## Unit 3

## SCARCITY, WORK, AND CHOICE

## OUTLINE

A. Introduction
B. Scarcity and choice: Key concepts
C. Decision-making under scarcity
D. Income and Substitution Effects
E. Application to technological change
A. Introduction

## The Context for This Unit

- Labour is work.
(Unit 1)
- Labour is an input in the production of goods and services.
(Unit 2)
- New technologies raise the productivity of labour.
- How would that affect living standards?
- How would that affect the free time and working hours chosen by individuals?


## This Unit



For most countries, living standards have greatly increased since 1870. But there are disparities in free time and income across countries.

## This Unit



Use a model of individual choice to explain the differences in work hours across countries and over time

## B. Scarcity and choice: Key concepts

## Example: Grades and study hours

|  | High study time | Low study time |
| :--- | :--- | :--- |
| Good environment | 3.63 <br> (11 students) | 3.43 <br> (31 students) |
| Poor environment | 3.36 <br> (31 students) | 3.17 <br> (11 students) |

Source: Plant et al (Contemporary Educational Psychology, 2005).

- Students choose how many hours to study, which affects their grade (GPA).
- We assume a positive relationship between GPA and the number of hours studied (evidence that this is true, ceteris paribus).


## Production function

| Study hours | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 or more |
| ---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Grade | 0 | 20 | 33 | 42 | 50 | 57 | 63 | 69 | 73 | 78 | 81 | 84 | 86 | 88 | 89 | 90 |

Production functions show how inputs (e.g. labour) translate into outputs (e.g. goods and services), holding other factors constant (e.g. production environment)


## What can production functions tell us?

1. Marginal product

Change in output per unit change in input (evaluated at a given point, holding other inputs constant)

## 2. Average product

Average output per unit of input

Slope $=$ Marginal product


## Studying example

| Study hours | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 or more |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Grade | 0 | 20 | 33 | 42 | 50 | 57 | 63 | 69 | 73 | 78 | 81 | 84 | 86 | 88 | 89 | 90 |



Marginal and average product of study hour


Diminishing marginal product: Studying becomes less productive, the more you study.

## Indifference Curves

Choices depend on preferences

Indifference curves show
all combinations of goods that give the same utility (satisfaction)

The marginal rate of substitution is the slope of the indifference curve, and represents the tradeoffs that an individual faces


Hours of free time per day

## Opportunity cost

- Choices are limited by constraints and involve tradeoffs (Studying example: higher grades vs. more free time)
- The opportunity cost of an action is the net benefit of the next best alternative action
- Compare actions based on economic cost

Economic cost = monetary costs e.g. transport + subjective costs e.g. effort of work

## Opportunity cost: Example

|  | A HIGH VALUE ON THE <br> THEATRE CHOICE (A) | A LOW VALUE ON THE <br> THEATRE CHOICE (A) |
| :--- | :--- | :--- |
| OUT OF POCKET COST (PRICE OF <br> TICKET FOR A) | $\$ 25$ | $\$ 25$ |
| OPPORTUNITY COST (FOREGONE <br> PLEASURE OF B, PARK CONCERT) | $\$ 15$ | $\$ 15$ |
| ECONOMIC COST (SUM OF OUT OF <br> POCKET AND OPPORTUNITY COST) | $\$ 40$ | $\$ 40$ |
| ENJOYMENT OF THEATRE CONCERT (A) | $\$ 50$ | $\$ 35$ |
| ECONOMIC RENT (ENJOYMENT MINUS | $\$ 10$ | SCONOMIC COST) |

If the benefit from an action exceeds the economic costs, you receive an economic rent from choosing it.

