Chapter 2
The Components of the Difference Between a Firm's Price and Conventional Marginal Costs and the Intermediate Determinants of the Intensity of Quality-and-Variety-Increasing-Investment Competition

Industrial Organization economists devote considerable attention to analyzing the competitive impact of various types of business conduct, and the antitrust laws of the United States and the E.U. make the legality of various types of business conduct depend (sometimes *inter alia*) on their competitive impact.[40] Surprisingly, neither Industrial Organization economists, nor the antitrust laws in question, nor the lawyers and judges that interpret and apply these laws have satisfactorily defined the concepts of the intensity of competition they use. The definitions that have been proposed for (1) the impact of conduct on price competition have been incomplete, inconsistent, and/or inappropriate[41] and (2) the concepts of the impact of conduct on QV-investment competition and the impact of conduct on price and QV-investment competition combined have been totally ignored. Chapter 4 will

[40] See, *e.g.*, (1) the Clayton Act, whose specific provisions make the legality of the conduct they cover depend on whether their "effect. . .may be to substantially lessen competition or tend to create a monopoly," (2) Article 101 of the 2009 Lisbon Treaty, which makes the legality of "agreements between undertakings, decisions by associations of undertakings and concerted practices" depend on whether they "have as their object or effect the prevention, restriction or distortion of competition," (3) one branch of Article 102 of the 2009 Lisbon Treaty, which (as interpreted and applied) makes the legality of the conduct of a dominant firm or a collectively-dominant set of firms depend on whether the conduct "has the effect of hindering the maintenance of the degree of competition still existing in the market or the growth of that competition," and (4) the European Merger Control Regulation (EMCR), which makes the legality of the mergers, acquisitions, and full-function joint ventures it covers depend on whether they "significantly imped[e] effective competition." See Manufacture Française des Pneumatiques Michelin v. Commission (Michelin II), Case T-203/01, ECR-II 4071 § 54 (2003). For a more detailed discussion of the conduct-coverage, the tests of illegality promulgated by, and the defenses recognized by the Clayton Act, the Sherman Act, Articles 101 and 102 of the 2009 Lisbon Treaty, and the E.C./E.U. Merger Control Regulation (EMCR) as written, interpreted, and applied, see Chap. 4.

[41] For a detailed analysis of the various ways in which economists and lawyers who are conversant with economics have assumed that the Clayton Act concept of "lessening competition" should be operationalized, see Richard S. Markovits, *Some Preliminary Notes on the U.S. Antitrust Laws' Tests of Illegality*, 27 STAN. L. REV. 841-844-50 (1975) and the summary of this discussion in Subsection 1B(2) of Chap. 4.

R.S. Markovits, *Economics and the Interpretation and Application of U.S. and E.U. Antitrust Law*, DOI 10.1007/978-3-642-24307-3_2,

offer a definition of "the impact of a choice on competition" that I think correctly operationalizes this concept in both the U.S. antitrust-law context and the E.C./E.U. competition-law context.

This chapter tries to remedy another set of related deficiencies in the current treatment of the concept "the intensity of completion": the failure of economists or lawyers (1) to distinguish various components of the gap between a seller's price and marginal cost that need to be separately analyzed, regardless of whether the goal is to predict the competitive impact of some conduct or natural event, to study its economic efficiency, to assess (in the case of conduct) its legality, or to predict its distributive impact or distributive desirability and (2)(A) to define the intermediate determinants of the intensity of QV-investment competition in any arbitrarily-defined (see Chap. 6) area of product-space and (B) to analyze the way in which the various determinants of the intensity of QV-investment competition in any area of product-space interact to determine the intensity of QV-investment competition in that area, regardless of how that intensity is operationalized.

Section 2.1 develops a conceptual scheme for analyzing the intensity of price competition or the impact of any conduct on that intensity, regardless of how the intensity of price completion is defined, and analyzes the connection between the various components of this scheme. Section 2.2 delineates the intermediate determinants of the intensity of QV-investment competition in any (arbitrarily-designated) area of product-space and explains how these determinants interact to determine that intensity, regardless of how it is defined.

1. The Price-Competition Conceptual Scheme

Economists and antitrust lawyers who have analyzed the impact of particular business conduct on the intensity of price competition have almost always focused exclusively on the overall gap between the price or prices that particular sellers charged and their respective marginal costs. Because (1) different factors determine the magnitudes of the various components of this P–MC gap that should be distinguished, (2) the law of various countries places a different significance on various such components' having non-zero values, and (3) changes in the magnitude of different components of a seller's P–MC gap have different economic-efficiency implications, I have developed two price-competition conceptual systems that subdivide the standard P–MC gap to facilitate the relevant micro-economic, legal, and economic-efficiency analyses.

However, before proceeding to give an account of these conceptual systems, I need to define or comment on three concepts or pairs of concepts that this account implicates. The first is the pair of concepts "individualized pricing" and "across-the-board pricing." In my vocabulary, a seller is said to be engaging in "individualized pricing" if it sets the price it charges each of its potential customers separately. By way of contrast, a seller is said to be engaging in across-the-board pricing if it establishes a single set of terms that applies to all its potential customers. As we shall see, this distinction is important because the conceptual scheme that is best adapted to individualized-pricing situations is different from its across-the-board-pricing counterpart.

The second is the pair of related concepts "strategic" decisions and "inherently-profitable" decisions. In my usage, the expression "strategic decision" refers to decisions whose subjective *ex ante* profitability is critically affected by the "strategic advantages" it is expected to generate for the business decisionmaker in question. The "strategic advantages" a decision generates for a business decisionmaker are the advantages it yields that actor (1) by deterring one or more of its rivals from undercutting it by inducing the rival or rivals in question to increase their estimate of the costs they will have to incur to undercut the actor in question because such undercutting will induce it to retaliate and/or deter it from cooperating with them—*i.e.*, by inducing the rival or rivals in question to forego "inherently-profitable" (see below) opportunities to undercut it—or (2) by inflating its profits by driving one or more rivals out of business or deterring a potential or established competitor from making a QV investment in its area of product-space in circumstances in which the exited rival or deterred investment either will not be replaced or will be replaced by a rival that or investment that will reduce the relevant business decisionmaker's profits to a lesser extent. Relatedly, the expression "inherently profitable" decisions will be used to refer to business decisions made by actors whose *ex ante* perception that the decisions would be profitable did not depend on their belief that the decisions might yield strategic gains.

The third concept that requires elucidation is "oligopolistic conduct." As I indicated in the Introduction to Part I of this study, on my definition, a seller is said to have initiated an oligopolistic-conduct sequence if and only if *ex ante* it perceived the profitability of its move to be critically affected by the fact that its rivals' responses to its conduct will or may be influenced by their realization that it can react to their responses.[42] I want to emphasize at the outset that this definition of

[42] Economists have never explicitly defined the concept "oligopolistic conduct"—*i.e.*, have defined it only implicitly through usage (by developing pricing models they denominate "oligopolistic"). My definition is narrower than its standard counterpart, which defines a choice to be oligopolistic when the actor realizes that its pay-off will be affected either by the choices that identifiable rivals have already made or (somewhat more narrowly) by the responses the choice elicits from one or more identifiable rivals—*i.e.*, to be oligopolistic when it manifests simple, two-stage recognized interdependence rather than the more-complex, three-stage type of recognized interdependence that is the identifying characteristic of the conduct I call "oligopolistic." Thus, the interdependence that is the basis of the leading conjectural-variations models of oligopolistic pricing is backward-looking: in the Cournot model, each firm assumes that its output-decision will not affect its rivals' output choices; in the Bertrand model, each firm assumes that its price decision will not affect its rivals' price decisions; and in the Stackelberg model, a leader-firm profits from the fact that its followers behave in the way that the Cournot model assumes. The interdependence that many of the more modern, game-theoretic, "oligopolistic-pricing" models posit, though forward-looking, is also two-stage (simple) recognized interdependence. For a discussion of several of these game-theoretic models that substantiates this conclusion, see DAVID CARLTON AND JEFFREY PERLOFF, MODERN INDUSTRIAL ORGANIZATION 380–903 (Harper Collins Pub., 1990). I hasten to add that some oligopolistic-pricing models do focus on the kind of three-stage interdependence

"oligopolistic conduct" in general and of "oligopolistic pricing" in particular is more restrictive than the definitions economists generally employ.

A. The Price-Competition Conceptual Scheme for Individualized-Pricing Situations

I will begin by describing the conceptual scheme I use to analyze the competitiveness of *individualized* prices and the impact of given transactions or practices on the competitiveness of *individualized* prices. I will then describe the conceptual scheme I use when pricing is done on an across-the-board basis.

My individualized-pricing conceptual system focuses on the gap between the price that a seller that is (privately) best-placed to supply a given buyer[43] charges that buyer and the conventional marginal costs that seller must incur to supply the buyer in question. My system subdivides the relevant P–MC gap into three major and a larger number of smaller components. The three major components are formed by inserting a seller's "highest non-oligopolistic price" (HNOP) and "no-error highest non-oligopolistic price" (NEHNOP) between its actual price and its conventional marginal costs. In an individualized-pricing context, the HNOP is defined to be the highest price that would be profitable for a seller that was best-placed to supply a particular buyer to charge that buyer if its rivals would always respond to its moves on the assumption that it could not react to their responses. The NEHNOP is defined to be the highest price that would be profitable for a seller that was best-placed to supply a particular buyer to charge that buyer if neither it, nor any of its rivals, nor any relevant buyer made any *ex ante* error and its rivals would always respond to its moves on the assumption that it could not react to their responses.

I will now delineate the various subcomponents respectively of NEHNOP–MC, HNOP–NEHNOP, and P–HNOP. In individualized-pricing situations, the

that makes conduct oligopolistic in my sense. See, *e.g.*, George Stigler, *A Theory of Oligopoly*, 72 J. POL. ECON. 44 (1964). In my judgment, my definition of "oligopolistic" is superior to (more useful than) its broader standard counterpart for two reasons. First, because (1) the standard definition labels as "oligopolistic" all pricing and advertising choices made by sellers that do not face perfect price competition and all QV-investment decisions made by sellers that do not face perfect QV-investment competition and (2) virtually no sellers face perfect price or QV-investment competition, the standard definition is too inclusive to be useful. Second, because the standard definition covers behaviors that manifest simple recognized interdependence as well as other, more-complicated kinds of interdependence, it is deficient in that it fails to capture the characteristics of particular pricing sequences that make them illegal under U.S. antitrust law or appropriate targets for prohibitory legislation.

[43] The seller that is privately-best-placed to supply a buyer in an individualized-pricing context is the seller that would find it inherently profitable to supply that buyer on terms contained in an offer that no rival would find inherently profitable to beat. For the definition of "inherently profitable," see the paragraph of the text that immediately precedes the paragraph that contains footnote-number 3.

NEHNOP–MC gap is first subdivided into (a) the best-placed seller's basic competitive advantage (BCA) when dealing for the patronage of the relevant buyer and (b) the contextual marginal costs (CMC) that the second-placed seller would have to incur to match (or infinitesimally beat) the best-placed seller's NEHNOP. Obviously, several terms in the preceding sentence require elucidation. I will analyze the concept "basic competitive advantage" on the assumption that neither the best-placed supplier of a given buyer nor its closest rival for that buyer's patronage (the second-placed supplier of that buyer) will have to incur any contextual marginal costs (see below) to supply the buyer in question on relevant terms. In this case, the best-placed supplier's BCA would equal the amount by which it was (privately) better-placed than anyone else to supply the buyer in question—the amount by which it could raise its price above its marginal costs of production and distribution without making it inherently profitable for any rival to "steal" the customer in question by beating its offer. This amount is equal to the sum of the buyer preference advantage (disadvantage) the best-placed supplier has over its closest rival for the relevant buyer's patronage at the relevant set of prices (the $BPA_{\#1}$—the additional amount of money that it would be inherently profitable for the buyer to pay to obtain its best-placed supplier's product variant or service variant rather than its second-placed supplier's product variant or service variant if the buyer's preference-perception were accurate) and the best-placed supplier's (conventional) marginal cost advantage (disadvantage) over its closest rival for the relevant buyer's patronage ($MCA_{\#1}$—the amount by which the marginal or incremental costs the best-placed supplier of the buyer in question would have to incur to supply the buyer in question were lower than the marginal or incremental costs its closest rival for that buyer's patronage would have to incur to supply him). As the preceding statement implies, a seller may enjoy a BCA in its relations with a particular buyer because it has both a BPA and an MCA, because its buyer preference disadvantage (BPD) is smaller than its MCA, or because its BPA exceeds its marginal cost disadvantage (MCD).

The second component of the NEHNOP–MC gap I find worth distinguishing in individualized-pricing contexts is the contextual marginal costs of the second-placed supplier of the buyer in question ($CMC_{\#2}$). Contextual marginal costs are the extra costs a seller has to bear because the price it is charging the buyer in question might expose the seller to some risk of cross-selling (*i.e.*, arbitrage) (to the extent that the price it is charging is discriminatory or multi-part [contains a lump-sum fee as well as a per-unit price]), might induce its other customers to intensify their bargaining (by putting the lie to its statements about its costs, by leading them to conclude that it has been treating them unfairly, or by suggesting that it can in fact be bargained down), and/or might expose it to *ex ante* legal-liability costs (to the extent that the price may appear to some to involve illegal price discrimination or some other price-regulation violation). Such costs are said to be "contextual" because they depend on various features of the context in which they are charged—*inter alia*, the prices the relevant seller is charging other buyers, various features of the legal milieu (*e.g.*, the existence of price-discrimination prohibitions or maximum or minimum price regulations), what the seller has told its other customers about its own costs, *etc*. In individualized-pricing situations, a #2 seller (a seller that is second-placed to obtain the relevant buyer Y's patronage) is likely to have to incur CMC to quote Y a price that makes #2's offer as attractive to Y overall as the offer Y received from its best-placed supplier (#1) because the price-component of #2's "matching" offer to Y is likely to be discriminatory—*i.e*., is likely to be lower than the price #2 charges those buyers it is best-placed to supply.

Unfortunately, once one recognizes the existence of contextual marginal costs, a series of additional, related terms have to be introduced: (1) the contextual marginal cost advantage or disadvantage (CCA or CCD) of a best-placed supplier in an individualized-pricing context ($CCA_{\#1} = CMC_{\#2}–CMC_{\#1}$), (2) the overall marginal cost a firm would have to incur to supply a particular buyer on specified terms (OMC = MC + CMC), and (3) the overall competitive advantage a best-placed seller enjoys in its relations with a particular buyer ($OCA_{\#1} = BCA_{\#1} + CCA_{\#1}$). The text that follows will sometimes make reference to relationships that involve these concepts—in particular, will sometimes make use of the facts that (1) $CMC_{\#2} = CMC_{\#1} + CCA_{\#1}$, (2) $OCA_{\#1} = BCA_{\#1} + CCA_{\#1}$, and (3) $(NEHNOP–MC)_{\#1} = OCA_{\#1} + CMC_{\#1}$. In the end, then, my conceptual system subdivides each of the two subcomponents of the NEHNOP–MC gap ($BCA_{\#1}$ and $CMC_{\#2}$) into two parts: $BCA_{\#1} = BPA_{\#1} + MCA_{\#1}$ and $CMC_{\#2} = CMC_{\#1} + CCA_{\#1}$.

In my scheme, the second major component of the P–MC gap is the HNOP–NEHNOP gap. This gap reflects various errors that can cause a best-placed seller's actual price to exceed or differ from its NEHNOP for non-oligopolistic reasons. My conceptual system distinguishes three subcomponents of the HNOP–NEHNOP gap—*i.e*., three categories of errors that can cause a seller's HNOP to exceed or differ from its NEHNOP: (1) buyer-error-generated HNOP–NEHNOP gaps or margins ($BEM_{\#1}$); (2) rival-error-related HNOP–NEHNOP gaps or margins ($REM_{\#1}$); and (3) best-placed-supplier-error-related HNOP–NEHNOP gaps or margins (#1EM). In my system, the total extra margin a best-placed seller obtains because of all relevant actors' errors—Its HNOP–NEHNOP gap—is symbolized by $\Sigma EM_{\#1}$. I will now comment on each of the three subcomponents of $\Sigma EM_{\#1}$ in turn.

I will restrict my comments about the relevant buyer-error margin to a few remarks about the contestability of the usefulness of the concept. Admittedly, if the buyer preferences that played a role in the analysis of the determinants of a best-placed individualized pricer's NEHNOP–MC gap are defined to refer to the buyer's perceived preferences as opposed to the preferences it would have if it were a sovereign maximizer, then the NEHNOP would already reflect any buyer errors that affected the price that a best-placed individualized pricer charged the buyer in question. However, for linguistic reasons and because the reality of buyer errors is sometimes relevant to both policy analyses and the determination of existing legal rights, it is useful to assume that the buyer preferences that lie behind the BPAs that are a component of a best-placed individualized pricer's NEHNOP are the monetized preferences of a sovereign maximizer and to handle separately the buyer errors that may enable such a best-placed seller to obtain higher prices from the erring customer than it otherwise could (or, for that matter, that may preclude it from obtaining as high a price from a buyer it was "objectively" privately-best-placed to supply as it otherwise could).

I will confine my comments about the relevant rival-error margin to a brief account of the various types of rival errors that can cause a best-placed seller's HNOP to exceed or differ from its NEHNOP. In an individualized-pricing context, a best-placed seller's closest competitor for a particular buyer's patronage (#2) may make at least four different types of errors that will enable the best-placed seller to obtain a price above its NEHNOP. First, #2—the rival that is second-placed to obtain the relevant buyer's patronage—may overestimate the overall marginal costs #2 would have to incur to supply the buyer in question at the price it would have to charge to beat the relevant best-placed-supplier's (#1's) offer (in which case #2 would fail to beat #1's offer despite the fact that it would beat it if it realized the inherent profitability of doing so); second, #2 may underestimate the relevant buyer's preference for #1's product or service in circumstances in which #2 will not have the opportunity to make a second bid for the relevant buyer's patronage (in which case #2 will make an offer to the buyer in question that will fail to obtain its patronage despite the fact that #2 believed that its offer would be successful and could in fact have profited by making a more attractive offer that would have been successful); third, #2 may critically overestimate the probability that #1 will beat any undercutting offer whose acceptance #2 would find profitable because #2 overestimates the probability that #1 will have the opportunity to change its initial offer to that buyer and/or the probability that #1 will find it inherently profitable to beat any relevant underbid #2 would otherwise find it profitable to make (in which case #2 will be deterred from making what would have been a successful, profitable underbid by the fact that the pricing and bidding costs it would have to incur to do so exceed its estimate of the weighted-average profits such a bid would yield it if pricing and bidding costs were zero [given its estimate of the probability that its undercutting offer will be accepted], though such bidding costs are in fact less than the weighted-average profits it should expect to make by undercutting #1's initial offer [bidding costs aside], given the actual [higher] probability that its undercutting offer will be accepted); and fourth, #2 may critically overestimate the sum of (1) the benefits #1 will allow it to obtain by engaging in reciprocal collaboration if #2 does not undercut #1's bid and (2) the costs #1 will impose on it by retaliating if #2 does undercut #1's bid (in which case #2 will be deterred from making a successful underbid that would have been profitable [strategic costs considered] by its misperception of the likelihood and/or likely extent of #1's relevant contrived oligopolistic reactions to #2's various possible responses to #1's initial price).

The third type of error that can cause a best-placed individualized pricer's HNOP to exceed its NEHNOP are errors that #1 makes itself. Thus, #1 may charge an individualized *supra*-NEHNOP price because it has overestimated its NEHNOP (its closest rival's MC, CMC, or BPD) and/or has incorrectly concluded that its closest rival will make errors that will enable it to get away with a price that that rival could have profited *ex ante* by undercutting (on the current assumption that the #1 seller did not intend to engage in oligopolistic conduct). As we shall see, such errors by #1 may not cause it to lose the sale in question if its rivals conclude that its price was intended to communicate its intention to retaliate against their undercutting and/or reciprocate to their not undercutting—that its price was contrived oligopolistic rather than mistaken.

