



How We Do Economics Today

- 1.1 Introduction – 6
- 1.2 Supplying Maximum Human Well-Being Through Markets – 6
- 1.3 Microeconomics and the Process of Self-regulation – 7
 - 1.3.1 The Primacy of Exchange – 7
- 1.4 Two Definitions of Scarcity – 8
- 1.5 How the Structure of the Economy Is Perceived – 8
- 1.6 Supply, Demand, and Their Theoretical Interaction in Markets – 9
 - 1.6.1 Assumed Constants for Demand – 10
 - 1.6.2 Assumed Constants for Supply – 11
 - 1.6.3 Self-regulations and Changes in the Supply and Demand Curves – 12
 - 1.6.4 Behind the Demand and Supply Curves – 14
- 1.7 Margins and Marginal Utility – 14
 - 1.7.1 Market Structures – 14
- 1.8 Macroeconomics – 15
- 1.9 Postwar Macroeconomics – 16
- 1.10 The Focus on Growth – 17
- 1.11 The Need for Biophysical Economics – 21
- References – 21

1.1 Introduction

We start with a definition of economics: it is derived from the Greek *oikos*, meaning pertaining to the household, so economics is the study of household management Aristotle wrote of this in his *Politics*. He believed wise household management, even if the household comprises the entire state, is part of natural law. But for Aristotle, and those who followed his philosophical lead long into the medieval period, *chrematistics*, or producing and lending money for profit, was unnatural. Economic thought has changed a great deal since ancient and medieval times! Curiously, ecology starts there too, although the ecologist's household can often be much larger. If you think about economics in your day-to-day life, you are probably thinking about providing yourself with the necessities of life (and hopefully a few amenities), that is, the basic stuff you need to survive and, hopefully, be happy. Often you need to think about the trade-offs that exist between the choices you have, a hamburger and no movie vs. Ramen soup and a movie, tuition vs. rent or a vacation, or how to budget whatever financial resources that you have to meet your needs and wants. Many elderly people of limited means must consider the trade-off between food and health care. Hence in very basic perspective, economics is about choice: how much we have and how we should decide among alternatives. Of course, economics pays a lot of attention to money, and a basic starting point for economic thought is that almost everything of concern to humans has a price and can be bought or sold for money. A starting assumption of mainstream economics is that the value of something is represented by its price.

Many people like to talk about the economy. You hear them in barbershops and grocery stores, outside of daycare centers, on the news, at various political functions, and at the park. People wonder whether they should spend their money now or save it for their children's future. Many people are passionate about what the proper role of government should or should not be in the economy. Politicians talk about their economic plans as do journalists and bartenders. These are all legitimate ways to think about the economy, but it is not how academic economics is undertaken. Instead, most mainstream economists build abstract, highly idealized, sets of models. But in this book, we want to do more: we want to capture the essence of how actual economies operate. To do this we

need to think deeply about what constitutes actual economies. Many other academic disciplines such as political science, sociology, or even biology do not always have a good command of the basics. We would like to start you off on the right foot when it comes to the study of economics in general and economic theory, reservations. We will do this here by introducing you in minimum space to the main concepts of nearly all basic economics courses, even though later we will address some serious issues we have with that approach.

1.2 Supplying Maximum Human Well-Being Through Markets

Economics courses start with the idea that economics should focus on deriving maximum well-being, as defined subjectively by each individual, and the resources available to each individual. The first question is how should an individual spend his or her money to generate the maximum psychological well-being. The second question is how should the economy as a whole operate to help every individual get as much satisfaction as possible? Although an actual economy is a complex entity with many facets, mainstream economics focuses in large part on what is called “the market.” Markets, as places of exchange and trade, have existed since antiquity. However, they were less important in the distant past, because most production of necessities took place in households. It was only in the sixteenth century that markets became a primary way to satisfy daily needs and a place where prices were formed. Adam Smith elevated the study of markets in eighteenth century England to a position of prominence in an era characterized by agriculture and small-scale manufacturing. Here farmers would lay out the leftover vegetables and eggs that they did not use themselves and trade them for money to buy other things such as the products of various smiths or artisans. In these environments purchasers could take their usually hard-earned money and carefully choose what was most needed or desired for their lives without too much in the way of manipulation or compelling authority. Contemporary mainstream economics believes that in an almost magical way “the market” will generate the maximum possible human well-being by generating the largest possible number of most desirable goods and services for

each member simply attempting to achieve his or her own self-interest. In the words of Adam Smith: “It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest” [1]. Thus, the basic concept of how economies are thought to work in a “free market” situation is that consumers will purchase goods and services to suit their own conception of the psychological satisfaction each purchase will make and that suppliers will shift to make what people want, for that is where they make their own largest profit. As consumers purchase additional commodities, they will get less satisfaction from the extra one and shift to another commodity.

Market is often imbued with nearly mystical power. Former President Ronald Reagan often spoke about the “magic of the market” [2]. Other ways of thinking about the economy are rarely, if ever considered. Most mainstream economists believe that the basic propositions of economics are true for all places and all times. The economic relations between people and nature that exist today existed tens of thousands of years ago for our hunting and gathering ancestors. The basic assumption of mainstream economists is that there wasn’t much difference between the medieval economy and that of the present day. Moreover, the future will be like the present.

1.3 Microeconomics and the Process of Self-regulation

Part of the reason why contemporary economists like this basic worldview is that it expresses the idea that the economy is *self-contained* and *self-regulating*. By self-contained it is meant that the economy is the primary system to be analyzed. It is not a subsystem of something larger such as nature or society. In the mainstream worldview, all human interactions are economic transactions. Nature is external to the system and hardly worth recognition at all. Besides, if necessary, nature can be easily brought within the economy by “internalizing the externalities.” Such internalization processes are the subject matter of the emerging field of environmental economics.

In the view of economists, the second concept, that of self-regulation, is very important because it means that an economic system, left to its own

devices, will produce outcomes that are efficient and equitable, a very desirable state of affairs. *Efficient* means that resources will flow to their best uses and that no one can be made better off without making another worse off. *Equitable* means that market outcomes are fair. Individuals are rewarded according to their productivity and contribution to society. In other words, the market knows best. If the market forces of competition and flexible prices can unfold without some type of external interference (such as by governments), the result will be that people’s needs are met and the economic resources available will be put to the best use, in terms of satisfying human wants and needs. This view of economics is perhaps best exemplified by the words of Voltaire’s Dr. Pangloss (based on philosopher and mathematician Gottfried Leibnitz) that “this is the best of all possible worlds.” While humans may not be able to fulfill all their wants and desires due to the limits of their purchasing power, at least by making their own free choices they will generate the maximum human psychological satisfaction possible. This has the added virtue, according to market advocates, in democratizing decision-making: society will produce those goods and services that its participants think are best and most desirable rather than what might be advocated by someone who “knows best” for all involved (i.e., centralized planning).

1.3.1 The Primacy of Exchange

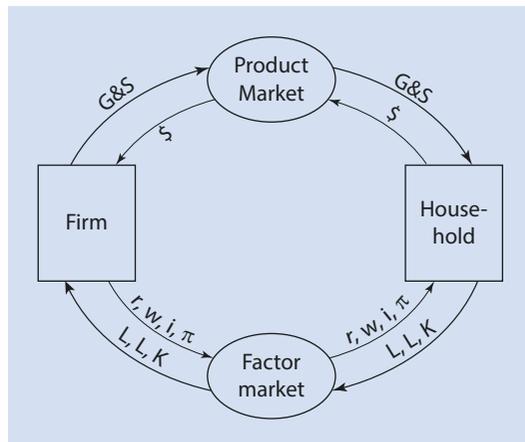
In the 1830s, economist Frederick Bastiat declared that “exchange is political economy.” By this he meant that the primary subject matter of economics should be the ordinary exchange of money for goods and services. As we will show in the next chapter, in previous times economists, then calling themselves political economists, focused on many processes with a biophysical basis, such as production, distribution, and capital accumulation. Economists still treat these materialistic subject matters, but mostly only within the context of exchange. The basic belief is that one can analyze sufficiently the complex economy just by looking at the processes of buying and selling. This approach comes replete with a definition of economics based on relative scarcity, a conceptual model of the circular flow of exchange value, and the ubiquitous supply and demand diagrams.

