of their work. A special word must be said about the role of Dr. Bailey. Anyone who has ever worked with her knows that her unparalleled ability to contribute a sense of excitement to a research enterprise imbues it with a magic vitality. For this, no less than for her direct contribution, she bears much of the responsibility for the appearance of this book. The reader may well surmise that the authors have a deep and lasting affection for her.

This encomium hardly completes a description of our intellectual obligations, but it is surely enough to indicate that our debt is enormous. Yet this debt constitutes no burden and certainly does not threaten bankruptcy. It merely serves to recall the pleasures of a cooperative, creative process which, we have been told by some of our creditors, was as valuable and delightful to them as it was to us.

We were indeed fortunate to have as our editor Emily Thompson, a person of intelligence, experience, love of language, and a sufficient sense of humor to survive collaboration with us. It was a great delight to work with her. We are also indebted to our secretaries for their incredible patience, understanding, and ability to decipher hieroglyphics (which came unaccompanied by any Rosetta stone). The bulk of this thankless task (for which we now give thanks so inadequately) was performed by Mary Mateja at New York University. But the burden was also shared (almost unflinchingly) by Sue Anne Batey Blackman and Betty Pizzarello at Princeton and Janice Ivanitz at Bell Laboratories. We were also aided immeasurably by Roger Koenker of Bell Laboratories, who (by our good fortune) also lives in Princeton and consequently could serve as a courier, undaunted by snow or rain or heat or gloom of night.

We gratefully acknowledge the generous research grants from the National Science Foundation (Division of Information Science and Technology Grant #SIS 7412785 and Division of Economics Grant #77-07080) and the Sloan Foundation, which were vital to the work of Baumol and Willig, and the support provided by Bell Laboratories, which made possible Panzar's research as well as that of Willig before 1978. However, the views expressed are the authors' and do not necessarily reflect those of Bell Laboratories or the Bell System.

Finally, though it may violate custom, it seems appropriate to offer a word of thanks to one another for extreme patience in adapting to one another's idiosyncrasies. Although our physical ability to endure such a process may have seemed questionable beforehand, we have survived and our affection for one another has prospered.

As a matter of good form we append a list of our writings from which portions of various chapters draw heavily.

We conclude by emphasizing, as we will do again at several points in the text, that we consider this book to be a beginning, rather than a completed line of inquiry. It is intended as a prologue to the work of others who, we trust, will find in its contents a basis for their own fruitful explorations. May the pleasures they derive from their work be as great as ours have been.

William J. Baumol
John C. Panzar
Robert D. Willig

Publications and Writings

Chapters 2–4 and 7 draw extensively from
W.J. Baumol, "Scale Economies, Average Cost, and the Profitability of Marginal-Cost Pricing," *in* R.E. Grieson, ed., *Essays in Urban Economics and Public Finance in Honor of William S. Vickrey*, Lexington, Mass.: D.C. Heath, 1975, pp. 43–57.

J.C. Panzar and R.D. Willig, "Economies of Scale and Economies of Scope in Multi-Output Production," Bell Laboratories Economic Discussion Paper No. 33, 1975.

J.C. Panzar and R.D. Willig, "Economies of Scale in Multi-Output Production," *Quarterly Journal of Economics*, **91**, August 1977, pp. 481–493.

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R.D. Willig, "Multiproduct Technology and Market Structure," *American Economic Review*, **69**, May 1979, pp. 346–351.

J.C. Panzar and R.D. Willig, "Economies of Scope," *American Economic Review*, **71**, May 1981, pp. 268–272.

Chapter 5 is, in part, reproduced from
W.J. Baumol and D. Fischer, "Cost-Minimizing Number of Firms and Determination of Industry Structure," *Quarterly Journal of Economics*, **92**, August 1978, pp. 439–467.

Chapter 8 is based upon
J.C. Panzar and R.D. Willig, "Free Entry and the Sustainability of Natural Monopoly," *Bell Journal of Economics*, **8**, Spring 1977, pp. 1–22.

