Public economics
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Undergraduate study in
Economics, Management,
Finance and the Social Sciences

This is an extract from a subject guide for an undergraduate course offered as part of the University of London International Programmes in Economics, Management, Finance and the Social Sciences. Materials for these programmes are developed by academics at the London School of Economics and Political Science (LSE).

For more information, see: www.londoninternational.ac.uk
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Introduction

Public economics

22 Public economics is a 300 course in the Economics, Management, Finance and the Social Sciences (EMFSS) degree programme. The subject is concerned with the economics of public policy. It employs the tools of economic analysis to develop a framework for the study of government decision making.

Exclusions and prerequisites

Exclusions: This course has replaced 18 Public sector economics and may not be taken if you are taking or have passed 18 Public sector economics.

Prerequisites: If you are studying this course as part of a BSc degree you are required to have taken course 28 Managerial economics or 66 Microeconomics; this will be dictated by the structure and requirements of the degree that you are taking. Please refer to your Regulations for further details.

Aims

Public economics is about the role of government and the different ways in which government policies affect the economy. It develops an analytical framework that facilitates the evaluation of public policy and subsequently informs the public debate.

The specific aims are to:

• provide an introduction to the activities of government and the motivation behind economic intervention
• show how the tools of microeconomics can be applied to policy analysis
• provide a conceptual framework for assessing the success of economic policy
• conduct an evaluation of policy proposals.

Learning outcomes

By the end of this subject guide and the relevant reading, you should be able to:

• describe the major items of government revenue and expenditure
• compare explanations for government intervention
• demonstrate why competition is efficient
• explain the sources of market failure and potential policy responses
• discuss the design of the tax structure using the concepts of efficiency and equity
• describe how the level of government expenditures is determined
• demonstrate how interaction between jurisdictions affects the choice of policy
• employ economic analysis to evaluate policy proposals.
Reading advice

The course uses an essential textbook, a range of Further reading and some additional Challenging reading. The Further reading extends the material in the textbook and provides the original sources. The Challenging reading uses advanced techniques. This reading material is listed at the start of each chapter in the subject guide.

Essential reading

The Essential reading for the course is:


Detailed reading references in this subject guide refer to the edition of the set textbook listed above. A new edition of this textbook may have been published by the time you study this course. You can, however, use a more recent edition; use the detailed chapter and section headings and the index to identify relevant readings. Also check the virtual learning environment (VLE) regularly for updated guidance on readings.

Further reading

Please note that as long as you read the Essential reading you are then free to read around the subject area in any text, paper or online resource. You will need to support your learning by reading as widely as possible and by thinking about how these principles apply in the real world. To help you read extensively, you have free access to the VLE and University of London Online Library (see below).

Other useful texts for this course include:


Rose-Ackerman, S. Corruption and Government: Causes, Consequences and Reform. (Cambridge: Cambridge University Press, 1999) [ISBN 0521659124 pbk].


How to use this subject guide

This guide is divided into seven parts as follows:

1. Public economics and efficiency
2. The public sector
3. Departures from efficiency
4. Political economy
5. Equity and distribution
6. Taxation
7. Multiple jurisdictions.

These parts develop the analysis of public economics taking as the starting point the efficiency of a competitive equilibrium. Building upon this the role of the public sector is motivated as an aid to efficiency and then through its redistributive role. Throughout the subject guide an emphasis is placed upon seeking the best policy response and the limitations upon policy.

The subject guide is intended to provide an introduction to the subject and not a comprehensive reference source. It can be used to obtain an initial insight into each topic but should be read in conjunction with the required reading. The required reading provides considerably more discussion of each subject and contains detailed derivations. The required reading also contains numerous exercises that further explore the material and test understanding.

At the start of each chapter is listed Further reading and Challenging reading. A good study plan would be to read the subject guide and then the Essential reading. The activities and exercises can then be attempted. To deepen knowledge the Further reading can be undertaken. Once this has been mastered the Challenging reading can be undertaken. Do not be surprised if some of the Challenging reading proves to live up to its name.

An essential skill is to learn to extract the central economic principles from among mathematically-sophisticated arguments. Once the central point is understood, an understanding of the mathematics often falls into place.

The subject guide also includes a number of activities, exercises and sample examination questions. Activities can be found at the end of each section. These are a mixture of short exercises, applications of the analysis and issues for discussion. The exercises at the end of each chapter are longer and generally harder than the activities. The sample examination questions provide a guide as to the nature of what will appear on the examination paper.

Online study resources

In addition to the subject guide and the Essential reading, it is crucial that you take advantage of the study resources that are available online for this course, including the VLE and the Online Library.

You can access the VLE, the Online Library and your University of London email account via the Student Portal at:
http://my.londoninternational.ac.uk
You should receive your login details in your study pack. If you have not, or you have forgotten your login details, please email uolia.support@london.ac.uk quoting your student number.

The VLE

The VLE, which complements this subject guide, has been designed to enhance your learning experience, providing additional support and a sense of community. It forms an important part of your study experience with the University of London and you should access it regularly.

The VLE provides a range of resources for EMFSS courses:

• Self-testing activities: Doing these allows you to test your own understanding of subject material.

• Electronic study materials: The printed materials that you receive from the University of London are available to download, including updated reading lists and references.

• Past examination papers and Examiners’ commentaries: These provide advice on how each examination question might best be answered.

• A student discussion forum: This is an open space for you to discuss interests and experiences, seek support from your peers, work collaboratively to solve problems and discuss subject material.

• Videos: There are recorded academic introductions to the subject, interviews and debates and, for some courses, audio-visual tutorials and conclusions.

• Recorded lectures: For some courses, where appropriate, the sessions from previous years' Study Weekends have been recorded and made available.

• Study skills: Expert advice on preparing for examinations and developing your digital literacy skills.

• Feedback forms.

Some of these resources are available for certain courses only, but we are expanding our provision all the time and you should check the VLE regularly for updates.

Making use of the Online Library

The Online Library contains a huge array of journal articles and other resources to help you read widely and extensively.

To access the majority of resources via the Online Library you will either need to use your University of London Student Portal login details, or you will be required to register and use an Athens login: http://tinyurl.com/ollathens

The easiest way to locate relevant content and journal articles in the Online Library is to use the Summon search engine.

If you are having trouble finding an article listed in a reading list, try removing any punctuation from the title, such as single quotation marks, question marks and colons.

For further advice, please see the online help pages: www.external.shl.lon.ac.uk/summon/about.php
Internet sources

The following internet links provide access to academic associations and research centres concerned with public economics. The OECD and the IMF are very useful sources of statistics and country reports. Econphd.net provides links to online lecture notes and advice for applicants to graduate programmes in economics. For anyone wishing to pursue further study in economics it is a very valuable reference source.

The Association for Public Economic Theory, the Public Choice Society, the International Institute for Public Finance and the Society for Social Choice and Welfare organise major conferences focused on public economics and related topics.

The Institute for Fiscal Studies (in the UK) and the National Bureau of Economic Research (in the USA) are both independent research centres with a focus on public policy. Both publish discussion papers, research reports and research journals.

Association for Public Economic Theory:
www.vanderbilt.edu/Econ/jpconley/APET.htm
Econphd.net: www.econphd.net
Institute for Fiscal Studies: www.ifs.org.uk
International Monetary Fund: www.imf.org
National Bureau of Economic Research papers:
www.nber.org/papersbyprog/PE.html
National Tax Association: www.ntanet.org
Organisation for Economic Co-operation and Development: www.oecd.org
Page of further links: www.helsinki.fi/WebEc/webech.html
Public Choice Society: www.pubchoicesoc.org
International Institute of Public Finance: www.iipf.net

Unless otherwise stated, all websites in this subject guide were accessed in 2005. We cannot guarantee, however, that they will stay current and you may need to perform an internet search to find the relevant pages.

Examination advice

Important: the information and advice given here are based on the examination structure used at the time this guide was written. Please note that subject guides may be used for several years. Because of this we strongly advise you to always check both the current Regulations for relevant information about the examination, and the VLE where you should be advised of any forthcoming changes. You should also carefully check the rubric/instructions on the paper you actually sit and follow those instructions.

Remember, it is important to check the VLE for:

• up-to-date information on examination and assessment arrangements for this course

• where available, past examination papers and Examiners’ commentaries for the course which give advice on how each question might be answered.
The assessment of this subject is by a three-hour written examination. The examination consists of two parts. Section A involves two compulsory questions. Question 1 requests definitions and description of three concepts. Question 2 requests the demonstration of three facts or theorems.

Section B of the paper presents eight further questions from which three must be chosen. These eight questions will be comprised of essays and analytical exercises. Sample questions for both Section A and Section B are given at the end of each chapter.

**Examination technique**

The most essential aspect of examination technique is to ensure the appropriate period of time is spent upon each question. This implies that 1 hour 15 minutes should be spent on Section A and 1 hour 45 minutes on Section B. Breaking it down further, this gives just over 10 minutes for each sub-question in Section A. The marking will be based upon an expectation of what can be achieved in this time. As a consequence, there will be rapidly decreasing returns to excessive time spent on sub-questions in Section A since no matter how much is written the maximum mark allocation cannot be exceeded.