1 1.4 Two Definitions of Scarcity

In the first two centuries of economics, a definition for economics did not exist. During the Great Depression Oxford economist Lionel Robbins, writing on economic methodology, came up with the most widely used definition of economics. He contended that economics was the “study of the allocation of scarce resources among alternative uses.” His definition itself needs a little explaining. Allocation means “who gets what.” The market allocates this book to a student of biophysical economics, while a pneumatic nail gun may be allocated to a finish carpenter and a tractor to a farmer. Allocation refers to stuff, most often called goods and services. Who gets what money is usually called distribution. The concept of scarcity underlies mainstream economics, although it does not mean exactly what we might first think. It does not relate to the limited availability of things like fish or petroleum or clean water. Mainstream economists rarely deal with such absolute scarcity. If one thinks about it, today is probably the most resource abundant time humanity has ever seen, but still there is scarcity, not to mention enormous poverty. The idea of *relative scarcity* depends upon the assumption that humans have unlimited wants, and any resource would be scarce relative to unlimited wants. Mainstream economists believe relative scarcity has existed in all times and all places. Biophysical economist John Gowdy disagrees. In a marvelous collection of essays on hunter-gatherer economies, entitled *Limited Wants, Unlimited Means*, Gowdy argues that hunter-gatherer bands were quite different than we are today. They were radically egalitarian, had no concept of private property, had few material desires, and faced a cornucopia of nature relative to their very modest wants [3]. This was largely because they were seminomadic, and they had to carry all their possessions on their backs from one water hole to another.

1.5 How the Structure of the Economy Is Perceived

How do economists conceptualize the economy? The most basic model, one found in the first chapters of essentially all economic textbooks, posits two sectors, two markets, and four flows. The model begins from the perspective of the



■ Fig. 1.1 Circular flow model without leaks or injections. In this model the factors of production are: Land (L), Labor (L), and Capital (K). Factor payments are indicated by: Rent (r), Wages (w), Interest (i), and Profit (π). The top flow from firm to households represents Goods and Services ($G&S$), while the top flow from household to firm takes the form of Money ($\$$)

individual. Individuals have but two identities in this view of society. People are either consumers, and are to be found in *households*, or they are producers and can be found in *firms*. Any other identities people may feel affinity toward such as race, ethnicity, nationality, or gender are not considered. And even though real people tend to live in households and work in firms, in this model they are only one or the other. Moreover, they never interact directly with one another. All human activity occurs indirectly through market transactions. People either buy or sell. There are also two markets. The first is the product market where money is exchanged for goods and services. The second is the factor market where the “factors of production,” that is, land, labor, and capital, are exchanged for a specific type of money known as *factor payments*. Land receives a rent. Labor gets wages, and capital is remunerated by profit and interest, depending upon whether one is an entrepreneur or a financier. Material goods and immaterial services flow one way, and money flows the other. What is important is the flows of exchange value—things humans perceive as valuable that can be exchanged for money (■ Fig. 1.1). Value is equated with price and human relations that are not captured in buying and selling, such as the relation between Adam Smith and his mother, are simply not considered. Neither is the human interaction with nature. While all goods

may be relatively scarce, nature imposes no absolute barriers that cannot be transcended by resource substitution, technological change, or entrepreneurial innovation.

The circular flow depicts an economic premise often called “Say’s Law of Markets,” or simply, “Say’s Law.” [4]. The economy is self-regulating because the money on the pathway that goes from household to firm exactly equals the money on the pathway from firm to household. This is the simplest, but not the most convincing, explanation of self-regulation. First, it contains no mechanism to translate production, consumption, and spending into forms of income. Second, it requires that everyone spends all their income on current consumption or production. Household members do not save, and businesses do not invest. Nobody buys imports, and firms do not export. No individuals pay taxes, and the government spends no money. But despite these and other problems, Say’s Law became an essential cornerstone of economics. After the severity of the Great Depression, economists, especially those following the trail blazed by British economist John Maynard Keynes, began to question the idea of Say’s Law. Consequently, when looking at the economy, the circular flow model was augmented to include money that “leaked” out of the spending stream such as saving, taxes, and spending on imports as well as money that was “injected” in the form of investment, government spending, and exports. If more money leaks out of the system than is reinjected, there will not be enough money to buy all the products firms desire to sell. This would cause firms to cut back on production and hire fewer workers. The result is a recession caused by lack of demand. If more money was

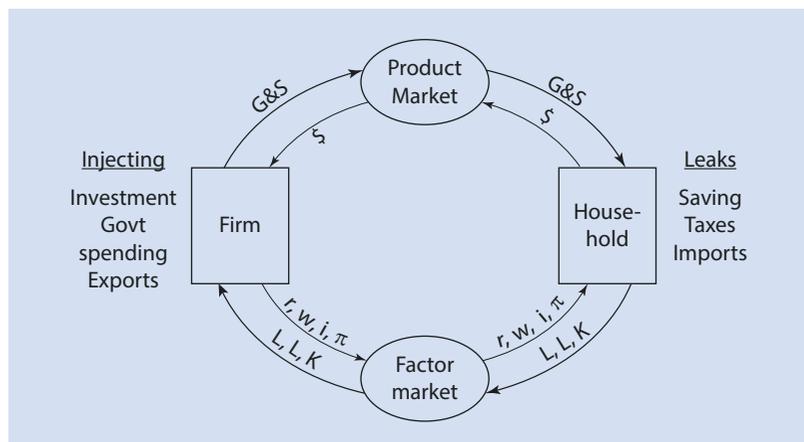
injected in than leaked out, there would be too much money chasing too few goods, and inflation, or a generalized increase in prices, may result. In addition, economic growth depends upon injections of new investment.

1.6 Supply, Demand, and Their Theoretical Interaction in Markets

A focal point of modern economics is the concept of supply and demand and their interaction to generate price. Supply measures how many units of a good or service sellers want to take to the market, and demand measures how much stuff consumers want to purchase. Both are a little tricky, as, for example, more units would be demanded if the price were lower and fewer if the price were higher. Likewise, if the price was higher, more suppliers would be likely to provide more units to the consumers. A second aspect is that a large number of things that affect the willingness and ability to buy or sell have to be held constant when in the real world they are changing all the time. But if we did not make these assumptions, the model would be very cluttered and difficult to solve even with advanced statistical techniques.

The most important first point to remember is that in the mainstream view the interaction of supply and demand determines simultaneously equilibrium levels of price and quantity. Prices, especially competitively derived prices, are the great regulating mechanism of mainstream economic theory. Equilibrium, also reflected in [Fig. 1.2](#), is also a useful concept. The idea, appropriated from physics, means a state of rest

Fig. 1.2 Circular flow with leaks and injections
In this model the factors of production are: Land (L), Labor (L), and Capital (K). Factor payments are indicated by: Rent (r), Wages (w), Interest (i), and Profit (π). The top flow from firm to households represents Goods and Services ($G&S$), while the top flow from household to firm takes the form of Money ($\$$)



where there is no internal tendency to change. If the system is perturbed from the outside, it will return, after adjustment, to the state of rest. It is derived from Newton's third law of motion, that all forces sum to zero, or for every action there is an equal but opposite reaction. In this idealized world of economics, prices, if disrupted (e.g., by an embargo), will return to the original equilibrium situation by means of price competition.

