ECON 102 - Introductory Macroeconomic Analysis

Michael Bar¹

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¹San Francisco State University, department of economics.
II Measuring the Macroeconomy

4 GDP and Standard of Living

4.1 Definition of GDP

4.2 Measuring Nominal GDP - Expenditure Approach

4.3 Nominal vs Real GDP

4.4 Limitations of GDP

5 Unemployment and Labor Markets

6 Price Level and Inflation
Part I

Micro Foundations
The first part of these notes presents the tools from introductory microeconomics course, necessary for the study of introductory macroeconomics. The approach taken here, and in virtually every introductory macroeconomics course on the market today, is that microeconomics precedes macroeconomics.
Chapter 1

Introduction

1.1 What is Economics?

There is a misconception that "economics is about money". The truth is that economics is about people, and how people (individuals, businesses, societies) make choices about scarce resources. Money is a technology that helps facilitate trade. Economics exists because of scarcity. The roots of all the principles of economics and all areas of economic discipline are derived from two pillars: (1) scarcity, and (2) rational choice axiom. In this section we carefully explain these two concepts.

**Definition 1  Scarcity** - a fact of life, that resources available to people are limited (time, natural resources, space in general and in our classroom in particular), but we have unlimited wants (we always want more).

As a result of scarcity, we can't always get what we want. It is important to emphasize that scarcity is not the same as poverty. Even bill Gates has only 24 hours a day, and if he spends one hour on meeting with business associates, he has one hour less to spend with his family, watching TV, or going to theater. Also, when we say that people have unlimited wants, we don't mean that people are greedy or selfish. We want more memory on our cell phone, a better and safer car, a bigger house in a better location, cleaner air, better health care services, more courses offered at our college. Even Buddhist monks who choose to live frugal life as part of their religion, and seem like they have very limited wants, would gladly accept donations for a children’s hospital or a school. So assuming that people always want more, does not imply that they want more for themselves. As a result of scarcity, people are forced to make choices, and economists make an assumption that people are making rational choices.
**Definition 2** Rational Choice Axiom - the assumption that all people make any choice if and only, for the person making the decision, we have:

\[ \text{Perceived Benefit} \geq \text{Perceived Cost} \]

An axiom is an assumption which is so evident that it does not require any proof. Indeed, we cannot prove the rational choice axiom, or disprove it. In order to disprove this axiom, one needs one example of people making choices for which the perceived benefit **for the choice maker** was smaller than his perceived costs. Students who are challenged to come up with such an example, typically suggest choices such as suicide, consumption of addictive drugs, crime, or charity. In all of these examples however we need to remember that the benefit and cost relevant for the choice making are the ones perceived by that person making the choice. Although a bystander observing a suicide might think that the person committing it is irrational and making a huge mistake, but this judgment is based on the observer’s perceived cost and benefit. The person who decides to end his life may perceive the cost and benefit differently from an outside observer. For example, the person committing suicide might perceive large benefit in the next life. Economists therefore do not attempt to judge people’s choices, but instead assume definition 2 as given.

Other social scientists, such as psychologists, also study how people make choices. Psychologists study the emotions and feelings that affect the perceived costs and benefits of people’s choices, and there is no contradiction between their theories and the economists’ rational choice axiom. We do not claim that mental state does not affect the perceived cost and benefit of an action. Psychologists would explain the mental state of a middle age man who buys a sports car as part of his mid-life crisis, and an attempt to compensate for underachieving in life. This explanation does not contradict the rational choice axiom, and that the middle-aged man perceived higher benefit from buying his sports car than the cost of that car.

Moreover, the rational choice axiom does not suggest that people always make the correct choices. Once again, the key assumption is that individuals make choices based on their perceived cost and benefit. For example, many couples decide to marry, but some of them divorce later on. At the time of their decision to get married, their perceived benefit of marriage was higher than their perceived cost. However, later on, they might change their view and decide to divorce if their perceived benefit from divorcing is higher than their perceive cost of divorcing. Similarly, students who decide to study little for a course, make a rational choice and consider their perceived cost and benefit from studying. However, after receiving a low grade, they might regret that they did not study more.
Thus, (1) scarcity and (2) rational choice axiom are the two pillars of economic analysis, from which economists derived many other ideas and principles, some of which we will present in the next section.

1.2 Ideas of Economic Analysis

In this section we briefly discuss 5 key ideas of economic thought, derived from the two pillars: (1) scarcity, and (2) rational choice axiom:

1. Incentives matter
2. Choices involve trade-offs
3. Opportunity costs
4. Marginal thinking
5. Trade creates value

1.2.1 Incentives matter

From the rational choice axiom in definition 2, it follows that any factors that affect the perceived cost or benefit, influence the choices that people make. These factors are called incentives.

**Definition 3 Incentives - factors that influence the perceived costs or benefits from an action, and therefore affecting people’s choices.**

Positive incentives are rewards, which increase the perceived benefit of an action. For example, if a teacher gives extra credit for class attendance, he gives a positive incentive to attend her classes. Negative incentives are punishments, which increase the cost of some choice. For example, if a teacher takes off points for missing classes, provides a negative incentive for skipping classes. A tax on cigarettes is another example of a negative incentive, to smoke. Positive and negative incentives are often referred to as "carrots" and "sticks", which are nicknames rewards and punishments.

