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Sustainability, Resources and the Environment

If the purpose of economics is to help people provision, what resources are available to help us achieve this important objective? This chapter begins with a classification of resources: what are they and how should they be used? We then introduce two individuals central to our themes of sustainability and justice: Thomas Malthus, whose population thesis predicted that global population will increase far more than the supporting resources, causing calamity; and Karl Polanyi, who argued quite persuasively that an economy is artificially constructed and needs to be embedded within the broader society. This chapter also introduces the important concepts of the laws of demand and supply and of elasticity. Each is a helpful working tool, essential in constructing economic models.

3.1 LIVING WITHIN OUR MEANS

Politicians, experts and many others use the phrase ‘living within our means’. What does this mean? On one level, we have been enjoying a better standard of living than our resources and our work efficiency have warranted, especially in the developed world. The affluent lifestyle of many Western countries has been funded by a boom in cheap energy and the creation of easy credit; and, because of how this credit was created, many of the world’s richest societies have accumulated significant amounts of public and private debt. But we are also living beyond our means on a deeper, more fundamental level, since our accustomed lifestyle is exhausting the Earth’s resources and poisoning the natural systems we rely on.

The common English definition of a **resource** is ‘a source of support or help’. The word is derived from the Latin *resurgere*, meaning to ‘rise again’, suggesting that resources are not dropped down from heaven but become resources as our knowledge, technology and culture progresses. A **natural resource** is something found in nature – trees, coal, wind, etc. Our present economic arrangements mean that we are using more materials, creating more waste and pollution, and using more (fossil fuel) energy than we can actually sustain. The global

population, especially in the affluent countries, is using finite resources as if there was a never-ending supply – or, putting it another way, using resources as if we had three or more Earths to plunder rather than just the one. We feel that our global society needs to respect the limits of what the planet can provide – and there is a plethora of evidence that we humans have overstepped our bounds. We also believe that a central task of the economics profession is to become aware of these limits and to conceptualise policies that work within them rather than ignore them. And, in the interest of sustainability, we believe that we owe discussion and consideration of these issues to future generations.

As Table 3.1 shows, we can divide nature's resources into four kinds: renewable, non-renewable, replenishable and recyclable. From an economic point of view, the important question is how we harvest and steward these resources. Renewable resources should not be used more rapidly than they can regenerate, so we should not use, for example, more timber than we can plant trees to replace it; replenishable resources should not be used at a faster rate than they can be replenished. There is a subtle difference between replenishable and renewable resources, relating to the speed of use compared with the speed of replacement. This means that replenishable resources must be stewarded with more care than renewable resources because it takes much longer for their supply to be replenished. To illustrate: consider the difference between the time needed to form an underground aquifer and for a tree to grow.

Table 3.1 Defining Resources

<i>Type of resource</i>	<i>Definition</i>	<i>Examples</i>
Renewable	Resources that can grow and therefore regenerate themselves.	Timber, food crops, fisheries.
Non-renewable	Resources that are finite within the planetary system and cannot be restored once used.	Petroleum, gas, coal, uranium.
Replenishable	Resources that can be renewed over a long time.	Groundwater, soil.
Recyclable	Resources that are limited within the planetary system but can be reused.	Copper, gold, iron ore.

Source: Authors.

Recyclable resources are limited, but once used they can be retrieved and used again. However, we should note that retrieving and recycling materials still requires energy inputs, so we should use them only when necessary and with care. Finally, we have non-renewable resources, primarily fossil fuels. Since their supply is limited and cannot be replaced, we should carefully steward their remaining reserves.

That resources are limited may seem self-evident, but neoclassical economists assume that no resource is so essential that a substitute will not be found as it nears depletion. They rely on market forces to allocate scarce resources, while ignoring the importance of power and sustainability. Specifically: as a good becomes scarcer its price will increase, inducing users to demand less, existing producers to find more (or produce more, or make available more), and potential producers to offer substitutes.

Evidence of impending resource shortages was offered by *The Limits to Growth* (Meadows et al., 1972), published by The Club of Rome, an organisation comprised of businesspeople, scientists and politicians. The most arresting aspect of the study was its computer model that simulated our future based on a number of assumptions about population, resource endowments and usage. Its conclusion was stark: sustained increases in consumption and economic growth would lead to an 'overshoot' of the Earth's 'carrying capacity'. As it turns out, many of the predictions were unduly pessimistic, as resources have lasted longer than predicted in many cases, although predictions for continuing and accelerating increased resource use and pollution have been reasonably accurate. The reason for the increased supply of once 'scarce' resources is that technological developments enable additional extraction, while reducing the quantity demanded of the resource. However, in 2005 the original authors reviewed their earlier findings and made a number of amendments in the face of criticisms and new evidence, and reaffirmed their vital message about necessary ecological limits to economic growth. Continuing research from the Stockholm Resilience Centre on planetary boundaries seems to confirm the validity of the Club of Rome's position, although the Centre's emphasis is a little different – not limits to growth but growth within limits (Rockström and Klum, 2015).

