MACROECONOMICS:

THEORY MARKETS AND POLICY

Douglas Curtis and Ian Irvine | VERSION 2013/2014

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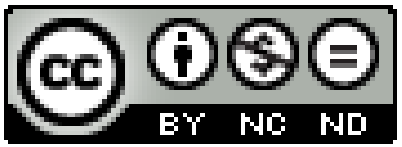

Douglas Curtis and Ian Irvine

About the Authors

Doug Curtis is a specialist in macroeconomics. He is the author of twenty research papers on fiscal policy, monetary policy, and economic growth and structural change. He has also prepared research reports for Canadian industry and government agencies and authored numerous working papers. He completed his PhD at McGill University, and has held visiting appointments at the University of Cambridge and the University of York in the United Kingdom. His current research interests are monetary and fiscal policy rules, and the relationship between economic growth and structural change. He is Professor Emeritus of Economics at Trent University in Peterborough, Ontario, and Sessional Adjunct Professor at Queen's University in Kingston, Ontario

Ian Irvine is a specialist in microeconomics, public economics, economic inequality and health economics. He is the author of some thirty research papers in these fields. He completed his PhD at the University of Western Ontario, has been a visitor at the London School of Economics, the University of Sydney, the University of Colorado, University College Dublin and the Economic and Social Research Institute. His current research interests are in tobacco use and taxation, and Canada's Employment Insurance and Welfare systems. He has done numerous studies for the Government of Canada, and is currently a Professor of Economics at Concordia University in Montreal.

Our philosophy

*Macroeconomic: Theory, Models and Policy i*s focused on the material that students need to cover in a first introductory course. It is slightly more compact than the majority of introductory macroeconomics books in the Canadian marketplace. Decades of teaching experience and textbook writing has led the authors to avoid the encyclopedic approach that characterizes the recent trends in textbooks.

Consistent with this approach, there are no appendices or 'afterthought' chapters. If important material is challenging then it is still included in the main body of the text; it is not relegated elsewhere for a limited audience; the text makes choices on what issues and topics are important in an introductory course. This philosophy has resulted in a Macro book of just 15 chapters, with three introductory chapters and the International Trade chapter, common to both Micro and Macro.

Examples are domestic and international in their subject matter and are of the modern era – financial markets, monetary and fiscal policies aimed at inflation and debt control, globalization and the importance of trade flows in economic structure and concerns about slow growth and the risk of deflation are included.

The title is intended to be informative. Students are introduced to the concepts of models early, and the working of such models is illustrated in every chapter. Calculus is avoided; but students learn to master and solve linear models. Hence straight line equations and diagrams are introduced early and are used throughout.

- Instructors may obtain the original Word files from the authors if the instructors decide that they want to amplify certain sections for their own students.

Our publishing format and linkages

The form of this book is completely new to the Canadian market. The authors have many years of experience in hard-copy book publishing with a major international publisher. This time they decided to break out and publish a high-quality book in electronic format only. This format has several advantages over the traditional format.

- It is fully downloadable, in contrast to texts that are typically 'on-line'. Most publishers give electronic access to students who purchase their books, but do not permit downloads.
- The book is accompanied by a full set of power points for instructors and students. These are downloadable in their original Microsoft PowerPoint format, and consequently can be further developed by instructors. Students can also download them and use them as a basis for note taking in class.
- Questions and problem sets that match each chapter are available. These questions, when submitted, get instant feedback. Instructors can use the question banks to structure their own weekly labs and assignments.

Content

Macroeconomics: Theory, Models and Policy, provides complete, concise coverage of introductory macroeconomic theory and policy. It examines the Canadian economy as an economic system, and embeds current Canadian institutions and approaches to monetary policy and fiscal policy within that system. Particular attention is given to the recent structure, performance, and evolution of the Canadian economy, and to the current targets and instruments of Canadian monetary and fiscal policy.

These are exciting and challenging times in which to study macroeconomics. We focus on short-run macroeconomic performance, analysis, and policy motivated by the recessions of the early 1980s and 1990s, the financial crisis and recession of 2008–2009, and the prolonged recovery in most industrial countries. To that end, the text examines macroeconomic institutions, performance, and policies in ways that help students understand and evaluate critically the news media coverage and broader public discussion of:

- Recessions and recoveries, unemployment and inflation, and conditions in financial markets—topics of ongoing reporting, discussion, and debate.
- Monetary and fiscal policy announcements and discussions focused on inflation targets, interest rate settings, budget balances, tax rates, expenditures, and public debt targets as these affect economic performance.
- Exports, imports, international capital flows, foreign exchange rates, and the importance of the international sector of the Canadian economy.
- Economic growth, productivity growth, and the importance of productivity growth for standards of living in Canada and other countries.

A traditional Aggregate Demand and Supply model is introduced to provide a consistent analytical framework for development of sector topics that follow. The analysis builds on a study of short-run business cycle fluctuations in output and employment, under *constant equilibrium price* conditions. The balance of payments, exchange rate policy, and monetary and fiscal policy under different exchange rate systems complete the short-run open economy model.

A basic modern Aggregate Demand and Supply model of output and the *inflation rate* is also developed based on:

- Current Canadian monetary policy based on inflation targets, interest rate policy instruments, and current Bank of Canada operating techniques, including the potential for quantitative or credit easing.
- Current Canadian fiscal policy based on deficit and debt control targets, the government's budget function, the temporary shift to fiscal stimulus in 2009 and the implications for budget balances and the public debt.

Numerical examples, diagrams, and basic algebra are used in combination to illustrate and explain economic relationships. Students learn about the importance of trade flows, consumption; government budgets; money supply; financial asset prices, yields, and interest rates; employment and unemployment; and other key relationships in the economy. Canadian and selected international data are used to provide real world examples and comparisons

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Part 5: International Macroeconomics and Trade Theory

Part 1:

Introduction

Economics is everywhere. It is about how society deals with the problems of scarcity and the allocation of resources among alternatives. It is the study of individual behaviours based on economic motives and the interactions among individual behaviours that result in societal and economy wide outcomes. Sometimes it makes sense to use markets and sometimes we need other solutions. Sometimes what seems to be common sense for individuals or individual families is nonsense for the economy as a whole. Economic analysis helps us to think about the need for and design of government policies to influence economic behaviour and outcomes.

This part of the text uses three chapters to introduce economics issues, economic questions, economic theory, economic tools of analysis and simple economic models

1

Introduction to Key Ideas

In this chapter we will explore:

1. The big issues in economics
2. Understanding through the use of models
3. Opportunity cost and the market
4. A model of exchange and specialization
5. Production possibilities for the economy
6. Aggregate output, growth and cycles

1.1 What's it all about?

The big issues

Economics is the study of human behavior. Since it uses scientific methods it is called a social science. We study human behavior to better understand and improve our world. During his acceptance speech, a recent Nobel Laureate in Economics suggested:

> *Economics, at its best, is a set of ideas and methods for the improvement of society. It is not, as so often seems the case today, a set of ideological rules for asserting why we cannot face the challenges of stagnation, job loss and widening inequality.*
>
> Christopher Sims, Nobel Laureate in Economics 2011

This is an elegant definition of economics and serves as a timely caution about the perils of ideology. Economics evolves continuously as current observations and experience provide new evidence about economic behavior and relationships. Inference and policy recommendations based on earlier theories, observations and institutional structures require constant analysis and updating if they are to furnish valuable responses to changing conditions and problems.

Much of today's developed world faces severe challenges as a result of the financial crisis that began in 2008. Unemployment rates among young people are at historically high levels in several economies, government balance sheets are in disarray, and inequality is on the rise. In addition to the challenges posed by this severe economic cycle, the world simultaneously faces structural upheaval: overpopulation, climate change, political instability and globalization challenge us to understand and modify our behavior.

These challenges do not imply that our world is deteriorating. Literacy rates have been rising dramatically in the developing world for decades; child mortality has plummeted; family size is a fraction of what it was 50 years ago; prosperity is on the rise in much of Asia; life expectancy is increasing universally and deaths through wars are in a state of long term decline.

These developments, good and bad, have a universal character and affect billions of individuals. They involve an understanding of economies as large organisms with interactive components. The study of economies as large interactive systems is called **macroeconomics**. Technically, macroeconomics approaches the economy as a complete system with feedback effects among sectors

that determine national economic performance. Feedbacks within the system mean we cannot aggregate from observations on one household or business to the economy as a whole. Application Box 1.1 gives an example.

Macroeconomics: the study of the economy as system in which feedbacks among sectors determine national output, employment and prices

Individual behaviors

Individual behavior underlies much of our social and economic interactions. Some individual behaviors are motivated by self-interest, others are socially motivated. The Arab Spring of 2011 was sparked by individual actions in North Africa that subsequently became mass movements. These movements were aimed at improving society at large. Globalization, with its search for ever less costly production sources in Asia and elsewhere, is in part the result of cost-reducing and profit-maximizing behavior on the part of developed-world entrepreneurs, and in part attributable to governments opening their economies up to the forces of competition, in the hope that living standards will improve across the board. The increasing income share that accrues to the top one percent of our population in North America and elsewhere is primarily the result of individual self-interest.

At the level of the person or organization, economic actions form the subject matter of microeconomics. Formally, **microeconomics** is the study of individual behavior in the context of scarcity.

Microeconomics: the study of individual behavior in the context of scarcity

Individual economic decisions need not be world-changing events, or motivated by a search for profit. For example, economics is also about how we choose to spend our time and money. There are quite a few options to choose from: sleep, work, study, food, shelter, transportation, entertainment, recreation and so forth. Because both time and income are limited we cannot do all things all the time. Many choices are routine or are driven by necessity. You have to eat and you need a place to live. If you have a job you have committed some of your time to work, or if you are a student some of your time is committed to lectures and study. There is more flexibility in other choices. Critically, microeconomics seeks to understand and explain how we make choices and how those choices affect our behavior in the workplace and society.

A critical element in making choices is that there exists a *scarcity* of time, or income or productive resources. Decisions are invariably subject to limits or constraints, and it is these constraints that make decisions both challenging and scientific.

Microeconomics also concerns business choices. How does a business use its funds and management skill to produce goods and services? The individual business operator or firm has to decide what to produce, how to produce it, how to sell it and in many cases, how to price it. To make and sell pizza, for example, the pizza parlor needs, in addition to a source of pizza ingredients, a store location (land), a pizza oven (capital), a cook and a sales person (labour). Payments for the use of these inputs generate income to those supplying them. If revenue from the sale of pizzas is greater than the costs of production, the business earns a profit for the owner. A business fails if it cannot cover its costs.

In these micro-level behaviors the decision makers have a common goal: to do as well as he or she can, *given the constraints imposed by the operating environment*. The individual wants to mix work and leisure in a way that makes her as happy or contented as possible. The entrepreneur aims at making a profit. These actors, or agents as we sometimes call them, are *maximizing*. Such maximizing behavior is a central theme in this book and in economics at large.

Application Box 1.1 The Paradox of Thrift.

Finance Minister Jim Flaherty and Bank of Canada Governor Mark Carney in 2011 urged Canadian households to increase their savings in order to reduce their record high debt-to-income ratio. On an individual level this makes obvious sense. If you could save more and spend less you could pay down the balances on credit cards, your line of credit, mortgage and other debts.

*But one household's spending is another household's income. For the economy as a system, an increase in households' saving from say 5 percent of income to 10 percent reduces spending accordingly. But lower spending by all households will reduce the purchases of goods and services produced in the economy, and therefore has the potential to reduce national incomes. Furthermore, with lower income the troublesome debt-to-income ratio will not fall, as originally intended. Hence, while higher saving may work for one household in isolation, higher saving by all households may not. The interactions and feed backs in the economic system create a '**paradox of thrift**.'*

The paradox can also create problems for government finances and debt. Following the recession that began in 2008/09, many European economies with high debt loads cut spending and increased taxes to in order to balance their fiscal accounts. But this fiscal austerity reduced the national incomes on which government tax revenues are based, making deficit and debt problems even more problematic. Feedback effects, within and across economies, meant that European Union members could not all cut deficits and debt simultaneously.

Markets and Government

Markets play a key role in coordinating the choices of individuals with the decisions of business. In modern market economies goods and services are supplied by both business and government. Hence we call them **mixed economies**. Some products or services are available to those who wish to buy them and have the necessary income - as in cases like coffee and wireless services. Other services are provided to all people through government programs like law enforcement and health care.

Mixed economy: goods and services are supplied both by private suppliers and government.

Markets offer the choice of a wide range of goods and services at various prices. Individuals can use their incomes to decide the pattern of expenditures and the bundle of goods and services they prefer. Businesses sell goods and services in the expectation that the market price will cover costs and yield a profit.

The market also allows for specialization and separation between production and use. Rather than each individual growing her own food, for example, she can sell her time or labor to employers in return for income. That income can then support her desired purchases. If businesses can produce food more cheaply than individuals the individual obviously gains from using the market – by both having the food to consume, and additional income with which to buy other goods and services. Economics seeks to explain how markets and specialization might yield such gains for individuals and society.

We will represent individuals and firms by envisaging that they have explicit objectives – to maximize their happiness or profit. However, this does not imply that individuals and firms are concerned only with such objectives. On the contrary, much of microeconomics and macroeconomics focuses upon the role of government: how it manages the economy through fiscal and monetary policy, how it redistributes through the tax-transfer system, how it supplies information to buyers and sets safety

standards for products.

Since governments perform all of these socially-enhancing functions, in large measure governments reflect the social ethos of voters. So, while these voters may be maximizing at the individual level in their everyday lives, and our models of human behavior in microeconomics certainly emphasize this optimization, economics does not see individuals and corporations as being devoid of civic virtue or compassion, nor does it assume that only market-based activity is important. Governments play a central role in modern economies, to the point where they account for more than one third of all economic activity in the modern mixed economy.

While governments supply goods and services in many spheres, governments are fundamental to the just and efficient functioning of society and the economy at large. The provision of law and order, through our legal system broadly defined, must be seen as more than simply accounting for some percentage our national economic activity. Such provision supports the whole private sector of the economy. Without a legal system that enforces contracts and respects property rights the private sector of the economy would diminish dramatically as a result of corruption, uncertainty and insecurity. It is the lack of such a secure environment in many of the world's economies that inhibits their growth and prosperity.

Let us consider now the methods of economics, methods that are common to science-based disciplines.

1.2 Understanding through the Use of Models

Most students have seen an image of Ptolemy's concept of our Universe. Planet Earth forms the centre, with the other planets and our sun revolving around it. The ancients' anthropocentric view of the universe necessarily placed their planet at the centre. Despite being false, this view of our world worked reasonably well - in the sense that the ancients could predict celestial motions, lunar patterns and the seasons quite accurately.

More than one Greek astronomer believed that it was more natural for smaller objects such as the earth to revolve around larger objects such as the sun, and they knew that the sun had to be larger as a result of having studied eclipses of the moon and sun. Nonetheless, the Ptolemaic description of the universe persisted until Copernicus wrote his treatise "On the Revolutions of the Celestial Spheres" in the early sixteenth century. And it was another hundred years before the Church accepted that our corner of the universe is heliocentric. During this time evidence accumulated as a result of the work of Brahe, Kepler and Galileo. The time had come for the Ptolemaic *model* of the universe to be supplanted with a better *model*.

All disciplines progress and develop and explain themselves using models of reality. A **model** is a formalization of theory that facilitates scientific enquiry. Any history or philosophy of science book will describe the essential features of a model. First, it is a stripped down, or reduced, version of the phenomenon that is under study. It incorporates the key elements while disregarding what are considered to be secondary elements. Second, it should accord with reality. Third, it should be able to make meaningful predictions. Ptolemy's model of the known universe met these criteria: it was not excessively complicated (for example distant stars were considered as secondary elements in the universe and were excluded); it corresponded to the known reality of the day, and made pretty good predictions. Evidently not all models are correct and this was the case here.

Model: a formalization of theory that facilitates scientific enquiry.

In short, models are frameworks we use to organize how we think about a problem. Economists sometimes interchange the terms theories and models, though they are conceptually distinct. A **theory** is a logical view of how things work, and is frequently formulated on the basis of observation. A model is a formalization of the essential elements of a theory, and has the characteristics we described above. As an example of an economic model, suppose we theorize that a household's expenditure depends on its key characteristics: such a

model might specify that wealth, income, and household size determine its expenditures, while it might ignore other, less important, traits such as the household's neighborhood or its religious beliefs. The model reduces and simplifies the theory to manageable dimensions. From such a reduced picture of reality we develop an analysis of how an economy and its components work.