Incentives can be direct or indirect. A direct incentive is given to induce (or discourage) a particular choice, but the same incentive can have an indirect impact on other choices, called indirect incentives. Often policy makers who provide an incentive for some choice, fail to predict the indirect incentives embodied in the policy. These unforeseen indirect
CHAPTER 1. INTRODUCTION

incentives are called unintended consequences. For example, a teacher may give points for a group project, as an incentive for students to work together and learn from one another. But this policy also provides an indirect incentive for weak students to put any effort in the group project and leave all the work for the other students (become free-riders). Similarly, governments provide unemployment insurance benefits for people who lose their jobs in order to help them retrain and find other jobs. But unemployment insurance benefits, also provide an indirect incentive to stay unemployed, because if the unemployed person finds a job, he loses the unemployment benefits.

1.2.2 Choices involve trade-offs

Because of the fact of life that people face scarcity, every choice that we make involves trade-offs.

Definition 4 Trade-offs - the reality, that because of scarcity, in order to get something, we always give up something else.

For example, when you decide to go to class, you give up 1 and a half hours that could be spent in other activities. For example, instead of coming to class, you could have watched TV, or exercise in a gym, or study in the library. When you spend time on one activity, you must give up some other activities, simply because time is scarce, and we all have only 24 hours a day and limited lives. As another example, when we buy something a book for $100, we have $100 less to spend on other things. This is a result of the fact that our budget is limited. The government budget, although bigger than that of any student, is also limited. When the U.S. government spends 1 billion dollars on education, it has 1 billion less to spend on other items, such as health care, national defence, welfare.

1.2.3 Opportunity costs

In the last section we claimed that due to scarcity, every decision involves giving up something, in order to get something else. In other words, every choice has a cost. The formal way of describing the costs in economics is opportunity cost.

Definition 5 An opportunity costs of something is the highest valued alternative that must be given up in order to obtain that something.

For example, Maria decided to attend the economics class for 3 hours a week. If she did not come to classes, she could have done many other things; either yoga class, or watching
TV or eating lunch, but not all at once. Suppose Maria’s highest valued alternative to attending the economics class is yoga class. Then we say that Maria’s opportunity cost of attending economics class is yoga class.

Whenever possible, economists try to measure all costs in terms of money, because it is convenient. In the case of the last example, it is not obvious how to attach monetary value to the yoga class, to watching TV and to Eating lunch. Suppose that the value of yoga class is $40, the value of having lunch is $30 and the value of watching TV is 25$. Then we can say that the opportunity cost of economics class is $40, which is the highest values alternative (the yoga class).

In some cases, the opportunity cost is directly measured in terms of money. For example, the opportunity cost of shoes that cost $130 is $130. Thus, by purchasing the shoes, the buyer gives up $130 worth of other goods that she would buy with that money, if she did not buy the shoes. In some cases however, the opportunity cost of something is higher than just the out of pocket money paid for it. For example, the cost of college education consists of the direct cost (tuition, board, comute, books, student fees, office supplies) + indirect cost (the earnings that the student gives up by attending school instead of working full time). Thus, when we measure the opportunity cost in terms of money, we still need to consider the highest valued alternative. In the case of attending school, the highest valued alternative could be working full time.

**Exercise 1** Calculate the opportunity cost of your college education. Remember to add the direct cost of college and the earnings that you think you give up over the course of college education.

When calculating the opportunity cost of college education, economists often obtain a very high value, sometimes nearly $250,000 for students attending private colleges with high tuition. This however doe not imply that you made a bad choice to pursue a college degree. Recall that according to the rational choice axiom in definition 2 people compare perceived cost with perceived benefits of any action. Since you decided to attend college, you must have estimated high benefit from the degree. Indeed, the wages of college graduates are on average about 50% higher that those of high school graduates. In addition, college degree opens the door for more interesting careers than high school degree. Moreover, the unemployment rate is much lower (about half) among college graduates than among high school graduates, so your college degree gives more job security.

**Exercise 2** List the benefits that you expect to get from your college degree.
1.2.4 Marginal thinking

Many choices in our lives involve decisions of "how much". For example, how much food we eat for lunch, how many hours to study for our courses, how many hours to watch TV, how many hours to exercise in a gym. The rational choice axiom implies that we must compare the cost and benefit from each additional unit of the item consumed, and decide to consume it is the benefit exceeds the cost. The cost and benefit form consuming additional unit of a something are called the marginal cost and the marginal benefit respectively.

**Definition 6** The **marginal cost** of an activity is the opportunity cost of additional unit of the activity. The marginal benefit of an activity is the benefit form consuming additional unit of the activity.

**Example 1** Suppose Quan buys pizza for the Super Bowl at the price of $5 per slice. Suppose that the benefit from each slice of pizza can be measured in money, and it equal to the maximal amount Quan is willing to pay for that slice. Thus, his marginal benefit and marginal cost of pizza are given in the next table:

<table>
<thead>
<tr>
<th>Slice #</th>
<th>MB</th>
<th>MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10</td>
<td>$5</td>
</tr>
<tr>
<td>2</td>
<td>$8</td>
<td>$5</td>
</tr>
<tr>
<td>3</td>
<td>$6</td>
<td>$5</td>
</tr>
<tr>
<td>4</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>5</td>
<td>$2</td>
<td>$5</td>
</tr>
<tr>
<td>6</td>
<td>$0.1</td>
<td>$5</td>
</tr>
<tr>
<td>7</td>
<td>-$3</td>
<td>$5</td>
</tr>
</tbody>
</table>

Notice that Quan’s marginal benefit from pizza is decreasing with the amount he eats; he is willing to pay $10 for the first slice because he is hungry, but he is willing to pay only $2 for the fifth slice because after 4 slices he is pretty full. How many slices of pizza would Quan eat during the Super Bowl?