Before proceeding to the P–HNOP component of an individualized pricer's P–MC gap, two additional points should be made about the HNOP–NEHNOP gap. First, although the preceding discussion presupposed that any errors that the best-placed individualized pricer and its rivals might make would always cause it to charge prices above the NEHNOP, that supposition is unjustified. Thus, if the best-placed supplier realized that its closest rival for the relevant buyer's patronage underestimated the marginal cost that that rival would have to incur to supply the buyer in question or if the best-placed supplier itself underestimated its closest rival's relevant marginal cost or its own BPA over that rival in relation to the relevant buyer, the best-placed supplier would tend on those accounts to charge the buyer a price below its NEHNOP.

Second, it is important to note that although the set of errors that affect a best-placed individualized pricer's HNOP–NEHNOP gap include errors its rivals make about its oligopolistic intentions, it does not include the errors it may make that affect whether it seeks to obtain an oligopolistic margin (OM) or the size of the OM it seeks to obtain.

In my scheme, the third major component of the gap between the price an individualized pricer actually charges a buyer it is best-placed to supply and the conventional marginal costs it would have to incur to supply that buyer are the oligopolistic margins it seeks to obtain from the buyer in question—*i.e.*, the extra sum it tries to obtain from this buyer because it believes that its closest rival or rivals for the relevant buyer's patronage will be deterred from making what would otherwise be a profitable undercutting response to any price it charges above its HNOP by a correct realization that it will react to such a response in a way that makes undercutting unprofitable for them. When the best-placed seller believes that its rivals will be deterred from undercutting it by their correct perception that it will react to such undercutting by making a move that is inherently profitable for it, the margin that it believes its ability to react will enable it to obtain is called a natural oligopolistic margin (NOM) and the best-placed seller's act of setting a price that relies on its rivals' being deterred from undercutting by their realization that it would react to their undercutting by making an inherently-profitable move that would make their undercutting unprofitable for them is called natural oligopolistic pricing (NOP). When the best-placed seller believes that its rivals will be deterred from undercutting it by their correct perception that it would react to such undercutting by making an inherently-unprofitable (strategic) move that would render undercutting unprofitable for them, the margin the anticipated strategic reaction enables the best-placed firm to obtain is called a contrived oligopolistic margin (COM), and the best-placed seller's act of setting a price that relies on its rival's or rivals' justified belief that it would react strategically to undercutting (as well as any collaborative response its rivals make and any strategic move it makes in reaction to their collaboration or undercutting) is called contrived oligopolistic pricing (COP). In my system, the total oligopolistic margin a best-placed seller obtains from a buyer it is best-placed to supply is symbolized as $\Sigma OM_{\#1} = NOM_{\#1} + COM_{\#1}$.

One additional point needs to be made about the situation that will prevail when $P_{\#1}$ exceeds $HNOP_{\#1}$. As you will recall, my original discussion of $CMC_{\#1}$ assumed that the best-placed seller was charging its HNOP, and my discussion of $CMC_{\#2}$ assumed that the second-placed seller was matching or infinitesimally beating an offer by #1 to supply the relevant buyer at #1's HNOP. If $P_{\#1}$ exceeds $HNOP_{\#1}$, that fact will affect both its CMC and the CMC its closest rival for the relevant buyer's patronage will have to incur to match #1's offer. In particular, #1's higher (supra-HNOP) price will reduce $CMC_{\#1}$ if it is less discriminatory than its HNOP or is less far below, equal to, or above a legally-required minimum price, while a $P_{\#1}$ that exceeds $HNOP_{\#1}$ will increase $CMC_{\#1}$ if it is more discriminatory or exceeds a maximum-price regulation. In general, #1's supra-HNOP price will tend to reduce $CMC_{\#2}$ by reducing the extent to which #2's matching-offer price discriminates in the relevant buyer's favor and may tend to reduce $CMC_{\#2}$ as well by reducing or eliminating any positive difference between the price #2 will have to charge to match #1's offer and some required minimum price though it may increase $CMC_{\#2}$ by increasing the positive difference between #2's matching-offer price and a maximum allowed price.

Chart I presents the conceptual scheme just delineated. It is accompanied by a glossary of all the symbols my individualized-pricing price-competition scheme involves. Before proceeding, I should point out that the preceding account of the determinants of an individualized pricer's P–MC gap has ignored the reality that such a pricer's actual price may also be influenced by conventional individual-product "promotional," product-line promotional, institutional promotional, network-building, "learning-by-doing," and "keeping-in-touch" considerations.[44]

[44] A seller is properly said to be engaging in (conventional single-product) "promotional pricing" at time t(0) when it lowers the price of its product X at t(0) to a level that would not otherwise be profitable because it expects the additional sales of product X that the price-reduction enables it to make at t(0) to increase the profits it makes at t(1. . .n) by increasing the demand it will face in relation to product X at t(1. . .n) for any or all of the following three reasons: (1) because it increases the demand that the additional buyer(s) the price-reduction enables it to sell X to at t(0) will have for product X at t(1. . .n)—"try it, you'll like it"; (2) because it increases the demand that other buyers will have for product X at t(1. . .n) by increasing the positive information they receive about X from the additional buyer(s) to which its price-reduction enabled it to sell X to at t(0) or from someone with whom these buyers talked or who observed these buyers using X or by observing themselves the way in which X performed for these additional buyers; and/or (3) because it increases the demand that other buyers will have for X at t(1. . .n) because they want to be identified with the additional buyers its price-reduction induced to buy X at t(0) or with particular attributes of these buyers. A seller is properly said to be engaging in product-line promotional pricing of product X1 at time t(0) when it charges a lower price for X1 because it expects that the additional sales of X1 that the reduction in X1's price will enable it to make of X1 at time t(0) will increase the demand curve it faces for products X2. . .n at time t(0) and subsequently because buyers have a preference for multiple members of the same product-line (1) because they find a matching set more aesthetically attractive than an unmatched collection, (2) because the proper way to use each member of a given product-line is the same while the proper method of using different product-lines varies from product-line to product-line and it is costly to learn how to use

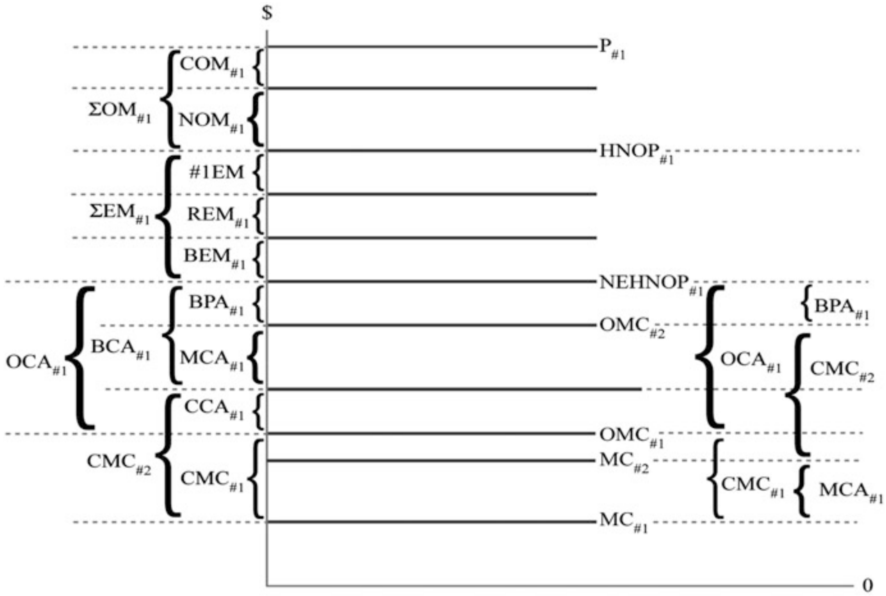

Chart I The components of the gap between a best-placed seller's actual individualized price and its (conventional) marginal cost

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the products in a product-line whose products one has not yet used, and/or (3) because the members of any given product-line have the same strengths and weaknesses and such strengths and weaknesses differ among rival product-lines and it is costly to learn the strengths and weaknesses of a product-line whose products one has not yet used. I should add that the benefits of product-line promotional pricing will tend to be higher to the extent that the additional purchases of X2. . .n made by a buyer of X1 that has been induced to purchase X1 by a reduction in its price induces other buyers to purchase a member of the product-line X1. . .n. A seller is properly said to be engaging in institutional promotional pricing if it charges a lower price for product X at time t(0) than it otherwise would have found profitable because it expects that the extra sales the price-reduction will enable it to make of X will increase the demand it faces for all its products (regardless of whether they are in the same product-line as X) because product X is a good product and any buyer that consumes it will revise upward its estimate of the quality of all of the seller's products as will anyone that is told of its performance by its actual consumer or that observes its performance by its actual consumer in circumstances that enable the observer to evaluate its performance. A seller is properly said to be engaging in network-building pricing of product X when it charges a lower price for product X than it would otherwise find profitable because the objective value of product X to an individual buyer increases with the number of other buyers (*i.e.*, users) of the product. A seller is properly said to be engaging in "learning-by-doing" pricing when it lowers its price at t(0) because it expects the additional sales that the price-reduction enables it to make at t(0) will increase the profits it makes at t(1. . .n) by reducing the costs it will have to incur to produce various relevant outputs of its product at t(1. . .n) or by enabling it to discover a somewhat-different product variant that it could produce at t(1. . .n) on which it would face a more attractive DD/MC combination. A competitive inferior is properly said to be engaging in "keeping-in-touch" pricing if it incurs the cost of making a bid that it knows will not be accepted to secure the advertising-like benefits such a bid will generate by making it more likely that the buyer will solicit bids from it in the future and/or to pay more attention to its bids in the future by inducing the buyer to have a better opinion of it than it otherwise would have.

Glossary of Symbols

(1) $P_{\#1}$—the best-placed seller's actual price
(2) $COM_{\#1}$—the best-placed seller's attempted contrived oligopolistic margin
(3) $NOM_{\#1}$—the best-placed seller's attempted natural oligopolistic margin
(4) $\Sigma OM_{\#1}$—the best-placed-seller's attempted oligopolistic margin = $NOM_{\#1} + COM_{\#1}$
(5) $HNOP_{\#1}$—the best-placed seller's highest non-oligopolistic price = $(P_{\#1}–\Sigma OM_{\#1})$
(6) #1EM—the additional margin that the best-placed seller's errors about its NEHNOP, BEM, or $REM_{\#1}$ (see item [7] in this list) lead it to believe it can obtain non-oligopolistically
(7) $REM_{\#1}$—the additional margin the best-placed seller can obtain because of errors its rivals make
(8) $BEM_{\#1}$—the additional margin the best-placed seller can obtain because of errors the relevant buyer makes
(9) $\Sigma EM_{\#1}$—the total additional margin the seller's actual price contains because of errors its customers make, its rivals make, or it makes on issues that do not cause it him to try for additional or higher OMs = HNOP–NEHNOP (see item [10] in this list)
(10) $NEHNOP_{\#1}$—the price that would be the best-placed seller's HNOP if no-one made any relevant errors = $(HNOP_{\#1}–\Sigma EM_{\#1})$
(11) $BPA_{\#1}$—the best-placed seller's buyer preference advantage over its closest rival for the relevant buyer's patronage
(12) $MCA_{\#1}$—the best-placed seller's (conventional) marginal cost advantage over this closest rival for the relevant buyer's patronage
(13) $BCA_{\#1} = BPA_{\#1} + MCA_{\#1}$—the best-placed seller's basic competitive advantage over its closest rival for the relevant buyer's patronage
(14) $CCA_{\#1}$—the best-placed seller's contextual (marginal) cost advantage over its closest rival for the relevant buyer's patronage when the best-placed seller is charging its NEHNOP and this closest rival is matching that offer
(15) $OCA_{\#1} = BCA_{\#1} + CCA_{\#1}$—the best-placed seller's overall competitive advantage over this closest rival for the relevant buyer's patronage when the best-placed seller is charging its NEHNOP
(16) $CMC_{\#1}$—the contextual marginal costs the best-placed seller would have to incur to supply the relevant buyer at its NEHNOP
(17) $MC_{\#1}$—the conventional marginal cost the best-placed seller (#1) would have to incur to supply the buyer in question
(18) $OMC_{\#1} = MC_{\#1} + CMC_{\#1}$—the best-placed seller's overall marginal cost if it charges the relevant buyer its NEHNOP
(19) $MC_{\#2} = MC_{\#1} + MCA_{\#1}$—the conventional marginal cost the second-placed seller (#2) would have to incur to supply the relevant buyer
(20) $CMC_{\#2}$—the contextual marginal costs the second-placed seller would have to incur to match or infinitesimally beat the best-placed seller's NEHNOP-containing offer to the relevant buyer

(21) $OMC_{\#2} = MC_{\#2} + CMC_{\#2} = MC_{\#1} + MCA_{\#1} + CMC_{\#2}$—the overall marginal costs the second-placed seller would have to incur to match or infinitesimally beat the best-placed seller's NEHNOP-offer to the relevant buyer

Not Represented: the contextual marginal costs and hence overall marginal costs that the best-placed seller would have to incur to make a sale or even an offer to the relevant buyer at a price that exceeded its NEHNOP or the contextual marginal and hence overall marginal costs that a second-placed seller would have to incur to match or infinitesimally beat any offer by a best-placed seller to the relevant buyer that contained a price that exceeded the latter's NEHNOP

N.B. $P_{\#1} - MC_{\#1} = CMC_{\#2} + BCA_{\#1} + \#1EM + REM_{\#1} + BEM_{\#1} + NOM_{\#1} + COM_{\#1} = CMC_{\#1} + OCA_{\#1} + \Sigma EM_{\#1} + \Sigma OM_{\#1}$

B. The Price-Competition Conceptual Scheme for Across-the-Board-Pricing Situations

My breakdown of the gap between an across-the-board pricer's P–MC gap is very similar to its individualized-pricing counterpart. Once more, the P–MC gap is subdivided into P–HNOP, HNOP–NEHNOP, and NEHNOP–MC components. Once more, P–HNOP = NOM + COM, and HNOP–NEHNOP = ΣEM. However, at least five differences between the across-the-board-pricing and individualized-pricing (P–MC)-gap breakdown are worth pointing out. First, because any across-the-board price that a seller charges will apply to some buyers that it is not "best-placed to serve" in any sense in which that expression might be usefully defined, I use the symbol S (for seller) rather than the symbols #1, #2, . . . #N to refer to any across-the-board pricer whose HNOP or NEHNOP I am considering. Second, and relatedly, the #1EM subcomponent of the individualized HNOP–NEHNOP gap is replaced by a seller-error-margin (SEM) subcomponent in the across-the-board pricing conceptual scheme. Third, and also relatedly, although I recognize that the following usage may be confusing and therefore not advisable, in across-the-board-pricing contexts, the analysis of the breakdown of an across-the-board-pricing seller's NEHNOP–MC gap will refer to it and its rivals' across-the-board-pricing BCA/BCD distributions where each across-the-board-pricing BCA or BCD (basic competitive disadvantage) that any S has in its relations with any particular buyer is equated with the sum of its BPA or BPD in relation to that buyer and the MCA or MCD it would have in relation to that buyer *if the marginal costs that the seller in question and each of its rivals would have to incur to supply a unit of their respective products to that buyer (assuming the buyer paid the delivery costs) were equated with the marginal costs each such S would have to incur to supply the last unit of its product it would supply if all of them charged the prices that would equal their NEHNOPs if they announced their prices in the order in which they actually announced their prices*. This definition would not be problematic if, as there is some reason to believe is often the case, the MC curves of all the relevant sellers were horizontal over the relevant ranges of output. However, when the relevant MC curves are not horizontal over the relevant ranges of output, this component (though still useful as a descriptive concept) cannot be used in any protocol for identifying a particular across-the-board pricer's HNOP: if the goal is to calculate a particular seller S*'s HNOP, one cannot do so through a protocol of measuring the components of its HNOP–MC gap if the definition of one of these components assumes that one already knows the HNOP not only of S* but also of each of its rivals. Fourth and again relatedly, the across-the-board-pricing counterpart to the BCA component of the gap between a best-placed seller's NEHNOP and MC in an individualized-pricing situation is the difference between the across-the-board price each across-the-board-pricing S* would charge if it and its rivals knew that it could not react to its rivals' responses and they charged its customers' prices equal to their conventional marginal costs. This component will depend not just on the relevant S*'s across-the-board-pricing BCA/BCD distribution as defined above but also on the way in which that S*'s and its rivals' marginal costs vary above and below the unit outputs they would respectively produce if none behaved oligopolistically and they announced their prices in the order in which they actually did announce them. And fifth, the across-the-board-pricing counterpart to the $CMC_{\#2}$ subcomponent of the individualized-pricing NEHNOP–MC gap is replaced by an analogous subcomponent that also equals the extra margin that the seller in question finds profitable to charge because its rivals are charging its customers prices that exceed their respective conventional marginal costs. However, whereas (1) in the normal individualized-pricing situation, a best-placed supplier's closest rival will usually charge the #1's customers prices above the #2's conventional marginal costs if the #1 charges its NEHNOP to the relevant buyer because (A) the individualized price the #2 will have to charge the relevant buyer to match the #1's NEHNOP-containing offer to that buyer will discriminate in the relevant buyer's favor and (B) sellers (including #2) will normally have to incur arbitrage-related, goodwill-related, bargaining-related, and/or law-related CMC to discriminate in favor of a buyer (to charge that buyer a lower price than the seller is charging other buyers—in particular, is charging other buyers that the seller is best-placed to supply), (2) in across-the-board-pricing situations, the rivals of each seller S* will be charging that seller's potential customers prices above their respective conventional marginal costs because (A) by definition, in such situations, these rivals will be charging their own customers the same price they are charging the relevant S*'s customers and (B) charging buyers that would be willing to pay them prices in excess of their respective conventional marginal costs prices equal to their respective marginal costs will be "costly" to them in that (1) each rival of each S* would on this account charge supra-marginal-cost prices to that S*'s potential customers even if each such rival believed that the other rivals of the S* in question would equate their prices with their respective marginal costs and (2) each rival of each S* would also be charging prices that exceed the rival's marginal costs because each of them would realize that in reality its rivals (often the S*'s other rivals) would also be charging the relevant rival's customers (across-the-board) prices that exceed their respective marginal costs.

I will now proceed to describe the protocol for determining the NEHNOP array for a relevant set of across-the-board-pricing sellers. (For simplicity, I will henceforth assume that no relevant errors are being made and therefore focus on the HNOP array for such sellers.) I will then delineate and explore two simple examples that illustrate the protocol, reveal the relevance of various determinants of the gap between the prices in an across-the-board-pricing HNOP array and the respective seller's marginal costs, and reveal as well the fact that the HNOP–MC gap for across-the-board pricers will almost always substantially exceed their average and even their highest across-the-board-pricing BCA in their relations with those buyers in relation to which (on my admittedly-awkward definition) they have a (positive) across-the-board-pricing BCA.

I will start by providing an account of how one would calculate the array of across-the-board-pricing HNOPs for a set of across-the-board pricers. To generate conclusions about such an HNOP array, one would have to know (1) the order in which the relevant sellers announced their prices, (2) each relevant seller's across-the-board BPA/BPD array, and (3) each relevant seller's MC curves over the relevant range of unit outputs.