Let us begin with the demand curve and a definition of demand.

Demand measures the willingness and ability of consumers to buy various quantities of goods and services at different prices, with all things that affect this willingness and ability, other than price, held constant.

For those new to mathematical modeling, one benefit of constructing models is the ability to separate cause and effect. This is more difficult if there are multiple causes, so one trick is to pretend that things you know are really changing all the time are constant for the purposes of the model. To lend even more credibility, we give this simplifying assumption a Latin name, *ceteris paribus*, which means all other things held constant. The use of Latin is meant to or is supposed to impress you. The definition of demand is a bit of a mouthful, so let us provide a mathematical shorthand:

$$Q_d = f(p) \text{ ceteris paribus.}$$

This says pretty much the same thing as the long-winded definition in words: the amount you are willing or able to buy depends upon the price. If prices go up, you are willing or able to buy less. If prices go down, you buy more, as long as everything that affects your willingness to buy, other than price, is held constant. Graphically, as in **Fig. 1.3** changes in price translate to a movement up and down a stable demand curve.

Note, and it is an important note for those who like technical precision, that a decrease in prices *does not* increase demand, and an increase in prices *does not* decrease demand in this model. It is a technical point that a lot of people get wrong: politicians, newscasters, ecologists, for example. A change in price can change only quantity demanded. Instead, the only change in one or more of our assumed constants (*ceteris paribus* assumptions) can change demand. You should commit the following list to memory if you plan on studying economics formally.

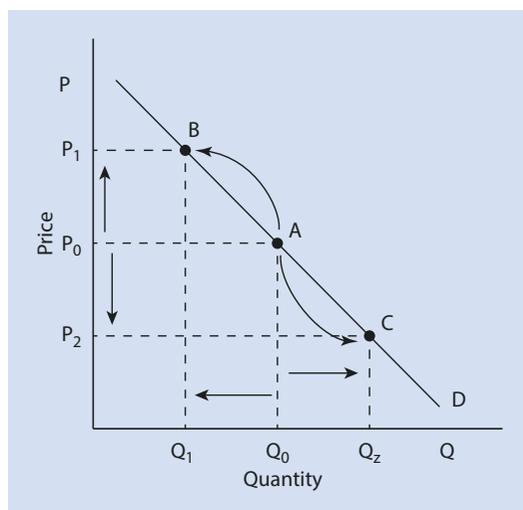


Fig. 1.3 Changes in price lead to changes in QUANTITY DEMANDED. This is graphically depicted as a movement along a stable demand curve. Price (P) and Quantity (Q)

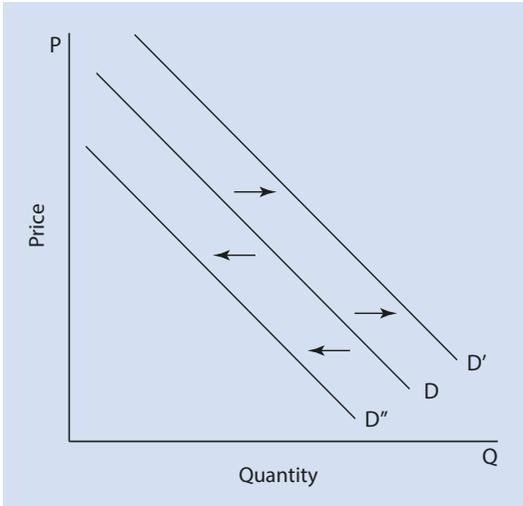
1.6.1 Assumed Constants for Demand

- Income and wealth
- Tastes and preferences
- Price of related goods
- Consumer expectations
- Number of consumers

If your income increases you are likely to buy more goods and services. If your tastes change, say because of advertising, you might buy more of this and less of that. If the price of a substitute goes up, you would shift to the good in question and buy more. If you expect a sale in the future, you might hold off and buy less now in anticipation. More people with money in their pockets, all other things held constant, will purchase more. A change in demand is depicted as a shift in the demand curve (**Fig. 1.4**). If it shifts to the right, demand has increased, and a shift to the left signifies a decrease in demand.

Supply looks at the market from the seller's point of view. The definition is remarkably similar to that of demand. If you change consumer to firm and buy to sell, the definition is exactly the same.

Supply measures the willingness and ability of firms to sell various quantities of goods and services at different prices, with all the things that affect the willingness and ability to sell, other than price, held constant. Mathematically:



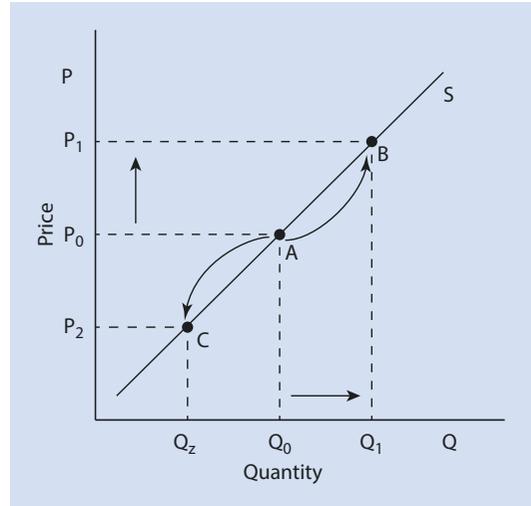
■ **Fig. 1.4** Changes in assumed constants lead to changes in DEMAND. The whole curve shifts to the right for an increase in demand and to the left for a decrease. Price (P) and Quantity (Q)

$Q_s = g(p)$ *ceteris paribus*, where Q_s is quantity supplied, g is the functional operator, and p stands for price. In this case the supply curve has a positive slope. This means firms will be willing or able to sell more at higher prices, all other things remaining constant. Not surprisingly, the list of assumed constants is different, because it affects the firm's cost of production instead of consumer preferences.

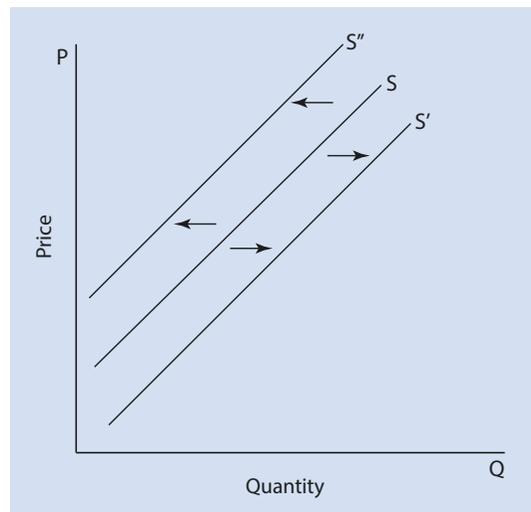
1.6.2 Assumed Constants for Supply

- Technology
- Input or resource prices
- Seller expectations
- Number of sellers

If price changes, the *quantity supplied* changes since at higher prices more suppliers will be interested in selling their stuff (■ Figs. 1.5 and 1.6). This is depicted graphically as a movement along a stable supply curve. Higher prices bring forth an increased quantity supplied, while lower prices mean that sellers will be less willing or able to bring forth their goods or services, and quantity supplied declines. If one of our assumed constants changes, *supply changes*. Changes in supply are shown as a shift of the curve. If supply increases from technological improvement or lower input prices (e.g., wages, energy, rent), the whole curve



■ **Fig. 1.5** Changes in price lead to changes in quantity supplied. This is graphically depicted as a movement along a stable supply curve. Price (P) and Quantity (Q)



■ **Fig. 1.6** Changes in assumed constants lead to a change in supply. The entire supply curve shifts to the right for an increase and to the left for a decrease. Price (P) and Quantity (Q)

will shift to the right, so that consumers are willing and able to purchase a higher quantity at the same price. If supply declines because of things like higher energy prices or higher wages, the entire supply curve will shift to the left.