Each sub-question in Section A should be answered with a brief introduction that places the topic in context. For example, if the question were on Arrow’s impossibility theorem you would want to say that this is a central result in social choice theory, and then briefly describe social choice theory. The introduction should then be followed by the central core that directly answers the question. This may involve stating the relevant theorem or describing the diagram that makes the point. Finally, the answer can be completed by briefly noting any extensions, limitations or applications. For the example of Arrow’s theorem the role of comparability could be noted or possibility results described for restricted preferences.

Similar comments on timing apply to Section B. Each of the three questions should be allocated 35 minutes. Spending longer than this on a question will rarely earn more than a few extra marks but many marks will be lost by taking time away from other questions. If you choose to undertake one of the analytical exercises from Section B it is better to leave this to last. If things do not work out there is always the temptation to try, and to try again, which can eventually use considerable time and make it difficult to provide adequate answers for the other questions. Leaving the analytical question to last ensures that this cannot happen.

In answering Section B you should also ensure that you answer the question that is asked. Candidates often take the path of writing all that they know about a subject regardless of whether or not it is pertinent to the answer. This approach is not rewarded with good marks. You should never forget that the aim is to demonstrate that you can apply your knowledge to address a particular question and you should always ensure that you do precisely that.

**Outline of the topics covered in this subject guide**

The first section of the subject guide introduces public economics and presents a revision of the efficiency of competition. It notes the policy significance of public economics and describes the methodology that the subject employs. Competition is defined and the efficiency of the competitive economy is demonstrated.
An overview of the public sector is provided in the second section. The historical growth of public sector expenditure over the previous century is charted and statistics on the present size of the public sector are reviewed. Reasons for the existence of the public sector are considered, as are theories that attempt to explain its growth.

The third section investigates departures from efficiency. Public goods, externalities, imperfect competition and asymmetric information are introduced as sources of market failure. In each case the cause of the market failure is identified and alternative policy schemes designed to improve efficiency are analysed.

In section four a positive analysis of how the government may have its objectives and actions determined is undertaken. Voting is analysed as a decision-making mechanism and Arrow’s theorem is described. An alternative perspective on government is then presented using the concept of rent-seeking.

The policy implications of equity considerations are then reviewed in section five, with an emphasis on the restrictions placed on government actions by limited information. Methods to measure inequality and poverty are discussed with a focus on the central role of utility and the desirable properties of measures.

The sixth section is concerned with taxation. It analyses the basic tax instruments and the economics of tax evasion. The effects of taxation are analysed and rules for optimal taxes derived. The degree to which taxation can achieve redistribution is studied and taxation is contrasted to other economic allocation mechanisms.

The final section studies public economics when there is more than one decision-making body. Fiscal federalism addresses why there should be multiple levels of government and discusses the optimal division of responsibilities between different levels. The study of tax competition shows how tax competition can limit the success of delegating tax-setting powers to independent jurisdictions.
Notes
Chapter 1: Introduction to public economics

Essential reading


Further reading


Chapter summary

This chapter introduces the nature and scope of public economics. After a brief overview, it distinguishes between the application of positive and normative analysis. The use of models to analyse policy is then described. This leads into a discussion of the methodology of public economics. Studying the justification for the public sector leads to the concept of the minimal state. Further intervention is motivated by both efficiency and equity considerations.

Learning outcomes

After completing this chapter and the relevant readings, you should be able to:

• describe public economics
• distinguish positive and normative analysis
• explain the role of modelling
• discuss the equity-efficiency trade-off.

1.1 Public economics

Public economics is about the interaction of the government and the economy. It considers the effects of taxes and government expenditures, with particular emphasis upon how the choices of the government can improve or hinder economic efficiency. Public economics also investigates the extent to which it is possible, or desirable, for the government to influence the distribution of income and wealth.

The study of public economics has a long tradition as a subdiscipline of economics and many eminent economists have contributed to the subject. Notable among these are Ricardo’s discussion of the effects of public debt, Edgeworth’s analysis of the effects of taxation on multi-product firms and Pareto’s contribution to the theory of social decision making.
More recently, the contributions of Arrow to social choice and Mirrlees to the study of income taxation have been awarded Nobel prizes. The explanation for this interest in public economics is found in its close connection to policy analysis and the interest of most economists in contributing to raising economic well-being.

Public economics attempts to understand how the government makes decisions and what decisions it should make. The subject encompasses topics as diverse as responses to market failure due to the existence of externalities and the philosophy behind the measurement of economic welfare. This reflects the development of public economics from its initial emphasis upon the collection and spending of government revenues to its present concern with all aspects of government economic intervention.

The intention of this subject is to provide an accessible introduction to both these aspects of public economics. It draws upon the tools of economic analysis to present an analytical approach to policy analysis. The subject guide should be used as an introduction to the 'Key points'. Further details will be found in the recommended text and a greater depth of knowledge is provided by the Further readings.

**Key points**

- Public economics analyses government economic intervention
- It studies *how* decisions are made
- It analyses *what* decisions should be made

**Activities**

1. Explain the economic implications of the imposition of quality standards for drinking water.
2. Can economics contribute to understanding how government decisions are made?
3. What should guide the choice of economic policy?

### 1.2 Normative and positive analysis

When thinking about economic policy it is helpful to focus upon the distinction between positive and normative analysis.

- **Positive analysis** is about explaining why there is a public sector, how government policies are chosen and how these policies affect the economy.

Analysing the voting of the monetary policy committee of a central bank over the level of the interest rate and analysing the effect of the corporate tax on inward investment are examples of positive analysis.

- **Normative analysis** investigates what the best policies are, and aims to provide a guide to good government.

Examples of normative analysis are whether the level of pensions should be indexed to average wages or whether a minimum income guarantee should be provided.

Positive analysis and normative analysis are not entirely distinct. To proceed with a normative analysis it is first necessary to conduct the positive analysis: it is not possible to determine the best policy without knowing the effects of alternative policies upon the economy.

**Key points**

- Positive and normative analysis
- The evaluation of policy employs both
Activities

1. ‘Poverty should be reduced to reduce malnutrition and raise economic growth.’
   Distinguish the positive and normative components of this statement.

2. ‘It is economically efficient to maintain a pool of unemployed labour.’ Is this claim
   based on positive or normative reasoning?

1.3 Modelling

Public economics uses economic models to provide simplified descriptions
of the parts of the economy relevant for the analysis. Models usually
incorporate independent decision making by firms and consumers. They
are used because the possibilities for experimentation are limited and
past experience cannot always be relied upon to provide a guide to the
consequences of new policies.

The two basic forms of model are:

- **Partial equilibrium** models that focus only on one or two markets,
taking behaviour elsewhere in the economy as given.

- **General equilibrium** models that provide a complete economic
  system with prices equilibrating supply and demand on all markets
  simultaneously.

The choice of which form to use depends upon how widely the
repercussions of the policy being analysed affect the economy.

The institutional setting for the study of public economics is the *mixed
economy* where individual decisions are respected but the government
intervenes to affect choices. Even within this setting, two alternative
objectives can be assigned to the government. It can be assumed to
be benevolent and to act selflessly to serve society. Alternatively, the
government can be viewed as being composed of a set of individuals, each
of whom is pursuing their own selfish agenda. This model of self-serving
provides a very different interpretation of the actions of the government
and implies a general suspicion of government intervention.

The analysis is applicable to most developed and developing economies
since its settingconcurs with the present ascendancy of the mixed
economy as the form of economic organisation. It also permits a study of
how the government behaves and how it should behave.

**Key points**

- The use of models

- Benevolence versus self-serving

- The mixed economy

Activities

1. To analyse the effect of a subsidy to rice production, would you employ a partial
   equilibrium or a general equilibrium model?

2. If the EU considered replacing the income tax with an increase in VAT, would you
   model this using partial equilibrium?

3. What proportion of the world’s economies (by number, population, and wealth) can
   be described as ‘mixed’?
1.4 Methodology

The method of analysis is to build models of the economy that consist of a government, consumers and firms. It is assumed that firms seek to maximise their profits and that consumers seek to maximise their private welfare. The reaction to a policy change can be predicted through the solutions to these optimisation decisions.

Normative analysis is conducted under the assumption that the government has a specified set of objectives and chooses the economic policy that best achieves these. Positive analysis investigates alternative explanations for the choice of government actions, for the emergence of objectives and the consequences of actions.

When considering policy choice, the focus of the analysis is upon the equilibrium achieved by the economy. The subject matter of public economics is both the comparison of alternative policies (including the policy of *laissez faire* or doing nothing!) and the choice of the optimal policy. A change in policy can be viewed as resulting in a different equilibrium for the economy. To treat the question of comparison of policies, the equilibria for different policies are contrasted with respect to how well they satisfy the government’s objectives. The same approach is taken to the selection of the optimal policy, which is defined as the policy yielding the highest level for the government’s objective.