The Limits to Growth was peremptorily dismissed by neoclassical economists for ignoring market forces. They replaced its circumspection with exuberance while ignoring ecological limits; however, their disregard is no longer shared by many, including global management consultants. A report from the global consultancy McKinsey (Dobbs et al., 2011), *Resource Revolution*, for example, argued that the twenty-first century will see increased resource depletion and a rising price for most resources.

Of course, if we accept this argument that resources are becoming scarce, it raises important questions about how remaining supplies will be shared between today's citizens and those of tomorrow. The McKinsey report takes the pro-market position that market systems and market forces are the most effective methods for allocating resources, while green economists argue that resources should be treated as the common property of local communities (Cato, 2012a). In contrast, institutionalists argue that we need to study the institutions that have developed around the allocation of resources in order to determine who benefits and who loses.

Cheap energy has enabled us to live beyond our means, while resulting in spectacular growth in population and GDP. But an increasing number of economists realise that economic growth is a threatening problem and that we need to restructure our economy away from constant growth. Not only has the effect of pollution on our planetary systems become apparent but it is also increasingly clear that easily available energy sources, particularly oil, are being exhausted. In addition, we need to drastically reduce our consumption of fossil fuels, especially oil and coal, if we are to avoid causing increased concentrations of carbon dioxide and other greenhouse gases in the atmosphere. Climate change is the best evidence yet of how our economy as presently structured fails to keep within natural limits. As Sir Nicholas Stern stated in his famous report for the UK Treasury, *The Economics of Climate Change* (2007), it is a clear and potentially very expensive example of market failure.

Another important book, *Prosperity Without Growth* (2009), argued that not only must growth end, but no basis exists for optimistically assuming improvements in technical efficiency as a panacea. The book's author, Tim Jackson (2009: 188) wrote, 'This delusional strategy has reached its limits. Simplistic assumptions that capitalism's propensity for efficiency will stabilise the climate and solve the problem of resource scarcity are almost literally bankrupt.'

3.2 THOMAS MALTHUS' ESSAY ON POPULATION AND THE GREAT LAND GRAB

Economics is not teleological, meaning that economics has not systemically evolved since Adam Smith such that today's ideas and concepts are superior to yesterday's. In fact, we believe the opposite: there is a lot of wisdom in the past, and that we can learn much from history. At the same time, however, economic laws and principles are seldom constructed in a vacuum; on the contrary, they are specific in terms of time and place in their objectives, and thus, not surprisingly, are highly ideological. There is nothing wrong with being either ideological or passionate about reform; this makes us human. However, if we use a concept, principle or theory today, we must not automatically apply it without first understanding its historical origins, initial objectives and underlying ideology. There is no better example than Malthus's *Principle of Population*:

Malthus lived in tumultuous times of intense class conflicts, and his writings reflect his positions on these conflicts. . . [He] was an outspoken champion of the wealthy, and his theory of population provided the framework within which he defended them.

Hunt and Lautzenheiser, 2011: 65, 71

When the Reverend Thomas Malthus (1766–1834), a professor of political economy, wrote his famous *Essay on Population* (1798), England was in the beginning stages of the Industrial Revolution. Not surprisingly, the dominant agricultural interests at the time were not keen to cede their power and control of the British Parliament to the burgeoning capitalists. In his *Essay*, Malthus was replying to the earlier arguments of William Godwin and Marquis de Condorcet, both bothered by the inequities and undue sufferings of many people during the Industrial Revolution. Each advocated reforms, including a primitive social security, limiting credit and even abolishing private property. Malthus, defending the interests of the wealthy, would have none of that. Not only is the separation of people into capitalists and workers classes natural, he argued, but such separation is also necessary for social progress and development. And furthermore, since only capitalists are socially virtuous, any attempts to improve the lot of workers will only make the situation worse by increasing their propensity to breed.

Stated succinctly, **Malthus' Law of Population** is: Population, if unchecked, will increase faster than the means of subsistence. In other words, population has a greater rate of change than the means of subsistence. Ironically, the use of coal by England during the Industrial Revolution, and oil later in the century, allowed us to increase our means of subsistence geometrically, thanks to cheap energy.