Applying the rational choice axiom, we need to compare the benefit and the cost of each slice. The the marginal benefit of the first slice is $10, which is higher than the marginal cost of that slice - $5. Therefore, Quan will eat the first slice. Similarly, the marginal benefit of two slices is the benefit from the second slice, and is equal to $8, which exceeds the marginal cost of $5. Thus, Quan will eat the second slice. You can see that he will eat the 3rd slice as well, since \( MB(3) \geq MC(3) \). The marginal benefit from 4 slices is equal to the marginal cost of 4 slices, and according to the rational choice axiom, he will eat the 4th slice as well.
since $MB(4) \geq MC(4)$. He will not eat more than 4 slices of pizza however, because the marginal benefit falls below the marginal cost after the fifth slice.

**Exercise 3** Consider the consumer from the previous example, but instead suppose that he attends a Super Bowl party at a friend’s house, and can eat the pizza for free. How many slices of pizza will he consume this time? Explain your answer.

**Exercise 4** Suppose that Juanita’s marginal benefit and marginal cost of studying time per day can be measured in dollars, and is given in the next table.

<table>
<thead>
<tr>
<th>Hours</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB</td>
<td>50</td>
<td>45</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>MC</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>19</td>
<td>27</td>
<td>34</td>
<td>42</td>
<td>51</td>
<td>61</td>
<td>72</td>
</tr>
</tbody>
</table>

Based on the marginal benefit and marginal cost data in the above table, how many hours would Juanita study per day? Explain your answer.

### 1.2.5 Trade creates value

The fact that people face scarcity encourages people to always think of ways to produce more with the limited resources that we face. Obviously, we cannot increase the number of hours we have per day, but new technology allows people to produce more than before. For example, faster computers enable scientist to complete a simulation in a shorter amount of time. ATM machines allow you to draw money and deposit checks in less time. E-mails allow us to send and receive more letters and communicate faster. Thus, better technology allows us to alleviate scarcity, i.e. produce more with the same resources, although scarcity is not eliminated.

Better technology is not the only way to alleviate scarcity. Trade and specialization, just like new technology, allow producing more with less resources. The idea that trade creates value, will be formally illustrated in chapter 2. At this point, think of the role of trade in your life and what life would be like if you did not trade. We buy food from farmers; imagine what life would be like if everybody had to grow their own livestock, fruits and vegetables. We go to the dentist for our dental care; we buy health care from physicians; we buy furniture, appliances, cars from manufacturers. It is hard to imagine life without a trade, and providing all our needs for by ourselves. Even countries trade with other countries, although it is easier for a nation to be self-sufficient.

The reason for being able to gain so much from trade, is the fact that people (or nations) differ from one another in their opportunity cost. For some people it is "cheaper" (lower
opportunity cost) to specialize in farming, while for others it is cheaper to specialize in dentistry or medicine. Having lower opportunity cost in something means having **comparative advantage** in that activity. Chapter 2 illustrates that by allocating resources towards activities in which people (or nations) have comparative advantage, we can produce more goods and services, without using more resources or more time.

### 1.3 Economics as a Social Science

Economists are trying to answer questions about the real world, by using the scientific method. In this section we describe several ideas and tools of economic research, that are common to all scientists.

#### 1.3.1 Positive and Normative Analysis

Scientists are trying to make clear distinction between facts and personal opinions.

**Definition 7** A **positive statement** is a statement that can be tested and either found to be truth or false.

**Definition 8** A **normative statement** is an opinion that cannot be tested.

For example, the statement "the earth is flat" is a positive statement, which was tested by scientists and found to be false. However, the statement "everybody should study economics" is an opinion. I personally might agree with this statement, and try to convince people of the great benefits from studying economics, but this statement cannot be tested and classified to be truth or false.

#### 1.3.2 Economic Models

All scientists use models as a research tool.

**Definition 9** A **model in science** is a simplified version of the actual object being studied.

Examples of models, that are not from economics, include: (1) a road map (a model of actual roads), (2) a rat’s brain in neuroscience (a model of a human brain). Economists use models to better understand the actual, real-life object being studied. All models are abstractions of reality, and include certain features of the real object being studied, while excluding other irrelevant features. For example, the road map excludes many features of
1.3. ECONOMICS AS A SOCIAL SCIENCE

the real world, such as trees, houses, people and animals. Nevertheless, the map contains enough details to be a useful model which can answer the question of how to get from point A to point B. Similarly, economic models include features that the researchers believe are relevant for answering a particular question.

**Endogenous vs Exogenous variables**

All variables the variables (factors) of a model can be classified into those given outside the model, and those that are determined inside the model.

**Definition 10** *Exogenous variables* are variables that are determined outside the model.

**Definition 11** *Endogenous variables* are variables that are determined inside the model. Also regarded as the model’s prediction.

For example, a microbiologist tests the effect of particular drug on some bacteria. He controls the amount of the bacteria placed in the jar, the amount of the drug, the temperature, the amount of food. All these variables, controlled by the scientist, are called exogenous. The outcome of the experiment - the number of bacteria destroyed by the drug, is the endogenous variable. The endogenous variables are the outcomes of experiments, and cannot be controlled in advance by the researcher. In all the models in the world, the exogenous variables are causing the endogenous variables. Figure 1.1 is an illustration of the relationship between exogenous and endogenous variables in a model.

![Figure 1.1: Exogenous variables are inputs in any model, and the endogenous variables are the outcome of the model.](image)

**Ceteris Paribus approach**

In all models in science, scientists examine effect of one particular exogenous variable on the endogenous variables. For example, in when we test whether drug A or drug B are more effective against a particular bacteria, we must hold other exogenous variables the
same (temperature, amount of drug, food given to the bacteria, etc.). Similarly, in order to investigate the effect of income on consumer demand for a product, all other factors affecting the demand, such as the number of buyers, prices of other goods, expectations and tastes, must be held constant. If scientists change several exogenous variables in a model at the same time, it is difficult to isolate the separate effect of each exogenous factor on the outcome (endogenous variables).

