

**ADAPTING REGULATION TO EVOLVING COMPETITION IN  
CONTEMPORARY TELECOMMUNICATIONS MARKETS**

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## PRESENTATION OUTLINE

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## 0.0 PRELIMINARY REMARKS

- The views expressed are those of the speaker and do not necessarily reflect the views of the Federal Communications Commission or its staff.
- The theme of the presentation is that:
  - (1) *competition* as an economic concept has different meanings with different implications for regulatory policy;
  - (2) the design and implementation of *efficient regulation* (where the incremental social benefit of government intervention exceeds the incremental social cost of imposing such regulation) should be predicated on a specific, clearly-articulated concept of competition; and
  - (3) regulatory decisions with respect to implementing efficient regulation or deregulation should depend on market-specific circumstances supported by rigorous empirical analysis.
- The role of a state regulatory commissioner is becoming increasingly complex as traditional monopoly regulatory processes are replaced by antitrust-like market interventions. Relevant economic analyses applicable to contemporary regulatory problems have also grown more complex, offering regulators a diverse array of economic tools and concepts in support of the exercise of their statutory responsibilities.

## 1.0 CONCEPTS OF COMPETITION

### 1.1 The Classical View: Behavioral or Conduct-Oriented Concept of Competition [Vickers (1995)]

- Adam Smith viewed the essence of competition as “. . . an *independent striving* for patronage by the various sellers in a market.” [Scherer and Ross, (1990), p. 15] This intuitive meaning of competition stresses “. . . a conscious striving against other business firms for patronage, perhaps on a price basis but possibly also (or alternatively) on nonprice grounds.” [Scherer and Ross (1990), p. 16]
- The conduct-oriented concept of competition, sometimes called *rivalry*, involves the pursuit of potentially incompatible outcomes by buyer and sellers in a market. For example, if Firm A sells X units of output to Customer Z, then Firm B will be unable to sell that portion of Customer Z's demand represented by X units *at that given time*. As Stigler observes, competition viewed from a behavioral perspective is akin to “. . . rivalry in a race,” which implies winners and losers viewed from either a buyer's or seller's perspective. [Stigler (1957), p. 1]
- Rivalry implies an *awareness* by one competitor of the actions of other competitors attempting to sell output in the same market. Thus, Firm A may be aware that other firms, including Firm B, are attempting to sell Customer Z a total of X units of output. Additionally, this awareness may influence the price and other terms and conditions of sale that Firm A offers to Customer Z. Yet rivalry does *not* involve awareness of the conduct of one's competitors sufficient to facilitate *coordination* of seller conduct (collusion) between and among rivals, either formally or informally.
- In practical terms, rivalry as business firm behavior involves identifying and pursuing potential customers; persuading customers to purchase goods or services from one firm rather than a competitor; and winning back former customers lost to a rival. Achieving these *objectives* of rivalry involves specific types of business *conduct* or *practices*, such as price cutting, advertising, or entry into new markets.
- Although business rivalry is motivated by the self-interest of entrepreneurs or, more specifically, the pursuit of profit, such behavior produces socially-beneficial consequences (Adam Smith's “invisible hand”). For example, price cutting as a way to attract the patronage of customers can lead to prices that just equal the marginal cost of production. This equality of price and marginal cost is one requirement for achieving a socially-optimal allocation of scarce resources, although rivalry among sellers is not motivated by this socially-desirable result.

- In terms of methodology, the classical view of competition does not stress a formal or rigorous sense of *market equilibrium*.

## 1.2 The Neoclassical View: Structure-Oriented Concept of Competition

- Although the classical view of competition focused on rivalry, there was some recognition that certain attributes of markets, such as the *number* of rivals competing in the same market, affect the behavior of competitors. This shift of emphasis away from the behavior of buyers and sellers toward the *market conditions* that influence such market conduct leads to a structure-oriented concept of competition. This *neoclassical* view of competition stresses specific *elements* that define market structure, where the relative presence or absence of these elements influences the types of behavior of both buyers and sellers actually observed in a given market.
- The major elements of market structure for any defined market include:
  - (1) the *number* and *size distribution* of buyers and sellers;
  - (2) the degree of *product differentiation* that distinguishes the output produced by one competitor relative to another;
  - (3) the presence or absence of *barriers to entry* by new firms in the defined market;
  - (4) the shapes of *cost curves* of firms supplying the market;
  - (5) the extent of *vertical integration* of firms; and
  - (6) the extent of *product line diversification* among firms competing in the same market.
- Depending on the specific theory advanced, one or more elements of market structure are linked causally to specific types of firm conduct, often the pricing of output.

- *Perfect competition* (or *pure competition* or *price competition*) is a technical, structure-oriented concept of competition that differs from the classical, conduct-oriented notion of rivalry. A market is *perfectly* or *purely competitive* if the number of buyers and firms selling a *homogeneous* product or service is so large, and the market share of any individual buyer or seller is so small, that no single buyer or seller can *individually* and *independently* exert a perceptible influence on market price by varying the quantity of output that it either buys or sells. Table 1 summarizes the market structure and contracting assumptions that imply the fundamental hypothesis of perfect competition, namely, no single buyer or seller can individually or independently exert a perceptible influence on market price.