Malthus' ideas remain influential today, with some neo-Malthusians arguing that we should carefully check population growth. However, if the environmentally focused economists are right, then as the population increases and resources become scarce we will see more competition for remaining resources. Some economists see this already happening in the growing attempt by global corporations and national governments to acquire land in other countries to feed their populations. The problem is most severe in Africa, where some countries are seeing vast areas of their agricultural land fall into the hands of foreign owners. Arguments can be made that such land purchases represent investments in poor countries, perhaps creating jobs. But in many cases the land is used to grow biofuels, which then exhaust the soil, while people using the land to support themselves through subsistence agriculture are displaced and forced into poverty. As de Schutter (2011) has argued, targeted countries become increasingly vulnerable to price shocks, and the development of the market for land rights has destructive effects on livelihoods dependent on 'the commons', such as grazing land and fishing areas.

This raises fundamental questions about who owns the land and whether, if land is a gift from nature, it should be allocated differently from products bought and sold on the market. In 1879 the US economist Henry George (1839–97) published his best-selling *Progress and Poverty*, in which he asked many challenging questions including why anyone should be excluded from the land. He argued that since land is scarce and provided free by nature, individuals fortunate enough to own land and receive rents, in exchange for allowing others

to use it should pay the community as a whole in return for this privilege. His idea of a land value tax was taken up in Australia and Canada, and is currently under discussion in other countries among many green groups as an ethical means to gain revenue for national investment.

3.3 KARL POLANYI AND *THE GREAT TRANSFORMATION*

Karl Polanyi (1886–1994) was a Hungarian economist who spent much of his life in London. His most famous book is *The Great Transformation* (1944). What makes Polanyi's economic theories unusual and particularly interesting is that he actively conducted research, undertaking anthropological studies of how people in different human communities engaged in the most fundamental economic task of provisioning. He learned that the market system, which many of his contemporaries assumed to be the basic form of economic organisation, was in fact extremely unusual and only an historically recent development. He called it a 'utopian myth' that a society relies entirely on the market for meeting needs. Indeed, Polanyi (1944: 48) was convinced that in most human communities the social life was more important than economic structures:

The outstanding discovery of recent historical and anthropological research is that man's [sic] economy, as a rule, is submerged in his social relationships. He does not act so as to safeguard his individual interest in the possession of material goods; he acts so as to safeguard his social standing, his social claims, his social assets. He values material goods only in so far as they serve this end.

Polanyi thought that economics should be 'embedded' within social relationships. Later economists with a concern for the environment have suggested that this idea of 'embedding' can be extended, arguing that economies are also embedded within their natural environments. Polanyi believed that traditional economies are closely embedded within their local land – 'an element of nature inextricably interwoven with man's [sic] institutions' (Ibid.: 187). He believed that this connection was only lost when the market economy developed and parts of the natural world were turned into commodities (what he termed 'fictitious commodities') in order to be sold in the market. Polanyi was convinced (Ibid.) that the market had utterly distorted the relationship between human communities and the land:

Traditionally, land and labour are not separated; labour forms part of life; land remains part of nature, life and nature form an articulate whole. Land is thus tied up with the organisations of kinship, neighbourhood, craft and creed – with tribe and temple, village, guild and church. One Big Market, on the other hand, is an arrangement of economic life which includes markets for the

factors of production. Since these factors happen to be indistinguishable from the elements of human institutions, man and nature, it can be readily seen that market economy involves a society the institutions of which are subordinated to the requirements of the market mechanism.

Polanyi argued that land and labour have an intrinsic value that can never be lost, and that the denigration and degradation of nature and people by their transformation into 'fictitious commodities' is harmful, both socially and ecologically. Real commodities are 'objects produced for sale on the market' (Ibid.: 75). Land, by contrast, 'is only another name for nature, which is not produced by humans [while] labour is only another name for a human activity'. (Ibid.: 75). To refer to these basic economic elements as equivalent to goods that were produced specifically to be sold he considered a fiction.

3.4 RESOURCES, OR FACTORS OF PRODUCTION

In this section we focus on how various resources become available for human use. This question concerned the early classical economists, like Adam Smith (1723–90) and David Ricardo (1772–1823). They defined resources in terms of 'factors of production', and more specifically as land, labour and capital. These are fundamental productive resources necessary to make anything that can later be sold in a market. According to the classical economists, the most fundamental economic resource was **land** (see our discussion of the physiocrats from the previous chapter): this comprised obviously the soil itself but also everything it contained, such as minerals, petroleum, diamonds, etc., along with the seas and inland water.

It is important to notice that their definition is rather limited, and instrumental, since it considers land in terms of what it can do for us. Thus 'the economic notion of resources is strictly *anthropocentric*. That is, the economic value of any resource is defined by human needs and nothing else' (Hussen, 2000: 4). This strongly contrasts with the view of land for much of human history, and still held by many indigenous people today, that land is our 'mother'. Today we are accustomed to thinking that the land belongs to us, whereas many Native American people, for example, feel that they belong to the land.

