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## Instructional Note

# Teaching Strategic Thinking on Oligopoly: Classroom Activity and Theoretic Analysis

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**Abstract**

*This paper examines the use of a simple classroom activity, in which students are asked to take action representing either collusion or competition for extra credit to teach strategic thinking required in an oligopolistic market. We suggest that the classroom activity is first initiated prior to the teaching of oligopoly and then the instructor teaches oligopoly together with more enhanced classroom activities in accordance with a dynamics of the oligopolistic market. With this approach, the instructor can guide students toward strategic thinking by demonstrating how a student's incentives lead to specific actions within the experiment, which approximates a core trait of Cournot competition.*

**Keywords:** *Experiment; pedagogy; non-cooperative games; group behaviour.*

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# Introduction

As oligopoly is one of the most significant market structures in free market economies, it is crucial to understand how firms operate in this type of market. The importance of understanding oligopoly is not limited to business people and consumers, but also to economics students and business majors, most of whom will be involved in the future decision-making processes of firms as found in the survey of employers made by Hellier et al. (2004). To equip the students with relevant knowledge, various economics courses teach oligopoly and other market structures. In an effort to provide students with market-like simulations, classroom activities date back to Chamberlin (1948) as Holt and McDaniel (1998) noted. Other examples of more recent classroom activities are found in Miller (1971), Nelson and Beil (1995), Meister (1999), Grobelnik et al. (1999), Brouhle (2011), Ryan and Doyle-Portillo (2014), and Elbeck and DeLong (2015) to name only a few.

This paper analyses the use of a simple classroom activity to teach oligopolistic behaviour, targeting the principles of microeconomics student (but not limited to that level). Using this classroom activity, an economics instructor enables the students to experience the interdependent actions of oligopolistic firms as well as the nature of their interaction. With the results of the activity revealed, an economics instructor can provide a theoretical analysis of the classroom activity when the topic of strategic behaviour for oligopolistic firms is studied. When providing the theoretical analysis of the classroom activity, the instructor can explain how the results of the activity would be different if some market characteristics change, e.g., market size, potential entrants in a market, or cost of production. Anticipating the possible outcomes as market characteristics change is crucial, as major decisions on price and production are often made on those expectations. This paper provides an economics instructor with theoretic predictions on competition versus collusion based on characteristics. With these predictions, an economics instructor can train students to think strategically about the behaviour of competing firms.

For this purpose, this paper is divided as follows. Learning objectives are listed in Section 2, and the implementation of this classroom activity is detailed in Section 3. The activity is theoretically analysed in Section 4, and then comparative analysis in which some key factors to the activity are changed is provided in Section 5. In Section 6, we present our own results to illustrate how to implement such classroom activities and to compare the theoretical predictions with the actual outcomes. In Section 7, we provide a framework on how to assess successful implementation of this activity as a teaching tool.

## *Learning Objectives*

In contrast to equilibria associated with perfect competition, monopoly, or monopolistic competition, firms operating in an oligopolistic market may choose to follow different strategies leading to different expected results. Oligopolistic firms may reap monopolistic profits if they successfully collude; these same firms may end up with profits equal to zero if they compete. This dichotomy presents a greater challenge for economics students who may be accustomed to only one expected result for firms operating in other types of markets. As such, the learning objectives for this activity are focused on the specific attributes of oligopoly that are unique to this market structure. As a result of this activity, students should be better able to understand:

1. Interdependence; students will recognise that their outcomes are determined not only by the actions that they choose but also by the actions of their classmates.

2. Strategic Thinking; students will formulate their decisions based on the incentives provided to the class as well as the anticipated responses of their classmates.
3. Obstacles to Collusion; students will understand how changes to incentives, changes to the number of participants, and changes to the availability of information impact incentives toward collusion and the ability to successfully collude.
4. Cost of Competition; ultimately students will recognise that their choice of competition is likely to reduce their payoffs. Furthermore, the cost of competition can be higher as the degree of competition becomes more intense.

Assessment of this activity will be focused on self-discovery by students resulting from greater engagement. Given the nature of this classroom experiment and the associated incentives, a learner-centred process that is andragogical rather than pedagogical is intended and desirable.