Interpretation of model’s results

Just because a model constructed by some researcher gives a particular prediction, we cannot interpret this outcome as a statement about how the real world works. We can conclude that if the world was like our model (i.e. if the features included in the model are important in the real world), then we would expect the real world to behave like the model.

1.3.3 Statistical Analysis

Economists look at correlations between variables (whether they move in the same direction), and economic theory tells us what is the direction of causality (i.e., which variables are exogenous and which are endogenous). Not every correlation between variables, automatically implies that one of the causes the other. Figure 1.2 shows that there is a positive correlation between ice cream consumption and sunburns. The correlation does not imply however that

Figure 1.2: Correlation is not causality
higher consumption of ice cream causes sunburns, in which case taxing ice cream may reduce sunburns. What causes both, higher consumption of ice cream and sunburns, is the sun and the high temperature.
Chapter 2

Gains from Trade

The main result of this chapter is that if people (or countries) have different relative productivity (different opportunity cost) in producing goods, then they can all gain from trading with each other (more goods can be produced). This is without working more. In other words, we will illustrate how trade can alleviate (but not eliminate) scarcity. In order to do that, it is useful to illustrate scarcity with a graph, called the Production Possibilities Frontier.

2.1 Production Possibilities Frontier

Definition 12 Production Possibilities Frontier – a graph that shows the combinations of outputs of X and Y, such that it is impossible to produce more of one good without decreasing the output of another good. Also known as the combination of technically efficient output levels.

Figure 2.1 is an example of production possibilities frontier.

Combinations on the frontier are feasible (attainable), and efficient. Combinations below the frontier are feasible and inefficient, and combinations above the frontier are not feasible. For example, all the points A-I are feasible and efficient. Points such as (20, 40) are feasible and inefficient. Points such as (30, 60) are not feasible. Efficiency is defined only for feasible production points, and therefore, we do not discuss whether non-attainable production points are efficient or not.

2.1.1 Opportunity cost on the PPF

We can see that the graph of the PPF in figure 1.1 is downward slopping, reflecting scarcity and trade-off; in order to get more of good X, we must give up some of good Y. The slope
of the PPF, in absolute value, is exactly the opportunity cost of good X measured in terms of good Y. The inverse of the slope is the opportunity cost of Y, measured in units of X.

\[
\text{Opp. cost of } X = \left| \frac{\Delta Y}{\Delta X} \right| \text{ units of } Y
\]

\[
\text{Opp. cost of } Y = \left| \frac{\Delta X}{\Delta Y} \right| \text{ units of } X
\]

The symbol "\(\Delta\)" means change, and \(|\ |\) is absolute value. For example, when we increase the production of X by moving from point F to point G on the PPF, the change in X is \(\Delta X = 33 - 30 = 3\) and the change in Y is \(\Delta Y = 30 - 42 = -12\). That is, as we move from F to G, we increase the production of X by 3 units and give up 12 units of Y. The opportunity cost of each unit of X along the section F-G is therefore 4 units of Y:

\[
\text{Opp. cost of } X = \left| \frac{\Delta Y}{\Delta X} \right| = \left| \frac{-12}{3} \right| = 4 \text{ units of } Y
\]

Table 2.1 calculates the opportunity costs of X and Y on all the sections of the PPF in figure 2.1.
Notice that the opportunity cost of X increases as we produce more X. Similarly, the opportunity cost of Y increases as we produce more Y. This is reflected by the bowed-out (concave) shape of the PPF in figure 2.1. We illustrated above that the absolute value of the slope of PPF is the opportunity cost of X. The concave shape of the PPF reflects the idea that the more X we produce, the more costly it becomes. Suppose that initially the economy is producing at point A on the PPF of figure 2.1 and it wishes to produce some X. If the production process is efficient, then the economy would allocate the most suitable resources for the production of X - those resources that are not very valuable in the production of Y, or those resources that have the lowest opportunity cost of producing X. Notice that at point G, the economy already produces a lot of X. If the economy wants to increase X even further, it has to allocate to X resources that are not as efficient in producing X, and therefore have higher opportunity cost in terms of foregone Y. The concavity of the PPF reflects the increasing opportunity cost of any good, as we produce more of it.

To fully make sense of the increasing opportunity cost principle, consider your own PPF, where you produce two goods: X - studying and Y - everything else. Notice that each time you study, the first hours are the most productive. If you have already studied 6 hours a day, then additional hour of studying does not contribute as much to your knowledge. And the 7th or 8th hour per day, contribute even less. Thus, the opportunity cost of schooling X, in terms of all other things that you are doing Y, is increasing with the amount of schooling.

### 2.1.2 Gains from trade

Now we have the tools to illustrate one of the most important results in all of economics - the Gains from Trade proposition.

**Proposition 1 (Gains from Trade).** If people (or countries) have different relative produc-
tivity (different opportunity cost) in producing goods, then they can all gain from trading with each other (more goods can be produced). This is without working more.

In order to illustrate the gains from trade, we need distinguish between the following concepts:

**Definition 13 Absolute advantage** – a person (or a country) has absolute advantage in producing a good if he can produce that good with less resources (say less time, less inputs).

**Definition 14 Comparative advantage** – a person (or a country) has a comparative advantage in producing a good if his opportunity cost in the production of that good are lower.

Thus, having absolute advantage means being more productive, and having comparative advantage means being relatively more efficient. In the next example we will show that in order to gain from voluntary trade, countries (or individuals) need to be different from each other, i.e. have different opportunity costs. We will also illustrate that even if a country (or individual) have absolute advantage in the production of every good, they can still gain from trading with others, who are less productive, but nonetheless relatively more efficient in some goods.

