Macroeconomics Lecture 7 Oligopolies

Hi, Prof. Nevarro here, and in this lecture we are going to complete our examination of market structure, conduct. And performance with an in-depth look at one of the most common forms of imperfect competition in all industrialized nations. Namely, oligopoly. Oligopoly exists when a small number of typically larger firms dominate an industry. And oligopolistic industries include everything from disposable diapers, chewing gum, and cigarettes to electric razors, car rentals, and beer. A central feature of oligopoly is strategic interaction that is given the small number of firms, each firm must take into account the expected reaction of the other firms. That in term means that oligopolistic firms engage in strategic decision making when setting things like price. Quantity and product quality, now the other thing that's really important about oligopoly from an anti-trust perspective is that given the small number of firms. Oligopolistic have a much better chance of colluding on price than suppliers in either perfect competition or monopolistic competition. It is the strategic decision-making and the possibility of collusive behaviour that makes oligopoly so interesting and sometimes very dangerous for society. In analyzing oligopoly, what we ultimately want to answer all these questions. What gives rise to the market structure of oligopoly? What kind of market conduct is likely to characterize oligopoly? And what does this market conduct imply for market performance?

So what do these American industries have in common? Tennis balls, disposable diapers, chewing gum. Cigarettes, baseball cards, electric razors, car rentals, batteries, soft drinks, credit cards, razor blades, toothpaste, beer, soap, coffee, canned soup, canned tuna, and spaghetti sauce. If you guessed that all of them are oligopolies, go to the head of the class. Because, oligopoly is as ubiquitous in the American economy as rain is in the Brazilian rain forest. But that's not the only reason we're going to study oligopoly. The other reason is that it is arguably the most fascinating of the four major industry market structures. This is because it is within oligopolistic industries that we observe the most complex and diverse examples of market conduct and corporate strategy. Oligopoly exists when a small number of typically large firms dominate an industry. And the central element of oligopoly is strategic interaction. In particular given the small number of firms each firm must take into account the expected reaction of the other firms. And because of this neutral interdependence recognized, oligopolistic firms therefore engage in strategic decision making when setting things like price. Quantity and product quality. At the same time, given the small number of firms, oligopolists have a much better chance of colluding than monoplistic competitors. It is this strategic decision making and possibility of collusive behavior that makes oligopoly so interesting. In analyzing oligopoly, what we ultimately want to answer are these questions. What gives drive to the market structure of an oligopoly? What kind of market conduct is likely to character ride oligopoly? What does this market conduct imply for market performance? Let's start then, by pointing out that it is the same barriers to entry that give rise to pure monopoly that are important in explaining oligopoly. First, there are scale economy barriers to entry to consider. Recall that, with monopoly, average costs decreased throughout the relevant range of production. So that one firm is eventually able to drive out all other firms, by producing at lowest cost. With oligopoly, it is simply a variation on this theme. It is a few firms, not just one, that drive everyone else out. This problem is illustrated in this figure. It shows the average total cost curve for an oligopolistic industry. In the figure, the relevant range of output extends to point D, since this reflects total industry output total sales. At the same time, between points C and D there are constant returns to scale. Whereas between points A and C, there are decreasing returns to scale. This clearly implies that the minimum efficient scale for a firm in this industry is a plant size of AC, which in this example, equals one third of the total output AD. By the way you may recall from lecture four, that the minimum efficient scale is defined as the smallest level of output at which a firm can minimize long run average cost. In the case of natural monopolies like the rail roads and utilities, small firms cannot realize the MES, the minimum efficient scale. So there is only one seller at the same time as I indicated in lecture four and this this example illustrates a a large minimum efficient scale can also give rise to oligopoly. Now let's assume that there are three big firms in this industry all produce an output of AC at their MES with an equal share of the market. Or market share is defined as the percentage of market output produced by a single firm. Can you see the dilemma for a new firm trying to enter this industry? If a new firm tries to enter the industry at a plant size less than the MES Say at output AB it will be a higher cost producer than its rivals and will be highly vulnerable to being driven out of the industry by its competitors. In fact, all its rivals need to do is set price below the new firm's costs for a while, cause it to incur heavy losses. And eventually it will withdraw. Alternatively, if the firm builds a