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**Table 1. Perfect Competition**

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**Market Structure Assumptions**

- Homogeneous and Perfectly Divisible Output
- No Barriers to Entry or Exit
- Many Buyers and Sellers with Negligible Market Share (no industry concentration)

**Contracting or Transactional Assumptions**

- Perfect Information (No Asymmetric Information)
- No Transactions Costs
- No Externalities

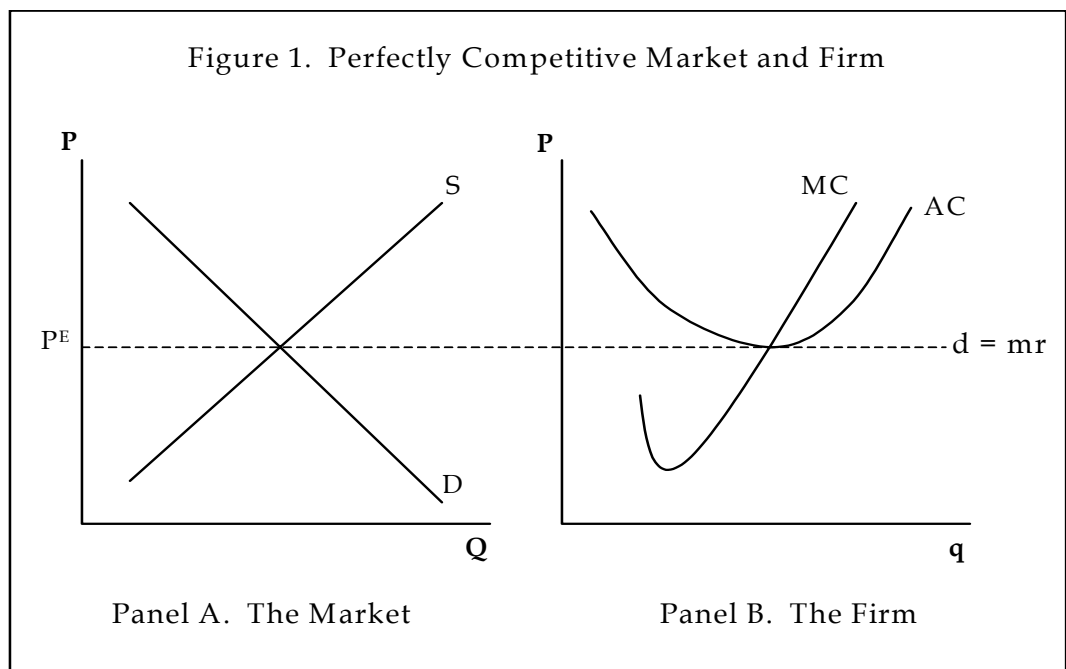
**Hypothesis**

- *Absence of Market Power and Rivalry*: No single buyer or seller can individually or independently exert a perceptible influence on market price.
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- The market structure assumptions of perfect competition foster *substitution* that limits or constrains the exercise of *market power*, the ability to alter prices profitably away from competitive levels, by either buyers or sellers. Thus:

(1) *Homogeneous output* means that buyers can substitute the output of one seller for that of another should any one seller attempt to exercise market power.

- (2) *Free entry*, i.e., the absence of barriers to entry or exit, means that new firms can enter the market to offer buyers additional output substitutes should incumbent sellers attempt to exercise market power.
  - (3) *Many buyers and sellers* means that a buyer may choose among many alternative suppliers, substituting the homogeneous output of one seller for another should any seller attempt to exercise market power.
  - (4) *Perfect information* means that buyers are fully informed of the prices of output produced by competing sellers and will switch to a competing seller if a seller attempts to exercise market power.
- Figure 1 illustrates *equilibrium price* in both a perfectly competitive *market* and for a perfectly competitive *firm*.

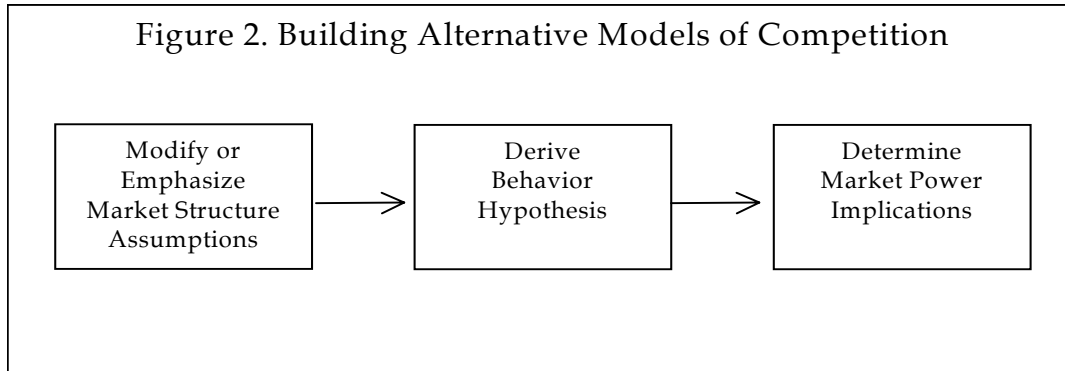


- An empirical measure of market power for a firm is the *Lerner Index* [Lerner (1934); Motta (2004)]

$$L = (\text{Output Price} - \text{Marginal Cost}) / \text{Output Price}$$

Under perfect competition,  $L = 0$ , since output price just equals marginal cost in equilibrium.