Suppose two individuals, Nicki and Drake, operate a pizza parlor. Each of them can produce pizza and salads. The next table describes their productivity in terms of time required to produce one unit of each good.

<table>
<thead>
<tr>
<th></th>
<th>Time required (in minutes) to:</th>
<th>Opp. cost of one unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make a pizza (X)</td>
<td>Nicki: 1.5</td>
<td>Drake: 10</td>
</tr>
<tr>
<td>Make a salad (Y)</td>
<td>Nicki: 1.5</td>
<td>Drake: 2</td>
</tr>
</tbody>
</table>

We can see that Nicki has absolute advantage in both goods because she can produce them with less resources (in this case, less time). In order to determine who has comparative advantage and in what good, we need to calculate the opportunity cost. Notice that when Nicki produces 1 unit of X, she spends 1.5 minutes, during which she could have produced 1 unit of Y. Therefore, her opportunity cost of X is 1 unit of Y. Similarly, her opportunity cost of producing 1 unit of Y is 1 unit of X. When Drake produces 1 unit of X (1 pizza), he spends 10 minutes, during which he could have produced 5 units of Y (5 salads). Therefore, his opportunity cost of 1 unit of X is 5 units of Y. Since the opportunity cost of Y is the inverse of the opportunity cost of X, we can conclude that Drake’s opportunity cost of 1 unit of Y is 1/5 units of X. Indeed, when he makes one salad, he spends 2 minutes, during which he can finish 1/5 of pizza. The next table shows the opportunity costs of X and Y for both individuals.
We see from the above table that Nicki has comparative advantage in X, because her opportunity cost of producing X is lower than that of Drake (1 vs 5). Drake has comparative advantage in Y, because his opportunity cost of producing Y is lower than that of Nicki.

The same information about Nicki’s and Drake’s productivity can be given in terms of output per hour of every good, as illustrated in the next table. For example, saying that it takes Nicki 1.5 minutes to produce 1 pizza, is the same as saying that she produces 40 pizzas per hour.

<table>
<thead>
<tr>
<th>Output per hour:</th>
<th>Opp. cost of one unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pizzas (X)</td>
</tr>
<tr>
<td>Nicki</td>
<td>40</td>
</tr>
<tr>
<td>Drake</td>
<td>6</td>
</tr>
</tbody>
</table>

You should be able to calculate the opportunity costs based on given productivities, regardless of whether they are given as time required to produce one unit or as output per unit of time.

Now, suppose that they reallocate their time towards the good in which they have comparative advantage. That is, suppose that Nicki reallocates on hour from Y to X. As a result, her output of Y decreases by 40 units and her output of X increases by 40 units. In addition, suppose that Drake reallocates 2 hours from X to Y. As a result, his output of X decreases by 12 and his output of Y increases by 60. The next table summarizes these changes.

<table>
<thead>
<tr>
<th>Change in output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizzas (X)</td>
</tr>
<tr>
<td>Nicki</td>
</tr>
<tr>
<td>Drake</td>
</tr>
<tr>
<td>Total change</td>
</tr>
</tbody>
</table>

The total output of both goods increased! And this remarkable result occurred without better technology and without working more. Recall that both Nicki and Drake simply reallocated some of their time towards the goods in which they have comparative advantage. The additional output of 28 units of X and 20 units of Y can be shared by both of them, so they can both gain. For example, they can have a trade agreement that gives Nicki 20 units
of X and 15 units of Y, and Drake gets 8 units of X and 5 units of Y. The above example does not tell us about the exact trade agreement between them. All we know is that if trade is voluntary, the trade agreement will be such that both of them will gain from trade.

This example also demonstrates that even though Nicki is more productive than Drake in both goods, she can benefit from trading with him. Notice that even though Nicki can produce more salads than Drake per hour, her opportunity cost of a salad is 1 pizza, while Drake can produce a salad at a cost of only 1/5 pizza. Thus, Nick will be better off importing salads from Drake, and exporting pizzas to him, than producing both goods herself.

An extreme case of the time reallocation in the above example, is specialization, i.e. Drake spends all his time on salads (Y, the good in which he has comparative advantage) and Nicki spends all her time on making pizza (X, the good in which she has comparative advantage). In the real world, it is not always possible for every country to specialize in a few goods. Especially if a country is large. Suppose that the Mexico has comparative advantage in apples over the U.S., but Mexico cannot provide all the demand for apples in the U.S. Then, U.S. will produce apples as well.
Chapter 3

Competitive Market: Supply and Demand

In previous chapters we discussed the reality of scarcity. One key implication of scarcity is that all societies need to find ways to allocate the scarce resources among its members. By far, the most popular allocation mechanism, dating to the beginning of civilization, is the market mechanism. According to the market mechanism, resources are allocated to those who are able and willing to pay for them. Most of the effort of economics and business is therefore devoted to the study of markets; how they operate, under what conditions do markets lead to efficient allocation, how can government regulations fix market failure, etc. In this chapter we present a benchmark model of a competitive market, characterized by many buyers and many sellers, each taking the market price as given. In this model buyers are represented with a demand curve and sellers are represented with a supply curve.

3.1 Demand Curve

Buyers in a competitive market are represented with a demand curve.

Definition 15 A demand curve is the graph that shows, at any given price, the quantity that buyers want to buy.

