

Production possibilities and opportunity cost

Chapter summary

In the previous chapter, it was seen that the problem of scarcity leads to choices that must be made. In turn, these choices lead to three fundamental economic questions that must be addressed by all societies – *what*, *how* and *for whom* to produce. Since resources are limited, society has to allocate these resources in order to maximise production. The decision to allocate resources to maximise production introduces two other key building blocks in the economic way of thinking – *opportunity cost* and *marginal analysis*. These two concepts can be illustrated using the production possibilities frontier. The *production possibilities frontier* is a simplistic visual diagram, illustrating the combinations of two outputs that an economy can produce, given its available resources and technology. The *production possibilities frontier* further explains other economic concepts like the law of increasing opportunity costs, economic growth, efficiency and investment.

Finally, this chapter briefly introduces the gains from trade based on the theory of *comparative advantage*, which uses the production possibilities frontier.

Key concepts

- What, How and For whom questions
- Opportunity costs
- Marginal analysis
- Production possibilities frontier
- Technology
- Law of increasing opportunity costs
- Economic growth
- Investment

Instructional objectives

After completing this chapter, students should be able to:

- understand the fundamental economic questions – what, how and for whom to produce
- understand what is meant by an opportunity cost and give some examples
- explain why an opportunity cost is an implicit cost incurred in making all decisions
- explain why marginal analysis can give rise to more rational decisions
- graphically express a production possibilities frontier model
- understand that the production possibilities frontier illustrates the problem of scarcity. Hence, choices have to be made. When choices are made an opportunity cost is incurred.
- illustrate production efficiency and inefficiency in the context of the production possibilities frontier
- calculate opportunity cost, using the production possibilities frontier
- describe what the law of increasing opportunity cost means and why it exists
- explain what is meant by investment
- explain why a nation's decision to invest and produce more capital goods now will increase the nation's rate of economic growth over time
- illustrate and explain economic growth in the context of a production possibilities model.

Chapter 2 outline

Introduction

The three fundamental economic questions

What to produce?

How to produce?

For whom to produce?

Opportunity cost

You're the economist: Are consumers and governments always conscious of opportunity cost?

Marginal analysis

The production possibilities frontier

Exhibit 2.1: The production possibilities frontier for consumer goods and consumer services

The law of increasing opportunity costs

Exhibit 2.2: The law of increasing opportunity costs

Shifting the production possibilities frontier

Exhibit 2.3: An outward shift of the production possibilities frontier for restaurant meals and television documentaries

Changes in resources

You're the economist: Does the ageing of the workforce shift the PPF?

Technological change

Economics and ethics

Present investment and future production possibilities frontier

Exhibit 2.4: Splurgeland's and Thriftyland's present and future production possibilities frontiers

Analyse the issue: Population growth, sustainability and the PPF

Gains from trade

Comparative advantage

Global perspective: How would abolition of child labour affect the PPFs of developing countries?

Key concepts

Summary

Study questions and problems

Answers to 'You're the economist'

Multiple-choice questions

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Hints for effective teaching

- 1 It is essential to elaborate on the three fundamental economic questions (*how*, *what* and *for whom* to produce). Ask students to think about how a government could answer such questions, how they would if they were in charge. It is one thing to work out priorities (health is important, education is important, and so on); it is another matter to work out how much to allocate to health, how many hospitals, machinery, doctors etc. This is not simple. You could compare the difference between a capitalist system and a command system in

terms of the economic questions. In a capitalist system consumer demand (sovereignty) predominately determines what gets produced. The question of *how* is predominately answered by businesses, who determine the resources used in the production process subject to their desire to limit their costs and maximise their profits. *For whom* goods and services are produced is largely determined by the distribution of income. If you have more money, you get more goods and services. What about the command system? How does it determine *how*, *what* and *for whom* to produce?

