19 | MORE PROFIT MAXIMIZATION FOR THE COMPETITIVE FIRM

Purpose: To examine the effects of taxes, subsidies, and changes in fixed cost on the choices made by a competitive firm

Computer file: **pcmax298.xls**

Instructions and background information:

This problem set is a follow-up on the previous one. You are still a management consultant to the **CLEAN CREW SERVICE CO.**, a small provider of apartment cleaning services in a large market with many competitors. The set up of the spreadsheet is the same as before. The only difference is that now you will advise the firm on the probable results of changes in the taxes the firm must pay, and on the results of changes in fixed cost.

You learned earlier that a per unit tax of t dollars per unit of output raises both average costs and marginal costs of the firm by exactly t dollars. Both average and marginal cost curves shift up by exactly the amount of the tax per unit. A per unit subsidy (a negative tax) has exactly the opposite effect.

A competitive firm that wants to maximize profit will want to produce the output where marginal revenue equals marginal cost. If a tax causes marginal cost to rise, then the firm will make appropriate adjustments to the tax by reducing output. The spreadsheet shows costs both before and after a tax is imposed. The graph shows the marginal and average cost curves only after the tax.

A change in fixed cost does not change marginal cost. You will see that when fixed cost is changed there is no incentive for the firm to change output. It maximizes profits at the same output both before and after the change in fixed cost.

Here are some things to watch for and learn as you do the problems:

1)   THE PROFIT MAXIMIZING OUTPUT IS THE ONE WHERE MR = MC. SO WHEN MR *MINUS* MC EQUALS ZERO, PROFIT IS MAXIMIZED.

2)   A per unit tax on output will cause the firm to reduce output in order to maximize profits. Total profits fall as a result of the tax.

3)   A per unit subsidy will lower marginal costs. The firm will respond to the subsidy by increasing output. Maximum profits will be larger with the subsidy than without it.

4)   A change in fixed cost will change the firm's profits by the amount of the change in fixed costs. But the profit maximizing output will be unchanged, and the same amount of resources will be devoted to production of the good in the firm.

MATH MAVEN'S CORNER: The total cost curve when there is a per unit tax is given by $TC = 250 + aQ + bQ^2 + tQ$, where Q is output, and t is the tax per unit. Total revenue is pQ, where p is the price of output. Profit = TR - TC. To maximize profit, take the derivative of profit with respect to output and set the derivative equal to zero. By definition, MR is the derivative of TR with respect to Q, and MC is the derivative of TC with respect to Q. Maximizing profit therefore requires $MR = MC$. Note that for a competitive firm MR *always* turns out to be equal to price. Note also that the tax raises the MC curve by exactly t.

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Questions

Set fixed cost and the tax to their baseline values.
      1) If price is $65 per apartment, what is the profit maximizing output for the firm?
      2) What are total profits at this output?

Increase the per unit tax to $10 per apartment, and keep output at the level you found in question 1.
      3) If price is at $65 per apartment, what is marginal revenue
      4) What is the value of marginal cost?

Keep the tax at $10 per apartment, and price at $65.
      5) What's the profit maximizing output?
      6) What are total profits at this output?
      7) What's the firm's tax bill at this output?

Set all variables to their baseline values, and set price to $65. Now raise fixed cost to $500.
      8) What's the new profit maximizing output? [Compare to 1 and 5.]

Following on from question 8:
      9) What's total profit when fixed cost is $500?
      10) By how much did profit fall when fixed cost increased by $250?

Set price to $65, and FC and TAX to their baseline values. Government now sets a subsidy of $8 per apartment cleaned.
      11) What's the new profit maximizing output? [Compare to question 1.]

Following on from question 11:
      12) What are total profits including the subsidy
      13) What's the total subsidy paid to the firm?

Set all variables to baseline values and set price to $60.
      14) How large a per unit tax must the government impose to get the firm to produce 20 units of output?