## *Implementation of Classroom Activity*

To emphasise strategic thinking in the market, we make use of a classroom activity as a way to approximate an oligopolistic market. To simulate decision-making related to an oligopoly, we treat an individual student as an individual firm who should decide if he/she would collude or compete. As an individual student is a firm, the class size (denoted by N) approximates the number of firms in the market. The class is offered an extra credit opportunity in which a student may compete by writing a question or collude by not writing a question[1]. The questions that students write may be used in a future quiz or test. Much in the same way that firms attempt to maximize profit in the market, students attempt to obtain as much extra credit as possible. The extra credit that each student obtains is his/her profit or payoff (denoted by $\pi$). The number of questions (denoted by q) that a student writes approximates the level of output that an oligopolistic firm produces.

Each student's extra credit per question is determined by the total number of questions submitted by the class to the instructor. The extra credit per question will be higher if students do not compete in the hope of successful collusion. On the contrary, the extra credit per question will be low if students compete. Then, each student's extra credit is determined by the values specified within the activity net of any cost of writing questions just as profit is determined by revenue net of cost. Using this proximity between the activities of oligopolistic firms and the structure of this extra credit opportunity, an economics instructor can conduct a classroom activity by specifying market demand that is exogenously given to an individual firm (or student) and the level of cost that a student may incur.

We prefer that an instructor introduces this activity before the topic of oligopoly is taught in the classroom as Kassis et al. (2012) did for their classroom experiment on banking. Students participate in the experiment only with a motive of obtaining maximum extra credit. In this way, students may recognise later, hopefully to their surprise, that the simple motive approximates the central outcome of oligopolistic market activity. This recognition will enhance students' understanding of the nature of market operations and interdependence.

For this reason, we present this classroom activity as simply as possible in a sequential framework: linear market demand and zero cost of writing questions. The market demand is $P = w + 1 - Q$ where P denotes a market price, w denotes maximum extra

[1] An instructor can limit the scope of questions that students can write. We prefer that students write questions only about market competition. From the instructor's viewpoint, making students write questions about market competition is a good way to enrich student's learning potential.

credit available, Q is total output supplied to the market, h is the payoff when students successfully collude. The payoff for collusion (h) should be set lower than maximum extra credit available (w). There would be no incentive to write a question if the payoff of collusion (h) is equal to or larger than total extra credit available (w). That is, each student would immediately recognise that everyone is unilaterally better off by not writing a question if.  Under the linear market demand and zero cost, each student should decide if he/she colludes by not writing a question or compete by writing a question. To help students make choices, an instructor provides information on the number of questions submitted by the entire class during the period for which the extra credit opportunity lasts.

The figure below is an example of an announcement to students for the classroom activity.

**Figure 1:**
*Announcement to students*

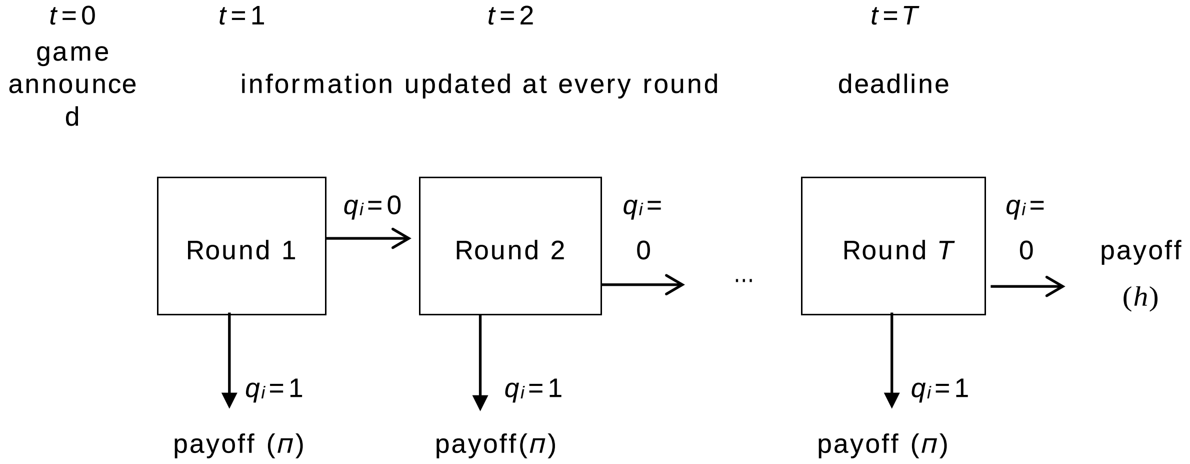
There is an extra credit opportunity! For the coming weeks, each of you may consider submitting one question for the topics related to market competition that we are studying. If you submit one question, you may obtain extra credit. The amount of extra credit you may receive depends upon not only your actions but also the actions of your classmates. For example, if only one student from the class submits a question, that student will receive *w* points, e.g., 10 points. If two of you submit questions, each of the two will receive (*w*-1) points, e.g., 9 points. If three of you submit questions, those three will receive (*w*-2) points, e.g., 8 points, and so forth. This payoff structure proceeds in this manner until the extra credit total reduces to zero. That is, no one receives any points if the number of questions submitted equals or exceeds maximum extra credit available. However, all of you will obtain *h* points, e.g., 5 points, if none of you submit a question. I will update the information on the number of questions submitted at the beginning of every class until the deadline for this extra credit opportunity.  If there are 0 questions submitted by the deadline, the opportunity will end with all students receiving 5 points.  If there are more than 0 questions submitted by the deadline, other students will have an extended time window to submit questions if they wish to do so.

