



## Student Performance Q&A: 2015 AP<sup>®</sup> Microeconomics Free-Response Questions

The following comments on the 2015 free-response questions for AP<sup>®</sup> Microeconomics were written by the Chief Reader, Pamela Schmitt of the United States Naval Academy, and Question Leaders Woodrow Hughes, David Burgin, and Michael Brody. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student performance in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

### Question 1

#### *What was the intent of this question?*

The question assessed the students' ability to work with a perfectly competitive model under various circumstances. Part (a) required the students to explain whether the market price is greater than, less than, or equal to the price a typical firm charges. The question tested whether the student understands why the perfectly competitive firm is a price taker. Part (b) required the students to draw and correctly label side-by-side graphs of a perfectly competitive market and a typical firm in the market. Items required in part (b) tested for understanding: 1) the determination of the market equilibrium price and quantity; 2) how a typical firm determines its profit-maximizing output level; 3) the average revenue (AR) for the firm is constant and equals the price determined by the market; 4) when the firm is earning economic profits the average total cost (ATC) must be less than the price at the level of output produced by the firm, and the marginal cost (MC) curve intersects the ATC at the minimum of the ATC curve; and 5) the determination of the total cost of a firm earning economic profits using a graph. In Part (c) the students needed to explain why, if one of the firms in the industry raises its price above the market price, its total revenue will fall to zero. Part (d) assumed the perfectly competitive industry is in long-run equilibrium. The two questions in part (d) tested whether the student understands the impact of a lump-sum subsidy on the firm's output in the short run, and the process that changes the market price and output in the long run.

#### *How well did students perform on this question?*

The mean score was 4.06, which is approximately 40 percent of the maximum possible score of 10 points. Students performed well in graphing supply and demand for the industry.

### ***What were common student errors or omissions?***

The lowest-scoring part of this question was the second point in part (d)(ii), which asked students to explain what would happen to the market price and quantity in the long run as a result of a lump-sum subsidy. About one-tenth of the students correctly stated that because of the subsidy, economic profits would be earned, which would attract new firms into the market, which shifts the market supply curve to the right. Almost one-third of the students correctly stated that in the long run market price would decrease and market quantity would increase, but many fewer provided a complete explanation, including all three elements listed above. Another common error was in part (d)(i), which asked the students to explain if the firm's quantity in the short run would increase, decrease, or remain the same. Many students incorrectly stated that quantity would increase because of the additional funds from the subsidy; however, only about one-fifth of the students correctly stated that the firm's quantity would remain the same because the lump-sum subsidy has no effect on marginal cost or marginal revenue. Since neither marginal costs nor marginal revenues change, the profit-maximizing output of the firm will remain the same. A third common error was in part (c), which asked students what would happen to the total revenue of a single firm if that firm raised its price above the market price. Many students answered that total revenue would decrease, but in a perfectly competitive industry, this firm would lose all sales, and its total revenue would drop to zero. Part (b)(v), which asked students to shade in the area representing total costs, was answered correctly by about two-fifths of the students. Students often answered this part by shading in the economic profit rather than the total costs.

### ***Based on your experience of student responses at the AP<sup>®</sup> Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?***

Almost half of the points in this question were linked to an explanation. Answering these types of questions requires a greater understanding of the concepts involved, which requires critical thinking skills and logical analysis. Students can practice these skills by answering questions such as, "If this happens, what will happen next?" and "Why did this happen?" Parts (a), (c), and (d) required an explanation to earn points.

Part (a) asked the student to explain the relationship between the market and firm price. Teachers need to emphasize that in perfect competition, firms are price takers, taking the price that is determined by the market. Part (c) asked students to explain what would happen to the total revenue of a competitive firm that raised its price above the market price. Many students answered that total revenue would decrease. This is partly correct; total revenue, in this case, would decrease to zero because the firm would lose all of its customers. The important part was not the directional change in total revenue, the decrease, but the conceptual understanding of perfect competition; that total revenues fall to zero because the firm loses all of its customers. This is one of the explanations teachers can use to interpret the perfectly elastic demand curve the firm faces.

In part (d) the assumption is that the market is now in long-run equilibrium. Teachers need to ensure that students have a full understanding of the conditions required for this to occur. Part (d)(i) asked what happens to the firm's quantity in the short run if the government gives a lump-sum subsidy. Teachers should emphasize the difference between a subsidy and a tax, as many times the students analyzed this question by using a tax. The major point of emphasis should be that because the subsidy is a lump sum the marginal cost for the firm will not change. Because marginal cost does not change, firms will not change the level of output. Part (d)(ii) asked what happens to market price and quantity in the long run as a result of this subsidy. In this case, teachers should emphasize the process that leads from the initial long-run equilibrium to another long-run equilibrium. The subsidy reduces the average cost for the firm; this creates positive economic profits in the short run. Positive profits for firms attract entry into the industry, so new firms enter the market. The new entrants in the market increase or shift the market supply curve to the right. This increase in supply decreases market price and increases market quantity.

Most students answered parts (b)(i), (ii), and (iii) correctly. Part (b)(iv) asked the student to draw the average total cost (ATC) curve for a firm earning profits in the short run. Teachers should emphasize that when a firm is earning profits in the short run, the ATC must be less than the price. Secondly, teachers should continue to emphasize that the marginal cost curve must intersect the average total cost curve at the lowest point of the ATC. One technique that may make this easier to do is to draw the marginal cost curve first then fit the average total cost curve around the marginal cost curve.