When the government’s objective is taken to be the aggregate level of welfare in the economy further questions are raised as to how this is actually measured. This issue is discussed in some detail in later chapters, but it can be noted here that the answer involves invoking some degree of comparison between individual welfare levels. It has been the willingness to accept such comparisons that has allowed the development of the theory of public economics. Whilst differences of opinion exist upon the extent to which these comparisons are valid, it is still scientifically justifiable to investigate what they would imply if they could be made.

**Key points**

- Objectives of firms, consumers and government
- Comparison of equilibria
- Measurement of welfare

**Activities**

1. Should firms maximise profit?
2. To what extent is it possible to view the government as having a single objective?
3. Are you happier than your neighbour? How many times happier or less happy?

1.5 The minimal state

Why do we have government? The most basic motivation for the existence of a public sector follows from the observation that entirely unregulated economic activity could not take place in a very sophisticated way.

An economy could not function effectively if there were no property rights (the rules defining the ownership of property). Without property rights, it would not be possible to enforce a prohibition against theft. Theft discourages enterprise since the gains accrued may be appropriated by others. It also results in the use of resources in the unproductive business of theft prevention.
An economy also needs **contract laws** (the rules governing the conduct of trade). Examples include the formalisation of weights and measures and the obligation to offer product warranties. Contract laws exist to ensure that the participants to a trade receive what they expect from that trade or, if they do not, have open an avenue to seek compensation. Without contract laws the satisfactory exchange of commodities could not take place given the lack of trust that would exist between contracting parties.

Property rights and contract laws are of limited consequence unless they can be policed and upheld in law. **Law enforcement** cannot be provided free of cost as enforcement officers must be employed and courts provided to hear litigation. An advanced society would also face a need for the enforcement of more general criminal laws. Once a country develops its economic activity it will need to defend its gains from being stolen by outsiders. This implies the provision of a means of **defence** for the nation which is also costly.

The **minimal state** provides contract law, polices it, and defends the economy against outsiders. The minimal state does nothing more than this, but without it organised economic activity could not take place. These arguments provide a justification for at least a minimal state and hence for having a public sector and public expenditure.

**Key points**

- Property rights and contract law
- Law enforcement and defence
- The minimal state

**Activities**

1. If it takes fours days of labour to produce a week’s food, and one day of labour to steal a week’s food, what will be the economic outcome?

2. Would a minimal state:
   - Ensure wage agreements were enforced;
   - Limit maximum working hours;
   - Prevent involuntary overtime?

### 1.6 Market failure

The minimal state intervenes only to ensure the smooth functioning of the economy. Whether this intervention is able to achieve efficiency depends upon the structure of the economy. Efficiency will be achieved in the idealised competitive economy – an economy with no market power in which equally-informed agents interact only with the ‘market’. Outside of this setting, there are many circumstances in which efficiency will not be achieved.

**Market failure** is said to arise when efficiency is not achieved. The sources of market failure are:

- monopoly
- public goods
- externalities
- asymmetric information.

These sources of market failure are discussed in later chapters.

When market failure is present, the argument for considering whether government intervention would be beneficial is compelling. But this does
not imply that intervention will always be beneficial. In every case, it must be demonstrated that the public sector has the ability to improve upon what the unregulated economy can achieve. This may not be possible if the choice of policy tools is limited or government information is restricted. It must be recognised that the actions of the state, and the policies that it can choose, are often restricted by the same features of the economy that make the market outcome inefficient.

Key points
- Efficiency of competition
- Sources of market failure
- The case for intervention

Activities
1. Will efficiency be achieved if:
   i. No agent knows what the profit level of a firm will be next year?
   ii. One agent does know what the profit level will be but all other agents do?
2. Can insider trading occur in the idealised competitive economy?
3. All our sulphur emissions are blown into a neighbouring country. Can our economy be efficient?

1.7 Redistribution

An argument for government intervention can also be made if the economy has widespread inequality of income, opportunity or wealth. Such inequalities can occur even if the economy is efficient in a narrow economic sense. In such circumstances, the level of economic welfare may be raised by the redistribution of resources to alleviate these inequalities. This reasoning underlies the provision of state education, social security programmes and compulsory pension schemes. It should be stressed that the gains from these policies are with respect to normative assessments of welfare, unlike the positive criteria lying behind the concept of economic efficiency.

In conducting an economic policy the state will have two conflicting aims. On the one hand, it will aim to raise revenue to finance the policy with the minimum loss to society. The raising of revenue leads to losses due to the resources used in the collection process and from the economic distortions that it causes. Minimising these losses is the efficiency aspect of policy design. Conversely, the state may also feel that it is desirable to intervene in the economy in order to attain a more equitable distribution of the economy’s resources. This is often accompanied by a corresponding reduction in the degree of concern for the aggregate level of economic activity. This motivation represents the equity side of policy design.

Due to their distinct natures, it is inevitable that the aims of equity and efficiency regularly conflict. The efficient policy is often highly inequitable, whilst the equitable policy may introduce into the economy significant distortions and disincentives. Given this, the design of optimal policy is concerned with reaching the correct trade-off between equity and efficiency objectives. The optimum trade-off will depend upon the concern for equity that is expressed in the objectives of the policy maker. The resolution of the trade-off between equity and efficiency is the major determinant of the resulting policy program, with aspects of the policy being attributable to one or the other. This distinction is often a helpful way in which to think about optimality problems and their solutions.
Key points

- Inequality
- Redistribution to raise welfare
- Efficiency/equity trade-off

Activities

1. Are the following policies conducted for efficiency or equity motives:
   i. provision of unemployment benefit?
   ii. provision of primary education?
   iii. provision of higher education?
   iv. provision of retirement pensions?

2. Should the government intervene with a redistributive policy if income inequality is due to:
   i. differences in work effort?
   ii. differences in ability?

Exercises

1. Consider two consumers who each have a total of $T$ hours to allocate between production and theft. Assume that the production produces output $y_{p} = \ln(t_{p})$ for $t_{p}$ units of time in production. If time $t_{f}$ is devoted to theft, then a proportion $\alpha t_{f}/T$ of the other consumer’s output can be stolen. Assuming each unit of output has price $p$ and both consumers attempt to maximise their wealth, what is the equilibrium? How does the equilibrium depend upon the value of $\alpha$? What is the equilibrium if there is no theft? What is the maximum that would be paid to prevent theft?

2. Assume that consumers are randomly allocated to either earn income $M_{l}$ or income $M_{h}$, with $M_{h} > M_{l}$. The probability of being allocated to $M_{l}$ is $\pi$. Prior to being allocated, consumers wish to maximise their expected income level. If it is possible to redistribute income costlessly, show that, prior to allocation, all consumers would agree to a transfer scheme. Assume there is a cost $\Delta$ for each consumer of income $M_{h}$ who is taxed. Find the maximum value of $\pi$ for which there is still unanimous agreement that transfers should take place.

A reminder of your learning outcomes

Having completed this chapter, and the Essential readings and activities, you should be able to:

- describe public economics
- distinguish positive and normative analysis
- explain the role of modelling
- discuss the equity-efficiency trade-off.
Sample examination questions

**Section A**

1. Define and briefly describe the following:
   i. The minimal state
   ii. An idealised competitive economy
   iii. General equilibrium

2. Briefly demonstrate:
   i. The role of positive analysis
   ii. How the prevention of theft can be beneficial
   iii. The economic consequences of pensions

**Section B**

3. Discuss the following claim: ‘Economic efficiency can be achieved by the minimal state. Therefore all additional government activity is unnecessary.’

4. Distinguish between positive and normative analysis of policy. Since there can never be unanimity of views, should economists avoid normative analysis?
Chapter 2: Competition and efficiency

Essential reading


Further reading


Challenging reading


Chapter summary

The efficiency of competition should be a result familiar from intermediate microeconomics. This chapter provides a brief reminder of the role and nature of competition and demonstrates the efficiency result in both an exchange economy and in an economy with production. The role of prices is stressed since prices are the signals which guide the decisions of firms and consumers and determine the relative values of different goods and services. Prices are also crucial in the attainment of economic efficiency. The efficiency of the competitive equilibrium has been known to economists for a considerable time. Its roots can be traced back to Adam Smith's eighteenth-century description of the workings of the invisible hand of competition. This was the idea that the price system guides individuals to make mutually efficient decisions. The concept of Pareto efficiency is introduced and the efficiency theorems are described for both the exchange economy and the production economy. The discussion then turns to the role of taxes and transfers in achieving a chosen equilibrium. This provides the foundations for the normative analysis of public policy.