- 2 Because opportunity cost is such a fundamental economic concept, you should make sure that students understand what it is through the use of examples. Ask them what their opportunity cost is for being in class today. Remind them that opportunity cost is the next best alternative: so even though there could be dozens of things they could have been doing, for each student the opportunity cost is the next best thing she or he could have done. That is, given the fundamental problem of scarcity and the need to make choices, each choice represents not only the chosen item but also the one that was not chosen: yes, you got the CD when you chose to buy it, but you went without the book that you were considering purchasing instead, ahead of anything else you might have wanted to buy.
- 3 Point out that opportunity costs are associated with every decision. They imply a ranking is made, in recognition that 'we can't have everything', so we need to organise what we can have, in terms of what we most want. This, in turn, recognises that 'there is no such thing as a free lunch'.
- 4 The examples discussed need to clarify that because opportunity cost is the next best alternative gone without, it is not necessarily a monetary cost. Time is a good example for this: if you choose to sleep longer when the next most pressing (preferred) thing to do was to finish some tutorial exercises (rather than go out for breakfast or go running or ...) then the opportunity cost of sleeping in is the tutorial exercises not done.
- 5 You may wish to elaborate on marginal analysis, which is at the heart of *rational* decision-making. This is not about the 'overall' situation. It is not about whether to study or not, it is about whether to study for one more hour. The key question is 'is it worth it?' since an alternative would be going to bed and benefitting from more sleep. The answer will come from the person's own assessment that there will be more benefit from the extra hour of study than the extra hour of sleeping. Point out, however, that the benefits and costs of a decision are not always clear. You don't always know what they are going to be. Moreover, they may not be easily measured or quantified. Instead, they will often have to be subjectively estimated. Therefore, what may appear as rational to one person may not appear as rational to someone else because of the different subjective estimates of benefits and costs.

After discussing a consumption decision, you may want to drive the point home by pointing out that reasonable people can disagree over whether government involvement in a particular situation is 'worth it' or not, because of their differing subjective measures of the benefits and costs associated with that government involvement.

- 6 Remind students that the PPF is a model that can show where a nation can be in terms of the resources it has, assuming just two outputs. This may seem too simplistic, but remind them that this is about the model being simple. It can demonstrate a situation where all the resources are being used (and it is not possible to produce more of one output without having less of the other). The goal for any nation, then, is to attempt to produce on its production possibilities frontier to maximise production given their limited resources. To do so requires employing all their resources. This is why *full employment is a universal national economic (macroeconomic) goal*. Because full employment is *illustrated as a point on the frontier*, all nations attempt to be on their production possibilities frontier. Note that this is not saying any one point on the PPF is necessarily better than another (more on that later) as any point on the PPF is using all the resources.

If some unemployment and/or underemployment are experienced, then it is illustrated as a combination of output shown by a point inside the curve. Make sure students can see why such a point is inefficient: it is possible to attain more output of one without less of the other.

A point outside the curve is *currently* unattainable, but may be attainable through the discovery of new resources, and /or technological improvement. That is, point out that given the assumptions, any point outside is unattainable, but at another time, if changes have taken place with resources or technology, then more can be produced.

Make sure that the students know how to draw the PPF and explain what the points mean.

- 7 Note also that the model can be useful for other purposes; it doesn't have to be just about nations. A consultancy firm, Montana International Safety Consultancy, gives an example of how they use the PPF in their analysis of processes and procedures. As noted on their website <http://misconsultancys.com/Construction%20Safety%20Services.html>, 'MISC gap analysis is defined as a business resource assessment tools. Its main function is enabling companies to compare their potential performance with their actual performance. When MISC Consultants conducts a gap analysis, the reasons that are responsible for your poor performances / productions are identified. Thus, the identification of areas with a lack of control or that are of substandard performance takes place. **The areas that are below a company's production possibilities frontier are clearly highlighted.**'
- 8 Students can have difficulties understanding the law of increasing opportunity costs. Start with the textbook example of an economy producing motor cars or university degrees. According to what we know about opportunity cost, this means that the next best alternative to motor cars for this economy is university degrees, and motor cars are the next best alternative to university degrees. Using the model, the overall opportunity cost, so to speak, is obvious – if the economy chooses the point where only cars are produced, the opportunity cost is the degrees foregone. From here, though, it can be seen that to choose some of the next best alternative means less of the best. Do the sums with them, using the diagram or the schedule so that they can see, both ways, that the costs are increasing. Then explain why the costs are increasing. Are the resources going to be equally suited for producing either product; e.g. how can degrees be produced with car manufacturing resources?
- 9 The model can be seen to be more realistic for an economy if it is considered that there are only two general types of products that can be produced – *consumer* and *capital* products. Consumer products satisfy our wants directly and in the present. Capital products satisfy our wants indirectly and in the future. It may appear tempting to produce a lot of consumer products now because this will satisfy us more now. However, the opportunity cost is less of the capital goods production that is necessary for future growth. (Explain that investment in capital goods will increase future production possibilities because workers are more productive the more plant and equipment they have to work with. Emphasise that greater growth is illustrated as a rightward/upward shift of the production possibilities curve). Therefore, if more consumer goods are produced now, it will be at the expense of not so many being produced later on. In essence, *our present location on the production possibilities curve will determine the future location of the curve.*

