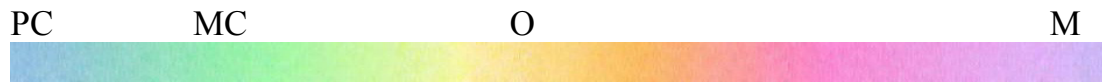


Chapter 13. OLIGOPOLY


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No class on December 3, 2009


In the spectrum of market organizations, there are two extremes. In terms of the number of firms, **monopoly** is on one extreme end of the market, and **perfect competition** lies on the other extreme. Monopolistically competitive markets and oligopolistic markets lie somewhere in between these two extremes.



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| <p>DEFINITION</p> <p>What is oligopoly?</p> | <p>“Oligopoly” comes from the Greek words, oligos = few, polein = selling. Thus, it is a market structure in which (i) there are a few sellers who are price setters. (ii) mutual interdependence exists among firms.</p> |
| <p>Are there entry barriers?</p> | <p>Some. If there were no entry barriers, there would be lots of firms. There must be significant entry barriers so that only a few sellers overcome the barriers.</p> |
| <p>Are patents entry barriers in oligopoly?</p> | <p>No. If there were patents, there would be only one seller (monopoly). Thus, oligopoly arises from large capital costs or economies of scale. Some firms over the hurdle but others don't. Accordingly, only a few firms survive in this environment.</p> |

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| <p> How do oligopolists split the market demand?</p> | <p>Demand Curve</p> <p>That is a fundamental question. There is a lot of uncertainty, because the behavior of other firms are not predictable.</p> |
| <p>If their behaviors are not predictable, how do we predict the outcome?</p> | <p>We can make certain assumptions, and depending on the assumptions, we can predict prices and outputs.</p> |

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|  <p>Is there a way to figure out price and output independent of other firms?</p> | <p>No.</p> <p>Mutual Dependence exists because the profit of a firm depends not only on its own output but also those of the rivals.</p> |
| <p>Do you mean the optimal output and price of an oligopolist depend on what the rivals will do?</p> | <p>Right.</p> |
|  <p>Then one's demand and marginal revenues also depend on what the rivals will do.</p> | <p>Thus, it is important to guess the rival's reaction to one's move.</p> |
| <p>Give me an example of oligopolistic industries.</p> | <p>Certamente!</p> <p>Examples of Oligopolistic Industries Commercial airplanes: Boeing, Airbus, McDonnell Douglas, Lockheed. Serials: Kellogg, General Mills, Quaker Oats. Beverage: Coca-cola, Pepsi, 7-up.</p> |
| <p>Do oligopolists manipulate only prices and outputs?</p> | <p>Surely, prices and outputs are important variables, but they are not the only tools or weapons.</p> |
| <p>What other tools do oligopolists have?</p> | <p>Almost anything!</p> <p>Oligopoly is like an Olympic game without rules, or a bunch of states during competing during the Warring States period (480 – 221 BC) in China.</p> <p>Anything goes!</p> |
| <p>I don't have a clue.</p> | <p>It is like playing games among people.</p> |
| <p>Then we can start with a game played between two people or two firms.</p> | <p>Why don't we start with a married couple?</p> |


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| What do you mean? | What is marriage? |
| I think, it is an agreement between man and his wife. | Right! |
| Not necessarily. | Do they always stick to the agreement? |
| But what has that got to do with oligopoly? | Some married couples get along fine. Likewise, some duopolies play cooperative games. |
|  What if they do not cooperate? | Then they play non-cooperative games. |
| They can also cheat! | Now you are on the right track! |
| They can also make agreements and break? | Right. Do you remember Japan's attack on Pearl Harbor? |
| No, but I learned about it. So you mean oligopoly is like war between states, and anything goes. | Absolutely. If Pepsi wants to introduce a new diet cola, it has to consider the reaction of Coca-cola. |

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| Empirical measures of Oligopoly | |
| How does one tell an oligopolistic industry from competitive markets? | <ul style="list-style-type: none"> • 4 Firm Concentration Ratio <p>The 4-firm concentration ratio is the percentage of industry output accounted for by the industry's largest four firms.</p> <p>This ratio varies from 0 to 100. If it is almost zero, the industry is competitive. If it is 100, then the four firms comprise the entire industry.</p> |
| The higher the index, the less competitive the industry is. | Right. |

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| | As the CR ratio increases, it is more likely for the firms to collude against consumers. |
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1982 Census of Manufacturers, US Department of Commerce



| Firms | Four firm CR | Number |
|-----------------------|--------------|--------|
| <u>High CR (40 +)</u> | | |
| Motor v/bodies | 92% | 284 |
| Cereal | 86% | 32 |
| Cookies | 59% | 296 |
| TV | 49% | 430 |
| <u>Medium CR</u> | | |
| Petroleum | 28% | 282 |
| Pharmaceutical | 26% | 580 |
| Mobile Homes | 24% | 261 |
| <u>Low CR</u> | | |
| Women's dress | 6% | 5,490 |
| Nuts and Bolts | 13% | 780 |