Learning outcomes

After completing this chapter and the relevant reading, you should be able to:

• describe utility and profit maximisation
• explain the role of price adjustment in reaching equilibrium
• characterise an efficient equilibrium
• explain why competition achieves Pareto efficiency
• discuss the use of lump-sum taxes.
2.1 The exchange economy

This model of the economy considers the simplest form of economic activity: the exchange of two commodities between two parties in order to obtain mutual advantage. Despite the simplicity of this model, it is a surprisingly instructive tool for obtaining fundamental insights about taxation and tax policy. The restriction on the number of goods and consumers does not alter any of the conclusions that will be derived.

The two consumers are labelled 1 and 2 and each has an initial stock, or endowment, of the economy’s two goods. The consumers exchange quantities of the two commodities in order to achieve consumption levels that are preferred to the initial endowments. The rate at which one commodity can be exchanged for the other is determined by the market prices. Both consumers believe that their behaviour cannot affect these prices. This is the fundamental assumption of competitive price-taking behaviour. There is also symmetry of information – both consumers know the market prices and the characteristics of the goods that are to be traded. There are no externalities between agents so all that matters to each consumer is their personal level of consumption. This set of assumptions describes the idealised competitive economy.

The endowment of consumer \( h, h = 1, 2 \), is denoted by \( \omega^h = (\omega^h_i, \omega^h_j) \), where \( \omega^h_i > 0 \) is \( h \)'s initial stock of good \( i, i = 1, 2 \). The endowments of the consumers are the economy’s supply of goods. Given the absence of production, supply remains constant. With prices \( p_1 \) and \( p_2 \), a consumption plan for consumer \( h, x^h(x^1_h, x^2_h) \) is affordable if it satisfies the budget constraint

\[
p_1 x^1_h + p_2 x^2_h = p_1 \omega^h_1 + p_2 \omega^h_2. \tag{2.1}
\]

Consumer \( h \) chooses the consumption plan that maximises their utility function

\[
U^h = U^h(x^1_h, x^2_h), \tag{2.2}
\]

subject to their budget constraint.

In equilibrium, the total consumption of the two consumers must equal the available stock of the goods. A pair of consumption plans for the two consumers that maximises utility and satisfies this requirement is called an equilibrium for the economy. An equilibrium ensures demand equals supply so

\[
x^1_i + x^2_i = \omega^i_1 + \omega^i_2, i = 1, 2. \tag{2.3}
\]

Key points

- Exchange of commodities
- Price-taking behaviour and symmetry of information
- Equilibrium of supply and demand

Activities

1. Graph the budget constraint of a consumer. Show that it always passes through the endowment point. Demonstrate the effect of a price change.

2. Illustrate utility maximisation in a diagram. What is the effect of an increase in the price of good 1 on the chosen consumption plan? Explain.

3. The exchange economy is often described in terms of bargaining over trades. Explain why this is equivalent to having prices.
2.2 The Edgeworth box

The exchange economy can be pictured in a simple diagram which can be used to explore its functioning. The diagram is constructed by noting that the set of consumption plans that are possible given the endowments can be represented as points in a rectangle with sides of length $w_1^1 + w_2^1$ and $w_1^2 + w_2^2$. In this rectangle the south-west corner can be treated as the zero consumption point for consumer 1 and the north-east corner as the zero consumption point for consumer 2. The consumption of good 1 for consumer 1 is then measured horizontally from the south-west corner and for consumer 2 horizontally from the north-east corner. Measurements for good 2 are made vertically.

The diagram constructed in this way is called an Edgeworth box and a typical box is shown in Figure 2.1. It should be noted that the method of construction results in the endowment point, marked $\omega$, being common to both consumers. Point $x$ is a potential allocation of consumption between the two consumers.

![Figure 2.1: An Edgeworth box](image)

The Edgeworth box is completed by adding the preferences of the consumers and the budget constraints. The indifference curves of consumer 1 are drawn relative to the south-west corner and those of consumer 2 relative to the north-east corner. From (2.1), it can be seen that the budget constraint of consumer $h$ must pass through the endowment point. Since the endowment point is common to both consumers, a single budget line through the endowment point with gradient $-p_1/p_2$ captures their market opportunities. Thus, viewed from the south-west it is the budget line of 1 and viewed from the north-east the budget line of 2. Given the budget line determined by the prices $p_1$ and $p_2$, the utility-maximising choices for the two consumers are characterised by the standard tangency condition between the highest attainable indifference curve and the budget line. This is illustrated in Figure 2.2, where $x^1$ denotes the choice of consumer 1 and $x^2$ that of consumer 2.

![Figure 2.2: Preferences and demand](image)
Key points

- The Edgeworth box
- The common budget constraint
- Utility maximisation

Activities

1. Construct the Edgeworth box when the endowments are (2, 1) and (2, 3). Display the allocation (2, 2), (2, 2).

2. In an Edgeworth box for an economy with 5 units of each of the two goods, display the preferences $U^i = \max\{x^i_1, x^i_2\}$. Repeat this for an economy with only 4 units of good 2.

3. Describe how the Edgeworth box can be used to analyse trade between two countries.

2.3 Equilibrium

An equilibrium of the economy is a position where supply is equated to demand. This is assumed to be achieved via the adjustment of prices. The prices at which supply is equal to demand are called equilibrium prices.

The consumer choices shown in Figure 2.2 do not constitute an equilibrium for the economy. This can be seen by summing the demands and comparing these to the level of the endowments. Doing this gives

\[ x^1_1 + x^1_2 > \omega^1_1 + \omega^1_2, \quad (2.4) \]

and

\[ x^2_1 + x^2_2 < \omega^2_1 + \omega^2_2. \quad (2.5) \]

From (2.4) the demand for good 1 exceeds the endowment but from (2.5) the demand for good 2 falls short.

To achieve an equilibrium position, the relative prices of the goods must change. An increase in the relative price of good 1 raises the absolute value of the gradient $-p_1/p_2$ of the budget line, making the budget line steeper. It becomes flatter if the relative price of good 1 falls.

Equilibrium is achieved when the prices are such that the indifference curves of the consumers have a common point of tangency on the budget line. At this point, total demand is equal to total supply. An equilibrium is shown in Figure 2.3.

![Figure 2.3: Equilibrium](image)

Key points

- Adjustment of prices
- Equilibrium at a point of common tangency
### Activities

1. Must excess demand for one good be balanced by excess supply of the other?

2. For an economy with two units of each good, sketch the equilibrium if the goods are:
   i. perfect complements;
   ii. perfect substitutes.

3. Assume the demand for good 1 exceeds the supply. Is it possible for the economy to move further from equilibrium if the price of good 1 rises?

### 2.4 Normalisations and Walras’ law

It has already been noted that the budget constraint always passes through the endowment point and its gradient is determined by the price ratio. The consequence of this is that only relative prices matter, rather than the absolute level, in determining demands and supplies. This can be seen taking the budget constraint (2.1) and expressing it as the linear equation

$$x^b = \frac{p_1 \omega^b_1 + p_2 \omega^b_2}{p_2} - \frac{p_1}{p_2} x^b_1 = \left[ \frac{p_1}{p_2} \omega^b_1 + \omega^b_2 \right] - \frac{p_1}{p_2} x^b_1$$

(2.6)

It follows from (2.6) that if both prices are increased by a factor \( \lambda \), the budget opportunities for the consumer do not alter. Hence if \( x^b(p_1, p_2) \) is the level of demand at prices \( p_1 \) and \( p_2 \), then

$$x^b(p_1, p_2) = x^b(\lambda p_1, \lambda p_2), \text{ for } \lambda > 0. \tag{2.7}$$

A demand function having the property shown in (2.7) is said to be **homogenous of degree 0**.

The explanation for this result is that consumers are only concerned with the real purchasing power embodied in their endowment and not in the price level itself. Since their nominal income is equal to the value of the endowment, any change in the level of prices raises nominal income just as much as it raises the cost of purchases. This leaves real incomes unchanged.

The first implication of this is that the model cannot determine the level of prices. This indeterminacy is removed by adopting a **price normalisation** which is a method of fixing a scale for prices. The simplest way to do this is to select a commodity as **numeraire**, which means that its price is fixed at 1 and all other prices are measured relative to this. The numeraire chosen in this way can be thought of as the **unit of account** for the economy. This is the role usually played by money but, formally, there is no money in this economy.

The second implication follows from observing that at the disequilibrium position described in equations (2.4) and (2.5) the demand for good 1 exceeds its supply whereas the supply of good 2 exceeds demand. In general whenever there is an excess of demand for one good, there is a corresponding deficit of demand for the other. Let the level of **excess demand** for good \( i \) be determined by

$$Z_i = x^i_1 + x^i_2 - w^i_1 - w^i_2$$

(2.8)

Using (2.8)

$$p_1 Z_1 + p_2 Z_2 = p_1 \left[ x^i_1 + x^i_2 - w^i_1 - w^i_2 \right] + p_2 \left[ x^1_1 + x^1_2 - w^1_1 - w^2_1 \right] + \left[ p_1 x^1_1 + p_2 x^1_2 - p_1 w^1_1 - p_2 w^2_1 \right] + \left[ p_1 w^1_1 + p_2 w^2_1 - p_1 w^1_2 - p_2 w^2_2 \right] = 0, \tag{2.9}$$
where the second equality is a consequence of the budget constraints in (2.1). The relationship in (2.9) is known as **Walras’ law** and states that the value of excess demand is zero. This must hold for any set of prices so it provides a connection between the extent of disequilibrium and prices. Since all consumers are equating their expenditure to their income, so must the economy as a whole.