Moreover, emphasise that *economic growth is another one of the three major macroeconomic goals*. It is a major macroeconomic goal because it increases the size of the 'economic pie.' Assuming no change in the distribution of income, growth ensures that everyone gets 'a bigger piece of the pie.' Otherwise stated, *economic growth is desired because it increases the nation's average absolute standard of living*. But, higher standards of living require the sacrifice of current consumption in order to free up resources to be devoted to the production of capital products. *We need less consumption and more investment for greater growth and higher standards of living.*

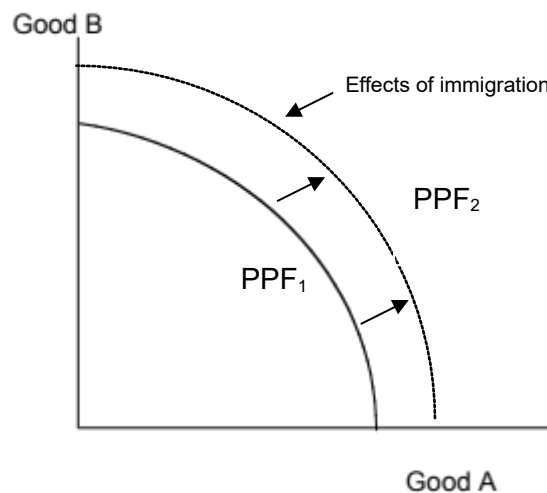
- 10 Some instructors might prefer to teach comparative advantage along with the concepts in this chapter. In such an instance, these instructors should cover Chapter 18, Section 2, which covers this topic. However, as the text is devised to teach economics at the elementary level, it is preferred that comparative advantage is taught under a separate module, such as 'International trade'.

Solutions to text problems

Analyse the issue

Population growth, sustainability and the PPF (pp. 44–5)

- 1 The diagram below shows an economy without immigration, at PPF_1 .



- 2 A significant immigration program can increase the labour force, which shifts the PPF outwards to PPF_2 (see the diagram above) as labour migrants bring with them financial, as well as human, capital.
- 3 New labour is not the only resource that shifts the PPF outwards when immigration is increased. Immigrants bring other resources, including financial capital and increased labour skills. These labour skills may promote technological change, which leads to more efficient use of equipment, which in turn increases the production level; thus shifting the PPF outwards. For the natural environment, though, there will be challenges in accommodating the extra people. Larger populations need more accommodation, transport, utilities and other services, which means more demands on land, water, oil etc. and will result in fewer open spaces, destruction of ecosystems and perhaps a drop in living standards. These effects were discussed by a colloquium on two reports commissioned by the Federal government into on the long-term effects of net overseas migration, though the authors noted this is a complex issue. The following publication provides a summary of the reports:
<http://www.border.gov.au/ReportsandPublications/Documents/research/colloquium-economic-physical-impacts-migration.pdf>
- 4 Yes, immigration affects the PPF of countries from which the people are emigrating. Loss of these resources will result in the PPF shifting inwards. War and political instability have similar impacts. The effect on the natural environment, though, could be positive to the extent that the pressures described in 3 above would be lessened.
- 5 In the short term, if a lot of parents left the labour force to look after their children, it could be argued that the PPF might shift inwards. However, in the long term, if a period of paid parental leave gives parents the opportunity to spend time with their children when they are younger, they may be more likely to enter the workforce full time when their children enter school. Parents would be able to take the parental leave when they need it, while retaining their full time employment, rather than having to take casual or part time jobs to accommodate the demands of raising children and working, or leaving the workforce