While lumping people with different beliefs, skills, loves and ambitions into the simple factor of **labour** is problematic, the third conventional factor of production, **capital**, poses even greater definitional problems. For Hussen (Ibid.), capital refers to 'a class of resources that is produced for the purpose of creating a more efficient production process. In other words, it is the stock of produced items available not for direct consumption but for further production purposes'. Examples include machines, buildings, computers and education (acquired skill).

Classical economists paid much more attention to land and labour, the more concrete sources of value, than to the rather more abstract and confusing 'capital'.

The UK-based sustainability consultancy and think tank Forum for the Future has further developed the notion of capital to encompass a range of other factors. Forum's **Five Capitals Framework** is fully explained by Parkin (2010), with the five 'capitals' explained in Table 3.2. 'Natural capital' is primary, embracing all other capitals. The environment, an extended version of 'land', appears as natural capital, and money appears as 'financial capital', which has been separated from 'manufactured capital' – the equipment and machinery needed to produce goods. People feature in this model in two ways: first, their skills and expertise as individuals reflected in 'human capital'; second, as 'social capital' or their shared institutions and culture – so important in making economic activity successful and efficient.

Table 3.2 The Five Capitals

<i>Type of capital</i>	<i>Definition</i>
Financial	Includes shares, bonds or banknotes; it is useful to facilitate exchange of the other capitals. Has no intrinsic value.
Manufactured	Machines and equipment.
Social	Civil society organisations and the relationships of trust they create.
Human	Health, knowledge, skills, motivation and spiritual ease of individuals.
Natural	The environment, including its available resources, and the natural systems supporting life.

Source: Adapted from Parkin (2010).

This model arises from a 'strong definition' of sustainability, such that any one capital cannot be substituted for another. But what is meant by 'substitution'? A good illustration is the idea of carbon offsetting. If you take a flight, you know it is producing carbon emissions (or do you?) and, if you have a conscience, you might feel guilty. A carbon offsetting company allows you to pay money to balance out the damage resulting from the pollution, thus substituting financial for natural capital. These examples, however, raise the important questions of how we value such damage, and can such damage even be measured?

3.5 DEMAND, SCARCITY, SUFFICIENCY AND ABUNDANCE

Allocating resources to members of a society is a crucial concern of all economic systems. Every society establishes rules of the game to determine how goods are allocated and who gets what. Much of the world is now organised according to some form of market economy, meaning that we purchase goods and services in

Box 3.1 The Jevons Paradox and Rebound Effects

Although many economists today are technological optimists (not concerned about resources becoming depleted), traditionally this was a central concern of economics. In 1865, for example, William Stanley Jevons¹ (1835–82) wrote *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-Mines*. The British Empire depended on coal to fuel industry and exports (as well as domestic heating and transportation), so this was a fundamental concern for the country's policy-makers.

Jevons' conclusions were unduly pessimistic, since later in the same year new sources of coal were found in South Wales, but he is remembered for sophisticated thinking about the complexity of resource use. Specifically, Jevons noticed that if we develop ways to use energy more efficiently, then its price decreases, and, all else equal, we are likely to use more. His ideas have contemporary relevance in terms of policies to reduce fossil-fuel usage and hence CO₂ emissions. An example of such a policy might be to better insulate our homes to reduce the need for burning fossil fuels to heat them. This will lead to decreased fuel bills, but would we respond by setting the thermostat higher, rather than keeping our house the same temperature? Another example is how improved design of trains and aircraft has reduced energy use per mile, but has also improved the speed and comfort of travel and reduced costs. The outcome has been more travel and far more transport-related emissions than before. These behavioural responses to technological improvements are known as **rebound effects** and indicate the importance of including human behaviour and social and cultural understanding when theorising about economics or designing economic policies (Cato, 2011).

1. Yes, this is the same William Stanley Jevons whom we noted in Chapter 1 as a co-founder of neoclassical economics.

exchange for money. Such markets are based on the interaction of the amount of a good available (the **supply**) and the people who want to buy it (the **demand**).¹ How this process works is the focus of a central debate in economics: what determines the price of an object? Remember that classical economists argued that the main determinant of price was the amount of labour needed to produce it: the more labour needed, the greater its price, and vice versa. Neoclassical economists, however, argue that its main determinant is how much people value the good: If more people value a good, its price will increase, all else being equal, and vice versa. Whether it does and by how much will, first of all, depend on the amount of the good: if it is unlimited, then an increase in demand does not matter. There is enough to satisfy everyone. But a limited amount means that not everyone who wants the good will be able to obtain it.