W.J. Baumol, E.E. Bailey, and R.D. Willig, "Weak Invisible Hand Theorems on the Sustainability of Prices in a Multiproduct Monopoly," *American Economic Review*, **67**, June 1977, pp. 350–365.

Chapter 9 draws heavily from
J.C. Panzar and R.D. Willig, "Economies of Scope, Product-Specific Economies of Scale, and the Multiproduct Competitive Firm," Bell Laboratories Economic Discussion Paper No. 152, 1979.

Chapter 10 is to a considerable degree reproduced from
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Chapter 11 draws on
R.D. Willig, "Multiproduct Technology and Market Structure," *American Economic Review*, **69**, May 1979, pp. 346–351.

Chapter 12 draws much material from
R.D. Willig, "What Can Markets Control?" *in* R. Sherman, ed., *Perspectives on Postal Service Issues*, American Enterprise Institute, 1980.

W.J. Baumol, "Quasi Permanence of Price Reductions: A Policy for Prevention of Predatory Pricing," *Yale Law Journal*, **89**, November 1979, pp. 1–26.

Chapter 13 makes use of
W.J. Baumol, "Optimal Depreciation Policy: Pricing the Products of Durable Assets," *Bell Journal of Economics and Management Science*, **2**, August 1971, pp. 365–376.

Chapter 14 has used materials from
W.J. Baumol and R.D. Willig, "Intertemporal Failures of the Invisible Hand: Theory and Implications for International Market Dominance," *Indian Economic Review*, **16**, 1981.

W.J. Baumol and R.D. Willig, "Intertemporal Unsustainability," Princeton University Economic Working Paper, 1980.

Chapter 15 draws upon
W.J. Baumol, D. Fischer, and I.M. Nadiri, "Forms for Empirical Cost Functions to Evaluate Efficiency of Industry Structure" (unpublished).

W.J. Baumol and Y.M. Braunstein, "Empirical Study of Scale Economies and Production Complementarity: The Case of Journal Publication," *Journal of Political Economy*, **85**, October 1977, pp. 1037–1048.

Finally, Chapter 16 relies heavily on material in
E.E. Bailey, "Contestability and the Design of Regulatory and Antitrust Policy," *American Economic Review*, **71**, May 1981, pp. 178–183.

Foreword

This book provides the building blocks of a new theory of industrial organization, one which, in my view, will transform the field and render it far more applicable to the real world. By bringing the large enterprise firmly into the body of microeconomic theory, this volume makes a major contribution to generalization of microanalysis. The world of single-product firms with U-shaped average cost curves simply is not the world of reality. Industrial organization has long awaited a theory dealing explicitly with the variety of outputs and prices and production processes that comprise our economy. This book begins the difficult transition to a theory of industrial organization that can encompass the richness and breadth of actuality while retaining a strong underpinning in theory. Moreover, the fundamentally new theoretical concepts it explores permit, for the first time, an endogenous determination of industry structure.

By describing the research process behind this book I hope to facilitate the work of future scholars. I hope to make clear, for example, that puzzled states and fuzzy thoughts are not manifestations of mental deficiency, but are the very stuff of which research is made.

The first step in the creative process behind the book was, characteristically, recognition of a puzzle or an apparent inconsistency in our analysis. In following the problem stubbornly to its source, new ideas and insights were brought to light. These ideas often appeared obvious and even trivial at first. Sometimes their power and startling implications became clear only a year or more later, and then, often, in the hands of some member of the group other than the originator of the idea. Through continuous interaction, new ideas were converted into systematic theory, the development of whose major concepts is recounted here.

Subadditivity of Costs

One of the fundamental insights on which this book is based is the finding that it is subadditivity of costs, and not scale economies, that determines when society can be served more economically by a monopoly firm.