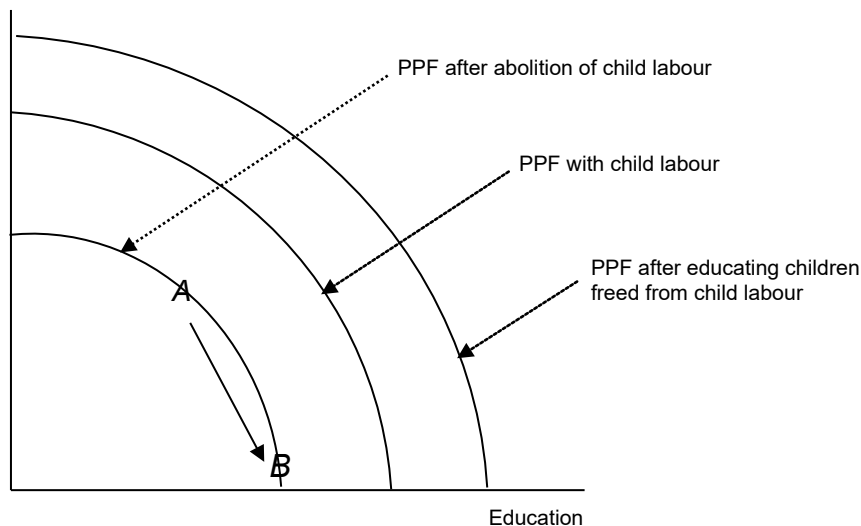
altogether (as high costs of childcare mean it is not feasible to work part time and have children in childcare). As an example, the Scandinavian countries have some of the most generous paid parental leave policies in the world, and they also have some of the highest rates of female workforce participation. In addition, if workers have access to paid parental leave, they may feel secure enough to have more children, which (in the long term) will increase the country's population growth rate and shift the future PPF outwards.

Global perspective

How would abolition of child labour affect the PPFs of developing countries? (p. 47)

The figure below shows the PPF, representing a developing country's goal of producing both consumer goods and education. If the use of child labour (where it is assumed that such labour makes a significant contribution to total output in the economy) were discontinued, the PPF will shift inward. Furthermore, the figure shows a movement from A to B on the new PPF as a result of a desire on the part of the community to increase educational outputs in order to educate the children released from child labour. The eventual effect of this increase in the overall educational standing of the community will be a rightward shift of the PPF shown in the Figure. Note that the new PPF is larger than the PPF that existed before child labour was abolished. This provides an illustration of how beneficial the abolition of child labour could be, at least in the long-term.

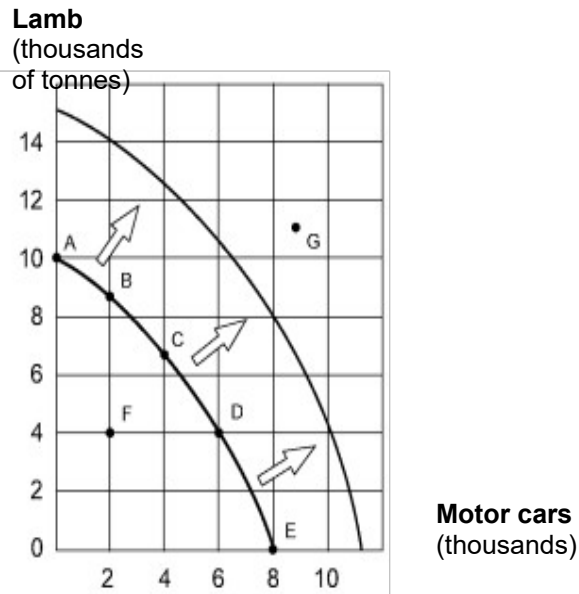
Consumer goods



Study questions and problems: Solutions

(pp. 49–50)