Under capitalism, a distinction is made between those who want an item and those who can actually demand it. This distinction is made by money, enabling

1. Supply and demand, as well as the concept of elasticity, is based on Newton's three laws of motion (see Chapter 2).

those who want the good to actualise their demand; conversely, those without money are excluded from participating in the market. (Is possession of money the most just way to distinguish between want and demand?) Consider a person living on the street in Calcutta (Kolkata), India's seventh-largest city. She sees new high-rise luxury towers being built, but without any money she is excluded from this market and cannot articulate a demand. How to provision for such people and how to re-include them are crucial questions that every economic system must answer. This doesn't mean that every person should be able to demand any good. Certainly we can distinguish luxury goods from necessities.

We will have much to say on this in later chapters, but for now, let us return to our basic issue. In a market economy, if an individual wants a good (or service) and possesses money, then she will translate her desire into a demand for that good. Its price will increase depending on a number of factors: the available supply; the power of those controlling the good; the power of those demanding it; the relevant institutions affecting demand and supply; and the culture and values of the economic system, i.e. do we help those in need, or is everyone on their own?

The interaction of supply and demand is key to illustrate how a market functions. Neoclassical economic theory suggests that as the price of a good increases, an individual will demand less of that good, all else equal, and vice versa. One reason is that an individual's budget is limited, so for a given price increase, she will have less money to spend on something else, all else equal. If, for example, the price of petrol doubles and my income is not unlimited, and if I continue to purchase the same amount of petrol, I must devote less of my income to other goods and services. This understanding of how people react to the limited nature of their spending power is based on the concept of **opportunity cost**: the cost of obtaining an item is equivalent to the next-best offer. If I am reading this textbook than I am not socialising, so the opportunity cost of reading is the missed socialising. In attending university, in addition to the direct costs, the opportunity cost is what I give up – perhaps the income I might have obtained from paid employment.²

The other side of the theory focuses on the price and the quantity supplied, specifically how much of the product to make available for sale, as a function of price. If we experience particularly cold weather, for example, more people will want to buy gloves, meaning that the price of gloves may rise. This will

2. Interestingly, the concept of opportunity cost is heavily influenced by the nineteenth-century Newtonian value of binary opposites. For example, an electron can be either a wave or a particle but not both; an object can be either mass or energy but not both. Black versus white; male versus female; and, in the above example, I'm either studying or socialising, but not both. But quantum physics teaches us that polar opposites are often more complementary rather than antithetical.

encourage clothes manufacturers to shift to glove production because they can achieve higher sales and higher profits.

Price changes illustrate how demand and supply interact. In Europe, for example, when the price of oil and therefore petrol increases, quantity demanded tends to fall, with people buying more fuel-efficient cars. In the USA, when the price of oil increases, efforts have been made to increase its supply by unconventional means such as using additional energy to crack rock deposits to release oil and gas, commonly known as ‘fracking’. ‘Fracking’ is short for **hydraulic fracturing**, and involves cracking rocks (deep in the Earth’s crust) which contain oil and natural gas deposits; injecting a mixture of sand, chemicals and water, causing the rocks to break and allowing the oil and gas to flow to the surface. While fracking obviously increases the supply of fossil fuels (and, all else equal, reduces their price), it comes at a significant cost of adding to global warming gases (via mining, transportation and consumption), contamination and depletion of local water resources, and the relatively unknown effects of fissured underground rock on the local environment.

In the United States, although fracking has provided additional jobs and income and reduced dependence on foreign oil, it is not sustainable and postpones efforts to develop renewable energy (remember Jevons’ Paradox). In spite of the central message of the Paris Climate Talks in December 2015 that human societies across the world are transiting to phase out fossil fuels by the middle of this century, we should not underestimate the huge social and economic changes this will entail:

If the world agrees to limit the burning of . . . fossil resources, then that would wipe out the wealth of fossil fuel businesses, governments reliant on fossil fuel incomes and individuals whose pensions and savings are invested in those fossil fuel companies. . . it would mean wiping out US\$20 trillion of wealth.

Birch et al., 2017: 145

This doesn’t mean that we should not transition; just that doing so has significant obstacles in terms of costs.

In neoclassical economics, the interaction of the desire to consume and the desire to profit is often portrayed via the **Laws of Demand and Supply**. The interaction of these two laws is referred to as **market forces**. Really the ‘laws’ are just generalisations of human behaviour and a simple way of understanding people’s market behaviour. The **Law of Demand** assumes that given a price increase, the quantity demanded will decrease all else equal; conversely, a price decrease will enable consumers to increase the quantity demanded. The **Law of Supply** assumes that given a price increase the quantity supplied will increase, all else equal; conversely, a price decrease will result in a decrease in quantity supplied, all else equal.