Theory: a logical view of how things work, and is frequently formulated on the basis of observation.

An economist uses a model as a tourist uses a map. Any city map misses out some detail—traffic lights and speed bumps, for example. But with careful study you can get a good idea of the best route to take. Economists are not alone in this approach; astronomers, meteorologists, physicists, and genetic scientists operate similarly. Meteorologists disregard weather conditions in South Africa when predicting tomorrow's conditions in Winnipeg. Genetic scientists concentrate on the interactions of limited subsets of genes that they believe are the most important for their purpose. Even with huge computers, all of these scientists build *models* that concentrate on the essentials.

1.3 Opportunity Cost and the Market

Individuals face choices at every turn: In deciding to go to the hockey game tonight, you may have to forgo a concert; or you will have to forgo some leisure time this week order to earn additional income for the hockey game ticket. Indeed, there is no such thing as a free lunch, a free hockey game or a free concert. In economics we say that these limits or constraints reflect opportunity cost. The **opportunity cost** of a choice is what must be sacrificed when a choice is made. That cost may be financial; it may be measured in time, or simply the alternative foregone.

Opportunity cost: what must be sacrificed when a choice is made

Opportunity costs play a determining role in markets. It is precisely because individuals and organizations have different opportunity costs that they enter into exchange agreements. If you are a skilled plumber and an unskilled gardener, while your neighbor is a skilled gardener and an unskilled plumber, then you and your neighbor not only have different capabilities, you also have different opportunity costs, and *you could gain by trading your skills*. Here's why. Fixing a leaking pipe has a low opportunity cost for you in terms of time: you can do it quickly. But pruning your apple trees will be costly because you must first learn how to avoid killing them and this may require many hours. Your neighbour has exactly the same problem, with the tasks in reverse positions. In a sensible world you would fix your own pipes *and* your neighbor's pipes, and she would ensure the health of the apple trees in both backyards.

If you reflect upon this 'sensible' solution—one that involves each of you achieving your objectives while minimizing the time input—you will quickly realize that it resembles the solution provided by the marketplace. You may not have a gardener as a neighbor, so you buy the services of a gardener in the marketplace. Likewise, your immediate neighbor may not need a leaking pipe repaired, but many others in your neighborhood do, so you sell your service to them. You each specialize in the performance of specific tasks as a result of having different opportunity costs or different efficiencies. Let us now develop a model of exchange to illustrate the advantages of specialization and trade, and hence the markets that facilitate these activities. This model is developed with the help of some two-dimensional graphics.

1.4 A model of exchange and specialization

We have two producers and two goods: Amanda and Zoe produce vegetables (V) and or fish (F). Their production capabilities are defined in table 1.1 and in figure 1.1, where the quantity of V appears on the vertical axis and the quantity of F on the horizontal axis. Zoe and Amanda each have 36-hour weeks and they devote that

time to producing the two goods. But their efficiencies differ: Amanda requires two hours to produce a unit of V and three hours for a unit of F. As a consequence, if she devotes all of her time to V she can produce 18 units, or if she devotes all of her time to F she can produce 12 units. Or, she could share her time between the two.

Table 1.1 Production Possibilities in a Two-Person Economy

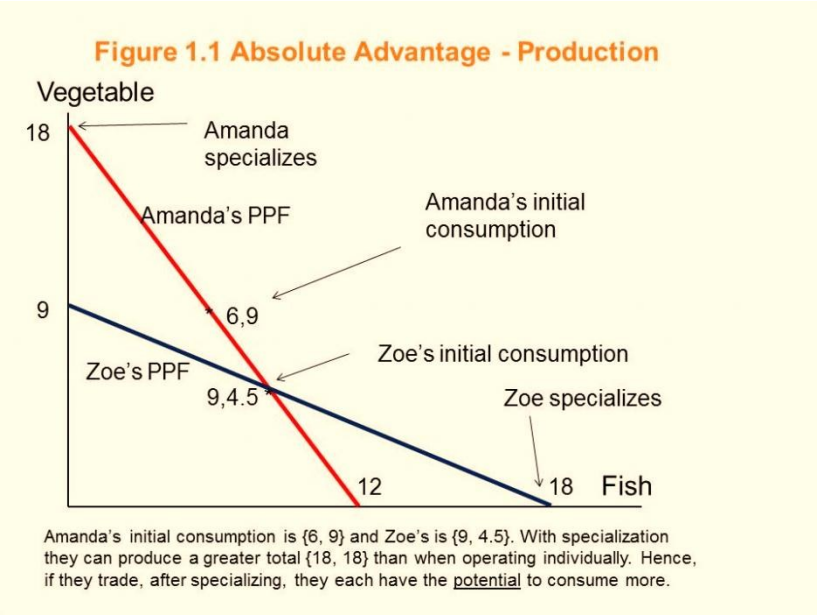
	Hours/ fish	Hours/ vegetable	Fish production	Vegetable production
Amanda	3	2	12	18
Zoe	2	4	18	9

Each producer has a time allocation of 36 hours. By allocating total time to one activity, Amanda can produce 12F or 18V, Zoe can produce 18F or 9V. By splitting their time each person can also produce a combination of the two.

In figure 1.1 Amanda's capacity is represented by the line that meets the vertical axis at 18 and the horizontal axis at 12. The vertical point indicates that she can produce 18 units of V if she produces zero units of F – keep in mind that where V has a value of 18, Amanda has no time left for fish production. Likewise, if she devotes all of her time to fish she can produce 12 units, since each unit requires 3 of her 36 hours. The point F = 12 is thus another possibility for her. In addition to these two possibilities, which we can term 'specialization', she could allocate her time to producing some of each good. For example, by dividing her 36 hours equally she could produce 6 units of F and 9 units of V. A little computation will quickly convince us that different allocations of her time will lead to combinations of the two goods that lie along a straight line joining the specialization points. We will call this straight line Amanda's **production possibility frontier (PPF)**: it is the combination of goods she can produce while using all of her resources - time. She could not produce combinations of goods represented by points beyond this line (to the top right). She could indeed produce combinations below it (lower left) - for example a combination of 4 units of V and 4 units of F; but such points would not require all of her time. The (4, 4) combination would require just 20 hours. In sum, points beyond this line are not feasible, and points within it do not require all of her time resources.

Production possibility frontier (PPF): the combination of goods that can be produced using all of the resources available.

Having developed Amanda's PPF, it is straightforward to develop a corresponding set of possibilities for Zoe. If she requires 4 hours to produce a unit of V and 2 hours to produce a unit of F, then her 36 hours will enable her to specialize in 9 units of V or 18 units of F; or she could produce a combination represented by the straight line that joins these two specialty extremes.



Consider now what we term the opportunity costs for each person. If Amanda, from a starting point of 18 V and zero F, wishes to produce some F, and less V she must sacrifice 1.5 units of V for each unit of F she decides to produce. This is because F requires 50% more hours than V. Her trade-off is 1.5:1.0, or equivalently 3:2. In the graphic, for every 3 units of V she does not produce she can produce 2 units of F, reflecting the hours she must devote to each. Yet another way to see this is to recognize that if she stopped producing the 18 units of V entirely, she could produce 12 units of F; and the ratio 18:12 is again 3:2. This then is her opportunity cost: the cost of an additional two units of F is that 3 units of V must be 'sacrificed'.

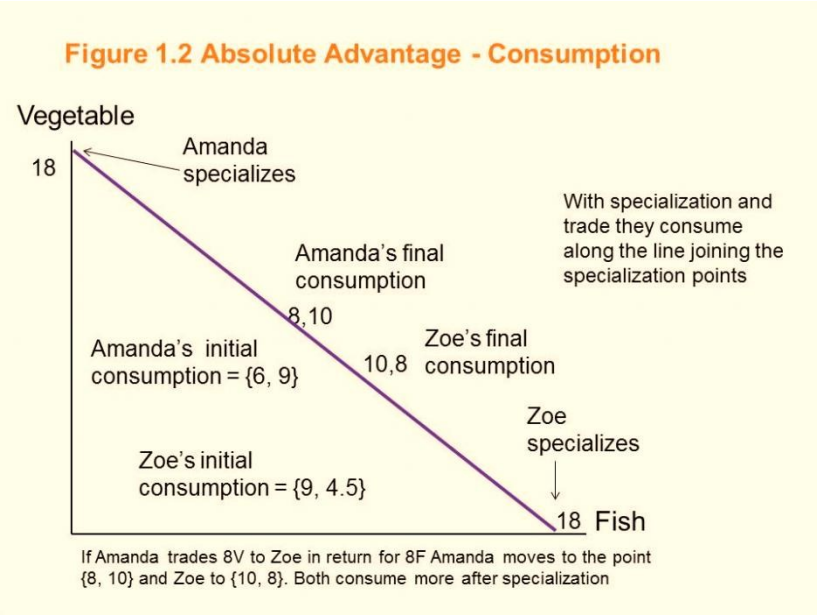
Zoe's opportunity cost, by the same reasoning, is 1:2 - 1 unit of V for 2 units of F.

So we have established two things about Amanda and Zoe's production possibilities. First, if Amanda specializes in V she can produce more than Zoe, just as Zoe can produce more than Amanda if Zoe specializes in F. Second, their opportunity costs are different: Amanda must sacrifice more V than Zoe in producing one more unit of F.

To illustrate the gains from specialization and trade, let us initially suppose that Amanda and Zoe are completely self-sufficient (they consume exactly what they produce), and they each divide their production time equally between the two goods. Hence, Amanda produces and consumes 6F and 9V, whereas Zoe's combination is 9F and 4.5V. These combinations must lie on their respective PPFs and are illustrated in figure 1.1.

Upon realizing that they are not equally efficient in producing the two goods, they decide to specialize completely in producing just the single good where they are most efficient. Amanda specializes in V and Zoe in F. Right away we notice that this allocation of time will realize 18V and 18F, which is more than the combined amounts they produce and consume when not specializing - 15F and 13.5V. Logic dictates that each should be able to consume more following specialization. What they must do however, is negotiate a rate at which to exchange V for F. Since Amanda's opportunity cost is 3:2 and Zoe's is 1:2, perhaps they agree to exchange V for F at an intermediate rate of 2:2 (or 1:1, which is the same). With Amanda specializing in V and Zoe in F they now trade one unit of V for one unit of F. Consider figure 1.2.

If Amanda can trade at a rate of 1:1 her consumption opportunities have improved dramatically: if she were to trade away all of her 18V, she would get 18 fish in return, whereas when consuming what she produced, she was limited to 12 fish. Suppose she wants to consume both V and F and she offers Zoe 8V. Clearly she will get 8F in return, and she will consume (8F + 10V) – more than she consumed prior to specializing.



By the same reasoning, after specializing in producing 18 fish, Zoe trades away 8F and receives 8V from Amanda in return. Therefore Zoe consumes (10F + 8V). The result is that *they are now each consuming more than in the initial allocation. Specialization and trade have increased their consumption*.[1]

1.5 Economy-wide Production Possibilities

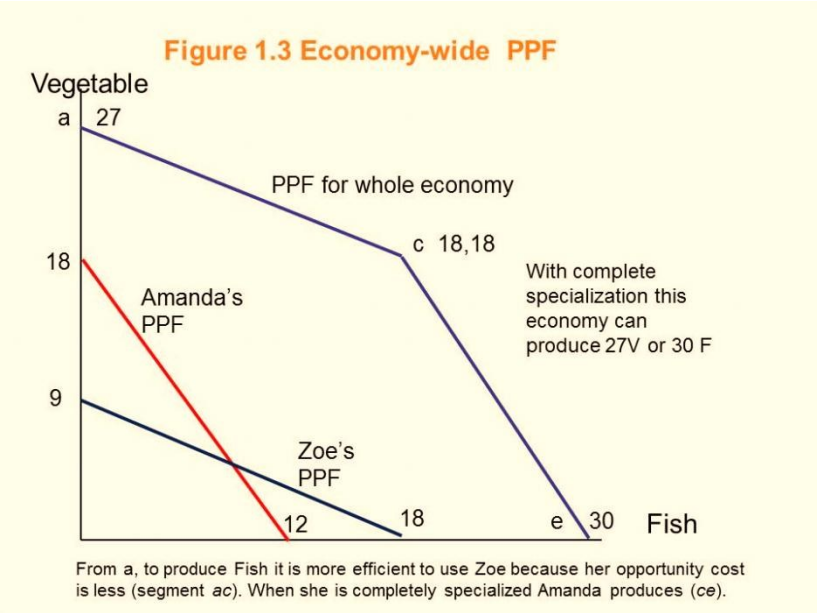
The PPFs in figure 1.1 define the amounts of the goods that each *individual* can produce while using all of their productive capacity - time in this instance. The national, or economy-wide, PPF for this two-person economy reflects these individual possibilities combined. Such a frontier can be constructed using the individual frontiers as the component blocks.

First let us define this economy-wide frontier precisely. The **economy-wide PPF** is the set of goods combinations that can be produced in the economy when all available productive resources are in use. Figure 1.3 contains both of the individual frontiers plus the aggregate of these, represented by the kinked line a, c, e. The point on the V axis, a = 27, represents the total amount of V that could be produced if both individuals devoted all of their time to it. The point e = 30 on the horizontal axis is the corresponding total for fish.

Economy-wide PPF: the set of goods combinations that can be produced in the economy when all available productive resources are in use.

To understand the point c, imagine initially that all resources are devoted to V. From such a point, a, we consider a reduction in V and an increase in F. The most efficient way of increasing F production at the point a is to use the individual whose opportunity cost of F is least - Zoe. She can produce one unit of F by sacrificing just 1/2 unit of V. Amanda on the other hand must sacrifice 1.5 units of V to produce 1 unit of F. Hence, at this stage Amanda should stick to V and Zoe should devote some time to fish. In fact as long as we want to produce more fish Zoe should be the one to do it, until she has exhausted her time, which occurs after she has produced 18F and has ceased producing V. At this point the economy will be producing 18V and 18F - the point *c*

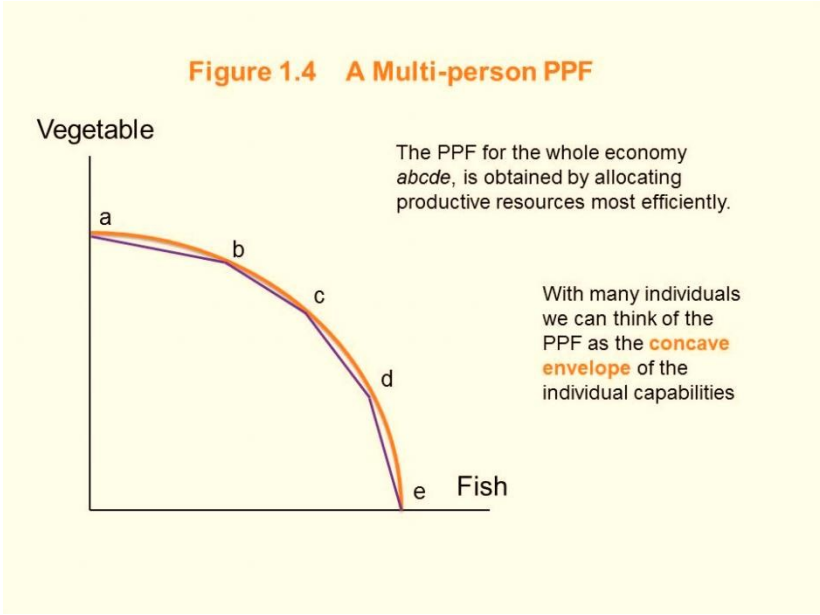
[1] In the situation we describe above one individual is absolutely more efficient in producing one of the goods and absolutely less efficient in the other. We will return to this model in chapter 15 and illustrate that consumption gains of the type that arise here can also result if one of the individuals is absolutely more efficient in produce both goods, but that the degree of such advantage differs across goods.



