International 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
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For more information, see: www.londoninternational.ac.uk
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This is one of a series of subject guides published by the University. We regret that due to pressure of work the authors are unable to enter into any correspondence relating to, or arising from, the guide. If you have any comments on this subject guide, favourable or unfavourable, please use the form at the back of this guide.
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Chapter 1
Introduction to the subject guide

1.1 Introduction

Welcome to this course in International economics, which is divided into two parts: international trade and international finance.

In this introductory chapter, we will look at the overall structure of the subject guide, we will introduce you to the subject area, to the aims and learning outcomes for the course and to the learning resources available. Finally, we will offer you some Examination advice.

We hope you enjoy this course and we wish you every success in your studies.

1.2 Route map to the course

The subject of International economics falls rather neatly into two distinct parts. One part deals with international trade and the other part deals with international finance. An undergraduate economics programme typically takes one term (or semester) to cover each part. Accordingly, the guide has been structured to provide you with two separate work programmes, one for international trade and one for international finance.

The subject guide consists of one introductory chapter, 10 chapters on international trade, nine chapters on international finance and one Sample examination paper with the associated Examiners’ commentary. You are advised to work through the introductory chapter and the 10 chapters of international trade in the Autumn term; in the Spring term, you are advised to work through the chapters on international finance; and at the end to attempt the Sample examination paper under examination conditions (that is, with closed books, limiting yourself to three hours). You are advised to progress at a rate of one chapter per week (about 20 weeks in total).

1.3 Introduction to the subject area

All countries are involved in economic relationships with other countries: they trade goods and services with each other; they buy and sell each other’s assets; often, they engage in the direct transfer of factors of production between one another in the form of foreign direct investment or migration. The nature of these relationships experiences constant change. Over time, a variety of formal and informal regional trading blocs and monetary unions has evolved.

Increasing liberalisation and integration of the world economy has led to an explosion of international trade and movement of capital. In April 1998, average daily global foreign exchange trading was already a staggering $1.5 billion but by April 2013 daily turnover
exceeded $5.3 trillion (Source: Bank of International Settlements), making foreign exchange markets the largest financial markets in the world.

With the liberalisation of trade and capital movements, the importance of international economic relationships has increased; as have the links through which economic shocks are transmitted across countries. The extent of these links can be witnessed in the global effects of the 2007 US sub-prime crisis.

The above all highlights issues in the sphere of international economics. International economics addresses questions such as:

- Why do countries trade and what determines the pattern of international trade?
- What are the sources of gains from trade and who might the losers be?

International economics is at the core of many important policy issues; for example:

- Problems surrounding bilateral trade have, for years, dominated China/US economic relationships.
- The Asian financial crisis of 1997 was a consequence of the development of complicated international financial linkages.
- As the financial crisis emanating from the US sub-prime crisis continues to unfold, important issues regarding the causes, consequences and policy responses to financial crises are reevaluated.
- The Euro, which may yet challenge the US dollar as a world currency, is a direct product of the drive to European integration.

Considering the importance of international economics, it is not surprising that our understanding of international economics is subject to constant change and development. Within the context of your degree, international economics represents an important application of the basic principles and methods that you have learned in your microeconomics and macroeconomics modules.

1.4 Syllabus

The module international economics is divided into two parts: international trade and international finance (sometimes referred to as international macroeconomics or international monetary economics). This split essentially coincides with the distinction between the microeconomics and the macroeconomics of the open economy.

**International trade** covers the reasons for trade and explanation of trade patterns and the gains accruing from trade or from restricting trade. These are core areas and call for extensive coverage. Linked to this core are a number of specific issues which must also be studied:

- increasing returns and trade;
- international factor movements;
- growth and trade;
1.5. Aims of this course

- income distribution and trade;
- economic integration;
- multinational enterprises;
- ‘North-south’ issues.

Empirical evidence supplements the theoretical treatment. The European Union (EU), World Trade Organization (WTO) and the United Nations Conference on Trade and Development (UNCTAD) are institutionally involved in trade policy issues and their major concerns are included in the subjects to be studied.

**International finance** covers the balance of payments, exchange rates and open-economy macroeconomics. Linked to this core are a number of specific issues which must also be studied: national income accounting; spot and forward markets; parity conditions; exchange rate determination; exchange rate regimes; exchange rate stability and currency crises; and currency unions. Empirical evidence, though often inadequate and conflicting, is relevant in many areas. Issues associated with the European Monetary System (EMS), the International Monetary Fund (IMF) and, in general, with international monetary relations are also included in the syllabus.

1.4.1 Prerequisites

If you are studying for this course as part of a University of London International Programmes BSc degree, you must have already passed **EC2065 Macroeconomics** and either **MN3028 Managerial economics** or **EC2066 Microeconomics**. Students should refer to the degree structures in the Regulations when choosing which prerequisite to select.

1.5 Aims of this course

The course aims to enable you to:

- acquire the analytical methods needed and understanding of how and when to apply different models and approaches to events in the world economy
- provide an understanding of the intellectual and practical problems that arise from the economic interaction between countries
- offer explanations of the international pattern of trade and specialisation and of the reasons why similar economies often trade more with each other than with dissimilar ones
- provide an account of the sources of the gains from trade
- offer explanations, in the monetary sphere, of the determinants of exchange rates; of the timing and causes of financial crises and an analysis of the channels of international economic interdependence.
1.6 Learning outcomes for the course

At the end of the course and having completed the Essential reading and activities, you should be able to:

- discuss and explain specific policy issues such as ‘environmentalism as protectionism’; international dumping; the choice of exchange rate regime; the desirability of free capital flows
- apply a specific framework to illustrate the connection between a variety of models and approaches. Explain the connections between Ricardian, Heckscher–Ohlin and the specific factors models in trade theory, or between the ‘monetary approach’ and the ‘asset approach’ in exchange rate theory
- explain how international economic theory has been shaped by real world events.

1.7 Overview of learning resources

1.7.1 The subject guide

The subject guide is intended for you to use in conjunction with the suggested textbooks. Therefore, it is important that you understand that the subject guide is not itself a textbook or a substitute for a textbook. Each chapter of the guide roughly corresponds to one week’s work if you were studying as a student on campus and covers a distinct topic or set of topics.

Each chapter begins with a list of Essential reading and Further reading. As the name suggests, Essential reading is required reading in order for you to fully understand the concepts introduced in the particular chapter. The items listed under Further reading will give you greater insight into the topics covered in the chapter. They are meant to both provide alternate textbook sources, if you still feel uncomfortable with the material; and advanced references if you want to read more on a particular topic.

Each chapter also provides you with a set of activities together with some Sample examination questions that will enable you to test your understanding of the basic ideas and concepts. It is vital that you attempt all the suggested activities since actively ‘doing’ is a better way of learning than passively absorbing material by reading.

1.7.2 Essential reading

This course is built predominantly around the following textbook:


International economics has a vast literature, including a large number of very good textbooks; the book by Paul Krugman, Maurice Obstfeld and Marc Melitz, in 2014 in its tenth edition, is one of the very best. It is written by three economists who have been at the forefront of recent
advances in international economics and contains some of the latest developments. At the same time, the textbook remains very user-friendly, is grounded in real-world experience and is widely used throughout the world. The main body of the text is non-technical and more advanced material is contained in appendices and mathematical appendices. References in this subject guide are to the ninth edition, which has the advantage of including more recent case studies, as well as an up-to-date discussion on international economic issues. Earlier editions of the textbook are sufficient for much of the material, but do not address recent debates such as those surrounding the global financial crisis and issues surrounding the use of unconventional monetary policy in the wake of the crisis.

Detailed reading references in this subject guide refer to the editions of the set textbooks listed above and below. New editions of one or more of these textbooks may have been published by the time you study this course. You can use a more recent edition of any of the books; 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.

It is essential that you access the textbook and we advise you to purchase it if at all possible. Note that references to book chapters, diagrams, etc. are for the editions of the books indicated above. Earlier editions of the textbook may be available second hand at more favourable prices, but you should weigh this against the fact that the references in this guide will not match exactly.

Some of the chapters of this syllabus refer to the Online Appendices of KOM. These Online Appendices can be found at http://wps.aw.com/bp_krgmnobstf_inter econ_10/.

In the second part of the syllabus, on international finance, there are a couple of instances where KOM is supplemented with required readings from one other textbook:


### 1.7.3 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).

There are many textbooks that cover the topics discussed in this subject guide; one textbook that can be used as a complement to KOM is:


You may also find Copeland (2014), mentioned under Essential reading, useful as Further reading for many chapters of Part 2 of the subject guide.

There are two free online textbooks available on international trade and international finance written by Suranovic. These are excellent online resources that are very easy to access:

Suranovic, S.M. *International Trade: Theory and Policy*. (referred to as ‘S(IT)’ in the subject guide);
1. Introduction to the subject guide

http://internationalecon.com/Trade/tradehome.php

Suranovic, S.M. *International Finance: Theory and Policy.* (referred to as ‘S(IF)’ in the subject guide);
http://internationalecon.com/Finance/financehome.php

However good a book might be, it is nevertheless essential that you read more widely. Many of the chapters of the subject guide provide several additional references under Further reading, which contain seminal contributions to the academic literature, survey papers, or in some instances relevant policy reports.

Unless otherwise stated, all websites in this subject guide were accessed in February 2015. We cannot guarantee, however, that they will stay current and you may need to perform an internet search to find the relevant pages.

1.7.4 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 have received your login details for the Student Portal with your official offer, which was emailed to the address that you gave on your application form. You have probably already logged in to the Student Portal in order to register. As soon as you registered, you will automatically have been granted access to the VLE, Online Library and your fully functional University of London email account.

If you have forgotten your login details, please click on the ‘Forgotten your password’ link on the login page.

1.7.5 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.
1.8. Study time

- 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.