Walras’ law has a further implication. Since \( p_1Z_1 + p_2Z_2 = 0 \), if \( Z_1 = 0 \) then \( Z_2 = 0 \) (and *vice versa*). That is, if demand is equal to supply for good 1 then demand must also equal supply for good 2. Equilibrium in one market necessarily implies equilibrium in the other. This observation allows the construction of a simple diagram to illustrate equilibrium. Choose good 1 as the numeraire (so \( p_1 = 1 \)) and plot the excess demand for good 2 as a function of \( p_2 \).

The equilibrium for the economy is then found where the graph of excess demand crosses the horizontal axis. At this point, excess demand for good 2 is zero so, by Walras’ law, it must also be zero for good 1.

![Figure 2.4: Equilibrium and excess demand](image)

**Key points**
- Homogeneity of demand
- Price normalisations
- Walras’ law

**Activities**
1. Determine the demand functions for the utility \( U^h = x^h_1x^h_2 \) and show that they are homogeneous of degree zero.
2. Explain why excess demand for good 2 will be positive as \( p_2 \) tends to zero.
3. Using Figure 2.4, provide an argument for why there will usually be an odd number of equilibria.

### 2.5 Pareto efficiency

In an economy with two or more consumers there will be a divergence of views on the most preferred allocation. To resolve this divergence it is necessary to construct a test of efficiency that can accommodate differences in preferences.

To achieve this, economists employ the concept of **Pareto efficiency**. Pareto efficiency judges an allocation by considering whether it is possible to undertake a reallocation of resources that can benefit at least one consumer without harming any other. If no such improving reallocation can be found, then the initial position is deemed to be Pareto efficient. An allocation that satisfies this test can be viewed as having achieved an efficient distribution of resources.
To provide a statement of Pareto efficiency it is first necessary to define the idea of a feasible allocation of resources. For an exchange economy with $H$ consumers the total stock of resources is given by the sum of the consumers’ endowments. An allocation of consumption between the consumers, with consumer $h$ receiving $x^h$ is then feasible if

$$\sum_{h=1}^{H} x^h = \sum_{h=1}^{H} \phi^h. \quad (2.10)$$

Using this definition of feasibility, Pareto efficiency can be defined. A feasible consumption allocation $\{x^1,...,x^H\}$ is Pareto efficient if there does no exist an alternative feasible allocation $\{x^{-1},...,x^{-H}\}$ such that

$$U^h(x^{-h}) \geq U^h(x^h), \quad h = 1,...,H, \quad (2.11)$$

with

$$U^h(x^{-h}) > U^h(x^h), \quad \text{for at least one } h. \quad (2.12)$$

Therefore $\{x^1,...,x^H\}$ is Pareto efficient if it is not possible to find an alternative feasible allocation which gives every consumer at least as much utility as $\{x^1,...,x^H\}$ (condition (2.11)) and gives strictly more utility to at least one consumer (condition (2.12)). In other words, an allocation is Pareto efficient if no reallocation can make someone better-off without making anyone worse-off.

Using the Edgeworth box in Figure 2.5, it can be seen that allocation $a$ is not Pareto efficient – the move to $b$ raises the utility of both consumers. Allocation $c$ is Pareto efficient since any change in allocation must make at least one consumer worse-off.

![Figure 2.5: Pareto efficiency](image)

**Key points**

- Diversity of views
- Feasible allocations
- Pareto efficiency

**Activities**

1. Does an economy have a unique Pareto efficient allocation?
2. Assume an equal endowment of two goods. What are the Pareto efficient allocations if the goods are perfect complements?
3. Is a Pareto efficient allocation necessarily equitable?
2.6 Exchange efficiency

It is surprising enough that prices can always be found which simultaneously equate demand and supply for all goods. What is even more remarkable is that the equilibrium obtained is efficient. Why this is remarkable is that individual consumers and firms pursue their independent objectives with no apparent coordination other than through the price system. Even so, the final state which emerges achieves efficiency solely through the coordinating role played by prices.

The welfare properties of the economy, which are called the Two 
Theorems of welfare economics, are the basis for claims concerning the desirability of the competitive outcome. In brief, the First Theorem states that a competitive equilibrium is Pareto efficient and the Second Theorem that any Pareto efficient allocation can be decentralised as a competitive equilibrium.

For a two consumer exchange economy, the First Theorem can be demonstrated by using an Edgeworth box diagram. In Figure 2.6 the Pareto efficient allocations are given by the tangencies of the indifference curves. There are many such points and the locus of tangencies is called the contract curve. A competitive equilibrium is given by a price line through the initial endowment point, \( w \), which is tangential to both indifference curves at the same point. Such an equilibrium is indicated by point \( e \).

![Figure 2.6: The First Theorem](image)

**Figure 2.6: The First Theorem**

It is clear that there is no other point which is preferred by both consumers to point \( e \). If a move is made in any direction from \( e \) one or both of the consumers must move onto a lower indifference curve. Since any change must make at least one consumer worse-off, the equilibrium is Pareto efficient. Stating this formally:

**First Theorem of welfare economics: A competitive equilibrium is Pareto efficient.**

The geometrical property of a Pareto efficient equilibrium is that the indifference curve of the consumers are tangential and so have identical gradients. The gradient of an indifference curve is defined as the ratio of the marginal utility of good 1 divided by the marginal utility of good 2 and is termed the marginal rate of substitution. Hence at the Pareto efficient equilibrium in Figure 2.6 the marginal rates of substitution of the two consumers are equal or

\[
\text{MRS}^1_{1,2} = \text{MRS}^2_{1,2}. \tag{2.13}
\]

This equality is achieved in the competitive economy because each consumer maximises utility when \( \text{MRS}^i_{1,2} = \frac{p_1}{p_2} \). Since both consumers react to the same prices, the equality in (2.13) follows.
It should be noted that point $e$ is not the only Pareto efficient allocation. All points on the contract curve are Pareto efficient since they are defined by a tangency between indifference curves. The only special feature of $e$ is that it is the allocation reached through trading from the initial endowment point $\omega$. If $\omega$ were different, then another Pareto efficient allocation would be achieved. Observing these points motivates the Second Theorem of welfare economics.

The Second Theorem is concerned with whether a given Pareto efficient allocation can be made into a competitive equilibrium by choosing a suitable location for the initial endowment. In the Edgeworth box, this involves being able to choose any point on the contract curve and turning it into a competitive equilibrium – this is called the process of decentralisation. It can be seen that this is possible if the consumers' indifference curves are convex. The common tangent at a Pareto efficient allocation provides the budget constraint that each consumer must face if they are to afford the chosen point. The convexity ensures that given this budget line, the Pareto efficient allocation will also be the optimal choice of the consumers. The construction is completed by choosing a point on this budget line as the initial endowment point.

This process is illustrated in Figure 2.7 where the Pareto efficient allocation $e'$ is made a competitive equilibrium by selecting $\omega'$ as the endowment point. Starting from $\omega'$, trading by consumers will take the economy to its equilibrium allocation $e'$. Note that if the endowments of the consumers are initially given by $\omega$ and the equilibrium at $e'$ is to be decentralised, some transfer of endowment or, equivalently, of income will be necessary.

![Figure 2.7: The Second Theorem](image)

The formal statement of the Second Theorem can now be given.

**Second Theorem of welfare economics:** Suppose that an allocation is Pareto efficient. Then, with convex preferences, there exists a set of prices such that the allocation is a competitive equilibrium given those prices.

**Key points**
- Every competitive equilibrium is Pareto efficient
- Prices equalise marginal rates of substitution
- A Pareto efficient allocation can be made a competitive equilibrium

**Activities**
1. Derive the marginal rate of substitution for a Cobb-Douglas utility function.
2. If two consumers have preferences $U^h = \ln(x^h_1) + \ln(x^h_2)$ derive the equilibrium price ratio for an economy with an endowment of two units of each good.
3. Display a competitive equilibrium that cannot be decentralised.
2.7 Lump-sum taxation

It is implicit in the proof of the Second Theorem that the consumers are given sufficient income to purchase the Pareto efficient commodity bundles. In fact, consumer \( h \) must receive an endowment and profit share such that their total income satisfies \( M^h = \hat{p} \hat{x}^h \). Any practical value of the Second Theorem depends on the possibility of achieving these required income levels. The way in which the Theorem sees this as being done is by making what are called lump-sum transfers between consumers. Quantities of endowments and profit shares are transferred between consumers to ensure the necessary income levels.