What is the difference between demand and quantity demanded and supply and quantity supplied, and why do we stress it so much? Studying economics is largely about figuring out cause and effect relations on these graphs. Let us summarize these causations:

Causation #1 : change in price leads to changes in quantity demanded (or $\Delta p \rightarrow \Delta Q_d$)

Causation #2 : change in a ceteris paribus condition of demand leads to a change in demand

$$(\Delta \text{assumed constants} \longrightarrow \Delta D)$$

Causation #3 : change in price leads to a change in quantity supplied ($\Delta p \rightarrow \Delta Q_s$)

Causation #4 : change in a ceteris paribus condition of supply leads to a change in supply

$$(\Delta \text{assumed constants} \longrightarrow \Delta S)$$

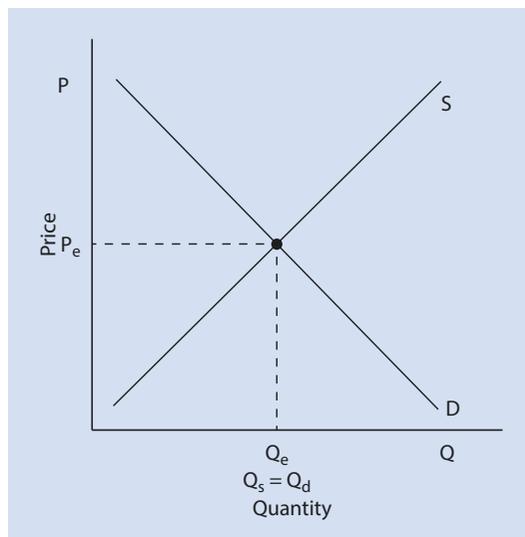
In ending let us say the difference between supply and quantity supplied, as well as demand and quantity demanded, can be seen geometrically. Supply is *all the possible combinations* of price and quantity, given our assumed constants. Quantity supplied is a *single point* on the supply curve. The same goes for demand.

1.6.3 Self-regulations and Changes in the Supply and Demand Curves

The argument for market self-regulation, which was analytically broad and rather unconvincing at the level of the circular flow model, becomes more cogent once the driving force of price competition is added to the process. Remember that a condition of stable equilibrium is that if the state of rest is perturbed, the equilibrium (original conditions where supply and demand are balanced) will be restored by forces within the system. Let us first consider the characteristics of market equilibrium, then two changes that will disturb the state of rest. The first will be a change in prices. We will trace the economic problems involved and show how price competition will restore the original equilibrium state. Next, we will consider one or more changes in our assumed constants (ceteris paribus assumptions) and show how a new equilibrium condition will emerge.

► <https://www.youtube.com/embed/fcx1sd-9pyKg>

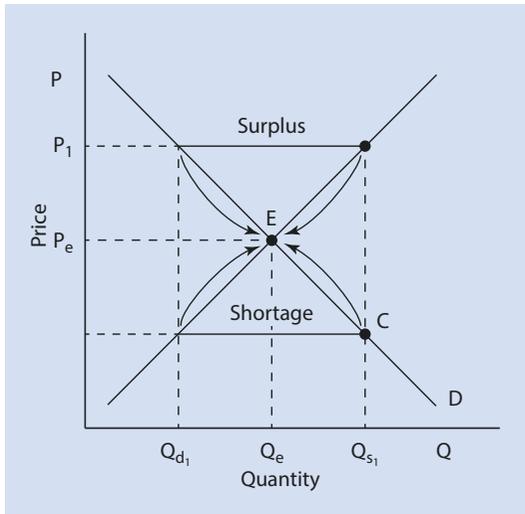
We begin our analysis of supply and demand by assuming that the market is in equilibrium.



■ **Fig. 1.7** Market equilibrium. At the equilibrium price quantity supplied = quantity demanded. Price (P) and Quantity (Q)

Here the supply curve intersects the demand curve. The higgling and haggling of the market process has found the one price where the quantity supplied just meets the quantity demanded. At this price, sellers are willing and able to bring forth to the market just the right amount of goods or services that buyers are willing and able to purchase. This does NOT mean that supply equals demand. Since both supply and demand curves represent all the possible combinations of price and quantity, the only way supply would equal demand would be if the curves were superimposed upon one another. This would be impossible because one curve has a positive slope and the other a negative (■ Fig. 1.7).

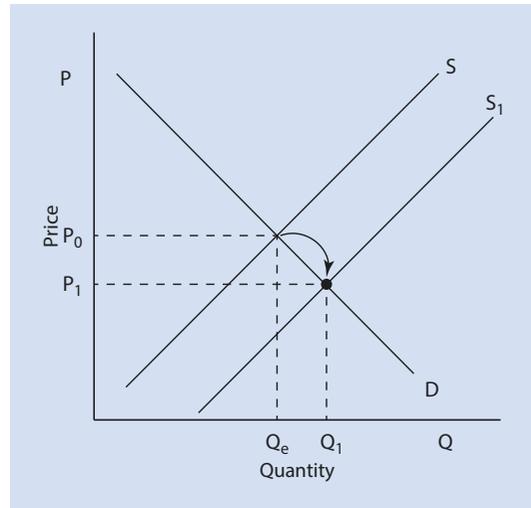
Next, assume that prices increase. The same action touches off two effects. The increase in price causes quantity demanded to decline (people will buy less because it costs more) while at the same time it causes quantity supplied to increase (suppliers see more opportunity for profit). At prices above equilibrium (“e” on ■ Fig. 1.8), the quantity supplied is greater than quantity demanded. Economists call this unstable situation a *surplus* and believe that market forces alone will be sufficient to restore the prior equilibrium. A surplus represents unsold goods for sellers. To try to get rid of the surplus, sellers will compete by reducing their prices. If one seller lowers his or her prices, then competitors will be forced to reduce theirs too. The reduction in price increases quantity demanded and lowers quantity supplied, thereby reducing the surplus. If



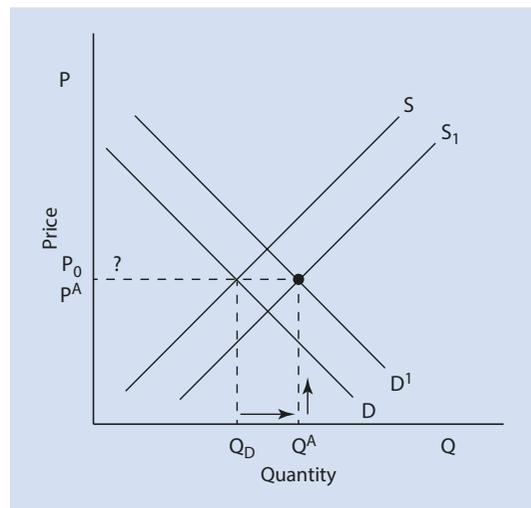
■ **Fig. 1.8** If prices exceed, equilibrium quantity supplied $>$ quantity demanded and a surplus arises. Price competition among sellers to get rid of unsold goods drives the price down toward equilibrium. If price is less than equilibrium, quantity demanded $>$ quantity supplied. A shortage results, and consumers bid up prices to obtain the goods in short supply. Equilibrium is restored by price competition. Price (P) and Quantity (Q)

the opposite occurs, and prices fall below equilibrium, quantity demanded will exceed quantity supplied. A shortage will ensue causing consumers to compete with one another by offering to pay more for the goods in short supply. The higgling and haggling continue until the market, as if by magic, finds the one price where quantity demanded equals quantity supplied, where the amount firms are willing and able to sell just equal to the amount that consumers are willing and able to buy. At this point, there is no further incentive to change or to raise or lower price. Equilibrium is thereby restored. Nothing other than price competition was needed to restore the balance. At least this is the theory.