. From this combination, if the economy wishes to produce more fish Amanda must become involved. Since her opportunity cost is 1.5 units of V for each unit of F, the next segment of the economy-wide PPF must see a reduction of 1.5 units of V for each additional unit of F. This is reflected in the segment c, e. When both producers allocate all of their time to F the economy can produce 30 units. Hence the economy's PPF is the two-segment line *ace*. Since this has an outward kink, we call it concave (rather than convex).

As a final step consider what this PPF would resemble if the economy were composed of many persons with differing degrees of comparative advantage. A little imagination suggests (correctly) that it will have a segment for each individual and continue to have its outward concave form. Hence, a four-person economy in which each person had a different opportunity cost could be represented by the segmented line a,b,c,d,e, in figure 1.4. Furthermore, we could represent the PPF of an economy with a very large number of such individuals by a somewhat smooth PPF that accompanies the 4-person PPF. The logic for its shape continues to be the same: as we produce less V and more F we progressively bring into play resources, or individuals, whose opportunity cost, in terms of reduced V is higher.

The outputs V and F in our economic model require just one input – time. But the argument for a concave PPF where the economy uses machines, labor, land etc. to produce different products is the same. Furthermore, we generally interpret the PPF to define the output possibilities *when it is running at its normal capacity*. In this example, we consider a work week of 36 hours to be the 'norm'. Yet it is still possible that the economy's producers might work some additional time in exceptional circumstances, and this would increase total production possibilities. This event would be represented by an outward movement of the PPF.



1.6 Aggregate Output, Growth & Business Cycles

The PPF can also be used to illustrate three aspects of macroeconomics: the level of a nation's output, the growth of national and per capita output over time, and short run business-cycle fluctuations in national output and employment.

Aggregate output

An economy's capacity to produce goods and services depends on its endowment of resources and the productivity of those resources. The two person – two product examples in the previous section reflect this.

The **productivity of labour**, defined as output per worker or per hour, depends on:

- the skill, knowledge and experience of the labour force
- the **capital stock**: buildings, machinery, and equipment, and software the labour force has to work with, and
- the current technology embodied in the labour force and the capital stock.

Productivity of labour: the output of goods and services per worker.

Capital stock: the buildings, machinery, equipment and software used in producing goods and services.

The economy' output, which we define by Y, can be defined as the output per worker times the number of workers; hence, we can write:

Y = (number of workers employed) x (output per worker).

When the employment of labour corresponds to 'full employment' in the sense that everyone willing to work at current wage rates and normal hours of work is working, the economy's actual output is also its capacity output Y_c. We also term this capacity output as **full employment output**:

Full employment output: Y_c = (number of workers at full employment) x (output per worker)

Suppose the economy is operating with full employment of resources producing outputs of two types: goods and services. In figure 1.5, PPF_0 shows the different combinations goods and services that the economy could produce in a particular year using all its labour, capital and the best technology available at the time.

An aggregate economy produces a large variety of outputs in two broad categories. Goods are the products of the agriculture, forestry, mining, manufacturing and construction industries. Services are provided by the wholesale and retail trade, transportation, hospitality, finance, health care, legal and other service sectors. As in the two-product examples used earlier, the shape of the PPF illustrates the opportunity cost of increasing the output of either product type.

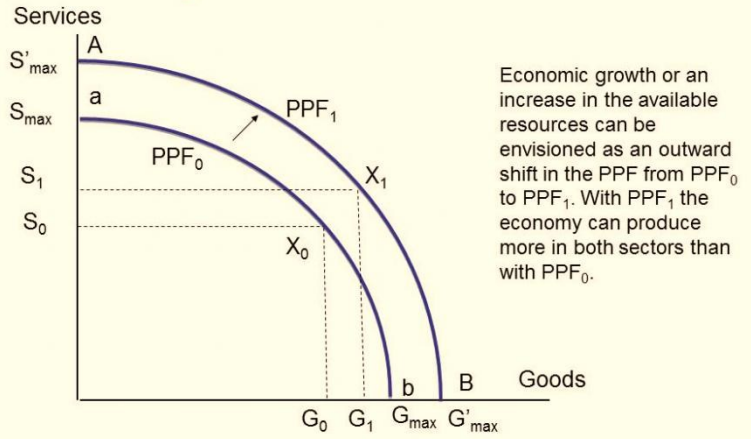
Point X_0 on PPF_0 shows one possible structure of capacity output. This combination may reflect the pattern of demand and hence expenditures in this economy. Output structures differ among economies with different income levels. High-income economies spend more on services than goods and produce higher ratios of services to goods. Middle income countries produce lower ratios of services to goods, and low income countries much lower ratios of services to goods. Different countries also have different PPF's and different output structures, depending on their labour forces, labour productivity and expenditure patterns.

Economic Growth

Three things contribute to growth in the economy. The labour supply grows as the population expands; the stock of capital grows as spending by business on new offices, factories, machinery and equipment expands; and labour-force productivity grows as a result of experience, the development of scientific knowledge combined with product and process innovations, and advances in the technology of production. Combined, these developments expand

capacity output. In Figure 1.5 economic growth shifts the PPF out to PPF_1.

Figure 1.5 Growth and the PPF



This basic description of economic growth covers the key sources of growth in total output. Economies differ in their rates of overall economic growth as a result of different rates of growth in labour force, in capital stock, and improvements in the technology. But improvements in standards of living require more than growth in total output. Increases in output *per worker* and *per person* are necessary. Sustained increases in living standards require sustained growth in labour productivity based on advances in the technologies used in production.

Recessions and Booms

The objective of economic policy is to ensure that the economy operates on or near the PPF – it would use its resources to capacity and have minimal unemployment. However, economic conditions are seldom tranquil for long periods of time. Unpredictable changes in business expectations of future profits, in consumer confidence, in financial markets, in commodity and energy prices, in output and incomes in major trading partners, in government policy and many other events disrupt patterns of expenditure and output. Some of these changes disturb the level of total expenditure and thus the demand for total output. Others disturb the conditions of production and thus the economy's production capacity. Whatever the exact cause, the economy may be pushed off its current PPF. If expenditures on goods and services decline the economy may experience a **recession.** Output would fall short of capacity output and unemployment would rise. Alternatively, times of rapidly growing expenditure and output may result in an economic **boom**: output and employment expand beyond capacity levels.

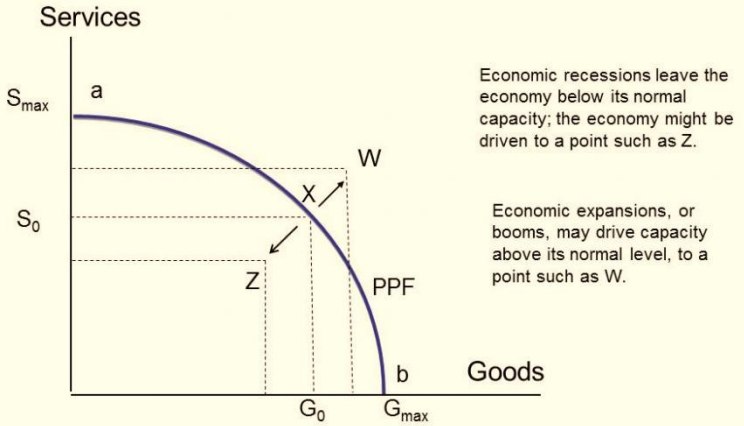
Recession: a fall in output to less than the economy's capacity output.

Boom: a period of high growth that raises output above normal capacity output.

Recent history provides examples. Following the U.S financial crisis in 2008-09 many industrial countries were pushed into recessions. Expenditure on new residential construction collapsed for lack of income and secure financing, as did business investment, spending and exports. Lower expenditures reduced producers' revenues, forcing cuts in output and employment and reducing household incomes. Lower incomes led to further cutbacks in spending. In Canada in 2009 aggregate output declined by 2.9 percent, employment declined by 1.6 percent and the unemployment rate rose from 6.1 percent in 2008 to 8.3 percent. Although economic growth recovered, that growth had not been strong enough to restore the economy to capacity output at the end of 2011. The unemployment rate fell to 7.4 but did not return to its pre-recession value.

An economy in a recession is operating inside its PPF. The fall in output from X to Z in figure 1.6 illustrates the effect of a recession. Expenditures on goods and services have declined. Output is less than capacity output, unemployment is up and some plant capacity is idle. Labour income and business profits are lower. More people would like to work and business would like to produce and sell more output but it takes time for interdependent product, labour and financial markets in the economy to adjust and increase employment and output. Monetary and fiscal policy may be needed to stimulate demand, increase output and employment and move the economy back to capacity output and full employment. The development and implementation of such policies forms the core of macroeconomics.

Figure 1.6 Booms and Recessions



Alternatively, an unexpected increase in demand for exports would increase output and employment. Higher employment and output would increase incomes and expenditure, and in the process spread the effects of higher output sales to other sectors of the economy. The economy would move outside its PPF as at W in figure 1.6 by using its resources more intensively than normal. Unemployment would fall and overtime work would increase. Extra production shifts would run plant and equipment for longer hours and work days than were planned when it was designed and installed. Output at this level may not be sustainable, because shortages of labour and materials along with excessive rates of equipment wear and tear would push costs and prices up. Again we will examine how the economy reacts to such a state in our macroeconomic analysis.

Output and employment in Canadian economy over the past twenty years fluctuated about growth trend in the way figure 1.6 illustrates. For several years prior to 2008 the Canadian economy operated slightly above the economy's capacity; but once the recession arrived monetary and fiscal policy were used to fight it – to bring the economy back from a point such as Z to a point such as X on the PPF.

Macroeconomic models and Policy

The PPF diagrams illustrate the main dimensions of macroeconomics: capacity output, growth in capacity output and business cycle fluctuations in actual output relative to capacity. But these diagrams do not offer explanations and analysis of macroeconomic activity. We need a macroeconomic *model* to understand and evaluate the causes and consequences of business cycle fluctuations. As we shall see, these models are based on explanations of expenditure decisions by households and business, financial market conditions, production costs and producer pricing decisions at different levels of output. Models also capture the objectives of fiscal and monetary policies and provide a framework for policy evaluation. A full macroeconomic model integrates different sector behaviours and the feedbacks across sectors that can moderate or amplify the effects of changes in one sector on national output and employment.

Similarly, an economic growth model provides explanations of the sources and patterns of economic growth. Demographics, labour market structures and institutions, household expenditure and saving decisions, business decisions to spend on new plant and equipment and on research and development, government policies in support of

education, research, patent protection, competition and international trade conditions interact in the growth process. They drive the growth in the size and productivity of the labour force, the growth in the capital stock, and the advances in technology that are the keys to growth in aggregate output and output per person.

Conclusion

We have covered a lot of ground in this introductory chapter. It is intended to open up the vista of economics to the new student in the discipline. Economics is powerful and challenging, and the ideas we have developed here will serve as conceptual foundations for our exploration of the subject. Our next chapter deals with methods and models in greater detail.

KEY CONCEPTS

Macroeconomics studies the economy as system in which feedbacks among sectors determine national output, employment and prices (1.1).

Microeconomics is the study of individual behavior in the context of scarcity (1.1).

Mixed economy: goods and services are supplied both by private suppliers and government (1.1).

Model is a formalization of theory that facilitates scientific enquiry (1.2).

Theory is a logical view of how things work, and is frequently formulated on the basis of observation (1.2).

Opportunity cost of a choice is what must be sacrificed when a choice is made (1.3).

Production possibility frontier (PPF) defines the combination of goods that can be produced using all of the resources available (1.4).

Economy-wide PPF is the set of goods combinations that can be produced in the economy when all available productive resources are in use (1.5).

Productivity of labour is the output of goods and services per worker (1.6).

Capital stock: the buildings, machinery, equipment and software used in producing goods and services (1.6).

Full employment output Y_c = (number of workers at full employment) x (output per worker) (1.6)

Recession: when output falls below the economy's capacity output (1.7).

Boom: a period of high growth that raises output above normal capacity output (1.7).

2

Theories, Models and Data

In this chapter we will explore:

1. Economic theories and models
2. Variables, data & index numbers
3. Testing, accepting, and rejecting models
4. Diagrams and economic analysis
5. Ethics, efficiency and beliefs

Economists, like other scientists and social scientists are interested observers of behaviour and events. Economists are concerned primarily with the *economic* causes and consequences of what they observe. They want to understand the economics of an extensive range of human experience including: money, government finances, industrial production, household consumption, inequality in income distribution, war, monopoly power, professional and amateur sports, pollution, marriage, music, art and much more.

Economists approach these issues using economic theories and models. To present, explain, illustrate and evaluate their theories and models they have developed a set of techniques or tools. These involve verbal descriptions and explanations, diagrams, algebraic equations, data tables and charts and statistical tests of economic relationships.

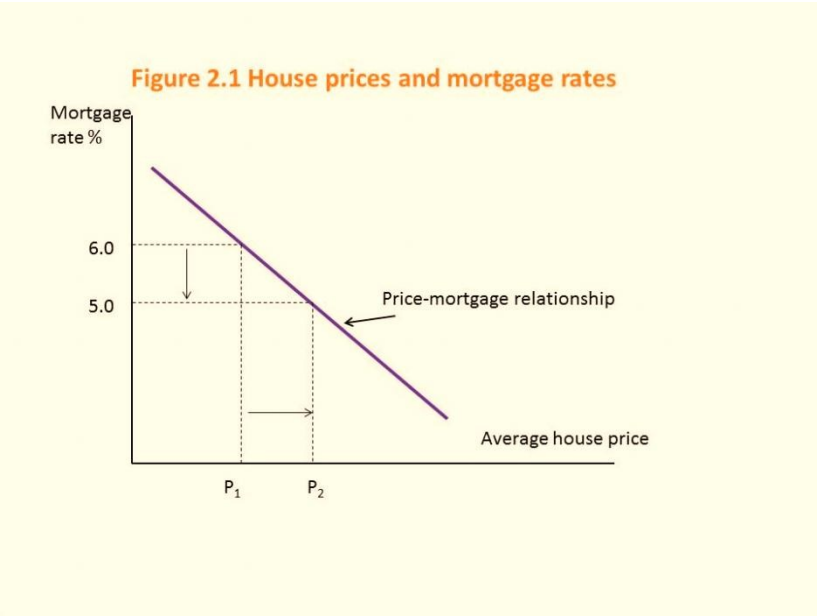
This chapter covers these basic techniques of economic analysis.

2.1 Observations, Theories and Models

In recent years the prices of residential housing have been rising at the same time as conventional mortgage interest rates have been low and falling relative to earlier time periods. These changes might be unrelated, each arising from some other conditions, or they might be related with rising housing prices pushing interest rates down, or perhaps low and falling mortgage rates push housing prices up. Each is a possible hypothesis or theory about the relationship between house prices and interest rates.

An economist would choose the third explanation based on economic logic. Mortgage rates determine the cost of financing the purchase of a house. A lower mortgage rate means lower monthly payments per dollar of financing. As a result buyers can purchase higher priced houses for any given monthly payment. Low and falling mortgage rates allow potential buyers to offer higher prices and potential sellers to expect higher prices. Lower mortgage rates may be an important cause of higher house prices. The reverse argument follows, namely that rising mortgage rates would cause lower house prices. In general terms, house prices are *inversely related* to mortgage interest rates.

A two dimensional diagram such as Figure 2.1 is an effective way to illustrate this basic model. Mortgage interest rates are measured on the vertical axis. Average house prices are measured on the horizontal axis. The *downward sloping line* in the diagram illustrates the *inverse* relationship between a change in mortgage rates and house prices predicted by the model. In the diagram, a fall in mortgage rates from 6.0 percent to 5.0 percent raises average house prices from P_1 to P_2.



Of course this model is very simple and naive. It formalizes an essential economic element of the theory. House prices may also depend on other things such as population growth and urbanization, new house construction, rental rates, family incomes and wealth, confidence in future employment and economic growth and so forth. By concentrating on interest rates and house prices the model argues that this relationship is the key explanation of short term changes in house prices. Other factors may be important but they evolve and change more slowly than mortgage rates.

A model reduces and simplifies. Its focus is on the relationship the economist sees as the most important. In this example it assumes that things other than the mortgage rate that might affect house prices are constant. A change in one or more of the conditions assumed constant might change house prices at every interest rate. That would mean a change the *position* of the mortgage rate – house price line but not the basic mortgage rate – house price relationship.