- 1 Scarcity implies limited resources, which means that individuals, businesses and governments can only do so much, or produce a certain amount of some product. People cannot have everything they want. Hence, if individuals, businesses or governments want more of something, due to limited resources, they will have to forego something else.
Examples: individuals – limited time (to study more of economics or accounting); businesses – limited funds (to spend on labour or equipment); governments – limited resources (to allocate to education or defence).
- 2 The answer to For whom in contemporary economies depends on levels of income, wealth, education, health and work ethic. The nature of these factors would be very different in rich countries like Sweden as compared with poor countries like Ethiopia. A prosperous country can rely on its consumers mostly being able to pay for the country's products. There may be a benefit system to look after those who have little or no income, probably financed by contributions from high-income earners. A poor country, though, with limited output and with the majority of the population on very low incomes will have severe distribution problems.
- 3 These changes have come about because the increase in population has increased the demand for these resources [e.g. city space (land), water] during the last few decades. The resources available, however, are limited (scarce). In other words, these resources have not grown to keep pace with the increasing population and its needs. Hence, the use of these resources has been restricted or controlled. The instruments used to restrict the use of these resources include user fees, permit systems or direct restrictions imposed on their use.
- 4 This would have reduced the production frontier, as it represents a decline in the availability of a factor of production (labour). However, the social changes that decreased the participation of children in the workforce brought other changes to the labour market. Rather than working as unskilled labourers from an early age, children now stay at school longer and thus have higher levels of education when they do enter the workforce (greater human capital). In addition, women now participate in the workforce in greater numbers. The increasing participation of women in the workforce has shifted Australia's production possibilities frontier (PPF) outwards. The increased participation means a larger labour force, which means more resources available for increased outputs.
- 5 With greater levels of migration, there will be increased competition for resources such as housing, and services that require the provision of costly infrastructure, such as health care, education, and public transport. On a more basic level, increased migration means there are more people accessing the same levels of water and food. Some resources and some goods and services that may become scarcer include clean air and water, open (green) spaces, local wildlife, native bushland, quiet neighbourhoods and the size of home gardens, as well as housing, parking, community services. The scarcity of these goods and services is reflected in higher prices for city apartments, parking spaces, water and amenities.
- 6 Decision a) has the greater opportunity cost because the next best alternative use of land in Beijing (developing the lot) is much more valuable than the next best use of a square kilometre of desert. Developing the desert into a service station has a low opportunity cost.
- 7 No. This is because building a service station in the Simpson Desert, although having a lower opportunity cost, may not be economically sound because the market is small.
- 8 See the figure below.



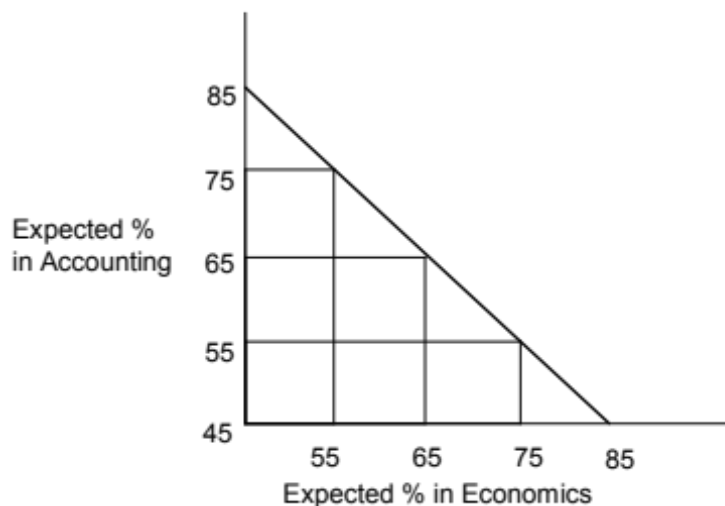
- a To go from Point A to B to get the first 2000 cars produced is at an opportunity cost of 1000 tonnes of lamb (from 10 000 to 9000 tonnes). From B to C, another 2000 cars, is at an opportunity cost of 2000 tonnes of lamb; from C to D, another 2000 cars, the opportunity cost is 3000 tonnes of lamb, and from D to E 2000 more cars is at an opportunity cost of 4000 tonnes of lamb. So the highest opportunity cost per thousand cars is between Points D and E. Each gain in Lamb involves an opportunity cost of 2000 cars, but from Points D to E the gain is 4000 Lamb, D to C 3000 Lamb, C to B 2000 Lamb and B to A 1000 Lamb, so the highest opportunity cost per thousand tonnes of lamb is from Point B to A (only 1000 more Lamb for 2000 cars).
 - b Point F is an inefficient point because it is possible to produce either more motor cars or more lamb without producing less of the other output (i.e. could have 4000 Lamb and 6000 Cars, or 2000 Cars and 9000 Lamb instead of 4000 Lamb and 2000 Cars). Point G is impossible to produce, given the definition of the production possibilities curve as the maximum combinations that can be produced with existing resources and technology. Points A–E are efficient because more of one of the products can be produced only by producing less of the other product.
 - c The law of increasing opportunity costs is reflected. Moving from the origin along the horizontal axis, each 2000-unit increase in the output of motor cars results in greater declines in lamb production, measured along the vertical axis, as shown above in a. These values reflect the changing slope that determines the bowed-outward shape of the production possibilities curve.
 - d Any of the assumptions could be changed to shift the frontier. To shift the frontier outwards (to the right), there could be an increase in resources (e.g. land, labour, capital, enterprise); more productive utilisation of the existing resources; or an advance in the technology. A decline in the quantity or the quality of resources or some technological setback would shift the production curve to the left. Students should be able to translate a 50 per cent increase in the production combinations into their graph.
- 9 An increase in administrative staff that entailed a concomitant decrease in academic staff could only be justified if the gain from the extra administrative staff outweighed the loss from the decrease in academic staff. Such a justification might be possible if it could be shown that the extra administrative staff would be able to, say, recruit more fee-paying students, bringing the university additional revenue that would more than cover the staff salaries, while the decrease in academic staff could be accommodated, at little cost, by combining some classes or discontinuing some units. In this way marginal analysis can show that the extra costs are less than the extra benefits and could justify the change.