## **Question 2**

### ***What was the intent of this question?***

The question assessed the students' ability to read and interpret a game theory matrix. It tested the students' ability to identify whether a dominant strategy exists or not. It asked the students to identify the payoffs for each sandwich shop without cooperation, which are the Nash equilibrium payoffs. The question then assessed the students' ability to redraw the matrix if the government would subsidize each sandwich shop that chooses to offer a low price. Using the redrawn matrix, the students then had to identify if the subsidy changed either shop's strategy as well as compare profits with and without the subsidy.

### ***How well did students perform on this question?***

The mean score was 2.99, which is 60 percent of the maximum possible score of 5 points. Students performed well redrawing the matrix after the subsidy to either sandwich shop that chooses the low-price strategy. Students also performed well identifying that Breadbasket's dominant strategy is to choose a low price and that Quicklunch does not have a dominant strategy in the original matrix.

### ***What were common student errors or omissions?***

The hardest part of this question was part (c)(ii), which asked students to compare the Nash equilibrium profits earned by one sandwich shop, Breadbasket, before and after the government subsidizes each shop for choosing to sell at a low price. This was difficult because it is counter-intuitive for a government subsidy to lower profits. However, it illustrates whether students understand that government intervention is not always beneficial and that game theory relies on the interdependence of firms. Forty-five percent of the students incorrectly added the \$20 subsidy to the profit they identified in (b)(i) instead of realizing that, with the subsidy, Quicklunch now has a dominant strategy to choose a low-price strategy. The change in Quicklunch's best response decreased Breadbasket's profits from \$120 to \$95. Forty percent of the students incorrectly interpreted the matrix after the subsidy to the low-price strategy was applied.

### ***Based on your experience of student responses at the AP® Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?***

Finding a Nash equilibrium in the absence of both players playing their dominant strategies are skills that need to be stressed in the classroom. In this problem, Breadbasket has a dominant strategy to choose a low price regardless of what Quicklunch chooses. When Quicklunch chooses a high price, Breadbasket can earn \$120 by choosing a low price or \$105 by choosing a high price. When Quicklunch chooses a low price, Breadbasket can either earn \$75 by choosing a low price or \$40 by choosing a high price. But Breadbasket's choice has nothing to do with choosing a dominant strategy; the best response for Breadbasket depends on Quicklunch's action. If Breadbasket chooses a high-price strategy, Quicklunch will choose a low-price strategy because \$130 is greater than \$110. If Breadbasket chooses a low-price strategy, Quicklunch will choose high since \$80 is greater than \$70. Quicklunch knows that Breadbasket has a low-price dominant strategy, Quicklunch will choose a high-price strategy giving Breadbasket a \$120 profit and Quicklunch an \$80 profit (and thus our Nash equilibrium).

While most students correctly redrew the matrix with the subsidy applied to a low-price strategy, many just assumed that the subsidy would benefit firms in relation to profits. Reading the matrix, identifying the dominant strategy after the subsidy, and then comparing the results with the original matrix were the areas in which students had the most difficulty. In general, students are taught that subsidies are used to benefit firms/consumers while taxes have the opposite effect. While these generalizations may hold true in many cases, students need to be encouraged to utilize the tools of game theory and trust the results, even if they at first seem counter-intuitive.

### Question 3

#### *What was the intent of this question?*

The question assessed the students' ability to analyze a given supply and demand graph in a competitive market when the market is both in and out of market equilibrium. The students were asked to calculate the area of producer surplus when the market is in equilibrium. Although the students did not have to identify the equilibrium price and quantity for the market, correctly identifying the equilibrium price and quantity was required in order to calculate the producer surplus. The students were given a price floor that is set below the equilibrium price, and the students were asked to explain why this price floor will not create a shortage or surplus. The students were then given a price ceiling that is set below the equilibrium price and the students are asked to explain whether this creates a shortage or a surplus and why. The students were then given a quantity produced in order for the students to calculate the deadweight loss caused by a restriction of output. Finally, the students were asked to calculate the price elasticity of demand over a specific range and then to interpret their calculation to determine if demand is relatively elastic or inelastic.

#### *How well did students perform on this question?*

The mean score was 3.34, which is approximately 56 percent of the maximum possible score of 6 points. Students performed well on part (a), which asked them to calculate the producer surplus using values taken from a graph, on part (b) which asked them to recognize that a price floor set below equilibrium is not effective, and on part (c), which asked them to explain that an effective price ceiling causes quantity demanded to exceed quantity supplied, resulting in a shortage. Students also scored well in part (e)(ii) which asked them to interpret their calculation from part (e)(i).

#### *What were common student errors or omissions?*

Incorrectly calculating elasticity of demand in part (e)(i) was by far the most common mistake on this question. Many students simply calculated the change in quantity divided by the change in price when they should have been calculating the *percentage* change in quantity divided by the *percentage* change in price. Another common error was to invert the equation and divide the percentage change in price by the percentage change in quantity. Part (d) was the next most missed point. A common error was for students to only calculate the portion of the deadweight loss that represents lost producer surplus, omitting the portion of the deadweight loss that represents lost consumer surplus.

#### *Based on your experience of student responses at the AP<sup>®</sup> Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?*

In general, a well-taught AP Microeconomics course should focus on teaching students to think like economists and not to focus on memorization. However, there are some things that students do need to memorize, and the formula for calculating elasticity of demand is one of them. When the questions on the exam ask students to "show your work," students should respond by first setting up the full equation and then performing the calculation. At the reading, we are more concerned with the setup (because that is where students show their economic knowledge) than with the final calculation.