The mortgage rate – house price model can also be illustrated using simple algebra. Equation 2.1 describes average house price P_H in terms of a constant P_{Ho} and the mortgage rate MR.

$$P_H = P_{Ho} - bMR \qquad (2.1)$$

The negative sign in the equation defines the inverse relationship between house prices and mortgage rates suggested by the model. A fall in the mortgage rate MR would cause an increase in the average house price P_H.

The size of the change in the average house price caused by a change in the mortgage rate is measured by the parameter 'b' in the equation. We argue that the sign attached to 'b' is negative and that 'b' has important size, but that argument needs to be tested. A model is only useful if the economic relationship it defines is supported by actual observations. Observations generate the facts or data needed for the conception and testing of a model.

2.2 Variables, Data & Index Numbers

Economic theories and models are concerned with economic variables. **Variables** are measures that can take on different sizes. The interest rate on a student loan, for example, is a variable with a certain value at a point in time but perhaps a different value at an earlier or later date. Economic theories and models explain the *causal* relationships between variables.

Variables: measures that can take on different values.

Data are the recorded values of variables. Sets of data provide specific values for the variables we want to study and analyze. Knowing that the Don Valley Parkway is congested does not tell us how slow our trip to downtown Toronto will be. To choose the best route downtown we need to ascertain the *degree of congestion*—the

data on traffic density and flow on alternative routes. A model is useful because it defines the variables that are most important and to the analysis of travel time and the data that are required for that analysis.

Data: recorded values of variables.

Sets of data also help us to test our models or theories, but first we need to pay attention to the economic logic involved in observations and modeling. For example, if sunspots or baggy pants were found to be correlated with economic expansion, would we consider these events a coincidence or a key to understanding economic growth? The observation is based on facts or data but it need not have any economic content. The economist's task is to distinguish between coincidence and economic causation.

While the more frequent wearing of loose clothing in the past may have been associated with economic growth because they both occurred at the same time (correlation), one could not argue on a logical basis that this behaviour *causes* good economic times. Therefore, the past association of these variables should be considered as no more than a coincidence.

Once specified on the basis of economic logic, a model must be tested to determine its usefulness in explaining observed economic events. The earlier example of a model of house prices and mortgage rates was based on the economics of the effect of financing cost on expenditure and prices. But we did not test that model by confronting it with the data. It may be that effects of mortgages rates are insignificant compared to other influences on house prices.

Time-Series Data

Data come in several forms. One form is **time-series**, which reflects a set of measurements made in sequence at different points in time. Table 2.1 reports the annual time series values for several price series. Such information may also be presented in charts or graphs. Figure 2.1 plots the data from column 2, and each point represents the data observed for a specific time period. The horizontal axis reflects time in years, the vertical axis price in dollars.

Time series: a set of measurements made sequentially at different points in time.

Annual data report one observation per year. We could, alternatively, have presented them in quarterly, monthly, or even weekly form. The frequency we use depends on the purpose: If we are interested in the longer-term trend in house prices, then the annual form suffices. In contrast, financial economists, who study the behavior of stock prices, might not be content with daily or even hourly prices; they may need prices minute-by-minute. Such data are called **high-frequency** data, whereas annual data are **low-frequency** data.

High (low) frequency data: series with short (long) intervals between observations.

TABLE 2.1 House Prices and Price Indexes

1	2	3	4	5
Date	**Price of detached bungalows, N. Vancouver**	**House price index**	**CPI**	**Real house price index**
1999Q1	330,000	100.0	100.00	100.00
2000Q1	345,000	104.55	101.29	103.21
2001Q1	350,000	106.06	104.63	101.37
2002Q1	360,000	109.09	105.49	103.41
2003Q1	395,000	119.70	108.61	110.21
2004Q1	434,000	131.52	110.01	119.55
2005Q1	477,000	144.55	112.81	128.13
2006Q1	580,000	175.76	114.32	153.75
2007Q1	630,000	190.91	117.33	162.71
2008Q1	710,000	215.15	118.62	181.38
2009Q1	605,000	183.33	120.56	152.07
2010Q1	740,000	224.24	125.40	178.96
2011Q1	800,000	242.42	129.06	187.83
2012Q1	870,000	263.33	131.00	210.02

Source: Prices for North Vancouver houses come from Royal Le Page; CPI from Statistics Canada, CANSIM II, V41692930 and author's calculations.

When data are presented in charts or when using diagrams the scales on the axes have important visual effects. Different scales on either or both axes alter the perception of patterns in the data. To illustrate this, the data from columns 1 and 2 of Table 2.1 are plotted in Figures 2.2a and 2.2b, but with a change in the scale of the vertical axis. The greater *apparent* slope in Figure 2.2a a might easily be interpreted to mean that prices increased more steeply than suggested in Figure 2.2b. But a careful reading of the axes reveals that this is not so; using different scales when plotting data or constructing diagrams can mislead the unwary viewer.

Figure 2.2a House prices in dollars
North Vancouver 1999 - 2012

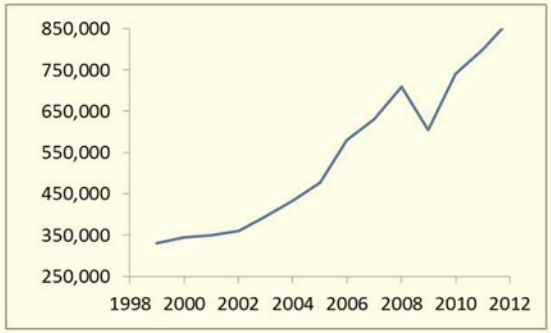
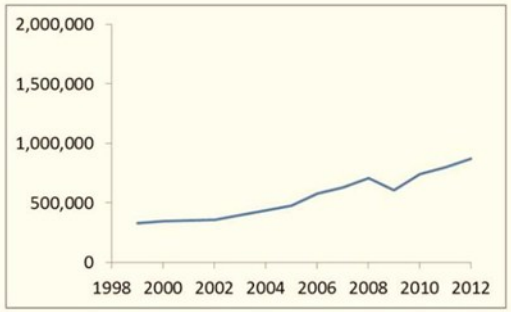


Figure 2.2b House prices in dollars
North Vancouver 1999-2009



Cross-Section Data

In contrast to time-series data, **cross-section data** record the values of different variables at a point in time. Table 2.2 contains a cross-section of unemployment rates for Canada and Canadian provinces economies. For January 2012 we have a snapshot of the provincial economies at that point in time, likewise for the months until June. This table therefore contains **repeated cross-sections**..

When the unit of observation is the same over time such repeated cross sections are called longitudinal data. For example, a health survey that followed and interviewed the same individuals over time would yield longitudinal data. If the individuals differ each time the survey is conducted, the data are repeated cross sections. **Longitudinal data** therefore follow the same units of observation through time.

Table 2.2 Unemployment rates, Canada and Provinces, monthly 2012
(% seasonally adjusted)

	Jan	Feb	Mar	Apr	May	Jun
CANADA	7.6	7.4	7.2	7.3	7.3	7.2
NFLD	13.5	12.9	13.0	12.3	12.0	13.0
PEI	12.2	10.5	11.3	11.0	11.3	11.3
NS	8.4	8.2	8.3	9.0	9.2	9.6
NB	9.5	10.1	12.2	9.8	9.4	9.5
QUE	8.4	8.4	7.9	8.0	7.8	7.7
ONT	8.1	7.6	7.4	7.8	7.8	7.8
MAN	5.4	5.6	5.3	5.3	5.1	5.2
SASK	5.0	5.0	4.8	4.9	4.5	4.9
ALTA	4.9	5.0	5.3	4.9	4.5	4.6
BC	6.9	6.9	7.0	6.2	7.4	6.6

Source: Statistics Canada CANSIM Table 282-0087

Cross-section data: values for different variables recorded at a point in time.

Longitudinal data: follow the same units of observation through time

Index Numbers

It is important in economic analysis to discuss and interpret data in a meaningful manner. **Index numbers** help us greatly in doing this. They are values of a given variable, or an average of a set of variables expressed relative to a base value. The key characteristics of indexes are that they are *not dependent upon the units of measurement of the data in question, and they are interpretable easily with reference to a given base value.* To illustrate, let us change the price data in column 2 of Table 2.1 into index number form.

Index number: value for a variable, or an average of a set of variables, expressed relative to a given base value.

The first step is to choose a base year as a reference point. This could be any one of the periods. We will simply take the first period as the year and *set the price index value equal to 100 in that year*. The value of 100 is usually chosen in order to make comparisons simple, but in some cases a base year value of 1.0 is used. If the base year value of 100 is used, the value of index in any year 't' is:

$$\textbf{Value of index} = \frac{\textbf{Absolute value in year t}}{\textbf{Absolute value in base year}} \times \mathbf{100} \qquad (2.2)$$

Suppose we choose 1999 as the base year for constructing an index of the house prices given in Table 2.1 House prices in that year were $330,000. Then the *index for the base year* has a value:

$$\text{Index in } 1999 = \frac{\$330{,}000}{\$330{,}000} \times 100 = 100$$

Applying the method to each value in column 2 yields column 3, which is now in index number form. For example, the January 2003 value is:

$$\text{Index for } 2003 = \frac{\$395{,}000}{\$330{,}000} \times 100 = 119.7$$

Each value in the index is interpreted relative to the value of 100, the base price in January 1999. The beauty of this column lies first in its *ease of interpretation*. For example, by 2003 the price increased to 119.7 points relative to a value of 100. This yields an immediate interpretation: The index has increased by 19.7 points *per hundred* or *percent*. While it is particularly easy to compute a percentage change in a data series when the base value is 100, it is not necessary that the reference point have a value of 100. By definition, a **percentage change** is given by the change in values relative to the initial value, multiplied by 100. For example, the percentage change in the price from 2006 to 2007, using the price index is: (190.91 – 175.76)/175.76 × 100 = 8.6 percent.

Percentage change: (change in values) / original value × 100

Furthermore, index numbers enable us to make *comparisons with the price patterns for other goods* much more easily. If we had constructed a price index for wireless phones, which also had a base value of 100 in 1999, we could make immediate comparisons without having to compare one set of numbers defined in dollars with another defined in tens of thousands of dollars. In short, index numbers simplify the interpretation of data.

Composite Index Numbers

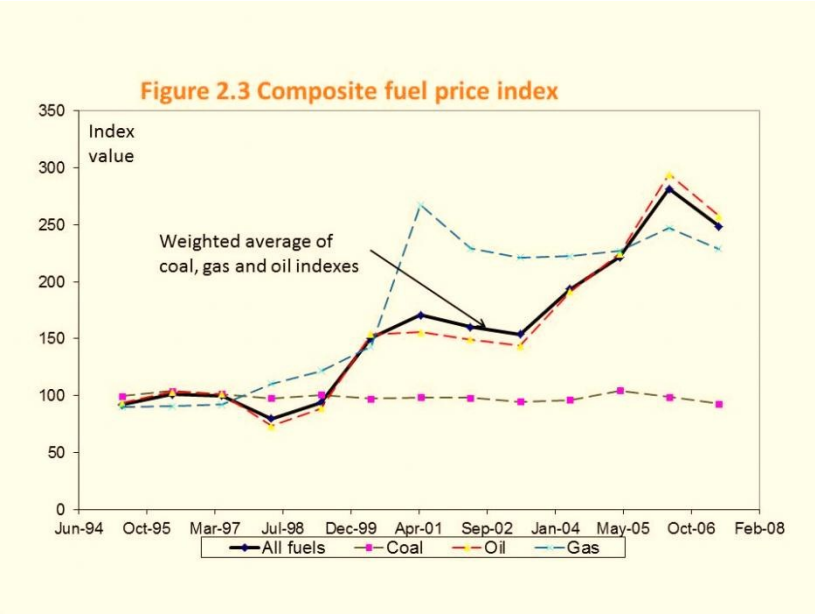
Index numbers have even wider uses than those we have just described. Suppose you are interested in the price trends for all fuels as a group in Canada during the last decade. You know that this group includes coal, natural gas, and oil, but you suspect that these components have not all been rising in price at the same rate. You also know that, while these fuels are critical to the economy, some play a bigger role than others, and therefore should be given more importance, or weight, in a general fuel price index. In fact, the official price index for these fuels is a *weighted average of the component price indexes*. The fuels that are more important get a heavier weighting in the overall index. For example, if oil accounts for 60 percent of fuel use, natural gas for 25 percent, and coal for 15 percent, the price index for fuel could be computed as follows:

$$\textbf{Fuel price index} = \textbf{oil index} \times 0.6 + \textbf{natural gas index} \times 0.25 + \textbf{coal index} \times 0.15 \qquad (2.3)$$

To illustrate this, Figure 2.3 presents the price trends for these three fuels. The data come from Statistics Canada's CANSIM database. In addition, the overall fuel price index is plotted. It is frequently the case that components do not display similar patterns, and in this instance the composite index follows oil most closely, reflecting the fact that oil has the largest weight.

Other Composite Price Indexes

The fuels price index is just one of many indexes constructed to measure a composite group of economic variables. There are also published indexes of commodity prices, including and excluding fuels, agricultural prices, average hourly earnings, industrial production, unit labour costs, Canadian dollar effective exchange rate (CERI), the S&P/TSX stock market prices and consumer prices to list just a few. All these indexes are designed to reduce the complexity of the data on key sectors of the economy and important economic conditions.



The **consumer price index (CPI)** is the most widely quoted price index in the economy. It measures the average price level in the economy and changes in the CPI provide measures of the rate at which consumer goods and services change in price—**inflation** if prices increase, **deflation** if prices decline.

The CPI is constructed in two stages. First, a consumer expenditure survey is use to establish the importance or weight of each of eight categories in a 'basket' of goods and services. Then the cost of this basket of services in a particular year is compared to its cost in the chosen base year. With this base year cost of the basket set at 100 the ratio of the cost of the same basket in any other year to its cost in the base year multiplied by 100 gives the CPI for that year. The CPI for any given year is:

$$\mathbf{CPI_t = \frac{Cost\ of\ basket\ in\ year_t}{Cost\ of\ basket\ in\ base\ year} \times 100} \qquad \mathbf{(2.3)}$$

Consumer price index: the average price level for consumer goods and services

Inflation rate: the annual percentage *increase* in the consumer price index

Deflation rate: the annual percentage *decrease* in the consumer price index

Using Price Indexes

The CPI is useful both as an indicator of how much prices change in the aggregate, and also as an indicator of *relative price* changes. Column 4 of Table 2.1 provides the Vancouver CPI with the same base year as the North Vancouver house price index. Note how the two indexes move very differently over time. The price of housing has increased considerably *relative to the overall level of prices* in the local economy, as measured by the CPI: Housing has experienced a *relative price increase*, or a **real price index**. This real increase is to be distinguished from the **nominal price index**, which is measured without reference to overall prices. The real price index for housing (or any other specific product) is obtained by dividing its specific price index by the CPI.

Real house price index = (nominal house price index/CPI) × 100

Real price index: a nominal price index divided by the consumer price index, scaled by 100

Nominal price index: the current dollar price of a good or service

The resulting index is given in column 5 of Table 2.1. This index has a simple interpretation: It tells us by how much the price of Vancouver houses has changed relative to the general level of prices for goods and services. For example, between 1999 and 2004 the number 119.55 in column 5 for the year 2004 indicates that housing increased in price by 19.55 percent *relative to prices in general*.

Table 2.3 Nominal and Real Earnings in Canada 2003 - 2011

Nominal earnings			Real earnings		
Year	**Average weekly earnings**	**Average hourly earnings**	**CPI**	**Average weekly earnings**	**Average hourly earnings**
2003	100.0	100.0	100.0	100.0	100.0
2004	102.7	102.7	101.8	100.8	100.9
2005	106.7	106.2	104.2	102.4	101.9
2006	109.4	108.8	106.1	103.0	102.5
2007	114.1	113.8	108.5	105.2	104.9
2008	117.4	117.7	111.0	105.7	106.1
2009	119.2	121.3	111.3	107.1	109.0
2010	123.5	125.0	113.3	109.0	110.3
2011	126.6	127.5	116.6	108.6	109.4

Source: Statistics Canada, CANSIM Series V1558664, V1606080 and V41690914 and author's calculations

Here is a further simple example. Table 2.3 reports recent annual data on indexes of **nominal earnings**, measured in current dollars, both average weekly and hourly rates, over the 2003-2011 time period. The table also reports the consumer price index for the same time period. To simplify the illustration all indexes have been *rebased to 2003 = 100* by dividing the reported value of the index in each year by its value in 2003 and multiplying by 100.