1.7.6 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

1.8 Study time

Study time is very much an individual matter. However, a student following an internal degree programme would normally have three to four hours’ of contact time per week on an international economics subject at this level. Normally an internal student would be expected to back this up by at least the same amount of time devoted to individual study. This implies a minimum of say, eight hours per week. If you are studying this subject over one year you would be advised to devote at least as much time to the subject but you can break this up into three or four sessions over the week.

1.9 Examination advice

1.9.1 The examination

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.

Assessment is by a three-hour unseen examination. From 2014, the examination will have two sections:

- Section A requires candidates to answer one compulsory question worth 40 marks (Question 1). Answers must be supported with a brief justification or explanation, which may include diagram(s) or equations, where appropriate. Unsupported answers will receive no marks.

- Section B contains 10 predominantly essay-style questions. Candidates are required to choose any three questions from this section, each carrying 20 marks. These questions are designed to test candidates’ analytical understanding of the course and require application of knowledge to details provided in the question.

Candidates should refer to the VLE and read the Examiners’ commentaries on the Zone A and Zone B examinations of recent years. These contain guidelines regarding what constitutes a poor/good/excellent answer to past examination questions and general advice on how to approach the examination, areas where candidates have exhibited weakness, etc.

### 1.9.2 Examination technique

Good examination technique can significantly improve your examination performance and poor technique may result in serious underachievement relative to your ability and understanding. Some aspects of good technique are elementary and require only awareness and self-discipline while others are more subtle.

You should regard the examination as an opportunity for you to demonstrate to the Examiners that you have covered the material of the subject, that you understand the material and that you can use and apply it in different situations. You should bear in mind that your examination script is the only evidence available to the Examiners on which to base their judgement about what you have achieved. They cannot read your mind, or ask you what you mean. Accordingly, it is important that what you write, clearly and unambiguously, demonstrates your mastery of the subject. This suggests a number of rules that you should follow:

You should read carefully the instructions at the beginning of the question paper and follow them. In particular, if you are asked to answer, say, three questions you should answer three. If you answer only two questions you will receive zero marks for the ‘missing’ third question. Thus you should pace yourself to allow time to answer all the required questions as even a moderately-answered question will score more than zero!

If a question is compulsory, then you must answer it. Also, there is no advantage in answering more than the required number of questions—you will receive credit only for what you are asked to do.

It is important that what you write is legible. The Examiners can only give credit for what they can read. If you have ‘problem’ handwriting you would be advised to write more slowly to ensure legibility. You might ask a friend or teacher to advise you on the legibility of your handwriting.

If you use diagrams or equations it is important that you label them and explain them clearly.
and that you refer to them in the text (narrative) of your answer. An isolated and unexplained
diagram is useless.

You should read each question carefully and attempt to identify the nuances that the
Examiners may have included. Questions are rarely of the form: ‘Write all you know about
comparative advantage.’ Usually a question requires you to show how a concept or theory
might be used or interpreted. You need to identify the particular angle the Examiner has
decided to emphasise and address that particular angle. Often it is helpful to use the opening
paragraph of your answer to discuss your interpretation of the question. This serves the
purpose of informing the Examiners of how you are thinking and may also help you to
structure your answer.

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 best be answered.
1. Introduction to the subject guide
Part 1
International trade
Introduction to international trade

The subject matter of international economics divides rather neatly into what are referred to as international trade and international finance. These areas form the two Parts of this subject guide. The body of thought that comes under the title of ‘international trade’ is concerned with ‘real’ aspects of international economics where the term ‘real’ is to be understood as contrasting with ‘monetary’ or ‘financial’. Alternatively, you might wish to think of international trade as the application of microeconomics to the international economy; and international monetary economics as the application of macroeconomics.

The starting point for studying international trade concerns questions such as:

- Why do countries trade with each other?
- How do countries gain from international trade?
- What determines the international pattern of specialisation and the commodity and composition of trade?

These are issues addressed in Chapters 2 to 7 which together form a conceptual unit. Each chapter deals with different international trade ‘models’ and offers a model that provides alternative theoretical explanations of international trade. Chapters 2 to 4 relate to models of international trade based on comparative advantage. Chapter 5 provides a synthesis of the common features of the comparative advantage models discussed in Chapters 2 to 4. Chapter 6 considers the movement of factors. Chapter 7 examines models of trade based on economies of scale and imperfect competition. The different models/explanations for international trade are in part complementary and in part competing, and the intention of these chapters is to highlight these features.

Chapters 8 to 11 form another block that deals with trade policy or commercial policy. Trade or commercial policy is to be understood as intervention by governments of international agencies in the trading process. Chapter 8 deals with the fundamentals of trade policy: what are the instruments of trade policy intervention? How do they work? How can they be compared? Economists are typically in favour of the absence of trade policy intervention (that is, in favour of what is sometimes known as ‘free trade’). In practice, very few countries operate free trade regimes and Chapter 9 is devoted to exploring the reasons for this. Regional trading arrangements have proliferated in recent years and Chapter 10 is devoted to exploring the reasons for this. Chapter 11 finishes up with some of the special trade issues faced by developing countries.
Chapter 2
The Ricardian model of international trade

2.1 Introduction

International trade theory seeks to explain or answer some of the following questions: Why do countries trade with each other? What are the gains from trade? What explains the pattern of international specialisation? What explains the commodity composition of trade? How is it possible for low productivity countries to trade with high productivity ones? How are international prices determined? How are the gains from trade distributed? Answers to most of these questions are offered by the principle of comparative advantage.

2.1.1 Aims of the chapter

At the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- summarise the theory of comparative advantage, in particular with reference to the Ricardian model, and apply this theory in the real world.

2.1.2 Learning outcomes

By the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- explain the concept of comparative advantage and distinguish it from the idea of absolute advantage
- explain how comparative advantage based on technological differences is the determinant of the pattern of trade and specialisation in the Ricardian model
- explain how the gains from trade arise in this model
- explain the relationship between relative international productivity and relative wages
- manipulate the RD/RS diagram to illustrate different possible equilibria in the Ricardian model
- explain how comparative advantage might be interpreted in a real world situation.
2. The Ricardian model of international trade

2.1.3 Essential reading

KOM, Chapter 3 ‘Labour Productivity and Comparative Advantage: The Ricardian Model’.

2.1.4 Further reading

FT, Chapter 2 ‘Trade and Technology: The Ricardian Model’.

S(IT), Chapter 40: http://internationalecon.com/Trade/Tch40/Tch40.php


2.1.5 References cited

No further references cited in the text.

2.1.6 Synopsis of chapter content

This chapter, like the other main chapters of this subject guide, follows a fairly standard structure. It begins with an Introduction—in this case on the Ricardian model—considers this model in more detail, before moving on to an Overview of the key content.

The chapter contains several activities for you to perform, and we recommend that you do these in order to facilitate your learning, and we recommend that you consider these an integral part of each and every chapter.

The chapter ends with a Reminder of your Learning outcomes for the chapter along with a ‘Test your knowledge and understanding’ section with sample examination questions that directly relate to the content of the chapter. There will also be some guidance on answering sample questions and there may be some guidance on approaching selected activities.
2.2 Chapter content

2.2.1 The Ricardian model

Adam Smith had previously shown the gains of trade in the presence of absolute advantage; that is, the situation in which a country is more efficient in producing a good than another country. Ricardo’s model shows that mutual gains from trade (and specialisation) arise even when one of the countries (say, the ‘poor’ country) is less efficient in the production of both goods. Although the poor country may be less efficient overall, and thus not have an absolute advantage, it may still have a relative efficiency, giving it a comparative advantage.

Developed by David Ricardo in the early nineteenth century to provide intellectual support for the abolition of Corn Laws in Great Britain – that is, to promote the benefits of free trade (in grain) – the principle of comparative advantage remains one of the enduring insights of economic theory. Many textbooks continue to use Ricardo’s original numerical example. The example uses two countries, Portugal and England, and the production and trade of two products, namely wine and cloth.

The further development of Ricardo’s numerical example as a two-good/two-country model has come to be known as the Ricardian model, also known as the classical model. The Ricardian model remains the starting point of the theory of international trade theory even now, nearly 200 years after Ricardo originally developed it.

The basis for comparative advantage in the Ricardian model, which drives the pattern of specialisation and trade lies in cross-country technological differences, as summarised by differences in the opportunity cost of the production of goods.

The advantages of the Ricardian model

Here are some of the advantages of the model:

- it is a particularly clear account of the principle of comparative advantage and how trade and specialisation according to comparative advantage will generate mutual gains from trade
- it demonstrates that a regime of free trade will actually generate a trade and specialisation pattern in accordance with comparative advantage
- it provides an understanding of the roles of wages and productivity in international competitiveness
- it gives an introduction to a methodology which is used in the development of many other propositions in trade theory
- it is a working example of a simple general equilibrium model.

2.2.2 Techniques and some formal results

The usual assumptions of the Ricardian model may be summarised as follows:

1. There are two countries, which we shall refer to as Home (H) and Foreign (F).
2. The Ricardian model of international trade

2. There are two goods, which we shall refer to as wine (w) and cloth (c).

3. Each good is produced with the aid of one factor of production, usually thought of as labour. (You might imagine that labour actually works with land and/or capital but these other factors are suppressed in this model and formally you can assume that one unit of labour works with a fixed bundle of other inputs.)

4. Production of both goods is subject to constant returns to scale and hence the technology for each good may be summed up by its unit labour requirement. The unit labour requirement in wine is given by the number of units (hours) of labour needed to produce one unit of output (in this case, a litre of wine). In cloth production, it is the amount of labour needed to produce a bale of cloth. The inverse of the unit labour requirement is the average (and marginal) product of labour.

5. All markets are assumed to be competitive. This means that all markets clear (that is, supply = demand) and that, in both sectors, price = average cost = marginal cost.

Note: It is not necessary for you to reproduce these assumptions in an essay or in an examination answer unless they are specifically asked for, but you should understand why the assumptions are needed.

You may find it helpful to approach the main properties and results of the model in two alternative but complementary ways: (i) comparing the equilibrium under autarky with the free trade equilibrium and (ii) the relative supply (RS)–relative demand (RD) analysis.