## *Theoretical Analysis of Classroom Activity*

A classroom experiment alone may not increase student learning as argued by Cardell *et al.* (1996). Deeper understanding of a topic is enhanced by a theoretical analysis, as theory provides a framework to derive benchmark predictions (Croson and Gächter 2010). By comparing and contrasting the results of an experiment with its theoretical counterpart, students explore any difference in outcomes, correct their misconceptions, and extend their understanding (Smith 2010). For this purpose, we provide a theoretical analysis of the classroom activity. An instructor can compare the theoretical predictions with outcomes from the activity, explaining any differences and similarities in outcomes to the students.  In this way, we are able to tie together both the conceptual knowledge with quantitative analysis as emphasised by Metzgar (2013).

The game in the activity is *per se* sequential as each student makes a decision at each class meeting until the opportunity for extra credit expires. The time of each class meeting, denoted by $t$, is a round at which each student either produces a question ($q=1$) or does not produce a question maintaining collusion ($q=0$) while the instructor updates information on the number of questions submitted. As we limit the number of questions that each student writes to one, a student finishes this classroom activity if he/she writes a question ($q$=1). A student moves to the next round if he/she waits to seek collusion ($q$=0). A student's payoff is determined when the game is complete at the deadline ($t$=$T$). The structure of the classroom activity is depicted in Figure 2 below.

**Figure 2**:
*Structure of the classroom activity*




At each round, the instructor updates information on the total number of questions submitted. As the information is updated, each student would update and compare his/her expected payoffs from each possible choice; the payoff of writing a question (π) and the payoff of collusion ($h$). Once collusion is no longer available, the classroom activity becomes the Cournot competition in which firms compete for outputs. The price of a question ($P$), which is the extra credit that a student can obtain by producing a question, is determined by supply and demand. From the linear market demand, $P = w + 1 - Q$, the price of a question is determined by the total number of questions submitted ($Q$). The total number of questions submitted ($Q$) is the sum of a student $i$'s question and all other students' questions, i.e., $Q = q_i + \sum_{j \neq i} q_j$. As there is no cost of writing a question, the price of a question ($P$), or the extra credit per question, is expected to be $P = w - Q$.

Given the expectation on the price of a question, each student would choose to submit or not submit a question to maximize his/her payoff that is revenue minus cost. The revenue of producing a question is the product of the number of questions ($q$) and the price of a question ( $P = w + 1 - Q$ ). As we assume zero cost, a student's optimization problem becomes

$$\underset{q_i}{Max} \ \pi_i = q_i(w + 1 - q_i - \sum_{j \neq i}^{N-1} q_j^*) \tag{1}$$

when the student expects that other students will choose their quantity of questions $(q_j^*)$.