plant size at the MES to be competitive, it will have to seize a sizeable market share from its rivals to achieve efficient production. In particular, in this example, it would have to cut each of its rivals back from a third to a fourth of the national market, and the likely result would be losses for everyone. Given this dilemma, it is perhaps not surprising that scale economy barriers data entry into the industry and preserve the oligopolistic structures. A closely related barrier to entry is the large capital requirements that characterize the industries like cigarettes, autos, steel, and petroleum refining. In each of these industries, it simply requires a lot of capital investment to set up the elaborate plant and equipment necessary to produce. In this case, the broader problem is that established firms with a track record may have better access to lower cost capital than new entrance. For example, a large existing firm with an established reputation will likely be able to borrow money at a significantly lower interest rate than a new firm without a track record. Still the third important barrier to entry has to do with absolute cost. Absolute cost barriers to entry are illustrated in this figure. One source of such barriers is that established firms may possess valuable know how in production or so called trade secrets. For example one of the best kept secrets in the industrial world is the secret ingredient in Coca Cola. Only a few executives in the company know what it is. In a similar vein an existing firm may have patents granting it exclusive rights to certain product features or production processes. In fact, that's how Polaroid got such a strong initial foothold in the instant camera market decades ago. Then of course there is the issue of who owns or controls the basic raw materials for a product. This type of absolute cost barrier explains, for example, the historic dominance of Alcoa in the production of aluminum ingots. This is because Alcoa owns much of the high-grade bauxite reserves used in aluminum production. Finally, product differentiation, which we discussed at length within the context of monopolistic competition, can be an important barrier to entry in and industry. In particular to the extent that a firm has an established brand name with consumers it has a distinct cost advantage over any other new firms entering the market. This is because any new firm entering the market would have to incur substantial advertising costs Just to enjoy the same size and any elasticity of demand for it's product. The bottom line here is that barriers to entry play a very important role in creating and sustaining oligopolistic industries. The question of course is, why should we worry about this particular market structure? And the answer lies in better understanding the concepts of market power and market concentration.

Market power signifies the degree of control that a firm or a small number of firms has over the price and production decisions in an industry. And the most common measure of market power is a tool which I introduced in the last lecture, the four-firm concentration ratio. You may recall that this ratio is simply defined as the percent of total industry output accounted for by the four largest firms. This figure illustrates the four firm concentration ratios for a sampling of some of the most highly concentrated of American industries. From instant breakfast, and disposable diapers, to canned tuna, spaghetti sauce, and aspirin. Take a very careful look at this table because it contains many of the titans, not just of American industry, but also of the international marketplace. Now, the reason why concentration ratios are so important, is that they help serve as an indicator of the degree of strategic interaction that might occur in an industry. Strategic Interaction is a term that describes how each firm's business strategy depends on their rival's strategy. But, simply as the number of firms in an industry shrink and industry concentration grows, each firm is more likely to base his or her pricing and output decisions on how other firms in the industry are likely to respond. Moreover, once this mutual interdependence is recognized, firms have a choice between pursuing cooperative and noncooperative behavior. On the one hand firms act noncooperatively when they act on their own without any explicit or implicit agreements with other firms. That's the kind of market conduct that typically characterizes monopolistic competition. On the other hand, firms operate in a cooperative mode when they try to minimize competition by agreeing explicitly, or tacitly, on price and output and other market issues. The clear danger of oligopoly is that it is fertile ground for cooperative behavior. When firms in an oligopoly act cooperatively they must engage in some form of collusion. Collusion occurs when one or more firms jointly set prices or outputs, divide the market among themselves, or make other business decisions jointly. Such collusion can be either explicit or tacit. One example of explicit collusion would be that of the Gilded Age oligopolists in the early years of American capitalism. As we discussed earlier, these oligopolists formed trusts or cartels to set prices. Of course, after the American public rose up and demanded the passage of tough antitrust laws in 1910, [NOISE] cartels and explicit collusion became illegal in the United States. [NOISE] I'd like to tell you that these laws have worked, but that has not always been