In reality, however, people respond to price changes in a number of different ways. If, for health reasons, politicians encourage people to smoke less, then an increase in the price of cigarettes might achieve this. But some people might be unwilling and unable to respond to price signals, which also depends on the nature of the commodity. Like the price of water, for example: however high, people still need it. Perhaps some goods are so basic to human survival that they should be beyond the confines of any pricing system? We can also question whether market forces are the most ethical way to allocate scarce resources, especially as this involves placing a price tag on nature.

3.6 TECHNIQUE 1: UNDERSTANDING BASIC MARKET FORCES

Notwithstanding the reservations outlined above, we can introduce five generic templates to understand market forces:

- With demand constant, and all else equal, if the supply of a good increases, its price will decrease. *Example:* after the recent financial crisis, additional unconventional oil supplies decreased the price of oil. Keep in mind that this is only a first approximation. And, as Jevons' Paradox predicts, reduced prices, all else equal, will then increase the quantity demanded.
- With demand constant and all else equal, if the supply of a good decreases, its price will increase. *Example:* it is predicted that a decreasing supply of conventional oil within the next five years will increase its price.
- With supply constant, and all else equal, if the demand for a good decreases, its price will decrease. *Example:* decreased demand for coal, due to heightened awareness of global warming has decreased its price.
- With supply constant, and all else equal, if the demand for a good increases, its price will increase. *Example:* vigorous economic growth will increase the demand for oil, increasing its price.
- If both demand and supply change in the same direction (e.g. demand and supply increase), then the effect on price depends on which effect is greater: if demand increases more than supply, then, all else equal, the price will rise, and vice versa. But if demand and supply change in opposite directions (e.g. demand decreases, causing the price to fall, while supply increases, also causing the price to fall), the two effects reinforce each other.

How much (and if) a quantity changes due to a 'stimulus change' can be predicted by *elasticity*, which we explain in the next section.

3.7 TECHNIQUE 2: CALCULATING ELASTICITY

A basic tenet of neoclassical economics is that consumers respond to incentives, especially changing prices, so that a price increase causes consumers to buy less

of a commodity, and vice versa. How much the reaction (in this case quantity demanded) changes due to a change in the stimulus (i.e. price) is measured by **elasticity**, defined as a response to a given stimulus. Such information guides firms as to how much to charge for their goods, when to increase or decrease prices, or how the demand for the good is expected to change as incomes change.

Elasticity of a good (or service) is determined by a number of factors:

- the need for the good
- the number of substitutes
- the good's importance in one's budget
- the length of time under consideration.

Each will now be explained.

If you usually drink orange juice every morning for breakfast, but a freak snowstorm in Florida reduces the supply, causing the price to double, you might switch to apple juice or another substitute. So goods with close substitutes will likely have a greater elasticity of demand. But if you are addicted to something, like tobacco or coffee, by definition the number of workable substitutes is limited, causing the demand to be inelastic. This is one reason why firms devote large sums of money to advertising and marketing: to convince you that you need the product.

As a general rule, the more important the good in one's budget, the more aware the consumer is of the item and the greater is the elasticity of demand: thus, demand for big-ticket items like housing and cars tends to be more elastic.

When it comes to the time period under consideration, the elasticity is likely to be greater in the longer term than in the short term, since one is more able to change one's preferences, and suppliers have more time to develop additional supplies or provide substitute products.

The general formula for any elasticity is:

$$\% \text{ change in response} \div \% \text{ change in stimulus}$$

So the **Price Elasticity of Demand (PED)**, for example, can be defined mathematically as:

$$\frac{\% \text{ change in demand for good X}}{\% \text{ change in price of good X}}$$

To calculate this elasticity (or any elasticity), we need two data points: (1) the initial price and quantity demanded; and (2) the final price and quantity demanded. Now, two questions arise: (1) If we have all four pieces of data, why do we need the formula? Can't we see how the data moves? While this

is true, the formula gives a precise number, easily amenable to interpretation. (2) How difficult is it to estimate the final quantity, since this occurs after the initial decision is made? For example, if Delta Air Lines increases its fare from Minneapolis to London, the initial price and final price are obvious and easy to obtain, as is the initial quantity, but what about the final quantity? Several methods are available, including past similar price changes, small sample survey, or statistical estimation.

In the above formula, if the absolute value of the PED is greater than 1, the demand is responsive to changes in price, and the good is **price elastic**. Conversely, if the absolute value of the PED is less than 1, then demand for the good is relatively unresponsive to changes in price and the good is **price inelastic**.

While elasticity is a somewhat useful idea, it is a limited way of considering how consumers really make decisions about their purchases. Elasticity assumes that people are rational and automatically react to incentives, while holding all else equal. Thus, elasticity eschews any complex or holistic analysis of human behaviour. For example, you may have established habits about purchasing that you are unwilling to change, or you may choose certain branded products and pay more for them although you are aware that they are of equivalent or even lower quality than similar substitutes. The discussion of elasticity also hides the power relationships between buyer and seller, and how desperate a person might be to obtain the good.