At the symmetric Cournot equilibrium, a student $i$'s best response is $q_i^* = q_j^* = (w+1)/(N+1)$ and the profit ( $\pi_i^*$ ) expected from writing $q_i^*$ is his/her expected payoff $(w+1)^2/(N+1)^2$. The expected payoff is contingent on the class size ($N$) and the maximum extra credit ($w$). It is not difficult to figure out that the expected payoff $(\pi_i^*)$ becomes smaller as the class size ($N$) increases and as the total extra credit ($w$) decreases. Once the expected payoff is determined, the student would choose to write a question (that is, engage in competition) if the expected payoff is larger than the payoff from successful collusion (*h*), and vice versa. That is,

$$q_i = 1 \text{ if } \pi_i^* \geq h$$
$$q_i = 0 \text{ if } \pi_i^* \leq h \quad (2)$$

A student *i*'s actual payoff may be different from the expected payoff as the actual payoff is the maximum amount of extra credit (*w*) net of the total number of questions actually submitted ($Q^A$). That is, $\pi_i^A = \max[w+1-Q^A, 0]$ where $Q^A$ is the total number of questions actually submitted by the deadline. Each student will get no extra credit if too many questions are submitted, i.e., $Q^A \geq w$. If an instructor announces this, then students would lose their motivation for extra credit, and thus the Cournot competition would be virtually over. Otherwise, the competition goes to the next round as long as the remaining extra credit is larger than the payoff from successful collusion.

## Comparative Analysis and Strategic Thinking

Any changes in the market structure alter the incentives of firms involved. Accordingly, a firm's expected payoff from the competition would be different and thus yield different outcomes in the market. As a market continually changes, firms need to identify any changes in the marketplace and to adjust their policies on production, price, and other factors as a result of these changes. Thus, students need to be aware of the dynamics in a market and be trained to tackle such dynamics.

To train students, an instructor additionally explains any possible impact on the outcome of the game when some factors of the experiment, e.g., class size (number of competing firms), total extra credit (demand or market size), or costs, are changed after the initial classroom activity has ended and thereafter the comparison of theoretical and actual outcomes are complete. Students are required to think strategically about these changes, the impact these changes have on a firm's profit, and the changes in a firm's incentives. Below are examples of additional activities that an instructor can use to explain such possible impacts.

### Change in Extra Credit

A market size may increase as the population grows or disposable income increases due to economic expansion. How would a firm respond to an increase in the market size? To capture this element of market dynamics, an instructor can change the amount of total extra credit available to his/her students. What would be expected from the students if more extra credit, e.g., from 10 points (*w*) to 20 points (2*w*), is available to the students? To see the possible changes in the choice of the students, consider first how each student's payoff changes if a question is submitted. That is, a student obtains 2*w* for *w*=10, e.g., 20 points, if he/she is the only student who writes a question. If two students submit questions, then those two will get 2(*w*–1), e.g., 18 points. If three students submit questions, then those two will get 2(*w*–2), e.g., 16 points, and so forth. Intuitively, it is expected that a larger potential payoff for competition would increase a student's incentive to write a question if the payoff from collusion remained the same. To illustrate, consider the following optimization problem of each student in the first round;

$$\underset{q_i}{Max}\ \pi_i = 2q_i(w+1-q_i-\sum_{j\neq i}^{N-1} q_j^*) \quad (3)$$

Each student's best response is $q_i^* = q_j^* = (w+1)/(N+1)$, which is the same as the one in the simple game. Given this best response, however, the expected payoff $\pi_i^* = 2(w+1)^2/(N+1)^2$ is larger than the one in the simple game. This result proceeds similarly to the last round. This larger expected payoff should enhance each student's incentives to write a question, rather than collude with each other. In the same manner, it is not difficult to expect that students are more likely to collude if the extra credit associated with no questions submitted becomes larger, e.g., from 5 points to 10 points, while the extra credit for a question remained unchanged.

**Change in Class Size**

New firms sometimes enter a market. If new firms enter the market, how would an incumbent firm in the market respond?[2] Would firms become more likely to collude or to compete? This is an interesting question to students. To teach students how incumbent firms would respond, an instructor can change the class size (*N*) that approximates the number of firms in the market.[3] How can the class size be changed? If an instructor teaches multiple sections of the same course, the instructor can perform the classroom activity over all such sections. Thus, the extra credit that can be obtained becomes dependent upon not only the number of questions submitted from students in one class but also the number of questions submitted from students in other classes while the total extra credit available remains same. If a class size doubles, then the maximization for a student *i* at the first round would be

$$\underset{q_i}{Max}\ \pi_i = q_i(w+1-q_i-\sum\nolimits_{j\neq i}^{2N-1} q_j^*), \quad (4)$$

producing smaller responses $q_i^* = q_j^* = (w+1)/(2N+1)$ and smaller expected payoff $\pi_i^* = (w+1)^2/(2N+1)^2$ than the ones in the simple game. It implies that students become less motivated to the extra credit opportunity. Rather, it is expected that students are more likely to collude for extra credit.