I will start by describing the protocol for calculating the across-the-board-pricing HNOP array for duopolists—X1, which produces product A1, and X2, which produces product A2. I will assume that (1) X1 announces its price for A1 before X2 announces its price for A2, (2) X1 knows that X2 realizes that X1 will not react to X2's response to X1's price, and (3) X1 and X2 have perfect information about their respective BPA/BPD arrays and the shapes of their respective MC curves over the relevant range of outputs. On these assumptions, X1 will identify its profit-maximizing (HNOP) price $P1^*$ by (1) determining for each price P1 it could charge the price P2 that X2 would find most profitable to charge in response, (2) calculating the unit sales it would make if it charged the P1 in question and X2 made its profit-maximizing price-response, (3) calculating the profits that it would make by charging the particular price P1 in question, given the unit sales X1 would make at that price and its marginal costs over the relevant output-range, and (4) identifying the price $P1^*$ that would yield it the highest profits in the circumstances in question. X2 would, of course, determine the price P2 that would be most profitable for it to charge in response to any price that X1 charged if X1 would not react to X2's price-response by (1) determining for each such price P2 that it could charge in response to the particular price P1 that X1 set for A1 the unit sales that it would make if it charged that P2, (2) calculating the profits it would make if it charged that price P2 in response to X1's price P1, given the marginal costs it would have to incur to supply the units it would sell if X1 charged that P1 and it responded with that P2, and (3) identifying the price that would yield it the highest profits if X1 charged the P1 in question. The relevant HNOP array would than consist of the price $P1^*$ that X1 would find most profitable if it could not engage in oligopolistic pricing and the price P2* that X2 would find most profitable to charge in response to X1's price P1* if X1 could not engage in oligopolistic pricing.

The relevant protocol is more complicated but essentially no different in across-the-board-pricing situations in which three or more relevant sellers are operating. The complication is that, in the three-seller case in which X1, X2, and X3 announce their binding prices in that order, X2's calculation of the price P2* that would constitute its profit-maximizing price-response to any price P1 that X1 might charge would take into account the response that X3 would find most profitable to make if X1 charged the P1 in question and X2 responded to X1's price P1 with a particular price P2 and neither X1 nor X2 would react to X3's response to their prices. Concomitantly, X1's calculation of its HNOP would have to take account of X2's prospective analysis of X3's profit-maximizing response to any price P2 that X2 could charge in response to any price P1 X1 charged on the assumption that X1 would not react to X2's and X3's responses to its price P1 and that X2 would not react to X3's response to X2's price (itself made in response to X1's price).

Although the relevant calculations will become highly complex as the number of rival sellers increases, if one had the relevant data, computer programs could be designed to generate HNOP-array conclusions quickly and without much expense. I should point out that there is little reason to believe that HNOP calculations will be less practicable in across-the-board-pricing contexts than in individualized-pricing contexts: the protocol I delineated for calculating individualized HNOPs was a protocol for calculating the HNOP for a best-placed single individualized-pricing seller to charge an individual buyer it was best-placed to supply whereas the protocol just delineated for calculating the HNOP array in an area of product-space in which across-the-board prices are being charged is a protocol for determining the prices that all relevant sellers in that area of product-space would be charging all relevant buyers. I do not want the wrong conclusions to be inferred from the preceding point. The fact that I do not think that it would be less practicable to determine the HNOPs of all the sellers that operate in a given area of product-space if they are setting across-the-board prices than if they are setting individualized prices has no bearing on whether I think it practicable to calculate such HNOP arrays in either type of pricing context. In fact, as I will argue in Sects. 2 and 3 of Chap. 10, I do not think it practicable to calculate HNOPs in either pricing context—*i.e.*, I do not think that in either individualized-pricing or across-the-board-pricing contexts, it will be cost-effective to determine whether a seller is charging an oligopolistic price by comparing its actual price with an estimate of its HNOP.

I will now develop and explore two highly-simplified examples (1) to illustrate the HNOP-calculation protocol respectively in duopoly and three-seller cases and (2) to reveal that, as the preceding discussion of the across-the-board-pricing counterpart to the $CMC_{\#2}$ component of a best-placed individualized pricer's HNOP–MC gap implied, the across-the-board-pricing HNOP–MC gaps for across-the-board pricers will almost always be higher not only than the average across-the-board-pricing BCA any such pricer enjoys in its relations with those buyers for which it has such a BCA but also than the highest such BCA an across-the-board pricer enjoys.

I will then explain (1) the various across-the-board-pricing-BCA/BCD-related determinants of the HNOP–MC gap of an across-the-board-pricing seller other than its highest and average across-the-board-pricing BCA in its relations with buyers for which it has a positive across-the-board-pricing BCA and (2) why the average across-the-board-pricing HNOP–MC gap for a set of across-the-board-pricing rivals will depend not only on their BCA/BCD distributions but also on the order in which they announce their prices. Considerations of space and reader patience have led me to conclude that I should not create and explore numerical examples to illustrate these points.

To ease the exposition, the examples I will use to illustrate the HNOP-calculation protocol respectively in duopoly and three-seller situations incorporate the usually-unrealistic assumption that only one of the set of across-the-board-pricing sellers in each case has any across-the-board-pricing BCAs (in fact, BPAs) in its relations with all the buyers concerned. This assumption does not critically affect any significant conclusion I use these examples to generate.

The first example is a simple duopoly case in which (1) there are two sellers X1 and X2 that respectively produce product variants A1 and A2, (2) X1 announces its price before X2 announces its price, (3) X1's and X2's marginal costs are constant over the relevant output ranges and both equal 1 cent, (4) there are 40 buyers Y1-40 each of which will purchase one unit of either A1 or A2, regardless of the prices that are being charged for these products within the relevant range, (5) buyers Y1-20 are indifferent between X1's product A1 and X2's product A2, (6) X1 has a BPA over X2 in its relations with buyers Y21-40—in particular, a BPA that is 1 cent for buyers Y21-22 and increases by 1 cent for each successive pair of buyers from buyers Y23-24 through buyers Y39-40. (Thus, X1's BPA is 2 cents for buyers Y23-24 and 10 cents for buyers Y39-40.) In addition to assuming that (7) X1 knows that X2 knows that X1 will not react to any across-the-board price P2 X2 charges in response to any across-the-board price P1 X1 sets and (8) X1 and X2 are perfectly informed about (A) both of their BPA/BPD distributions and (B) their actual MC curves over the relevant ranges of output, the analysis that follows also assumes that (9) prices cannot contain any fractional part of a cent, (10) if X1 and X2 make equally-attractive offers to any buyer, each will have a 50 % chance to obtain that buyer's patronage, (11) X1 and X2 are both risk-neutral, and (12) X1 and X2 will both prefer to earn the same profits on higher unit-sales than on lower unit-sales (because [1] they will have to provide more working capital to produce and sell more units in that they will have to pay the cost of producing and selling those units before they obtain the revenue from selling them and [2] they are just satisfied by as opposed to being indifferent toward the normal rate-of-return they will earn on that working capital when their sales cover their marginal costs, which include the cost of the associated working capital to them). Thus, if X2 matches X1's price, X2 will expect to sell 10 units to Y1-20; if X2 beats X1's price by 1 cent, X2 will expect to sell a total of 20 units to Y1-20 and a total of one unit to Y21-22; if X2 beats X1's price by 2 cents, X2 will expect to sell a total of 20 units to Y1-20, a total of two units to Y21-22, and a total of one unit to Y23-24; and so on and so forth.

We should now be able to calculate X1's and X2's across-the-board-pricing HNOPs in this case—*i.e.*, to determine (1) the price P1* that X1 will find most profitable to charge for A1 when no-one makes any mistakes, X1 sets its price for A1 before X2 sets its price for A2, and X1 cannot react to X2's response to X1's price and (2) the price P2* that on those assumptions X2 will find most profitable to charge for A2 in response to X1's price of P1* for A1. To do so, I will simply follow the protocol previously delineated—*i.e.*, I will calculate for each across-the-board price P1 that X1 could charge the price P2 that X2 would find most profitable to charge in response, the number of units of A1 that X1 would sell if it charged that P1 and X2 responded with that P2, and the profits that X1 would make by selling that number of units at that price P1.

I will assume that X1 will begin by considering the profits it would make in the case described if it charged a price of 1 cent for A1 and proceed by calculating the profits it would make in this case if it charged prices of 2 cents, 3 cents, 4 cents. . .for A1. I will not consider the possibilities that X1 or X2 might charge a price below their marginal cost of 1 cent (*i.e.*, on our assumption that prices cannot contain any fraction of a cent, a price of zero cents) because any such price would clearly be unprofitable for any seller (on my implicit assumption that it would not be promotional and explicit assumption that it would not be retaliatory).

In the case I have described, X1 will begin its calculation of the most profitable price it could charge for A1 if it could not practice oligopolistic pricing by determining that, if it sets its price for A1 at its marginal cost of 1 cent, (1) X2 will respond by charging a price of 1 cent for its product A2 and (2) X1 will sell 30 units of A1 (a total of 10 units to Y1-20 and a total of 20 units to Y21-40) but will make no profits on those sales (since the price of 1 cent just equals the marginal costs X1 must incur to produce and sell each of the 30 units in question). X1's conclusion that X2 will respond to its price of 1 cent for A2 by charging a price of 1 cent for A2 reflects the following calculations: (1) if X2 responds by charging 1 cent for A2, it will sell a total of 10 units to Y1-20 and will just break even on those sales (an outcome that I am assuming X2 will find better than making no sales) and (2) if X2 responds by charging 2 cents or more for A2, X2 will sell no units of A2 (given A1's price of 1 cent) and incur no loss and obtain no profits.

X1 would then determine the profits it would realize if it charged a price of 2 cents for A1. In particular, X1 would determine that, if it charged 2 cents for A2, X2 would respond by charging a price of 2 cents for X2's product A2, X1 would sell 30 units of A1 (a total of 10 units to Y1-20 and a total of 20 units to Y21-40) and would realize 30 cents in operating profits = (30 units)(2 cents–1 cent). X1's conclusion that X2 would respond to a price of 2 cents for A1 by charging 2 cents for A2 reflects the following calculations: (1) if X2 responded with a price of 1 cent, X2 would sell 21 units of A2 (20 units to Y1-20 and one unit to Y21-22) but would realize no operating profits on any of these sales (since X2's marginal costs are 1 cent on each of those units); (2) if X2 responded with a price of 2 cents, X2 would sell 10 units of A2 to Y1-20 and no units to anyone else and would realize 10 cents = (10 units)(2 cents–1 cent) profits on those sales; and (3) if

X2 responded with a price of 3 cents or more, it would sell no units of A2 and therefore earn no profits.

X1 would then determine the profits it would realize if it charged a price of 3 cents for A1. In particular, X1 would determine that, if it charged 3 cents for A1, X2 would respond by charging a price of 2 cents for A2, X1 would sell 19 units of A1 (a total of one unit to Y21-22 and a total of 18 units to Y23-40) and would realize 38 cents = (19 units)(3 cents–1 cent) in profits. X1's conclusion that X2 would respond to X1's price of 3 cents for A2 by charging 2 cents for A2 reflects the following calculations: (1) if X2 responded by charging 1 cent for A2, X2 would sell 23 units of A2 (a total of 20 units to Y1-20, a total of two units to Y21-22, and a total of one unit to Y23-24) but would earn no profits on those sales; (2) if X2 responded by charging 2 cents for A2, X2 would sell 21 units of A2 (a total of 20 units to Y1-20 and a total of one unit to Y21-22) and would realize 21 cents = (21 units)(2 cents–1 cent) in profits on those sales; (3) if X2 responded by charging a price of 3 cents for A2, X2 would sell 10 units of A2 (a total of 10 units to Y1-20 and no units to anyone else) and would realize 20 cents = (10 units) (3 cents–1 cent) in profits on those sales; and (4) if X2 responded by charging a price of 4 or more cents for A2, X2 would make no sales of A2 and would realize no profits on A2. X1 will therefore conclude that on our assumptions it will be more profitable for it to charge a price of 3 cents for A1 than to charge a price of 2 cents for A1.

X1 would then proceed to calculate in the above way for each price above 3 cents it might charge for A1 (1) the price that X2 would find most profitable to charge in response on our assumptions, (2) the unit sales that X1 would make at the price of A1 in question, given X2's response, and (3) the profits X1 would realize by charging the price in question—(the difference between the price in question and X1's constant marginal costs of 1 cent) *times* (the number of units of A1 that X1 would sell if it set the relevant price for A1). There are limits to how tedious even I am willing to be. If one made all the relevant calculations, one would discover that the most profitable price for X1 to charge on our assumptions—*i.e.*, X1's HNOP in the case in question—is 17 cents: if X1 charges 17 cents for A1, X2's most profitable response will be to set A2's price at 14 cents, X1 will sell 15 units of A1 (a total of one unit to Y25-26 and a total of 14 units to Y27-40) and will realize $2.40 on its sales of A1—(17 cents–1 cent) (15 units). In this case, therefore, the HNOP array is 17 cents for X1's product A1 and 14 cents for X2's product A2.

It may be worthwhile to point out that in this case (1) the gap between X1's HNOP and MC (16 cents = 17 cents–1 cent) is higher not only than X1's average across-the-board-pricing BCA in its relations with those buyers for which X1 has a positive across-the-board BCA (buyers Y21-40, in relation to which X1's average BCA is 5 [1/2] cents) but also than X1's highest across-the-board-pricing BCA in its relations with any buyer (the 10 cent BCA X1 enjoys in its relations with Y39-40) and (2) the gap between X2's HNOP and MC (13 cents = 14 cents–1 cent) is higher than its average and highest across-the-board-pricing BCA in its relations with buyers for which it has a positive BCA of this kind (zero and zero, since *X*2 enjoys no such BCA in relation to any buyer). In the duopoly case just analyzed, these outcomes reflect the facts that (1) X1 can take a "piggyback ride" on X2's decision to charge a price for A2 (14 cents) that exceeds X2's marginal costs of 1 cent and (2) *X*2 can take a "piggyback ride" on X1's decision to charge X2's potential customers a price for X1 (17 cents) that exceeds X1's marginal costs (1 cent).

The second example is a three-seller example that is designed *inter alia* to concretize the protocol for calculating the HNOP array of a set of three or more across-the-board-pricing rivals. This case assumes that (1) there are three rival sellers X1, X2, and X3 that respectively produce product variants A1, A2, and A3; (2) X1 announces its price first, X2 announces its price second, and X3 announces its price third; (3) X1, X2, and X3 all face the same marginal-cost curve—an MC that is horizontal over the relevant range at the height of 1 cent, (4) only three buyers—Y1, Y2, and Y3—are interested in purchasing A1, A2, or A3, and each of these buyers will purchase one and only one unit of one of the products in question, regardless of the prices that are charged for them over the relevant range, (5) buyer Y1 has a 4 cent buyer preference for A1 over both A2 and A3—*i.e.*, X1 has a 4 cent BPA (and across-the-board-pricing BCA) over X2 and X3 in their relations with buyer Y1, buyer Y2 has a 1 cent buyer preference for A1 over both A2 and A3—*i.e.*, X1 has a 1 cent BPA (and across-the-board-pricing BCA) over both X2 and X3 in their relations with buyer Y2, and buyer Y3 also has a 1 cent buyer preference for A1 over both A2 and A3—*i.e.*, X1 has a 1 cent BPA (and across-the-board-pricing BCA) over both X2 and X3 in their relations with buyer Y3, (6) X1, X2, and X3 are perfectly informed about their own BPA/BPD positions and marginal costs and about each other's BPA/BPD positions and marginal costs, (7) X1 cannot react to X2's response to X1's price or to X3's response to the prices it and X2 charge, X2 cannot react to X3's response to X2's price, and X1, X2, and X3 are all aware of the above realities, (8) prices must be in whole-cent denominations, (9) if two sellers make equally-attractive offers to any buyer, each will have a 50 % chance of obtaining that buyer's patronage, and if three sellers make equally-attractive offers to any buyer, each will have a 1/3 chance of obtaining that buyer's patronage, (10) X1, X2, and X3 are all indifferent to risk, and (11) X1, X2, and X3 would rather cover their marginal (variable) costs on positive sales than make no sales at all, and X1, X2, and X3 would rather earn given profits on higher unit-sales than on lower unit-sales because they are just satisfied by rather than indifferent to any normal returns they realize on the working capital required to finance production and sales. As always, the prices that X1, X2, and X3 will find most profitable to charge in these circumstances will constitute their across-the-board-pricing HNOP array on the assumptions in question—*inter alia*, when they are announcing their prices in the stipulated order.

Once more, I will assume that X1 (1) will proceed by considering in the stated order the unit-sales it will make and profits it will earn if it charges a price of 1 cent, 2 cents, 3 cents. . .for A1 when these outcomes will depend *inter alia* on the ways in which X2 and X3 will respond sequentially to that price under the circumstances in question where X2's response will partly depend on X2's conclusions about the way in which X3 will respond to X2's responding to each price P2 that X2 could charge for A2 in response to X1's charging a particular price for A1 and then

(2) charge the price P1* that will yield it the most profits, given the responses from X2 and X3 that the various prices P2 and P3 that each P1 would elicit. P1* will be X1's HNOP, and the prices P2* and P3* that X2 and X3 will sequentially find are their most profitable price responses respectively to P1* and to P1* and P2* will be their HNOPs.

On this example's assumptions, if X1 charges 1 cent for A1, X2 and X3 will not be able to make any sales of their respective products A2 and A3 unless they charge a price at least 1 cent below 1 cent, which they obviously will not find profitable to do. Hence, X1 will conclude that if it sets A1's price at 1 cent, it will sell three units of A1 (one unit each to Y1, Y2, and Y3) but will make no profits on those sales since one cent also equals X1's marginal costs for each of the units in question.

X1 would then determine that, if it charged a price of 2 cents for A1, (1) X2 would respond by charging a price of 1 cent for A2 and X3 would respond to X1's price of 2 cents for A1 and X2's price of 1 cent for A2 by charging a price of 1 cent for A3, (2) X1 would sell (expect on the weighted average to sell) 1(2/3) units of A1—one unit to Y1 and 1/3 of a unit to each of Y2 and Y3, and (3) X1 would make 1(2/3) cents profits on the sales in question. X1's conclusion that X2 and X3 would respond to a price of 2 cents for A1 by charging respectively and sequentially 1 cent for A2 and 1 cent for A3 would be based on the following calculations: (1) if X2 responded to X1's price of 2 cents for A1 by charging a price of 2 cents or more for A2, X2 would make no sales of A2 and no profits on A2, regardless of how X3 responded; (2) if X2 responded to X1's price of 2 cents for A2 by charging 1 cent for A2, X3 would respond by charging a price of 1 cent for A3 and that would result in X2's making weighted-average-expected sales of 2/3 of one unit—1/3 of a unit to Y2 and 1/3 of a unit to Y3—on which it would just break even (since the price of 1 cent just covers X2's marginal costs of 1 cent for any relevant unit of A2). The conclusion that X3 would respond to X1's charging 2 cents for A1 and X2's charging 1 cent for A2 is based on the following calculations: (1) if X3 responded to X1's charging 2 cents for A1 and X2's charging 1 cent for A2 by charging 2 cents or more for A3, it would make no sales of A3, and (2) if X3 responded by charging 1 cent for A3, X3 would expect on the weighted average to sell 2/3 of a unit of A3 (none to Y1, 1/3 to Y2, and 1/3 to Y3), X3 would break even on those sales, and on assumption (11) X2 would prefer to break even on positive sales than to make no sales. Assumption (11) implies not only that (1) X3 will prefer to respond to a price of 2 cents for A1 and a price of 1 cent for A2 by charging a price of 1 cent for A3 rather than by not bidding for the relevant buyers' patronage at all or charging a price of two or more cents for A3 but also that (2) X2 will prefer to respond to a price of 2 cents for A1 with a price of 1 cent for A2 that would induce X3 to set a price of 1 cent for A3 rather than by not bidding for Y1-3's patronage at all or charging a price for A2 of 2 cents or higher, which would result in X2's making no sales to Y1-3.