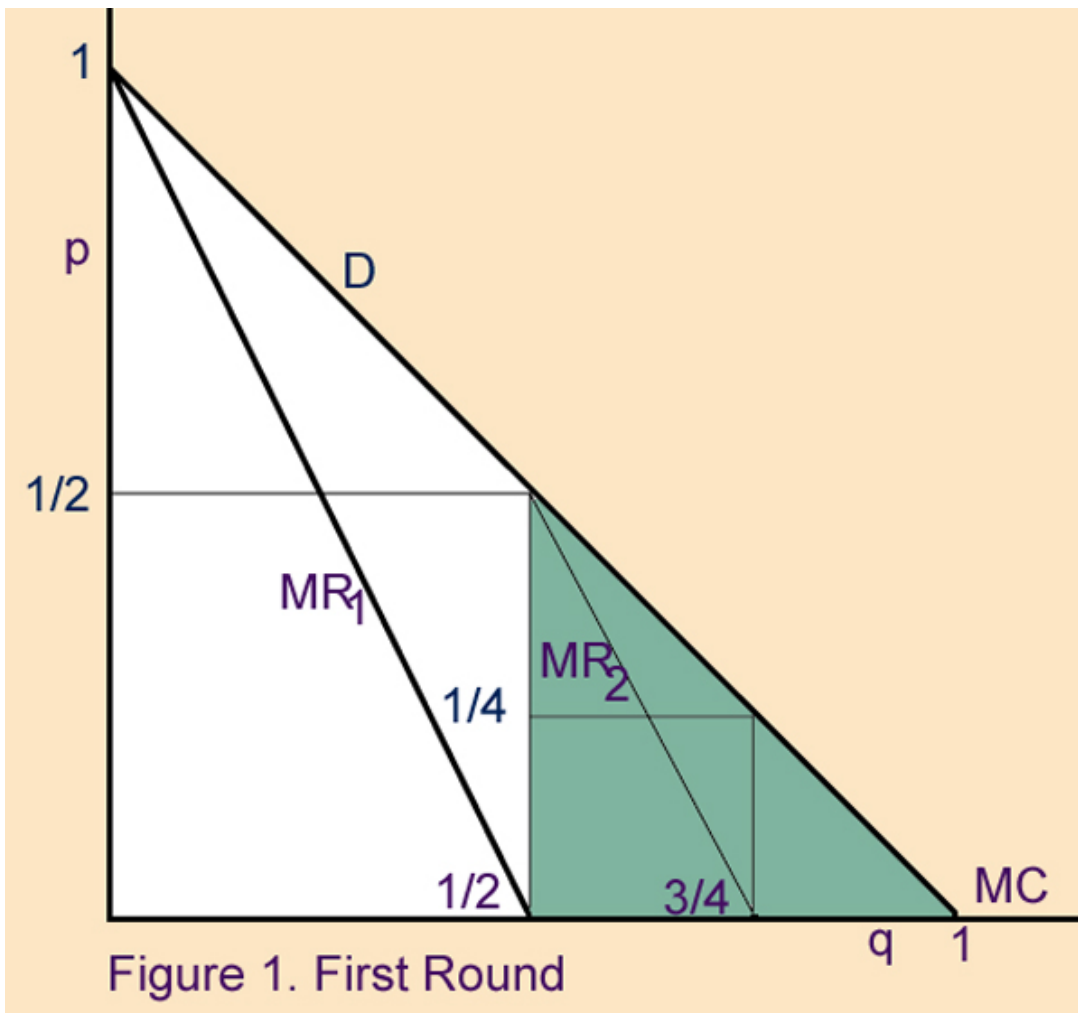
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|  Paul Krugman, I hear, received a Nobel prize for his theory of monopolistically competitive market. How does it differ from Oligopoly? | <p>Oligopoly versus Monopolistic Competition</p> <p>First, Oligopoly exists because of <i>significant entry barriers</i>. e.g., economies of scale. Relatively few sellers dominate the industry. In MC, entry of firms is easy, and a large number of firms compete each other.</p> |
| What about the product differentiation? | <p>In theory, there could be homogeneous oligopoly and differentiated oligopoly. However, in practice, there are few industries in which oligopolists produce homogenous products.</p> <p>In a monopolistically competitive market, products are differentiated.</p> |
| Are firms mutually interdependent? | Not in a monopolistically competitive market. |
| What about prices? | In oligopoly, prices are relatively rigid; they do not change frequently, except when there are price wars or when |

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| | there is collusive price fixing. In MC, prices can change frequently. |
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Price and Quantity Determination in Duopoly

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| <p>We can start with duopoly? What kinds of models describe prices and outputs in a duopolistic market?</p> | <p>COURNOT'S SOLUTION</p> <p>The French mathematical economist Antoine Cournot published his theory of duopoly in 1838.</p> <p>Although most of his models were crude and involved very unrealistic assumptions, his method of analysis has been useful for subsequent theoretical development in the area of oligopoly.</p> |
| <p>What are the assumptions?</p> | <p>Cournot's model is a very special example of two-person game. Even when there are two players, in the real world there are no rules again.</p> <p>Cournot's model is an example of games in which players make moves sequentially. If there are two players, A and B, A makes the first move, A_1, then B responds by B_1. In the second round, A_2 and B_2, and so on. It is like playing chess.</p> |
| <p>In the real world, a player can make several moves at a time, as in boxing.</p> | <p>Right.</p> <p>If several actions can be combined as one move, then the model still applies.</p> |
| <p>So what are the assumptions?</p> | <ol style="list-style-type: none"> 1. There are two profit-maximizing duopolists. 2. Both duopolists produce an identical product. 3. Both duopolists sell at identical prices. 4. Duopolists act independently |