**Lack of Information on the Number of Questions Submitted**

In some cases, firms in the market may not obtain relevant information regarding the total output supplied to the market. Then, an interesting question is how a firm changes its behaviour under uncertainty. To approximate this situation, an instructor may choose not to provide information on the number of questions submitted. If no information is provided to the students, this repeated game would become a one-shot game. Therefore, the expected payoff at the first round would be the payoff at this one-shot game. We expect that students are more likely to choose competition when the information on the number of questions submitted is not revealed because the expected payoff at the first round, $(w+1)^2/(N+1)^2$, is larger than the expected payoff at the last round, $(w+1-\sum\nolimits_{t=1}^{T} Q_t^A)^2/(N+1)^2$.

## *Activity Results*

To implement the classroom activities explained above, we chose two separate sections of a microeconomics course (ECON 2106): Section A and Section B. The sections differed in terms of the class meeting time and the composition of students, but identical course materials and presentation were offered by the instructor. Section A had 31 students while Section B had 28 students.

We implemented four classroom activities for each section during the fall semester (mid-August to mid-December). As a topic of oligopoly is scheduled in November, the two earlier classroom activities were completed before the topic was taught and the later, two activities were completed afterward. Earned extra credit, if any, was added to a student’s test score each time. The format of each activity was same except the key

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[2] The relation between entrants and incumbents in the market is extensively exploited. Many of studies in the game theoretic analysis focus on the response of incumbent firms to the threat of potential entry. An instructor may explain this to the students, but our focus is how incumbents change their behaviour once new firms have entered the market.

[3] Shapiro (1986) provides through analysis on this type of informational incompleteness.

factors explained in the comparative analysis: maximum amount of extra credit, class size, and availability of information. The following classroom activities were performed in each section.

**Activity 1** follows the basic design mentioned in Table 1. The maximum amount of extra credit available to a student is 10 points, i.e., $w$=10, if the student is the only one submitting a question. If two students submit questions, then those two students received 9 points each. If three, those three students received 8 points each, and so forth. All students in a class received 5 points each, i.e., $h$=5, if they were successful in the collusion with no questions submitted.

**Activity 2** was different only in the maximum amount of extra credit available to a student. The extra credit doubled, e.g., 20 points for only one question submitted, 18 points for two questions, and so on, while the point value for a successful collusion remained same, i.e., $h$=5. This activity was used to investigate if a student changed his/her behaviour as the extra credit changed, representing a change in demand.

Then, we performed **Activity 3** in which we told the two sections that the payoff was based on the combined decision of the two separate sections. That is, students in Section A would not get any points even though Section A successfully colluded by not submitting any questions if one student in Section B submitted a question. This activity was used to investigate if students' behaviour changes as the number of students that they have to compete or collude changes to approximate a change in the size of a market. In this activity, the maximum amount of extra credit remained at 20 points ($w$=20) and the point value for successful collusion remained 5 points ($h$=5).

**Activity 4** was different from Activity 2 in that the information on the number of questions submitted to the instructor was not available to students and there was no additional time window for students to submit questions. The maximum extra credit remained the same at 20 points ($w$=20) and the point value for successful collusion remained the same at 5 points ($h$=5) for each student. Thus, the payoff schedule was somewhat similar to that of Activity 1. Thus, Activity 4 was conducted to determine if greater uncertainty associated with a lack of information changed a students' behaviour.

The results of the activities that we implemented are summarized in Table 1. All outcomes of the activities fell in line with the theoretical predictions: no questions in Activities 1, 2, and 3 whereas more incentives for writing a question led to competition in the Activity 4.