Equilibrium under autarky and the free trade equilibrium

One route to show the advantages of trade is to assume that initially there is no trade between Home and Foreign (perhaps because transport costs are prohibitively high). This is known as autarky (that is, both countries are self-sufficient in both goods and consume what they produce). Thus, under autarky, each country can be regarded as a closed economy and hence equilibrium in each is simply the closed economy equilibrium.

With two goods, constant returns to scale and one factor of production, the production possibility frontier (PPF) can be depicted as a straight line. For each country, the area on and below the PPF represents feasible production of that country (if there is full employment, the actual production should lie on the PPF). The slope of the PPF reflects the opportunity cost of cloth in terms of wine and in equilibrium also the autarky relative price of cloth in terms of wine. (Here we assume that in the autarky equilibrium cloth and wine are both produced and consumed.)

The coincidence of the price ratio and the opportunity cost ratio follows from the fact that in competitive equilibrium, prices must equal costs.

Autarky equilibrium in Foreign can also be represented in this way with the difference being that the slope of the production possibility frontier/relative price line will be different if relative costs are different from what they are in Home.

Activity 2.1 Check for yourself that in equilibrium the price ratio = the cost ratio. (Hint: for the price of each good note that price = marginal cost = unit labour requirement × wage rate.)
Let us assume for the sake of argument that Home has a higher opportunity cost of cloth in terms of wine, relative to Foreign. That is, more wine needs to be sacrificed in Home to produce one more unit of cloth, than in Foreign. This is reflected in Figures 2.1 and 2.2, where Home’s PPF is drawn steeper than the PPF of Foreign. Hence cloth is more expensive in the Home autarky equilibrium than it is in Foreign.

The autarky equilibrium in Home and Foreign is denoted by A and A′ in Figures 2.1 and 2.2, respectively, where consumers choose consumption to maximise utility (indifference curves IA), given the range of feasible production possibilities. Hence the PPF is also the consumers’ budget set in the autarky equilibrium. Note that the consumption side of these two economies is assumed to be identical; that is, consumers in Home and Foreign have the same preferences over wine and cloth.

Suppose that trade between Home and Foreign becomes possible (because of, say, a transport revolution that slashes international transport costs). Economic agents observe that cloth is relatively cheap in Foreign but wine is relatively cheap in Home, so Home buyers will switch to Foreign as their source for cloth and Foreign consumers (realistically specialised importers who are not modelled here) will switch to Home for wine. This will have two effects:

1. The demand switch will tend to lower the relative price of cloth at Home and the relative price of wine in Foreign. Clearly relative prices in the two countries will tend to converge and given free trade and negligible transport costs, there will be just one unified international relative price. (Transport costs can be rather important for some internationally traded goods and, of course, shipping and other forms of international transport are important sectors in their own right. However, incorporation of transport costs into trade models creates much complexity without changing the basic results. Because of this, transport costs are conventionally assumed to be zero in trade models.)

2. These price developments will cause Home to specialise in wine production and Foreign in cloth production and exchange goods in order to consume a mix of the two. It is the ability to separate production and consumption through trade that generates gains in the
2. The Ricardian model of international trade

Wine

Cloth

\[ \frac{P_C}{P_W} \]

\[ \frac{(P_C/P_W)_{FT}}{I_{FT}} \]

\[ \frac{(P_C/P_W)}{I_A} \]

\[ \frac{(P_C/P_W)}{B} \]

\[ \frac{(P_C/P_W)}{A'} \]

\[ \frac{(P_C/P_W)}{A'} \]

\[ \frac{(P_C/P_W)_{FT}}{C'} \]

\[ \frac{(P_C/P_W)}{C} \]

\[ 0 \]

Figure 2.2: Autarky and free trade equilibrium in Foreign

Ricardian model.

Specialisation in Home and Foreign is depicted by production points \( B \) and \( B' \) in Figures 2.1 and 2.2, respectively. Home can export wine in exchange for cloth at world prices, reflected by the shallower dotted relative price line in Figure 2.1. This Consumption Possibilities Frontier (CPF) reflects consumers’ budget line under free trade, which is now higher than the PPF. Similarly, the higher relative price for cloth in Foreign resulting from free trade expands consumers’ consumption possibilities, as reflected by the CPF. Consumers in each economy maximise their utility given their consumption possibilities so consumption under free trade is at \( C \) and \( C' \), respectively (for the moment we assume that trade is balanced; that is the value of exports will be equal to the value of imports).

The gains from trade

In Ricardo’s numerical example the gains from trade are established by showing that if specialisation is according to comparative advantage, the total world production of both goods can be greater than under autarky. Thus both countries can be made better off. More generally, it can be shown that free trade, and hence specialisation according to comparative advantage, will expand consumption possibilities in both countries. This is shown in Figure 2.3, which is constructed by combining Figures 2.1 and 2.2. The dimensions of the box in Figure 2.3 show total world production of wine and cloth when both countries are specialised according to comparative advantage. Under autarky, consumption must be identical with production in both countries. Hence Home consumption (and production) would occur at a point like \( A \) and Foreign production and consumption would be at a point like \( A' \). When free trade is possible, both will specialise and be able to trade at international prices (the arrowed line in Figure 2.3). Thus a consumption point such as \( C \) is attainable. The consumption point \( C \) is clearly superior to both \( A \) and \( A' \). This is because at \( C \) Home consumers can consume more of both goods than at point \( A \) and Foreign consumers can consume more of both goods than at \( A' \).

The gains from trade are also reflected in Figures 2.1 and 2.2 directly, as consumers are able to
reach a higher indifference curve (and thus welfare level) than under free trade.

**Relative Supply (RS)–Relative Demand (RD) analysis**

The relative world price of cloth to wine in the free trade equilibrium was argued to lie in between the autarky relative prices of the two countries. The next issue we need to address is exactly how relative world prices are determined. To do so, we need to use a piece of technical apparatus emphasised in KOM, the world Relative Supply (RS)–world Relative Demand (RD) analysis.

The RS curve is derived from the production possibility curves of the two countries and the condition that producers maximise profits. The RS curve is step-shaped (see KOM Figure 3-3 ‘World Relative Supply and Demand’) because the technology assumes fixed labour requirements. The intersection of world RS and RD curves illustrates world trading equilibrium. Two types of equilibria are possible:

1. An equilibrium in which both countries specialise (Equilibrium 1 in KOM Figure 3-3).
2. An equilibrium in which one of the countries is incompletely specialised (such as Equilibrium 2 in KOM Figure 3-3).

Consider Figure 2.4, which illustrates RS and RD for the Ricardian model. RD is quite straightforward to grasp: as the relative price of cloth falls, there is more demand for cloth relative to wine in the world.

The RS is a piece-wise function and needs careful construction. Consider the incentives for production for different relative prices of cloth to wine. If \( P_c/P_w < (P_c/P_w)^F \), then firms cannot cover the costs of cloth production, so there will be no production of cloth in either country. Hence the RS is vertical at 0 for all relative prices up to \( (P_c/P_w)^F \). If \( P_c/P_w = (P_c/P_w)^F \), only country F can produce cloth, and can choose anywhere along its PPF, giving a range of possible relative supplies of cloth to wine. For relative prices in the range \( (P_c/P_w)^F < P_c/P_w < (P_c/P_w)^H \), Foreign will produce only cloth, while Home will produce only wine. This gives the vertical segment of the RS step-function. Finally, for prices

![Figure 2.3: The gains from trade](image-url)
2. The Ricardian model of international trade

\[
\frac{P_C}{P_W} > (\frac{P_C}{P_W})^H, \text{ there is no incentive for either country to produce any wine, so the relative supply of cloth to wine tends to infinity at } (\frac{P_C}{P_W})^H.
\]

Combining the steps in this reasoning yields the RS schedule in Figure 2.4. The free trade equilibrium relative prices are determined where RS and RD meet, such as point E in Figure 2.4.

**Advantages of RS–RD approach:**

- It shows the simultaneous determination of prices, specialisation and trade.

- One can use the diagram to do simple comparative statics (for example, analyse the effects of changes in input requirements – productivity); of changes in size of country; of demand changes.

- The analysis can be extended to more than one country.

Consider how world relative prices might be different if the Foreign economy were very large in size (large labour force) relative to Home. This could also reflect the case of an efficiency gain in labour productivity; whereby the same labour force becomes uniformly more productive. The PPF of the Foreign economy is further out than that depicted in Figure 2.2, so there is more scope for the production of cloth (and wine) than before. It follows that the step-function changes, with a deeper ‘step’ reflecting larger Foreign production if \(\frac{P_C}{P_W} = (\frac{P_C}{P_W})^F\). This is illustrated in Figure 2.5. Country size and world relative prices, where an overall gain in labour productivity in Foreign results in a change from free trade equilibrium \(E\) to equilibrium \(E'\).

The interesting result is that the free trade relative price coincides with the autarky relative price of Foreign. Without a change in relative prices, there is no CPF expansion in Foreign, which implies Foreign does not gain from trade; by its sheer scale Foreign’s autarky prices prevail for the world once trade is liberalised between Home and Foreign, with all the gains accruing to Home.
Figure 2.5: Country size and world relative prices

Activity 2.2  Home has 1,200 units of labour available. It can produce wine \((w)\) and cloth \((c)\), the unit labour requirement of wine production is 4, while the labour requirement of cloth is 3.

(a) Graph Home’s production possibility frontier.

(b) What is the opportunity cost of wine in terms of cloth?

(c) Explain what the price of wine, in terms of cloth, would be in autarky (that is, in the absence of trade).

Now consider Foreign, with a labour force of 900. Foreign’s unit labour requirements are 5 for a unit of wine, and 1 for a unit of cloth.

(d) Graph Foreign’s production possibility frontier.

(e) Construct the world relative supply curve.