The insight was attained by a roundabout process. The first contributor was William Baumol, who in July 1970 devised a formal "burden test" for the prices charged by a multiproduct firm. This test proved to be a catalyst

not only for the notion of subadditivity but also for that of sustainability. Baumol's aim was to determine whether or not, at a given set of prices, some one of a firm's products received cross subsidies from the consumers of the firm's other products. He devised what appeared to be a straightforward formula, whose use in practice was relatively simple. Basically, the rule rests on the conclusion that when a firm's profits are constrained by a regulatory ceiling, if at the pertinent prices a product contributes net incremental revenues that exceed its incremental cost (taking into account cross-elasticity effects), then the supply of that product must reduce the net (incremental) profits required from other products. The good in question will then, by definition, constitute no "burden" upon the customers of those goods. Thus, provision of this product can in no sense be considered the source of a cross-subsidy payment.

Two years later—in the summer of 1972—while examining this test, it occurred to Edward Zajac and Gerald Faulhaber, both of Bell Laboratories, that Baumol's insight on the nature of cross subsidy might be deceptively simple. Faulhaber, in particular, tried to persuade himself that if two products of a firm passed the burden test individually, they would pass it jointly. He began using game-theoretic tools to explore this hypothesis.

By considering the price-setting issues examined in the burden test as a cooperative game in which subsidy-free prices were the core, Faulhaber was able to deduce three important conclusions. First, he demonstrated that the burden test must be carried out not just for each product in isolation but also for all products in every combination. Second, the game-theoretic framework made it clear that subadditivity of costs is the right criterion for determining when efficiency is served by having only a single producer in an industry. Third, he reached the surprising and disturbing conclusion that even if a firm's cost function is subadditive, there might exist *no* subsidy-free prices; that is, the core might be empty. Thus, subsets of the group of consumers might well find it more economical to buy from a second supplier, even though a single (exclusive) supplier might minimize total social costs.

In the fall of 1972, Faulhaber reported these results to Baumol, who was stimulated by it, but somewhat disturbed: stimulated by the role of subadditivity, but disturbed by the conclusion that a subadditive cost function might preclude all subsidy-free prices. Baumol felt instinctively that this result must be attributable to some perversity of the cross elasticities, which were the sole source of complexity in the burden test. But Faulhaber was able to construct a devastating counterexample. Although it seemed obvious that a multiproduct firm with a cost advantage can always find prices that preclude entry, the counterexample showed that this is not so. (This example was eventually published; see Faulhaber, 1975b.)

Faulhaber posited a situation in which three towns desire water supplies in given quantities. The cost of supplying any one of the towns by itself is

$300, of supplying any two of them via one facility is $400, and of all three towns jointly is $660. He pointed out that, from the point of view of society, it was cheaper for only one company to supply all three towns because $660 is less than the cost of supply by three separate plants ($3 \times \$300 = \$900$), or of supply of any two towns by one plant with the other town supplied by a second plant ($\$400 + \$300 = \$700$). However, there are then no fixed prices at which a single firm can keep the market entirely for itself. For example, at a price per town of $\$660/3 = \$220$, it is cheaper for some two of the towns to split off and supply themselves (at a cost of $\$400/2 = \$200$ apiece) than for them to join the third town as customers of the single supplier. Thus, Faulhaber proved that there can be a situation in which there is a natural monopoly in the sense of subadditivity of production costs, but in which monopoly supply may be difficult to preserve in the free marketplace.

Economies of Scale and Scope

It was not until the late fall of 1974 and the early winter of 1975 that the attempt was made to build a bridge between the subadditivity concept and the cost concepts traditional in the study of industrial organization. This bridge-building effort resulted in a wealth of new ideas about cost concepts in a multiproduct environment.

Baumol had received a grant from the Office of Science Information Services of the National Science Foundation to study the economics of information dissemination. This required him to reexamine the nature of any possible economies of joint publication of technical journals. He had naturally supposed that the idea of scale economies could be generalized directly to the multiproduct firm, and that it would serve his purpose. Instead, he found himself forced to devise what were apparently totally new cost concepts, such as decreasing ray average costs and trans-ray convexity of cost functions.