A transfer is defined as lump-sum if no change in a consumer’s behaviour can affect the size of the transfer. The transfer is optimal if the resulting equilibrium is the policy maker’s most preferred outcome. It should be noted that the transfers do affect consumers’ behaviour since their incomes are either increased or reduced. The transfers have an income effect but do not lead to a substitution effect between commodities.

The illustration of the Second Theorem in an exchange economy in Figure 2.8 makes clear the role and nature of lump-sum transfers. The initial endowment point is denoted \( \omega \). Assume that the Pareto efficient allocation at point \( e \) is to be decentralised. At the initial point, the income level of \( h \) is \( \hat{p} \omega^h \) when evaluated at the equilibrium prices \( \hat{p} \). The value of the transfer to consumer \( h \) that is necessary to achieve the budget constraint through point \( e \) is \( \hat{p} \omega^h - \hat{p} \omega^h \). One way of achieving this is to transfer a quantity \( \hat{x}^1 \) of good 1 from consumer 1 to consumer 2.

Figure 2.8: The use of lump-sum transfers

The analysis of lump-sum transfers can now be rephrased in order to introduce the concept of a lump-sum tax. Suppose that the two consumers sell their entire endowments at prices \( \hat{p} \). This generates incomes \( \hat{p} \omega^1 \) and \( \hat{p} \omega^2 \) for consumers 1 and 2 respectively. Now make consumer 1 pay a tax of amount \( T^1 = \hat{p} \hat{x}^1 \) and give this tax revenue to consumer 2. Consumer 2 therefore pays a negative tax (or, in simpler terms, receives a subsidy) of \( T^2 = \hat{p} \hat{x}^1 = - T^1 \). This pair of taxes can be seen to move the budget constraint in exactly the same way as the lump-sum transfer of endowment. The taxes are also lump-sum since they are determined without reference to either consumer’s behaviour and their values cannot be affected by any change in behaviour.

Lump-sum taxes have a central role in public economics due to their efficiency in achieving distributional objectives. The economy’s total endowment is not reduced by the application of the lump-sum taxes. This point applies to lump-sum taxes in general. There are no resources lost due to the imposition of lump-sum taxes and redistribution is achieved with no efficiency cost. In short, if they can be employed in the manner described they are the perfect taxes.
Key points
• Lump-sum transfers and taxes
• Income effect, no substitution effect
• Perfect tax instrument

Activities
1. Show that the lump-sum transfer which decentralises an efficient allocation is not unique.
2. Show that all the transfers which decentralise an efficient allocation have the same value.
3. How would lump-sum transfers work if most consumers only had an endowment of labour supply?

2.8 Firms

A firm is described by its production set, \( Y \), which summarises the production technology it has available. A production technology can be thought of as a list of ways that the firm can turn inputs into outputs. A typical production set for a firm operating in an economy with two goods is illustrated in Figure 2.9. This figure employs the standard convention of measuring inputs as negative numbers and outputs as positive. The reason for this convention is that the use of a unit of a good as an input represents a subtraction from the stock of that good available for consumption.

Figure 2.9: A typical production set

Consider the firm shown in Figure 2.9 choosing the production plan described by \( y = (y_1, y_2) = (-2, 3) \). When faced with prices \( p = (p_1, p_2) = (2, 2) \), the firm’s level of profit is

\[
\pi = py = (2, 2).(-2, 3) = -4 + 6 = 2. \tag{2.14}
\]

The positive part of (2.14) is sales revenue and the negative part production costs. This is equivalent to writing profit as the difference between revenue and cost. Written in this way, (2.14) shows that, for given prices, profit is linear in output. What places a limit on achievable profit is the production technology of the firm.

Profit maximisation can be displayed by constructing the isoprofit curves for the firm. Given a set of prices, an isoprofit curve shows all the production plans that achieve a given level of profit. For profit level \( \bar{\pi} \), the isoprofit curve at \( \bar{\pi} \) shows all the values of \( y \) that solve \( \bar{\pi} = py \). These values of \( y \) all lie on the same straight line which is at right angles to the price vector. In addition, the isoprofit curve through the origin represents...
the zero profit level. Higher isoprofit curves then represent higher levels of profit. Curves below the zero profit one represent negative profits. The firm then maximises profit at the point where its production set reaches the highest attainable isoprofit curve. This construction is shown in Figure 2.10. If the relative prices of the two goods change, the gradient of the isoprofit curve changes and the profit-maximising production plan moves around the frontier of the production set.

Figure 2.10: Profit maximisation

Key points

• Production set describes technology
• Inputs as negatives, output as positives
• Profit maximisation using isoprofit curves

Activities

1. Sketch a production set for a technology that has:
   i. Constant returns to scale;
   ii. Increasing returns to scale.
   For (ii), discuss the profit-maximisation decision.
2. If a firm’s production technology has decreasing returns to scale, how is the production plan affected by an increase in the price of output?
3. Assume a firm has constant returns to scale technology. Show how its profit-maximising production plan is related to prices.

2.9 Equilibrium with production

The addition of production to the exchange economy provides a complete model of economic activity. Such an economy allows a range of activities to be included. Some goods are viewed as being present in initial endowments (such as labour), others are produced from the initial endowments, while some goods, intermediates, are produced by one productive process and used as inputs into another.

An economy with production consists of consumers and firms. The firms use inputs to produce outputs in order to maximise their profits. Each has available a production technology which describes the ways in which it can use inputs to produce outputs. The consumers hold shares in the firms and profits are distributed in proportion to the shareholdings. The consumers receive income from the sale of their initial endowments of goods and from the dividends from firms. When the economy is competitive both firms and consumers treat prices as outside of their control.
Let the economy have \( n \) goods which are indexed \( i = 1, \ldots, n \). Good \( i \) has associated price \( p_i \). Production is carried out by \( m \) firms. Each firm \( j, j = 1, \ldots, m \), uses inputs to produce outputs and maximises profits given the market prices. Demand comes from the consumers, who are labelled \( h = 1, \ldots, H \). They aim to maximise their utility. The total supply of each good is the sum of the production of it by firms and the initial endowment of it held by the consumers.

Each firm selects a production plan \( y_j^i \), where
\[
y_j^i = (y_{1j}^i, \ldots, y_{nj}^i). \tag{2.15}
\]
This production plan is chosen to maximise profits, \( \pi^i = py_j^i \), subject to the constraint that the chosen plan must be in the production set. From this maximisation can be determined firm \( j \)'s supply function of good \( i \)
\[
y_j^i = y_j^i(p). \tag{2.16}
\]
The level of profit is then
\[
\pi = py_j^i(p) = \pi^i(p). \tag{2.17}
\]
Aggregate supply from the production sector of the economy is obtained by summing the supply decisions of the individual firms. This gives aggregate supply as
\[
Y_i^p = \sum_{j=1}^{m} y_j^i(p) = Y_i(p). \tag{2.18}
\]

Each consumer has an initial endowment of commodities and also a set of shareholdings in firms. These shareholdings are exogenously given and remain fixed. For consumer \( h \) the initial endowment is denoted \( \omega^h = (\omega_{h1}, \ldots, \omega_{hn}) \) and the shareholding in firm \( j \) is \( \theta_j^h \). The firms must be fully owned by the consumers so \( \sum_{j=1}^{m} \theta_j^h = 1 \).

The preferences of consumer \( h \) are given by the utility function
\[
U^h(x_1^h, \ldots, x_n^h). \tag{2.19}
\]
Consumer \( h \) chooses a consumption plan \( (x_1^h, \ldots, x_n^h) \) to maximise their utility subject to the budget constraint
\[
\sum_{i=1}^{n} p_i x_i^h = \sum_{i=1}^{n} p_i \omega_{ih}^h + \sum_{j=1}^{m} \theta_j^h \pi_j^h. \tag{2.20}
\]
This budget constraint requires that the value of expenditure is not more than the value of the endowment plus income received from dividends.

The maximisation of utility by the consumer then results in the demand for good \( i \) from consumer \( h \) taking the form
\[
x_i^h = x_i^h(p_1, \ldots, p_n) \tag{2.21}
\]
The level of aggregate demand is found by summing the individual demands of the consumers to give
\[
X_i = \sum_{h=1}^{H} x_i^h(p_1, \ldots, p_n) = X_i(p_1, \ldots, p_n). \tag{2.22}
\]
The equilibrium of the economy occurs when demand is equal to supply. Excess demand for good \( i \), \( Z_i(p) \), can be defined by
\[
Z_i(p) = X_i(p) - Y_i(p) - \sum_{h=1}^{H} \omega_i^h. \tag{2.23}
\]
Here excess demand is the difference between demand and the sum of initial endowment and firms' supply. The equilibrium occurs when \( Z(p) = 0 \) for all of the goods \( i = 1, \ldots, n \). There are standard theorems that prove such an equilibrium must exist under fairly weak conditions.
The properties established for the exchange economy also apply to the economy with production. Demand is determined only by relative prices (so it is homogeneous of degree zero). Supply is also homogeneous of degree zero. Together, these results imply that excess demand is also homogeneous of degree zero. To determine the equilibrium prices that equate supply to demand, a normalisation must again be used. Equilibrium prices are those which equate excess demand to zero.