We assume that when the price of a good increases, buyers want to buy less, an assumption called the law of demand. Figure 3.1 illustrates a demand curve and the law of demand. Notice that the demand curve is downward slopping, reflecting the law of demand. When the price is \( P_1 \), the buyers want to buy quantity \( Q_1 \). When the price is \( P_2 \), the buyers want to buy \( Q_2 \) (less than \( Q_1 \)). Changes in price of the good are represented by movement along the same demand curve of that good.
If the demand curve represents the demand of a particular buyer, we call it \textit{individual demand} curve. When we add up all the quantities demanded of all buyers, we obtain the \textit{market demand} curve. Table 3.1 illustrates the market demand in a market that consists of 2 buyers with individual demand curves $D_1$ and $D_2$. Here the demand is represented not by graph, but with a table, called the \textbf{demand schedule}. 

The last column in table 3.1 shows the market demand as the sum of individual demands. For example, at the price of $3, the first buyer wants to buy 4 units and the second buyer wants to buy 2 units. The market demand at the price of $3 dollars is therefore 6 units.
3.1.1 Shifts in demand

We will see later that the price and the quantity traded in a market are determined by the demand and supply, i.e. within the model. Therefore, $P$ and $Q$ are endogenous variables. All variables, other than $P$ and $Q$, are exogenous to the model, i.e., determined outside of the model. We will now discuss the main exogenous variables (determined outside of the model), which determine the location of the demand curve. Figure 3.2 illustrates an increase in demand, i.e. at any given price buyers wish to buy more. An increase in demand is reflected in a shift to the right of the entire demand curve. Notice that at price $P_1$, the quantity demanded increased from $Q_1$ (on demand curve $D_1$) to $Q_2$ (on demand curve $D_2$). Similarly, a decrease in demand is a shift to the left of the demand curve, meaning that at each given price, buyers want to buy less. Shifts in demand can result from several reasons, some of which we discuss below.

**Changes in income**

The effect of higher income on the demand for any given good is not obvious.

**Definition 16** A *normal good* is such a good for which the demand increases when income
goes up.

**Definition 17** An *inferior good* is such a good for which the demand decreases when income goes up.

Inferior goods are goods for which there are more expensive and higher quality substitutes. For example, used textbooks or cars, fast food, specific low-price clothing items. Large categories of goods, such as food, clothing, and entertainment, must be normal. Thus, an increase in demand, as shown in figure [3.2](#) can result from higher income of buyers, if the good is normal, and from a decrease in income, if the good is inferior.

### Changes in prices of related goods

**Definition 18** Two goods are *complements* if they are consumed together (complete each other). When the price of a good rises, the demand for its complement decreases.

**Definition 19** Two goods are *substitutes* if they fulfill similar need, and can replace each other. When the price of a good rises, the demand for its substitute increases.

### Changes in preferences

Buyers’ preferences can change as the good becomes fashionable, perhaps as a result of advertising or new information. For example, a positive road test and expert reviews can increase the demand for a given car. New studies about the health benefits of organic food, can increase the demand for such products. Similarly, bad publicity can decrease the demand for any given product.

### Expected change in future price

If buyers expect the price to rise in the future, they will hurry to buy the good now. As a result, the current demand will go up. Similarly, if buyers expect the prices to drop in the future, their current demand might decrease because they will postpone the purchase.

### Number of buyers

As illustrated in table [3.1](#), the market demand is the sum of quantities demanded by all buyers. More buyers, means that the market demand is higher at any given price.
3.2 Supply Curve

Sellers in a competitive market are represented with a demand curve.

**Definition 20** A *supply curve* is the graph that shows, at any given price, the quantity that sellers want to sell.

It can be proved that when the price of a good increases, sellers want to sell more, a proposition called the *law of supply*. Figure 3.3 illustrates a supply curve and the law of supply.

![Supply Curve Diagram](image)

Notice that the supply curve is upward sloping, reflecting the law of supply. When the price is $P_1$, the sellers want to sell quantity $Q_1$. When the price is $P_2$, the sellers want to sell $Q_2$ (more than $Q_1$). Changes in the price of the good are represented by movement along the same supply curve of that good.

### 3.2.1 Shifts in supply

Just like with demand curve, changes in exogenous variables (i.e. all variables other than $P$ and $Q$), determine the location of the supply curve. Figure 3.4 illustrates an increase in supply, i.e. at any given price sellers wish to sell more.
An increase in supply is reflected in a shift to the right of the entire supply curve. Notice that at price $P_1$, the quantity supplied increased from $Q_1$ (on supply curve $S_1$) to $Q_2$ (on supply curve $S_2$). Similarly, a decrease in supply is a shift to the left of the entire supply curve, meaning that at each given price, sellers want to sell less. Shifts in supply can result from several reasons, some of which we discuss below.

**Changes in cost of inputs**

It can be shown that the supply curve represents is the marginal cost curve of the firm, i.e. the cost of producing additional unit of the good. Anything that lowers the cost of production, increases the supply. Costs can decline due to lower input costs, or improvements in management and efficiency, technological improvement.

**Technological improvement**

As argued above, technological improvement that lowers the cost of production, increases the supply.
3.3. MARKET EQUILIBRIUM

Table 3.2: Market supply

<table>
<thead>
<tr>
<th>$P$</th>
<th>$S_1$</th>
<th>$S_2$</th>
<th>$S = S_1 + S_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>8</td>
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<tr>
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<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Taxes and subsidies

Lower taxes and higher subsidies, are similar to cost reduction from the point of view of the firm. Thus, lower taxes and higher subsidies also increase the supply.

Expected change in future price

If the sellers expect the price of their product to decline in the future, they will try to make more profit by selling more now. Thus, lower expected future price increases the supply.

Number of sellers

Just as with market demand, the market supply is the sum of the quantities supplied by all sellers. Table 3.2 demonstrates a market with two sellers.

