|  |  |
| --- | --- |
| **Microeconomics - Unit 6: Costs of Production in the Short Run** | |
|  | **Learning Objectives:** | |
|  | At the end of this unit you should be able to:   1. Understand how and why economists measure costs differently from accountants 2. Understand the crucial relationship between productivity and costs 3. Understand the important difference between fixed costs and variable costs. 4. List and graph the seven specific cost definitions used by economists 5. Explain the meaning of increasing productivity and cutting costs |  |
|  | **Learning Materials:** | |
|  | * Chapter 6 - Principles of Microeconomics | |
|  | **Overview of this Unit** | |
|  | **Introduction:**  In this unit, we shift our focus away from the buyer, to the seller’s point of view. In microeconomics the seller is often referred to as the “firm”. Managing costs is a critical factor for any firm as there are many costs associated with running it – some obvious and some not so obvious. We will explore how these costs can be classified and how we can analyze these costs to help make better business decisions. We will also introduce you to the concept of the “Short Run” costs. The Short Run is a period of time in which the business cannot significantly change any of the factors of production. Recall from the first unit, that the factors of production include Land (natural resources), Labour (employees), Capital (productive resources including money) and Entrepreneurship (innovation). It’s hard to get more money, people and buildings in a very short time – it’s also hard to get rid of these factors quickly if you need to reduce your costs or get your hands on more money. Recognizing that factors of production are hard to adjust in the near term constrains our ability to react to opportunities and threats.  A cost analysis in the short run is critical to effective business management because if you know your costs you can better plan and set a level of production and a price that allows your company to make a profit and thereby stay in business. | |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    The Production Process

|  |
| --- |
| **Unit 6 - Topic 1: The Production Process - Costs and the Production Process** |
| In Newfoundland and Labrador we have been blessed with an abundance of natural resources.  As this is written, the Pulp and Paper industry in this province has been thrown into crisis.  Paper mills in Stephenville and Grand Falls-Winsor have been shut down and only one mill remains in Corner Brook. Keeping the Corner Brook mill open in such an environment calls for careful control of short run costs. We will use the Corner Brook paper mill as an example of how real world events can be applied to the economic theory that we will be discussing in this unit.  If we consider a paper mill as a production facility, inputs go in, are change or processed and outputs come out.  Productive inputs would include wood fiber, employees, the physical mill and its equipment, and management.  The output would be the paper products that the mill produces and sells all over the world.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **The Production Process in the Paper Making Business** | | | | | | **INPUTS** |  | https://d2l.cna.nl.ca/content/On_Campus_Course_Support/EC1100_On_Campus_PT_CL/images/corner_brook_from_above.jpg |  | **OUTPUTS** | | Land: **Wood supply**  Labour: Employees  Capital: Mill, Equipment  Entrepreneurship: Abitibi Consolidated Management | Paper | |
| Each of these inputs identified in the paper making / production process have costs associated with them. In business we divide costs into two categories - Operational Costs and Capital Costs. Operational costs are incurred during the production process and are relatively easily quantified and applied to the costs of goods produced. A defined amount of raw material such as wood, for example, can be associated which each roll of paper produced in a paper mill.  Unfortunately, Capital Costs associated with each level of production are less easily determined. Capital equipment, such as the mill building, has a lasting value over time and its cost is less easily quantified as a set cost per roll of paper produced. Accounting has resolved this problem by inventing the concept of depreciation in which the relative costs of capital goods can be expensed over time or over the production process. |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    Costs of Production