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| | <p>without collusion.</p> <p>5. Each duopolist assumes that the rival's output will remain unchanged.</p> |
| <p>The last assumption might be problematic.</p> | <p>Right.</p> <p>When the game is played many times, the players will soon learn that rivals almost always respond. The last assumption is very naïve because it implies that the duopolists do not learn from experience. But this assumption gives a deterministic solution to the problem.</p> |
| <p>What products do they produce?</p>  | <p> In Cournot's example, two firms produce mineral water from two adjacent springs, produced at zero marginal cost.</p> |



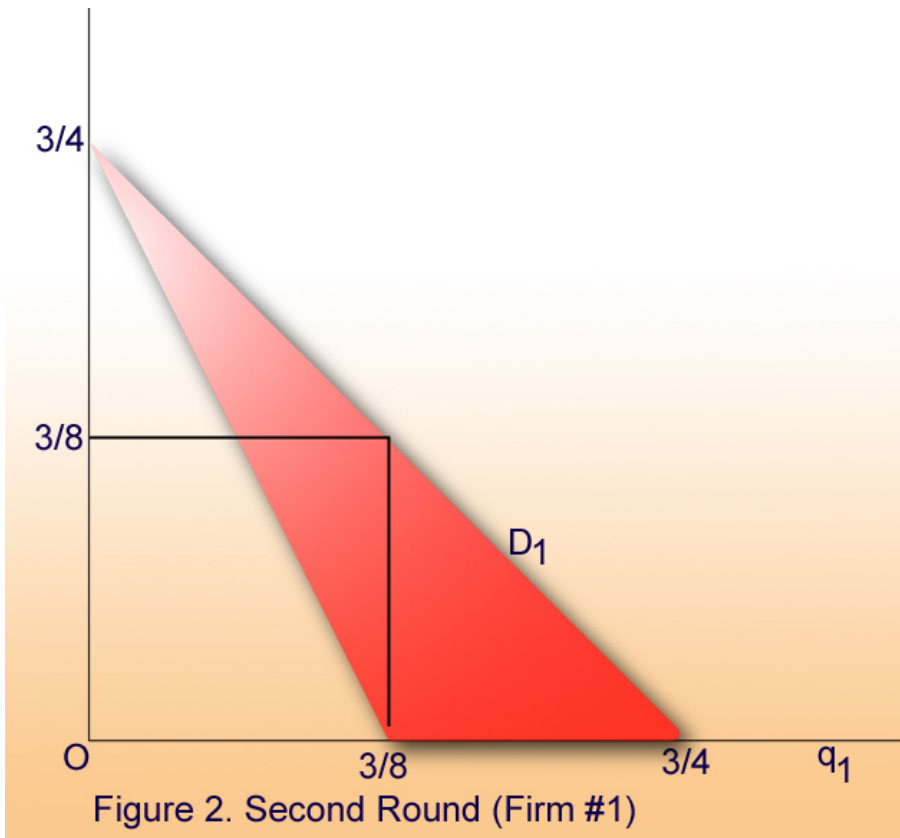
The First Round

In the morning, Firm #1 opens his business, selling mineral water. Production cost is zero, and hence marginal cost is also zero. Each consumer brings his bottles. His demand curve has a vertical intercept, equal to 1, and the horizontal intercept is also 1. From this demand curve, Firm #1 derives MR curve, which intersects MC at $q = \frac{1}{2}$. Price is also $\frac{1}{2}$.

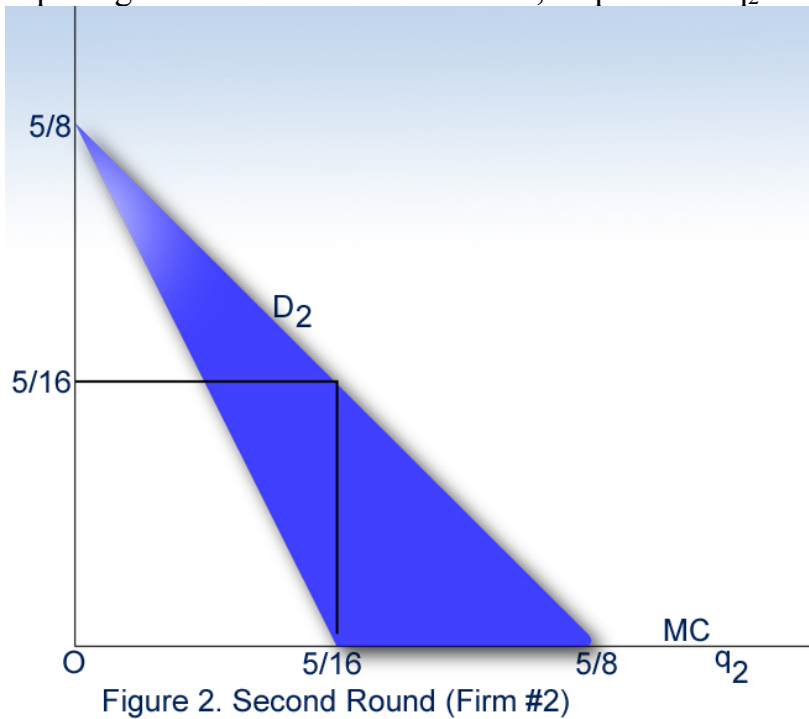
In the afternoon, Firm #2 inspects the market and assumes Firm #1's output is $\frac{1}{2}$. Thus, he sees the remaining (blue) area as his demand curve. His MR curve intersects MC curve at $q = \frac{1}{4}$. His price is also $\frac{1}{4}$.