- *Alternative models of competition* may be constructed by (1) modifying or emphasizing specific elements of market structure; (2) deriving alternative hypotheses with respect to the conduct of buyers and sellers; and (3) determining implications for market power.



- Some alternative models of competition that analyze competition in different types of real-world markets include:

(1) *Workable Competition* [Clark (1940), (1961)]

Recognizing that perfect competition may represent an austere, unrealistic standard for assessing the state of competition in many, if not most, real-world markets, Clark's concept of *workable competition* proposed a less abstract formulation of perfect competition as a benchmark for assessing competition. Although the concept still persists today in some legal antitrust writings and some public policy discussions of the role of government in markets, most economists favor the application of other models of competition for analyzing the nature and extent of competition.

(2) *Monopolistic Competition* [Chamberlin (1933)]

Markets considered monopolistically competitive include many buyers and sellers like perfect competition, but the output of each firm is *differentiated* in terms of packaging, location, advertising, or some other product or service attribute. This product differentiation limits to some extent the substitutability of one firm's output for another by buyers and gives the firm some degree of market power. Again, like perfect competition, entry into and exit from the market are assumed to be easy, which constrains the extent of market power that product differentiation would otherwise confer upon the firm. Unlike the *perfectly elastic* (flat or horizontal) demand curve facing the perfectly competitive firm, the monopolistically competitive firm faces a downward-sloping demand curve such that equilibrium price is *not* equal to marginal cost.

### (3) *Theory of Contestable Markets* [Baumol, Panzar, Willig (1982)]

The theory of contestable markets shifts the emphasis of market structure away from the number of independent firms actually competing in the market to the *conditions of entry into and exit from the market*. Contestable market theory assumes (a) entry into the market is extremely easy and exit from the market is virtually costless; (b) new firms entering the market can produce at the same per-unit costs as the incumbent firms; (c) firms that exit the market can easily dispose of their *fixed assets* by selling them to other firms without loss or redeploying them to other markets, such as shifting a passenger airplane from one market destination to another. In other words, the investment costs of durable assets essential to producing output in the market are fixed but not *sunk*, i.e., irreversible investments with no opportunity cost in any other deployment. A fundamental hypothesis of contestable market theory is that the possibility of “hit and run” entry, or *potential competition*, where an entrant may enter the market for just one period paying only the one-period rental price of capital, may occur so rapidly that incumbent firms cannot react to the entering firm’s decisions. This behavioral consequence of free and easy entry and exit forces incumbent firms, or an *incumbent monopolist*, to make pricing and output decisions that approximate the results of perfect competition, e.g., zero economic profits notwithstanding that only a few, or perhaps just one, incumbent firms are in the market.

### (4) *Intermodal Competition*

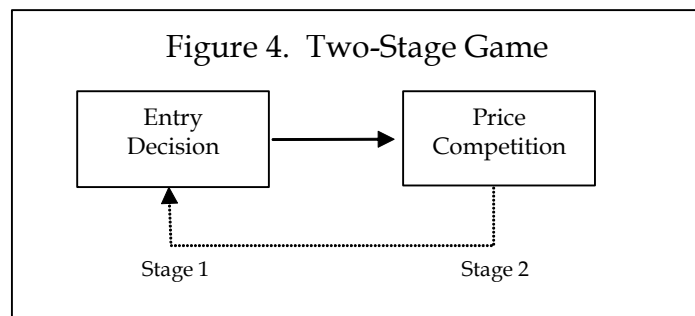
The output of firms in one market or industry may evolve through technical change, innovation, or changes in the cost of production into an effective *substitute* for the output of firms in a different market or industry. If consumers perceive that the product produced in a different market or industry is a *close substitute* for a given product in terms of functionality, quality and unit price, then the ability and willingness of consumers to substitute the new product for the old, should the firm producing the old product attempt to increase its product prices, will constrain the market power of the firm producing the old product. [See Porter (1980), pp. 23-24] Some industry observers contend that wireless telephony as supplied by the wireless industry is now an effective substitute for landline telephone services such that regulation of local telephone services is no longer required. Whether such *intermodal competition* with landline telephone service effectively constrains the market power of incumbent local telephone companies is an empirical question.

- Structure-oriented concepts of competition form a *continuum* from perfect competition to monopoly.