X1 would then determine that, if it charged a price of 3 cents for A2, (1) X2 would respond by charging a price of 2 cents for A2 and X3 would respond to X1's and X2's decisions by charging a price of 2 cents for A3, (2) if X1 charged a price of 3 cents for A2, it would therefore make 1(2/3) units of sales—would sell one unit to Y1 and 1/3 or a unit to each of Y2 and Y3, and (3) X1 would earn (weighted-average-expected) profits of 3(1/3) cents = (2 units) (1[2/3] cents). X1's conclusions about how X2 and X3 would respond to its setting A1's price at 3 cents would reflect the facts that (1) if either of them charged 1 cent for A2 and A3 respectively, that firm would make no profits on the resulting sales, (2) if either charged 3 cents or more for A2 and A3 respectively, that firm would make no sales, but (3) if they respectively charged a price of 2 cents for A2 and A3, each would expect to sell on the weighted average 2/3 of a unit of its product—1/3 of a unit to Y2 and 1/3 of a unit to Y3—and would realize weighted-average-expected profits of 2/3 cents.

On my account, X1 would then proceed to determine that, if it charged a price of 4 cents for A1, (1) X2 and X3 would successively charge 2 cents for A2 and 2 cents for A3, (2) X1 would sell one unit of A1 (to Y1), and (3) X1 would realize 3 cents profits on that sale (less profits than X1 could earn by charging 3 cents for A1). X1's conclusion that X2 and X3 would respond sequentially to its charging 4 cents for A1 by charging respectively 2 cents for A2 and 2 cents for A3 is based on the following calculations: (1) X2 will not charge 1 cent for A2 in response to X1's pricing A1 at 4 cents because, regardless of how X3 would respond, X2 would not make any profits by selling A2 for 1 cent (since its marginal cost for each relevant unit of A2 is 1 cent); (2) X2 will not charge 4 cents or more for A2 if A1 is priced at 4 cents because, if it did, it would make no sales of A2 and therefore no profits; (3) X2 will find it more profitable to charge 2 cents than 3 cents for A2 because (A) if X2 charges 3 cents for A2, X3 will find it more profitable to charge 2 cents for A3 since doing so would result in its selling two units of A3 (one unit to Y2 and one unit to Y3) and earning 2 cents in profits than to charge 3 cents for A3 since doing so would result in its selling 2/3 of a unit of A3 (1/3 of a unit to Y2 and 1/3 of a unit to Y3) and earning 1(1/3) cents in profits and (B) if X2 charges 2 cents for A2, X2 will also find it most profitable to charge 2 cents for A3 since doing so will enable it to sell one unit of A3 (1/2 of a unit to Y2 and ½ of a unit to Y3) and to earn 1 cent profits while charging 3 cents or more for A3 would result in its making no sales of A3 and charging 1 cent for A3 would result in its making no profits on the two units of A3 it would sell at that price (inasmuch as X3 must also incur 1 cent in marginal costs to produce each unit of A3 in question), and (4) for the reasons just articulated, if X1 charges 4 cents for A1 and X2 charges 2 cents for A2, X3 will charge 2 cents for A3.

However, although X1 would conclude that in the situation in question it would be more profitable for it to charge 3 cents than 4 cents for A1, X1 would conclude that a price of 5 cents for A1 would be even more profitable. This conclusion reflects the fact that, if X1 charges 5 cents for A1, (1) X2 will charge 2 cents for A2, and X3 will charge 2 cents for A3, (2) X1 will therefore still sell one unit of A1 (to Y1) but now (3) will realize 4 cents profits on that sale. X1's conclusions about X2's and X3's responses to its pricing A1 at 5 cents will reflect the following calculations: (1) X2 will not respond to a price of 5 cents for A1 by charging a price of 1 cent for A2 because that price will yield X2 no profits and (as we shall see) X2's decision to charge a price of 2 cents for A2 will yield it some profits; (2) X2 will not respond to a price of 5 cents for A1 by charging 5 cents or more for A2 because, if it does, it will make no sales of A2 and hence no profits on A2; and (3) X2 will not respond to a price of 5 cents for A1 by charging prices of 4 or 3 cents for A2 because, if it does, X3 will find it most profitable to respond to such prices by charging a price for A3 that precludes X2 from making any sales of or any profits on A2: thus, (A) if X2 charges 4 cents for A2, X3 will know that (i) if it charges 4 cents for A3, it will sell 2/3 of a unit of A3 (1/3 to Y2 and 1/3 to Y3) and realize 2 cents = ([2/3] of a unit)(4 cents–1 cent) profits whereas [ii] if it charges 3 cents for A3, it will sell two units of A3 (one unit each to Y2 and Y3), leaving X2 with no sales of A2, and realize 4 cents = (2 units)(3 cents–1 cent) profits and (B) if X2 charges 3 cents for A2, X3 will know that (i) if it charges 3 cents for A3 it will sell (expect to sell on the weighted average) one unit of A3 (1/2 of a unit to Y1 and 1/2 of a unit to Y2) and realize 2 cents = (one unit)(3 cents–1 cent) profits whereas (ii) if X3 charges a price of 2 cents for A3, it will sell two units of A3 (one each to Y1 and Y2), thereby leaving X2 with no sales of A2, and also realize 2 cents = (one unit)(2 cents–1 cent)—an outcome I am assuming X3 would prefer in that X3 would prefer to realize the same profits on higher unit-sales. Thus, X2 will charge a price of 2 cents for A2 if X1 has priced A1 at 5 cents because, if X2 charges a price of 2 cents for A2, X3 will charge a price of 2 cents for A3 and X2 will sell one unit of A2 (1/2 a unit to Y2 and 1/2 a unit to Y3) and make 1 cent in profits = (one unit)(2 cents–1 cent) whereas, if X2 charges a price of three or more cents for A2, X3 will charge 2 cents for A3 and X2 will make no sales of A2 and earn no profits. Hence, if X1 charges a price of 5 cents for A1, X2 and X3 will charge 2 cents for their products, X1 will sell one unit of A1 and realize 4 cents in profits on that sale—more profits than it would realize by charging any lower price for A1.

In fact, on the assumptions of this second case, 5 cents will be X1's most profitable price and concomitantly its HNOP. To give you some sense of why this is so, I will explore the consequences of X1's charging a price of 6 cents for A1. If X1 charges a price of 6 cents for A1, X2's analysis of the most profitable response for X3 to make to the various prices that *X*2 could charge for A2 will lead X2 to conclude that its most profitable response to X1's price of 6 cents for A1 is 2 cents. X2 will reach this conclusion by making the following calculations: (1) if X2 charges 2 cents for A2 after X1 has priced A1 at 6 cents, (A) X3 will charge 2 cents for A3 because at that price it will sell 1(1/3) units of A3 (1/3 of a unit to Y1 and 1/2 of a unit to each of Y2 and Y3) and earn 1(1/3) cents by doing so whereas (B) if X3 charges a price above 2 cents for A3 it will make no sales of and hence no profits on A3 so that if X2 responds to X1's pricing A1 at 6 cents by charging 2 cents for A2, X2 will sell 1(1/3) units of A2 (1/3 of a unit to Y1 and 1/2 of a unit to Y2 and Y3) and earn 1(1/3) cents by doing so, (2) if X2 responds to X1's decision to charge 6 cents for A1 by charging 3 cents for A2, X3 will respond to those prices by charging 2 cents for A3 because X3 will realize that (A) if it charges 4 cents or more for A3, it will make no sales of that product, (B) if it charges 3 cents for A3, it will sell one unit of A3 (1/2 a unit to each of Y2 and Y3) and realize a total of 2 cents profits on A3, and (C) if it charges 2 cents for A3, it will sell 2(1/3) units of A3 (1/3 of a unit to Y1 and one unit each to Y2 and Y3) and realize a total of 2(1/3) cents profits on those sales so that, if X2 responds to X1's price of 6 cents for A1 by charging 3 cents for A2, it will make no sales of and no profits on A2. Note, too, that if X2 responds to X1's setting a price of 6 cents for A1 by charging a price of 4 cents for A2 it will also make no sales of or profits on A2 because X3 will respond by charging a price of 3 cents for A2. This last conclusion reflects the following calculations: on our assumptions, (1) if X3 charges a price of 4 cents for A3 after X1 has announced a price of 6 cents for A1 and X2 has announced a price of 4 cents for A2, X3 will sell one unit of A3 (1/2 unit to Y2 and 1/2 unit to Y2) and will make 3 cents profits; (2) if X3 charges a price of 3 cents for A3 after A1 is priced at 6 cents and A2 at 4 cents, X3 will sell two units of A3 (one unit to each of Y1 and Y2) and realize 6 cents = (2 units)(4 cents–1 cent) profits on those sales; and (3) if X3 charges a price of 2 cents for A3 after A1 is priced at 6 cents and A2 is priced at 4 cents, X3 will sell 2(1/2) units of A3 (1/2 unit to Y1 and one unit each to Y2 and Y3) and earn 2(1/2) cents = (2[1/2] units)(2 cents–one sent) profits. Note, finally, that, if X2 responds to X1's charging 6 cents for A1 by charging 5 cents for A2, X2 will also make no sales of or profits on A2 because, on our assumptions, X3 will find it most profitable to respond by charging 4 cents for A3. Thus, on our assumptions, (1) if X3 responds by charging 5 cents for A3, it will sell 2/3 of a unit of A3 (1/3 of a unit to each of Y2 and Y3) and realize 3(1/3) cents = (2/3 of a unit)(5 cents–1 cent) profits; (2) if X3 responds by charging 4 cents for A3, it will sell two units of A3 (one unit to each of Y2 and Y3) and earn 6 cents = (two units)(4 cents–1 cent) profits; (3) if X3 responds by charging 3 cents for A3, it will still sell only two units of A3 (to the same buyers) and earn 4 cents = (2 units)(3 cents–1 cent) profits; and (4) if X3 responds by charging 2 cents for A3, it will sell 2(1/2) units of A3 (1/2 a unit to Y1 and one unit each to Y2 and Y3) and earn 2(1/2) cents = (2[1/2] units) (2 cents–1 cent). Hence, on the assumptions of our second example, if X1 charges 6 cents for A2, X2 will respond with a price of 2 cents for A2, and X3 will then charge 2 cents for A3. The result will be that X1 will sell only 1/3 of a unit of A1 (to Y1) and will realize 5/3 cents = ([1/3] unit)(6 cents–1 cent) profits if it charges 6 cents for A1—less profits than X1 would earn on A1 if it charged 5 cents for that product.

Any price above 6 cents that X1 might charge for A1 would result in its making no sales of or profits on A1. This conclusion follows from the fact that on our assumptions X3 would always find it profitable to undercut any price above 2 cents X2 might charge for A2 (thereby causing X2 to make no sales of or profits on A2)—*i.e.*, from the fact that on our assumptions X2 and X3 would respond to any price X1 might charge above 6 cents with two-cent prices that would deprive X1 of any sales of or profits on A1 and yield X2 and X3 each sales of 1(1/2) units (since their 2-cent prices would beat X1's price by more than X1's 4-cent BPA in its relations with Y1) and profits of 1(1/2) cents. Hence, in this second example, the across-the-board-pricing HNOP array is 5 cents for X1, 2 cents for X2, and 2 cents for X3. In this case, X1's HNOP–MC gap of 4 cents equals its highest across-the-board-pricing BCA (its BPA of 4 cents in its relations with Y1) but is higher than its average such BCA in its relations with those buyers for which it has such a BCA (2 cents). X2's and X3's HNOP–MC gap (1 cent) obviously exceeds their highest and average across-the-board-pricing BCAs (which, for each, are zero and zero).

(Before proceeding, I should point out that the no-oligopolistic-pricing outcomes in the duopoly and three-seller cases just analyzed would be economically inefficient if the economy did not contain Pareto imperfections that caused the sellers [X2 and X3] that had across-the-board-pricing BCDs in their relations with particular buyers to be allocatively at-least-as-well-placed to supply those buyers as was the seller [X1] that had an across-the-board-pricing BCA in its relations with the buyers in question. Thus, in the duopoly case, the fact that in the relevant non-oligopoly equilibrium, X2 [1] will sell one unit to each to Y21 and Y22 despite the fact that it has a 1 cent across-the-board-pricing BCD in its relations with them, [2] will sell one unit each to Y23 and Y24 despite the fact that it has a 2-cent across-the-board-pricing BCD in its relations with them, and [3] will sell a total of one unit to Y25 and Y26 despite the fact that it has a 3-cent across-the-board-pricing BCD in its relations with them that would [in an otherwise-Pareto-perfect economy] be associated respectively with 2 cents = [two units][1 cent] *plus* 4 cents = [two units][2 cents] *plus* 3 cents = [one unit][3 cents] = 9 cents in economic inefficiency. And in the three-seller example, the fact that, in the relevant non-oligopoly equilibrium, [1] X2 and X3 will each sell 1/2 of a unit to Y2 and 1/2 of a unit to Y3 despite the fact that both sellers have a 1-cent across-the-board-pricing BCD in their relations with Y2 and Y3 implies that a total of 2 cents in economic inefficiency would be generated by their supplying these buyers if these sellers' private BCDs equaled their allocative counterparts. [Admittedly, since the assumption of our duopoly and three-seller examples that the relevant buyers' total unit purchases of the product variants will not be affected by those product variants' prices over the relevant range does not rule out the possibility that the unit-sales of A1 would be below three units if X1 would find it profitable to charge a price that exceeds the price that is its HNOP when X2 in the duopoly case and X2 and X3 in the three-firm case are present and they announce their prices in the sequence stipulated if it were freed from X2's competition in the duopoly case or X2's and X3's competition in the three-firm case, X2's or X2's and X3's operation might in the respective cases reduce misallocation by preventing X1 from reducing its output of A1 below the three total units of A1, A2, and A3 that will be produced if X1 and X2 or X1, X2, and X3 are operating respectively in the duopoly and three-seller cases. But even if that is the case, *inter alia*, because other imperfections do not reduce the economically-efficient output of A1 below 3 units, the duopoly and three-seller no-oligopolistic-pricing equilibria in question would be economically inefficient: even if X2's operation in the duopoly case and X2's and X3's operation in the three-seller case do prevent X1 from underproducing A1 from the perspective of economic efficiency, their operation will achieve this result only by causing another type of misallocation.])

I now want to delineate and explain three points about the determinants of a set of across-the-board-pricing rivals' HNOP–MC gaps. First, these gaps depend on the order in which the sellers in question announce their prices. In particular, such a set of rivals' HNOP–MC gaps will tend to be higher the greater the extent to which the firms for which the following ratio is low announce early in the relevant sequence: the ratio of (the frequency with which the relevant firm has an across-the-board-pricing BCA) to (the frequency with which it has the lowest or close-to-lowest across-the-board-pricing BCD). This conclusion reflects the fact that any seller for which this ratio is lower has more of an incentive than do its rivals to undermine their prices since the amount of potential profits it will lose by charging a lower across-the-board price to buyers that would have been willing to pay it a higher price will be small relative to the amount of additional sales and related profits it will be able to make by charging (roughly speaking) a lower price than its earlier-announcing rivals charged.

Second, in what I take to be the not-uncommon special case in which the relevant across-the-board pricers face constant marginal costs over their respective relevant output ranges, each seller's HNOP–MC gap will depend on its and the other relevant sellers' respective across-the-board-pricing BCA or BCD in relation to each relevant buyer. Thus, in such a situation, a given such seller's HNOP–MC gap depends not only on (1) its positive across-the-board-pricing BCA array but on (2) the across-the-board-pricing BCD positions of rivals whose across-the-board-pricing BCDs in relation to buyers for which it has an across-the-board-pricing BCA are not lowest as well as on (3) the across-the-board-pricing BCA positions that firms that have across-the-board-pricing BCDs in relation to buyers in relation to which it has an across-the-board-pricing BCA enjoy in relation to buyers for which they have across-the-board-pricing BCAs and (4) the across-the-board-pricing BCD positions that rivals occupy in their relations with buyers in relation to which other rivals have across-the-board-pricing BCAs. The immediately-preceding, unfortunate sentence is a corollary of the earlier discussion of the across-the-board-pricing counterpart to the $CMC_{\#2}$ component of an individualized-pricing seller's HNOP–MC gap in its relations with a buyer it is best-placed to supply. (The second point in the sentence before last is reflected in the fact that, if I adjusted the three-seller example so that X2 and X3 had respectively 1-cent and 3-cent BCDs in relation to Y2 and Y3 rather than both having 1-cent BCDs in relation to those buyers, X1's HNOP would be considerably higher because X3 would put *X*2 under less pressure to charge a low price for A2 in response to any price P1 X1 charged for A1.)

Third, in the general case in which the relevant sellers' marginal costs can vary from output-unit to output-unit, the HNOP–MC determinants on which it is cost-effective to focus are (1) the BPA or BPD of each seller in relation to each relevant buyer and (2) the MC curves of the relevant sellers over the relevant output ranges.

* * *

The price-competition conceptual schemes this section has delineated will be used for many purposes in this study—*inter alia*,

(1) to explain why market definitions are inherently arbitrary, not just at their periphery but comprehensively, and, relatedly, to explain why the two approaches to market definition that both the 1992 and the 2010 US DOJ/FTC Horizontal Merger Guidelines prescribe cannot be defended;
(2) to generate operational definitions of a firm's monopoly and/or oligopoly control over price;

(3) to generate an operational definition of a firm's highest non-oligopolistic (lowest non-predatory) price;
(4) to structure my analysis of the determinants of the feasibility of natural oligopolistic pricing and the profitability of contrived oligopolistic and predatory pricing;
(5) to structure my analysis of the kinds of evidence that can properly be used in court to prove that firms have engaged in contrived oligopolistic or predatory pricing;
(6) to structure my critiques of various protocols that others have argued courts should use to determine whether firms have engaged in contrived oligopolistic or predatory pricing;
(7) to structure my analysis of the factors that determine the impact of horizontal mergers, acquisitions, or joint ventures on the intensity of price competition;
(8) to structure my critiques of the traditional approach to predicting the impact of horizontal mergers on price competition and the approach to this issue taken both by the U.S. 1992 and 2010 Horizontal Merger Guidelines and by the European Commission;
(9) to structure my analysis of the impact of conglomerate mergers, acquisitions, and joint ventures that do and do not involve potential competitors (including geographical-diversification conglomerate mergers) on price competition;
(10) to structure my critique of the traditional analysis of the impact of conglomerate mergers on price competition (including limit-price theory); and
(11) to structure my analysis of the determinants of the most-inherently-profitable (non-monopolizing) pricing strategy for firms to employ in different situations.

2. The QV-Investment-Competition Conceptual Scheme

As we have seen, (1) "QV investments" are investments that create additional or superior product variants, additional or superior distributive outlets, or additional capacity and/or inventory (which enable their owner to provide faster average speed of supply during a fluctuating-demand cycle), and (2) "QV-investment competition" is the process through which the supernormal profits that a QV investment could generate are eliminated by the introduction of additional QV investments into the relevant area of product-space—*i.e.*, by new entries by the relevant QV investor's potential competitors and by (QV-investment) expansions by the QV investor itself or by its established rivals. This section of Chap. 2 delineates the conceptual scheme I use to analyze QV-investment competition. More specifically, this section (1) defines the various intermediate determinants of QV-investment competition in any area of product-space and (2) distinguishes three different types of QV-investment equilibria that may be established and analyzes the different ways in which the intermediate determinants just listed interact to generate them.