At about the same time, at Bell Laboratories, John Panzar produced an important insight while working on a peak-load pricing model. He showed that many traditional results, including some of my own, followed only from the special cost structure assumed in the literature. He showed that these results must be modified if a neoclassical production function describes the supply of peak and off-peak services, so that marginal cost increases gradually as quantity demanded approaches capacity (Panzar, 1976). Panzar noted that the cost structure in the traditional peak-load pricing model involves constant returns because both capacity costs and operating costs per unit are taken to be constant. Yet because capacity, once built, can be

used in both periods, it is normally better to have the same firm produce in both periods rather than to use two separate firms—one producing in the peak and the other in the off-peak period. Thus, Panzar realized that a cost function involving constant returns can lead to production by multiproduct firms.

Panzar and Robert Willig began a collaborative process. Panzar was puzzled because he had always believed that scale economies imply that marginal cost prices do not cover costs. Yet, here was a case in which there were clear economies to single-firm production relative to multifirm production; yet average costs were not decreasing and marginal cost pricing yielded all the revenues the firm needed to cover its costs. A series of mathematical explorations followed, leading to clarifications in the definition of scale economies for the multiproduct firm, and, equally important, to the identification of other fundamental properties of cost functions that had not been recognized before. The most significant of these, in my view, is that of "economies of scope" (Panzar and Willig, 1975). This concept refers to situations in which the cost of producing two products in combination, $C(A, B)$, is less than the total cost of producing each product separately, $C(A, 0) + C(0, B)$.

Working independently, Baumol at New York University and Panzar and Willig at Bell Laboratories began to explore the interplay between subadditivity and other cost concepts, both old and new. In the course of this research, summarized in Chapters 3, 4, and 7 of this book, they discovered that scale economies were neither necessary nor sufficient for monopoly to be the least costly form of productive organization. Subadditivity of costs was the requisite concept; yet neither ray concavity nor ray average costs that decline everywhere were even necessary for strict subadditivity. But Baumol did demonstrate that declining ray average costs, together with a form of complementarity which he called "trans-ray convexity," were sufficient for the purpose (Baumol, 1975, 1977). Panzar and Willig (1977b, 1979) showed that the ideas of economies of scope and overall and product-specific returns to scale are inextricably related. Indeed, economies of scope and decreasing average incremental costs in each product line together imply both overall scale economies and strict subadditivity.

Over the next few years, the exploration of cost conditions continued. Dietrich Fischer and Baumol at New York University devised a series of graphical and numerical examples exploring the conditions under which multiproduct firms exhibit economies of scale and trans-ray convexity. Baumol and Yale Braunstein conducted the first empirical study of scale economies and production complementarity, using the new theoretical tools (Baumol and Braunstein, 1977). Panzar and Willig (1981), as well as David Teece (1981), conducted both theoretical and empirical studies of sources of economies of scope, and others began to join this line of work, conducting increasingly sophisticated empirical analyses of multi-output production

(see Chapter 15 and references therein for a discussion of some of this work).

Sustainability

Meanwhile, as an adjunct professor at New York University as well as a supervisor at Bell Laboratories, I provided liaison, communicating many of these discoveries back and forth. I became hooked myself, the form of my addiction requiring delving in more depth into the significance of the Faulhaber counterexample. I was struck by the fact that in Faulhaber's example, market failure occurred when there were economies in single-firm production, yet the demand curve intersected a U-shaped average cost curve in its upward sloping portion, a region not ordinarily associated with scale economies.

The more I thought about it, the more I was persuaded that there must be ways in which natural monopolies can hold together. Faulhaber's pathology did not arise in the downward sloping portion of the U-shaped average cost curve. By seeking to discover the counterpart of this region in the world of the multiproduct firm, I stumbled upon the notion that there must be a set of conditions under which a multiproduct natural monopoly can be sustained.