|  |
| --- |
| **Unit 6 - Topic 2: Costs of Production** |
| Determining the cost of producing a roll of paper is not necessarily a simple task.  Some of the costs can be calculated relatively easily.  If wood costs the mill $200 a tonne and to make each roll of paper requires 5 tonnes of wood then the task of assigning cost would be relatively easy - 5 x $200 = $1000.  This is known as an **Explicit Cost**. But the key question is: how do you consider other less tangible costs such as the cost of an owner’s investment?  Can you allocate an exact cost of the **owner’s** investment into each roll of paper? It is not always easy!  While Explicit costs can be calculated using normally accepted accounting measures (showing up on firm’s financial statements) certain other costs, known as **Implicit Costs**, can be more challenging to calculate because they are not strictly costs identified with running the business.  If you run a small logging operation harvesting logs, for example, and after expenses you make an Accounting profit of  $10,000 a year, while you could have made $30,000 if you had worked for someone else, then your implicit costs would be $30,000-$10,000 = $20,000.  This $20,000 is the monies foregone  (opportunity costs) of the next possible option for you.  By asking, “What else could you have done with that time or your money?”  Economists factor in implicit or opportunity cost and they argue that these costs be included into the assessment of what they refer to as **“Economic Profit”**   |  |  |  | | --- | --- | --- | | **Total Accounting Profit** | = | **Total revenue less total explicit costs** | | **Total Economic Profit** | = | **Total revenue less total costs (both implicit costs and explicit costs)** |   So how can a firm use this information in its decision making process?  Well, before making investments, a firm needs to consider other options for a potential investment first.  Now that businesses operate in a global context we are seeing this happen more and more often.  So what costs should firms ignore in making decisions? Let us say Corner Brook mill owners had just spent $100,000,000 on refitting that mill. Should that influence their decision to potentially close it? The short answer is no! Money that has been invested in the past that cannot be recouped should have no influence on future decision-making. We say that these investments are "**Sunk**" because they are unrecoverable and cannot be ‘earned back’ in future years. Sunk costs therefore should not be a consideration in business decision making.  So on what basis should a firm decide to remain open or close down? As long as a firm can make enough money to cover off its explicit and implicit costs it should remain in business. If Mill owners could cover its costs of product, labour and the like (explicit costs) as well as if its investors could make as much as their next available alternative investment (implicit costs), then the mill should remain open. Under this scenario, investors would make a **Normal Profit**. Any amount they receive in excess of a basic amount to cover explicit costs and implicit costs would be considered as **Economic Profit**.   |  |  |  | | --- | --- | --- | | **Normal Profits are the profits required to keep a firm in business** | = | **Total Revenue less Explicit costs & Implicit Costs** | | **Economic profits are profits in excess of Normal Profits** | = | **Total revenue less Normal Profit** | |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    The Theory of Production