the case. Indeed the lure of lavish profits have tempted many a business executive to skirt the law, and many have wound up in a small prison cell rather than in a big mansion for their efforts. Perhaps the most famous historical example of explicit collusion, involves the so called Phases of the Moon Conspiracy. In 1960, some executives at General Electric, Westinghouse, and Allis-Chalmers, among others, cooked up a scheme to fix prices in the market for heavy electrical equipment such as transformers, turbines, and circuit breakers. The scheme work something like this. Each of the various companies would submit sealed competitive bids. But it was arranged beforehand that the work would be allocated to a particular company based on which phase the moon was in. This allowed all the companies to submit bids higher than would have prevailed without this collusion. It also allowed the prearranged winner to submit an only slightly lower bid, one well above the competitive outcome. Well, the eventual outcome of this conspiracy is that 29 manufacturers and 46 company officially were eventually indicted, [NOISE] substantial fines were levied, and many of the executives went to jail. [SOUND] Now again, I would like to tell you that after this highly publicized event, American executives have learned their lesson and have refrained from explicit collusive behavior. That's just not the case however. And, indeed more modern examples abound. For example, in 1993, Borden Incorporated paid $8 million in fines for fixing bids on milk sold to schools. While Bristol-Meyers Squibb and American Home Products paid $5 million in 1992 to settle charges that they had fixed prices on baby formulas. And in a cola war meltdown, local executives for both Coca Cola and PepsiCo went to prison for conspiring to fix soft-drink prices in Virginia. While Mitsubishi plead guilty and paid a $1.8 million fine for conspiring to raise the price of fax paper. More broadly, a recent study found that about 9% of major corporations have admitted to, or been convicted of, illegal price fixing. The alleged perpetrators range from the makers of scouring pads and Kosher Passover products, to universities, art dealers, the airlines, and the telephone industry. I'm telling you all this to make the point that the lure of economic profits is often irresistible and drives many a firm and too many executives to bend, an often break America's antitrust laws.

It is not just explicit collusion that is the only problem with oligopoly. The broader problem is with implicit or tacit collusion that arises precisely because explicit collusion is illegal The word tacit means to express or carry on without words or speech. And tacit collusion is said to occur when firms in and industry refrain from competition without explicit agreements. So how do executives tacitly collude? That is how do they communicate with one another without surreptitious phone calls or secret meetings? Well it's easier than you might think, one common vehicle is public speeches given by leading executives. In some of those speeches, when executives are talking about, say, how costs are rising in an industry and why it might be time to raise prices, They are not just talking to who is in the room. They are talking through the media to the other top executives in the industry, and its all quite legal. Similarly industry trade associates can play an important role in tacit collusion. This is because such trade associations can act as a conduit and clearing house for information about prices and costs in an industry. And from such information, executives can better glean what their rivals are doing and, in some cases, then coordinate their activities. The upshot of all this is that when firms tacitly collude, they often quote identical high prices which push up profits and decrease the risk of doing business. The better understand how both explicit and tacit collusion can shape oligopoly conduct. We need to turn now to a more systematic discussion of the various models of oligopoly behavior. In this discussion, I'm going to draw heavily upon an important sub-field in economics known as industrial organization and the related discipline of game theory. In doing so please keep in mind two major points. First, there is no unified theory of oligopoly, but rather many different models, each of which may have some application to specific industries. Second, we can only scratch the surface of industrial organization and game theory here, so what we will present will be more illustrative than definitive. I'm going to start this discussion, then, by presenting three of the basic models of oligopoly behavior that appear prominently in the traditional industrial organization literature. The cartel model provides insight into the price and quantity that oligopolists are likely to set when they can successfully collude. The price leadership model provides insight into how firms in an industry might tacitly collude as well as how firms in that industry who refuse to collude might be punished for failing to follow the leader. The third model, the kinked demand theory, offers an explanation other than collusion as to why prices in an oligopoly might be set higher than the perfectly competitive outcome. Once we come to understand these models, we can move onto the richer and more complex and modern realm of game theory. In this realm we are better able to capture the full diversity as well as the ambiguity of strategic behavior in oligopolistic situations.