Next, assume technological improvement, such as a new and more efficient use of energy. Starting from an equilibrium position, the supply curve shifts to the right because of a change in a *ceteris paribus* condition of supply. Relative to the starting point, the increase in supply results in lower prices and larger quantities. The resulting price drop leads consumers to increase their *quantity demanded* and purchase more at the new, lower price. This condition, where improvements in efficiency lead to more, not less, resource consumption is known as *Jevons' paradox*. We will consider it in more detail in the next chapter, but it helps to understand the market mechanism behind



■ **Fig. 1.9** A change in supply drives down equilibrium price. Consumers are willing or able to buy more at the lower price, establishing a new equilibrium. Price (P) and Quantity (Q)



■ **Fig. 1.10** When demand and supply change at the same time, either price or quantity is indeterminate. Price (P) and Quantity (Q)

the process. If consumer incomes were to change along with technology, demand would also rise, pushing both prices and quantities up. The new equilibrium would exhibit some uncertainty because while we could easily say that equilibrium quantities would rise, it would be harder to be certain about price. Because increase in supply would pull prices down, and increases in demand would push them up. We would need more information to tell for certain (■ Figs. 1.9 and 1.10).

We will not bog you down in any further details. If you find this information interesting, or at least useful, you might want to consult a textbook in *Principles of Microeconomics*. Our favorite is *Microeconomics in Context* by Neva Goodwin and her colleagues at the Global Development and Environment Institute of Tufts University. It is very well written and represents one of the few attempts to introduce the limits of nature and society at the introductory level [5].

1.6.4 Behind the Demand and Supply Curves

Why does a demand curve have a downward slope? Is it just because it seems normal to buy more stuff when it is cheaper or is there something more sophisticated going on? The answer can be found in the theory of *marginal utility*. As we will see in the next chapter, the idea developed over the hundred or so years from the 1790s to the 1890s and depends upon a specific philosophy of human behavior called *utilitarianism*. In the 1790s, British philosopher Jeremy Bentham asserted that humans had but two emotions: we sought pleasure and avoided pain. In the absence of pleasure or pain, we would do nothing. Bentham called the sense of pleasure, or satisfaction, or well-being, utility. He believed that the object of a good society was to provide the greatest good (or level of utility) for the greatest number. Bentham also thought that each individual is the best judge of his or her own pleasure. We can't say ours is better than yours. By strict Benthamist principles, Hall could not claim the joy he feels from his beloved Puccini operas were better than Klitgaard's experience at a Quicksilver Messenger Service concert in San Francisco. Neither of us could claim that our musical preferences are superior to the latest hip-hop compositions that we do not understand completely.

1.7 Margins and Marginal Utility

At this point, we find it necessary to introduce the concept of the margin, which will appear repeatedly in myriad economic contexts. *Margins*, as defined by words, always represent the contribution of the extra, additional, one more, or incremental. *Marginal utility* is the addition to satisfaction that

results from consuming one more unit of a product. In terms of mathematics, margins are always the change in the effect divided by the change in the cause, or Δ dependent variable/ Δ independent variable. Marginal utility is the change in the result (satisfaction) divided by the change in the cause (consumption). But how much does satisfaction change? Say you have been working clearing brush, and someone gives you something cold to drink. The first few sips would give you a great deal of extra satisfaction. But if you were to drink a gallon, the last few sips would not be as satisfying as the first. This is called *diminishing marginal utility*. The extra satisfaction from one more unit is less when you have a lot than when you have very little. Because marginal utility decreases as we consume more, we would be less willing to pay for the extra consumption of goods. Therefore, the demand curve slopes downward. You might realize there are some problems. If one cannot compare interpersonal utility, how can one aggregate it? This, and many other mysteries, awaits you should you decide to take a course in intermediate microeconomics.

In the 1890s, mainstream, or neoclassical, economists put the theory of supply on a marginal utility basis, changing only the names of the variables but not the analysis. If one input was fixed, say land or capital, as you added more units of a variable input like labor to a fixed amount of land or capital, the amount of extra work would eventually decline. This is known as *diminishing marginal returns*. Each incremental unit of labor produces a little bit less than the last one. As a result, the cost of producing the next unit of output increased on the margin. This rising marginal cost was the basis of a positively sloped supply curve.

1.7.1 Market Structures

The marvel of self-regulation by means of prices alone requires something that may or may not exist in the real world: price competition. Early economic models created an abstract world in which there were so many companies that none could influence the market price, and none had any technological advantage. This structure was known as *perfect competition*, and it rested upon a set of assumptions that must be satisfied simultaneously:

1. A large number of small firms.
2. Each firm is so small as to not affect the market price.

1.8 · Macroeconomics

3. Every firm made exactly the same thing (homogeneous product).
4. All firms had perfect knowledge and perfect foresight of market conditions.
5. There are no barriers to entry or exit.

These assumptions result in an economy of tiny, powerless firms that can do nothing except responding to the price dictates of an impersonal market.

In fact, it would be extremely difficult to compete under these conditions. Indeed, all profits other than the maintenance of the entrepreneur (known as normal profit) would be competed away, and all the benefits would accrue to the consumer in the form of the lowest possible prices. All outcomes should be “efficient.” Resources would flow to their best use, and individuals would earn their contribution to the total (not surprisingly, known as marginal product), no more and no less.

But businesses want to make profits, retain them and invest them in improved technologies. As far back as the 1500s, British coal companies began to monopolize their markets with the purpose of avoiding price competition, largely by deciding not to overproduce a surplus which would drive down prices. In the United States, merger activity flourished in the years after the Civil War. (We will chronicle the development of monopoly power in ► Chap. 9.) Also, in the chaos created by the Great Depression of the 1930s, more and more economists began to question this idealized world of perfect competition. Economists in the two Cambridge’s (England and Massachusetts) developed theories of imperfect competition, where firms cooperate for their mutual benefit, rather than compete with one another. We will develop this strand of theory more deeply in the next chapter. Suffice it to say that these models of imperfect competition, while far more realistic, cannot produce outcomes characterized by efficiency and equity. Rather they lead to overproduction, excess capacity, and exploitation. Most conservative economists barely give these criticisms passing notice, although these are crucially important factors in the actual economy.

1.8 Macroeconomics

In the early years of the twentieth century, the ideas of neoclassical economics were extended to interpret the overall, or *aggregate*, economy.