**Key points**

- Profit-maximisation determines supply from firms
- Consumers receive dividend income
- Equilibrium when excess demand is zero

**Activities**

1. Can dividend income ever be negative?
2. Provide an argument to show that the supply of a firm is determined only by relative prices.
3. Why can we be sure that a set of equilibrium prices will exist?

### 2.10 Efficiency with production

The extension of the two welfare theorems to an economy with production is straightforward. The major effect of production is to make supply variable: it is now the sum of the initial endowment plus the net outputs of the firms. In addition, a consumer's income includes the profit derived from their shareholdings in firms.

Given an equilibrium price vector, \( \hat{p} \), the supply decision by firm \( j \) has the property that it maximises profit over all available choices. Since \( \pi = py \), this means that the output choice \( \hat{y}^j \) satisfies

\[
\hat{p}\hat{y}^j \geq \hat{p}y^j, \tag{2.24}
\]

for all alternative production plans, \( y^j \). Letting

\[
\hat{x} = \sum_{h=1}^{H} \hat{x}^h \quad \text{and} \quad \hat{y} = \sum_{j=1}^{m} \hat{y}^j,
\]

then feasibility of the allocation requires that

\[
\hat{x} \leq \hat{y} + \omega. \tag{2.25}
\]

This is just the requirement that demand, \( \hat{x} \), does not exceed supply, \( \hat{y} + \omega \).

The proof of the First Theorem can now be constructed for the economy with production by assuming that at least one of the consumers is non-satiated. This implies that \( \hat{x} = \hat{y} + \omega \) (if it were not, the non-satiated consumer would always be willing to purchase the surplus which would be a contradiction). Now suppose that the equilibrium is not Pareto efficient. If this is the case, then there is an alternative, \( \bar{x} \), that makes no consumer worse-off and at least one strictly better-off. This alternative must cost strictly more than the equilibrium outcome, so \( \bar{p}\bar{x} > \hat{p}\hat{x} \), otherwise it would have been chosen in preference to \( \hat{x} \). The implied production choice for firms, \( \bar{y} \), must also make no more profit than the choice made by the firms at the equilibrium, giving \( \bar{p}\bar{y} \leq \hat{p}\hat{y} \). To do otherwise would contradict profit-maximisation. Putting these observations together implies that

\[
\hat{p}[\bar{x} - \bar{y} - \omega] > \hat{p}[\hat{x} - \hat{y} - \omega] = 0. \tag{2.26}
\]

This inequality establishes that the alternative allocation cannot be feasible, a contradiction which establishes the theorem.
The extension of the Second Theorem is illustrated in Figure 2.11. The set
\( W \) represents the feasible consumption plans where each point is equal to \( y + \omega \) for some production plan \( y \) by the firms and initial endowment \( \omega \). \( Z \) denotes the set of points that represent improvements over the allocation \( \hat{x}^1, \hat{x}^2 \). These are improvements in the Pareto sense that at least one must gain. It can be seen that the prices determined by the tangent between this set and the production possibility set make the choices optimal for the consumers.

If \( W \) is convex, which occurs when individual firms’ production sets are convex, then a common tangent to \( W \) and \( Z \) can be found. This would make \( \hat{x} \) an equilibrium. Individual income allocations, the sum of the value of endowment plus profit income, can be placed anywhere on the budget lines tangent to the individual allocations \( \hat{x}^1 \) and \( \alpha \) provided they sum to the total income of the economy.

![Figure 2.11: Proof of the Second Theorem](image)

**Key points**
- First and Second Theorems extend to production
- Second Theorem requires convexity

**Activities**
1. Demonstrate the Second Theorem can fail if \( W \) is not convex.
2. Show how the set of Pareto-improving allocations, \( Z \), is constructed.
3. If firms have constant returns to scale, what is the shape of \( W \)?

**Exercises**
1. Consider an economy with 2 consumers, \( A \) and \( B \), and 2 goods, 1 and 2. The utility function of \( A \) is

\[
U_A = \gamma \ln(x_i^A) + (1 - \gamma) \ln(x_{i-1}^A),
\]

where \( x_i^A \) is consumption of good \( i \) by \( A \). \( A \) has endowment

\[
\omega_A = (\omega_1^A, \omega_2^A) = (2, 1).
\]

For consumer \( B \),

\[
U_A = \gamma \ln(x_i^B) + (1 - \gamma) \ln(x_{i-1}^B),
\]

and \( \omega_B = (3, 2) \).

i. The income of \( A \) is given by \( M_A = p_1 \omega_1^A + p_2 \omega_2^A \), so the budget constraint of \( A \) can be written \( M_A = p_1 x_1^A + p_2 x_2^A \). Use this expression to substitute for \( x_2^A \) in \( U_A \) and, by maximising over \( x_1^A \), calculate the demands of \( A \). Repeat for \( B \).
ii. Choosing good 2 as numeraire, graph the excess demand for good 1 as a function of $p_1$.

iii. Calculate the competitive equilibrium allocation by equating the demand for good 1 to the supply and then substituting for $M^A$ and $M^B$. Verify that this is the point where excess demand is zero.

iv. Show how this equilibrium price is affected by a change in $\gamma$ and in $w_A$. Explain the results.

2. It has been argued that equilibrium generally exists. Referring to Figure 2.4, there must be a point where excess demand is zero if excess demand is positive as the price of good 2 tends to zero and negative as it tends to infinity. Select good 1 as numeraire and show that these properties hold when preferences are given by the utility function $U^h = \log x^h_1 + \log x^h_2$ and the consumer’s endowment of both goods is positive.

3. Assume an economy has a total endowment of two units of the two available goods. If the two consumers have preferences $U^h = \alpha \ln(x^h_1) + (1 - \alpha) \ln(x^h_2)$, find the ratio of equilibrium prices at the allocation where $U^1 = U^2$. Hence find the value of the lump-sum transfer that is needed to decentralise the allocation if the initial endowments are $(1/2, 3/4)$ and $(3/2, 5/4)$.

A reminder of your learning outcomes

Having completed this chapter, and the Essential readings and activities, you should be able to:

• describe utility and profit maximisation
• explain the role of price adjustment in reaching equilibrium
• characterise an efficient equilibrium
• explain why competition achieves Pareto efficiency
• discuss the use of lump-sum taxes.

Sample examination questions

Section A

1. Define and briefly describe the following:
   i. an Edgeworth box
   ii. Pareto efficiency
   iii. the Second Theorem of welfare economics.

2. Briefly demonstrate:
   i. the decentralisation of a Pareto efficient allocation
   ii. the proof of the First Theorem of welfare economics
   iii. the role of prices in achieving efficiency.

Section B

3. Using an Edgeworth box, describe how a competitive equilibrium is achieved by the adjustment of prices. Show that the equilibrium is Pareto efficient. Do these results provide an argument in favour of the unregulated competitive economy?

4. State and interpret the Second Theorem of welfare economics. What conditions must be met for it to hold? Does it provide an argument for the practical use of lump-sum transfers?
Chapter 3: Government

Essential reading


Further reading


Chapter summary

The purpose of this chapter is to provide an introduction to the nature of the public sector in modern market economies. It presents a review of data on the public sector which looks at its size, sources of income and patterns of expenditure. This reveals the extent and range of activities that the public sector undertakes. It also demonstrates the similarities between public sector behaviour in countries that are otherwise very different culturally.

Learning outcomes

After completing this chapter and the relevant reading, you should be able to:

• describe the growth of public expenditure
• explain the main categories of expenditure
• explain the relative importance of the main tax instruments.

3.1 Historical growth

The historical development of the public sector over the past century can be briefly described as one of significant growth. In most western economies, government expenditure was around 10 per cent of gross domestic product in 1900. Expenditure then rose steadily over the next sixty years, levelling out in the latter part of the century. This pattern of growth is illustrated in the following two figures.

Figure 3.1 displays the growth of public spending during the last century in five developed economies. Only a selection of years are plotted - the years of the Second World War are left out for example - but the figure provides a clear impression of the overall trend. There is a persistent difference in the levels of expenditure between the three European countries and the two non-European countries, but the pattern of growth is the same for all. These economies have a clear long-run upward path in public spending relative to gross domestic product.

Starting at a level of public spending around 10 per cent of gross domestic product in the late nineteenth century, the share increased markedly
at around the time of the First World War and then continued to rise afterwards. It now exceeds a third of gross domestic product in all cases and, for France, exceeds one half.

**Figure 3.1: Growth of total expenditure**

A more detailed representation of expenditure in the last 30 years is provided in Figure 3.2. The picture this presents is of a slowing, or even a stagnation, of the growth in public sector expenditure. Although expenditure is higher in 2002 for the six countries shown, the increases for the UK and the USA are very small. For the UK especially, expenditure was clearly higher in the early 1980s than in 2002. The figure also suggests that there has been convergence in the level of expenditure between the countries. For example, in 1970 expenditure in Japan was only half that in France, Germany and the UK but by 2002 it almost matched that in the UK.