Now suppose that the world relative demand takes the following form:

\[
\left( \frac{D_c}{D_w} \right)^W = \left( \frac{P_c}{P_w} \right)^W
\]

where \(D_c\) and \(D_w\) are the demand for cloth and wine respectively.

(f) Graph the relative demand curve along with the relative supply curve.

(g) What is the equilibrium relative price of wine?

(h) Describe the pattern of trade.

(i) Show that both Home and Foreign gain from trade.

Add a third country, Moon, with labour force 2,000 and unit labour requirements of 4 for both wine and cloth.
2. The Ricardian model of international trade

(j) Graph the relative demand curve along with the relative supply curve for the three country case.

(k) What is the new equilibrium relative price of wine?

Relative wages

The Ricardian model offers a clear insight into the way in which international relative wages are influenced by relative productivity. This can be seen most clearly in the case of complete specialisation. Assume that Home specialises in wine and Foreign in cloth so that the price = cost conditions imply:

\[ P_w = a_w^H \times w^H \]  \hspace{1cm} (2.1)
\[ P_c = a_c^F \times w^F \]  \hspace{1cm} (2.2)

where \( a_w^H \) and \( a_c^F \) are the labour input coefficients in Home for wine production and in Foreign for cloth production, respectively. \( w^H \) and \( w^F \) are wages at Home and in Foreign. Taking the ratio of equation 2.1 to 2.2 and rearranging to solve for relative wages yields:

\[ \frac{w^H}{w^F} = \frac{a_c^F}{a_w^H} \times \frac{P_w}{P_c} \]  \hspace{1cm} (2.3)

Thus equation 2.3 shows that in equilibrium, relative wages are linked to relative productivities, through the ratio of input requirements, and to product demand through the price ratio. Other things being equal, higher productivity at Home (a lower unit labour requirement) implies higher relative Home wages and a lower productivity implies lower wages. Thus wages adjust to compensate for productivity in the Ricardian model. This adjustment in wages ensures that the country will have a labour cost advantage in at least one sector.

Activity 2.3

1. Reading KOM Chapter 3 section ‘Misconceptions about Comparative Advantage’, list three common arguments against free trade and provide reasons against these arguments.

2. Reading KOM Chapter 3 section ‘Comparative Advantage with Many Goods’, show how the two goods, two country model described in this chapter can be extended to a multi-goods model. Verify the results given in KOM Table 3-2 and KOM Figure 3-5.

2.2.3 Empirical evidence and application

As with all economic models, it is important to ask yourself the question: does this model describe reality well? For the Ricardian model, the answer is a heavily qualified yes.

For instance, MacDougall (1951) shows that post-Second World War Britain had lower productivity than the US in almost every sector. Still, Britain was exporting about as much as the United States. As the trade could not have been the result of an absolute advantage on the side of Britain, this is indicative of a comparative advantage of some sort. Balassa (1963) provides further support to the concept of comparative advantage by looking at the trade of
individual industries within the US and Britain. KOM Figure 3-6 ‘Productivity and Exports’ shows that sectoral exports from the US were positively related to the comparative advantage of that sector.

It is difficult to directly test the Ricardian model because its predictions depend on properties of unobservable autarky equilibria or equivalently upon the relative supply curve that is also unobservable. Attempts to test the model have accordingly examined the way in which productivity differences have influenced trade shares in third country markets. On the whole such indirect evidence is supportive of the model.

Of course, we need to be careful when applying the Ricardian model, or any other trade model. Leamer and Levinsohn (1995) provide the following two pieces of sobering advice:

1. Don’t take trade theory too seriously.

2. Don’t take trade theory too casually.

The Ricardian model, like all economic theory, is not meant to be taken literally. It is a simplified version of reality, meant to elucidate certain key points, not to describe it exhaustively. As such you should not take it too seriously. This also means that finding a piece of evidence against the Ricardian model is not necessarily useful; it is much more useful to establish how important comparative advantage is, rather than showing that it is not always exactly true.

However, this does not mean that one should ignore the Ricardian model, and trade theory in general. To make sense of the data, it is important to try and connect it to a good theoretical model. The theory provides predictions on what patterns to look for in the data, and how to interpret these patterns.

In particular Leamer and Levinsohn (1995) conclude, based on the economic literature up to that point that the empirical evidence validates the predictions of the Ricardian model that:

1. Except when labour inputs are equal across countries, there exist gains from trade.

2. A country exports the commodity in which it has a comparative labour cost advantage and imports the commodity in which it has a comparative disadvantage.

2.3 Overview of chapter

In this chapter, we have discussed the theory of comparative advantage and in particular how the Ricardian model relates to this. We have considered the advantages of this model and how it can be applied in terms of estimating comparative advantage from a country’s trade data.

This model is important within international trade and is therefore significant for the chapters that follow.

2.4 Reminder of learning outcomes

Having completed this chapter, and the Essential readings and activities, you should be able to:
explain the concept of comparative advantage and distinguish it from the idea of absolute advantage

explain how comparative advantage based on technological differences is the determinant of the pattern of trade and specialisation in the Ricardian model

explain how the gains from trade arise in this model

explain the relationship between relative international productivity and relative wages

manipulate the RD/RS diagram to illustrate different possible equilibria in the Ricardian model

explain how comparative advantage might be interpreted in a real world situation.

2.5 Test your knowledge and understanding

2.5.1 Sample examination questions

1. Hardware, $H$, and Software, $S$, are perfect substitutes. Consumers combine a unit of hardware with a unit of software to obtain a laptop, so that consumers have a Leontief utility function of the form

$$U(H, S) = \min\{H, S\}.$$ 

Hardware and Software are produced both in England and in Portugal using labour as the only production factor. England is endowed with 800 units of labour, while Portugal is endowed with 400 units of labour. Labour productivity is described in the following matrix:

<table>
<thead>
<tr>
<th></th>
<th>Hardware</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>1/10</td>
<td>1/30</td>
</tr>
<tr>
<td>Portugal</td>
<td>1/40</td>
<td>1/20</td>
</tr>
</tbody>
</table>

(Namely, one unit of labour in England produces one tenth of Hardware, etc.)

(a) Does either of the two countries have an absolute competitive advantage? Does England have a comparative advantage? In which sector? What about Portugal?

(b) How many laptops are produced in England under autarky? How many laptops are produced in Portugal under autarky? How many units of labour are employed in the production of Hardware in the two countries? What are the relative autarky prices?

(c) Suppose free trade is now allowed between England and Portugal. Is either of the two countries fully specialising? What is the number of Hardware and Software units produced in Portugal and in England? What is the free trade equilibrium relative price?

2. Show how the relative supply/relative demand (RS–RD) curve diagram may be used to illustrate international equilibrium in the Ricardian model. How would equilibrium change if the size of one of the countries doubled but labour productivity halved?
2.5.2 Guidance on answering Sample examination questions

1. (a) Neither country has an absolute competitive advantage, but England has a comparative advantage in making Hardware and Portugal has a comparative advantage in making Software.

(b) As consumers have a Leontief utility function, the quantity of Hardware produced in each country will be equal to the quantity of Software. For example, in England it will take 40 hours of labour to produce one laptop: 10 hours to produce a piece of hardware and 30 hours to produce a piece of Software.

So, Portugal will produce six laptops \((400 / (40 + 20)) = 6.67\), round down to the nearest integer).

England will use 200 hours of labour in the production of Hardware \((10/40 \times 800)\), Portugal 266.67 hours \((40/60 \times 400)\).

The relative price of Hardware is \(10/30 = 0.33\) in England and \(40/20 = 2\) in Portugal.

(c) A good answer would conduct an analysis similar to that provided in KOM Figure 3-3 ‘World Relative Supply and Demand’. From (a), we know that England will produce mainly Hardware, and Portugal mainly Software. In equilibrium the number of Hardware produced equals the number of Software produced: a total of 35 units of each.

Portugal will specialise completely in Software.

Portugal will produce 20 units of Software (and no Hardware), England will produce 35 pieces of Hardware and 15 pieces of Software.

As Portugal specialises completely, the relative price of Hardware is determined by the productivity in England: the relative price of Hardware will be 0.33 (see (b)).

2. See KOM and the subject guide (Figure 2.4 and surrounding text) for details on the RS–RD diagram.

2.5.3 Feedback to selected activities

Activity 2.2

(a) The Home production possibility frontier is given in Figure 2.6; it is a straight line that intercepts the \(Y\)-axis at \(1, 200/4 = 300\) and at the \(X\)-axis at \(1, 200/3 = 400\).

(b) The opportunity cost of wine in terms of cloth is \(4/3 = 1.33\). For each wine produced, 1.33 units of cloths could have been produced instead.

(c) Labour mobility between the two sectors ensures that wages are equal in both sector, and in efficient markets the price of each good reflects the marginal price, so the relative price of wine will be equal to the opportunity cost of wine, at 1.33 units of cloth per unit of wine.

(d) The Foreign production possibility frontier is given in Figure 2.7; it is a straight line that intercepts the \(Y\)-axis at \(900/5 = 180\) and at the \(X\)-axis at \(900/1 = 900\).
2. The Ricardian model of international trade

Figure 2.6: Home production possibility frontier

Figure 2.7: Foreign production possibility frontier
2.5. Test your knowledge and understanding

Relative price of wine ($P_w/P_c$)

Relative quantity of wine ($Q_{HW} + Q_{FW}$) / ($Q_{FC} + Q_{FC}$)

1

$\frac{4}{3}$

RD

RS

Figure 2.8: World relative supply and demand curve

(e) The World relative supply curve is constructed by determining the supply of wine relative to the supply of cloth at each relative price. The lowest relative price at which wine is produced is 1.33 units of cloth per unit of wine. The relative supply curve is flat at this price. The maximum number of wine supplied at the price of 1.33 is 300, supplied by Home. At this price, Foreign produces 900 units of cloth and no wine. This implies that the relative supply of wine is $\frac{300}{900} = \frac{1}{3}$. This relative supply holds for any price between 1.33 and 3 (the autarky price in Foreign). At the price of 3, both countries would produce only wine and no cloth and the relative supply of wine goes to infinity. Thus, the relative supply curve is step shaped, as seen in Figure 2.8.