Second Round:

In the morning, Firm #1 recognizes Firm #2 has entered the market, noticing his output ($\frac{1}{4}$). He subtracts this from the entire market. Firm #2 perceives that his demand curve now has a vertical intercept, $\frac{3}{4}$ ($= 1 - \frac{1}{4}$). The new MR curve intersects MC curve at $q = \frac{3}{8}$. Accordingly, price is equal to $\frac{3}{8}$.



In the afternoon, Firm #2 notices that Firm #1 reduced his output by $1/8$. Accordingly, Firm #2 perceives his demand curve increased to $5/8 (= 1 - 3/8)$. Equating the new MR curve with MC, he produces $q_2 = 5/16$.



You now notice that in the second round, Firm #1 reduced his output and Firm

#2 increased his output. On the third round, Firm #2 again notices that Firm #1 increased output and adjusts his production, and Firm #2 responds to this change. This process goes on and on.

Sequence of Outputs

| Firm | 1 st round | 2 nd round | 3 rd round | 4 th round | ... |
|------|-----------------------|-----------------------|-----------------------|-----------------------|-----|
| I | 1/2 | -1/8 | -1/32 | -1/128 | |
| II | 1/4 | +1/16 | +1/64 | +1/256 | |

I: 1/2 -1/8 -1/32 -1/128 - ...

II: 1/4 + 1/16 + 1/64 + 1/256 + ...

Equilibrium output of firm 2

$$y_2 = b + b^2 + b^3 + \dots$$

$$by_2 = b^2 + b^3 + b^4 + \dots$$

Then $y(1-b) = b$. Thus,

$$y = \frac{b}{1-b}.$$

Thus, firm 2's output is $y_2 = b/(1-b) = 1/4 \div 4/3 = 1/3$. Since the two firms are symmetric with zero costs, industry output is $Q = 2/3$.

If there are three firms, industry output = 3/4.

If there are N firms, then an oligopolist's output is:

$$\frac{1}{N+1}.$$

The industry output is:

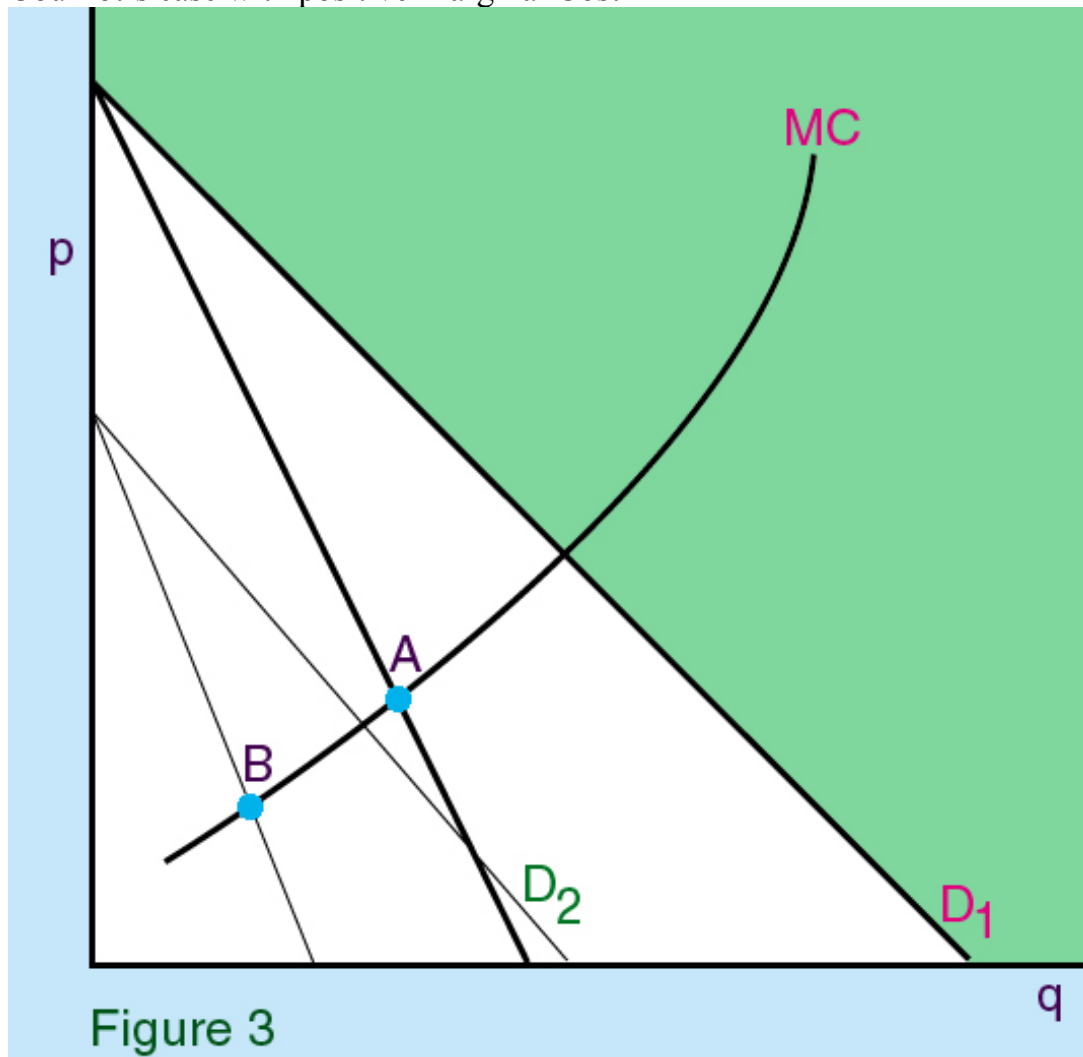
$$\frac{N}{N+1}.$$

If N is very large, i.e.,

$$\lim_{N \rightarrow \infty} \frac{N}{N+1} = 1.$$

Thus, as the number of firms approaches infinity, industry output approaches 1, which is the output of a perfectly competitive market.