This definitional and analytic work is long overdue. Although economists do sometimes refer to one set of the relevant determinants—"barriers to entry"—different economists define "the barriers to entry" to which they refer differently, and all economists that use this concept do so to analyze the supposed effect of such barriers on the competitiveness of prices (usually, on whether so-called limit pricing is practiced) rather than on the competitiveness of QV investment. Moreover, to my knowledge, no economist has ever focused on the other two major categories of intermediate determinants of the intensity of QV-investment competition—*viz*., (1) barriers to expansion and (2) monopolistic or natural oligopolistic QV-investment disincentives and monopolistic QV-investment incentives. Indeed, to my knowledge, no economist has ever attempted to execute an analysis of competition that focuses separately on QV-investment competition. These omissions are important not just because QV-investment competition is a significant social phenomenon but also because (1) the determinants of the intensity of QV-investment competition are different from the determinants of the intensity of price competition and given practices or transactions can increase price competition while decreasing QV-investment competition or *vice versa*, (2) increases in QV-investment competition will often reduce economic inefficiency in our Pareto-imperfect economy while increases in price competition will always or virtually always increase economic efficiency in our Pareto-imperfect economy, and (3) increases in QV-investment competition have a different distributive impact from that of increases in price competition and, from various value-perspectives, this difference will sometimes critically affect the desirability of increasing one or the other of these types of competition.

Before proceeding, two additional pieces of terminology need to be explained. The first is the concept of an "ARDEPPS." By its very nature, QV-investment competition is not individual-buyer or individual-product specific—*i.e.*, QV-investment competition is a process that takes place in an area of product-space. The determinants of the intensity of QV-investment competition (however that intensity is defined) will, therefore, be aggregated concepts. Unfortunately, Chap. 6's demonstration that it is not possible to define markets non-arbitrarily implies that it is also not possible to define non-arbitrarily the area of product-space within which QV-investment competition takes place. To remind readers both (1) that the domain of QV-investment competition is an area of product-space and (2) that the "relevant" area of product-space cannot be defined non-arbitrarily, I will use the acronym "ARDEPPS" to refer to the arbitrarily-designated portion of product-space within which QV-investment competition takes place. I should emphasize at the outset that my use of the concept of an ARDEPPS and correlatively of various ARDEPPS-aggregated concepts does not make me vulnerable to the same criticisms this study makes of market-oriented approaches to firm-economic-power assessment or competitive-impact prediction. At no point will any of the protocols I delineate for executing any type of analysis presuppose the non-arbitrary definition of any area of product-space: all uses I make of the concept of an ARDEPPS and various correlative ARDEPPS-aggregated concepts are purely heuristic.

The second set of vocabulary that must be discussed relates to the time-period to which the curves and concepts I am about to define refer. Unfortunately, this time-period question is quite complicated. Even if one assumes (contrary to fact—see below) that a static equilibrium will eventually be established, the lifetime of at least some of the QV-investment projects in an ARDEPPS can be divided into three different periods: (1) the period before the period on which the analysis is focusing—the "pre-analysis period"—at the end of which the ARDEPPS contains some QV investments and its established firms are considering whether to expand their QV-investment holdings in the ARDEPPS themselves or perhaps to allow entry to take place; (2) the "analysis period," which extends from the end of the pre-analysis period to the establishment of the hypothesized static equilibrium; and (3) the post-equilibrium period. The time-period problem reflects the fact that, since the rate-of-return that various individual QV investments generate will often vary from period to period, it is essential to specify the time-period to which any curve or concept refers.

The period on which an analysis should focus depends on the question the analysis is trying to answer. If the question is "do pioneers (early entrants) have systematic advantages over copycats (latecomers)," the appropriate focus is on lifetime rates-of-return (though one must take account of the possibility that any correlation between an investor's lifetime rate-of-return and its date of entry may be false—*i.e.*, that pioneers may have attributes that give them an advantage over copycats that do not depend on the pioneers' entering earlier). If the question is "why does no-one enter or expand despite the fact that the established firms are realizing lifetime supernormal rates-of-return on some projects," the appropriate focus is also on lifetime rates-of-return. If, however, perhaps because of the difficulty of establishing the rates-of-return that existing projects generated in the past, the question is "why does no-one enter or expand despite the fact that the established firms would be said to be realizing supernormal rates-of-return on some projects post-equilibrium if one ignored the subnormal profits the projects in question generated in the pre-equilibrium period," the appropriate focus is on the post-equilibrium rate-of-return. Although, in practice, lawyers and applied economists who are concerned with the concept of barriers to entry seem to have this third question in mind, I have chosen to define the curves in all the QV-investment diagrams I use to refer to lifetime profit-rates. Primarily, my choice reflects the fact that the use of the most-likely alternative time-period would complicate the definition of a number of other concepts that I have developed—*e.g.*, would create the possibility that a QV investment whose post-equilibrium supernormal profit-rate is highest does not belong to the set of projects that are most profitable over their lifetimes. I should emphasize that no conclusion I reach will turn on the time-period in terms of which the relevant curves and concepts are defined.

A. The Intermediate Determinants of the Intensity of QV-Investment Competition

I have found it useful to distinguish 11 intermediate determinants of the intensity of QV-investment competition—four barriers to entry, four counterpart barriers to expansion, the monopolistic QV-investment incentives or disincentives that a potential QV-investment expander may face, and the natural oligopolistic QV-investment disincentives that two or more potential QV-investment expanders may face. All barriers to entry and expansion cause the "nominal" or "conventional book" supernormal profit-rate a potential entrant or expander would expect to realize on its new QV investment to be lower than the lifetime supernormal rate-of-return that would be generated by the most-profitable QV investments in the relevant area of product-space at the original QV-investment level. In this last sentence, the word "nominal" and the expression "conventional book" indicate the fact that the relevant calculations ignore any monopolistic QV-investment incentives or disincentives and any oligopolistic QV-investment disincentives a potential expander may have to make a particular QV investment. Somewhat optimistically, I am assuming that "conventional book" supernormal-profit calculations will take into account any positive contribution a relevant QV investment makes to the profit-yields of one or more of the investor's other QV investments by generating traditional joint cost-reduction economies or increasing the demand for its other products by filling out its product-line or increasing its reputation for quality. The monopolistic QV-investment incentives, monopolistic QV-investment disincentives, and (natural) oligopolistic QV-investment incentives a QV investor faces on a particular QV investment all reflect the fact that for reasons that will be delineated below (reasons that are unrelated to its generating traditional joint-cost economies or increasing the demand for the investor's other products by filling out its product-line or increasing its reputation for quality), the QV investment in question will affect the profit-yields of the investor's other projects and, in the case of natural oligopolistic QV-investment disincentives, will yield lower nominal profits itself because it will induce the execution of a rival QV investment that would not otherwise have been made. After defining the four different types of barriers to entry or expansion that a QV investor may face, this section defines the monopolistic QV-investment incentives and disincentives and the natural oligopolistic QV-investment disincentives a QV-investment expander may face.

(1) The Profit-Rate-Differential Barrier to Entry or Expansion—Π_D

The Π_D barrier faced by a particular potential entrant or expander on the most-privately-attractive QV-investment project available to it at the relevant point in time indicates the amount by which the weighted-average lifetime rate-of-return[45]

[45] Throughout this text, the expressions "rate-of-return" or "profit-rate" are being defined in the way that lawyers use them—*viz.*, to refer to rates that are gross of capital costs. The expressions

gross of capital costs that that project would be expected to generate in the absence of retaliation at any relevant ARDEPPS QV-investment level would be lower than its counterpart at that ARDEPPS QV-investment level for the most-profitable QV-investment project or projects already in the relevant area of product-space.[46] I will first discuss Π_D barriers to entry and then discuss Π_D barriers to expansion.

Π_D barriers may confront potential entrants—even-best-placed potential entrants—for a wide variety of reasons: (l) because the established firms were able to occupy some locations in product-space that were inherently more profitable than any the best-placed potential entrant could occupy; (2) because the established firms were able to obtain patents at a lower cost than the cost the best-placed potential entrant would have to incur to invent around them, buy them, or buy the right to use them; (3) because the established firms were able to obtain natural resources more profitably than the best-placed potential entrant can now obtain them; (4) because the established firms had more profitable reputation-building options available to them than were available to the potential entrant that was best-placed to enter the ARDEPPS in question at a particular point in time (because, *e.g.*, it was cheaper and more feasible for a pioneer to establish a reputation for quality and reliability than for the potential competitor that was best-placed to enter at some point in time to match it—that the advantages of being an old reliable are greater than the disadvantages of being lumbered with a reputation for low or inconsistent quality long after the pioneer's product-quality and quality-control improved); and/or (5) because the managers of the ARDEPPS' pioneers have managed and will manage its most-profitable projects better over their lifetimes than their managerial counterparts for the ARDEPPS' best-placed potential competitor will manage its most-privately-attractive project and only part of the managerial-productivity difference in question is offset by compensation-differences (a possibility that reflects two facts: the fact that the pioneers' managers learned the business in competition with other neophytes [a factor that is admittedly offset by the copy-cat's ability to learn from the pioneers' early experience] as well as the fact that, since part of any company's managers' knowledge is company-specific, managers cannot obtain compensation equal to their contribution to their company's profits [their compensation aside]). In practice, the size of the Π_D barrier facing an ARDEPPS' best-placed potential entrant will tend to be lower when that firm is not an entirely-new business concern but a well-established firm operating in a related field or geographic area that is considering product or geographic diversification.

"supernormal" rate-of-return or "supernormal" profit-rate refer to rates whose calculation takes capital costs into consideration (to rates that economists would use the expression "rate-of-return" or "profit-rate" to signify).

[46] In my terminology, the most-profitable QV-investment projects in any area of product-space are those with the highest, identical supernormal rate-of-return. For expositional reasons, I will assume (often counterfactually) that all these projects have the same weighted-average-expected rates-of-return (gross of capital costs) and the same normal rate-of-return.

Π_D barriers may also confront firms established in the relevant ARDEPPS that are considering QV-investment expansions. The Π_D barrier to expansion facing a firm that is established in the relevant ARDEPPS on the privately-most-attractive QV-investment project it could introduce into that ARDEPPS is defined precisely the same way as the Π_D barrier to entry facing a potential competitor.

The Π_D barrier facing an ARDEPPS' best-placed potential expander at any point in time will tend to be smaller than the Π_D barrier facing its best-placed potential entrant at that time because the experience of operating in an ARDEPPS contributes to the insiders' ability to conceive and execute new projects in it. However, this difference will tend to be smaller when the best-placed potential entrant is an established firm operating in a related area. It will also tend to be smaller when the QV investment in question would not be the first that the best-placed potential expander would be making in a relatively short time-period. A firm that is expanding rapidly will face a higher Π_D barrier on an additional expansion both because the nth-best project a management devises will usually be worse than its (n-1)th-best project and because firms execute projects less efficiently when they are expanding rapidly.

Although the Π_D barrier facing an ARDEPPS' best-placed potential expander at any point in time—$(\Pi_D)_E$ where the subscript E stands for "established firm"—will *tend to be* lower than the Π_D barrier facing its best-placed potential entrant at that point in time—$(\Pi_D)_N$ where the subscript N stands for new entrant, there clearly will be situations in which $(\Pi_D)_N$ is lower than $(\Pi_D)_E$. In particular, this relationship may prevail in two types of situations: (1) when a potential competitor has made a technological, promotional, or distributive breakthrough and (2) when equilibrium QV investment is rising rapidly in the ARDEPPS in question (because "ARDEPPS demand" is rising rapidly and/or costs are falling rapidly). In this latter case, the Π_D barriers facing the established firm that is best-placed at the relevant point in time to execute an expansion that would deter an entry may be high because all the established firms may have had to expand quite rapidly to raise QV investment in the ARDEPPS to the prevailing non-equilibrium level so that the Π_D barrier to each's making yet another QV investment was considerably higher than the Π_D barrier each faced on its first or even last fairly-recent expansion.

(2) The Risk Barrier to Entry or Expansion—R

R indicates the amount by which in the absence of retaliation the normal rate-of-return for the project in question would be higher than its counterpart for the relevant most-profitable projects. A best-placed potential competitor will confront a risk barrier to entry to the extent that the profitability of its project is more uncertain than was the lifetime profitability of the most-profitable projects in the ARDEPPS in question, to the extent that the best-placed potential competitor is more risk-averse than the established owners of an ARDEPPS' most-profitable projects, and to the extent that the best-placed potential entrant is less able than the owners of the ARDEPPS' most-profitable projects to make investment-portfolio moves that reduce the contribution of the project in question to the overall risk they respectively faced. In practice, once more, the size of the relevant R is likely to be lower when the best-placed potential entrant into the ARDEPPS in question is a large established firm that sells similar goods or services in the same territory or the same goods or services in other territories: such potential entrants will tend to be less uncertain about the outcomes of their contemplated entry, less risk-averse, and more able to reduce risk by compiling appropriate investment portfolios than are entirely-new potential entrants.

Not only potential entrants but also potential QV-investment expanders can face R barriers. For the same reason that the Π_D faced by a potential expander will tend to be lower than the Π_D barrier faced by an already-established firm that is not operating in the ARDEPPS in question and for the same reason that these latter barriers in turn tend to be lower than the Π_D barrier faced by an entirely-new company, the R barrier faced by established firms will tend to be lower than those facing potential entrants that are established elsewhere and *a fortiori* than those facing entirely-new-firm potential entrants. Once again as well, the R barrier that an established firm will face on an nth expansion in any time-period will tend to increase with n both because the nth expansion will tend to be inherently more risky than the (n-1)th new project and because the nth new project will tend to be executed with less-experienced personnel whose performance is riskier than the performance of the personnel that would execute the (n-1)th new project.

(3) The Scale Barrier to Entry or Expansion—S

S indicates the amount by which the relevant new entry or expansion would reduce the supernormal profit-rate generated by all projects in the relevant area of product-space (assuming, for simplicity, that the new project has an equal effect on all such projects)[47] by increasing the amount of QV investment and (in the case of new entry) the number of independent sellers that the ARDEPPS contains. Any QV investments that are added to an ARDEPPS will decrease their predecessors' rates-of-return by reducing the average BPA of best-placed products in the ARDEPPS in question, by lowering the average natural and contrived oligopolistic margins in the ARDEPPS, and (usually) by increasing the average total cost of each product in the ARDEPPS by reducing the quantity of each that is sold. Although a potential competitor or expander could reduce S by reducing the scale of its entry or expansion below the minimum scale that would minimize the $(\Pi_D + R)$ barriers it faced, I will assume that no entrant or expander will do so—that each entry and expansion takes place at or above the scale that minimizes the sum of the investor's Π_D and R barriers. Admittedly, this assumption is not consistent with my current

[47] This assumption is admittedly unrealistic. Indeed, the fact that projects in a given area of product-space will have different effects on the rates-of-return generated by the various other projects in that area of product-space plays a significant role in my argument for the inevitable arbitrariness of market definitions and underlies my claim that, in some circumstances, potential expanders have monopolistic QV-investment incentives to make a particular QV investment.

static assumptions. However, it is quite realistic in the normal "dynamic" case in which "demand" for each relevant set of products increases through time since the prospect of such increases and the concomitant tendency of equilibrium QV investment to rise through time in the relevant area of product-space reduces the benefits of investing at less than minimum efficient scale by implying that in the medium or long run the larger magnitude of a QV investment of minimum efficient scale will not reduce the rate-of-return it generates by increasing total QV investment in the ARDEPPS in which it is located. The S barrier faced by potential entrants that are well-established in related fields and *a fortiori* the S barrier faced by potential established expanders will tend to be lower than those facing entirely new companies because the Π_D-cost to the former two types of firms of investing at lower scales will tend to be lower than those facing entirely new companies—*i.e.*, because such established firms may be able to take advantage of joint economies in production, promotion, and distribution.

(4) The Retaliation Barrier to Entry or Expansion—L

The retaliation or L barrier facing a potential entrant or potential expander indicates the amount by which the expected supernormal rate-of-return for the new QV investment in question is reduced by the possibility of retaliation. I will assume for simplicity that the supernormal rate-of-return that will be generated by the set of most-profitable projects in the ARDEPPS will not be reduced by retaliation. On this assumption, L_N and L_E at any ARDEPPS QV-investment level will respectively equal the amount by which the prospect of retaliation will reduce the supernormal rate-of-return the best-placed potential competitor or the best-placed potential expander at that QV-investment level should expect to realize on the most-privately-attractive QV investment it can make in the ARDEPPS in question. For simplicity, I will also assume that the prospect of retaliation will affect the attractiveness of making a QV investment exclusively by reducing the potential competitor's or expander's gross-of-capital-cost expected rate-of-return on that investment—*i.e.*, I will ignore the extent to which the prospect of retaliation increases the risk costs of making the QV investment in question. It is difficult to tell whether the retaliation barriers facing a potential entrant that is well-established in other areas or by a potential expander will be lower than those facing an entirely-new potential entrant. On the one hand, already-established firms may have "Don't Tread on Me or Don't Try to Deter Me" reputations, the ability to survive retaliation, or the ability to retaliate against retaliators that deter retaliation. On the other hand, well-established potential entrants and *a fortiori* potential expanders provide retaliators with more targets.

(5) The Monopolistic QV-Investment Disincentives—$M > 0$—and Incentives—$M < 0$—That a Potential Expander May Face

The monopolistic QV-investment incentives and disincentives (*M*) a potential expander may face reflect the effect the relevant QV investment has on the profit-yields of the expander's pre-existing (or, more generally, pre-existing and other future) projects in the relevant ARDEPPS not by generating joint-cost economies or increasing the demand for the investor's other products by filling out its product-line or enhancing its reputation for quality but

(1) by taking sales away from those projects directly,
(2) by inducing established rivals to make non-retaliatory responses that do not involve their increasing their QV investments in the relevant area of product-space but that do reduce the expander's pre-existing projects' profit-yields, and
(3) by deterring established or potential competitors from making additional QV investments in the relevant area of product-space.

When a potential expander's QV investment would do more damage to its pre-existing projects' profit-yields in the above ways (in comparison with the *status quo ante*) than would have been done by any QV investments it deters others from making, the potential expander will face a QV-investment disincentive equal to the amount by which these effects reduce the actual supernormal rate-of-return its project should be expected to generate *ex ante* below the supernormal rate-of-return it should have been expected to generate absent these effects. When the project in question will do less damage in the above ways to the profit-yields of the relevant expander's pre-existing projects than would otherwise have been done by the QV investments of others that its expansion would deter, the potential expander will have a QV-investment incentive.

(6) The (Natural) Oligopolistic QV-Investment Disincentives—$O > 0$—That a Potential Expander May Face

A potential expander will be said to face (natural) oligopolistic QV-investment disincentives when, rather than deterring others from making QV investments, its expansion will induce an established rival to make a QV investment that that firm would otherwise not have made. On my definition, the *O*s a potential expander faces equal (1) the amount by which its QV investment will reduce its pre-existing projects' profit-yields (A) by taking sales away from those projects directly and inducing others to make QV investments that take sales away from those projects directly and (B) by inducing established rivals to make non-retaliatory, non-QV-investment responses to the investment expansion in question and the expansions it induces others to make *plus* (2) the amount by which the QV investment its relevant QV investment induces others to make reduces the nominal profits its relevant QV investment generates both (A) directly and (B) by inducing still others to react to the induced QV investment by making non-retaliatory changes in their prices and other non-QV-investment choices. This definition implies that the "nominal profits" yielded by an expansion that will induce someone to make a QV investment it would not otherwise have made are defined to equal the profits the expansion in question would yield if, counterfactually, it would not cause any additional QV investments to be made in the relevant area of product-space and the *O*s that will be said to face a potential expander in this position will be defined to equal the amount by which the supernormal rate-of-return the expansion in question should be expected to generate *ex ante* will be reduced by the four effects just listed.