(f) See Figure 2.8.

(g) The equilibrium price and supply can be found where the supply and demand intersect. In this case, the equilibrium price would be three units of cloth per unit of wine.

(h) At the equilibrium, Home produces only wine and exports some of it to Foreign, while importing some of the cloth from Foreign. (In particular, Home will export 150 units of wine and import 450 units of cloth).

(i) Home now consumes 150 units of wine and 450 units of cloth, a consumption bundle that lies well outside its autarky production possibility frontier. Likewise the consumption bundle of Foreign (150 wine, 450 cloth) also lies outside its autarky possibility frontier. Figure 2.9 compares the PPF before and after trade.

(j) See Figure 2.10 for the diagram. Note that the autarky price in Moon is 1 wine per cloth, and Moon can produce either 500 wine or 500 cloth (or a linear combination between the two). So, for a relative price less than 1, all three countries produce cloth (400 + 900 +
2. The Ricardian model of international trade

Figure 2.9: Home PPF, Autarky versus trade
2.5. Test your knowledge and understanding

Figure 2.10: World relative supply and demand curve with three countries

500), so the relative supply of wine is 0. For relative prices between 1 and 1.33, Moon produces wine (500) and Home and Foreign produce cloth (400 + 900), for a relative supply of wine of $\frac{500}{400 + 900} \approx 0.38$. When the relative price is between 1.33 and 5, Moon and Home produce wine (500 + 400) and Foreign produces cloth (900), for a relative supply of 1. Once the price rises above 5, the relative supply of wine goes to infinity as all three countries supply wine, but no cloth.

(k) The new equilibrium is reached at a relative price of $\frac{4}{3} = 1.33$ and a relative supply of $\frac{1}{1.33} = 0.75$. This implies that Moon fully specializes in wine (producing 500), Foreign fully specializes in cloth (producing 900 units) and Home produces both wine and cloth (238 wine and 83 cloth to be precise). In terms of trade this implies that Moon will export wine for cloth, Foreign will export cloth for wine. The trade patterns of Home are a bit more tricky, as it produces both goods, but as the relative demand in Home (and in the rest of the world) is 0.75, it also has an excess supply of wine and will, like Moon, trade wine for cloth.
2. The Ricardian model of international trade
Chapter 3
The Heckscher–Ohlin model

3.1 Introduction

The Heckscher–Ohlin (HO) model of international trade was originally developed by two Swedish economists Eli Heckscher and Bertil Ohlin in the early part of the twentieth century. Like the Ricardian model, it is a comparative advantage model of international trade where differences between countries are the basis for trade. Unlike the Ricardian model, where comparative advantage originates in differences in technology between countries, technology is assumed to be the same across countries in the HO model, with the emphasis instead placed on differences in factor endowments as the origin of comparative advantage.

The model is explicitly general equilibrium in character and this feature is emphasised through the linkages between factor prices and choice of inputs, and factor prices and product prices. Accordingly, the model provides a particularly rich account of the mechanisms by which trade influences the economy.

A notable insight of the model is that trade in goods can be regarded as a substitute for the international movement of factors (that is, trade in goods is indirectly trade in factors of production). This is seen most clearly in the factor price equalisation Theorem.

3.1.1 Aims of the chapter

At the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- describe the Heckscher–Ohlin model, its advantages and limitations and its applications to problems in international economics.

3.1.2 Learning outcomes

By the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- explain the shape of the production possibility frontier with two factors of production
- explain how differences in factor endowments can provide a basis for international trade
- explain why trade can have profound effects on income distribution
- explain the direction of income distribution effects, namely that trade benefits a country’s abundant factor and worsens the real income of the scarce factor
- explain the effect of changed factor endowments on sectoral outputs
3. The Heckscher–Ohlin model

- explain the limitations of the Heckscher-Ohlin (HO) model as an empirical hypothesis about the commodity composition of trade.

3.1.3 Essential reading

KOM, Chapter 5 ‘Resources and Trade: The Heckscher–Ohlin Model’.

There is an interactive webpage through which you can practise building and manipulating the Lerner diagram:
http://www-personal.umich.edu/~alandear/glossary/figs/Lerner/ld.html

3.1.4 Further reading

FT, Chapter 4 ‘Trade and Resources: The Heckscher–Ohlin Model’.

S(IT), Chapter 60.
http://internationalecon.com/Trade/Tch60/Tch60.php


3.1.5 References cited

No further references cited in the text.

3.1.6 Synopsis of chapter content

This chapter describes the Heckscher-Ohlin model of trade.

3.2 Chapter content

3.2.1 Assumptions

A limitation of the Ricardian model is that it assumes a single factor of production, usually taken to be labour or a dose of labour combined with other factors in fixed proportions. This is
firstly unrealistic and secondly, it does not permit the analysis of the impact of trade and trade policy on income distribution. In contrast, the HO model is what is known as a $2 \times 2 \times 2$ model. That is, it is characterised by the assumptions of two goods, two factors of production and two countries. Let us also assume that there are:

- two goods, say, food (F) and manufactures (M)
- two factors of production, labour (L) and capital (K)
- two countries, say, Home (H) and Foreign (F).

Further, assume that technologies are identical across countries but different across sectors. In particular, let manufactures be the relative capital intensive sector and food the relative labour intensive sector. That is, for all possible relative factor prices, the ratio of capital to labour employed in the production of manufactures exceeds the ratio of capital to labour employed in the food sector (see Figure 3.1). While the sectors use factors of production with different intensities, it is assumed, in contrast to the Ricardian model, that both countries have access to the same technology (that is, they have the same production functions in both sectors). This is to concentrate attention on differences in resource endowments as the potential origin of comparative advantage.

Figure 3.1 illustrates the relationship between relative price of labour to capital ($w/r$, where $w$ is the wage rate and $r$ is the rental price of capital) and the capital–labour ratio employed in each sector. As labour becomes more expensive relative to capital, Figure 3.1 shows the production process of both sectors becomes more capital intensive, but the capital–labour ratio in manufacturing is always higher than that in food production. In other words, we assume there are no factor intensity reversals.

The phenomenon in which relative factor-intensities change at different factor prices is known as factor-intensity reversal. Although in theory there can be many factor-intensity reversals it is debatable whether they are important empirically. The often convenient assumption of no factor-intensity reversal is sometimes known as the strong factor intensity condition.
Here we impose both the strong factor intensity condition as well as assuming that: perfect competition prevails in both goods and factor markets; and that production functions satisfy constant returns to scale. The assumption of constant returns to scale is crucial in deriving a number of results. The two countries are assumed to differ in their endowments of factors. In particular, assume Home is relatively more capital abundant than Foreign. Hence, \((K/L)^H > (K/L)^F\). Finally, consumers of the two countries are assumed to have identical preferences.

The assumptions of the HO model imply that countries are effectively identical in every respect except their endowment of factors of production. It is the interaction of different factor abundances across countries and different factor intensities across sectors that gives rise to a pattern of comparative advantage and thus a basis for international trade.

3.2.2 Tools and results for a closed economy

The procedure for understanding the workings of the model is similar to that employed in the Ricardian model. Firstly, we describe the characteristics of an economy that does not trade and then we consider what happens when two such economies trade with each other.

From goods prices to input choices

The key analytic concepts of the HO model concern the way in which resources (that is, labour and capital), are allocated between the two sectors, food and manufactures, as well as the backward linkage to factor prices and the forward linkage to product prices. The most important single tool of the HO model is the diagram expressing these linkages. In KOM it is Figure 5-7 ‘From Goods Prices to Input Choices’. A version of this diagram is reproduced as Figure 3.2. This figure is based on two assumptions of the model. These are:

- cost minimisation
- price equals average cost.

Thus in each sector producers are assumed to minimise costs. This means that at each factor price ratio \((w/r)\) they choose the factor input ratios \((K_i/L_i)\) which minimises costs. The assumption of constant returns to scale means that the cost-minimising input ratio is independent of the scale of production. For further details see KOM Chapter 5 as well as KOM Appendix to Chapter 5 ‘Factor Prices, Goods Prices, and Production Decisions’. To understand the mechanisms behind Figure 3.2 we examine the cost minimisation decision more carefully. Figure 3.2 illustrates unit-value isoquants for food and manufactures. These are isoquants, one for each sector, along which the value of output (revenue) is equal to 1. That is, \(P_M Q_M = 1\) holds along the \(M\) isoquant, which implies the quantity of manufactures associated with this isoquant is \(Q_M = 1/P_M\), the inverse of the price of manufactures. Similarly, \(P_F Q_F = 1\) holds along the \(F\) isoquant, which implies the quantity of food associated with this isoquant is \(Q_F = 1/P_F\), the inverse of the price of food. Notice the \(M\) isoquant is positioned towards the \(K\)-axis as it is relatively capital intensive, while \(F\) is positioned towards the \(L\)-axis as it is relatively labour intensive.

Firms will choose the factor input ratios \((K_i/L_i)_M\) and \((K_i/L_i)_F\) that minimises the cost of producing a given value of output. The assumption of perfect competition implies there are zero profits in equilibrium, so cost is equal to revenue in the production of each sector. Hence,
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Figure 3.2: Unit value isoquants

\[ P_M Q_M = 1 = wL_M + rK_M \] implies zero profit in the \( M \) sector and \( P_F Q_F = 1 = wL_F + rK_F \) implies zero profit in the \( F \) sector. Figure 3.3 depicts the Lerner diagram, which illustrates cost minimisation in both sectors. There is a unique isocost line \((wL + rK = 1)\) that is tangent to both isoquants. This determines the (unique) equilibrium factor price ratio \((w/r)\), which reflects the slope of the isocost line, at which both goods are produced with zero profits. The prices of the two goods determine the position of the isoquants and cost minimisation pins down the equilibrium factor price ratio and factor input ratios in the two sectors. The rays through the origin through points \( M \) and \( F \) in Figure 3.3 describe the equilibrium techniques of production for the two sectors. The area enclosed by these two rays is called the cone of diversification. If the endowment point of the economy lies within this cone, then there is incomplete specialisation (both goods are produced in positive amounts).