The conservative approach of the 1920s, dubbed “the Classical Model” by John Maynard Keynes, held that the overall economy behaved on the same principles of supply and demand as did an individual firm or industry. It worked as follows, at least in theory: Starting in the labor market, the demand for labor depended upon workers’ marginal products, and an individual worker was free to choose the number of hours he or she wished to work by equating the satisfaction of receiving a paycheck (the marginal utility of the wage) with the drudgery of the job (the marginal disutility of the work). The resulting equilibrium assured the economy would operate at full employment. Any unemployment was the result of a surplus of workers, meaning that the price of labor was “too high.” Wage cuts could easily restore the balance. Say’s Law assured that income translated into spending while the commitment to balanced budgets at home and abroad meant that neither budget nor trade deficits would exist for more than the short while it took markets to adjust. Interest rates, or the price of money, would be set in the market for “loanable funds.” Here, the demand for loanable funds was an inverse function of interest rates, which produced a downward sloping curve. The supply of loanable funds would respond positively to increases in interest rates. The resulting market equilibrium created an interest rate that automatically balanced savings and investment. The economy would run like a smooth machine provided that no outside entities like governments or labor unions would disturb the delicate balance.

This explanation held until the collapse of the Great Depression. In the United States, “official” unemployment rates increased to nearly 25% by 1933, and new investment was actually negative. In other words, more equipment was wearing out than was being replaced. The banking system collapsed three times between 1929 and 1933, while international trade dried up under high tariffs and the banner of “America First.” Events were worse in Europe and far worse in the poor countries of Africa, Asia, and Latin America. Moreover, the depression lasted for nearly a decade and came to an end only with the spending for Second World War. Out of this chaos, the theories of John Maynard Keynes gained acceptance. Keynes accepted most of the neoclassical economics but rejected Say’s Law and the idea that workers could choose their own hours of work based on their

utilities and disutilities. Because of these, he concluded that a mature, industrialized, capitalist economy could achieve equilibrium at any level of output, including one at high unemployment levels. Remember that equilibrium means no internal tendency to change, so an economy in this situation would have unemployment rates that persisted. Unchanging unemployment was a factor in the rise of fascism in Europe and in the Bolshevik Revolution. Keynes was determined to save capitalism from itself in the form of a tendency toward politically untenable levels of unemployment and perpetual economic stagnation. Keynes believed that the fundamental cause of a depression was *a lack of demand*, and more specifically a lack of aggregate demand. Aggregate demand is the demand for all goods and service by all economic sectors and consists of consumption, investment, government spending, and foreign trade. If people do not purchase all the goods and services that are produced, surplus inventories will build up. Falling prices will put even more pressure on struggling businesses. They will produce less and perhaps cut wages. But poorer workers spend less money, and the downward spiral begins. This seemed to explain the recurrent recessions and depressions that were characteristic of capitalist societies.

Keynes suggested public works programs, and if those failed he recommended burying money in bottles and paying people to dig them up. He thought anything that put money in people's hand would be part of the solution. He also wanted to abandon the gold standard that kept prices, wages, and profits falling. Keynes also did not believe in the lockstep of a balanced budget. He reasoned that if the government ran a deficit, the economy would expand all the much faster. The cause of the depression was a lack of demand, and a cure for the depression was to boost aggregate demand. In the United States, former Governor of New York Franklin D. Roosevelt was elected president. He implemented a program called the New Deal to relieve the suffering of America's most vulnerable citizens and to begin the recovery. Roosevelt initiated many spending programs but also raised taxes because he also believed in a balanced budget. The recovery was tepid to say the least. Unemployment never dropped below 13% during the entire decade of the 1930s.

1.9 Postwar Macroeconomics

The proof that Keynesian economics “worked” came with the spending for Second World War, and, as Roosevelt put it, “Dr. New Deal was replaced by Dr. Win the War.” Nobody complained about big government or deficit spending during the war. As a result, unemployment dropped to nearly 1% by 1944. (We will chronicle the specifics of the postwar experience later in ► Chap. 10.) For the time being, it is safe to say that Keynesian economics entered the canon of economic theory, especially for those of us who began studying economics in the late 1960s. But it was a new, more sanitized version of Keynes that developed in the United States. Gone were radical proposals for income redistribution and calls for the “voluntary euthanasia of the rentier class.” In its place came a commitment to economic measurement, the “grand neoclassical synthesis,” and an obsessive focus on economic growth. Before the Great Depression, the United States had no consistent method of accounting for economic activity. To improve this situation, Congress commissioned Harvard Economist Simon Kuznets to improve the economic statistics available to the nation's policy makers. Even though partial, the statistics proved very useful in the war effort. Fellow Harvard economist Paul Sweezy won the Bronze Star for his statistical work to enable the Normandy Invasion on D-Day, 1944. After the war, the *Survey of Current Business* began to publish the “national income and product accounts.” The focus was upon *gross national product* (GNP), or the dollar value of all final newly produced goods and services in the country, as the primary measure of economic success final goods are those purchased by the ultimate consumer, and not sold to someone else. All the components, for example, consumption, investment, government spending, and net exports, added up to equal the GNP. Both economic growth and economic development were defined as increases in gross national product. In 1948, Massachusetts Institute of Technology economist Paul Samuelson created the grand neoclassical synthesis in his textbook, *Economics*. Here he argued that the private sector was best at allocating resources and distributing incomes. The government's participation was needed simply to produce regular and consistent levels of economic growth. This could be done by changing directly the levels

of government spending and taxation, known as *fiscal policy*, or by changing the levels of the supply of money and the interest rates, referred to as *monetary policy*. If these policy measures were implemented subtly, economists could “fine-tune” the economy and relegate recessions and depressions to vestiges of the past. If unemployment rose too much to be politically acceptable because of too little aggregate demand, the government could just spend more or tax less. The nation’s central bank, the Federal Reserve, could add to the money supply and charge lower interest rates. If prices in general started to rise because of too much aggregate demand, the government could spend less or tax more or make money harder to get and more expensive. The reductions in money and spending would simply bring down prices while full employment was maintained. Life seemed easy, especially in theory. In the real world, attempts to control inflation actually increased unemployment, but British economist A.W. Phillips showed, along with his famous “Phillips curve,” how the trade-off could be managed acceptably. The trade-off was a small price to pay for economic growth. This was all predicated on the fact that inflation and unemployment were mutually exclusive events, at least for the time being.

1.10 The Focus on Growth

Keynes himself was not particularly focused on economic growth but upon aggregate demand, economic recovery, and full employment. However, his colleague and biographer Roy Harrod did produce *An Essay in Dynamic Theory* [6] in the last year of the depression. Harrod argued that because of psychological forces, the trajectory of economic growth would be highly unstable. Any deviation from the warranted growth path would touch off unstable oscillations that he compared to a knife edge. Eight years later American economist Evsey Domar published a foundational article that also showed the path of economic growth to be highly unstable [7]. He attributed this instability to “the dual nature of investment.” Investment is part of aggregate demand, and its increase leads to growth in GNP. However, investment also produces long-lived fixed capital. If too much capital exists, the overproduction leads to excess capacity which

reduces growth. Fine tuning was not as easy as it seemed, although this would not be seen until the 1970s. The best efforts to fine tune the economy in the 1970s were no match for the peak of domestic oil production, and the collapse of the International Monetary Accords. Meanwhile, to the rescue rode Samuelson’s MIT colleague, Robert Solow. In his 1956 *Contribution to the theory of economic growth*, Solow made some technical changes to the production function [8]. He accused Harrod of assuming that inputs were used in fixed proportions. Solow constructed a series of equations based on substitutable inputs (also known as the Cobb-Douglas production function) and, viola, the instability disappeared. Solow’s analysis did have the problem of a large unexplained residual, and we will address this later in ► Chap. 3. In the 1950s, growth theory consisted of the work of Harrod and Domar. By the late 1950s, Solow’s approach was given equal footing. By the 1980s, Harrod and Domar’s work was relegated to a footnote, and by the twenty-first century all reference to their work had disappeared from the neoclassical literature. What remained was a theory of economic growth in a frictionless, perfectly competitive idealized economy. The model predicted steady growth. Unfortunately, the actual economy produced stagnation, financial collapse, and severe recession.