Let's start with the simplest model of oligopoly, known as the lucrative oligopoly, or joint profit maximization. The cartel model provides insight into the price and quantity that oligopolists are likely to set when they can collude successfully. Consider then, a four-firm industry, in which each firm had grown tired of ruinous price wars. So, during the industries annual trade show in Las Vegas, the chief executive officers of all four companies ignore anti-trust laws against explicit collusion, and risk a possible jail sentence, as they slip off to a secret rendezvous. During that rendezvous, they then negotiate what price should be charged for the product. And of course, as part of their secret cartel agreement each firm will also have to agree to restrict its output so the price can be maintained in the market. So where do you think these oligopolies will set price? Okay, maybe that really was an obscure question. But if you think about it, the answer is simple. If the oligopolists can truly coordinate their activities, the obvious price to set is the same as that which would be set by a monopolist. That means of course that, price will be set by the profit maximizing rule of marginal revenue equals marginal cost. And if the price is set at that point, the oligopolists will jointly maximize their profits, which is why this model is often called the joint profit maximization model. Now one other point, in order for the monopoly price to hold in the marketplace, total industry output must equal the monopoly output. This is where problems with the cartel are likely to emerge. Because, if any one firm in the oligopoly decides to cheat by producing more than its agreed upon share of output, it can make higher profits. Than if it adheres to the cartel agreement. It is precisely such cheating that has made OPEC, the international oil cartel, so unsuccessful over the past several decades at propping up oil prices. Note however that in the dark days of 1973 and 1974. During those years, the members of OPEC banded together, slapped an oil embargo on the U.S for its support of Israel, and more than quadrupled prices. The result was long gas lines and a strong negative shock to the American economy. And I might add here that under international law, OPEC's cartel behaviour was quite legal. Even if cartels are illegal within the U.S. Note however that in the ensuing years the OPEC cartel has been unable to keep the price of oil high, and at least part of the problem has been on the demand side. After the 1970s oil price shocks, motorists started driving smaller, more fuel-efficient cars. Home owners more fully insulated their homes. Businesses adopted new technologies to dramatically cut energy use, and the world in general adopted wide-ranging energy conservation measures. At the same time, on the supply side, higher oil prices stimulated the search for new oil reserves. And many non-OPEC members like Norway and Mexico entered the global oil market. Nonetheless the biggest problem was not these forces of supply and demand, but rather that OPEC has faced wide scale cheating within its ranks. This is due largely to the economic and political diversity of members as well as the large number of members in the cartel. On the one hand, this sparsely populated and fabulously wealthy members of the cartel like Saudi Arabia, Kuwait and Qatar have been perfectly content with restrict output and enjoy monopoly profits. On the other hand, other much more populous and poorer nations, like Venezuela and Nigeria, haven't been able to resist the urge to cheat on their production quotas. Because of large external debts to be paid and growing needs for cash. The broader problem has been that OPEC has no effective enforcement mechanism to police its agreements. That is, OPEC has little effective way to punish any members who do cheat on the collusive bargain.