The Stolper–Samuelson (SS) Theorem

We can use the Lerner diagram to examine the implications of price changes on factor prices. This gives a diagrammatic demonstration of the Stolper–Samuelson (SS) Theorem, one of the most important results of the HO model. The Stolper–Samuelson Theorem states that if both goods continue to be produced (incomplete specialisation), an increase in the relative price of a good will increase the real return of the factor used intensively in the production of that good and a decrease in the real return to the other factor of production.

To demonstrate the SS Theorem of the HO model consider the implications of an increase in the price of manufactures from \( PM \) to \( PM' \), as illustrated in Figure 3.4. When the price of manufactures rises, the quantity of output needed to generate one unit of revenue falls, shifting in the \( M \)-sector unit-value isoquant inwards. Cost minimisation implies a lower equilibrium factor price ratio (that is, \( w/r \) falls) lowering the relative cost of labour to capital so both food and manufactures are produced using a less capital intensive technique of production than before the prices change (this corresponds with the shape of the curves in Figure 3.1). To find the effect of the price change on \( w \) and \( r \) independently, consider the intercepts of the isocost line on the \( L \)-axis and \( K \)-axis respectively. Recall that the equation for the isocost schedule is
3. The Heckscher–Ohlin model

\[ \frac{K}{L} \frac{1}{P_M} - \frac{1}{w/r} \]

\[ \text{Cone of Diversification} \]

\[ \frac{(K_M/L_M)}{(K_F/L_F)} \]

**Figure 3.3:** Lerner diagram: cost minimisation

\[ wL + rK = 1. \] Along the K-axis \( L = 0, \) so \( r = 1/K. \) The change in the intercept from \( y \) to \( x \) in Figure 3.4 therefore corresponds to a fall in K-intercept and hence a rise in \( r. \) Similarly, examination of the intercept along the L-axis yields a fall in \( w. \) Hence a rise in the price of manufactures has been shown to raise the nominal price of capital, the factor used intensively in manufacturing, and lowers the nominal price of labour, the factor used intensively in the food sector. To establish that the real wage falls and the real rental rate rises, thereby completing the proof of the SS Theorem, we need to consider prices. Since the price of food is unchanged, the real wage and real rental rate have obviously fallen and risen, respectively, in terms of food. Additionally, the price of manufactures has risen, so the real wage in terms of manufactures has unambiguously fallen. The conflict arises in the case of rental rates in terms of manufactures since \( r \) has risen but so has the price of manufactures. To resolve this we appeal to the magnification effect, which is that the change in \( r \) is more than proportional to the change in \( PM. \) This can be seen in Figure 3.4 since \( xy/0y > vz/0z, \) where the former reflects the proportional change in \( r \) and the latter the proportional change in \( PM. \)

**Goods prices, factor prices and factor intensity linkages**

We can combine the analysis of Figures 3.1–3.4 to construct Figure 3.5, which shows the way in which resources (that is, labour and capital), are allocated between the two sectors, food and manufactures, as well as the backward linkage to factor prices and the forward linkage to product prices. The factor intensity curves in the right-hand half of Figure 3.5 reflect the choice of cost-minimising technique. In both sectors as wages rise relative to rental rates, producers substitute capital for labour (that is \( (K_i/L_i) \) rises), but the capital-labour ratio of food is always lower than that of manufactures, reflecting the fact that food is the relatively labour-intensive sector.

In the left-hand half of Figure 3.5 the SS curve, which shows the relationship between goods prices and factor prices reflects the Stolper-Samuelson Theorem. Here, it is shown that the relative wage/land rent ratio rises when the relative food price (in terms of manufacturing) rises. The SS curve is drawn as a straight line in Figure 3.5. This need not be the case, and in
3.2. Chapter content

Figure 3.4: The Stolper–Samuelson Theorem

Figure 3.5: Goods prices, factor prices and factor intensity linkages
3. The Heckscher–Ohlin model

general it will be non-linear, as in KOM Figures 5-6 ‘Factor Prices and Goods Prices’ and 5-7 ‘From Goods Prices to Input Choices’.

As it stands, Figure 3.5 says nothing about the direction of causality between its components. The relationships illustrated are simply necessary consequences of the twin assumptions of cost minimisation and price equals average cost. However, if one of the elements is fixed, say the goods price ratio, then the mechanism of the SS curve and the sectoral factor-intensity curves determine the wage-rental ratio and the choice of technique in the two sectors. If, instead, we held fixed the relative factor price ratio, then the SS curve determines the relative goods price ratio consistent with the assumptions of the model. The intuition for this follows from the fact that food is always more labour-intensive than manufacture, and hence, as the cost of labour rises relative to the cost of capital the unit cost of the labour-intensive good (food) must rise relative to the land-intensive good (food).

**Activity 3.1** As an exercise in the use of Figure 3.1, assume that at low \(w/r\), food is relatively labour-intensive but that at high \(w/r\) this is reversed, and food is relatively capital-intensive. Redraw Figure 3.1 to reflect this and consider the implications for Figure 3.5. In particular, what does the SS curve look like? What happens to the above-mentioned linkage between goods prices and factor prices?

**Factor endowments and production possibilities**

A second important tool of the HO model is the Edgeworth Box diagram (or box-diagram) – see for example Figure 3.6. The box-diagram shows how a given endowment of resources, labour and capital, is allocated between sectors when the wage-rental ratio (and implicitly also the goods-price ratio) is given.

An interesting and famous result employing the box-diagram concerns what happens to resource allocation and sectoral outputs when the factor-endowment changes. Figure 3.7 illustrates the case where the supply of land (the factors of production are land and labour in this example, instead of labour and capital) is taken to increase. If goods prices (and hence factor prices also) are taken to be fixed, then Figure 3.7 shows that an increase in the endowment of land will lead to an increase in the output of the land-intensive good and a decrease in the output of the capital intensive good. More generally, it can be shown that if the endowment of a factor increases (or decreases) then at unchanged goods prices, the output of good which uses that factor intensively will increase (or decrease) and the output of the other good will decrease (or increase). This result is known as the Rybczynski Theorem.

The Lerner diagram can be used to construct the Edgeworth box. Consider Figure 3.8, where \(E\) denotes the endowment point of this country (within the cone of diversification). Employment of labour and capital in the two sectors must sum to the total endowment in the economy if there is to be full employment. The factor input ratios determined by cost minimisation (through points \(M\) and \(F\)) facilitate the construction of the employment vectors in the two sectors by ‘completing the parallelogram’ to \(E\). Vector \(OA\) (employment in the manufacturing sector) plus vector \(AE\) (employment in the food sector) must equal \(OE\), that is, must exhaust resource endowments in the economy. The employment vectors (from factor input ratios) can be transferred to the Edgeworth box, whose dimensions reflect the endowment of labour and capital in the economy, as illustrated in Figure 3.9. The Edgeworth box can be used to demonstrate the Rybczynski Theorem. Holding relative goods prices
3.2. Chapter content

Labour used in food production

Labour used in cloth production

Figure 3.6: The allocation of resources

Figure 3.7: An increase in the supply of land
3. The Heckscher–Ohlin model

Figure 3.8: The Lerner diagram revisited

Figure 3.9: From Lerner diagram to Edgeworth box
constant implies that relative factor prices and the factor input ratios are also fixed (from Figure 3.5). An increase in the endowment of, say, labour, expands the width of the box, as illustrated in Figure 3.10. With constant factor input ratios, it is straightforward to find the new allocation of labour and capital between the two sectors by extending employment vectors from the origin and the new endowment point $E'$. Comparing $A$ with $A'$ shows that there is more employment of both factors in the food sector, causing an expansion of the food sector, and less employment of both factors in the manufacturing sector, which causes the manufacturing sector to shrink. This demonstrates the Rybczynski Theorem. The box-diagram can also be used to derive a country’s production possibility curve. It is then possible to see that if the endowment of a factor grows, its production possibility curve will be shifted outward in a manner that is biased towards the good which uses the growing factor intensively. This is of interest in its own right but can also be used to compare production possibilities of different countries with different factor endowments. Thus a country which is overall relatively well-endowed with labour as compared with another country will possess a production possibility curve which is biased towards food, the labour-intensive good. This is illustrated in Figure 3.11 below, where two production possibility curves are depicted. As Home is capital-abundant relative to Foreign, its PPF is biased towards manufactures, while the Foreign PPF is biased towards cloth.

**Activity 3.2** Using Figure 3.11 show that at the same relative goods prices the labour-abundant country will produce a larger quantity of food relative to manufactures. Hence show that the labour-abundant country’s relative supply curve of food lies below the relative supply curve of the capital-abundant country (Hint: see the example in KOM with food and cloth and examine KOM Figures 5-8 ‘Resources and Production Possibilities’ and 5-9 ‘Trade Leads to a Convergence of Relative Prices’.)
3. The Heckscher–Ohlin model

3.2.3 Trade, income distribution and factor price equalisation

The pattern of trade

The impact of trade in the HO model may be analysed by first considering what prices would be in the two countries in the absence of trade (that is, pre-trade or autarky prices). For this we need to make some assumptions about demand conditions in the two countries. Usually it is assumed that demand conditions are ‘similar’ in the two countries but for easy exposition it is convenient to assume that they are identical. This may be represented in the KOM framework as identical relative demand curves and the same pattern of indifference curves in the PPF diagram.

It is then easy to see from Figure 3.12 below that the autarky relative price of manufactures will be low in the capital-abundant Home country while the relative price of food will be low in the labour-abundant Foreign country. Accordingly, the labour-abundant country will find it profitable to export food, while the capital-abundant country will find it advantageous to export manufactures.