As we explain in ► Chap. 7, the 1970s were a challenging time for Keynesian economics. The international monetary accords, negotiated in 1944 in a grand hotel in Bretton Woods, New Hampshire, no longer functioned. They were predicated on economic power at the end of the war. But post war conditions changed Germany and Japan caught up, and the costs of a failed adventure in Vietnam meant the United States could no longer make good on its promises. Second, high rates of unemployment and inflation occurred at the same time. Attempts to reduce unemployment just raised inflation, while unemployment remained persistently high. Policies designed to reduce inflation were ineffective but raised unemployment. Keynesian economics could no longer “deliver the goods.” On top of all that, disruptions in the world supply of oil led to two energy crises in the 1970s. The cheap fuel that postwar Americans had come to see as their birthright was no longer cheap. Moreover, recessions followed every spike in oil prices.

A more conservative approach began to emerge. *Monetarist* economists argued that inflation “always was and always will be a monetary phenomenon.” Too much aggregate demand was not the problem, too much money was. Fiscal policy was seen as ineffective, and monetary policy (money supply and interest rates) began to rule the policy roost. Wall Street banker Jude Wannisky devised the idea of “supply-side” economics and convinced the newly elected president, Ronald Reagan, to change policy. According to supply-side economics, inflation and unemployment could be solved by increasing aggregate supply. To do this the cost of regulation and wages needed to fall. The policy also got a boost from the decline in world energy prices. Since then, policies have become more conservative. As we show in ► Chap. 7, supposedly liberal Bill Clinton and Al Gore reinvented government by reducing its funding and “ended welfare as we know it.” After the 2001 attacks on the World Trade Centers and the Pentagon, President George W. Bush told the Americans to “go out and shop” while increasing military spending and fomenting perpetual war.

In 2008, young Americans came within a hair’s breadth of experiencing the same type of depression that their grandparents and great grandparents did. The response of the Obama administration was to implement the equivalent of Herbert Hoover’s plan for the economy at the beginning of the Great Depression. The Troubled Assets Relief Program (TARP), patterned after Hoover’s Reconstruction Finance Corporation (RFC), poured billions of dollars into the rescue of banks, while leaving millions of everyday working Americans dispossessed from their homes. Government spending for infrastructure projects was part of an overall stimulus program, and military spending continued to grow with active wars in Afghanistan and Iraq. President Obama actively championed a return to Keynesian economics. Efforts at decarbonization were progressive in rhetoric yet small in outcome, as the administration did not see fit to challenge its commitment to economic growth for environmental purposes. Its sustainability program depended largely upon technological change in electrical generation (wind and solar subsidization) coupled with an expansion of hydraulic fracturing of shale gas and tight oil. What lies in store for the United States after the election of Donald Trump remains an open question. One

thing is certain, however. “Making America great again” will entail a doubling-down on fossil fuels.

What we have presented so far is an introduction to basic micro- and macroeconomics for those who have not studied economics formally and a brief review for those who have. However, the total discipline of economics does not confine itself to these limited sets of questions. Over the course of history, economics has focused on other questions not usually covered in introductory textbooks. We will end this chapter by posing these questions and answer them in an historical context in ► Chap. 2.

Question #1 : What Are the Origins of Wealth and Value?

We begin our discussion of the main questions of economics by distinguishing between income and wealth; throughout the ages, the distinction has not always been clear. Wealth has long been seen as an abundance of goods that are available to a society or to an individual. In preindustrial societies, wealth was the stocks of what nature bequeathed us. But as the economy began to grow and develop, wealth began to be defined as the sum of what humans produced, in other words an accumulation of the flows of value extracted from nature. The question as to whether wealth is a stock or a flow has been debated ever since economic theory developed, and the resolution has never been conclusive. The distinction is also complicated by the level of analysis. Most individuals see wealth as a stock of assets that produce a flow called income. Economists of the neoclassical era defined wealth as a stock called *capital*, while “capital” has been extended to describe all factors of production. Ecological economists regularly refer to the stocks of nature as *natural capital*. Mainstream labor economists see their discipline as the study of *human capital*. In the end, questions of capital and income resolve to a discussion of wealth and value.

Question #2 : How Are Wealth and Value Distributed?

Some schools of thought find the question of distribution of the rewards of production to be fairly uninteresting. Some find it the focal point of their analyses. In general, classical political economists found questions of production and questions of distribution to be interrelated but analytically separable. Neoclassical economists, however, found them analytically identical. The neoclassical theory of production, known as

marginal productivity, is also the neoclassical theory of distribution. Marginal productivity theory stated that each “factor of production” would receive exactly its additional contribution to production. John Maynard Keynes, for the most part, accepted the marginal productivity theory of distribution, with a few, but important, reservations. While the theories of distribution are but peripherally related to energy, they are sufficiently important to economics to deserve specific treatment, especially in the neoliberal era.

Question #3 : How Does the Economy Balance Supply and Demand?

Since the late 1700s, most economists have focused on the possibility that the impersonal market forces of competition and flexible prices could balance the needs and desires of consumers with those of firms. Adam Smith wrote first of this possibility although he never drew a supply and demand diagram. His French popularizer, Jean Baptiste Say, codified Smith’s vision of the “invisible hand” into “Say’s Law,” which expressed the idea that the process of producing goods and services simultaneously creates the income to purchase them. This is better known as “supply creates its own demand.” Neoclassical economics accepted “Say’s Law” as a fundamental part of their system. British neoclassical economist Alfred Marshall provided us with the modern supply and demand schema that we use currently.

Swedish economist Knut Wicksell extended the analysis to the market for savings and investment, concluding that the overall economy would find its equilibrium at full employment. Keynes disagreed fundamentally with this proposition. Rather, he argued, the economy could reach equilibrium at a level of output that was substantially less than full employment and that it exhibited no internal tendency to change from that low-employment equilibrium. Keynes’ arguments for governmental intervention in the economy remain hotly debated today, but there is no question that the cycles of boom and bust that followed the publication and at least partial implementation of his ideas have become much more subdued [22].

Question #4 : What Are the Limits to Capital Accumulation?

While the crucially important subject matter of economics from the time of the mercantilists was the accumulation of wealth, the methods of

dealing with accumulation and growth changed substantially once the age of abundant and cheap fossil fuels began. All theorists who wrote in the age of solar flow developed theories of self-limiting accumulation. All classical political economists had growth theories that ended ultimately with society in a nongrowing stationary state. But after the introduction of cheap oil, the focus on the stationary state ended, replaced with the idea of indefinite growth as the result of efficiently functioning markets. However, the transition from classical political economy to neoclassical economics also saw a shift from the concept of long-term accumulation to that of static equilibrium. A neoclassical growth theory did not emerge until the 1950s in response to Keynesian views on the internal limits to growth and accumulation. As we enter the second half of the age of oil, we are facing a new set of biophysical limits that interact with the internal limits found largely in the investment process. To address the role of biophysical limits adequately, we first turn to the historical perspectives on the internal limits to accumulation.

Question #5 : What Is the Proper Role of Government?

Classical political economists stood for a limited role of government. These limited roles are embodied, in fact, in the US Constitution. Governments should maintain property rights, enforce contracts, protect the nation from domestic and foreign enemies, and provide public goods. They should not intervene in market processes or regulate prices. Instead the invisible hand of the market would be sufficient to translate individual self-interest into social harmony. Say’s Law assured that the overall system would balance at full employment without the need for government direction. Thus, our constitution reflected the dominant economic thought of the time.