The table shows the difference between changes in nominal and real earnings. **Real earnings** are measured in constant dollars adjusted for changes in the general price level. The adjustment is made by dividing the indexes of nominal earnings in each year by the consumer price index in that year and multiplying by 100.

Nominal earnings: earnings measured in current dollars

Real earnings: earnings measure in constant dollars to adjust for changes in the general price level

As measured by the nominal weekly and hourly indexes, nominal earnings increased by 26 to 27 percent over the eight year period 2003-2011. However, the general price level as measured by the consumer price index (CPI) increased by close to 17 percent over the same period. As a result, real earnings, measured in terms of the purchasing power of nominal earnings increased by only about 9 percent, notable less than in 26 percent increase in nominal earnings.

These observations illustrate two important points. First the distinction between real and nominal values is very important. If the general price level is changing, changes in real values will differ from changes in nominal values. Real values change by either less or more than changes in nominal values. Second, in addition to tracking change over time, index numbers used in combination simplify the adjustment from nominal to real values, as shown in both Table 2.1 and 2.3

However, a word of caution is necessary. Index numbers can be used to track both nominal and real values over time but they do not automatically adjust for change in the quality of products and services or the changing patterns of output and use in the cases of composite indexes. Index number bases and weights need constant adjustment to deal with these issues.

2.3 Testing Economic Models and Analysis

Let us now investigate the interplay between models and data by means of a couple of examples.

The first simple economic model we proposed related house prices and mortgage rates. That model argued that an important cause of the recently observed rise in house prices was the decline in mortgage interest rates. Figure 2.1 illustrated that relationship with a diagram and equation 2.1 put the model in terms of basic algebra.

The logic of the model is based on the effects of the costs of financing on prices and specifically on house prices. Lower mortgage rates make financing house purchases more affordable and lower the income criteria that mortgage lenders apply to mortgage approvals. Potential buyers can afford higher priced houses and potential sellers may expect to get more for their properties. As a result, our model argues that lower mortgage rates push up house prices.

There is also an important policy issue here. On several occasions the federal government minister of finance has expresses concerns about low mortgage rates and long mortgage terms as a potential cause of a house price 'bubble'. Experience with house price increases in other countries leading up to the financial crisis of 2008 provides a solid basis for this concern. As a result starting in 2008 and as recently as 2012 the federal government has taken action to discourage competitive reductions in mortgage rates, to limit the terms and amortization periods and to increase down payment requirements for new mortgages. The underlying rationale for these actions is the belief that higher mortgage rates, shorter terms and higher down payments will relieve upward pressure on house prices.

Let us now formalize the above ideas into an economic model of house prices. Several factors influence house prices and mortgage rates are one; another is the income of the potential buyers; a third is the number of houses or condominiums that come on the market – either new or not; a fourth could be the growth in population in the area where we are exploring house prices. If we think these are the main determinants of house prices then we could formalize this theory in the following model:

House prices = f(mortgage rate, incomes, supply of housing offered on the market, population growth……)

The notation *f(...)* means that the variable on the left-hand side of the equation is *a function of* the variables inside the parentheses. This equation is, therefore, an economic model that links behaviour to its main determinants.

Evidence

To support or reject the above models, we need to confront them with data. Unlike natural sciences, economics is a social science; therefore we rarely have data that come from laboratory experiments. Most of our research uses data collected over periods of time during which many relevant factors change simultaneously. A basic challenge in testing is how to disentangle the separate influences of these changing factors.

Table 2.4 contains data on the 5-year conventional mortgage interest rate and an index of resale-housing prices, quarterly for the period from the first quarter of 2007 to the fourth quarter of 2011. The house price index has a base value of 100 in the last quarter of 2006, and reflects a weighted average of detached bungalows, executive and detached two-story houses. Figure 2.4 is a **scatter diagram** of the data in Table 2.4.

A **Scatter diagram** plots pairs of values simultaneously observed for two variables.

A clear negative relationship between the two variables is evident in figure 2.4. A higher mortgage rate is associated with lower house prices.

Fitting Lines through the Scatter Plot

A line through the scatter of points in Figure 2.4 shows the average relationship between mortgage rates and house prices. A challenge is to define the line that most accurately characterizes the

relationship. This task is the job of **econometricians**, who practice **econometrics**. Econometrics is the science of examining and quantifying relationships between economic variables. It attempts to determine the separate influences of each variable, in an environment where many things move simultaneously.

Econometrics is the science of examining and quantifying relationships between economic variables

Table 2.4 Mortgage rates and house prices Canada 2007-2011

Year, quarter	5-year conventional mortgage rate	Resale house price index 2006q4 = 100
2007Q1	6.5	108.4
2007Q2	7.2	118.4
2007Q3	7.2	128.7
2007Q4	7.5	139.4
2008Q1	7.2	150.5
2008Q2	7.2	157.1
2008Q3	6.9	160.9
2008Q4	6.8	157.2
2009Q1	5.8	149.2
2009Q2	5.8	143.4
2009Q3	5.5	142.2
2009Q4	5.5	149.9
2010Q1	5.9	167.3
2010Q2	5.9	183.7
2010Q3	5.4	195.4
2010Q4	5.2	207.5
2011Q1	5.3	218.5
2011Q2	5.4	231.0
2011Q3	5.2	246.9
2011Q4	5.3	262.5

Source: Mortgage rate: Statistics Canada, CANSIM Series V122521; Resale Housing Price index: www.royallepage.com, and authors' calculations

Figure 2.4 House prices and the mortgage rate

In two dimensions, the line drawn through the scatter is chosen to minimize the sum of distances (or distances squared) between the line and the various points. It is called a **regression line** or a trend line if the data are in time-series form. Computer algorithms that do this are plentiful, and fortunately computers can work in many

dimensions in order to capture the influences of *all* the variables simultaneously[1].

Regression line: representation of the average relationship between two variables in a scatter diagram

2.4 Diagrams and Economic Analysis

Much of our economic analysis can be developed with the help of simple two-dimensional linear diagrams. Such diagrams and graphics contain economic information – information that can be obtained by examining the properties of the regression lines that we fit through scatter plots. Consider another linear example: Imagine that we survey a group of economics students on their car use and how it would vary with a tax imposed on gasoline. Such a tax might be a carbon tax designed to reduce greenhouse gases. Our survey involves asking them how many liters of gas they would purchase at different tax rates. Evidently, at high rates they purchase less and at low rates they purchase more.

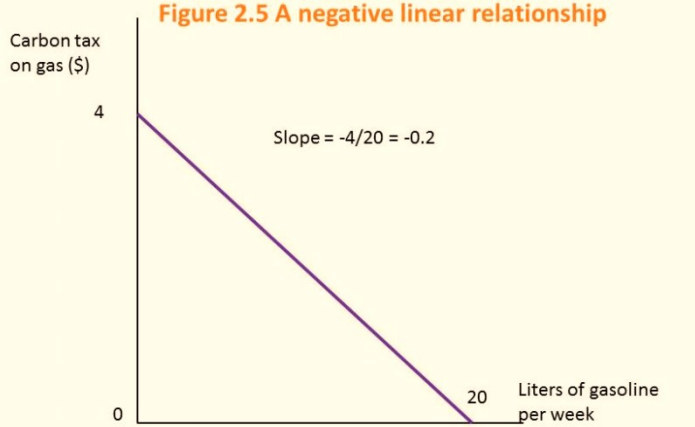
Having performed the survey, and plotted the scatter of points that represent their answers, we again fit a regression line through the points and project this regression line to meet each axis. The outcome to our experiment is represented in figure 2.5. The line meets the vertical axis at a value of $4 and the horizontal axis at 20 liters. The $4 intercept value means that if the tax, which goes on top of the distributor's price, becomes this high, no student will drive their car (gasoline purchases are zero). In contrast, if the tax falls towards zero and only the distributor's price is payable, students will use 20 liters of gas per week. And the downward slope of the line tells us that more gasoline is purchased at lower tax rates.

[1] Note in figure 2.4 that the vertical axis begins at the value of 4, and the horizontal axis begins at a value of 100.

When the function is a straight line, two pieces of information fully describe the relationship: the **intercept** and the **slope**. The vertical intercept is the height of the line when the variable on the horizontal axis has a zero value - in Figure 2.5 it has a value of 4.

Intercept of a line: height of the line on one axis when the value of the variable on the other axis is zero.

Figure 2.5 A negative linear relationship



A straight line is defined totally by the intercept – where the line meets one of the axes, and the slope – the ratio of the vertical to horizontal distances over any line segment. Downward sloping lines have negative slope; upward sloping lines have positive slope.

The slope of the line indicates the amount by which the variable on the vertical axis increases in response to a change in the value of the variable on the horizontal axis. Since this is a straight line, the slope is constant throughout. It is measured as the ratio of the vertical distance divided by the horizontal distance for any segment of the line.

Slope of a line: ratio of the change in the value of the variable measured on the vertical axis to the change in the value of the variable measured on the horizontal axis (i.e.: rise/run).

In this example, that ratio is given by −4/20 = −1/5 = −0.2. It is negative, since an increase in one variable is associated with a decrease in the other. We can now define a linear equation for this regression line:

$$T = 4 - 0.2 \times L$$

T denotes the tax and L defines the liters of gas. To verify that this indeed represents the line, remember that the (vertical) intercept reflects the value of T when L is zero. In this equation a zero value of L yields:

$$T = 4 - 0.2 \times 0 = 4.$$

Second, the number 0.2 is the slope. It indicates that, for every unit change in L, the T variable changes by 0.2 points. Since there is a negative sign governing the term, an increase in L is associated with a *decline* in T. In geometric terms; the line is negatively sloped.

It is worth repeating that this line is an average representation of the relationship between the two variables; it does not go through every point in the scatter diagram. For any mortgage rate value that is fed into the equation, we obtain a corresponding price of houses, (or for any price of house value that is fed into the equation we can solve for a corresponding mortgage rate). The prediction therefore always lies on the line, whereas the actual value seldom does. When the predictions and the actual values are very close to one another, i.e., where the scatter is closely concentrated around the regression line, we say that the line is a *good fit*.

Finally note that economic relationships need not be linear; we could imagine fitting a slightly curved function through the scatter in figure 2.4. Such a curved function might result in the points being slightly closer to such a line on average. But to maintain simplicity we will work with linear functions and lines throughout. Furthermore, economic relationships are not unchanging. Had we constructed a scatter plot for earlier or later years in figure 2.4, the slope and intercepts of the regression line that best represented the extended data set might well have been different.

2.5 Ethics, Efficiency and Beliefs

Positive economics studies objective or scientific explanations of how the economy functions. Its aim is to understand and generate predictions about how the economy may respond to changes and policy initiatives. In this effort economists strive to act as detached scientists, regardless of political sympathies or ethical code. Personal judgments and preferences are (ideally) kept apart. In this particular sense, economics is similar to the natural sciences such as physics or biology.

Positive economics studies objective or scientific explanations of how the economy functions

In contrast, **normative economics** offers recommendations based partly on value judgments. While economists of different political persuasions can agree that raising the income tax rate would lead to a general reduction in the number of hours worked, they may yet differ in their views on the advisability of such a rise. One may believe that the additional revenue that may come in to government coffers is not worth the disincentives to work; another may think that, if such monies can be redistributed to benefit the needy or provide valuable infrastructure, the negative impact on the workers paying the income tax is worth it.

Application box 2.1: Statistics for policy makers

Data are an integral part of policy making in the public domain. A good example of this is in the area of road safety. Road fatalities have fallen dramatically in recent decades in Canada, in large measure due to the introduction of safety measures such as speed limits, blood-alcohol limits, seat belt laws, child-restraint devices and so forth. Safety policies are directed particularly strongly towards youth: they have a lower blood-alcohol limit, a smaller number of permitted demerit points before losing their license, a required period of learning (driver permit) and so forth. While fatalities among youth have fallen in line with fatalities across the age spectrum, they are still higher than for other age groups. Figure 2.6 presents data on fatalities per licensed driver by age group in Canada relative to the youngest age group. Note the strong non-linear pattern to the data – fatalities decline quickly, then level off and again increase for the oldest age group.

In keeping with these data, drivers are now required to pass a driving test in most provinces once they attain a certain age – usually 80, because the data indicate that fatalities increase when drivers age.

See: CANADIAN MOTOR VEHICLE TRAFFIC COLLISION STATISTICS 2009, Transport Canada .http://www.tc.gc.ca/media/documents/roadsafety/tp3322-2009_eng.pdf

Normative economics offers recommendations that incorporate value judgments

Scientific research can frequently resolve differences that arise in positive economics—not so in normative economics. For example, if we claim that "the elderly have high medical bills, and the government should cover all of the bills", we are making both a positive and a normative statement. The first part is positive, and its truth is easily established. The latter part is normative, and individuals of different beliefs may reasonably differ. Some people may believe that the money would be better spent on the environment and have the aged cover at least part of their own medical costs. Economics cannot be used to show that one of these views is correct and the other false. They are based on value judgments, and are motivated by a concern for **equity**. Equity is a vital guiding principle in the formation of policy and is frequently, though not always, seen as being in competition with the drive for economic growth. Equity is driven primarily by normative considerations. Few economists would disagree with the assertion that a government should implement policies that improve the lot of the poor and dispossessed—but to what degree?

Economic equity is concerned with the distribution of well-being among members of the economy

Most economists hold normative views, sometimes very strongly. They frequently see their role as not just to analyze economic issues from a positive perspective, but also to champion their normative cause in addition. Conservative economists see a smaller role for government than left-leaning economists. A scrupulous economist will distinguish her positive from her normative analysis.

Many economists see a conflict between equity and the efficiency considerations that we developed in chapter 1. For example, high taxes may provide disincentives to work in the marketplace and therefore reduce the efficiency of the economy: plumbers and gardeners may decide to do their own gardening and their own plumbing because, by staying out of the marketplace where monetary transactions are taxed, they can avoid the taxes. And avoiding the taxes may turn out to be as valuable as the efficiency gains they forego.

In other areas the equity efficiency trade-off is not so obvious: if taxes (that may have disincentive effects) are used to educate individuals who otherwise would not develop the skills that follow education, then economic growth may be higher as a result of the intervention.

Revisiting the definition of economics

This is an appropriate point at which to return to the definition of economics in chapter 1 that we borrowed from Nobel Laureate Christopher Sims: economics is a set of ideas and methods for the betterment of society.

If economics is concerned about the betterment of society, clearly there are ethical as well as efficiency considerations at play. And given the philosophical differences among scientists (including economists), can we define an approach to economics that is shared by most of the economics profession? Most economists would answer that the profession shares a set of beliefs, and that differences refer to the extent to which one consideration may collide with another.

First of all we believe that *markets are critical* because they facilitate exchange and therefore encourage efficiency. Before the arrival of Man Friday, Robinson Crusoe had to hunt, cook, make fire, and sustain shelter. The arrival of Man Friday enabled Crusoe to *specialize* in the tasks where he was relatively more productive. More generally, trade creates benefits for the trading parties. For example, Canada has not the appropriate climate for growing coffee beans, and Columbia has not the terrain for wheat. If Canada had to be self-sufficient, we might have to grow coffee beans in green-houses—a costly proposition. But with trade we can simply exchange some of our wheat for Columbian coffee. Similar benefits arise for the Columbians.

A frequent complaint against globalization is that it does not benefit the poor. For example, workers in the Philippines may earn only a few dollars per day manufacturing clothing for Western markets. What these voices are really trying to say is that, in their opinion, most of the gains from trade go to the Western consumers, and a lesser part to the Asian worker.

A corollary of the centrality of markets is *that incentives matter*. If the price of business class seats on your favorite airline is reduced, you may consider upgrading. Economists believe strongly that the price mechanism influences behavior, and therefore favor the use of price incentives in the marketplace and public policy more generally. Environmental economists, for example, frequently advocate the use of tradable pollution permits—a type of permission slip that can be traded (at a price) between users, or carbon taxes on the emission of greenhouse gases such as carbon dioxide. We will develop such ideas in *Microeconomics* Chapter 5 more fully.

