

FROM FIRMS' CHOICE TO MARKET SUPPLY: MAKING THE CONNECTION THROUGH A COMPETITIVE MARKET EXPERIMENT WITH COST CARDS

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Abstract

Active learning allows educators to engage students in the learning process, making the material clearer and more memorable. To promote active learning in an introductory economics class, this paper presents an interactive classroom experiment in which students role-play as firms in a competitive market to make the connection between a firm's profit maximization and market supply. In addition to improving engagement, by reinforcing main ideas from various chapters (market structures, supply and demand, and firms' choices), this activity helps students develop a sound, less fragmented understanding of the related topics, whereas the collaborative component of the activity enables students to enhance understanding through collective decision-making.

Keywords: active learning; classroom experiment; experiential learning; firms' choice; profit maximization; supply curve; teaching economics

JEL classification: A20; A22

Introduction

Students in introductory economics classes often struggle to connect abstract theory to real business decisions. They perceive the material as disconnected from the real world and lose interest in the subject. Educators are then responsible for restoring interest by making the class engaging and relevant to the learners.

An active-learning approach that directly involves students in decision-making activities helps them truly experience the economic concepts taught in class. In addition, active-learning experiments improve learning, and students who participate in them score higher on tests (Dickie 2006), especially if these activities involve collaborative learning (Huynh et al. 2010). Classroom experiments also bridge some achievement gaps between whites and minorities and between older and younger students (Emerson and English 2016).

In this paper, we propose an active learning activity in which students can either work individually or, preferably, collaborate in teams with their classmates. Each team takes on the role of a price-taking firm in a competitive market. The instructor gives each team a "cost card" that shows the cost of producing each unit and the maximum number of units the firm can make. The "firms" choose the number of units to produce at each market price. The instructor collects the data on the quantity supplied by each firm and then adds up these quantities to determine the market quantity supplied at each price level. Using this data, the students and the instructor plot

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the market supply curve. Students are also asked to draw their individual firm's supply curve. Finally, we introduce events that change the production costs and therefore shift supply.

Literature Review

Active learning strategies, including classroom experiments, can significantly improve student learning outcomes. Empirical studies have found that students who participate in in-class economic experiments often achieve higher test scores and a deeper understanding of the material. For example, in a controlled study, Emerson and Taylor (2004) demonstrate that students in experimental sections scored significantly higher on the Test of Understanding in College Economics after introducing classroom experiments. Similarly, Dickie (2006) finds that adding experiments to an introductory microeconomics course increases post-test scores relative to traditional instruction. Beyond test performance, such activities can improve student interest in economics and increase knowledge retention. Durham et al. (2007) report that students exposed to economics games show more positive attitudes and better information retention than those in a lecture-only environment.

Despite the demonstrated benefits of classroom experiments, many educators avoid incorporating them in economics instruction, partly due to the time required to prepare and other related challenges. Yet, market and trading games have long been popular for illustrating supply and demand (e.g., Holt 1996). In fact, a recent meta-study by Cartwright and Cartwright (2024) analyzes data from 85 classroom market sessions (with over 240 simulated markets) and finds that trading prices have moved in the predicted direction of equilibrium in about 90% of the cases. This indicates that well-designed classroom experiments can reliably illustrate core market principles.

There is existing literature that focuses on teaching supply decisions and cost structures. Barseghyan and Grigoryan (2019) propose a classroom experiment to demonstrate how competitive markets adjust to cost shocks when they have capacity constraints. Hong (2020) develops a supply-chain simulation game where students consider production decisions and trade to minimize the total cost of assembling a smartphone. Geerling and Mateer (2015) designed a classroom activity that uses karaoke to teach about the law of supply, construct the market supply curve, and illustrate shifts in supply.

While these games enrich economics education, students still often struggle with fundamental economic concepts and, especially, connections between various topics. We extend the existing literature by offering an activity that relates two essential topics covered in microeconomics courses: perfect competition and profit maximization, and supply.

Teaching guide

In this section, we present the classroom experiment and how it could be used to illustrate key economic concepts. We provide detailed instructions to help educators lead the activity and the related discussion. The activity is most appropriate for introductory Microeconomics courses.

Learning objectives:

- Determine the profit-maximizing output level of a firm operating under perfect competition.
- Construct a market supply curve.
- Connect the individual firm's choice of its optimal output level to the market supply.
- Analyze the effect of events on market supply (shifts of supply).

- Distinguish between a movement along and a shift of the supply curve.