I could not, however, figure out how to provide a workable definition of this concept. I had long discussions at Bell Laboratories with Panzar and Willig and at New York University with Baumol. As it turned out, the formal definition of sustainability was invented independently—on the same day—by Baumol and me at New York University and by Panzar and Willig at Bell Laboratories. Both groups arrived at the definition that takes the announced prices of a monopolist to be sustainable if the monopoly is viable financially at these prices and if there exists no output-price vector for any potential entrant that can be expected to yield economic profits covering the costs of entry. Thus was born what was to become an important new way of looking at potential entry. Potential entry was judged in terms of enterprises facing the same market demands and having access to the same productive techniques as those available to incumbent firms. The attractiveness of entry was to be evaluated at the incumbent firms' pre-entry prices. Taken literally, the definition implies that the entrant supposes the monopolist to be constrained from adjusting prices in response to entry. The entering firms can thus be interpreted to be price takers of a sort, price takers who are aware of the negative slopes of the industry demand curves and who therefore know that their contribution to industry output can lead to a new equilibrium with reduced prices.

Panzar and Willig soon began to use this concept in rather different ways than did Baumol and I (see Panzar and Willig, 1977a). They explored its

relationship to Faulhaber's concept of subsidy-free prices and derived a set of economically significant conditions necessary for sustainability of a monopoly. By focusing on the problems of the regulator, they showed that, contrary to conventional wisdom, a regulated natural monopoly may be vulnerable to entry by noninnovative competitors even if it is producing and pricing efficiently and earning zero economic profits. Panzar and Willig were also able to show that strong demand substitutability and product-specific scale economies work against sustainability and that oligopoly cannot be sustained where there is a natural monopoly that is unsustainable.

In contrast, Baumol and I began to seek sets of conditions, both on the cost and the demand sides, that yield sustainable prices. We were more optimistic about finding relevant conditions for the cost side than those applicable to the demand side, for we knew of some disturbing results that had been contributed by Edward Zajac. In raising his questions about the burden test, Zajac had begun by noting that the burden test implicitly used as its standard of comparison the case in which the price of the product being tested is so high that all demand for it is choked off. But if that service were instead offered by a different supplier, its price might be expected to be somewhat higher than it would be if offered as part of the product line of a natural monopolist, but far lower than the price necessary to reduce its demand to zero. This lower price might very well have a more moderate effect upon the demands for other (substitute or complementary) products of the natural monopoly and could thus require a revision of the burden test's calculations.

Zajac had also been studying Frank Ramsey's rule for optimal pricing under a budget constraint and was led to wonder whether such Ramsey prices would automatically pass the burden test. In an illuminating graph with the prices of two products on the axes, Zajac was able to depict the locus of prices subsidy-free under the burden test and to construct examples in which the point representing the Ramsey prices can lie at a point not on this locus.

Since Baumol was well aware of these results, he did not expect Ramsey-optimal prices to play much of a role in the new sustainability theory. He was as surprised as I was when (while standing in line at a theater) he suddenly envisioned the outlines of a proof of a startling new result involving Ramsey pricing. The result was to play a critical role in the development of this book. The theorem asserted that there is a set of circumstances—apparently not implausible—that may lead even a monopolist to adopt Ramsey-optimal prices, for such prices can then prevent the entry of competing firms.

Thus, a fundamental new idea was conceived. However, a rigorous mathematical formulation turned out to be difficult. Our initial assumptions included both strict global ray concavity and strict global trans-ray convexity, which proved to be mutually inconsistent. Willig pointed this out, but

was so intrigued by the result that he set out to devise a set of mathematical conditions that were capable of yielding the result. Thus, at its (eventual) publication, the authors of our paper were Baumol, Bailey, and Willig (1977).

Panzar has gone on to apply the notion of sustainability to problems that span the borderline between theory and application, in particular exploring its relevance for the issue of vertical integration (Panzar, 1980). He has also examined its relevance for nonlinear pricing.