B. The Three Different Types of QV-Investment Equilibria and the Conditions for Their Generation

I will now use the preceding concepts to analyze three different types of QV-investment equilibria it is useful to distinguish. I begin by defining four different QV-investment-level concepts and explaining two diagrams that play important roles in the analyses that follow. The first relevant QV-investment level is the lowest equilibrium QV-investment level in a given ARDEPPS. The adjective "lowest" is included because, given the presence of economies of scale in making a QV investment, there will often be a range of ARDEPPS QV-investment levels at which all QV investments that have been made are profitable and no QV investment that has not been made would be profitable. In the text that follows, the expression "equilibrium QV-investment level" will always refer to the lowest equilibrium QV-investment level in the ARDEPPS in question.

Second, some of the analyses that follow will make reference to the (lowest) entry-preventing QV-investment level. This is the lowest level of QV investment that will render unprofitable the most-profitable QV investment any potential competitor could introduce into the ARDEPPS at the time of analysis.

Third, some of the analyses that follow will make reference to the relevant ARDEPPS' (lowest) entry-barred expansion-preventing QV-investment level. This level is calculated on the normally-counterfactual assumption that something (usually a legal prohibition or bar) prevents any new entry from being executed at or after the time of analysis even if one or more potential competitors would otherwise have found entry profitable. In many situations, the relevant ARDEPPS' entry-barred expansion-preventing QV-investment level is higher than the level of QV investment in the ARDEPPS at the time of analysis—*i.e.*, some expansions will have to be executed after the time of analysis to raise total QV investment in the ARDEPPS to the entry-barred expansion-preventing QV-investment level.

The fourth and final QV-investment level to which some of the analyses that follow will refer is the "actual, competitive" QV-investment level. This is the level of ARDEPPS QV investment at which the ARDEPPS' most-profitable projects will generate a normal rate-of-return over their lifetimes, given the relationship between price and marginal cost at different QV-investment levels in the ARDEPPS in question. The first adjective in the expression "actual, competitive QV-investment level" refers to the assumption that is being made about the competitiveness of pricing. The second, to the assumption that is being made about the competitiveness of QV investment.

I will now turn to the two diagrams to illustrate the analysis of the three types of QV-investment equilibria it is useful to distinguish. Diagrams I and II illustrate the individual determinants of the intensity of QV-investment competition in any

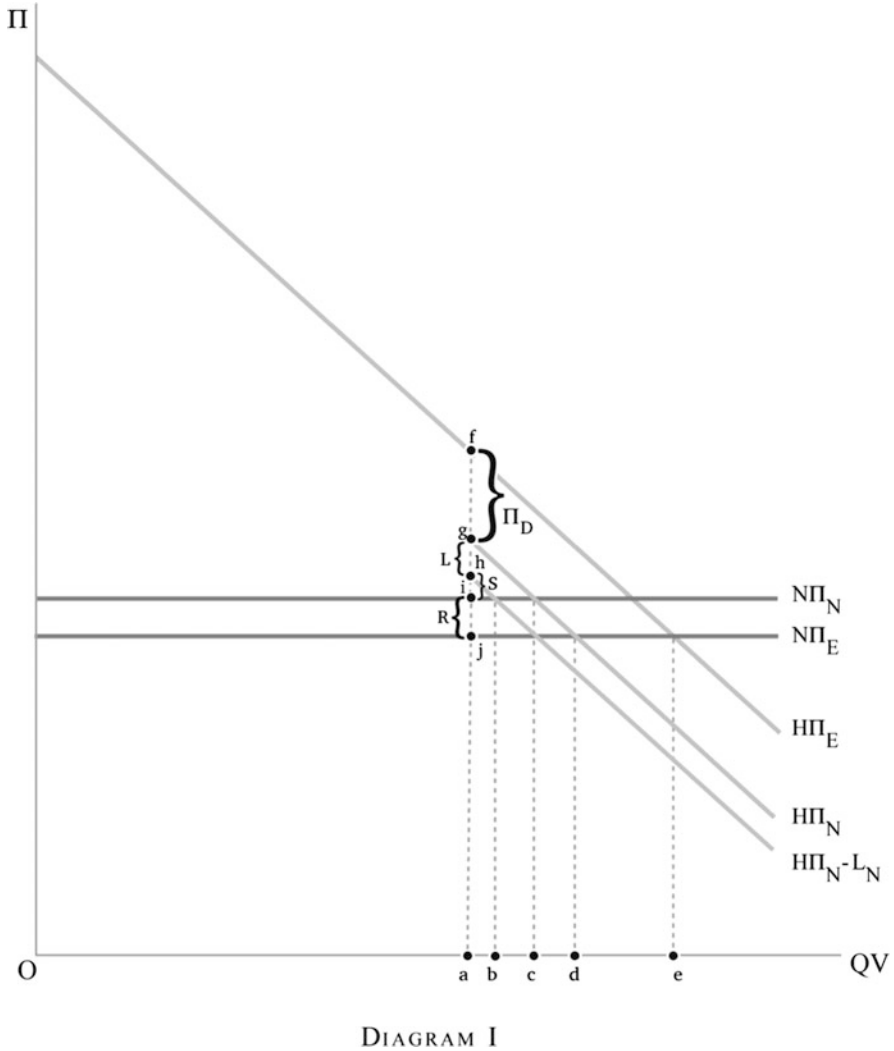

Diagram I The determinants of the entry-preventing QV-investment level

ARDEPPS, the different types of QV-investment equilibria that can be established in any ARDEPPS, and the complex relationship between the various individual determinants or sets of determinants in question on the one hand and the three types of equilibria I will distinguish on the other.

Diagram I contains two highest-profit-rate (HΠ) curves and two normal-profit-rate (NΠ) curves. I will begin by analyzing the HΠ curves and then proceed to the NΠ curves.

$H\Pi_E$ (recall: the subscript "E" stands for "established firms") indicates the relationship between the equilibrium QV-investment level in the ARDEPPS and the "gross" weighted-average-expected lifetime rate-of-return (gross of capital costs) the established owner(s) of the most-(supernormally)-profitable (hereinafter "most-profitable") QV-investment project(s) in the ARDEPPS would expect to realize on these project(s) if they faced no retaliation barriers and faced neither monopolistic nor natural oligopolistic QV-investment disincentives nor monopolistic QV-investment incentives on the investments in question.[48] It should be emphasized at the outset that the height of the $H\Pi_E$ curve at any given QV-investment level does not in general indicate the gross lifetime rate-of-return expected to be yielded by the QV investment that would bring ARDEPPS QV investment to that level. Indeed, the gross rate-of-return that its owner should expect this last QV investment to generate over its lifetime at the relevant ARDEPPS QV-investment level will equal the height of the $H\Pi_E$ curve at that QV-investment level only if the investment in question belongs to the set of most-profitable QV-investment projects in that ARDEPPS. In most situations, the analysis of the relationship between the equilibrium-QV-investment level and the actual, competitive QV-investment level (the QV-investment level at which the ARDEPPS' most-profitable QV investments yield just a normal rate-of-return—Oe in Diagram I, the QV-investment level at which the $H\Pi_E$ curve cuts the $N\Pi_E$ curve [see below] from above) will focus on the height of the $H\Pi_E$ curve at QV-investment levels that exceed the sum of the QV investments in the ARDEPPS that are most profitable. I have stressed this point because this feature of the $H\Pi_E$ curve distinguishes it from the demand curves with which economists are accustomed to dealing. The height of the demand curve at quantity "X" indicates the price for which the "X"th unit (the unit that raises the relevant output to X) can be sold. By way of contrast, the height of the $H\Pi_E$ curve at QV-investment level "X" does not in general tell you the gross (of capital costs) rate-of-return that is expected to be generated by the "X"th QV investment (more precisely, the QV investment that raises total QV investment in the ARDEPPS to "X"): what changes as one moves to the right along an $H\Pi_E$ curve is the total QV investment in the relevant ARDEPPS, not the identity of the QV investment(s) to which the information provided by the height of the curve applies.

$H\Pi_N$ (recall: the subscript "N" stands for "new entrant") indicates the relationship between (1) the "gross" weighted-average-expected lifetime rate-of-return (gross of capital costs) that the potential entrant that was best-placed to enter the relevant ARDEPPS at the time of analysis should anticipate realizing on the most-privately-attractive QV investment it could make within the ARDEPPS if it did not face any retaliation barriers to entry and (2) various hypothetical equilibrium QV-investment levels in that ARDEPPS. The expression "best-placed potential

[48] Although the identity of the projects that are most profitable may vary either with the equilibrium level of QV investment in the ARDEPPS or with changes in the ARDEPPS' structure that do not alter its equilibrium QV-investment level, I will ignore this possibility in the text that follows.

competitor" refers to the potential competitor that can make a QV investment in the relevant ARDEPPS whose *ex ante* supernormal profit-rate exceeds or equals its counterpart for any QV investment that any other potential competitor can introduce into the ARDEPPS in question at the time of analysis. The $H\Pi_N$ curve resembles the $H\Pi_E$ curve in that its height at any ARDEPPS-QV-investment level indicates the rate-of-return that a given project (the most-supernormally-profitable project that can be introduced by any potential competitor at the time of analysis) would yield if it raised ARDEPPS QV investment to the indicated level—*i.e.*, the identity of the QV-investment project to which the varying height of the $H\Pi_N$ curve applies does not vary as one moves to the right along the $H\Pi_N$ curve.[49]

Four further points should be made about the $H\Pi_E$ and $H\Pi_N$ curves. First, the height of the $H\Pi_E$ and $H\Pi_N$ curves at any given QV-investment level increases as the prices of the products in the ARDEPPS rise from competitive to monopolistic levels (from the products' respective marginal costs to the levels that maximize the total supernormal profits that the ARDEPPS' QV investors realize, given the amount of QV investment in the ARDEPPS). The $H\Pi_E$ and $H\Pi_N$ curves in Diagram I (and the $H\Pi_E$ curve in Diagram II—see below) are constructed on realistic assumptions about the prices that will be charged at different QV-investment levels in the relevant ARDEPPS—*i.e.*, are in this sense actual $H\Pi_E$ and $H\Pi_N$ curves.[50] Second, relatedly, and somewhat inconsistently, my construction of the $H\Pi_E$ and $H\Pi_N$ curves in Diagram I assumes that their heights at any given QV-investment level will not depend on the percentage of ARDEPPS QV investment that has been made by new entrants as opposed to expanding established firms. This clearly unrealistic assumption is made for expositional reasons and is relaxed when appropriate—for example, when analyzing QV-investment incentives and disincentives.[51]

[49] Unless otherwise indicated, the analyses that follow assume (admittedly sometimes counterfactually) that QV investments will be introduced into an ARDEPPS in the order of their profitability.

[50] Thus, one might also construct a "monopolistic" and a "competitive" $H\Pi_E$ curve for a particular ARDEPPS. The former would indicate the rate-of-return the ARDEPPS' most-profitable projects would yield as its QV-investment level varied if prices in the ARDEPPS were always perfectly monopolistic (maximized the profits that the ARDEPPS' constituent firms realized, given the ARDEPPS' QV-investment level). The latter would indicate the rate-of-return the ARDEPPS' most-profitable projects would yield as its QV-investment level varied if prices in the ARDEPPS were always perfectly competitive (equaled the respective products' marginal costs). The monopolistic $H\Pi_E$ curve will tend to be higher to the extent that the monopolist is able to increase its returns on a given amount of QV investment (l) by charging supra-marginal-cost prices for its products and services and/or (2) by making a less-overlapping set of QV investments (by offering a set of products and services whose members' appeal overlaps to a lesser extent than the appeal of its competitive counterparts). Obviously, all actual $H\Pi_E$ curves will start at the height of the monopolistic $H\Pi_E$ curve (since prices will be monopolistic when the ARDEPPS contains one QV investment) and progressively converge on the competitive $H\Pi_E$ curve as one moves to the right.

[51] In practice, the rate at which any given actual $H\Pi_E$ curve converges on the lower, competitive $H\Pi_E$ curve will increase *inter alia* with the percentage of any additional QV investments made by new entrants because a new entry will militate more against contrived oligopolistic pricing than an

Third, the downward slope of both the $H\Pi_E$ and $H\Pi_N$ curves reflects the fact that the introduction of additional product variants, outlets, or capacity will lower the rates-of-return generated by the ARDEPPS' pre-existing QV investments (including those that are "most profitable") both (1) by reducing the prevailing price level in the ARDEPPS (by reducing BCAs and perhaps NOMs and/or COMs as well) and (2) by increasing the "per-unit" average total cost of using the pre-existing QV investments because the unit sales the new QV investment takes from its predecessors exceed the additional units the new QV investment's introduction causes its predecessors to sell by inducing the owners to lower their prices. I should note that the expression "per unit" is enquoted in the preceding sentence to reflect the fact that when demand fluctuates through time the relevant "product" will change when the average rate of capacity-utilization drops since this drop will be associated with an increase in the average speed of supply through a fluctuating-demand cycle.[52]

Fourth, Diagram I's assumption that the $H\Pi_E$ and $H\Pi_N$ curves are linear and parallel is not intended to be realistic. This assumption has been adopted solely to ease construction and facilitate textual exposition. It does not critically affect any significant conclusion. The distance between $H\Pi_E$ and $H\Pi_N$ at any given QV-investment level equals the profit-rate-differential (Π_D) barrier to entry faced by the relevant ARDEPPS' best-placed potential competitor at the time of analysis. Diagram I's construction of $H\Pi_N$ parallel to $H\Pi_E$ assumes that this Π_D barrier to entry will not vary with the ARDEPPS' QV-investment level, assuming (as I will) that variations in the pre-existing relevant QV-investment level will not change the identity of the ARDEPPS' most-profitable projects or the most-privately-attractive project that could be introduced by any potential competitor. In Diagram I, $\Pi_D = fg$.

As I have already indicated, Diagram I also contains two $N\Pi$ curves. $N\Pi$ indicates the normal rate-of-return (the minimum weighted-average-expected rate-of-return needed to induce investment, which varies *inter alia* with the riskiness of the QV-investment project in question). $N\Pi_E$ indicates the rate-of-return that owners of the ARDEPPS' most-profitable projects will consider normal on these investments if those investments would generate no retaliation. $N\Pi_N$ indicates the rate-of-return that the ARDEPPS' best-placed potential entrant would find normal for the most-privately-attractive project it could execute to enter the ARDEPPS in question if that entry would generate no retaliation. Diagram I's construction of the two $N\Pi$ curves as horizontal implies that the riskiness of the relevant QV investments

equally-large QV-investment expansion by a new entrant would (and because an expander will tend to choose a location in product-space that reduces BCAs less than they would be reduced by the equally-large but differently-located QV investment a new entrant would make).

[52] Admittedly, since the presence of additional product variants or distributive outlets in the early stages of an ARDEPPS' formation may increase the sales of their predecessors by making more consumers aware of the ARDEPPS' product or by increasing consumer-confidence in the quality and reliability of all products produced by the ARDEPPS, the $H\Pi$ curves may slope upward over a low range of ARDEPPS QV investment. Diagram I ignores this possibility. The text that follows also ignores the fact that such new product variants may have different effects on the rates-of-return generated by what originally were the most-profitable QV investments in the ARDEPPS.

will not vary with the QV-investment level of the ARDEPPS. This assumption will not always be realistic—*e.g.*, would be unrealistic if an ARDEPPS' constituent firms would clearly be able to contrive OMs when QV investment is low (because only a few firms are in the relevant ARDEPPS at such times), would clearly be unable to contrive OMs when QV investment is high (because the additional QV investments are made by new entrants and most or all products in the ARDEPPS other than the product that is best-placed in relation to each relevant buyer are second-placed or close-to-second-placed to obtain the patronage of the buyer in question), and may or may not be able to contrive OMs when QV investment is middling (to the extent that in such situations the number of firms that are second-placed or close-to-second placed is middling). In such situations, the relevant NΠ curves would be horizontal at low and high QV-investment levels but have a bubble in the middle. The assumption that the NΠ curves are horizontal is adopted primarily for expositional reasons but also because, as we shall see, the three generalizations in the preceding sentence are extremely crude. In any event, Diagram I's assumption that the NΠ curves are horizontal does not critically affect any significant conclusion. The vertical distance between $N\Pi_N$ and $N\Pi_E$ in Diagram I indicates the risk barrier to entry (R). The assumption that $N\Pi_N$ and $N\Pi_E$ are horizontal implies that this risk barrier will not vary with the ARDEPPS' QV-investment level. In Diagram I, R = ij.

Diagram I also illustrates the remaining two barriers to entry I find useful to distinguish—the retaliation barrier to entry (L or L_N where the subscript "N" indicates that the relevant barrier relates to the position of a new entrant) and the scale barrier to entry (S or S_N). I will assume that the owners of the ARDEPPS' most-profitable projects face no retaliation barriers on those QV investments. On that assumption, L_N indicates the amount by which the best-placed potential entrant's *ex ante* supernormal rate-of-return is reduced by the possibility that the established firms may retaliate against its entry. Although in reality the prospect of retaliation will reduce the best-placed potential competitor's *ex ante* supernormal rate-of-return both by reducing its weighted-average-expected gross rate-of-return and by increasing its risk costs, for simplicity Diagram I assumes that the L_N barrier will affect only the weighted-average-expected gross rate-of-return of the best-placed potential competitor—that the possibility of retaliation will not raise the best-placed potential entrant's R barrier. For this reason, the L barrier in Diagram I is represented as a vertical distance (hi) between the $H\Pi_N$ and ($H\Pi_N$-L_N) curves. Also for simplicity, Diagram I assumes in addition that the L_N barrier does not vary with the ARDEPPS' QV-investment level. In Diagram I, L = gh.

The final barrier to entry is the scale barrier (S_N). It reflects the fact that, since entry is lumpy (since there are economies of scale in entry), any QV investment a potential competitor finds profitable to introduce will reduce not only the supernormal rate-of-return it realizes on its new entry (below the rate it would have realized post-entry on its entry if its entry would not raise total QV investment in the ARDEPPS) but the supernormal rate-of-return generated by all pre-existing QV investments in the ARDEPPS by raising the ARDEPPS' QV-investment level. In a static world, a potential competitor might well find it profitable to reduce the S_N

barrier it faced by entering with a smaller QV investment whose size causes it to face higher (Π_D + R) or (Π_D + R + L) barriers than it would face if it entered with a larger QV investment. However, since in our actual, dynamic world ARDEPPS $H\Pi_E$ and $H\Pi_N$ curves tend to rise through time because "ARDEPPS demand curves"[53] tend to rise through time and ARDEPPS cost curves tend to decrease through time, the S-barrier advantage such a choice would yield is unlikely to survive long enough to make such a trade-off worthwhile (since the extra QV the larger entry would introduce will reduce the amount of additional investment by others the relevant increase in demand will stimulate). I will therefore assume that potential competitors will always choose to enter on a scale that is at least large enough to minimize the sum of the (Π_D + R) barriers they face (hereinafter the "minimum efficient scale"). In Diagram I, the minimum efficient scale is assumed to be ab and the associated scale barrier—S—equals (ab *times* the slope of the $H\Pi_N$ curve [which Diagram I assumes does not vary with the ARDEPPS' QV-investment level]) = hi.

It should now be possible to use Diagram I to illustrate some of the QV-investment levels that play a significant role in the analysis that follows. First, in Diagram I, Oe—the level of QV investment at which $H\Pi_E$ and $N\Pi_E$ intersect—is the "actual," competitive level of QV investment (where the first adjective refers to the competitiveness of pricing at the relevant QV-investment level and the second, to the competitiveness of QV investment at that QV-investment level). QV investment is said to be "competitive" when it is at the level at which any firm that owned a most-profitable project would realize a normal rate-of-return on that project. Second, in Diagram I, Oa (actually, an investment-level infinitesimally above Oa) the quantity of QV investment that equals the quantity at which ($H\Pi_N$–L_N) falls just below $N\Pi_N$ (Ob) *minus* the minimum efficient scale of entry (ab)—is the "entry-preventing QV-investment level," the lowest level of QV investment whose attainment would result in the best-placed potential competitor's confronting an *ex ante* subnormal rate-of-return on its most-privately-attractive project.