Overview of the activity:

This activity is designed as an in-class simulation game for introductory economics classes. The classroom transforms into a competitive market where each team of students represents a firm. The instructor gives each "firm" a card that specifies the marginal cost of supplying different quantities of cotton or another good of the instructor's choice (e.g., corn, wheat, soybeans). Then, the instructor announces various market prices. At each price, teams decide how many units (e.g., bales) their firm will produce to maximize its profit. The collaborative component of the activity here is essential as it allows students to learn collectively and from each other. The instructor writes the quantity supplied of each team on the board, adds the quantities, and uses the data to construct a market supply curve. This exercise helps students learn how businesses choose the output level to maximize their profit and connects firms' individual choices to market supply.

As an extension, the instructor could ask students to analyze the effect of different events on the market for the good. This exercise helps students recall the factors that shift supply.

Time needed: 45-60 minutes.

Materials needed:

- Cost cards (one per team) to distribute to students (available in the Appendix of this article). Note that you need to print and prepare these cards before class.
- Whiteboard and markers, or an Excel spreadsheet and a projector, to collect data and show the supply schedule and the supply curve.
- Cards with events to discuss (optional and also available in the Appendix).

Direct instructions:

- Explain that the goal of any business is to maximize its profit. Explain how a firm that operates in a perfectly competitive market chooses the profit-maximizing output level (by setting $MR = MC = P$). Emphasize that firms in this market structure take the price as given from the market.
- Then, begin the activity.
- **Split the class into teams of 4 – 6 students.** Feel free to adjust the sizes of the teams as needed, depending on the number of students in the class. For a class of 20–40 students, 5–8 teams work well. Typically, small teams make it more likely that all students will participate in the decision-making. On the other hand, the more teams, the more time data collection and/or calculations in further steps could take the instructor. Regardless, instructors have the flexibility to adjust the numbers as they see fit for their classes. In addition, the fact that students have to work in teams is more important than the size of these teams. Teamwork enables the learners to amplify their understanding of the material through shared knowledge related to firms' decision-making and collaboration.
- Explain to the students that **each team represents a firm** that grows cotton (or another good of your choice) in a perfectly competitive market. Each team will receive a "cost card" (available in the Appendix) that lists the marginal cost (MC) of producing each additional unit for the team's firm. For example, a card might show that the first, second, and third bales of cotton cost, respectively, \$1, \$1.20, and \$1.40 (in thousands) to

produce. Costs on the cards could be the same or different, suggesting that various firms typically have varying efficiencies and cost structures. The cards also provide the firm's production capacity limit: the maximum number of units the firm can produce. On a typical card, the capacity constraint is between 5 and 10 bales of cotton.

- **Distribute the cost cards.**
 - *Note to instructors:* If you are planning to split the class into more teams than the cards available in the Appendix, you can create additional cards with different MC, or you can give identical cards to multiple teams, suggesting firms with the same cost structure.
- Ask the teams to keep their cards private, i.e., know their own costs but not those of their competitors.
- **Explain** that all teams (firms) compete in the same market, you will be announcing different price levels, and given each price level, teams will have to decide and report how much they would produce (to maximize their profit). You could say the following: "You are all owners of farms growing cotton. Your goal is to maximize your profit given a market price and your production cost is listed on your cost card."
 - *Note to instructors:* Because many classroom games involve strategic behavior, considering the potential responses of the competitors, you could point out that this game is not one of strategy. Rather, firms simply take the price from the market and choose an output level that maximizes their profit.
- Ask students to recall where the price comes from under perfect competition. Ask: Does your cotton farm have control over the market price?
- Then, also ask: How does your business decide how much to produce?
 - Students usually remember the rule for determining the profit-maximizing quantity, i.e., $MR = MC$.
 - Make sure that all students understand that a firm in a perfectly competitive market produces a given unit as long as the market price (P) is greater than or equal to the marginal cost (MC) of making that unit, i.e., $P \geq MC$. A firm increases output until the last unit satisfies the rule $P = MC$.
 - In other words, companies in any market structure set $MR = MC$ to maximize their profit. For a perfectly competitive firm, $MR = MC = P$, because a firm's demand curve coincides with the MR of the company, and it is a horizontal line at the market price.
- If you have time, this is also a good moment to recall that the MC curve is U-shaped, and ask the class why MC generally rises as output increases, that is, why firms tend to operate in the upward-sloping part of the MC curve. Intuitively, each additional unit is more costly than the last due to diminishing returns and/or capacity constraints.
- After students confirm that they understand the information provided on their cards and what they need to do, **announce an initial market price of \$1 (in thousands of dollars per bale)**. Give the teams a minute to choose their output. Using the cost cards in the Appendix, all teams should report zero quantity at the price of \$1 (thousand) per bale of cotton.
- Then, gradually **increase the market price to \$1.50, \$2, \$2.50, and \$3 (thousand) in subsequent rounds.**