In saying that economists believe in incentives, we are not proposing that human beings are purely mercenary. People have many motivations: a sense of public duty, kindness, *noblesse oblige*, etc. Acting out of a sense of self-interest does not imply that people are morally empty or have no sense of altruism. It is just recognition of one important motivating factor in an individual's life.

Whether conservative or liberal, economists believe universally in the *importance of the rule of law*, and a set of legal institutions that govern contracts. If goods and services are to be supplied in a market economy, the suppliers must be guaranteed that they will be remunerated. And this requires a developed legal structure with penalties imposed on individuals or groups who violate contracts. Markets alone will not function efficiently.

The development of markets in less developed economies was viewed as essential by many development economists in the nineteen eighties. The focus on 'freeing up' productive resources from the hand of the state was a central idea in what became known as the 'Washington Consensus'. This emphasis represented a turning point in development philosophy - away from believing in the efficacy of the mega project, protectionism and state-led development. While the latter approach rarely produced the desired result on account of the missing incentives, the Washington Consensus did not produce the hoped-for results either. This was because the supposed 'free markets' were not always accompanied by property rights, or enforceable contracts – markets and contracts do not work well in a legal vacuum. Oxford economist Marcel Fafchamps has described these supposed 'free markets' as 'flea markets'.

Not surprisingly, economists have found a high correlation between economic growth and national wealth on the one hand and the rule of law on the other. The consequence on the world stage is fascinating: numerous 'economic' development projects now focus upon training jurists, police officers and bureaucrats in the rule of law!

Finally economists believe in the importance of government policy. Governments can solve a number of problems that arise in market economies that cannot be addressed by the private market place. For example, governments can best address the potential abuses of monopoly power. Monopoly power, as we shall see in *Microeconomics* Chapter 10, not only has equity impacts it may also reduce economic efficiency. Governments are best positioned to deal with what economists term externalities – the impact of economic activity on sectors of the economy that re not directly involved in the activity under consideration. A good example is environmental policy. Governments may also wish to impose standards on products – consumers might not know if a bicycle helmet is effective unless safety standards are put in place.

In sum governments have a variety of roles to play in the economy. These roles apply not only to making the economy a more equitable place (which governments achieve by their tax and redistribution policies), governments can also make the marketplace more efficient.

KEY TERMS

Variables: measures that can take on different sizes (2.2)

Data: recorded values of variables (2.2)

Time series data: a set of measurements made sequentially at different points in time (2.2)

High (low) frequency data series have short (long) intervals between observations (2.2)

Cross-section data: values for different variables recorded at a point in time (2.2)

Longitudinal data follow the same units of observation through time (2.2)

Index number: value for a variable, or an average of a set of variables, expressed relative to a given base value (2.2)

$$\textbf{Value of index} = \frac{\text{Absolute value in year t}}{\text{Absolute value in base year}} \times 100 \quad (2.2)$$

Percentage change: (change in values) / original value × 100 (2.2)

Consumer price index: the average price level for consumer goods and services (2.2)

Inflation rate: the annual percentage increase in the consumer price index (2.2)

Deflation rate: the annual percentage decrease in the consumer price index (2.2)

Real price index: a nominal price index divided by the consumer price index, scaled by 100 (2.2)

Nominal price index: the current dollar price of a good or service (2.2)

Nominal earnings: earnings measured in current dollars (2.2)

Real earnings: earnings measure in constant dollars to adjust for changes in the general price level (2.2)

Scatter diagram plots pairs of values simultaneously observed for two variables (2.3)

Econometrics is the science of examining and quantifying relationships between economic variables (2.3)

R**egression line** represents the average relationship between two variables in a scatter diagram (2.3)

Intercept of a line: height of the line on one axis when the value of the variable on the other axis is zero. (2.4)

Slope of a line: ratio of the change in the value of the variable measured on the vertical axis to the change in the value of the variable measured on the horizontal axis (i.e.: rise/run) (2.4).

Positive economics studies objective or scientific explanations of how the economy functions (2.5)

Normative economics offers recommendations that incorporate value judgments (2.5)

Economic equity is concerned with the distribution of well-being among members of the economy (2.5)

3

The Classical Market: Demand and Supply

In this chapter we will explore:

1. Trading
2. The market's building blocks
3. Demand curves and supply curves
4. Other influences on demand
5. Other influences on supply
6. Simultaneous demand and supply impacts
7. Market interventions
8. From individuals to markets

3.1 Trading

The marketplace in today's economy has evolved from earlier times. It no longer has a unique form – one where buyers and sellers physically come together for the purpose of exchange. Indeed, supermarkets require individuals to be physically present to make their purchases. But when purchasing an airline ticket, individuals simply go online and interact with perhaps a number of different airlines (suppliers) simultaneously. Or again, individuals may simply give an instruction to their broker, who will execute a purchase on their behalf – the broker performs the role of a middleman, who may additionally give advice to the purchaser. Or a marketing agency may decide to subcontract work to a translator or graphic artist who resides in Mumbai. In pure auctions (where a single work of art or a single residence is offered for sale) buyers compete one against the other for the single item supplied. These institutions are all different types of markets; they serve the purpose of facilitating exchange and trade.

We should also keep in mind that not all goods and services in the modern economy are obtained through the marketplace. Schooling and health care are allocated in Canada primarily by government decree. In some instances the market plays a supporting role: Universities and colleges may levy fees, and most individuals must pay for their pharmaceuticals. In contrast, broadcasting services may carry a price of zero – as with the Canadian Broadcasting Corporation.

The importance of the marketplace springs from its role as an allocating mechanism. Elevated prices effectively send a signal to suppliers that the buyers in the market place a high value on the product being traded; conversely when prices are low. Accordingly, suppliers may decide to cease supplying markets where prices do not remunerate them sufficiently, and redirect their energies and the productive resources under their control to other markets – markets where the product being traded is more highly valued, and where the buyer is willing to pay more.

Whatever their form, markets are central to the economy we live in. Not only does it facilitate trade, it also provides a means of earning a livelihood. Suppliers must hire resources – human and non-human in order to bring their supplies to market and these resources must be paid a return – income is generated.

In this chapter we will examine the process of price formation – how the prices that we observe in the marketplace come to be what they are. We will illustrate that the price for a good is inevitably linked to the quantity of a good; price and quantity are different sides of the same coin and cannot generally be analyzed separately. To understand this process more fully, we need to *model* a typical market. The essentials are demand and supply.

3.2 The market's building blocks

In economics we use the terminology that describes trade in a particular manner. Noneconomists frequently describe microeconomics by saying "it's all about supply and demand". While this is largely true we need to define exactly what we mean by these two central words. Let's start with demand. **Demand** is the quantity of a good or service that buyers wish to purchase at each conceivable price, with all other influences on demand remaining unchanged. It reflects a multitude of values, not a single value. It is not a single or unique quantity such as two cell phones, but rather a full description of the quantity of a good or service that buyers would purchase at various prices.

Demand is the quantity of a good or service that buyers wish to purchase at each possible price, with all other influences on purchasing decisions remaining unchanged

As an example, the first column of table 3.1 shows the price of natural gas per cubic foot. The second column shows the quantity that would be purchased in a given time period at each price. It is therefore a schedule of prices.

Supply is interpreted in a similar manner. It is not a single value; it is a schedule of the quantity that sellers would want to sell at each price. Hence we say that **supply** is the quantity of a good or service that sellers are willing to sell at each possible price, with all other influences on supply remaining unchanged. Such a supply schedule is defined in the third column of the table. It is assumed that no supplier can make a profit (on account of their costs) unless the price is at least $2 per unit, and therefore a zero quantity is supplied below that price. The higher price is more profitable, and therefore induces a greater quantity supplied, perhaps by attracting more suppliers.

Table 3.1 Demand and supply for natural gas

Price ($)	Demand (thousands of cu feet)	Supply (thousands of cu feet)	Excess
10	0	18	
9	1	16	**Excess**
8	2	14	**supply**
7	3	12	
6	4	10	
5	5	8	
4	6	6	**Equilibrium**
3	7	4	
2	8	2	**Excess**
1	9	0	**Demand**
0	10	0	

Supply is the quantity of a good or service that sellers are willing to sell at each possible price, with all other influences on supply remaining unchanged

We can now identify a key difference in terminology – between the words demand and quantity demanded, and between supply and quantity supplied. While the words demand and supply refer to the complete schedules of demand and supply, the terms **quantity demanded** and **quantity supplied** each define a single value of demand or supply at a particular price.

Quantity demanded defines the amount purchased at a particular price.

Quantity supplied refers to the amount supplied at a particular price.

Thus while the non-economist may say that when some fans did not get tickets to the Stanley Cup it was a case of demand exceeding supply, as economists we say that the quantity demanded exceeded the quantity supplied *at the going price of tickets*. In this instance, had every ticket been offered at a sufficiently high price, the market could have generated an excess supply rather than an excess demand. A higher ticket price would reduce the quantity demanded; yet would not change demand, because demand refers to the whole schedule of possible quantities demanded at different prices.

Other things equal – *ceteris paribus*

The demand and supply schedules rest on the assumption that all other influences on supply and demand remain the same as we move up and down the possible price values. We use the expression *other things being equal*, or its Latin counterpart *ceteris paribus*, to describe this constancy of other influences. For example, we assume on the demand side that the prices of other goods remain constant, that tastes and incomes are unchanging, that the size of the market is given, and so forth. On the supply side we assume, for example, that there is no technological change in production methods.

Market equilibrium

Let us now bring the demand and supply schedules together in an attempt to analyze what the market place will produce – will a single price emerge that will equate supply and demand? We will keep other things constant for the moment, and explore what materializes at different prices. At low prices, the data in Table 3.1 indicate that the quantity demanded exceeds the quantity supplied – for example, verify what happens when the price is $3 per unit. The opposite occurs when the price is high – what would happen if the price were $8? Evidently, there exists an intermediate price, where the quantity demanded equals the quantity supplied. At this point we say that the market is in equilibrium. The **equilibrium price** equates demand and supply - it clears the market.

The **equilibrium price** equilibrates the market. It is the price at which quantity demanded equals the quantity supplied.

In table 3.1 the equilibrium price is $4, and the equilibrium quantity is 6 thousand cubic feet of gas (we will use the notation 'k' to denote thousands). At higher prices there is an **excess supply**—suppliers wish to sell more than buyers wish to buy. Conversely, at lower prices there is an **excess demand**. Only at the equilibrium price is the quantity supplied equal to the quantity

Excess supply exists when the quantity supplied exceeds the quantity demanded at the going price

Excess demand exists when the quantity demanded exceeds the quantity supplied at the going price

Does the market automatically reach equilibrium? To answer this question, suppose initially that the sellers choose a price of $10. Here suppliers would like to supply 18k cubic feet, but there are no buyers—a situation of extreme excess supply. At the price of $7 the excess supply is reduced to 9k, because both the quantity demanded is now higher at 3k units, and the quantity supplied is lower at 12k.

But excess supply means that there are suppliers willing to supply at a lower price, and this willingness exerts continual downward pressure on any price above the price that equates demand and supply.

At prices below the equilibrium there is, conversely, an excess demand. In this situation, suppliers could force the price upward, knowing that buyers will continue to buy at a price at which the suppliers are willing to sell. Such upward pressure would continue until the excess demand is eliminated.

In general then, above the equilibrium price excess supply exerts downward pressure on price, and below the equilibrium price excess demand exerts upward pressure on price. This process implies that the buyers and sellers have information on the various elements that make up the marketplace.

Note that, if sales do take place at prices above or below the equilibrium price, the quantity traded always corresponds to the short side of the market: At high prices the quantity demanded is less than supply, and it is the quantity demanded that is traded because buyers will not buy the amount suppliers would like to supply. At low prices the quantity demanded exceeds quantity supplied, and it is the amount that suppliers are willing to sell that is traded. In sum, when trading takes place at prices other than the equilibrium price it is always the lesser of the quantity demanded or supplied that is traded. Hence we say that at non equilibrium prices the **short side** dominates. We will return to this in a series of examples later in this chapter.

The **short side of the market** determines outcomes at prices other than the equilibrium

Supply and the nature of costs

Before progressing to a graphical analysis, we should add a word about costs. The supply schedules are based primarily on the cost of producing the product in question, and we frequently assume that all of the costs associated with supply are incorporated in the supply schedules. In chapter 6 we will explore cases where costs additional to those incurred by producers may be relevant. For example, coal burning power plants emit pollutants into the atmosphere; but the individual supplier may not take account of these pollutants, which are costs to society at large, in deciding how much to supply at different prices. Stated another way, the private costs of production would not reflect the total, or full social costs of production. For the moment the assumption is that no such additional costs are associated with the markets we analyze.

3.3 Demand and Supply Curves

The **demand curve** is a graphical expression of the relationship between price and quantity demanded, holding other things constant. Figure 3.1 measures price on the vertical axis and quantity on the horizontal axis. The curve *D* represents the data from the first two columns of Table 3.1. Each combination of price and quantity demanded lies on the curve. In this case the curve is *linear*—it is a straight line. The demand curve slopes downward (technically we say that its slope is negative), reflecting the fact that buyers wish to purchase more when the price is less.

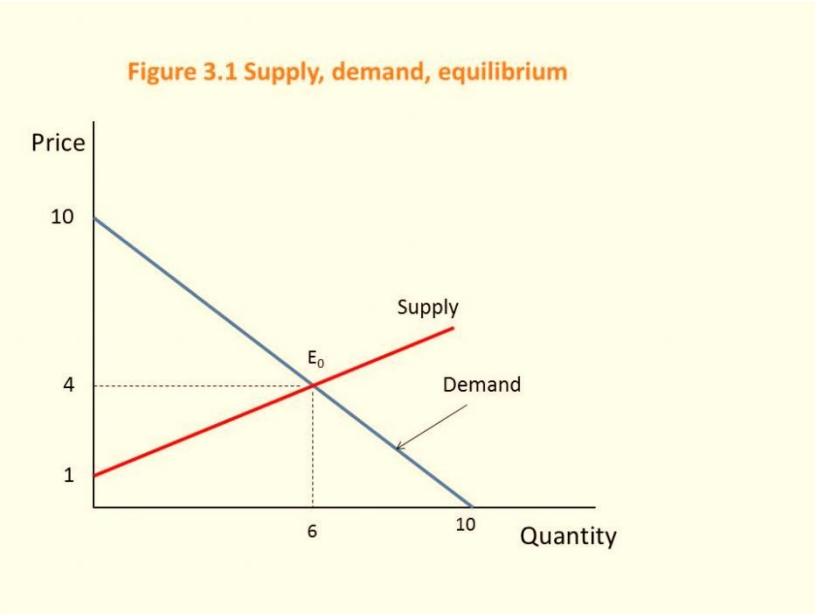
The **demand curve** is a graphical expression of the relationship between price and quantity demanded, with other influences remaining unchanged

The **supply curve** is a graphical representation shows the relation between price and quantity supplied, holding other things constant. The supply curve *S* in Figure 3.1 is based on the data from columns 1 and 3 in Table 3.1. It, too, is linear, but has a positive slope indicating that suppliers wish to supply more at higher prices.

The **supply curve** is a graphical expression of the relationship **between price and quantity supplied, with other influences remaining** unchanged

The demand and supply curves intersect at point E, corresponding to a price of $4 which, as illustrated above, is the equilibrium price for this market. At any price below this the horizontal distance between the supply and demand curves represents excess demand, because demand exceeds supply. Conversely, at any price above $4 there is an excess supply that is again measured by the horizontal distance between the two curves. Market forces tend to eliminate excess demand and excess supply as we explained above.

Computing the market equilibrium



It is not difficult to represent the supply and demand functions underlying Table 3.1 in their mathematical form:

Demand: P = 10 – 1Q. Supply: P = 1 + 1/2Q

In the previous chapter we stated that a straight line is represented completely by the intercept and slope. Let us first verify that these equations do, indeed, represent the data in Table 3.1. On the demand side, we see that a zero quantity is demanded at a price of $10, and this is therefore the intercept with the price (vertical) axis. To see this just set P = 10 in the demand equation. As for the slope, each unit change in quantity demanded (measured in thousands) is associated with a $1 change in price. For instance, when the price is increased by $2, the quantity demanded declines by 2 units. In reverse, if the price is lowered by $2, the quantity demanded increases by 2 units. Since the price is on the vertical axis, it follows that the slope is given by –$1/1 = –1. It is negative because an increase in quantity demanded is associated with a decrease in price.