Cournot's case with positive Marginal Cost



First Round:

D_1 = Firm 1's demand. Firm 1's output occurs at point A. Subtracting this output from D_1 , Firm 2 faces the demand curve D_2 . Its optimal output occurs at point B.

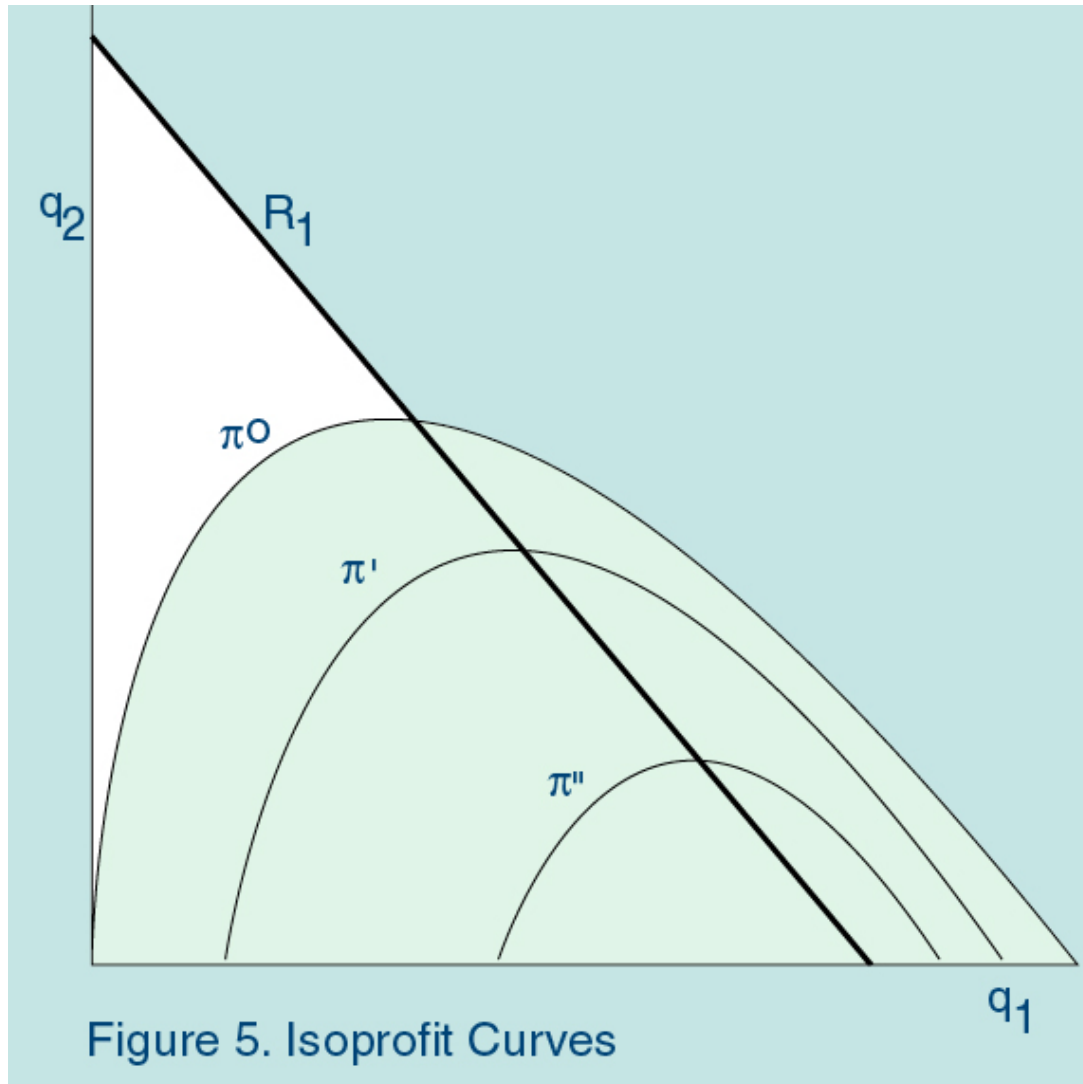
Second Round:

Firm 1 derives its demand curve by subtracting the output at point B and repeat the above process, and so and so on.

Reaction Functions (Curves)

RF is also called the *best response function*. For instance, R_1 is Firm 1's best response to Firm 2's output. Thus, it depends on its rival's output, and is written as $R_1(q_2)$. Similarly, the best response function of firm 2 depends on its rival's output, and hence is written as $R_2(q_1)$. Cournot equilibrium occurs at the intersection of the two reaction functions.