Thus, Diagram I indicates that in the circumstances it portrays the relevant barriers to entry permit the established firms to restrict their QV investment

[53] A "demand curve" is a diagrammatic representation of a schedule indicating the quantity of an indicated product that will be sold at different prices. Demand curves are usually constructed in diagrams whose vertical axis measures some monetary unit (say dollars—$) and whose horizontal axis measures the quantity of the good in question (Q). Economists distinguish between the demand curve a given seller of a particular product faces when selling that product—the "firm" demand curve—and the demand curve faced by an industry whose members produce identical physical products with identical images that they distribute from an identical location—so-called industry demand curves. The text enquotes the expression "ARDEPPS demand curve" because in all or virtually all cases the sellers in a given ARDEPPS will be producing physically-different products, will be producing products with different "images," and/or will be distributing their products from different locations among which relevant buyers will not be indifferent. Since the "products" in the ARDEPPS are different, there will usually be no straightforward ARDEPPS counterpart for the traditional notion of an industry demand curve. My use of the concept of an "ARDEPPS demand curve" should therefore be regarded as purely heuristic.

(infinitesimally less than) ea below the actual, competitive level Oe without making it profitable for any potential competitor to enter. Of this amount ea, de reflects the profit-rate-differential barrier Π_D (the difference between the intersection of $H\Pi_E$ and $N\Pi_E$ on the one hand and $H\Pi_N$ and $N\Pi_E$ on the other); cd reflects the risk barrier R (the difference between the intersection of $H\Pi_N$ and $N\Pi_E$ on the one hand and $H\Pi_N$ and $N\Pi_N$ on the other); bc reflects the retaliation barrier L (the difference between the intersection of $H\Pi_N$ and $N\Pi_N$ on the one hand and $[H\Pi_N - L_N]$ and $N\Pi_N$ on the other); and ab reflects the scale barrier S (assuming that ab is the minimum efficient scale of entry in QV-investment terms and that entry will always take place at at least minimum efficient scale).

Diagram I also indicates that in the circumstances it portrays, the established firms can realize a supernormal rate-of-return infinitesimally below (fj $= [\Pi_D + R + S + L]_N$) on their most-profitable projects without making it profitable for a potential competitor to enter their ARDEPPS. In brief, this conclusion reflects the fact that $(\Pi_D + R + L + S)_N$ equals the difference between the established firms' pre-entry lifetime supernormal profit-rate on their most-profitable projects and the best-placed potential competitor's expected post-entry supernormal profit-rate—the supernormal profit-rate the best-placed entry would generate if its execution would bring the ARDEPPS into equilibrium. A numerical example might make this point more comprehensible. Assume that the lifetime supernormal profit-rate that the established firms that owned most-profitable QV investments would realize on these projects if the pre-entry QV-investment level in the ARDEPPS were the ARDEPPS' equilibrium QV-investment level was 8.25 % and that $(\Pi_D + R + S + L)_N = (5\,\% + 2\,\% + 1\,\% + .26\,\%) = 8.26\,\%$. In such a case, the fact that the established firms would realize a lifetime supernormal profit-rate of 8.25 % on any most-profitable projects they owned if the pre-entry QV-investment level were the equilibrium QV-investment level would not imply that new entry would be profitable: in fact, the best-placed potential competitor would anticipate realizing a .01 % subnormal profit-rate if it entered. Thus, if $N\Pi_E = 10\,\%$ and the established firms' lifetime gross rate-of-return would therefore be 18.25 % on any most-profitable projects they owned if QV investment were in equilibrium at the pre-entry level, entry would not be profitable because the best-placed potential competitor's weighted-average-expected gross rate-of-return ($18.25\,\% - [\Pi_D]_N - S_N - L_N] = 18.25\,\% - 5\,\% - 1\,\% - .26\,\% = 11.99\,\%$) would be lower than the normal rate-of-return for the privately-best project it could introduce into the ARDEPPS in question ($N\Pi_E + R_N = 10\,\% + 2\,\% = 12\,\%$).

Diagram II illustrates the various barriers to expansion, monopolistic QV-investment incentives, and monopolistic and oligopolistic QV-investment disincentives that may confront the established firms that are successively-best-placed to add QV investments to their ARDEPPS after the time of analysis. In fact, Diagram II illustrates the *M*s and *O*s that the relevant successive, best-placed potential expanders will face both given the actual entry situation and on an artificial (*i.e.*, usually counterfactual) assumption that entry is barred (for example, because some law effectively prohibits entry, regardless of whether entry would be profitable absent the law in question). Diagram II also illustrates the determinants of the

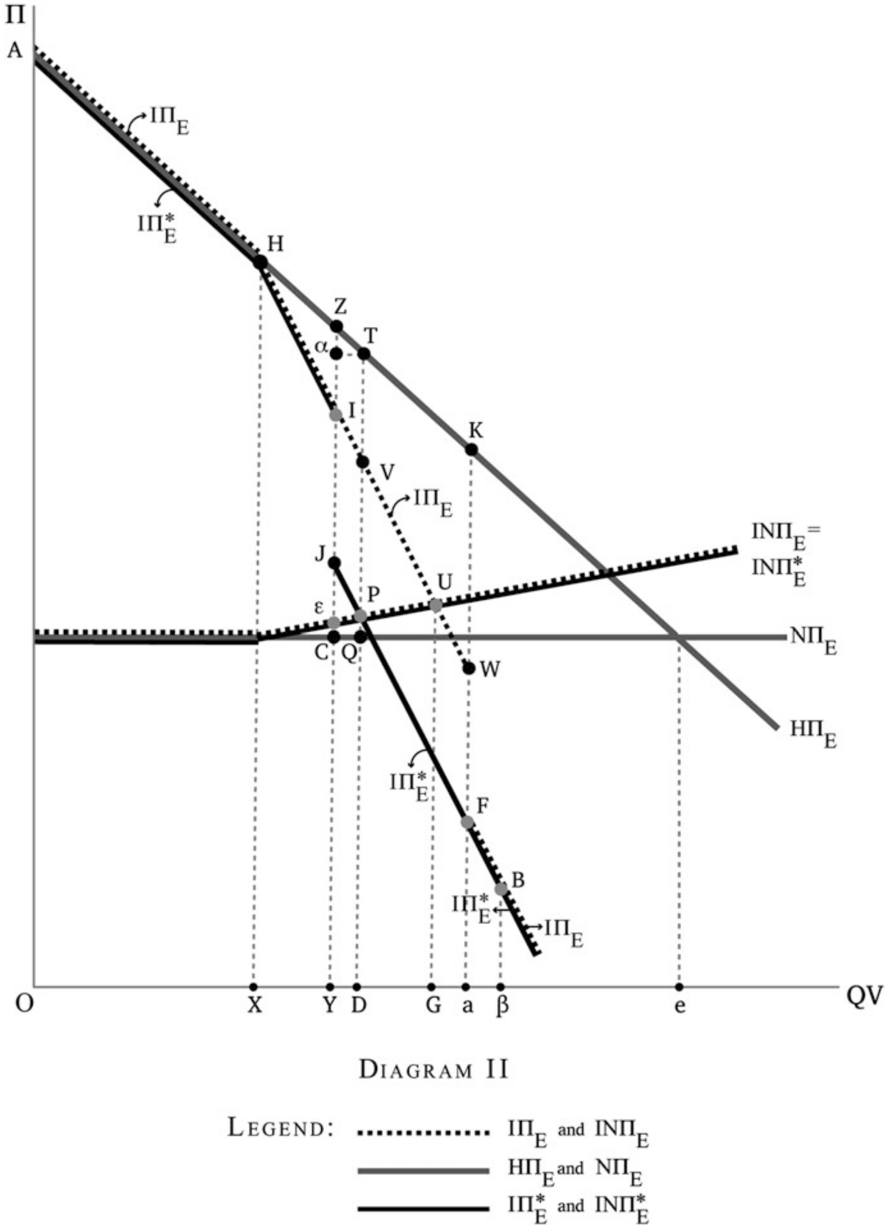

Diagram II The determinants of the entry-barred, expansion-preventing QV-investment level

entry-barred expansion-preventing QV-investment level (the level of QV investment at which expansion would cease if entry were barred at the time of analysis), given the $H\Pi_E$ and $N\Pi_E$ curves in question. In combination with Diagram I, Diagram II will also be used to illustrate the analysis of (1) the conditions under which potential competition is effective (*viz*., the conditions under which the entry-preventing QV-investment level is higher than the entry-barred expansion-preventing QV-investment level), (2) whether and the extent to which an ARDEPPS' established firms will find it profitable to respond to potential competition by making QV investments whose profitability is critically affected by the fact that they would deter new entry, and relatedly (3) the relationship between (A) the entry-preventing QV-investment level and the entry-barred expansion-preventing QV-investment level on the one hand and (B) the equilibrium QV-investment level in the ARDEPPS in question on the other hand.

Diagram II incorporates the $H\Pi_E$ and $N\Pi_E$ curves that Diagram I contains. In addition, Diagram II contains three "incremental" curves—the $I\Pi_E^*$ curve, the $I\Pi_E$ curve, and the $IN\Pi_E = IN\Pi_E^*$ curve. $I\Pi_E^*$ indicates the actual incremental (hence "I") lifetime rate-of-return (gross of capital costs) that the established firm that would be best-placed to expand the ARDEPPS' QV investment to various levels if no entry could take place after the beginning of the analysis period—*i.e*., if entry were barred (hence the asterisk)—should expect to realize on this expansion. $I\Pi_E$ indicates the same information, given the actual position of potential competitors. The $IN\Pi_E$ and $IN\Pi_E^*$ curves respectively indicate the normal rate-of-return for the successive best-placed QV-investment expansions that could be executed by the relevant ARDEPPS' established firms, respectively on actual-condition-of-entry and entry-barred assumptions. For simplicity, I have assumed that these two normal rates-of-return are equal—that the $IN\Pi_E = IN\Pi_E^*$ curves coincide. It is critical to emphasize that the different points on the $I\Pi_E$, $I\Pi_E^*$, and $IN\Pi_E = IN\Pi_E^*$ curves provide information about the different, successive, most-privately-attractive expansions the ARDEPPS' established firms would or could undertake. In this respect, the incremental curves resemble demand curves rather than $H\Pi_E$, $N\Pi_N$, $N\Pi_E$, and $N\Pi_N$ curves, whose points indicate the gross rate-of-return that *a given*, *unchanging* QV investment or group of investments—the most-profitable QV investment or investments in the relevant ARDEPPS—would generate or would have to be expected to generate to be privately attractive at different equilibrium QV-investment levels.

I will now consider the $I\Pi_E$ and $I\Pi_E^*$ curves in Diagram II. In Diagram II, $I\Pi_E$ is the disjointed line AHIVUWFB, while $I\Pi_E^*$ is the disjointed line AHIJPFB. As I have already indicated, by definition, $I\Pi_E^*$ differs from $I\Pi_E$ in that $I\Pi_E^*$ is the incremental profit-rate curve that would be applicable if (usually counterfactually) entry were barred while $I\Pi_E$ is the incremental profit-rate curve that actually is applicable—*i.e*., that is constructed on realistic assumptions about the entry-preventing QV-investment level (in Diagram II, Oa). This difference causes the two curves to diverge whenever the monopolistic QV-investment incentives, monopolistic QV-investment disincentives, or natural oligopolistic QV-investment disincentives confronting the ARDEPPS' best-placed potential expander at a relevant QV-investment level are affected by the possibility of entry—*viz*., in virtually all situations in which the established firm that would be best-placed to expand ARDEPPS QV investment from some level below the entry-preventing level would face *M* disincentives, *M* incentives, or *O* disincentives if entry were barred. This conclusion reflects the fact that in the vast majority of such cases the possibility of entry will affect the existence or magnitude of the incentives and disincentives in question. I will return to this issue when explaining the divergence between $I\Pi_E$ and $I\Pi_E^*$ between QV-investment levels OY and Oa.

I will discuss separately three pairs of segments of the $I\Pi_E$ and $I\Pi_E^*$ curves that Diagram II contains. The first pair of segments contains the portions of the curves between ARDEPPS QV-investment levels zero and OY. Between these two levels, $I\Pi_E$ and $I\Pi_E^*$ coincide. Their coincidence reflects an assumption that the established firms that would be successively best-placed to raise ARDEPPS QV investment from zero to OY would not have an *M* incentive, *M* disincentive, or *O* disincentive to make the investments in question, regardless of whether the entry-preventing QV-investment level was Oa or entry was assumed to be barred. Diagram II constructs $I\Pi_E$ and $I\Pi_E^*$ to coincide with $H\Pi_E$ between QV-investment levels zero and OX. This construction assumes not only that (*M* or *O*) and (M^* or O^*) are zero between those QV-investment levels but that Π_D and L are also zero over this QV-investment range—that the projects that create the first OX in QV investment in the ARDEPPS in question are all most-profitable projects (given the diagram's assumption [see below] that R is also assumed to be zero for the QV investments in question) and that the relevant established firms face no retaliation barriers on the QV investments in question. However, although Diagram II also constructs $I\Pi_E$ and $I\Pi_E^*$ to coincide with each other between QV-investment levels OX and OY, it constructs both to be progressively lower than $H\Pi_E$ as one moves from QV-investment level OX to QV-investment level OY. This divergence could reflect the fact that Π_D becomes increasingly positive for the ARDEPPS' successive best-placed potential expanders as one moves progressively above OX, the fact that L becomes increasingly positive for the ARDEPPS' successive best-placed potential expanders as one moves progressively above OX, or the fact that (Π_D + L) becomes increasingly positive for the ARDEPPS' successive best-placed potential expanders as one moves progressively above OX. However, for simplicity, I will assume that L_E is zero throughout and that all the divergences between $H\Pi_E$ and $I\Pi_E$ or $I\Pi_E^*$ at all QV-investment levels above OX that cannot be attributed to *M* disincentives (see below) reflect Π_D barriers.

The second segments of $I\Pi_E$ and $I\Pi_E^*$ in Diagram II contain the portions of the curves between QV-investment levels OY and Oa. In Diagram II, $I\Pi_E^*$ diverges from $I\Pi_E$ at QV-investment level OY. In particular, although $I\Pi_E$ drops continuously progressively below $H\Pi_E$ to the right of QV-investment level OY, $I\Pi_E^*$ first jumps discontinuously from point I to point J at QV-investment level OY before declining continuously to the right of point J in precisely the same way that $I\Pi_E$ does. ($I\Pi_E^*$ is parallel to $I\Pi_E$ between QV-investment levels OY and Oa.) This construction reflects three assumptions.

First, it assumes that although the established firms that would be best-placed to add the successive QV investments to the ARDEPPS in question that would raise its QV-investment level to OY would not face *M* incentives, *M* disincentives, or *O* disincentives on those investments even if entry were barred (because, I am assuming, their failure to make an additional QV investment would induce an established rival to make an equally-large QV investment that would be equally damaging to the actual investor's other QV investments' profit-yields as its own expansion would be [relative to the *status quo ante*]), at QV-investment level OY, each successive best-placed potential expander would face *M* disincentives if entry were barred because each would know that it was the only established firm that could earn normal returns on any additional project it introduced into the relevant area of product-space—*i.e.*, that its decision not to expand would not induce any established rival to expand instead. I hasten to point out that, given that the entry-preventing QV-investment level in Diagram II—Oa—is higher than OY, no similar *M* disincentives will cause $I\Pi_E$ to drop continuously at point I: at least if one assumes that the new entry that would actually take place because the established firm that was best-placed to raise ARDEPPS QV investment above OY failed to do so would be equally damaging to the profit-yields of this potential expander's other projects, the relevant potential expander would face no *M* disincentives (and no *M* incentives) at QV-investment level OY on the realistic entry assumptions on which $I\Pi_E$'s construction is based, though it would face them on the counterfactual entry-barred assumption on which $I\Pi_E^*$'s construction is based.

Second, $I\Pi_E^*$'s construction between QV-investment levels OY and Oa is based on the assumption that the successive best-placed expanders in question would face the same *M* disincentives on their QV-investment projects. This assumption is unrealistic (since on our assumptions the successive expansions in question will be made by the same firm, the *M* disincentives that firm faces will tend to increase as one moves to the right because the number of pre-existing projects it owns [whose profit-yields an expansion will reduce] will increase as one moves to the right), but the assumption's lack of realism does not affect any significant conclusion I generate.

Third, the construction of $I\Pi_E$ and $I\Pi_E^*$ between OY and Oa also reflects the continuance of our assumptions that Π_D increases progressively as one moves to the right of OX and that L equals zero.

The third segments of the $I\Pi_E$ and $I\Pi_E^*$ curves in Diagram II contain the portions of the curves that lie between QV-investment levels Oa and Oβ. The critical point is that between QV-investment levels Oa and Oβ, $I\Pi_E$ coincides with $I\Pi_E^*$ once more—*i.e.*, that at QV-investment level Oa, $I\Pi_E$ drops discontinuously from point W above $I\Pi_E^*$ to point F on $I\Pi_E^*$. This drop reflects the fact that, once the entry-preventing QV-investment level Oa is reached, the entry-barred assumption becomes irrelevant since the established firm's failure to expand the ARDEPPS' QV investment beyond Oa will not induce entry. The fact that the coincident segments of $I\Pi_E$ and $I\Pi_E^*$ to the right of QV-investment level Oa continue to drop further below $H\Pi_E$ between points F and B (between QV-investment levels Oa and Oβ) reflects my continuing assumptions that Π_D rises progressively as one moves to the right beyond QV-investment level OX and that L is zero throughout.

Finally, since as already stated $IN\Pi_E$ and $IN\Pi_E^*$ indicate the normal rates-of-return for the expansions that would successively be the most-privately-attractive expansions any established firm could execute if entry respectively were not and were barred, R_E and R_E^* at any QV-investment level will respectively equal $IN\Pi_E$–$N\Pi_E$ and $IN\Pi_E^*$–$N\Pi_E$ at that level. In what follows, I will assume that $IN\Pi_E = IN\Pi_E^*$ and that R_E therefore equals R_E^*. For simplicity, Diagram II is also constructed on the assumption that the risk barrier to expansion appears at precisely the same QV-investment level at which the Π_D barrier to expansion appears—that the first QV-investment expansion for which $I\Pi_E < H\Pi_E$ (because $\Pi_D > 0$) is the first QV-investment expansion for which $IN\Pi_E > N\Pi_E$ (because $R_E > 0$). In particular, in Diagram II, the QV-investment expansion for which these two barriers appear is the expansion that would raise the total amount of QV investment in the ARDEPPS to a level above OX.