For example, at the price of $5 seller 1 wants to sell 3 units and seller 2 wants to sell 2 units. The market supply is therefore 5 units at the price of $5.

3.3 Market Equilibrium

Figure 3.5 describes a competitive market with buyers represented by the demand curve $D$ and sellers represented by the supply curve $S$. The model predicts that in the long run, the equilibrium price in this market is $P^*$ and equilibrium quantity traded $Q^*$. We need to explain why the intersection of demand and supply is an equilibrium. Suppose that the price was above $P^*$. At this price the sellers want to sell more that what the buyers are willing to buy - an excess supply. Competition among firms on the limited demand will lead to declining prices. Similarly, if the price is below $P^*$, there is excess demand. Competition among buyers who are unable to purchase the good, will drive prices up. Only at the price of $P^*$, there are no economic forces that drive prices up or down.
3.4 Changes in Market Equilibrium

Figure 3.6 illustrates the effect of an increase in demand, on the market equilibrium. As a result of an increase in demand, from \( D_1 \) to \( D_2 \), the equilibrium price went up, and equilibrium quantity traded also went up.

Figure 3.7 illustrates the effect of an increase in supply on the market equilibrium. As a result of an increase in supply, from \( S_1 \) to \( S_2 \), the equilibrium price declines, and equilibrium quantity traded increases.

Figure 3.8 illustrates the combined effect of increasing in the demand and supply. Notice that equilibrium quantity unambiguously increased, because both forces work to increase the equilibrium quantity. However, since higher demand increases the prices, but higher supply decreases it, the total effect on equilibrium price is ambiguous. This means that the equilibrium price can go up or down or remain unchanged.
3.4. CHANGES IN MARKET EQUILIBRIUM

Figure 3.6: Increase in demand

Figure 3.7: Increase in supply
Figure 3.8: Demand and supply increase
Part II

Measuring the Macroeconomy
When a patient comes to a doctor, the visit always starts with doctor’s assistant measuring vital signs of the patient: pulse, temperature, blood pressure, weight, height. Just like doctors, economists measure important aspects of the economy. In the next 3 chapters, we will describe how economists measure the economy’s output, labor markets and inflation - the three most important measures of the economy’s health.
Chapter 4

GDP and Standard of Living

Our first goal is to come up with a notion of the economy’s “output” or productive capacity of the economy. The U.S. produces a variety of goods and services, and we cannot just add up quantities of apples, cars, haircuts... The solution is to add the monetary value (in dollars) of goods and services. The most important measure of aggregate output is the GDP. The development of GDP, and in general, the National Income and Product Accounts (NIPA) is a contribution of Simon Kuznets (1901 - 1985), a Belarusian-American economist, statistician, demographer, and economic historian who won the 1971 Nobel Memorial Prize in Economic Sciences "for his empirically founded interpretation of economic growth which has led to new and deepened insight into the economic and social structure and process of development."

As we will demonstrate below, GDP can be used to compare the country’s output in different years and monitor its economic growth and its business cycles (recessions and expansions). In addition, GDP can be used to measure the standard of living in different countries, and explore why some countries are poor while others are rich.

4.1 Definition of GDP

Definition 21 Gross Domestic Product (GDP) – the market value of the final goods and services produced by labor and property located within the borders of an economy during certain period of time (e.g. during a the year of 2014).

Let’s discuss the key parts of this definition:

1. "Market value" means that the GDP is measured in the country’s currency, and only goods and services traded in legal markets are count as part of GDP. Economic activity that does not take place in legal markets is not counted in the GDP. For example, if
you make a cup of coffee at your home and drink it, this production will not be counted in the GDP. If, on the other hand, Starbucks produces and sells a cup of coffee, then the value of that cup of coffee will be counted as part of GDP. Also, illegal activity, which does not take place in official markets, is not surveyed and does not count as part of GDP (e.g. drug sales).

2. "Final goods" are goods that sold to their end users, as opposed to intermediate goods, which are used as inputs in order to produce other goods. For example, when a consumer buys sugar from a supermarket for his own use, then this purchase is considered a final good that will be counted in the GDP. When a bakery buys sugar and uses it as an input in the production of cakes, then sugar is an intermediate good and is not counted in the GDP. However, when the cake is sold to the consumer, the price of the cake includes the value of all the inputs that were used in the production of the cake (sugar, eggs, flour, labor,...). Therefore, if we also counted intermediate goods as part of the GDP, those intermediate goods would be counted multiples times - at each stage of production they were used, and also as part of the value of the final good.

3. "Located within the borders of an economy" means that the U.S. GDP measures the output produced within the U.S. borders (domestically), whether the output was produced by American residents or by foreign workers. A related measure to GDP is GNP (Gross National Product), which measures the aggregate output of the country’s residents. Gross National Product (GNP) – the market value of the (final) goods and services produced by labor and property supplied by the economy’s residents during certain period of time (e.g. during a the year of 2014). For example, if an American professor teaches a course in China, then this output is part of the Chinese GDP and U.S. GNP.

4. "During certain period of time" means that the GDP of 2014 counts only the output of goods and services that were produced during that year. Goods that were produced before the year 2014 are not counted in the GDP of 2014.

4.2 Measuring Nominal GDP - Expenditure Approach

There are several equivalent ways to measure and report the GDP. The Expenditure Approach is considered the most accurate and the official way of measuring and reporting the GDP. The expenditure approach measures the expenditures (purchases) of the economy’s GDP by major groups of buyers: Consumers, Investors, Government and Foreigners. The
GDP calculated with expenditure approach is given by:

\[
GDP = C + I + G + X - IM
\]

- **C - Personal Consumption Expenditures** (or simply Consumption), goods and services purchased by persons resident in the United States, except for new housing.