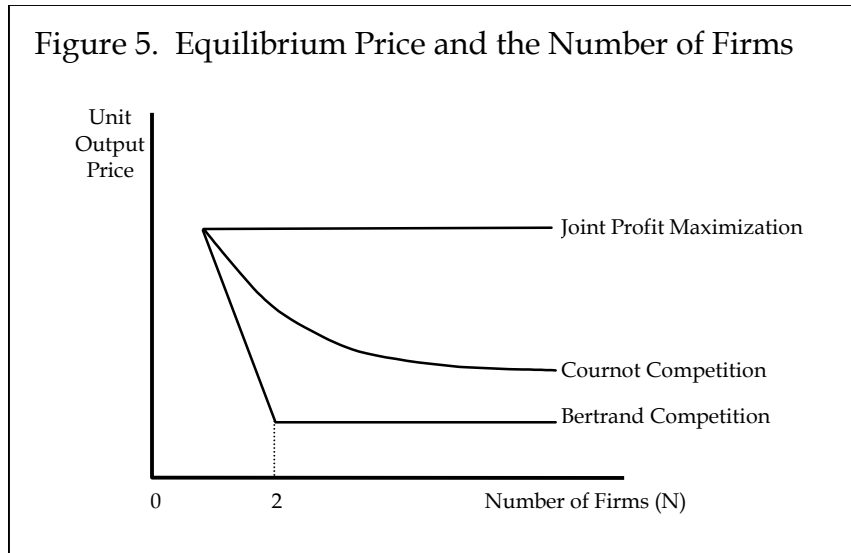
Figure 3. Structure-Oriented Concepts of Competition				
Nature of Output	Number of Firms			
	Many	Few	Two	One
Homogeneous	Perfect Competition	Oligopoly	Duopoly	Single-Product Monopoly
Differentiated	Monopolistic Competition	Oligopoly	Duopoly	Multi-Product Monopoly

### 1.3 Oligopolistic Competition With Sunk Costs [Sutton (1991); Duvall and Ford (2001)]

- Investment in *sunk cost* assets is a characteristic attribute of telecommunications networks that will affect the number of firms entering the market and the nature of price competition following entry.
- Game-theoretic analyses of price competition, where *fixed* and *sunk costs* are important, may be viewed as a *two-stage game* [See Sutton (1991)]



- An entrant's decision-making process may be modeled as two distinct stages: (1) the decision to *enter* the market and to *commit* to making a substantial *sunk cost* in plant capacity; and (2) the decision regarding a *pricing strategy* consistent with the first decision.
- Stage 2 of the entry game analyzes the *intensity* of price competition following entry. Three models of price competition help explain real-world pricing behavior: (1) Cournot competition; (2) Bertrand competition; and (3) joint-profit maximization.



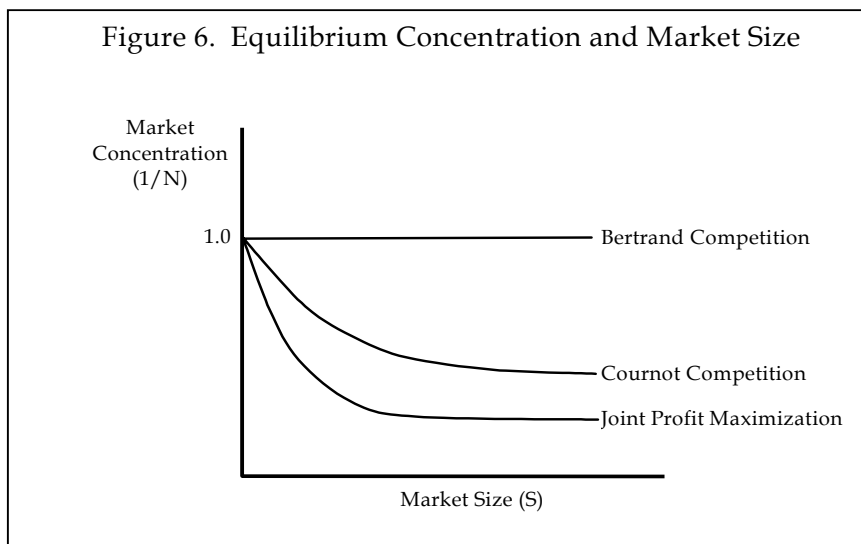
- The decision to enter depends on the *interplay* between the fixed and sunk *setup costs* incurred in Stage 1 and the anticipated *intensity of price competition* that firms face in Stage 2.
- For both Cournot and Bertrand competition, more entrants imply a lower unit price following entry. A lower unit price (for any given number of entrants and level of setup cost) means, however, that entry is *less attractive*.
- Growth in market size (total industry revenues or consumer expenditures) tends to result in less concentration ( $1/N$  becomes smaller as  $N$  increases) if Stage 2 price competition follows either a Cournot or joint-profit maximization model. In these two cases, market structure converges to a *fragmented (deconcentrated) market structure*. Bertrand competition is a limiting case where market concentration remains unaffected by increases in market size. In this case, entry results in such a sharp fall in output price that additional entry is deterred, since economic profit margins will be insufficient to recover the setup costs of more than one firm.

ILLUSTRATION [Sutton (1991)]:

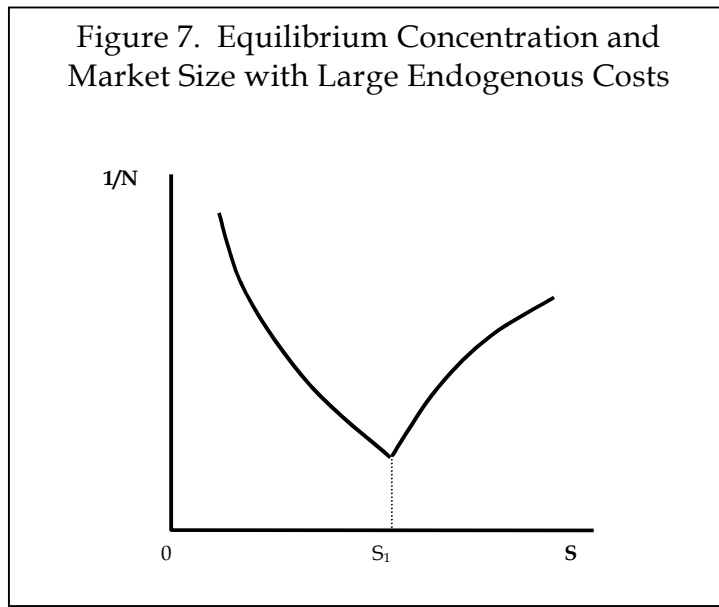
Suppose that market demand for a given product is given by the equation  $X = S/p$ , where  $X$  measures the total quantity demanded of the given product;  $S$  measures total spending for the product and may be viewed as a measure of market size; and  $p$  measures unit market price. In the case of the monopoly joint-profit maximization subgame, total profit,  $\pi_0$ , is jointly produced and, in Sutton's analysis, is invariant with respect to the number of firms joining the cartel. Equilibrium market structure as measured by the equilibrium number of firms,  $N^*$ , requires

that each firm just recover its sunk costs, i.e.,  $\sigma N^* = \pi_0$  or  $N^* = \pi_0 / \sigma$ , where  $\sigma$  measures the setup cost of a firm of minimum efficient scale. In other words, equilibrium market structure will consist of as many firms as the setup costs per firm and total profit,  $\pi_0$ , will permit. (See Sutton (1991) at 33).

Sutton shows that the Cournot second-stage subgame will result in equilibrium profits per firm just equal to  $\pi = S/N^2$ , where  $N$  measures the number of firms. Producing the given product is profitable for the firm so long as  $S/N^2 - \sigma > 0$ . The equilibrium number of firms entering the market is given by the expression  $N^* = \sqrt{S/\sigma}$ , reflecting the substitution  $\pi = \sigma$ . An implication of  $\sqrt{S/\sigma}$  is that growth in market size relative to setup cost increases the equilibrium number of firms,  $N^*$ , producing a more fragmented industry structure. (See Sutton (1991) at 31-32).



- The presence of *endogenous sunk costs*, such as spending on advertising, research and development, and product differentiation in general, may alter the concentration-market size relationship.
- Under *Cournot competition*, market concentration may *increase* as market size *increases* if endogenous costs *exceed* the exogenous sunk costs of market entry.



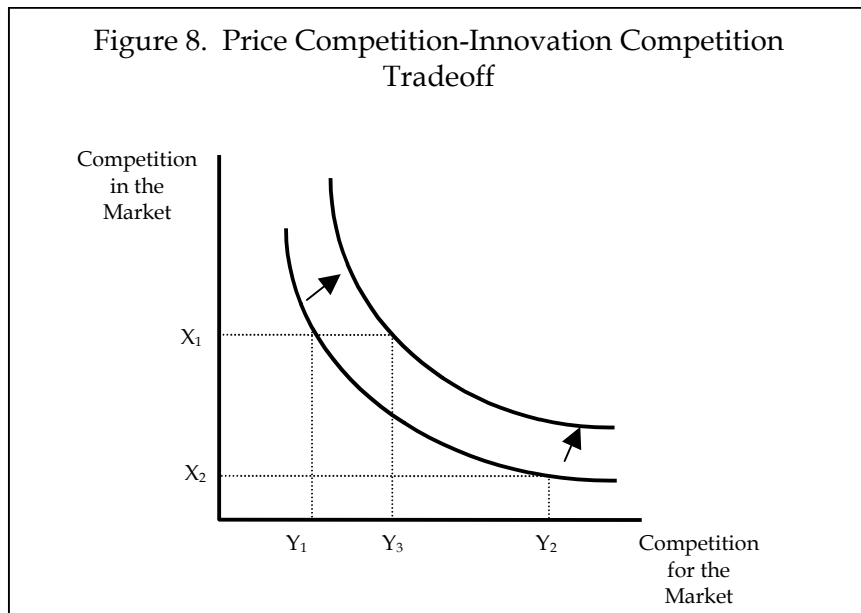
- Given the quantitative significance of both exogenous sunk setup costs and endogenous sunk costs in modern telecommunications networks, it is likely that local telecommunications markets, even in the longer term, will be highly concentrated, notwithstanding public policies intended to foster competitive entry.

#### 1.4 Innovation Competition [Schumpeter (1950); Evans and Schmalensee (2001); Farrell (1997)]

- *Innovation competition* is a dynamic type of competition *for the market* that stresses investment in research and development (R&D), an endogenous sunk cost, to develop new products, services, or features that will make the firm a *market leader* while disadvantaging or eliminating actual or potential rivals that must compete with technically-inferior products or services.
- Markets described as “new economy” or “high technology” often typify innovation competition, where price competition *in the market* is considered as secondary in importance. Although heavy investment in intellectual property may provide the innovation, firm market leadership and dominance, such leadership may only be transitory as a result of the constant threat of major product or service innovations by competitors.
- Telecommunications products and services tend to reflect the attributes of high-technology markets, namely, (1) *network effects*, such that growing acceptance of a product by consumers increases its value to other customers; (2) *economies of scale* in production such that marginal cost is less than average cost; (3) large *uncertainty* regarding the likely

success or failure of new products; and (4) *large sunk costs* in the research and development of new products.