On the supply side, column 3 in Table 3.1 indicates that at a quantity of zero the price is $1. Therefore, $1 is the price intercept. As for the slope, each 2-unit change in quantity is associated with a change in price of $1. Consequently, the slope is given by $1/2 = 1/2. In this case the slope is positive, since both the price and quantity move in the same direction.

We have now obtained the two defining characteristics of the demand and supply curves, which enable us to write them as above. Next we must find where they intersect—the market equilibrium. Since, at their intersection point, the price on the demand curve equals the price on the supply curve, and the quantity demanded equals the quantity supplied, this unique price-quantity combination is obtained by equating the two curves:

$$10 - 1Q = 1 + 1/2Q, \text{ or, } 10 - 1 = 1 + 1/2Q, \text{ or, } 9 = 1.5Q.$$

Therefore: Q = 9/1.5 = 6

The *equilibrium solution* for Q is therefore 6 units. What about an equilibrium price? It is obtained by inserting the equilibrium Q value into *either the supply or the demand function*. *Either* function can be used because, where Q = 6, the supply and demand functions intersect - they have equal P values:

Demand price at Q = 6: $P = 10 - 1 \times 6 = 10 - 6 = 4$.

Supply price at Q = 6: P = 1 + 1/2 × 6 = 1 + 3 = 4.

We have just solved a mathematical model of a particular market! It was not so difficult, but the method is very powerful and we will use it many times in the text.

In the demand and supply equations above the price appeared on the left hand side and quantity on the right. Normally this format implies a causation running from the right to the left hand side variable, while in economic markets we normally think of the quantity demanded and supplied depending upon the price in the market place. But the supply and demand equations can be rearranged so that quantity appears on the left and price on the right. For example the demand equation can be rewritten as follows:

P = 10 – 1Q implies 1Q = 10 – P,

or: Q = 10/1 – P/1, or, Q = 10 – 1P.

Writing the demand curve this way illustrates that the quantity intercept is 10 - the quantity demanded when the price becomes zero. The supply curve can be rearranged similarly.

3.4 Other Influences on Demand

We have emphasized several times the importance of the *ceteris paribus* assumption when exploring the impact of different prices on the quantity demanded: we assume all other influences on the purchase decision are unchanged (at least momentarily). These other influences fall into several broad categories: the prices of related goods; the incomes of buyers; buyer tastes; and expectations about the future. Before proceeding, note that we are dealing with *market* demand rather than demand by one *individual* (the precise relationship between the two is developed later in this chapter).

The prices of related goods

We expect that the price of other forms of energy would impact the price of natural gas. For example, if electricity, oil or coal becomes less expensive we would expect some buyers to switch to these other products. Alternatively, if gas-burning furnaces experience a technological breakthrough that makes them more efficient and cheaper we would expect some users of other fuels to move to move to gas. Among these examples, it is clear that oil and electricity are substitute fuels for gas; in contrast the efficient new gas furnace complements the use of gas. We use these terms, **substitutes** and **complements**, to describe products that influence the demand for the primary good.

Substitute goods: when a price reduction (rise) for a related product reduces (increases) the demand for a primary product, it is a substitute for the primary product

Complementary goods: when a price reduction (rise) for a related product increases (reduces) the demand for a primary product, it is a complement for the primary product

Clearly electricity is a substitute for gas whereas the gas furnace is a complement for gas as a fuel. The words “substitutes” and “complements” immediately suggest the nature of the relationships. Every product has complements and substitutes. As another example: electronic readers are substitutes for paper-form books; a rise in the price of paper books should increase the demand for electronic readers at any price for electronic readers. In graphical terms, the demand curve *shifts* in response to changes in the prices of other goods – an increase in the price of paper-form books will shift the demand for electronic readers outward, because more electronic readers will be demanded at any price.

Buyer incomes

The demand for most goods increases in response to income increases. Given this, the demand curve for gas will shift outward if

household incomes in the economy increase. Household incomes may increase either because there are more households in the economy or because the incomes of the existing households grow.

Most goods are demanded in greater quantity in response to higher incomes at any given price. But there are exceptions. For example, public transit demand may decline at any price when household incomes rise, because some individuals move to cars. Or the demand for laundromats may decline in response to higher incomes, as households purchase more of their own consumer durables – washers and driers. We use the term **inferior good** to define these cases: An inferior good is one whose demand declines in response to increasing incomes, whereas a **normal good** experiences an increase in demand in response to rising incomes.

An **inferior good** is one whose demand falls in response to higher incomes

A **normal good** is one whose demand increases in response to higher incomes

There is a further sense in which consumer incomes influence demand, and this relates to how the incomes are *distributed* in the economy. In our discussion above we stated that higher total incomes shift demand curves outwards when goods are normal. But think of the difference in the demand for electronic readers between Portugal and Saudi Arabia. These economies have roughly the same average per-person income, but incomes are distributed more unequally in Saudi Arabia. It does not have a large middle class that can afford electronic readers or *iPads*, despite the huge wealth held by the elite. In contrast, Portugal has a relatively larger middle class that can afford such goods. Consequently, the *distribution of income* can be an important determinant of the demand for many commodities and services.

Tastes and networks

While demand functions are drawn on the assumption that tastes are constant, in an evolving world they are not. We are all subject to peer pressure, the fashion industry, marketing, and a desire to maintain our image. If the fashion industry dictates that lapels or long skirts are *de rigueur* for the coming season, some fashion-conscious individuals will discard a large segment of their wardrobe, even though the clothes may be in perfectly good condition: Their demand is influenced by the dictates of current fashion.

Correspondingly, the items that other individuals buy or use frequently determine our own purchases. Businesses frequently decide that all of their employees will have the same type of computer and software on account of *network economies*: It is easier to communicate if equipment is compatible, and it is less costly to maintain infrastructure where the variety is less.

Expectations

In our natural gas example, if households expected that the price of natural gas was going to stay low for many years – perhaps on account of the discovery of large deposits – then they would be tempted to purchase a gas burning furnace rather than an oil burning furnace, particularly if they anticipated that the price of oil would increase. In this example, it is more than the current price that determines choices; *the prices that are expected to prevail in the future* also determine current demand.

Expectations are particularly important in stock markets. When investors anticipate that corporations will earn high rewards in the future they will buy a stock today. If enough people believe this, the price of the stock will be driven upward on the market, even before profitable earnings are registered.

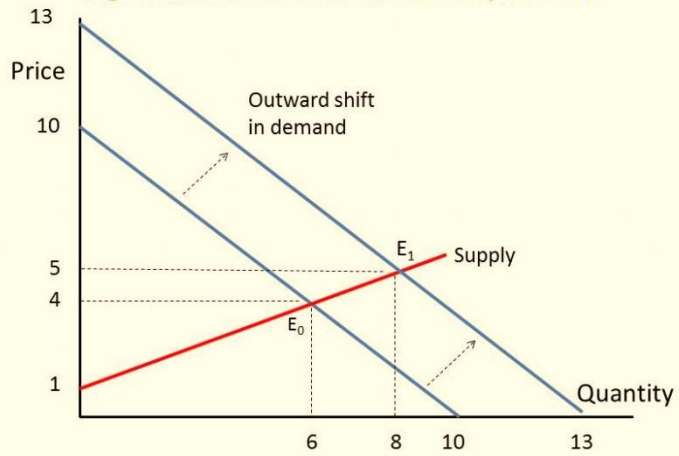
Shifts in demand

The demand curve in Figure 3.1 is drawn for a given level of other prices, incomes, tastes, and expectations. Movements along the demand curve reflect solely the impact of different prices for the

good in question, holding other influences constant. But changes in any of these other factors will change the position of the demand curve.

Figure 3.2 illustrates a shift in the demand curve. This shift could result from a rise in household incomes that increase the quantity demanded *at every price*. This is illustrated by an outward shift in the demand curve. With supply conditions unchanged, there is a new equilibrium at E^1, indicating a greater quantity of purchases accompanied by a higher price. The new demand curve reflects a *change in the quantity demanded.*

Figure 3.2 Demand shift and new equilibrium



The outward shift in demand leads to a new equilibrium E_1.

Modeling other influences

How are such changes reflected in our *economic model*? Let us say that market research quantifies the degree to which the demand curve shifts: Market analysis indicates that the new demand curve is given by P = 13 – 1Q. Note that the intercept is greater while the

Application Box 3.1 Corn prices and demand shifts

In the middle of its second mandate, the Bush Administration in the US decided to encourage the production of ethanol—a fuel that is less polluting than gasoline. The target production was 35 billion for 2017 – from a base of 1 billion gallons in 2000. Corn is the principal input in ethanol production. It is used primarily as animal feed, as a sweetener and a food for humans. The target was to be met with the help of a subsidy to producers and a tariff on imports of Brazil's sugar-cane based ethanol.

The impact on corn prices was immediate; from a farm-gate price of $2 per bushel in 2005, the price reached the $4 range two years later, despite a significant increase in production. In 2012 the price is $7. While other factors, such as growing incomes, have stimulated the demand for corn; ethanol is seen as the main price driver.

The wider impact of these developments was that the prices of virtually all grains increased in tandem with corn. For example, the prices of sorghum and barley increased because of a switch in land use towards corn. Corn was seen as more profitable, less acreage was allocated to other grains, and the supply of these other grains fell.

While producer benefited from the price rise, consumers - particularly those in less developed economies - experienced a dramatic increase in their basic living costs. Visit the site of the United Nations' Food and Agricultural Organization for an assessment.

In terms of supply and demand shifts, the demand side has dominated. The ethanol drive, combined with secular growth in the demand for food, means that the demand for grains shifted outward faster than the supply, as illustrated in figure 3.4 below.

slope is unchanged, so the demand curve in this instance shifts outward while maintaining the same slope; it is parallel to the original demand curve.

The new market equilibrium can be established by solving for the intersection of the new demand curve with the existing supply curve. Let us do it.

Demand: P = 13 – 1Q. Supply: P = 1 + 1/2Q

Equating the two yields: 13 – 1Q = 1 + 1/2Q,

or, 13 – 1 = 1Q + 1/2Q, or, 12 = 1.5Q.

Therefore: Q = 12/1.5 = 8.

8 units of gas are now traded, rather than 6. The new equilibrium price is obtained as before, by estimating the price at which 8 units of gas will be supplied or demanded. Inserting Q = 8 in either the supply or (new) demand function yields a value of $5. As a result of the demand increase, therefore, both the equilibrium quantity traded and the equilibrium price in the market increase (see figure 3.2).

We may well ask why so much emphasis in our diagrams and analysis is placed on the relationship between *price* and quantity, rather than on the relationship between quantity and its other determinants. The answer is that we could indeed draw diagrams with quantity on the horizontal axis and a measure of one of these other influences on the vertical axis. But the price mechanism plays a very important role. *Variations in price are what equilibrate the market*. By focusing primarily upon the price, we see the self-correcting mechanism by which the market reacts to excess supply or excess demand.

In addition, this analysis illustrates the method of **comparative statics**—examining the impact of changing one of the other things that are assumed constant in the supply and demand diagrams.

Comparative static analysis compares an initial equilibrium with a new equilibrium, where the difference is due to a change in one of the other things that lie behind the demand curve or the supply curve.

Comparative obviously denotes the idea of a comparison, and static means that we are not in a state of motion. Hence we use these words in conjunction to indicate that we compare one outcome with another, without being concerned too much about the transition from an initial equilibrium to a final equilibrium. The transition would be concerned with dynamics rather than statics. In Figure 3.2 we explain the difference between the points E^0 and E^1 by indicating that there has been a change in incomes or in the price of a substitute good. We do not attempt to analyze the details of this move or the exact path from E^0 to E^1.

3.5 Other Influences on Supply

To date we have drawn supply curves with an upward slope. Is this a reasonable representation of supply in view of what is frequently observed in markets? We suggested earlier that the various producers of a particular good or service may have different levels of efficiency. If so, only the more efficient producers can make a profit at a low price, whereas at higher prices more producers or suppliers enter the market - producers who may not be as lean and efficient as those who can survive in a lower-price environment. This view of the world yields an upward-sloping supply curve, although there are other perspectives on the supply curve's slope.

Frequently producers simply choose a price and let buyers purchase as much as they want at that price. This is the practice of most retailers. For example, the price of Samsung's *Galaxy* is typically fixed, no matter how many are purchased – and tens of millions are sometimes sold at a fixed price when a new model is launched. The manufacturer *Apple* also sets prices for its *iPhones*, and buyers purchase as many as they desire at that price.

In yet other situations *supply* is fixed. This happens in auctions, and bidders at the auction simply determine the price to be paid. At a real estate auction a fixed number of homes are put on the market and prices are determined by the bidding process.

Regardless of the type of market we encounter, however, it is safe to assume that supply curves do not slope downward. So, for the moment, we adopt the stance that supply curves are generally upward sloping – somewhere between the extremes of being vertical or horizontal – as we have drawn them to this point.

Next, we examine those other influences that underlie supply curves. Technology, input costs, the prices of competing goods, expectations and the number of suppliers are the most important.

Technology

A technological advance may involve an idea that allows more output to be produced with the same inputs, or an equal output with fewer inputs. A good example is *just-in-time* technology. Before the modern era, auto manufacturers kept large stocks of components in their production facilities, but developments in communications and computers at that time made it possible for manufacturers to link directly with their input suppliers. Nowadays assembly plants place their order for, say, seat delivery to their local seat supplier well ahead of time. The seats swing into the assembly area hours or minutes before assembly—just in time. The result is that the assembler reduces his seat inventory (an input) and thereby reduces production cost.

Such a technology-induced cost saving is represented by moving the supply curve downward or outward: The supplier is willing to supply the same quantity at a lower price because of the technological innovation. Or, saying the same thing slightly differently, suppliers will supply more at a given price than before. This is but one example of how "supply chains" are evolving in the modern globalized world. Computer assemblers are prime examples of the same developments.

Input costs

Input costs can vary independently of technology. For example, a wage negotiation that grants workers an increase above the general inflation rate will increase the cost of production. This is reflected in a leftward, or upward, supply shift: Any quantity is now priced higher; alternatively, suppliers are willing to supply less at the going price.

As a further example, suppose the government decrees that power-generating companies must provide a certain percentage of their power using 'green' sources – from solar power or windmills. Since such sources are not yet as cost efficient as more conventional power sources, the electricity they generate comes at a higher cost.

Competing products

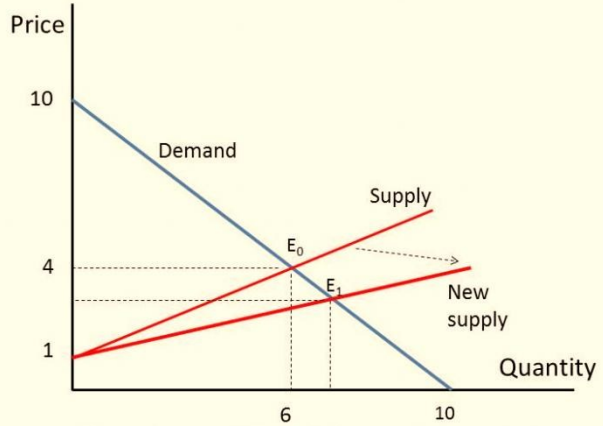
If competing products improve in quality or fall in price, a supplier may be forced to follow suit. For example, Hewlett-Packard and Dell are constantly watching each other's pricing policies. If Dell brings out a new generation of computers at a lower price, Hewlett-Packard will likely lower its prices in turn—which is to say that Hewlett-Packard's supply curve will shift downward. Likewise, Samsung and Apple each respond to the other's pricing and technology behaviors.

These are some of the many factors that influence the position of the supply curve in a given market.

Shifts in supply

Whenever technology changes, or the costs of production change, or the prices of competing products adjust, then one of our *ceteris paribus* assumptions is violated. Such changes are generally reflected by shifting the supply curve. Figure 3.3 illustrates the impact of the arrival of just-in-time technology. The supply curve shifts, reflecting the ability of suppliers to supply the same output at a reduced price. The resulting new equilibrium price is lower, since production costs have fallen. At this reduced price more gas is traded at a lower price.