- 10 Investing in capital goods in the current period rather than purchasing consumer goods increases the production capacity of the economy in future. Increasing an economy's stock of capital is an investment. This process means that an economy is replacing worn out capital and producing a net gain in new factories, equipment, and other capital goods. This increases the productivity of the other factors of production. The increased quantity of capital results in additional capacity of the economy to produce goods and services. Thus, the production possibilities curve shifts rightward, and economic growth is achieved. On the other hand, producing consumer goods does not produce such an outcome in the future.
- 11 a Maximum production possibilities for expected grades in economics and accounting:

Number of hours studied (economics)	Expected percentage in economics	Number of hours studied (accounting)	Expected percentage in accounting
0	45	12	85
3	55	9	75
6	65	6	65
9	75	3	55
12	85	0	45

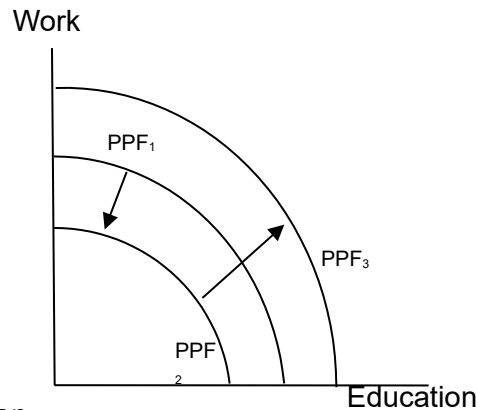
Note, to construct the table, start from six hours allocated for each subject. *The student scores 65 per cent for both. These data are given. Then complete the rest of the table according to the information that is provided.*

b



- c The curve is not bowed outward and, instead, is a downward-sloping straight line, reflecting constant opportunity costs. Selecting any of the output combinations requires shifting three hours study time from one subject to another. Each change in three hours of study time reflects a constant slope of 10 per cent gain for 10 per cent loss.

12



Increasing the proportion of young people attending university will mean less young people available for work so the PPF will decrease (from PPF_1 to PPF_2). However, in the long run, the skills attained will enable economic growth, so the economy will move out to PPF_3 (and beyond PPF_1) because of the higher-skilled labour force.

- 13 As population increases, especially in urban areas, clean air, wilderness and wildlife have become less abundant. Local extinctions are also taking place. For instance, records show that local wildlife that were once common in the Brisbane CBD have either declined in numbers or have altogether disappeared. A good example that can be provided is the Red-necked wallabies that have almost disappeared during the last 10–30 years from suburbs close to the Brisbane city centre.

Yes, there are simple economic ways to make such judgements. For example, it is possible to look at yearly hospital data (time series data) to examine the impact of poor air quality on human health, especially children. The data can then be used to estimate the economic costs of poor air quality.

Another example that can be provided is that when local wildlife and recreational areas disappear, residents have to travel further to enjoy them. A simple survey can determine this relationship and also estimate the economic costs of such travel.

Multiple-choice solutions

(pp. 51–2)

- 1a What to produce? How to produce it? For whom to produce it?
- 2e All of the above
- 3e All of the above
- 4c the movement along the frontier.
- 5c \$100.
- 6c movement from a point inside the frontier to a point on the frontier.
- 7a shift out.
- 8a decreasing the production of another good.
- 9e inside the frontier.
- 10d experience all of the above.
- 11b adding to its stock of capital.

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