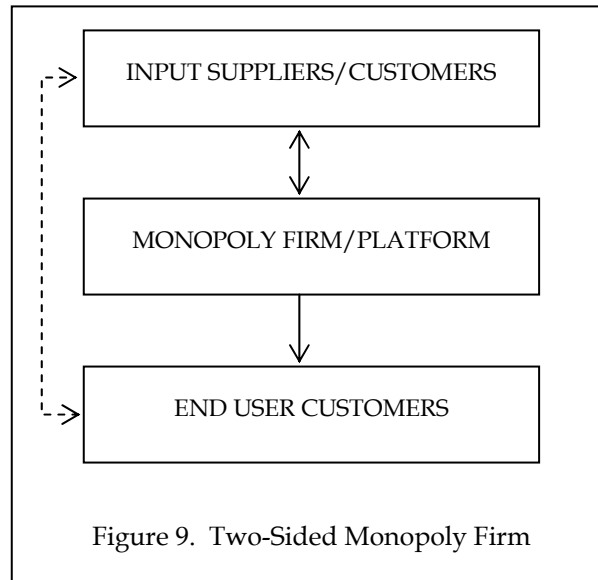
- Competition for the market may be viewed as a dynamic process resulting in “winner take all” outcomes and strong *critical mass* effects.
- The attributes of high-technology markets tend to *limit* the intensity of price competition while *encouraging* firms to leapfrog, preempt, or otherwise introduce product innovations in order to attain market dominance.
- *Both* price competition and innovation competition provide benefits to consumers, although there tends to be a *tradeoff* between the two types of competition.



- In an abstract sense, a mixture of price and innovation competition given by the combination  $X_1Y_1$  may be equivalent in terms of consumer welfare as the combination  $X_2Y_2$ . (Reduced price competition provides a profit incentive for more innovation competition.) Since both increased price and innovation competition benefit consumers, the focus of public policy should be to *shift out* the tradeoff curve linking the two types of competition. This shift permits attainment of a combination such as  $X_1Y_3$ , which maintains price competition at a level represented by  $X_1$ , while increasing innovation completion from  $Y_1$  to  $Y_3$ .

1.5 Two-Sided Markets [Rochet and Tirole (2003); Evans (2003); Parker and Alstyne (2005)]

- Figure 9 illustrates the exchange relationships existing between and among input suppliers/customers, the monopoly firm or *platform*, and end user customers.



- In broad terms, a *two-sided market* is one supplied by a firm(s) or platform(s) that provide(s) a “matchmaking” service to two sets of customers which are dependent on each other. [Rochet and Tirole (2003); Evans (2003)]
- In general, *three conditions* [Evans (2003)] are required for a market to be considered two-sided, namely:

(1) There must exist two or more distinct *groups of customers* served by the platform.

Examples: shopping mall retailers and customers  
shoppers using debit cards and merchants accepting debit cards  
software developers and software users

In many cases, members of one customer group consume a *different* platform service than other customer groups, although the platform products/services are related by the second condition.

- (2) Members of one customer group benefit in some way from the presence of members from some other customer group, i.e., there exist *network effects*, especially indirect network effects.

In general, network effects cause the value of a product to be *greater* as the number of users of the same product *increases*. *Direct network effects* occur if an increase in the *size* of a network increases the number of others that a network subscriber can communicate or interact with. This increase in the number of potential contacts makes network subscribership more valuable or beneficial to the network subscriber since the network subscriber is provided “more product,” i.e., potential points of contact. *Indirect network effects* occur if an increase in the *size* of a network expands the scope and variety of *complementary* products available to network subscribers.

Examples: Video game developers value video game consoles more if the console attracts more users; game players value consoles that support more games.

- (3) Customer groups find it too difficult or too costly to *internalize the network effects* directly on a bilateral basis. Finding a way to *reduce* the high transaction cost of internalizing the network effects creates the business opportunity for a platform operator.

- Four categories of two-sided markets may be identified [Hagiu (2004)]:

(1) *Intermediation Markets*

Platforms in these markets act as *matchmakers*, such as dating services, real estate firms, auctioneers, and stock trading systems. Such platforms are pure intermediaries.

(2) *Audience-Making Markets*

Platforms in these markets serve as *market-makers* matching groups of buyers (audiences) with groups of sellers (advertisers). Markets of this type include yellow page directories, television, newspapers, and Internet portals.

### (3) *Shared Input Markets*

Examples include software for computers, servers, PDAs, and videogames. Platforms in these markets coordinate the demand between two groups of customers. Typically, members in one customer group (users) are interested in a *subset* of products offered by members of the second customer group (application producers or developers) but cannot use them unless a platform is used or acquired (operating system or console).

### (4) *Transaction-based Markets*

Platforms in these markets *meter* all transactions between customer groups on both sides of the market. As a business, platforms in these markets must solve two problems, namely, (1) the platform must get both sides “on board;” and (2) the platform must encourage the two customer groups to generate many transactions. The most prominent example of a platform serving this type of two-sided market is a credit card firm, such as Visa or Mastercard. A credit card has value to customers only if it is accepted by many vendors. Similarly, vendors will only have the incentive to invest in credit card equipment and incur the transaction fees charged by the platform only if a sufficient number of customers accept and use the specific credit card.