Figure 3.3 Supply shifts and new equilibrium



The supply curve shifts due to lower production costs. A new equilibrium E_1 is attained in the market at a lower price.

3.6 Simultaneous Supply and Demand Impacts

In the real world, demand and supply frequently shift at the same time. We present two very real such cases in Figures 3.4 and 3.5.

Figure 3.4 is a development of the gas market already discussed. In 2003/04 the price of oil sat at about $30 US per barrel. By the end of the decade it had climbed to $100 per barrel. During the same period the price of natural gas dropped from the $8 per unit range to $3 per unit. A major factor in generating this decline was the development of new 'fracking' technologies – the retrieval of gas from shale formations. These technologies are not widespread in Canada due to concerns about their environmental impact, but have been adopted on a large scale in the US. Cheaper production has led to a substantial shift in supply, at the same time as users were demanding more gas due to the rising price of oil. Figure 3.4 illustrates a simultaneous shift in both functions, with the dominant impact coming from the supply side.

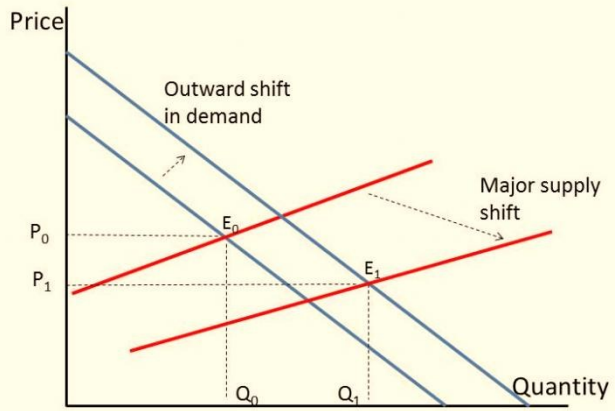
Application Box 3.2 The price of light

Technological developments have had a staggering impact on many price declines. Professor William Nordhaus of Yale University is an expert on measuring technological change. He has examined the trend in the real price of lighting. Originally, light was provided by whale oil and gas lamps and these sources of lumens (the scientific measure of the amount of light produced) were costly. In his research, Professor Nordhaus pieced together evidence on the actual historic cost of light produced at various times, going all the way back to 1800. He found that light in 1800 cost about 100 times more than in 1900, and light in the year 2000 was a fraction of its cost in 1900. A rough calculation suggests that light was five hundred times more expensive at the start of this 200-year period than at the end.

In terms of supply and demand analysis, light has been subject to very substantial downward supply shifts. Despite the long-term growth in demand, the technologically-induced supply changes have been the dominant factor in its price determination.

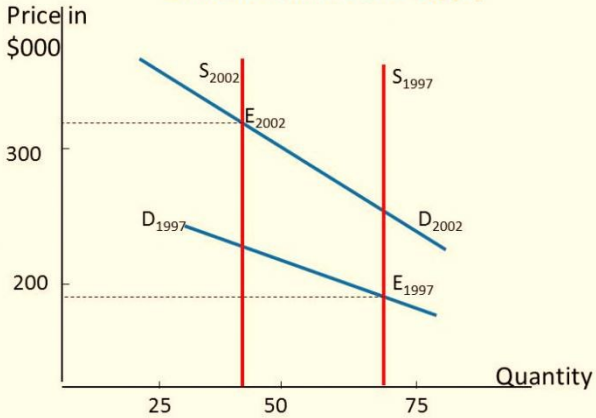
For further information, visit Professor Nordhaus's Web site in the Department of Economics at Yale University.

Figure 3.4 Simultaneous demand and supply shifts



The outward shift in supply dominates the outward shift in demand, leading to a new equilibrium E_1 at a lower price and higher quantity

Figure 3.5 A Model of the housing market with shifts in demand and supply



The vertical supply denotes a fixed number of houses supplied each year. Demand was stronger in 2002 than in 1997 both on account of higher incomes and lower mortgage rates. Thus the higher price in 2002 is due to both a reduction in supply and an increase in demand.

Our second example comes from data on a small Montreal municipality. Vertical curves define the supply side of the market. Such vertical curves mean that a fixed number of homeowners decide to put their homes on the market, and these suppliers just take whatever price results in the market. In this example, fewer houses were offered for sale in 2002 (less than 50) than in 1997 (more than 70).

During this time period household incomes increased substantially and, also, mortgage rates fell. Both of these developments shifted the demand curve upward/outward: buyers were willing to pay more for housing in 2002 than in 1997. The higher price in 2002 was therefore due to *both* demand and supply side shifts in the marketplace.

3.7 Market Interventions

The freely functioning markets that we have developed so far certainly do not describe all markets. For example, minimum wages characterize the labor market, most agricultural markets have supply restrictions, apartments are subject to rent controls, and blood is not a freely traded market commodity in Canada. In short, price controls and quotas characterize many markets. **Price controls** are government rules or laws that inhibit the formation of market-determined prices. **Quotas** are physical restrictions on output.

Price controls are government rules or laws that inhibit the formation of market-determined prices.

Quotas are physical restrictions on output

Price controls come in the form of either *floors* or *ceilings*.

Price ceilings

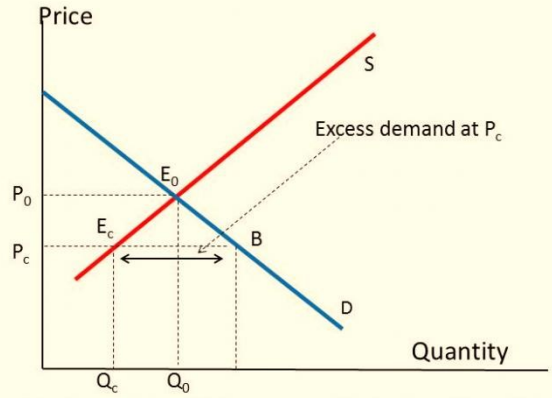
Ceilings mean that suppliers cannot legally charge more than a specific price. Limits on apartment rents are one form of ceiling. In times of emergency – such as flooding or famine, price controls are frequently imposed on foodstuffs, in conjunction with rationing, to ensure that access is not determined by who has the most income. The problem with price ceilings, however, is that they leave demand unsatisfied, and therefore they must be accompanied by some other allocation mechanism.

Consider an environment where, for some reason - perhaps a sudden and unanticipated growth in population - rents increase. Let the resulting equilibrium be defined by the point E_0 in Figure 3.6. If the government were to decide that this is an unfair price because it places hardships on low- and middle-income households, it might impose a price limit, or ceiling, of P_c. The problem with such a limit is that excess demand results: Individuals want to rent more apartments than are available in the city. In a free market the price would adjust upward to eliminate the excess demand, but in this controlled environment it cannot. So some other way of allocating the available supply between demanders must evolve.

In reality, most apartments are allocated to those households already occupying them. But what happens when such a resident household decides to purchase a home or move to another city? It holds a valuable asset, since the price/rent it is paying is less than the free-market price. Rather than give this surplus value to another family, it might decide to sublet at a price above what it currently pays. While this might be illegal, the family knows that there is excess demand and therefore such a solution is possible. A variation on this outcome is for an incoming tenant to pay money, sometimes directly to an existing tenant or to the building superintendent, or possibly to a real estate broker who will "buy out" existing tenants. This is called "key money."

Rent controls are widely studied in economics, and the consequences are well understood: Landlords tend not to repair or maintain their rental units and so the residential stock deteriorates. Builders realize that more money is to be made in building condominium units, or in converting rental units to condominiums. The frequent consequence is a *reduction* in supply and a reduced quality. Market forces are hard to circumvent because, as we emphasized in Chapter 1, economic players react to the incentives they face. This is an example of what we call the *law of unintended consequences*.

Figure 3.6 The effect of a price ceiling



The free market equilibrium occurs at E_0. A price ceiling at P_c holds down the price but leads to excess demand E_cB, because Q_c is the quantity traded. A price ceiling above P^0 is irrelevant since the free market equilibrium E^0 can still be attained.

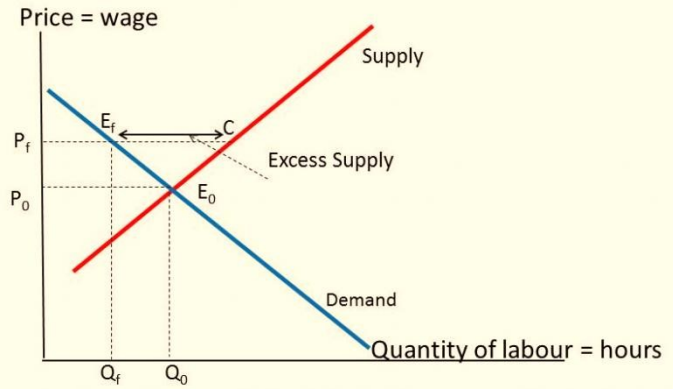
Price floors

An effective price floor sets the price *above* the market-clearing price. A minimum wage is the most widespread example in the Canadian economy. Provinces each set their own minimum, and it is seen as a way of protecting the well-being of low-skill workers. Such a floor is illustrated in Figure 3.7. The free-market equilibrium is again E_0, but the effective market outcome is the combination of price and

quantity corresponding to the point E_f at the price floor, P_f. In this instance, there is excess supply equal to the amount E_fC.

Note that there is a similarity between the outcomes defined in the floor and ceiling cases: The quantity actually traded is *the lesser of the supply quantity and demand quantity at the going price: the short side dominates*.

Figure 3.7 Price floor - minimum wage



In a free market the equilibrium is E_0. A minimum wage of P_f raises the hourly wage, but reduces the hours demanded to Q_f. Thus E_fC is the excess supply.

Quotas

A quota represents the right to supply a specified quantity of a good to the market. It is a means of keeping prices higher than the free-market equilibrium price. As an alternative to imposing a price floor, the government can generate a high price by restricting supply. Agricultural markets abound with examples. In these markets, farmers can supply only what they are permitted by the quota they hold, and there is usually a market for these quotas. For example, in several Canadian provinces it currently costs in the region of $30,000 to purchase a quota granting the right to sell the milk of one cow. The cost of purchasing quotas can thus easily outstrip the cost of a farm and herd. Canadian cheese importers must pay for the right to import cheese from abroad. Restrictions also apply to poultry. The impact of all of these restrictions is to raise the domestic price above the free market price.

In Figure 3.8, the free-market equilibrium is at E_0. In order to raise the price above P_0, the government restricts supply to Q_q by granting quotas, which permit producers to supply a limited amount of the good in question. This supply is purchased at the price equal to P_q.

Modeling market interventions

To illustrate the impact of these interventions on our numerical market model for natural gas, let us suppose that the government imposes a minimum price of $6 – above the equilibrium price obviously. We can easily determine the quantity supplied and demanded at such a price. On the supply side:

$$P = 1 + 1/2Q.$$

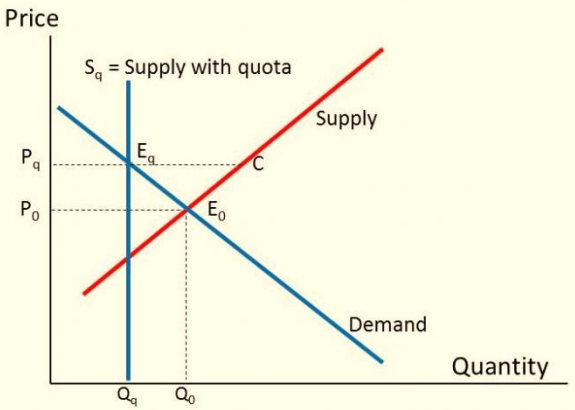
Hence at P = 6 it follows that 6 = 1 + 1/2Q; that is 5 = 1/2Q. Thus Q must take a value of 10, which is to say that suppliers *would like to supply* 10 units at this price.

Correspondingly on the demand side:

$$P = 10 – 1Q,$$

at P = 6, it follows that 6 = 10 – 1Q; that is Q = 4. So buyers *would like to buy* 4 units at that price: there is excess supply. But we know that the short side of the market will win out, and so the actual amount traded at this restricted price will be 4 units.

Figure 3.8 The effect of a quota



The government decides that the equilibrium price P_0 is too low. It decides to boost price by reducing supply from Q_0 to Q_q. It achieves this by requiring producers to have a production quota. This is equivalent to fixing supply at S_q.

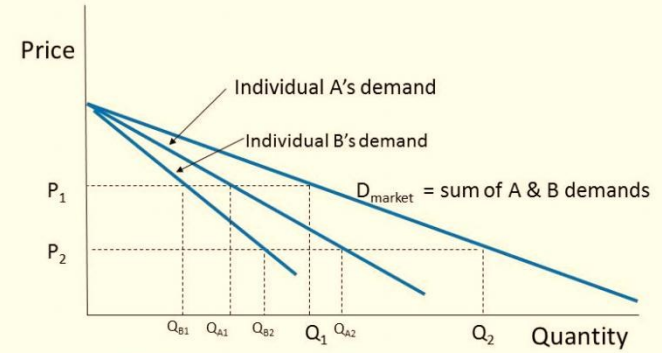
3.8 Individual and Market functions

Markets are made up of many individual participants on the demand and supply side. The supply and demand functions that we have worked with in this chapter are those for the total of all participants on each side of the market. But how do we arrive at such market functions when the economy is composed of individuals? We can illustrate how, with the help of Figure 3.9.

To concentrate on the essentials, imagine that there are just two buyers of gasoline in the economy. A has a bigger car than B, so his demand is greater. To simplify, let the two demands have the same intercept on the vertical axis. The curves D_A and D_B indicate how much gasoline A and B, respectively, will buy at each price. The market demand indicates how much they buy *together* at any price. Accordingly, at P_1, A and B purchase the quantities Q_{A1} and Q_{B1} respectively. At a price P_2, they purchase Q_{A2} and Q_{B2}. The **market demand** is therefore the horizontal sum of the individual demands at these prices. In the figure this is defined by D_{market}.

Market demand: the horizontal sum of individual demands

Figure 3.9 Summing individual demands



At P_1 individual A purchases Q_{A1} and B purchases Q_{B1}. The total demand is the sum of these individual demands at this price (Q_1). At P_2 individual demands are summed to Q_2. Since the points Q_1 and Q_2 define the demands of the market participants it follows that market demand is the horizontal sum of these curves.

Conclusion

We have covered a lot of ground in this chapter. It is intended to open up the vista of economics to the new student in the discipline. Economics is powerful and challenging, and the ideas we have developed here will serve as conceptual foundations for our exploration of the subject. Our next chapter deals with measurement and responsiveness.

SUMMARY

Demand is the quantity of a good or service that buyers wish to purchase at each possible price, with all other influences on demand remaining unchanged (3.2)

Supply is the quantity of a good or service that sellers are willing to sell at each possible price, with all other influences on supply remaining unchanged (3.2)

Quantity demanded defines the amount purchased at a particular price (3.2)

Quantity supplied refers to the amount supplied at a particular price (3.2)

Equilibrium price: equilibrates the market. It is the price at which quantity demanded equals the quantity supplied (3.2)

Excess supply exists when the quantity supplied exceeds the quantity demanded at the going price (3.2)

Excess demand exists when the quantity demanded exceeds quantity supplied at the going price (3.2)

Short side of the market determines outcomes at prices other than the equilibrium (3.2)

Demand curve is a graphical expression of the relationship between price and quantity demanded, with other influences remaining unchanged (3.3)

Supply curve is a graphical expression of the relationship between price and quantity supplied, with other influences remaining unchanged (3.3)

Substitute goods: when a price reduction (rise) for a related product reduces (increases) the demand for a primary product, it is a substitute for the primary product (3.4)

Complementary goods: when a price reduction (rise) for a related product increases (reduces) the demand for a primary product, it is a complement for the primary product (3.4)

Inferior good is one whose demand falls in response to higher incomes (3.4)

Normal good is one whose demand increases in response to higher incomes (3.4)

Comparative static analysis compares an initial equilibrium with a new equilibrium, where the difference is due to a change in one of the other things that lie behind the demand curve or the supply curve (3.4)

Price controls are government rules or laws that inhibit the formation of market-determined prices (3.7)

Quotas are physical restrictions on output (3.7)

Market demand: the horizontal sum of individual demands (3.8)