Trade will tend to equalise goods prices in the two countries, thereby raising the price of food in the labour abundant country and raising the relative price of manufactures in the capital-abundant country. As a consequence, in the trading equilibrium, Home will be more specialised in manufactures than in autarky (production moves from $A$ to $B$ with trade); and similarly, Foreign will be more specialised in food than in autarky (production moves from $A'$ to $B'$ with trade). These arguments can be summarised thus: a country will tend to specialise and export those goods that intensively use the factor with which it is abundantly endowed. This proposition is sometimes known as the Heckscher-Ohlin Theorem and represents a core insight of the HO model, namely that when technology is internationally identical it is differences in relative resource endowments that are the origin of differences in relative costs and hence of comparative advantage.
Income distribution and factor price equalisation

Figure 3.13 below reproduces the SS curve from the left-hand segment of Figure 3.5. If Home and Foreign have access to the same technology then they will have the same SS-curve, but capital-abundant Home has a higher autarky relative wage and a higher relative price of food than Foreign.

Activity 3.3  Explain why identical technology for both goods in both countries implies that the SS-curve is the same in both countries.

Free trade in goods will equalise goods prices in the two countries at, say, \((P_F/P_M)^W\), which from Figure 3.13 we see must also equalise factor prices at \((w/r)^W\). This is a remarkable result and is known as the Factor Price Equalisation Theorem. It shows that trade in goods can act as a complete substitute for the international mobility of factors; that trade in goods represents an
implicit trade in factors of production.

**Activity 3.4** In the real world factor prices are clearly not internationally equalised. What are the empirical and the theoretical reasons why factor price equalisation might fail? (Hint: when considering theoretical reasons investigate what happens to the SS curve when the strong factor-intensity condition fails to hold.)

From Figure 3.13 you can also see that in the labour-abundant country, trade has the effect of raising the wage-rental rate ratio, and in the capital-abundant country trade has the effect of lowering the wage-rental rate ratio. This links back to the Stolper-Samuelson Theorem discussed earlier in the chapter.

### 3.2.4 Empirical evidence

The hypothesis of the Heckscher–Ohlin Theorem that countries tend to export goods that use their abundant factors intensively, has been one of the most tested hypotheses in the whole of economics. In the most famous result, Leontief (1953) found that US exports appeared to be more labour-intensive than US imports. This result appeared to contradict the intuition that the US was a capital-abundant country relative to the rest of the world; a finding that quickly became known as the **Leontief paradox**. Subsequently, the Leontief tests and other variants have been widely repeated and a number of explanations have been put forward to explain the finding. Studies that looked at an international sample found results broadly similar to Leontief (1953). Furthermore, Trefler (1995) shows that the actual volume of trade between countries is considerably less than that predicted by the HO Theorem. Thus relative factor endowments represent a weak or partial explanation of the observed commodity composition of international trade.

One key explanation in the literature for the Leontief paradox lies in the assumption by the HO Theorem that production technologies are the same across countries. This is clearly not true empirically: the US, and western countries in general, have much higher levels of production technology than developing economies. This is reflected in the fact that the US exports are made with much more skilled labour than its imports.

All this does not mean that the HO Theorem is useless. For instance, the HO Theorem correctly predicts the pattern of trade between the industrialised and developing countries, with developing countries trading their mainly labour-intensive products against capital-intensive products from industrialised countries.

**Activity 3.5** Consider KOM Figure 5-13 ‘Changing Patterns of Comparative Advantage’. How can you explain the shift in US imports from Japan and the four miracles between 1960 and 1998? How does this shift fit with the predictions made by the HO model?

### 3.3 Overview of chapter

In this chapter, we have discussed the Heckscher-Ohlin model, including its limitations. This model is important and significant for the chapters that follow.
3.4 Reminder of learning outcomes

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

- explain the shape of the production possibility frontier with two factors of production
- explain how differences in factor endowments can provide a basis for international trade
- explain why trade can have profound effects on income distribution
- explain the direction of income distribution effects, namely that trade benefits a country’s abundant factor and worsens the real income of the scarce factor
- explain the effect of changed factor endowments on sectoral outputs
- explain the limitations of the Heckscher-Ohlin (HO) model as an empirical hypothesis about the commodity composition of trade.

3.5 Test your knowledge and understanding

3.5.1 Sample examination questions

1. Consider a standard Hecksher–Ohlin world, with the following endowment of production factors.

<table>
<thead>
<tr>
<th></th>
<th>Home</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>45</td>
<td>20</td>
</tr>
<tr>
<td>Capital</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

There are two goods: Computers, which are capital intensive, and T-shirts, which are labour intensive.

(a) Based on the table above, explain what are the expected patterns of trade in this world.

(b) Based on your answer above, explain who, in this example, stands to gain from free trade and who stands to lose.

(c) Assume for a moment that the relative price of computers is fixed at say (Pc/Pt) and there is a sudden increase in the available Labour in Home. Explain what will happen to the production possibility frontier and Home’s production of Computers and T-shirts.

2. Suppose the world is made of two countries: Home and Foreign. Home is a small labour-abundant country, while Foreign is capital-abundant. Both Home and Foreign produce two goods: food and cloth. Food production is labour-intensive and cloth production is capital-intensive. What is the effect of the introduction of an export subsidy in the Home country on the return to each factor of production in the Home country?
3. The Heckscher–Ohlin model

3.5.2 Guidance on answering Sample examination questions

1. Approaching the question
   (a) Note that Home is more labour abundant than Foreign. Therefore we expect labour to export T-shirts (labour intensive) to Foreign and import Computers from Foreign.
   
   (b) In an HO world, factor prices will equalise due to free trade. Thus owners of the abundant factor gain from trade, owners of the scarce factor lose. In this case that means that Home workers and Foreign capitalists benefit from trade, and Home Capitalists and Foreign workers will lose from trade.
   
   (c) The PPI will shift outwards; Home will shift production towards the factor that has increased, leading to an increase in the production of T-shirts, and a decrease in the production of Computers. See also KOM Figure 5-8 ‘Resources and Production Possibilities’ and the discussion about biased expansion of production possibilities.

2. Let Good 1 be relatively labour intensive and Good 2 be relatively capital intensive. The Heckscher-Ohlin Theorem states that a country will export the good that uses relatively intensively its relatively abundant factor of production. Since H is assumed to be labour abundant it will export the labour-intensive good (Good 1) and import the relatively capital-intensive good (Good 2). World prices are fixed at \((P_1/P_2)\). Calling \(t\) the subsidy, \(P_1^d\) and \(P_2^d\) the domestic prices of Good 1 and 2 in country H gives:

\[
P_2^d = (1 - t)P_2^w \quad (3.1)
\]

\[
P_1^d = P_1^w \quad (3.2)
\]

Divide equation 3.2 by equation 3.1 to get:

\[
\left(\frac{P_1}{P_2}\right)^d = \frac{P_1^w}{(1 - t)P_2^w} > \left(\frac{P_1}{P_2}\right)^w \quad (3.3)
\]

Hence an import subsidy increases the relative domestic price of Good 1. The Stolper-Samuelson Theorem states that an increase in the price of a good will result in an increase in the price of the factor used intensively in its production, in relative, nominal and real terms, and a decrease in the price of the other factor, assuming both goods continue to be produced. Furthermore, the increase in the price of the factor used relatively intensively will be more than proportional to the original increase in the price of the good (magnification effect). Thus an import subsidy, which increases the domestic relative price of the exported labour-intensive Good 1, will increase the relative, nominal and real wage and will decrease the relative, nominal and real rental rate.
Chapter 4
The specific factors model

4.1 Introduction

In contrast to the Ricardian and Heckscher–Ohlin (HO) models, the specific factors model assumes that some factors are not all fully mobile between sectors. One factor of production, say labour, is assumed to be mobile, while other factors of production are assumed specific to a sector because it is embodied in, say, a form of equipment, such as a machine; the specific factors have no use in other sectors and are thus not mobile. However, in the long-run, as the equipment is amortised, the capital it embodies can be switched to other sectors. Once specific factors are considered, analysis of the short-term effects of trade and endowment changes is made possible.

The model also takes into account diminishing returns to a factor. This then gives rise to the familiar production possibility set/frontier with the usual curved shape, reflecting a diminishing marginal rate of transformation, such as in the HO model and in contrast to the constant marginal rate of transformation assumed by the Ricardian model of Chapter 2 of the subject guide.

4.1.1 Aims of the chapter

At the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- discuss the specific factors model and how it relates to the Ricardian and the HO model.

4.1.2 Learning outcomes

By the end of this chapter, and having completed the Essential readings and activities, you should be able to:

- explain the mobile factor market diagram
- use the mobile factor market diagram to illustrate the effects of trade on labour allocation, outputs and on income distribution
- use the mobile factor market diagram to illustrate the effects of simple trade policy instruments on labour allocation, outputs and on income distribution
- contrast the effects of trade liberalisation on factor incomes in the Heckscher–Ohlin and specific factors model
- define and explain the distributional effects of international migration.
4. The specific factors model

4.1.3 Essential reading

KOM, Chapter 4 ‘Specific Factors and Income Distribution’.

4.1.4 Further reading

FT, Chapter 3 ‘Gains and Losses from Trade in the Specific-Factors Model’.

S(IF), Chapter 70-20 to 70-30: http://internationalecon.com/Trade/Tch70/Tch70.php


4.1.5 References cited

No further references cited in the text.

4.1.6 Synopsis of chapter content

This chapter discusses the specific factors model to trade.

4.2 Chapter content

4.2.1 Assumptions

The model assumes two goods and three factors of production. One factor of production is assumed to be fully mobile between the two goods sectors. The other two factors are each regarded as ‘specific’ to each of the two goods sectors and can only be employed in that sector. There are fixed endowments of each factor.