- **I - Gross Private Domestic Investment**, the spending of firms on plant, equipment and inventories, and the spending of households on new houses.

- **G - Government Consumption Expenditures and Gross Investment**, net purchases of goods, services, from business and from the rest of the world by general government; payments by general government to households in the form of compensation of employees; the consumption of general government fixed capital; inventory change of government enterprises. Gross government investment is net purchases of fixed assets by the general government.

- **X - Exports** of goods and services.

- **IM - Imports** of goods and services.

- **NX = X - IM**, Net Exports of goods and services, exports less imports of goods and services.

The reason why we subtract the imports is because these include goods and services produced in other countries. So for example, if you buy a Banana Republic at the mall, the shirt is most likely imported from India or another country. The purchase of the shirt will be recorded as part of personal consumption expenditures and as part of imports, so the transaction will not affect the U.S. GDP. For example, if the price of the shirt is $70, then the purchase of the shirt is recorded as follows in the U.S. GDP:

\[
GDP = \underbrace{C}_{\$70} + I + G + \underbrace{X - IM}_{NX}
\]

Notice that both figures in the above equation cancel out, and the U.S. GDP is not affected by the transaction. If, on the other hand, the shirt is imported for $40 and sold by the Banana Republic store for $70, then the transactions are as follows:

\[
GDP = \underbrace{C}_{\$70} + I + G + \underbrace{X - IM}_{\$40}
\]
### Table 4.1: Table Caption

Notice that the U.S. GDP will increase by $30, which is the value added by the Banana Republic store located in the U.S.

### 4.3 Nominal vs Real GDP

The nominal GDP measures the value of goods and services produced in a given year, using prices and quantities of that year. Therefore, a rise in nominal GDP over time can be a result of increasing prices or increasing production, or both. Economic growth occurs when the economy is able to produce more goods and services, i.e. growth in Real GDP. Rising prices do not reflect expanding economy. To understand this argument, imagine that we add a zero to every price in the economy. An item that had a price of $5 for instance, now cost $50, and wage of $70,000 becomes $700,000. In the new economy, in which all the prices increase tenfold, all the people are still able to buy exactly the same amounts of goods and services as they were able to purchase before the prices increase 10 times. Therefore, rising prices, in and of themselves do not represent expanding economy.

The Bureau of Economic Analysis (BEA, http://www.bea.gov) - the government agency that measures the GDP and other indicators in the National Income and Product Accounts, estimates the Real GDP in such a way that growth in Real GDP represents only increased production capacity, and not inflation. This is achieved by holding the prices of goods and services fixed, when calculating growth in Real GDP. At the same time, the BEA estimates the price level, i.e. the average price of all the goods and services comprising the GDP. This price level is called the GDP Deflator, and can be used to adjust the nominal GDP for inflation. Table 4.1 presents the data on nominal GDP and price level for selected years.

One of the years is chosen to be the base year, and for convenience the price level at
that year is normalized to 100. In table 4.1, the base year is 2005. We can see that the price level in 2007 is 106.2, and based on this number we can immediately see that the price level since the base year (2005) increased by 6.2% (from 100 to 106.2). In general, the rate of change (and percent change) in any variable from \( x_0 \) to \( x_1 \) is

\[
\frac{x_1 - x_0}{x_0} = \left( \frac{x_1 - x_0}{x_0} \cdot 100 \right) \%
\]

Applying this to changes in the price level from 100 to 106.2, gives:

\[
\frac{P_1 - P_0}{P_0} = \frac{106.2 - 100}{100} = \frac{6.2}{100} = 0.062 = 6.2\%
\]

To calculate the real GDP in any year \( t \), based on table

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal GDP (billions of dollars)</th>
<th>Price Level (GDP deflator)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>$9,951.5</td>
<td>88.7</td>
</tr>
<tr>
<td>2001</td>
<td>10,286.2</td>
<td>90.7</td>
</tr>
<tr>
<td>2002</td>
<td>10,642.3</td>
<td>92.2</td>
</tr>
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<td>2003</td>
<td>11,142.2</td>
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<td>2004</td>
<td>11,853.3</td>
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</tr>
<tr>
<td>2005</td>
<td><strong>12,623.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
<tr>
<td>2006</td>
<td>13,377.2</td>
<td>103.2</td>
</tr>
<tr>
<td>2007</td>
<td>14,028.7</td>
<td>106.2</td>
</tr>
<tr>
<td>2008</td>
<td>14,291.5</td>
<td>108.6</td>
</tr>
<tr>
<td>2009</td>
<td>13,939.0</td>
<td>109.7</td>
</tr>
<tr>
<td>2010</td>
<td>14,526.5</td>
<td>111.0</td>
</tr>
</tbody>
</table>

Source: BEA

Figure 4.1: Nominal GDP and Price Level
4.4 Limitations of GDP

We needed a measure of the productive capacity in the economy, and the most important measure is the GDP. However, there are certain production activities that are not captured by the GDP. Recall that the GDP records only transactions that take place in legal markets. Thus, the GDP does not record illegal activities (sales of forbidden drugs for example), and home production. In the home production the household combines his time and purchased goods in order to produce other goods. For example, you combine your time with teabags and sugar to make a cup of tea. This production is not recorded in the economy. The problem is not severe if in all the countries the size of the home sector is the same as a fraction of the total output. In this case comparisons across countries will not be biased. The problem is that in some underdeveloped countries the home sector is quite large, and thus the GDP of these countries underestimates the level of overall production in those countries.
Chapter 5

Unemployment and Labor Markets
Chapter 6

Price Leve and Inflation
<table>
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</tr>
</tbody>
</table>

Table 6.1: Table Caption