## The Feasible Frontier

The feasible frontier shows the maximum output that can be achieved with a given amount of input

The marginal rate of transformation (MRT) is the slope of the feasible frontier, and represents the tradeoffs that an individual faces

## C. Decision-making under scarcity

## Constrained choice problem

|  | THE TRADE-OFF | WHERE IT IS ON <br> THE DIAGRAM |
| :--- | :--- | :--- |
| MRS | Marginal rate of substitution: The <br> number of percentage points Alexel is <br> willing to trade for an hour of free time. | The slope of <br> the indifference <br> curve. |
| MRT, OR <br> OPPORTUNITY <br> COST OF FREE | Marginal rate of transformation: The <br> number of percentage points Alexei <br> would gain (or lose) by giving up (or <br> taking) another hour of free time. | The slope of <br> the feasible <br> frontier. |

- Model of how individuals choose, given their preferences and the constraints they face, when the things they value are scarce.
- Studying example: Free time and exam score are scarce because they are both goods, each with an opportunity cost.


## Optimal Decision Making

The utility-maximising choice is where the amount of one good the individual is willing to trade off for the other good (MRS) equals the actual tradeoff between the two goods (MRT)


$M R S=M R T$

## Another example: Grain production




- Tradeoff between grain produced and free time
- Technological change shifts the production function upwards, and expands the feasible frontier


## Optimal Decision Making

## What happens when the feasible frontier changes?

- Technological progress makes it feasible to both consume more and have more free time.
- Choice of free time/consumption depends on relative preferences and willingness to substitute one good for another.



## D. Income and Substitution Effects

## Example: Working hours

| Hours of work | $\mathbf{0}$ | $\mathbf{2}$ | $\mathbf{4}$ | $\mathbf{6}$ | $\mathbf{8}$ | $\mathbf{1 0}$ | $\mathbf{1 2}$ | $\mathbf{1 4}$ | $\mathbf{1 6}$ |
| ---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Free time, $t$ | 24 | 22 | 20 | 18 | 16 | 14 | 12 | 10 | 8 |
| Consumption, $c(\$)$ | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 |

Budget constraints are the feasible frontiers for consumption choices

The optimal choice is where the slope of the indifference curve (MRS) equals the wage (MRT)


## Two important effects

Wage changes affect the slope of the budget constraint (MRT).
Consider a wage increase - it will have 2 effects:

- Your total earnings increase, holding working hours fixed (income effect)
- The opportunity cost of free time increases (substitution effect)


## Income effect

Income effect = the change in optimal choice when income changes, keeping opportunity costs (the budget constraint slope) fixed

A wage increase gives more income per hour worked -> incentive to decrease working hours


## Substitution effect

Substitution effect = the change In optimal choice when the opportunity cost changes, at the new level of utility

A wage increase raises the opportunity cost of free time $\rightarrow$ incentive to increase hours worked


## Overall effect on labour choice

Overall effect $=$ Income effect + Substitution effect

Income effect is positive (increase hours of free time)
Substitution effect is negative (decrease hours of free time)

Which effect dominates depends on individual preferences


## E. Application to technological change

## Working hours: Differences over time



Income and substitution effects can explain trends in working hours over time. E.g. In the US, the income effect dominated the substitution effect, so consumption and free time both increased.

## Working hours: Cross-country differences

Differences in working hours can be explained by preferences that differ across countries.

Other explanations?

- Differences in culture (norms)
- Politics (legal limits on hours)
- Social preferences (e.g. ‘Keeping
 up with the Joneses')


## Is this a good model?

- Not realistic: People don't actually do MRS/MRT calculations. Most people cannot choose their working hours.
- BUT still a good approximation: Over time, people learn what combination of working hours and free time suits them best. Working hours can change due to culture and politics (indirect choice); people can choose which jobs to apply for.
- Helps us understand real-world phenomena: preferences and income/substitution effects can explain differences in working hours across countries and over time.


## Summary

1. Simple model of decision-making under scarcity

- Indifference curves represent preferences
- Feasible frontier represents choice constraints
- Utility-maximising choice where MRS = MRT

2. Used model to explain effect of technological change on labour choices

- Overall effect = Income effect + Substitution effect
- Limitations of model - omits important factors


## In the next unit

- Models of individual choice that include other important factors
- The role of social interactions in individual choice
- The effect of individual choice on social outcomes