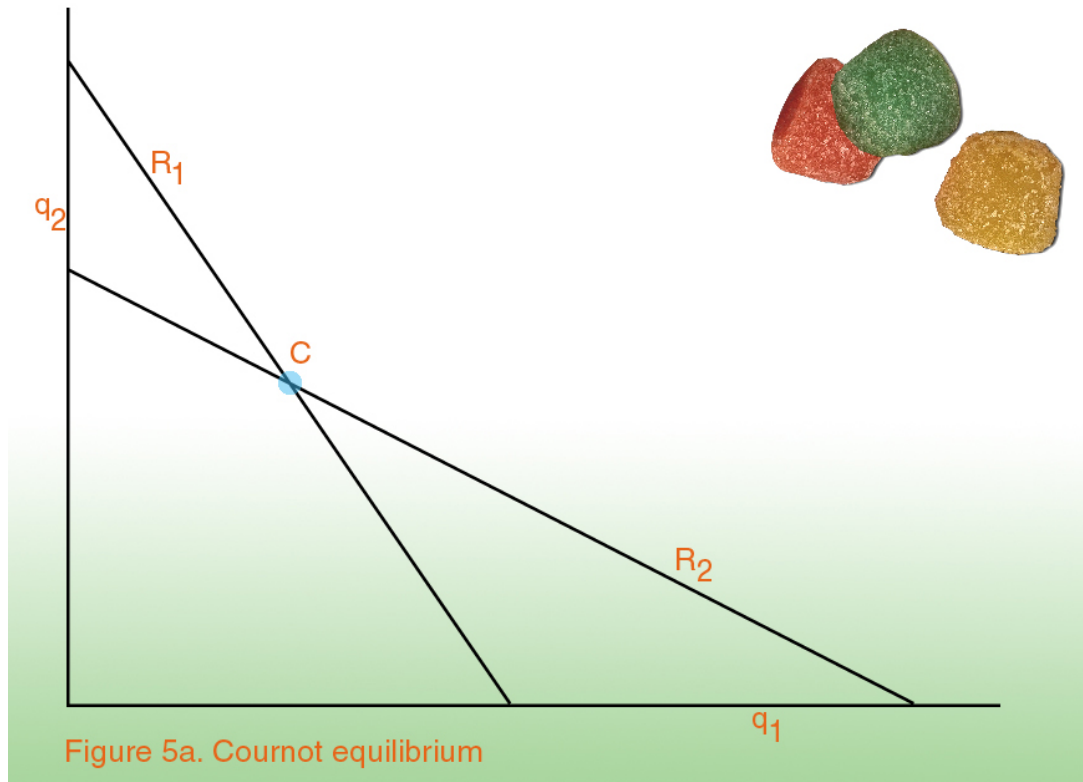
Derivation of Reaction Functions.



Each point on Firm #1's reaction curve is a tangency point between his isoprofit curve and a horizontal line (because he assumes that Firm #2's output is given). Similarly, each point on Firm #2's reaction curve is a tangency point between his own isoprofit curve and a vertical line (because he assumes Firm #1's output is given and does not respond to a change in his output).

Cournot Equilibrium

CE is the intersection of two reaction curves.



BERTRAND

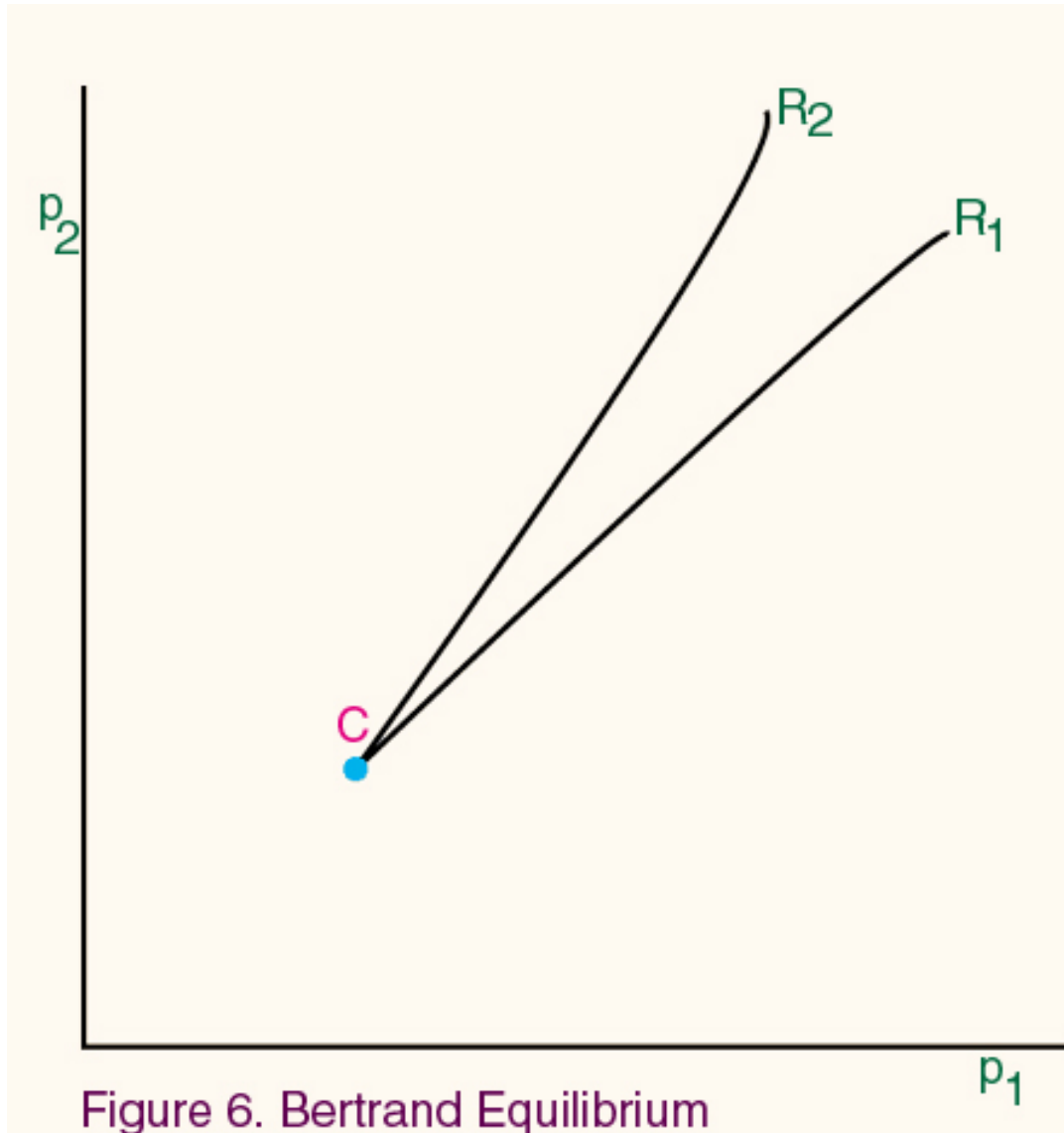
Cournot's model is based on the assumption that duopolists use quantity as the strategic variable. Cournot's assumption that each firm believes that the rival firm will not change its output was criticized by a French mathematician Joseph Bertrand in his review of Cournot's book in 1883.