John Steinbeck's epic Depression novel *The Grapes of Wrath* tells the story of the Joad family: they become dispossessed from their land in Oklahoma and travel to California looking for work. With very limited resources and a low budget, the family has a continuous angst, easily read on their faces. Consider this scene where the family desperately needs an automobile tire – a desperation easily read by the tire seller: 'We got to get a tire, but Jesus, they want a lot for a ol' tire. They look a fella over. They know he got to go on. They know he can't wait. And the price goes up' (Steinbeck, 1939 [1996]: 120). Alas, very typically in market reactions there is a psychological element in pricing, based on the relational power between buyer and seller.

The above example discussed one specific elasticity: elasticity of demand. Other elasticities include elasticity of supply, elasticity of income and cross elasticity. For each, the general formula is the same:

$$\% \text{ change in response} \div \% \text{ change in stimulus}$$

But the specific response and stimulus is different. For elasticity of supply, the stimulus is a change in price and the response is the amount supplied; for elasticity of income, the stimulus is a change in income and the response is quantity demanded; for cross elasticity, the stimulus is a change in the price of

one good, and the response is the quantity demanded of either a complement or a substitute.

In addition, the interpretation is different for each elasticity. For income elasticity, an answer greater than 1 means this is **luxury good**; an answer less than 1 but greater than 0 means the good is a **necessity**. A negative answer means the good is an **inferior good**: as income increases we demand less, and vice versa, as with the demand for lottery tickets, hamburger meat or potatoes. For cross elasticity, a positive answer means that the two goods are **substitutes** (think of Delta Air Lines increasing prices, with a resultant increase in demand for American Airlines); and a negative answer means that the two goods are **complementary**, that is, they go together.

3.8 MEETING OUR NEEDS

We began this chapter by noting that our planet's resources are limited, suggesting the need to steward them carefully and to ensure that they are shared fairly. However, neoclassical economists believe that rather than thinking about limits we should think of resources in terms of scarcity. The difference between these two concepts is critical to how we respect and preserve the planet we share.

This distinction is important because whether you focus on scarcity or limits depends on whether or not you try to limit your desires. If your desires are infinite then scarcity is ubiquitous, whereas if your desires are small you will find the world abundant. It is for this reason that the anthropologist Marshall Sahlins (1972) referred to the hunter-gatherer communities he studied as 'the original affluent society'. They defined their needs very frugally, and so met them easily with a few daily hours gathering food and the occasional hunting expedition. By contrast, he found a great deal of scarcity in his own society (the USA in the 1970s), where people defined their needs excessively and devoted lots of time trying to satisfy them, usually without success.

It is important to recognise that expectations about the scarcity or abundance of resources significantly affect economic behaviour. For example, if you are expecting something to run out, or expecting not enough to meet your needs, you might choose to buy more and hoard it. You might deprive somebody of access to the resource whose need is actually greater than yours because of your perception of scarcity, which might not even be well-founded. In the worst case, the panic-buying and hoarding behaviour of a large number of people can actually create a shortage which did not previously exist. Such an example occurred in the UK in 2012 when the government took a critical position towards the lorry-drivers' (truckers') union for threatening a strike over pay rates. The government stated that the union members were creating a shortage, which caused people to buy extra supplies of fuel.

Capitalism is a system of allocating scarce resources, goods and services, via the fundamental laws of supply and demand, within a context of private ownership. However high the level of demand, it is assumed that there will always be enough supply because price would effectively ration the supply to those who could afford it. The assumption is that the good is scarce: if it were freely available, it would have no price.

Hence capitalism cannot function without scarcity. This has led commentators such as Panayotakis (2012; 2011) to suggest that scarcity is artificially created, and that we are encouraged to think of ourselves as having unmet needs. In particular, he is concerned with how the advertising industry constantly creates demand for new products, such as the mobile phone or tablet computer. He concludes that this creation of scarcity undermines attempts to achieve a sustainable economy and so must be ended.

The other side of the coin is the question 'Where do our economic desires (our needs) come from?' Although it may feel as if we are incomplete without our mobile phones and tablet computers, we were not born with a desire for these high-tech products. In modern societies our patterns of consumption form an important part of our identity. So does the advertising industry's artificial creation of our perceived need for the good, suggesting that it will bring us happiness, friendship or human warmth, even though such things can never be gained through the purchase of a material item.