- In each round, give the teams a minute to choose their output, write the chosen quantity supplied by each firm on the board or in an Excel spreadsheet, and add the quantities to obtain the market quantity supplied (Q_s) at the various prices. **Construct a table (supply schedule).**
- Feel free to suggest as many price levels as desired, but typically, 3-4 rounds should be sufficient for students to notice the pattern (the law of supply) and to start feeling confident about firms' profit-maximization process.
- If you notice that students are struggling, you could provide more price levels for additional practice. Make sure that the decision-making is a shared learning process, that is, students make decisions together as a team and discuss to learn from each other and understand the material better and more thoroughly.
- Optionally (and if time permits), you could ask students to calculate the total cost of production at each quantity, as well as the profit at different quantities and market price. Throughout the entire process, encourage collaborative work primarily to improve understanding, but also to build connections and to learn how to work with a team effectively.
- Ask students what connection they notice between the price and the market Q_s . Which curve have they learned about graphically that shows this relationship? Using the data collected, ask them to draw the supply curve for their firm in their notebooks. Then, ask them to draw the market supply curve. The individual firm's supply curve coincides with the vertical (price) axis (zero output) until the price reaches the cost of the first unit. Then, it is upward-sloping. **Show the supply curve** for one of the firms and the market on the board. Make sure that students understand that the prices on the vertical axis are the same on all graphs, but the quantity supplied in the entire market is greater than that of any of the individual firms.
 - *Note to instructors:* If you record the quantities in an Excel spreadsheet, you can plot a figure in Excel that you could show the class on a projector on the board.
 - *Note to instructors:* Note that making sure that all teams apply the profit-maximizing rule correctly could be challenging. When students make a mistake, it usually involves the firm stopping production at an output level one unit lower than the correct profit-maximizing quantity. However, even if students make this mistake, the data collected would be consistent with an upward-sloping supply curve, and the aggregate results would still show the qualitative patterns. The reported quantity supplied would just slightly underestimate the correct one.
- **Debrief:** Ask students to summarize what they have learned with and from their teams – you can either ask them to list at least two main conclusions, or summarize with questions:
 - How does a firm in a perfectly competitive market choose the optimal output level?
 - How does an individual firm's supply curve look?
 - Is it optimal for every firm to always produce at any given price?
 - How is the market supply curve obtained, given all individual firms' supply schedules?
- **Extension:** If you have time, you could ask students what would happen in the market for the good in each, or some, of the **scenarios** described in the Appendix. You could also add any scenario of your own. You could show the scenarios through a projector on the

whiteboard, simply tell students about each event, or distribute cards with the scenarios. If you choose to provide cards with events, you need to print (and cut) prior to class.

- *Note to instructors:* Each of the events in the Appendix leads to a shift of supply. When the exact change in the costs of production is provided, you could additionally ask students to modify their existing cost cards by making the necessary calculations. For instance, consider the scenario "Good News: Your farm has just acquired a state-of-the-art automated irrigation system that optimizes water use. This new technology reduces water use, lowering your costs by 20% for every bale of cotton grown." You could instruct students to adjust MC by multiplying the numbers on their cards by 0.8 to reflect the 20% cost reduction. Then, you could select two or three price levels again, ask each team (firm) what its new optimal quantity is, calculate the market quantity supplied at each price level, and show the new (shifted) supply curve. Because calculations and repeating the activity as described are time-consuming, if you choose to do this, it could be optimal to do it by utilizing only one of the scenarios above. The remaining scenarios could be discussed only graphically without going through the entire calculation and data collection process.
- *Reflection (optional):* If you have time and would like, you could ask students to reflect on their learning experience by answering the following questions: How did the activity help you understand firms' choice and market supply? How would you change the activity to make it better?

A few final thoughts are worth mentioning. First, this activity is most appropriate for a discussion related to profit maximization of firms in a perfectly competitive market. However, if you prefer, you could perform the experiment when you first discuss the law of supply and the difference between a movement along and a shift of the supply curve. In the latter case, you will need to explain how firms choose whether to produce a given unit intuitively through marginal analysis, i.e., comparing the marginal cost to the marginal benefit.

Second, if you do this activity when you discuss profit maximization, then the extension (the scenarios) will be an opportunity to review the factors that shift supply, and the distinction between a movement along the supply curve and a shift of supply. If you perform the experiment when you introduce students to the supply side of the market for the first time, then this extension would help students distinguish between a movement along the supply curve and a shift of the supply curve. Specifically, elaborate on the fact that a change in the quantity supplied is associated with a movement along the supply curve, whereas a change in supply is a shift of this curve. The distinction between the two terms often confuses the students. Explain that whenever the price was changing in the activity, they were choosing an optimal quantity supplied (i.e., a movement along the supply curve). In contrast, the scenarios in the Extension change the supply (i.e., the supply curve shifts).