For the Activity 1 in which the maximum extra credit was 10 points, and the point value for successful collusion was 5 points, both sections did not produce any questions. Thus, the students in both sections obtained 5 points each for their successful collusion. This outcome was theoretically expected because the expected payoffs of writing a question were smaller than the payoff of the successful collusion, i.e., $h$=5 points, as clearly indicated in Equation (2). From the theoretical value of the expected payoff of writing a question, i.e., $\pi_i^* = (w+1)^2 / (N+1)^2$, we calculate that the expected payoffs of writing a question were $\pi_i^*$ = $11^2/(31+1)^2$ =0.12 for Section A and $\pi_i^*$ = $11^2/(28+1)^2$=0.14.

Even for the Activity 2 in which maximum extra credit doubled to 20 points, both sections did not produce any questions as theoretically predicted. Given $\pi_i^* = 2(w+1)^2 / (N+1)^2$ from Equation (3), the expected payoffs of writing a question, i.e., $\pi_i^*$ = $2\times11^2/(31+1)^2$ =0.24 for Section A and $\pi_i^*$ = $2\times11^2/(28+1)^2$=0.29 for Section B, were still smaller than the points from the successful collusion, i.e., $h$=5. For Activity 3 in which two separate sections were combined with a maximum extra credit of 20 points, no questions were submitted as expected from the theoretical prediction. The expected payoff of a question from Equation (4) was now $\pi_i^* = (w+1)^2 / (2N+1)^2 = 21^2/(31+28+1)^2 = 0.12$ which was smaller than the point from the successful collusion. Note here that $w = 20$ as we use *w*, instead of 2*w*, for the maximum extra credit.

However, for the Activity 4 in which information on the number of submitted questions was not available to students, we had 4 questions submitted in Section A and 11 questions submitted in Section B. This outcome was consistent with our theoretical prediction that a student has more incentive to write a question given a lack of information on the actions of others.

**Table 1**:
*Theoretical predictions and the results of activities*

| | Theoretical Predictions | | Results of activity |
|---|---|---|---|
| | Expected Payoff from a question | Expected Results [1] | No. of questions submitted |
| Activity 1 | | | |
| - Section A | 0.12 | No questions expected | 0 |
| - Section B | 0.14 | No questions expected | 0 |
| Activity 2 | | | |
| - Section A | 0.24 | No questions expected | 0 |
| - Section B | 0.29 | No questions expected | 0 |
| Activity 3 - Sections combined | 0.12 | No questions expected | 0 |
| Activity 4 | | | |
| - Section A | More incentive for questions | | 4 |
| - Section B | More incentive for questions | | 11 |

1. See Equation (2).

## Assessing Success of Classroom Activity

We propose a 3-step framework that an economics instructor uses for this classroom activity to enhance student understanding of strategic thinking in an oligopolistic market. The process, particularly the first two steps, features an androgogical approach, as students discover the results based on their own actions and the actions of their classmates and may begin to connect these results to theory.

**Step 1**: Classroom activity for extra credit
**Step 2**: Lecture on oligopoly
**Step 3**: Discussion of the results of the activity

The first step is to perform the classroom activity for extra credit. Students would understand from their experience in the activity that a firm's behavioural assumption for maximum profit is valid when the classroom activity and operations of oligopolistic firms are compared later in step 3. An instructor can perform several iterations of the activity as we did.

The second step is that an instructor teaches oligopoly as he/she normally would including the concepts common to most textbooks. Various models explaining oligopoly, e.g., Cournot model, Bertrand model, etc., may be taught. In this step, an instructor does not necessarily mention the classroom activity that has been performed. However, is it possible that students will recognise readily the relationship between the classroom activity and the theoretical constructs associated with oligopoly. As such, the instructor should be prepared for students to ask questions or make comments during the class meeting

The third step is to transition to a connection of the classroom activity to the choice to compete or collude by firms in an oligopolistic market. For this purpose, an instructor can ask students to compare the Cournot competition with the classroom activities for extra credit. By comparison, an instructor can ask students to think about the following items;

> "What are the similarities and differences between these classroom activities and operations of an oligopolistic market?"
> "What was your decision and why did you make that decision?"
> "Did you consider the incentives that your classmates faced?"

This process would enhance student understanding of oligopolistic markets and, in particular, the importance of strategic thinking in terms of both collusion and competition. To help navigate this process, we provide Table 2. It summarizes the comparison of the Cournot competition with the classroom activity.