Contestability

After some period of work on the theory of subadditivity and sustainability, Baumol began to conjecture that it constituted the basis for a systematic theory of industry structure. The notion was pursued in an all-night discussion with Willig on the long flight to a conference in Leningrad. The first fruit of this approach was a paper by Baumol and Fischer (1978), now summarized in Chapter 5, in which they examined the number of firms required to produce an industry's vector of outputs at minimum cost, given the characteristics of its cost function. This paper is, in a sense, normative in analyzing the character of the industry structure dictated by productive efficiency. But its relevance stemmed from the conjecture—not then proved, except for the case of monopoly—that any inefficient industry structure *must* be unsustainable. If so, the analysis must be considered behavioral and not merely normative.

The new theory of industry structure is the chief contribution of this book. The notion of contestable markets offers a generalization of the notion of purely competitive markets, a generalization in which fewer assumptions need to be made to obtain the usual efficiency results. Using contestability theory, economists no longer need to assume that efficient outcomes occur only when there are large numbers of actively producing firms, each of whom bases its decisions on the belief that it is so small as not to affect price. What drives contestability theory is the possibility of costlessly reversible entry. Where such entry is possible, efficient outcomes are shown to be consistent with the relatively large scales of operation that characterize many industrial technologies.

The notion of contestability was contributed by Willig. In 1978, Willig, who had by then moved to Princeton University, agreed to present an analysis of a relatively simple policy approach to postal issues, resting on free markets (see Willig, 1980). In essence, he set out to explore how well economic markets can deal with such traditional problems as inefficiencies in the provision of products and cross subsidization of services. He sought conditions under which markets can generally be relied upon to exercise effective control over these problems and looked to sustainability theory

to provide him an entrée. But this time, he did not want to prejudge whether the industry was a natural monopoly.

The result of his thinking was the invention of a type of idealized economic market, later termed a "contestable" market. A perfectly contestable market is defined as one in which entry and exit are easy and costless, which may or may not be characterized by economies of scale or scope, but which has no entry barriers, as discussed by Baumol and Willig (1981b). Potential entrants are assumed to face the same set of productive techniques and market demands as those available to incumbent firms. There are no legal restrictions on market entry or exit and no special costs that must be borne by an entrant that do not fall on incumbents as well. An entrepreneur will enter the market if he expects to obtain a positive profit by undercutting the incumbent's price and serving the entire market demand at the new lower price. If the incumbent readjusts his price, reducing it beneath that of the entrant, then the new competitor can readily exit from the market without loss of investment. Thus, potential entrants are undeterred by prospects of retaliatory price cuts by incumbents and instead are deterred only when the existing market prices leave them no room for profitable entry.

Willig distinguished between his concept of idealized markets and the textbook notion of a perfectly competitive market. Both concepts involve markets in which there is frictionless free entry. But, the purely competitive model assumes that there exist in the market a large number of firms each of whom considers its production decisions to have no effect on market prices. In contrast, both incumbents and potential entrants in a contestable market recognize their power over prices and realize that they cannot sell more than consumers demand at given prices, without bidding market prices down. Consequently, a contestable market need not be populated by a great many firms; indeed, contestable markets may contain only a single monopoly enterprise or they may be comprised of duopolistic or oligopolistic firms.

Thus, it was only during the last phases of the writing of this book that the theorems of Chapter 2 about sustainable industry configurations were derived. Only then was it discovered that the absence of entry barriers can lead to just the socially "right" amount of entry. Willig was able to prove that for a feasible industry configuration to be sustainable, it must minimize total industry cost for the production of the aggregate industry output (Willig, 1979a). Moreover, the authors discovered the applicability to contestable markets of the traditional results of the theory of perfect competition. All firms producing any given product must select output levels at which marginal cost of all the firms are equal. Moreover, these marginal costs must equal the market price of that product, so that profits must be zero when there are constant returns to scale, locally. But these results now are shown to hold not only for an industry with a large number of firms, but for any contestable market in which each good is supplied by