Instead of infinite desires and limited products leading to a situation of scarcity, many economists advocating sustainability propose the idea of a 'sufficiency economy', based on the understanding that nature offers abundance but not an infinite supply of resources. Its motto might be Mohandas Gandhi's adage that 'Earth has enough to satisfy the needs of all but not the greed of some'. This insight has been developed by Molly Scott Cato (2011) as well as the ecofeminist economist Mary Mellor (2012), who describes a sufficiency economy thus:

Arguments for de-growth raise questions about what level of consumption is sustainable. One principle offered is 'sufficiency' or 'enough', where the economic system would remove incentives for over-production and over-consumption above the level necessary for a needs-based economy. A sufficiency green economy would aim to provide enough goods and services to enable each person to flourish without destructive growth. As sufficiency for one must mean sufficiency for all, it would be necessary to meet human needs on an egalitarian basis. Sufficiency economics would remove the impetus for environmentally damaging growth and create the potential for socially just de-growth.

A framework for considering satisfaction within such an economy is provided by Manfred Max-Neef in his theory of 'human-scale development'. He argues that

Box 3.2 Climate Finance: Highlights

According to the World Bank, **climate finance** refers to financial resources invested in climate mitigation and adaptation measures via loans, grants and guarantees. The amount of such resources has steadily increased, now standing at US\$741 billion¹ (UNFCCC, 2016). **Climate mitigation** is any action taken to eliminate or reduce the long-term risks of climate change; **climate adaptation** enhances the economy society's ability to adjust to climate-change outcomes. In other words, climate mitigation tackles the causes, while climate adaptation tackles the effects. Table 3.3 shows some examples.

Table 3.3 Uses of Climate Financing: Mitigation and Adaptation Strategies

<i>Mitigation</i>	<i>Adaptation</i>
Renewable energy generation	Water-supply management
Energy-efficiency in industry and buildings	Climate-resilient infrastructure
Sustainable transport	Coastal protection
AFOU (Agriculture, forestry and other land use) and livestock management (how farms and ranches operate)	Disaster risk reduction

Source: Cordova (2015).

East Asia and the Pacific, mainly China, is the largest recipient of climate finance, with Western Europe the second. According to Buchner et al. (2014), the private sector provides approximately 61 per cent of total climate finance resources. The main private actors are:

- project developers: national/regional utilities / independent power producers
- corporate actors: manufacturers, corporate end-users
- private households: high net-worth individuals
- commercial financial institutions

Although the public sector provides only 39 per cent of climate resources, its role as a key driver in covering risks and bridging viability gaps is important. The main public actors are:

- governments and bilateral aid agencies, export credit agencies and UN institutions
- development finance institutions: multilateral development banks, national development banks and bilateral financial institutions
- climate funds: global environment policies, adaptation funds, climate investment.

According to the UNFCCC (2016), mitigation-focused finance represented more than 70 per cent of public-sector climate finance in developing countries in 2014.

1. A billion is 1,000,000,000 (one thousand million).

when we buy material products to find satisfaction, we are actually seeking to meet a deeper emotional need. If we could clearly delineate our basic 'subsistence' needs, we might be able to meet them with considerable less use of materials and energy, but in a capitalist economy it is the process of making and selling actual products that generates profits. As an example, we might be seeking identity, which could be met by buying certain branded goods. Max-Neef (1991) suggests we could instead develop the sense of belonging and self-esteem that brings us the identity we crave by enjoying deeper relationships with other people and within our local place. As Max-Neef (quoted in Cato, 2012a: 140) explains:

in conventional economics we have two links: wants and goods. In Human Scale Development Theory we have three links: needs, satisfiers and goods. For instance, there is the need for Understanding, whose satisfier is literature and whose good is a book.

It is interesting to note that the idea of 'human-scale development' arose from an economist based in the Global South, whereas it is the countries of the over-developed Global North whose consumption patterns threaten the future of life on Earth. We make clear that the principle of reducing consumption is aimed at countries that already have the basic health and social security systems in place, as well as a high level of material security.

THINKING QUESTIONS

What is a resource? How would you define it? When does an item become a resource?

What other needs and satisfiers could be added to Max-Neef's formulation?

CLASS ACTIVITY

Discuss how the concept of 'capital' can be rethought so that it helps create a more sustainable world. How does the Five Capitals Framework do this?

AREAS FOR RESEARCH

Are the terms 'economic growth' and 'sustainable development' mutually contradictory? Might your geographical location, say Global South or Global North, influence how you tackle that question?

UN SDG FOCUS

Goals #6, #7 and #13 call for:

6. Ensure access to water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable and modern energy for all.
13. Take urgent action to combat climate change and its impacts.

How would you conceptualise, define and measure 'modern, affordable and reliable'? What is meant by 'urgent action'? Research the UN's findings on Goals #6, #7 and #13. How would you recommend implementation?

FURTHER READING

- Jackson, T. (2009) *Prosperity Without Growth: Economics for a Finite Planet*. London: Earthscan.
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