Neoclassical economists too accepted this proposition and translated it into mathematical propositions. The Walrasian core of neoclassical economics asserts that individual exchange based on self-interest (in the form of equal marginal rates of substitution among trading partners) will satisfy not only the traders but result in the general equilibrium of the system at a point where no individual can be made better off without harming another. Prices serve as perfect carriers of information, and any intrusion of the government

into market processes will distort the markets' price signals and simply make system not work.

Keynesian economics takes a very different position. The private operation of markets periodically produces insufficient demand, and government action is needed to provide sources of demand that the private sector cannot do profitably. Although Keynes himself believed in the necessity for planning in the long term, there is little in Keynesian economics that justifies government intervention in the internal mechanisms of production and profit-making itself. Nevertheless, an increasing number of economists and politicians “bought into” government intervention as Keynes had suggested. For many decades, from roughly 1930 through 1973, Keynesian demand management, or something like it, helped propel a long wave of economic growth that seemed to work extremely well as the US government pumped more and more money into the economy in both war and peace and as the economy grew steadily year after year. Few paid attention to the fact that this was also an era of expanding supplies of cheap oil, which was, according to economists, “just another commodity.”

But after the peak of US oil production in 1970, long-term prosperity gave way to long-term stagnation amid rising prices and a disenchantment with Keynesian economics and its attendant requirement for government intervention. This, and other factors, led to a return to political and economic conservatism in the nation accompanied by a conservative resurgence in the economics profession. Neoclassical economists were back in the saddle emptied of Keynesians and legislation reflected their free market orientation. One can argue, however, the long-term result of these “reduce government intervention” policies resulted in the near financial collapse in 2008. The election of 2010 seemed much like a contest between two sets of policies, neither of which worked in the recent past. Subsequent austerity programs such as those in Greece have led not to prosperity but to continued stagnation and increased human misery.

Question #6 : What Is the Role of Money?

What is money and why does it play such a key role over economic activity? Over the course of history, economists and philosophers have look at money from various perspectives. Is it “the root of all evil?” Is money something simple like a medium of exchange, or is money bound up with cultural iden-

tity and national sovereignty? Where did money come from, and how has its different uses over time affected how scholars have theorized about it? What is the relation between money and debt? Should money necessarily be backed by some precious metal, or is paper money backed only by the productivity of the economy and the stability of the government's promise to repay its debts? Can one adequately control an economy by adjusting the amount of money that circulates, or does money play a relatively minor role in overall economic performance? Is money merely a lien on energy, or is it far more complicated? Economists have struggled with these questions since people began to use and write about money. Not surprisingly, different schools of thought have different emphases and outcomes.

Historically, money mostly took the form of debt. Cuneiform tablets, one of the first forms of writing, were actually records of debts. Metallic money, stamped with the ruler's image, arose with the military. Precious metals were an effective way to pay soldiers [7]. Today money is mostly debt. Most of the developed world went off the gold standard in the Great Depression of the 1930s, never to return to it. In the post-Second World War era, the US dollar replace gold as the international currency, and gold was demonetized domestically. Currency is now just the debt of the Federal Reserve System, our nation's central bank. Moreover, most of our money supply consists of checks, which are merely the debt of private banks, and monetary policy is simply a matter of a central bank enabling or restricting the commercial bank's ability to create additional debt. But the debate rages on as to whether money drives the economy, or economic activity determines the amount of money in the system.

Over the course of time, money has fulfilled several roles. Money serves as a medium of exchange, as a readily acceptable way to trade goods and services whose use values are not similar. Money can also be a unit of account. When asked “how much is that worth,” most people give monetary value, rather than the number of labor hours it took to produce or acquire or the emotional attachments between humans that the good or service represents. Money may be a store of value. That is why many people fear inflation. It reduces the stored value in money. Unfortunately, the different uses of money are not always served equally well by the same currency. Economist

Richard Douthwaite lists several questions that should be asked to figure out how well money functions for its different purposes:

1. Who issued the money? Many beginning students are surprised that most of our money supply is the debt of private banks and not the government.
2. Why did they do so? Most often a bank, like any private enterprise, does so in order to earn profits for their shareholders.
3. Where was the money created? Was it a national currency, a regional money like the Euro, or a local currency like Ithaca dollars or Berkshares?
4. What gives money its value? Is it backed by something like a precious metal or simply the promise to accept the money for payment?
5. How was the money created? Did people go into debt for a central organization like an international bank, or was it a system for debt and credit at the local level?
6. When was the money created? Was it a one-time event or an ongoing process?
7. How well does it work? Does money meet all three goals?

Douthwaite argues that a single form of money does not fulfill all its functions equally well and advocates different currencies for different purposes [9].

1.11 The Need for Biophysical Economics

The ability to live well within Earth's limits calls for fundamental change, and mainstream economics is not designed to guide such system-level transformations [10]. Consequently, economics as is taught today leaves out several crucial factors. It neglects the fact that all work, including economic production, is driven by flows and stocks of energy. Yet energy is not part of the model that sees instead a circular flow of exchange as the primary system. In addition, the turn toward political conservatism and belief in self-regulating markets has caused economists to return to the ideas of Say's Law and perfect competition. But the real world contains monopolies, non-price competition, and great inequities of political power. While economists emphasize growth, the economy produces

long-term, secular stagnation, whether or not the theories recognize this. We need a theory that acknowledges both the biophysical limits of nature and the internal limits to economic growth. Much of the rest of this book does that.

References

1. Smith, Adam. 1923. *An inquiry into the nature and causes of the wealth of nations*, 14. New York: Modern Library.
2. Political economist Anwar Shaikh is also an amateur magician. When asked whether he believed in the magic of the market he said "certainly." He then proceeded to make an egg disappear and pull it from the coat pocket of his enquirer. Professor Shaikh then went on to say that magic, like the market, is mostly illusion. What you see is not necessarily what is going on. What we see is the voluntary exchange between equals. What we don't see is the hierarchy of production, the depletion of high quality resources, and the destruction of the environment.
3. Gowdy, John. 1998. *Limited wants, unlimited means*. Washington, DC: Island Press.
4. Notice the quotation marks around "Say's Law." This means we are highly skeptical of the term. For something to meet the criteria of a scientific law, three conditions must be met: the phenomenon always occurs, and there are no counterexamples. Any scientific law must be consistent with other scientific laws. Moreover, the law can be expressed mathematically. Examples that fit are the Ideal Gas Law, Newton's Law of Gravity, and the Laws of Thermodynamics. The existence of periodic recessions and depressions is a counterexample to Say's supposed law. In addition, the fact that the money on the top loop just equals the money on the bottom loop means no waste occurs in production. But the second law of thermodynamics states that some work is always turned into waste heat. Consequently "Say's Law" is contrary to the basic laws of thermodynamics and doesn't really represent a law in the scientific sense.
5. Goodwin, Neva, Jonathan Harris, Julie Nelson, Brian Roach, and Mariano Torras. 2014. *Microeconomics in context*. Armonk/New York: M.E. Sharpe.
6. Harrod, Roy. 1939. An essay in dynamic theory. *Economic Journal* 49: 14–33.
7. Domar, Evsey. 1947. Expansion and employment. *American Economic Review*. 37 (1): 34–55.
8. Solow, Robert. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economics* 70 (1): 65–94.
9. Douthwaite, Richard. 1999. *The ecology of money*. Devon: Green Bools Ltd..
10. Raskin, Paul, Tariq Banuri, Gilberto Gallopin, Pablo Gutman, and Al Hammond. 2002. *The great transition*. Stockholm: The Stockholm Environment Institute.