|  |
| --- |
| **Unit 6 - Topic 3: The Theory of Production** |
| The concept of productivity is heavily discussed in modern business courses.  Productivity refers to the amount of outputs you get from the production process relative to the amount of inputs.  As production increases, it is obvious that production costs will rise accordingly, however with increases in productivity, costs do not rise at the same rate as production output (more "bang for the buck").  To evaluate productivity, we need to measure the relative changes in input as compared to the relative changes in output.  Before we do this we need to be familiar with the terminology that we will use:   * Marginal Product(MP) is defined as the increase in total product as a result of adding one more unit of input. * MP = Change in total Product (or output) / Change in Input * Average product (AP) is defined as the Total product (or total output) divided by the quantity of inputs used to produce that total.  This yields the average amount produced per unit of input. * AP = Total Product / Units of Input   To demonstrate how Marginal and Average product are calculated and used **let’s** look at a simple example:  Assume that you own a logging company with yourself as the sole employee.  You have a couple of saws and a horse.  Working alone you can cut 8 cords of wood a day.  Remembering Marginal Product is = Change in total Product (8-0) / Change in Input (1-0), for a Marginal Product of 8.  Remembering Average Product = Total Product (8)/ Units of Input (1), for an Average Product of 8.   |  |  |  |  | | --- | --- | --- | --- | | **Units of Labour (input)** | **Total Product (output)** | **Marginal Product** | **Average Product** | | 0 | 0 | 0 | 0 | | 1 | 8 | 8 | 8 |   Now assume that you hire an extra logger.  Together, you can cut 20 cords of wood a day.  Marginal Product for the additional logger is = Change in total Product (20-8) / Change in Input (2-1), for a Marginal Product of 12.  Average Product  = Total Product (20)/ Units of Input (2), for an Average Product of 10.  This means that on-average, you both cut 10 cords - up from the 8 you cut when working alone.     |  |  |  |  | | --- | --- | --- | --- | | **Units of Labour (input)** | **Total Product (output)** | **Marginal Product** | **Average Product** | | 0 | 0 | 0 | 0 | | 1 | 8 | 8 | 8 | | 2 | 20 | 12 | 10 |   Finally, assume that you hire a third logger.  Together, three of you can cut 25 cords of wood a day.  Marginal Product is = Change in total Product (25-20) / Change in Input (3-2), for a Marginal Product of 5.  Average Product = Total Product (25)/ Units of Input (3), for an Average Product of 8.3.  Note in this case that Marginal product compared to the two person operation dropped – **a** correspondingly Average product dropped as well. If marginal product drops, average product will begin to drop as well.     |  |  |  |  | | --- | --- | --- | --- | | **Units of Labour (input)** | **Total Product (output)** | **Marginal Product** | **Average Product** | | 0 | 0 | 0 | 0 | | 1 | 8 | 8 | 8 | | 2 | 20 | 12 | 10 | | 3 | 25 | 5 | 8.3 |   This simple example not only demonstrates the process of calculating the marginal and Average products, it also shows the optimal level of productivity.  Two workers give the maximum average product.  Why does productivity fall with the addition of a third worker.  Well although workers were added you only had 2 saws and one horse - you had limits placed on these productive resources so the third worker could not contribute much to the overall process.   Inevitable in all production process, when resources are limited over the short term, output will be constrained.  This is a demonstration of a concept called the **Law of Diminishing Returns**.  It States that as more of a variable input is added to a fixed input in the production process, the resulting increase in output will, at some point, begin to diminish.  So how does this all relate to business?  To manage a firm so that it operates most efficiently it is important that we understand these important concepts:  **The Law of Diminishing Returns** - As additional input is added to a production process the total amount of product produced will increase, however the rate of increase will begin to decline at some point because inefficiencies begin to occur.  In our example, you will notice that total product increases as units of input increases.  Think of cooks in a kitchen - more cooks can do more but as you add bodies into a confined space people start bumping into one another – too many cooks in the kitchen! Hence as you add cooks and things get crowded, each successive one will contribute less.  **Maximum average product** – Typically we would like to measure that “output per unit of input”.  To do this we simply take the total output and divide by the units of input. This tells us the point of highest or best productivity.  The point at which this yields the highest average output is the most efficient point. In our example, the optimum output per unit of input occurs at 2 units of labour. |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    Incorporating Costs into Output

|  |
| --- |
| **Unit 6 - Topic 4: Incorporating Costs into the Determination of the Best Level of Output** |
| With an understanding of the basic concepts of Marginal Product and Average product we can move deeper into our analysis of production efficiency. We now need to include an evaluation of our cost structure in order to determine the best level of output that we should produce. To be able to do this we need to understand the basic terms and what each term means.  ***Variable Costs***  Variable Unit Costs are the additional costs incurred to make each additional unit of product produced. Combining each unit’s variable cost gives us the Total Variable Cost.  ***Marginal Costs***  Marginal costs are simply the additional variable cost incurred as we move from one level of production to another. Marginal cost can be calculated between levels of production.  To calculate Marginal Cost we need to divide the change in total variable cost by the change in output (marginal product). As long as our marginal costs continue to decline through our various levels of output we are achieving economies of scale.  ***Average Variable Costs***  To calculate average variable costs simply take the total variable costs and divide it by the total output. As long as our average costs are declining through the various levels of output, we should continue to add additional units of input. Looking over the various levels of output, we can determine our most productive point at the lowest average variable cost point.  ***Total Fixed Costs***  Some costs remain constant regardless of the level of output.  These costs are said to be fixed and they do not change over the relevant range of production.  ***Total Costs***  The fixed cost of making a product combined with the variable costs of making a product yield the total cost.  ***Average Total Costs***  To get a better picture of costs per unit produced, we can take our total costs and divide it by the number of products produced to calculate an average total cost per unit.  By evaluating average total costs over the relevant range of output you will note that average costs decline as output increases, reaches a minimum and then begins to increase – remember too many cooks in the kitchen?  The output level with the lowest Average Total Cost is said to represent the economic capacity of the firm.  Once we can calculate each of these cost calculations we can then use this data to make informed business decisions. |
|  |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    Interactive Graph - Production and Costs