Third, experiments such as the one suggested in this article undoubtedly take class time, but research suggests that they do improve learning outcomes, interest in the topic, and retention (Dickie 2006). Additionally, students' attention lasts only for a certain amount of time. However, research has found fewer attention lapses during times of active learning (Pillana 2020), suggesting that active learning could alleviate lost learning concerns driven by the drop in the attention span and concentration struggles of today's students (Cueto 2025).

Finally, while this activity connects abstract theory to real-world business decision-making processes, its major strength is the active learning and student collaboration components. Students tend to be engaged and eager to perform the activity. They have shared with the instructors that it helped them better understand the related concepts and their applications, and they additionally enjoyed connecting with classmates during the learning process. This is consistent with the literature on learning, retention and engagement. Specifically, Dickie (2006) claims that in-class experiments are effective in improving student outcomes. Literature has not reached a consensus about the precise level of effectiveness of experiments (Picault 2019), but it has suggested that they do improve motivation and engagement (Logan 2022). They also allow for active, experiential learning that facilitates understanding of the material and makes it more memorable (Settlage et al. 2019).

Conclusion

Experiments in economics classes improve understanding, interest, and student engagement. This article proposed such an activity that illustrates firms' choice, the law of supply, and the link between individual firms' decisions and the market. This activity is easy to implement and builds a community in the classroom through cooperative decision-making. It requires minimal resources and can easily be adjusted for any class size.

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Appendix: A sample cost card

Your company grows cotton. The following is your cost schedule:

Quantity (Q) in bales of cotton	Marginal cost (MC) in thousands of dollars (\$)
1	\$1.2
2	\$1.4
3	\$1.6
4	\$1.8
5	\$2.0
Fixed cost (FC) = \$0.1	

1. How many bales of cotton are you willing and able to supply if the market price is:

- a) \$1?
- b) \$1.50?
- c) \$2?
- d) \$2.50?
- e) \$3?

2. (*Extension*) Consider each of the events below. In each scenario, how will the supply of cotton be affected?

- a) Good News: Your farm has just acquired a state-of-the-art automated irrigation system that optimizes water use. This new technology reduces water use, lowering your costs by 20% for every bale of cotton grown. *Hint:* Adjust your cost by multiplying the baseline costs by 0.80.
- b) Breaking News: The government increases tariffs on fertilizer imports from China and Canada. As many cotton growers rely on imported fertilizers, your cost of a key input increase by 25%. *Hint:* Adjust your cost by multiplying the baseline costs by 1.25.
- c) Market Update: Consumers have become more concerned about chemicals applied to cotton. Hemp has emerged as a viable alternative to cotton because it is more resistant to pests. Due to an increase in consumer interest in hemp, its price has risen sharply, and now you prefer to sell more hemp. Many of your resources could be reallocated from cotton to hemp production. Such resource reallocation would reduce your ability to supply cotton.
- d) Economic Outlook: Cotton growers are predicting that a new farm bill that would introduce new cotton regulations could drive up cotton production costs by 15%. Expecting higher future prices, many cotton growers prefer to withhold part of their current cotton supply.
- e) Industry News: A large farm has announced plans to start growing cotton in your area. With more competitors entering the market, the overall number of sellers is increasing.

Note to instructors: The instructor has to provide a different cost card to each team. The following are some possible variations of the card above:

Quantity (Q) in bales of cotton	Marginal cost (MC) in thousands of dollars (\$)								
	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I
1	\$1.2	\$1.2	\$1.3	\$1.5	\$1.2	\$1.3	\$1.2	\$1.3	\$1.3
2	\$1.4	\$1.4	\$1.5	\$1.8	\$1.4	\$1.5	\$1.4	\$1.5	\$1.5
3	\$1.6	\$1.7	\$1.7	\$2.1	\$1.6	\$1.7	\$1.5	\$1.7	\$1.6
4	\$1.8	\$1.9	\$1.9	\$2.4	\$2.0	\$1.9	\$1.7	\$1.9	\$1.8
5	\$2.0	\$2.2	\$2.2	\$2.7		\$2.2	\$1.9	\$2.1	\$1.9
6		\$2.4	\$2.4	\$3.0		\$2.4	\$2.1		\$2.1
7		\$2.7		\$3.3			\$2.3		\$2.2
8				\$3.6					\$2.4
9				\$3.9					
	Fixed cost (FC) = \$0.1	Fixed cost (FC) = \$0.1	Fixed cost (FC) = \$0.2	Fixed cost (FC) = \$0.3	Fixed cost (FC) = \$0.1	Fixed cost (FC) = \$0.2	Fixed cost (FC) = \$0.3	Fixed cost (FC) = \$0.2	Fixed cost (FC) = \$0.3