**Figure 3.2: Total outlays as a percentage of GDP**

**Key points**

- Significant growth of expenditure from 1900
- Public expenditure up to 50 per cent of GDP
- Recent slackening of growth

**Activities**

1. Obtain data on public sector expenditure and estimate the growth trend
   i. over the last 50 years;
   ii. over the last 20 years. Has there been a structural break?
2. Why may expenditure data underestimate the role of the public sector?
### 3.2 Expenditure by category

This section looks in more detail at the composition of expenditure. Expenditure is considered from the perspective of its division into categories and its allocation between various levels of government.

Figure 3.3 displays consolidated expenditure for the USA, UK and Germany. By consolidated general spending is meant the combined expenditure of all levels of government. The figures avoid double counting by subtracting intergovernmental transfers. The expenditures are presented as proportions of government spending and the numbers recorded on the right are unweighted averages across the three countries.

The spending on the goods associated with the core functions of the state — defence and public order — make up only a tenth of spending on average. Costs of an administrative and governmental nature are recorded under the heading general public services and add no more than another 6 per cent on average. Health and education, despite providing benefits of an arguably largely private nature, are substantial in all countries. Spending on housing and community amenities, on recreation and culture, and on the transport and communications sectors are comparatively small. Subsidies to agriculture, energy, mining, manufacturing, and construction sectors are brought together here under the heading of other economic affairs and also appear relatively minor. Social security and welfare spending is the largest single item in all countries. This is true even for the USA, although it is noticeably smaller than in the three European countries. On average it constitutes over a third of spending.

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**Figure 3.3: Composition of consolidated general spending**

Figures 3.4 and 3.5 show how spending responsibilities are allocated between different tiers of government in the USA, UK and Germany. This provides an interesting contrast since Germany and the USA are
federal countries with highly devolved government whereas the UK is not. Nonetheless, some common observations can be made. Certain items such as defence are always allocated to the centre. Redistributive functions also tend to be concentrated centrally for the reason that redistribution between poor and rich regions is only possible that way and attempts at redistribution at lower levels are vulnerable to frustration through migration of richer individuals away from localities with internally redistributive programs.

Education on the other hand seems in all these countries to be largely devolved to lower levels, either to the states or to local government. Public order is also typically dealt with at lower levels. Health spending, on the other hand, is always substantial at the central level but can also be important at lower tiers, for example in Germany.

![Figure 3.4: Composition of central spending](image)

The fact that spending is made by lower levels does not mean that it is financed from local taxes. In most multiple-tier systems, central government partly finances lower-tier functions by means of grants. These have many purposes, including correcting for imbalances of resources between localities and between tiers given the chosen allocation of tax instruments. Sometimes grants are lump sum and sometimes they depend on the spending activities of the lower tiers. In the latter case, the incentives of lower tiers to spend can be changed by the design of the grant formula and central government can use this as a way to encourage recognition of externalities between localities.
Figure 3.5: Composition of state spending

Key points

- Importance of social security and health
- Redistribution organised centrally
- Education spending delegated to lower levels

Activities

1. Do the figures support the view that governments have expanded beyond the minimal state?
2. Explain why defence spending is organised centrally and education locally.
3. Is expenditure to combat market failure greater than expenditure for redistributive purposes?

3.3 Tax revenues

The discussion of expenditure is now matched by a discussion of revenue. The following figures first view tax revenues from an historical perspective and then relate revenues to tax instruments.

Figure 3.6 charts total tax revenue as a percentage of GDP for seven countries from 1965 to 2000. The general picture that emerges from this mirrors that drawn from the expenditure data. Most of the countries have witnessed some growth in the tax revenues and there has been a degree of convergence. In 2000 the revenues in these countries as a percentage of GDP ranged between 27 per cent and 45 per cent.

Looking more closely at the details, France (45 per cent) and the United Kingdom (37 per cent) have the highest percentage, closely followed by Canada (36 per cent) and Turkey (33 per cent). The USA (30 per cent) and Japan (27 per cent) are somewhat lower. The country that has witnessed the most growth is Turkey, where tax revenue has risen from 11 per cent of GDP in 1965 to 33 per cent in 2000. Tax revenue also grew strongly in Japan between 1965, when it was 11 per cent, and 1990, when it reached 30 per cent, but has levelled off since.
Overall, this data is suggestive of a degree of convergence and uniformity between these countries. All can be characterised as mixed economies with tax revenues a significant percentage of GDP. The countries have reached fairly similar outcomes at this level of aggregation.

Figure 3.6: Total tax revenue as a per cent of GDP

Figure 3.7 looks at the proportion of tax revenue raised by six categories of tax instrument in 2000. This figure shows that income and profit taxes raise the largest proportion of revenue in Australia (57 per cent), the USA (51 per cent), Canada (49 per cent) and the UK (39 per cent). Social security taxes are the largest proportion in Japan (36 per cent), France (36 per cent) and Germany (39 per cent). Among these countries, Turkey is unique with taxes on goods and services the most significant item (41 per cent).

There is also a noticeable division between the European countries, where taxes on goods and services are much more significant, and the USA. For instance, taxes on goods and services raise 32 per cent of revenue in the UK but only 16 per cent in the USA. This is a reflection of the importance of valued-added taxation (VAT) in Europe which has been a significant element of European Union tax policy. Property taxes are significant in the majority of countries (12 per cent in the UK and 10 per cent in the USA and Japan). Payroll taxes are only really significant in Australia (6 per cent).

Figure 3.7: Tax revenue for category of taxation, 2000

Key points

- Growth in tax revenue as a percentage of GDP
- Convergence between countries
- Taxes on commodities relatively more important in Europe, taxes on income relatively more important in the USA
Activities

1. Why is income taxed rather than wealth?
2. What explains the limited revenue from property taxation?
3. Should social security taxes be viewed as a second component of income taxation?

3.4 Taxation by level

The next two figures display the proportion of tax revenue raised by each level of government. Figure 3.8 considers the proportions in five federal countries. By federal it is meant that the structure in these countries consists of central government, state government and local government. In contrast, Figure 3.9 considers five unitary countries. These unitary countries divide responsibilities between central government and local government.

For all the federal countries, the central government raises more revenue than state government. The two are closest in Canada, with the central government raising 42 per cent and the provinces 36 per cent, and in Germany, with central government 31 per cent and the Bundeslander 23 per cent. The federal governments in the USA and Australia raises considerably more revenue than the states (46 per cent and 20 per cent for the USA and 83 per cent and 14 per cent for Australia). In all countries, local government raises the smallest proportion of revenue. The USA local government raises 11 per cent of revenue which is the largest among these countries. The smallest proportion of revenue raised by local government is 3 per cent in Australia.

![Figure 3.8: Tax revenue by level of government, federal countries, 2000](image)

The unitary countries in Figure 3.9 display the same general pattern that the central government raises significantly more revenue than local government. The largest value is 70 per cent in Turkey and the smallest 37 per cent in Japan. Local government is most significant in Japan (25 per cent) and least significant in France (10 per cent).
Comparing the federal and unitary countries, it can be seen that local government raises slightly more revenue on average in the unitary countries than the federal countries. What really distinguishes them is the size of central government. The figures suggest that the revenue raised by central government in the unitary countries is almost the same on average as that of central plus state in the federal countries. The absence of state government does not therefore put more emphasis on local government in the unitary countries. Instead, the role of the state government is absorbed within central government.

**Key points**

- Central government raises more revenue than state government
- Local government raises the smallest proportion
- Size of local government is the same in unitary and federal countries

**Activities**

1. What factors may determine the allocation of revenue collection between levels of government? Does the political division between levels of government have any economic implications?
2. Does the political division between levels of government have any economic implications?
3. Provide an interpretation of the structure of the EU from the perspective of the division of tax collection.

**Exercises**

1. Obtain data on the tax revenue by tax instrument for different levels of government. How can the observed patterns be explained?
2. Do increases in public expenditure cause economic growth, or vice versa? How would you test which is the case?

**A reminder of your learning outcomes**

Having completed this chapter, and the Essential readings and activities, you should be able to:

- describe the growth of public expenditure
- explain the main categories of expenditure
- explain the relative importance of the main tax instruments.
Sample examination questions

Section A
1. Define and briefly describe the following:
   i. consolidated expenditure
   ii. intergovernmental grants
   iii. federal and unitary countries.

2. Briefly describe:
   i. the growth in government expenditure in the last century
   ii. the division of expenditure between central and local government
   iii. the relative importance of different tax instruments.

Section B
3. Describe the growth of public sector expenditure over the last century.
   To what extent has the public sector moved beyond the minimal state?
   Has the growth now reached a limit?

4. What factors explain the division of taxation and expenditure responsibilities between different levels of government?