- The nature of demand facing a platform operator in a two-sided market differs from that of a firm in a single-sided market. Assuming that the platform operator is a monopoly supplying platform services or access to both sides of the market, the *total* demand for platform access, i.e., the combined demand from both sides of the market, may be conceptualized as the *multiplicative* relationship

$$D_T = D_1(p_1) \times D_2(p_2) \quad (1)$$

where  $D_T$  measures total platform demand;  $D_1(p_1)$  measures the demand for platform access for customer group 1; and  $D_2(p_2)$  measures the demand for platform access for customer group 2. The multiplicative demand relationship captures the economic interaction and dependency that exists between the two customer groups as a consequence of network effects.

- Pricing and costing the output of a platform firm in a two-sided market is more complex than for a firm in a single-sided market. Rochet and Tirole (2003) show that a profit-maximizing platform monopolist supplying a two-sided market will set a *total* price using the formula

$$(p_T - c)/p_T = 1/E \quad (2)$$

where  $p_T = p_1 + p_2$ , and  $E$  measures the own-price elasticity of total platform demand.  $E$  is the *sum* of the separate own-price elasticities of demand for the two customer groups, i.e.,  $E = E_1 + E_2$ . The per unit variable cost of supplying platform access is measured by  $c$ , where  $c$  is viewed as joint cost with respect to both customer groups. With respect to the *total* price of platform access, the profit-maximizing monopoly pricing rule for a two-sided market is formally the same as the Lerner rule for a one-sided market.

- While equation (2) determines the profit-maximizing total price, an additional rule is necessary for determining the optimal *allocation* of total price,  $p_T$ , between the two customer groups. Rochet and Tirole (2003) show that in equilibrium the ratio of prices for the two sides of the market is proportional to the ratio of the own-price elasticities of demand for each side of the market or, equivalently,

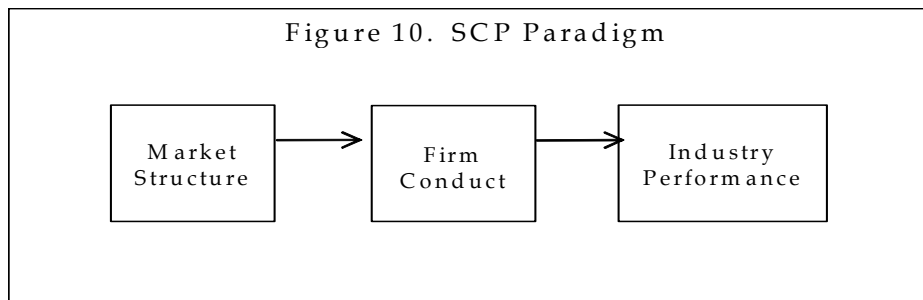
$$p_1/E_1 = p_2/E_2 \quad (3)$$

- The relationship in equation (3) helps explain the different *business models* that are observed in real-world two-sided markets.
- A significant issue is whether the *price structure* adopted by platform firm where one side often appears to subsidize the other is socially *inefficient*.
  - Rochet and Tirole (2003) find that the price structure adopted by a monopoly platform firm, a platform facing competition, and a benevolent social planner would be similar (actually identical if demand curves are linear).
  - As a theoretical matter, it does not appear that charging one side of a market a relatively *low* price and one side of the market a relatively *high* price is inherently inefficient.

- Firms in concentrated, multi-sided markets still may be able to set price levels which result in supra-competitive profits, i.e., profits that exceed those required to attract capital after adjusting for risk.

## 2.0 REGULATORY IMPLICATIONS OF ALTERNATIVE CONCEPTS OF COMPETITION

### 2.1 A Framework for Normative Competitive Analysis: Structure-Conduct-Performance (SCP) Paradigm [Bain (1956); Scherer and Ross (1990)]



- *Demand-Size Basic Conditions.* Own-price elasticity of demand, nature and extent of product substitutes, rate of demand growth through time, cyclical and seasonal character of product demand, methods of purchasing, marketing practices.
- *Supply-Side Basic Conditions.* Nature and extent of technological change, the availability of raw materials, the extent of unionization of the relevant labor force, product durability, business attitudes, laws and public policies affecting a given industry.
- *Market Structure.* Number of buyers and sellers, extent of product differentiation, barriers to entry, cost structure (ratio of fixed to variable costs), economies of scale, extent of vertical integration.
- *Firm Conduct.* Pricing behavior, product strategy and advertising, extent of research and development and product innovations, extent of investment in plant and equipment, legal tactics.
- *Industry Performance.* Static and dynamic economic efficiency, technical efficiency, full employment, equity.

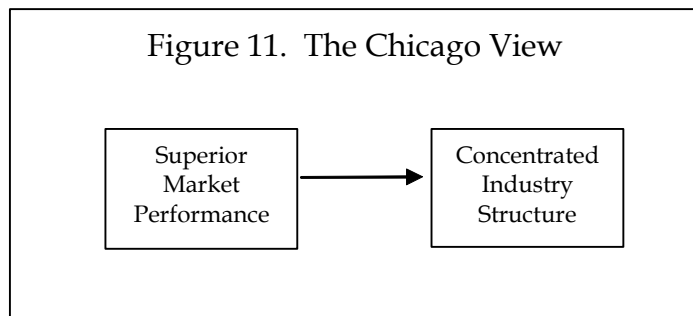
### 2.2 Theory of Economic Policy [Tinbergen (1952); Acocella (1998)]

- Designing and implementing regulatory policies for improving market performance can be approached systematically, with a logical structure that can test the internal consistency of proposed policies and rules.