|  |
| --- |
| **Unit 6: Interactive Graph - Production and Costs** |
| **Graphing Exercise: Production and Costs**  In making payments for its resources, the firm incurs costs of production. In the short run, a time frame over which capital is fixed, the total cost of any given level of output can be broken into fixed cost and variable cost. On a per unit basis, these can be expressed as average fixed cost and average variable cost, which together sum to average total cost. Marginal cost refers to the extra cost of producing one additional unit. Obviously, these short-run costs reflect both the costs and the productivity of the inputs.  **Exploration: What is the relationship between input prices, productivity, and costs?** |

|  |
| --- |
|  |
| This interactive graph contains productivity data - the physical relationship between inputs and output - for a hypothetical firm. Total product, the relationship between labour input and output, is graphed on the upper panel, while marginal and average product are graphed below. Clicking and dragging the Productivity Index slider to the right allows you to increase the productivity of labour by any amount up to 25 percent.  By clicking on the Production/Costs button, the applet toggles to the graphical portrayal of the firm's cost curves: Variable Cost, Fixed Cost, and Total Cost are in the upper graph, while the lower panel contains the corresponding Marginal and Average-Total-Cost curves. You can change the wage rate and fixed cost by clicking on the corresponding bold values below the tabular productivity data. In either the production or the cost mode, clicking Reset restores all values to their initial levels. |

|  |  |  |
| --- | --- | --- |
| **Self Quiz** | | |
| ***1.*** | How are the positions of the production graphs affected by an increase in labour productivity? | Show Answer |
| ***2.*** | Over what range of labour input are there increasing marginal returns to labour? Over what range are there decreasing marginal returns to labour? | Show Answer |
| ***3.*** | Reset productivity to its original level. Over what range of output does marginal cost decrease? Over what range does it increase? How do these ranges correspond to labour productivity? | Show Answer |
| ***4.*** | When the wage is $20 and fixed cost is $100, what is the marginal cost of the 420th unit of output? How is this affected by a decrease in fixed cost? How is it affected by an increase in the wage? How is it affected by an increase in labour productivity? | Show Answer |
| ***5.*** | Experiment on your own. Considering the three factors investigated in the applet - fixed cost, wage rate, and productivity - which factor(s) will increase marginal cost? How will these same factors affect average total cost? Can average total cost increase without an increase in marginal cost? | Show Answer |
|  | | |

|  |
| --- |
| Economic growth allows for expanded choices: larger quantities of both pizzas and robots become attainable with either advances in technology or the availability of greater resources. One way that greater resources may become available is by choosing to use some of society's currently available resources to invest in the future-for example, by spending on education or research, or by producing capital goods.  The amount of resources available to an economy at some future point depends upon the choices it makes today. To use the graph, use the mouse to drag the scroll bar button to the left or right, observing the impact of different choices on the future position of the production possibilities curve. |
|  |
|  |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    Summary

|  |
| --- |
| **Unit 6 - Summary** |
| This unit introduced you to the concept of production costs for a firm over the short run. In the short run, levels of inputs from factors of production (land, labour, capital and enterprise) are essentially fixed.  All firms operate in the short run and an appreciation of how costs can be measured and evaluated is very important in order to determine capacity and sustainability. |

EC1100 Microeconomics - PT (CL) - Unit 6.  Short Run Costs -    Suggested Problems

|  |
| --- |
| **Unit 6 - Suggested Problems** |
| In order to reinforce what you have learned in this unit I suggest you review the following end-of chapter problems.  Once you have attempted this review  [Student Answer Key](http://highered.mcgraw-hill.com/sites/0070946418/student_view0/answer_key.).   * **Answered Problems: 36A, 37A, 38A, 39A, 40A, 41A, and 42A** |