In order to use Diagram II to illustrate the determinants of the lowest entry-barred expansion-preventing QV-investment level, one additional piece of information must be supplied—information on the scale of the expansion that would be best-placed to raise total QV investment in the ARDEPPS above the entry-barred expansion-preventing QV-investment level. Diagram II assumes that this scale will be YD, the minimum efficient scale of expansion. YD is constructed to be slightly lower than ab in Diagram I because the minimum efficient scale of expansion will tend to be lower than the minimum efficient scale of entry (ab) since established firms will be more able than potential competitors to take advantage of economies of scale in production, promotion, and distribution by producing, promoting, and distributing their new products together with their old. In any event, if the expansion that would be best-placed to raise QV investment in the ARDEPPS in question above the entry-barred expansion-preventing QV-investment level would take place at a scale of YD, the (lowest) entry-barred expansion-preventing QV-investment level would be infinitesimally above OY $=$ OD–YD where OD is the QV-investment level at which the $I\Pi_E^*$ curve cuts the $IN\Pi_E^*$ curve from above (at point P) and YD is the minimum scale at which any expansion of ARDEPPS QV above OD would take place if entry were barred. In what follows, I will assume that the entry-barred expansion-preventing QV-investment level in the ARDEPPS in question is (infinitesimally above) OY—*i.e.*, that the lumpiness of QV investments will not cause this level to diverge from OY. At a QV-investment level (infinitesimally above) OY, the established firms that owned most-profitable projects would be realizing a supernormal profit-rate infinitesimally less than ZC on these QV investments. Despite this fact, no established firm would find it profitable to expand because the sum of the barriers to expansion and monopolistic QV-investment disincentives that the best-placed potential expander at OY would face would equal ZC. Thus, in Diagram II, the value of the barriers and disincentives that would affect this next expansion are as follows: S_E for an expansion of scale YD equals Zα (the difference between the vertical coordinates of points Z and T on $H\Pi_E$),[54] $(\Pi_D + L^*)_E =$ TV (the vertical distance between the $H\Pi_E$ and $I\Pi_E$ curves

[54] I should note that one should not count as part of the scale barrier that would confront the established firm that was contemplating making a QV investment that would raise the total QV investment of the ARDEPPS in question from OY to OD the amount by which the R barrier to expansion at QV-investment level OD exceeds the R barrier to expansion at QV-investment level OY—PQ–εC—because on the assumptions of Diagram II the expansion in question will not raise the risk costs of any pre-existing QV investment. However PQ–εC is a component of the risk barrier R faced by the established firm that is best-placed to increase the ARDEPPS' QV-investment level from OY to OD: the other component of that risk barrier is εC (the risk barrier to the execution of the expansion that would be best-placed to raise the ARDEPPS'

at QV-investment level OD), M^* = VP (the vertical distance between curves $I\Pi_E$ and $I\Pi_E^*$ at QV-investment level OD), and R = PQ = εC + (PQ–εC) (the vertical distance between curves $IN\Pi_E^*$ and $N\Pi_E$ at QV-investment level OD). An inspection of Diagram II reveals that ZC = Zα + TV + VP + PQ.

Now that Diagrams I and II and the various barriers, (dis)incentives, and QV-investment levels they illustrate have been explained, it should be possible to analyze the determinants of the equilibrium QV-investment level in an ARDEPPS with a given actual, competitive QV-investment level and correlatively the determinants of the lifetime supernormal profit-rate that will be generated in equilibrium by the most-supernormally-profitable QV investments in the ARDEPPS in question. In addition to the assumptions on which (as I have explained) the construction of Diagrams I and II are based, the analysis that follows is based on four further assumptions.

The first is that at the time of the analysis QV investment in the ARDEPPS in question has not yet attained its static equilibrium level. New QV investments that are introduced into this ARDEPPS may be introduced either by firms that are already established in the ARDEPPS (in which case they will be described as QV-investment expansions) or by potential entrants (in which case they will be described as new entries). QV-investment expansions that would not have been executed but for their tendency to deter someone else (either an established firm or a potential competitor) from making a QV investment will sometimes be described as "limit investments."

The second is that, although I will continue to assume generally that QV investments are introduced into any ARDEPPS in the order of their profitability, I will also assume (somewhat inconsistently) that whenever an established firm finds an expansion profitable and a potential competitor finds an entry profitable, any relevant QV investment that is executed will be made by the established firm (regardless of whether it is more profitable than the deterred QV investment of the potential competitor). This expositionally-useful assumption has some basis in reality. Although the following justification is somewhat undercut by the fact that an ARDEPPS' best-placed potential competitors are normally-existing companies operating in nearby geographic "markets" or related product "markets," I suspect that established firms usually learn of QV-investment opportunities (*i.e.*, that a QV investment that would create a particular type of product or distributive outlet would be profitable) sooner than do potential competitors and can commit themselves to making or completing the relevant type of QV investment before outsiders can do so.

The third additional assumption is that QV investments are sufficiently immobile that it will never be inherently profitable for someone to make a QV investment on the assumption that its execution will induce an established QV investment to be withdrawn. This third assumption will be more realistic the more use-specific the established QV investments. Thus, QV investments in product or outlet design are least likely to be withdrawn because they cannot be converted into alternative uses.

QV-investment level to OY). For convenience, however, I am classifying this component of the scale barrier to the relevant expansion to be a component of the risk barrier to that expansion.

QV investments in physical distributive outlets will be more likely to be withdrawn to the extent that they can be (profitably) used to distribute either products that would be rivalrous with the product their creator built them to distribute or completely-different, non-rivalrous products. QV investments in capacity-increasing machinery will be more likely to be withdrawn to the extent that the machinery can be used equally well to produce other products, to the extent that their alternative users are geographically proximate to the actor that invested in them, and to the extent that the cost of transporting them any distance is low. QV investments in capacity-increasing plants will be more likely to be withdrawn to the extent that the plants are physically and geographically equally suitable for producing other products.

The fourth and final additional assumption is that all the expansions that could be made in or entries that could be made into the ARDEPPS in question after the time of analysis will have the same QV-investment magnitude. This assumption is made purely for expositional reasons: it enables me to refer to the number of entries that could be made absent established-firm expansions and the number of expansions that would deter a given number of entries rather than the total monetary magnitudes of the investments in question.

On the above assumptions, I will now analyze the determinants of the lifetime supernormal rate-of-return that will be generated by an ARDEPPS' most-profitable projects in equilibrium. The fact that I am focusing on this variable does not imply my belief that, in the context of antitrust-law analysis, the intensity of QV-investment competition should be defined in terms of the highest supernormal lifetime rate-of-return any relevant project generates. I have adopted this focus because the analysis it requires me to execute is germane to the issues that the relevant antitrust laws make legally salient—in Clayton Act analysis, the effect a practice or transaction will have on the equivalent-dollar welfare of the customers of the actor(s) and the customers of the actors' product-rivals by reducing the absolute attractiveness of the best offer they respectively receive from any inferior supplier[55] and, in Sherman Act analysis, the tendency of a practice or transaction to inflate the actor or actors' profits critically by reducing the attractiveness of the offers against which it or they have to compete. Since, in one sense, the determinants of this highest supernormal profit-rate will depend on which of three "types" of equilibria is established in the ARDEPPS in question, the analysis that follows will analyze these three types of equilibria separately.

(1) Equilibria in Which QV Investment Exceeds the Entry-Preventing Level at the Time of Analysis

The first set of equilibria worth distinguishing in this context are equilibria at a level of QV investment that is higher than the level that would prevent all entry at the time of analysis. An equilibrium will be established above the time-of-analysis

[55] In my terminology, a buyer's "inferior suppliers" are the potential suppliers that are worse-than-best-placed to supply it.

entry-preventing QV-investment level in two sets of circumstances. First, such an equilibrium will be established when (unlike in Diagram II) the entry-barred expansion-preventing QV-investment level is higher than the entry-preventing QV-investment level.

Second, such an equilibrium will be established when (unlike in Diagram II) (1) the entry-barred expansion-preventing QV investment level is lower than the entry-preventing QV-investment level or (2) one or more established firms find it profitable to expand sufficiently to prevent all entry—a possibility that may reflect the fact that the threat of entry may critically reduce the monopolistic QV-investment disincentives the potential expander faces, indeed may cause it to have monopolistic QV-investment incentives to make the relevant investment—and the lumpiness of QV investments (the fact that there are economies of scale in making such investments) makes it profitable for the expander that executes the equilibrating QV investment in the relevant ARDEPPS to make an investment that will raise QV investment in the ARDEPPS in question above the entry-preventing level.

The lifetime supernormal profit-rate that will be yielded by an ARDEPPS' most-profitable projects in either of the two situations just described will equal the sum of (1) the supernormal profit-rate the investor whose expansion brought the ARDEPPS into equilibrium anticipated realizing on this QV investment *plus* (2) the sum of the (Π_D + R) barriers to expansion it faced on the expansion that brought the ARDEPPS into equilibrium *plus* (3) (A) the monopolistic QV-investment disincentives it faced on that investment or *minus* (3) (B) the monopolistic QV-investment incentives it had to make that investment. The (Π_D + R) expansion barriers must be added to the expander's supernormal rate-of-return to calculate the most-profitable projects' equilibrium supernormal rate-of-return because, by definition, the most-profitable projects' profits are not reduced by any such barriers. In the normal situation in which the number of QV investments in an ARDEPPS in equilibrium exceeds the number of most-profitable QV investments it contains, the equilibrium supernormal rate-of-return of the most-profitable projects will also be augmented by any positive difference between the monopolistic QV-investment incentive their makers had to make them and any monopolistic QV-investment incentive the last expander had to make its last QV investment or the sum of the monopolistic QV-investment incentive the owner of the relevant most-profitable project had to execute the project and any monopolistic QV-investment disincentive that faced the expander that established the ARDEPPS' QV-investment equilibrium on that equilibrating investment.

(2) Equilibria at the Time-of-Analysis Entry-Preventing QV-Investment Level

The second set of equilibria worth distinguishing in this context are equilibria at the time-of-analysis entry-preventing QV-investment level. Such equilibria can prevail in four situations. First, this type of equilibrium can result when (unlike in Diagram II) the entry-barred expansion-preventing QV-investment level at the time of analysis happens to equal the time-of-analysis entry-preventing QV-investment level.

Second, this type of equilibrium can result when the threat of entry makes it individually profitable for various established firms to make enough QV investments to bring total QV investment in the relevant ARDEPPS to the entry-preventing level despite the fact that (as in Diagram II) the entry-barred expansion-preventing QV-investment level is lower than the time-of-analysis entry-preventing QV-investment level. As already indicated, potential competition can make it profitable for established firms to make QV investments that would not otherwise have been profitable because the threat of entry will reduce or eliminate what may otherwise have been critical monopolistic QV-investment disincentives—indeed, may cause an established firm to have (critical or non-critical) monopolistic QV-investment incentives. This type of equilibrium is most likely to prevail when (1) the number of QV-investment expansions that the established firms must execute to deter all entry at the time of analysis is as large or almost as large as the number of new entries that would result if the established firms did not make any additional (limit) investments to deter entry and (2) the sum of the barriers to expansion that will face the established firm that will be best-placed to make the last QV investment necessary to deter all entry does not significantly exceed the sum of the barriers facing the best-placed potential competitor. The first of these conditions is most likely to be satisfied when QV investment at the time of analysis is close to the entry-preventing level or the number of potential entrants that are equal-best-placed to enter or close-to-best-placed to enter equals the number of limit investments the established firms must execute to deter all entry. If I relax the assumption that the equilibrium in question must be static, the second of the above two conditions is most likely to be satisfied if "demand" for the products of the ARDEPPS is not rapidly increasing or costs in the ARDEPPS are not rapidly falling: if demand increases and/or costs fall, the actual dynamic equilibrium may be rising sufficiently rapidly to increase the number of expansions that the established firms must execute quickly to deter entry to the point that the Π_D and R barriers they would confront on their last limit investments would become prohibitively higher than the barriers faced by the best-placed potential entrant (given that the efficiency with which any given company can execute an internal expansion will tend to be inversely related to the rate at which it will have to grow to execute the expansion in question).

Third, an equilibrium may be established at the time-of-analysis entry-preventing QV-investment level if (1) as in Diagram II, the time-of-analysis entry-barred expansion-preventing QV-investment level is lower than the time-of-analysis entry-preventing QV-investment level, (2) the established firms do make some (limit) QV investments to deter some entry but not enough to deter all entry, and (3) the number of new entries that are executed equals the difference between the number of limit investments the established firms would have to execute at the time of the analysis to deter all entry and the number of limit investments the established firms did execute post-analysis. This result is likely to obtain if (1) the barriers to expansion facing the successively-best-placed potential expanders rise so that at some QV-investment level below the entry-preventing level the barriers facing the best-placed potential expander exceed the barriers facing the best-placed potential entrant sufficiently to outweigh any monopolistic QV-investment incentive the potential expander may have to execute an additional expansion and (2) the number of equally-best-placed potential entrants equals or exceeds the difference between the number of QV-investment expansions the established firms must execute at the time of analysis to deter all entry and the number of such investments the established firms actually do execute.

Fourth, an equilibrium may also be established at the time-of-analysis entry-preventing QV-investment level if (1) as in Diagram II, the time-of-analysis entry-barred expansion-preventing QV-investment level is lower than the time-of-analysis entry-preventing QV-investment level, (2) the established firms make no limit QV investments (because the barriers to expansion they face are sufficiently higher than the barriers confronting the best-placed potential entrant to outweigh any monopolistic QV-investment incentives they may have to expand—*i.e.*, if the relevant barriers are prohibitive), and (3) actual entry brings QV to the entry-preventing level (because the number of equally-best-placed potential entrants equals or exceeds the difference between the number of QV investments the established firms own in the relevant ARDEPPS and the number that is entry-preventing).

In any event, if an equilibrium is established in an ARDEPPS at the entry-preventing QV-investment level and we assume that the owners of the ARDEPPS' most-profitable projects faced neither monopolistic QV-investment incentives nor monopolistic QV-investment disincentives in relation to them, the most-profitable projects in the ARDEPPS in question will all generate a supernormal rate-of-return equal to the sum of the $(\Pi_D + R + S + L)_N$ barriers confronting the potential competitor that was best-placed to enter the relevant ARDEPPS at the time of the analysis, regardless of which of the four scenarios just described brought the ARDEPPS to this equilibrium. If some entries have been executed, the new entrant will anticipate realizing a supernormal rate-of-return equal to the S barrier it faced so that the most-profitable projects' equilibrium supernormal rate-of-return will also equal the sum of the $(\Pi_D + R + L)_N$ barriers confronting the time-of-analysis best-placed potential competitors and the supernormal profit-rate the actual new entrants anticipated realizing on their entries. If some expansions have been executed, the least profitable expansion to have been executed will yield an anticipated supernormal rate-of-return equal to (1) the S barrier that the best-placed potential entrant faced *plus* (2) the difference between the sum of the $(\Pi_D + R + L)_N$ barriers confronting the potential competitors that were best-placed to enter the ARDEPPS in question at the time of analysis and the sum of the $(\Pi_D + R + L)_E$ barriers the firm that executed this expansion faced on the QV investment in question *plus* or *minus* any QV-investment incentives or disincentives the relevant investor had to execute the expansion in question (which I am assuming are zero). In such cases, the most-profitable projects' equilibrium supernormal rate-of-return will also equal (1) the supernormal rate-of-return the last expander anticipated realizing on this last expansion *plus* (2) the $(\Pi_D + R + L)$ barriers it faced on this expansion *plus* or *minus* (3) the QV-investment disincentives or incentives the last expander faced on the last expansion.

(3) Equilibria at QV-Investment Levels That Are Lower Than the Time-of-Analysis Entry-Preventing QV-Investment Level

The third set of QV-investment equilibria worth distinguishing in this context are equilibria at a QV-investment level that is lower than the level that would prevent all entry at the time at which the relevant investigation was being executed. This type of equilibrium will tend to be established when (1) as in Diagram II, the entry-barred expansion-preventing QV-investment level is lower than the entry-preventing QV-investment level and (2) the difference between the number of QV investments that would be entry-preventing in the ARDEPPS in question at the time of analysis and the number of QV investments that would be expansion-preventing if entry were barred is bigger than the sum of the limit investments the established firms will make (the QV investments that will be induced by the prospect of entry) and the number of new entries that potential competitors will find profitable to execute after the established firms have made the limit investments they will find profitable to make. Not surprisingly, the analysis of the factors that determine the equilibrium that will obtain in this type of situation is quite complicated. Put crudely, the outcome depends on four factors:

(1) the difference between the number of limit investments that the established firms must make to deter all entry at the time of analysis (say, total limit QV investments, ΣLQV) and the number of entries that will be executed if the established firms make no limit investments—which, given ΣLQV, will depend on the number of potential competitors that are equal-best-placed to enter at the time of analysis (up to ΣLQV) and the rate at which the relevant barriers rise for the successive worse-than-best-placed potential entrants
(2) the difference between the $(\Pi_D + R + S + L)_E$ barriers that would have confronted the established firm that would have executed the last expansion in the ARDEPPS in question had entry been barred and the $(\Pi_D + R + S + L)_N$ barriers facing the established firms' best-placed potential competitors at the time of analysis,
(3) the rate at which the relevant barriers rise as one moves down the list of successive best-placed potential expanders in the ARDEPPS in question, and
(4) in practice, though for the most part I have been ignoring this consideration, the extent of any monopolistic QV-investment incentives the successive best-placed potential expanders have to substitute their respective individual expansions for the rival expansion or entry their respective expansions would deter.

In any event, if an equilibrium is established at a QV-investment level that is lower than the time-of-analysis entry-preventing QV-investment level, the most-profitable projects' equilibrium supernormal rate-of-return will equal (1) the supernormal rate-of-return the last entering potential competitor anticipated on its investment *plus* (2) the sum of the $(\Pi_D + R + L)_N$ barriers to entry it faced on that investment. In such situations, the most-profitable projects' equilibrium supernormal rate-of-return will also equal (1) the supernormal rate-of-return the last expanding established firm anticipated realizing on this last investment *plus* (2) the $(\Pi_D + R + L)_E$ barriers to expansion it faced on this investment *plus* or *minus* (3) any QV-investment disincentives or incentives it had to make this investment (which I am assuming to be zero).

* * *

This section defined and diagrammatically illustrated the various intermediate determinants of the intensity of QV-investment competition as well as a number of QV-investment levels that play a role in QV-investment-competition analysis. It also explained and diagrammatically illustrated the relationship between the above determinants and the QV-investment levels in question.

The QV-investment-competition-related vocabulary and analyses this section respectively delineated and executed will be used for many purposes in this study—*inter alia* (1) to demonstrate that market definitions are inherently arbitrary, (2) to articulate the distinction between natural and contrived oligopolistic QV-investment restrictions, (3) to criticize various proposed tests for contrived (or natural or contrived) oligopolistic pricing, (4) to articulate correct definitions of predatory QV investments and predatory cost-reducing investments, (5) to criticize various proposed tests for predatory pricing, (6) to articulate the conditions under which "systems rivalry" will and will not be predatory, (7) to structure the analysis of the impact of horizontal mergers, acquisitions, and joint ventures on QV-investment competition, (8) to reveal the conditions under which and the way in which potential competition will be effective, to criticize the 1992 Horizontal Merger Guidelines' position on this issue, and to criticize various arguments that have been made for the profitability of limit pricing and various ways in which some scholars have claimed limit-price theory could be tested, and (9) to structure the analysis of the conditions under which conglomerate mergers, acquisitions, and joint ventures that do or do not involve potential competitors will decrease QV-investment competition.

* * *

Chapter 2 has defined a large number of concepts that the study will use to analyze a wide variety of micro-economic, antitrust-law, and antitrust-policy issues. As I indicated in this study's introduction, these types of conceptual innovations are neither right nor wrong. The relevant question is whether they are useful. I think that Part II of this study demonstrates the utility of these conceptual innovations by demonstrating that they enable me to formulate important new questions and to give more accurate answers than could otherwise be provided both to those questions and to questions that can be formulated without them.

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http://www.springer.com/978-3-642-24306-6

Economics and the Interpretation and Application of
U.S. and E.U. Antitrust Law
Volume I Basic Concepts and Economics-Based Legal
Analyses of Oligopolistic and Predatory Conduct
Markovits, R.S.
2014, XLV, 761 p. 4 illus. in color., Hardcover
ISBN: 978-3-642-24306-6