Bertrand argued that a more realistic assumption is that each firm believes that the rival firm will not change its price. He further added the assumption that each duopolist has sufficient capacity to satisfy the entire market.

To make the story more interesting, assume that the duopolists have constant costs, i.e., average cost is equal to marginal cost. In this case, firm I starts with the monopoly price. Firm II then enters the market reducing the price somewhat, and captures the whole market.

Firm I then lowers the price below that of Firm II, and captures the market and so on. Finally, the price war ends at point C, where price is MC for both firms, and the total output is equal to the competitive market. Once price is equal to marginal cost, neither firm can undercut its rival, because it would be incurring a loss.

Reaction curve R_1 is slightly below the 45 degree line (not drawn) as Firm 1 charges a price slightly below that of its rival. Similarly, R_2 is slightly above the 45 degree line.



BRUCE EINHORN

GOOD TIMES FOR CHEAP CELL PHONES (BW, MAY 11, 2009)

Shenzhen, China - Give Hou Weigui credit for not letting something like a global economic crisis get in the way of big plans. The 67-year-old founder and chairman of Chinese telecom equipment maker ZTE is trying to transform his company into the mainland's most successful consumer-focused multinational. In the past two years, ZTE has come out of nowhere to become the world's No. 6 maker of cell phones, and it's growing fast. "We still have a long way to go," Hou allows. But, he adds, "in five years we hope we can become No. 3."

That would put ZTE in the same rarefied territory as Nokia ([NOK](#)) and Samsung. Pretty ambitious for a little-known company from Shenzhen, just north of Hong Kong. Hou's ambitions, though, aren't far-fetched. Two of the top five—Sony Ericsson and Motorola ([MOT](#))—are stumbling even as ZTE powers ahead. On Apr. 23 the company said earnings for the first quarter grew 29%, to \$11.5 million, on a 35% increase in sales, to \$2.6 billion. For the year, profits are likely to grow 28%, to \$312 million, as revenues jump 26%, to \$8.2 billion, Goldman Sachs ([GS](#)) estimates. The company's Hong Kong-listed shares are up 72% this year.

Since carriers worldwide already buy networking gear from ZTE, Hou figures he can persuade them to buy his handsets, too. Vodafone Group ([VOD](#)) and Australia's Telstra are among the companies that now sell ZTE phones, often dropping the ZTE name in favor of their own brands. Larger handset makers typically don't want to do that because they make more money on branded products, but Hou is willing to sacrifice some earnings to gain market share. ZTE "obviously is undermining the profitability of many manufacturers," says Jake Saunders, an analyst at ABI Research in Singapore.

Chinese companies have tried to climb into the big leagues before, with mixed results. Computermaker Lenovo Group ([LNVGY](#)) acquired IBM's ([IBM](#)) PC division in 2005 and quickly jumped to the No. 3 position globally. The company poached executives from No. 2 Dell ([DELL](#)) and set its sights on the U.S. and Europe. But Lenovo has since stumbled, falling behind Taiwanese rival Acer. Television and cell-phone manufacturer TCL bought Thomson's TV business in 2003 and Alcatel's handset unit in 2004, but it has also struggled.

ZTE, by contrast, resisted the temptation to grab down-on-their-luck Western brands. Hou says he never really considered buying Motorola's handset business, despite speculation last year that ZTE might snap up the troubled division to kick-start its global push. "Some Chinese companies are too eager to go overseas" via acquisition, he says. Instead, he focused on building ZTE's business organically, starting with handset sales in China—where business is now booming—then moving to developing markets across Asia and Africa.

Now ZTE is targeting Europe and North America with higher-end phones. Vodafone, Canada's Telus ([TU](#)), and 3 Italia are all selling ZTE's 3G handsets or smartphones, and Texas-based MetroPCS Communications ([PCS](#)) is considering doing so. Hou's ambitious growth plans will surely be helped by a five-year, \$15 billion credit line from state-owned China Development Bank to build business overseas.

Hou argues the shaky economy, both in China and around the world, actually gives ZTE an advantage even with more advanced phones. During hard times, "people still need to buy handsets," he says. "But they tend to pay more attention to cost."