- The theory of economic policy, both macroeconomic and microeconomic, stresses the careful identification of all policy *targets* or *objectives* and all *instruments* available to policymakers for achieving the identified objectives. Instruments should be paired with targets to reflect the *efficiency* of the instrument in attaining the target.
- In general, successful implementation of policy requires *at least* as many instruments as targets.

### 2.3 Implementing Efficient Regulation [Laffont and Tirole (2000)]

- *Conduct-Oriented Concept of Competition:* Minimal role for regulation or government intervention generally; enforcement of property rights and terms of contract would be within the appropriate scope of government intervention in market exchange.
- *Structure-Oriented Concept of Competition:* Market power with its adverse effects on market performance, i.e., reductions in the quantity produced and increases in unit price, emerges in various structure-oriented models of competition as a consequence of the presence or absence of certain elements of market structure, such as barriers to entry. Policies and rules that reduce, modify, or eliminate such adverse elements of market structure should improve market performance, so long as the forecast incremental social benefits of the regulatory market intervention exceed the incremental social cost of implementing the regulation. The *Chicago School of Antitrust* [Alchian (1950), Posner (1972), Stigler (1971)] challenges the inference derived from the SCP paradigm that conduct and market performance are strictly related to market power. Viewing competition as rivalry, Chicago advocates contend that a variety of market structures can produce efficient outcomes. For example, achieving productive efficiency may require large economies of scale with large firms such that a highly concentrated industry may be highly efficient. The Chicago view asserts that markets behave in most cases *as if* they are competitive and in long run equilibrium. Monopolies persist only because they are efficient, not because they exercise market power to disadvantage potential efficient rivals.



- *Oligopolistic Competition With Sunk Costs*: Given the large fixed and exogenous sunk costs required for market entry, the number of firms likely to enter capital-intensive industries, such as telecommunications, is likely to be small, assuming a lack of “irrational expectations” respecting investment decisions. Observed market power will depend on the type of price competition observed in the second-stage pricing game, ranging from collusive monopoly to intense price competition. If endogenous sunk costs exceed the exogenous sunk investment costs of market entry, then the focal point of competition among rivals will tend to be *product quality* or *innovation* rather than price competition. Efficient regulation will be narrowly scoped under such circumstances, restricted to ensuring accurate product or service information for consumers. If rivals are facilities-based telecommunications networks, efficient regulation should focus *interconnection arrangements* among networks, *inefficient discriminatory behavior* by incumbent networks, and *efficient pricing of network access* (intercarrier compensation) if incumbent networks supply unbundled network facilities and services on a wholesale basis to other networks which compete with the incumbent in retail telecommunications services markets.
  
- *Innovation Competition*: In the short term, market power may be endemic in markets where innovation competition tends to dominate over price competition. If perfect competition is taken as the benchmark for assessing market performance, then innovation competition likely implies substantial *static economic inefficiency* (since output prices differ markedly from a marginal cost). This loss in static economic efficiency may be offset in part, or entirely, by welfare gains in the form of dynamic economic efficiency resulting from technological change and innovation. The role of efficient regulation in markets dominated by innovation competition is complex, problematic, and case-specific for several reasons:
  - (1) The persistence of market power in high-technology industries can be viewed as a *necessary condition* for dynamic competition. Such market power, however, is ultimately dissipated over the longer term by the innovations of competitors.
  
  - (2) High market concentration, high rates of return, and prices well above marginal cost are *characteristic* of high-technology markets. Consumer welfare in high-technology markets is probably more closely linked to a continuing stream of product innovations than vigorous price competition.

Appropriate focal points of regulatory or antitrust intervention in dynamically-competitive markets may include (1) collusive pricing agreements among competitors; (2) licensing terms and conditions with

firms in a vertical relationship; and (3) vertical relationships more generally.

- *Two-Sided Markets*: As a result of network effects and the fixed and sunk costs of creating a platform business, the number of platform competitors tends to be small. The fewness of competitors and the existence of network effects raise issues concerning the efficacy of competition in multi-sided markets and the possible role for government intervention. Pricing and investment strategies of platform firms focused on “getting all sides on board” and “balancing the interests of all sides” raise new competition issues relative to one-sided markets.

Some implications for efficient regulation in two-sided markets include the following:

- (1) Prices on each side of a multi-sided market do not track costs or demand on that side alone: benefits and costs arise *jointly* over multiple sides of the market.
- (2) Price on one side of the market without consideration of the prices on other sides is not meaningful: changes in demand or cost on one side of the market affect the level and structure of prices on other sides of the market.
- (3) Platforms and their products cannot exist unless all sides are brought “on board.” Pricing and investment strategies will, therefore, tend to differ from one-sided markets.
- (4) Assessing the social welfare consequences of observed competition in platform industries should account for the pricing level, price structure, and alternative organizational arrangements for getting all sides on board.

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