One can interpret the model in several ways. The most common interpretation is that the mobile factor is homogeneous labour and the specific factors are capital and land; or two different types of capital (two different machines, each specific to a sector). Suppose the labour market is assumed to be competitive and hence wages in the two sectors are equalised. Thus if the two goods are ‘food’ and ‘manufacturing’ then ‘capital’ might be the factor specific to manufacturing and ‘land’ might be the factor specific to food. By definition, a specific factor is immobile between sectors. Thus, in the example above, capital cannot be employed in the food sector and land cannot be employed in the manufacturing sector.

An alternative interpretation is to assume capital, $K$, is the mobile factor of production used in both sectors and the two specific factors are skilled labour, $L^S$, and unskilled labour, $L^U$. 

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Suppose the two sectors are ‘textiles’, $T$, and ‘software’, $S$. Textiles are manufactured using capital and unskilled labour and software is developed using capital and skilled labour. With a competitive capital market, the rental rate equalises between the two sectors. Skilled workers receive the skilled wage, $w_S$, while unskilled workers receive the unskilled wage, $w_U$. For the rest of the chapter we will consider this case. It is of particular interest as it can shed light on how international trade can affect the wage gap between skilled and unskilled workers in the short-run. In the long-run, workers can train to become skilled workers, so they can become mobile between sectors, as is assumed in the HO model. Contrasting the results of the specific factors model and the HO model sheds light on the short- and long-run effects of trade on factor prices, and can inform the debate on the phenomenon of rising wage inequality experienced in the US and other countries.

4.2.2 Tools and results

Under the assumptions of the model, production in each sector can be represented as depending on the amount of the variable, mobile factor capital. Given a fixed amount of the specific factor, this implies diminishing returns to capital. As already noted, this implies a standard textbook concave production possibility curve.

However, the most important theoretical construct or tool of the specific factors model is the mobile factor market diagram, which shows how capital is allocated between sectors for given technology and international prices (note that when labour is assumed to be the mobile factor, the diagram reflects labour market equilibrium and shows wage equalisation). This is given in Figure 4.1 below. The two curves in the diagram represent the marginal revenue product of capital in the textile sector ($P_T \times MPK_T$) and in the software sector ($P_S \times MPK_S$). These curves also represent the demand curves for capital in each sector. The total (fixed) supply of capital in the economy is represented by the length of the horizontal axis in Figure 4.1. Capital market equilibrium occurs when the rental rate, $r$, equates supply and demand for capital and this is represented by the point of intersection of the two marginal revenue product curves. The equilibrium rental rate is $r^*$, the amount of capital allocated to the textile sector is $K_T$ and the amount of capital allocated to software is $K_S$.

4.2.3 Effects of trade

Figure 4.1 can be thought of as representing, in the first instance, a closed economy or autarky equilibrium. Suppose trade is now possible. Trade will take place provided world prices are different from autarky prices and the country will export the good which is expensive abroad (cheap at home) and import the other good (expensive at home but cheap abroad). In a trading equilibrium, world prices replace autarky prices; in other words the relative price of the export good will tend to rise and the relative price of the import good will tend to fall, as compared with the autarky equilibrium.

Figure 4.2 analyses the effects of a rise in the price of software. This exercise can be interpreted as analysing the effects of a rise in the relative price of software, with the price of textiles held constant (numeraire, or unit of account). If software happens to be the export good, then this exercise can also be interpreted as analysing the effects of trade, where the opening up of trade leads to a rise in the price of the export good relative to the price of the import good. This could reflect the US, for example, trading with China. With relatively more skilled to unskilled workers, the US has a comparative advantage in software development.
4. The specific factors model

Relative to China, whose relatively large number of unskilled workers gives a comparative advantage in textile production. When the two open to trade, the US exports software and imports textiles from China.

Figure 4.2 shows that a rise in the price of software increases the marginal revenue product of capital in the software sector, and thus shifts the demand for capital in the software sector rightwards. Equilibrium in the capital market moves from A to B. This leads to a reallocation of capital from textiles to software and, with fixed amounts of specific factors, implies an increase in the output of software and a decrease in the output of textiles. The increase in the supply of the mobile factor in one sector raises the marginal product of the specific factor in that sector; here, the increase in capital in the software sector makes skilled workers better off; the decrease in capital in the textiles sector makes unskilled workers worse off.

The nominal rental rate increases as a result of a higher price of software, but what about the real rental rate of capital? As the price of textiles is constant, the real rental rate rises with respect to textile price \( r/P_T \). In contrast, the real rental rate falls with respect to the price of software, \( r/P_S \), which itself has risen. This can be seen in Figure 4.2, where the proportional change in the price of software, reflected by \( (y_B/z_B) \), is less than the proportional change in the rental rate, reflected by \( (x_B/z_B) \). The effect on the real rental rate on capital is thus ambiguous because the real rental rate falls in terms of the export good but rises in terms of the import good. Hence the effect on real rental rates depends on the consumption pattern of capitalists.

Rising wage inequality

Figure 4.2 shows that if a country trades and exports the good in which skilled labour is the specific factor, then the return to skilled labour rises and unskilled labour falls in the short-run (the long run effects are reflected by the Stolper–Samuelson Theorem of the HO as described in Chapter 3 of the subject guide). The implication is that trade expands the wage gap between skilled and unskilled labour. This is of interest because it offers a possible explanation for the
widening income gap between skilled and unskilled workers experienced by the United States during the 1980s. However, empirical evidence points to skill-biased technological change as the primary factor behind the increase in US wage inequality over the past thirty years and trade as a secondary rather than a primary factor.

**Activity 4.1**

1. In Figure 4.2 the opening up of trade has been depicted in terms of a rise in the price of software (the export good), while keeping the price of textiles constant (numeraire). Since free trade will raise the relative price of the export good to the import good, we could instead keep the price of software fixed and lower the price of textiles (the import good). Use the capital market clearing diagram to show that a fall in the price of textiles has the same effects on capital allocation, outputs, and income distribution as a rise in the price of software.

2. Compare and contrast the income distribution effects of trade in the specific factors and HO models.

**4.2.4 The pattern of trade**

The specific factors model does not offer any very sharp predictions about the pattern of trade. However, loosely speaking, comparative advantage depends on either relative endowments of factors or on differences in technology. Thus the specific factors model can be interpreted as a hybrid of the Ricardian model (differences in technology) and the Heckscher-Ohlin model (differences in factor endowments). Since explaining the pattern of trade is not the major aim of the specific factors model, it has not attracted empirical testing.
Activity 4.2

1. Undertake a variety of exercises involving manipulation of Figure 4.1 in response to different parameter changes. In particular:
   (a) the effects of changes in factor endowments on capital allocation, on outputs and on income distribution
   (b) the effects of an import tariff on capital allocation, outputs and income distribution
   (c) the effects of an export tax on capital allocation, outputs and income distribution
   (d) a comparison of the effects of an import tariff and an export tax.

2. Identify two real-world examples where you believe the specific factors model provides insights.

4.3 Overview of chapter

This chapter has discussed the specific factors trade model and how it relates to the Ricardian and HO model.

4.4 Reminder of learning outcomes

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

- explain the mobile factor market diagram
- use the mobile factor market diagram to illustrate the effects of trade on labour allocation, outputs and on income distribution
- use the mobile factor market diagram to illustrate the effects of simple trade policy instruments on labour allocation, outputs and on income distribution
- contrast the effects of trade liberalisation on factor incomes in the Heckscher-Ohlin and specific factors model
- define and explain the distributional effects of international migration.

4.5 Test your knowledge and understanding

4.5.1 Sample examination questions

1. Consider the case of Thailand, a small open economy that faces constant goods prices. Assume that there are two sectors, manufacturing and farming. There are three productive factors. Labour is employed in both sectors and is freely mobile between
4.5. Test your knowledge and understanding

Figure 4.3: The effect of a flood

them. Capital is used only in manufacturing and land only in farming. After the recent floods a relevant part of arable land has been destroyed: discuss the effect on wages and the incomes of capital and land owners.

2. Compare and contrast the Ricardian and specific factors models.

4.5.2 Guidance on answering Sample examination questions

1. In a small open economy factor prices and labour allocation are determined as follows:
   - In each sector $i \in \{m, f\}$, labour is demanded up to the point where the value marginal product of labour equals the wage rate:
     \[
     VMPL_i \equiv MPL_i = \frac{\partial F_p(K, L_i)}{\partial L_i} = w.
     \]
   - Labour is mobile so the wage must be the same in both sectors:
     \[
     pMPL_m = w = pMLP_f.
     \]
   - Labour is fully employed: $L_m + L_f = L$.

Graphically, the equilibrium is at point $E$ in Figure 4.3 below where for each sector:
   - the area under the $VMPL$ schedule is the value of total output
   - the return to the specific factor is the value of total output minus the wage bill.

Because of the floods the land endowment of the economy decreases. The fall in $T$ decreases the marginal product of labour in the farming sector. The new equilibrium wage is lower and labour moves to the manufacturing sector. Under the small open economy assumption, the price of both sectors remains constant. Given that labour moves
4. The specific factors model

to manufacturing, the marginal product of capital increases (hence \( r \) rises); thus, the income of capital owners

\[ r \times K = p_m \times MPK_m \times K \]

increases. As labour in farming decreases, the value marginal product of land, \( v \), goes down, but the reduction in land has a positive effect on \( v \) so that the overall effect on the value marginal product of land is ambiguous. However, under reasonable assumptions, given that \( T \) diminishes the overall effect on the income of landowners \((v \times T)\) is negative.

2. Comparing different models is the sort of question that Examiners often ask. Models may be compared in terms of any or all of the following:

- assumptions
- purposes
- results.

A list of assumptions is usually not interesting, but here we have a question where it is relevant, at least insofar as the assumptions of the two models are different. So you should spell out the differences.

The purposes of the two models are different. The Ricardian model focuses on determinants of the pattern of trade while the specific factors model focuses on how trade affects income distribution.

Differences in assumptions and purposes lead to differences in the kind of results which the models generate and these should be outlined.

Finally, note that you could also be asked, for instance, to compare the model with the Heckscher-Ohlin model covered in Chapter 3 of the subject guide.