**Table 2**:
*Comparison of Cournot competition and classroom activity*

| | Cournot Competition | Classroom Activity |
|---|---|---|
| Behavioural Assumption | A firm maximizes profit | A student maximizes extra credit |
| Output-Input | Output: a product or a service<br>Input: resources | Output: a question ($q_i$)<br>Input: student effort |
| Market Demand | Exogenously given to a firm | Exogenously determined by an instructor, e.g., *w.* |
| Market Supply | Sum of individual supply | Sum of questions submitted ( $Q = \sum_i^N q_i$ ) |
| Price of output | Determined by quantity supplied in the market, e.g., *P=a + b Q.*<br>→ *"Other firms' quantities supplied have an impact on your profit."* | Determined by number of questions submitted, e.g., $P = w - q_i - \sum_{j \neq i}^N q_j$ .<br>→ *"Other students' questions have an impact on your extra credit."* |
| Strategic Thinking | How much of output a firm produce must be decided in strategic thinking | How many questions a student must write in strategic thinking. |

In the third step, an instructor can also ask students to think how the outcome would be different if the maximum amount of extra credit or other factors, e.g., point value for successful collusion, class size, changed. For example, an instructor can ask the following questions;

"Would you write a question if the maximum amount of extra credit tripled?"
"Would you still attempt to collude if the benefit for collusion dropped to near zero?"
"What would you do if the number of participants decreased to 10?"

These discussions and the entire process should feature greater student involvement than a standard lecture on oligopoly. The success of the activity would be based not only on greater understanding or higher scores on subsequent testing but also on the increased level of interaction by students. Our anticipation is that students will more readily interact with the instructor and their classmates explaining their views on the incentives associated with the activity. In fact, the instructor may need to budget more time for discussion during the class meeting as students offer their questions to the instructor and comments on strategy to their classmates. In general, the classroom discussion is likely to be most intense when the extra credit is first offered and also when the results are announced.

The goal of this activity is greater student understanding of the concepts such as interdependence, strategic thinking, obstacles to collusion, and the cost of competition. However, the intent of the activity is for students to come to such understanding through self-discovery as a group. Therefore, it is likely more appropriate to focus on the quantity and quality of responses and comments of the class as a whole than the reactions of individual students. In particular, we expect to see more discussion and participation in general coupled with the application of specific economic concepts to the incentives associated with this classroom activity. In fact, the instructor will likely need to budget additional class time for group discussion. Successful implementation of this activity would be primarily gauged by increased levels of participation and involvement, which would then lead to greater understanding of fundamental concepts including firms' benefits of collusion and costs of competition.

## Conclusions

This paper applies a simple classroom activity to teach strategic thinking required by oligopolistic firms. The game chosen for this purpose approximates oligopolistic market operations, inclusive of a possible collusion in the sequential structure. Students are asked either to compete by writing a question for extra credit that is determined *per se* by the Cournot competition or to collude by not writing a question for a fixed amount of extra credit only if other students (firms) choose collusion also. By participating in the classroom activity, students experience simulated oligopolistic interdependence and better understand the nature of the decision-making within this market type when the topic is taught in the class.

A theoretical analysis of the classroom activity is provided to make it possible for an economics instructor to understand the nature of classroom activity. This understanding enables an instructor to compare and contrast theoretical predictions with actual results of the activity. Comparing and contrasting the results will enhance student understanding of oligopolistic competition as well as the importance of strategic thinking to the choice between collusion and competition. To help prompt students to think critically about the competition, the paper provides a 3-step framework of teaching strategic thinking on oligopoly; classroom activity → lecturing on oligopoly → explanation of results.

We also show our own classroom activities in this paper. Four different activities for extra credit were performed in two separate sections of principles of microeconomics courses. The activities' outcomes were consistent with theoretical predictions. The summary of the theoretical predictions is a) a student's incentive for competition increases when the extra credit doubles and the class size increases, and b) a student's incentive for competition increases substantially when no information on the number of questions from other students is announced.

The classroom activity for extra credit that we detail in this paper is designed to approximate the real market conditions of oligopolistic firms. By approximating their actions, we attempt to enhance student understanding of their decision making as well as strategic thinking. However, we recognise that the activity for students would better approximate decision-making by oligopolistic firms if the element of cost were included. As such, future research should be directed towards classroom experiments that incorporate costs into various activities and detail how changes in cost impact student choice.

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