A second model of oligopoly, the price leadership model, provides insight into how firms in an industry might tacitly collude. As well as how firms which refuse to collude might be punished. In the price leadership model. The policing or enforcement mechanism used is often punishment by the price leader. Usually the biggest or dominant firm in the industry. With price leadership, executives within the industry don't have to slip off to a secret rendezvous in Vegas to set prices. Rather, a practice evolves where the dominant firm, usually the largest firm, initiates a price change. And all other firms more or less automatically follow that price change. Moreover, if one or more firms refuse to follow suit, the price leader may choose to back down. Alternatively. And they punished the non-cooperative firms by significantly lowering prices for a while, forcing the followers to incur losses. In the way, the oligopoly can maintain price discipline. A classic case of such price leadership involves the cigarette industry. The Big three firms Reynolds, American, and Liggett and Meyer, evolved a highly profitable practice of price leadership. Which resulted in virtually identical prices over the entire period between 1923 and 1941. During that period, the companies averaged a whopping 18% rate of return after taxes. Roughly double the rate earned by American manufacturing as a whole. In more recent time, other industries such as farm machinery, anthracite coal, cement, copper, gasoline. Newsprint, tin cans, lead, sulfur, rayon, fertilizer, glass containers, steel, automobiles. And nonferrous metals have likewise practiced some type of price leadership. Still a third interesting model of oligopoly involves the kinked demand curve. This model helps to explain why prices are sticky in oligopolistic industries, that is, why prices don't rapidly adjust to changes in supply and demand. In doing so, the model also helps explain why prices may be high relative to the perfect competition outcome. Even if there is no collusion. Imagine then an oligopolistic industry with three firms A, B and C. Each of which have one third of the total market. Further assume that each firm sets its price independently, meaning that there is no collusion. This situation is depicted in this figure. Now, the question is what does the firm's demand curve look like? And what makes this an interesting question is their mutual independent of the three firms. Coupled with the uncertainty of each rival's reaction to the pricing moves of the other. Let's look at the possibilities. If Firm A raises its price, and the firm believes that the other firms won't go along. Its perceived demand curve for increasing price will be very elastic. In particular, because of its fear of losing business to its rivals. Firm A's demand curve looks like D1 in the figure. While the relevant portions of the demand curve and its marginal revenue curve are shown in blue. Alternatively, suppose firm A decides to lower it's price. What might it most logically expect its rivals to do? That's right, the most logical response of form A's rivals to a price decrease would be for the firms to match that decrease. Otherwise, they will lose market share to firm A. Under this strategic assumption, a large drop in price by firm A would yield only a small, if any increase in sales. So demand under this scenario is very inelastic. This is represented by the curve D2. While the relevant portions of this demand curve and the marginal revenue curve, are shown in red in the figure. Thus, and here's the punch line [SOUND] the firm's perceived demand curve has a kink in it. That is, when we draw the relevant marginal revenue curve for this kink demand curve. We see that it has a gap in it. Therefore the relatively large shifts in marginal costs between points c and d as indicated by the shaded area. Will not change the price or the output that maximizes profits since they do not change the intersection of marginal cost and marginal revenue. Hence, in this industry, prices will tend to be sticky. And if they are set high to begin with, they will tend to remain high, even in the absence of collusion. You can see from these traditional models of oligopoly behavior. How important the strategic behavior of rivals can be in determining the eventual outcome in an industry. Let's take a deeper look at these strategic interactions through the lens of game theory. A subject which may sound frivolous from its name, but which in fact is fraught with economic

The guiding philosophy in game theory is this. You will pick your stategy by asking what makes most sense assuming that your rival is analyzing your strategy and acting in his or her own best interest. Game theory is important for two reasons. First, the many different possible games articulated by the theory, help capture the essence and complexity of oligopoly conduct. This is because with mutual interdependence recognized between firms, oligopoly conduct becomes a game of strategy such as poker, chess or bridge. And the best way to play your hand in a poker game Depends on the way rivals play theirs. Second, game theory sheds a very bright light on the importance of collusion in driving socially undesirable economic outcomes. The insights of game theory thereby help to underscore why such collusion is often made illegal in a given economic system. To show you what I mean let's look at the Prisoner's Dilemma, a well-known game that demonstrates the difficulty of cooperative behavior in certain circumstances. Suppose then that two suspects in a bank robbery, Bonnie and Clyde, are arrested and interrogated in separate rooms. Each of the prisoners is offered the following options. First, if one prisoner confesses and the other does not, the one who confesses will go free and the other will be given a 20 year sentence. Second, if both confess each will receive a five year sentence. Finally, if neither confesses, each will be given a six month sentence on a minor charge. So which strategy would you choose if you were Bonnie or Clyde? Making up your