AN ALL-OUT ONLINE ASSAULT ON THE IPHONE

(April 6, 2009) [Free Library](#)

On Apr. 1, [Mike Lazaridis](#) **Mihal "Mike" Lazaridis** (born 1961, Istanbul, Turkey) is the founder and co-CEO of Research In Motion (RIM), which created and manufactures the BlackBerry wireless handheld device. He is also the chancellor of the University of Waterloo, and an Officer of the Order of Canada.

..... Click the link for more information., co-CEO of Research in Motion, is expected to take the stage at the wireless industry's annual trade show in [Las Vegas](#) Las Vegas (lās vā`gəs), city (1990 pop. 258,295), seat of Clark co., S Nev.; inc. 1911. It is the largest city in Nevada and the center of one of the fastest-growing urban areas in the United States. and open the virtual doors to a much anticipated new online store. BlackBerry App World will be chock-full of software programs created by outside developers that visitors will be able to download to their RIM phones.

It's the first of several major assaults by rivals on Apple's fast-growing iPhone business. Apple has [stoked](#) stoked (*adj. Slang* **1.** Exhilarated or excited. **2.** Being or feeling high or intoxicated, especially from a drug. demand for the device by offering thousands of software applications from independent developers through its App Store. Now, Nokia, Microsoft, and Palm plan to follow RIM with virtual software stores of their own this year. "There's going to be a significant counter-challenge to Apple," says Mike McGuire, analyst with researcher Gartner.)

Nokia, RIM, and others sell more phones than Apple. But Apple has leapt out to an early lead in transforming the mobile phone into a sophisticated computing device onto which people load their favorite software. The number of mobile phones that can browse the Web and handle other advanced tasks is expected to surge from 139 million last year to 295 million in 2010, according to Gartner. These so-called smartphones are on track to eclipse the 300 million-unit personal computer market. "This could make the PC wars of the 1980s look like small potatoes RIM may seem an unlikely contender in this fight. Its BlackBerry is often dismissed as the utilitarian, slightly boring alternative to the stylish iPhone. But RIM is taking aim at the one clear weakness in Apple's approach--the [paltry](#) profits for developers who create software for the iPhone. RIM plans to make the business more lucrative for developers, to lure them away from the House that Jobs Built. "RIM's strategy is defensive," notes Anil Doradla, an analyst with [William Blair](#).

"But based on RIM's track record, I'd give them high marks."

RIM starts with a more established base in the corporate world. BlackBerry users tend to be well-off, and some will be able to charge App World software to their employers. RIM also plans to take just 20% of BlackBerry software sales, compared with Apple's 30% cut. And RIM's starting price (*at auction* for apps (not including freebies) is \$2.99, vs. Apple's 99 cents. "Obviously, more is better for us," says Robert Kao, a New Jersey software developer who plans to sell his \$9.99 e-mail application on App World.

RIM is no [newbie](#) in software. The company has been working with developers since 2002 to create applications for the BlackBerry. During that time, developers downloaded more than 100,000 kits to write code for such products as Intuit's QuickBooks budgeting software and Tarascon Primary Care Pocketbook, a clinical reference guide for physicians. Until the app store's opening, however, the BlackBerry programs have been scattered across the Web, rather than collected in one central site. "This is not new for us," says Lazaridis.

[VORACIOUS](#) CONSUMERS

Still, it will be difficult for any company to match Apple's momentum in mobile software. The company's App Store has grown into a sprawling bazaar of software, with 25,000 apps for everything from calculating tips at restaurants to monitoring your blood pressure. Developers have flocked to Apple in part because its customers are far and away the most voracious consumers of mobile software. The average iPhone owner has downloaded more than 20 applications, several times that of competing phones.

Apple is trying to build on its lead with a software upgrade called iPhone OS 3.0. On Mar. 17, Apple revealed new capabilities that developers can build into their programs. The company added [peer-to-peer networking](#) that makes it dead simple for people within a few feet of each other to trade contacts or music wirelessly. And while business people are used to the "push" technology that allows e-mail to pop up on a BlackBerry in real time, Apple has extended the technology so any application can deliver relevant information in minutes. One iPhone app from Oracle delivers an alert to [salespeople](#) if inventories run low, so they can push alternatives on their rounds.

Apple also unveiled new ways for developers to make money, including subscription pricing. Many developers say Apple's real edge is in providing the tools to help them build cool, innovative programs. Oracle offers its software for both the iPhone and the BlackBerry. But Mark [Woolen](#), an Oracle vice-president, says the Apple approach provides a smoother experience for users. "It's just very, very elegant," he says.

The competition among Apple, RIM, and other rivals is likely to fuel innovation on all mobile phones. Microsoft plans to offer [Windows Mobile](#) The Windows platform from Microsoft for handheld devices, including PDAs, cellphones and Portable Media Centers. See Pocket PC, Pocket PC Phone Edition, Smartphone and Portable Media Center. phones that work more easily with [Windows PCs](#) An x86-based computer that runs some version of Windows. See x86 and Windows. . Nokia, the world's largest mobile-phone maker, is taking a creative approach with its Ovi Store, scheduled to open in May. Rather than just listing available apps, each consumer will be offered content based on personal tastes, location, and friends' recommendations. "No two users will get the same lineup of content," says George Linardos, a Nokia vice-president.

Still, some developers say the sheer number of competitors gunning for Apple may actually work to the company's advantage. Without a clear No. 2, many developers say they'll focus on the proven Apple market. "The distance between Apple and the others is huge," says Satoshi Nakajima, president of a photo-editing startup called Big Canvas. "We don't have time to look at other platforms seriously."