mind, assume that you don't trust your partner, and your partner doesn't trust you. Well, your best strategy is likely to be choice b, confess and take your five year sentence. And that's what makes this prisoner's dilemma interesting. You see, it's pretty clear that if both prisoners could talk to one another after they are arrested, they could collusively agree not to confess, and both would get light sentences if they kept the bargain. In the absence of collusion, however, there is great pressure on each prisoner to confess, because he or she knows that if he doesn't confess and his partner does, he'll get a very long sentence. In the absence of collusion therefore, the typical result is that both prisoners confess, and get medium sentences. This is because the only other way out of the Prisoner's Dilemma, Absence Collusion, is trust. But trust is something that is very hard to come by unless there is an explicit enforcement mechanism. The Prisoner's Dilemma has its simplest application to oligopoly when the oligopoly is a duopoly. That is, when the industry consists of only two firms. A duopoly might emerge in an industry when the minimum efficient scale of production is about half that of the total industry sales. And that's what we will assume in this set of figures, that depict a duopoly in packaging materials. In particular, in the left hand figure, we've drawn the average total cost and marginal cost curves for one of the firms. Note that the minimum efficient scale occurs at point A, where the ATC is at a minimum, and production is 4,000 tons. Assuming that both firms in the duopoly have identical cost curves, we can then draw supply, demand, and several possible equilibria in the packaging materials market. So here's your first question. Suppose that, just like in the prisoner's dilemna. The two firms are unable to communicate with one another and therefore are unable to collude in any way, either explicitly or tacitly. What is the likely strategic pricing decision to be? How much will each produce? And what will be their totally economic profits? The correct choice is a. Did you get it right? In the absence of collusion, the two duopolists are likely to behave like perfect competitors. The market price will be $500 per ton. Output will be 8,000 tons, or twice that of the minimum efficient scale of production. And economic profits will be zero. Suppose on the other hand, the two duopolists are able to fully collude, and each keeps the bargain that they strike. What is the likely market price, output, and profit, and which of the three oligopoly models does this outcome most resemble? The correct choice is b. Did you get it right? If the two duopolists can collude, they will act together, just like a monopolist, and jointly maximize their profits. The price will be $600. Output will be 3000 tons per firm and profits will equal $75,000. Okay so far so good. But now let's entertain the all two distinct possibility. That while the two duopolists fully collude and shake hands on the monopoly deal, one of the duopolists is a no good, back stabbing, four flushing, varmint who decides to cheat on the agreement. In particular, this cheating duopolist refuses to limit his share of production to 3,000 tons and instead produces 4,000 tons. This situation is depicted in this set of figures. What happens now to the market price, output, and profit? The correct choice is A. Did you get this right? Price falls to $550 per ton, and will stay there, so long as the non-cheating firm doesn't increase his production. While industry output increases to 7000 tons. As for the profits of each firm, note in the figure that the non-cheating firm receives $550 per ton, but because it doesn't produce at its minimum efficient scale it incurs costs of $575 per ton. This leads to a loss of $75,000 as indicated by the shaded arrow. In contrast, the cheating firm produces at its MES where costs are $500 per ton. And its profit is the shaded area in the figure, or $200,000. By the way, this example should demonstrate clearly, the often huge incentive to cheat that colluding oligopolists face. In this case the successful cheater can more than double his profits from $75,000 to $200,000. Now it is precisely to provide insight into this type of strategic situation that game theory was developed. It does so by analyzing the strategies of both firms under all circumstances and placing the combinations in a so-called payoff matrix or payoff table. In this matrix, each box shows the payoff from a pair of decisions listed in the columns and rows. The blue triangles show firm A's profit, while the gold triangles show firm B's profit. The box represents the outcome for successful collusion. The lower left and upper right hand boxes are the cheating outcomes and the box in the lower right hand corner is the non cooperative outcome. Notice the dilemma both firms are in, if it is impossible to detect cheating. If they can't detect cheating, and each believes the other is maximizing profit, than each must expect the other to cheat. Just as in the prisoner's dilemma, each prisoner must expect the other to confess. And in this case, the optimal strategy for both firms is to cheat. However, when both firms cheat, they both wind up in the lower right-hand box with the zero profit competitive outcome. By the way, the non-clusive outcome in box D is called the Nash Equilibrium in Game Theory. A Nash Equilibrium describes a situation in which no player can improve his or her payoff given the other player's strategy. The concept of the Nash Equilibrium is important, because it often describes a non-cooperative equilibrium. This is because in the absence of collusion, each party chooses that strategy, which is best for itself, without collusion, and without regard for the welfare of society, or any other party. Well that completes our discussion of oligopoly. Please remember that economics is not something to be memorized But rather something to conceptualize. So as you study it, think about it too. Your job and your business just might depend on it.