

# Chapter 13

## Economic Growth

### Introduction

This chapter provides a brief introduction of economic growth. After defining economic growth, the chapter provides an historical perspective. We look at the output data estimates in the recorded human history. We compare the growth rates of per capita output of various countries and ask the question: Why is it that some countries grow faster than others? The chapter provides some insights.

### A Definition of Economic Growth

Since we are talking about the growth of the economy, a natural measure of economic growth is the growth of the economy's total output. In simple terms, economic growth refers to an increase in the per capita output of the economy. It is a measure of the material wellbeing of a country's residents.

Recall from Chapter 6, a measure of the overall output of the economy is Gross Domestic Product (GDP). And dividing GDP by the country's population gives us per capita GDP. That is,

$$\text{Per Capita GDP} = \frac{\text{GDP}}{\text{Population}} \quad (13.1)$$

Take the example of the US. According to the Bureau of Economic Analysis, the nominal GDP of the US in 2020 was \$21,060,474 million US dollars.<sup>1</sup> Total US population according to the Bureau of Census in 2020 was 331,449,281 million.<sup>2</sup> Using Equation (13.1) we get,

$$\text{Per Capita GDP} = \frac{\text{GDP}}{\text{Population}} = \frac{\$21,060,474}{331,449,281} \approx \$0.063541$$

The resulting figure, \$0.063541, is in millions of US dollars. To convert this figure into thousands of US dollars, we multiply it by 1,000,000, and we get (approximately) \$63,541. These data are in current US dollars, i.e., these data are nominal. We can convert nominal GDP into real GDP using the formula developed in Chapter 6. Keep in mind that whenever you need to convert a nominal variable into a real variable, you divide the nominal variable by the price level. It is important to report which measure of price level you have used. This is because, as we learned in Chapter 6, there are several measures of the overall price level. And since different

<sup>1</sup> US GDP in 2020. U.S. Bureau of Economic Analysis, "[Table 1.1.5. Gross Domestic Product](#)" (accessed Thursday, May 4, 2023).

<sup>2</sup> US population in 2020. The US Census Bureau (<https://www.census.gov/programs-surveys/decennial-census/about/rdo.html>) Accessed: May 4, 2023.

measures of price level (e.g., GDP Deflator, Consumer Price Index, etc.) are calculated different procedures, the resulting real variable value may differ slightly.

Note that for Per Capital GDP to grow over time, the output of the country, the numerator in Equation (13.1), must grow at a faster rate than the population of the country, the denominator in Equation (13.1). If the GDP of a country is growing slower than the population of that country, over time per capita GDP will decline.

### Economic Growth versus Economic Development

The concepts of economic growth and economic development are often used interchangeably. While related these two concepts are related, economic growth and economic development do not represent the same underlying phenomenon.

As we just saw, economic growth refers to having a higher per capita aggregate output. Economic development, on the other hand, relates to how this output is distributed among the citizens, and what this level of per capita GDP affords the citizens. In this respect, economic development is a broader concept related to human wellbeing.

In his book, *Development as Freedom*, Amartya Sen, a Nobel laureate, writes,

Development can be seen... as a process of expanding real freedoms that people enjoy. Focusing on human freedoms contrasts with narrower views of development, such as identifying development with the growth of gross national product, or with the rise of personal incomes, or with industrialization, or with technological advance, or with social modernization. (p.3).<sup>3</sup>

Sen calls these human freedoms that denizens of developed economies have “instrumental freedoms.” These are “(1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees and (5) protective security.” (p.38).<sup>4</sup>

It is important to note that having a higher per capita GDP does not guarantee these instrumental freedoms to the masses. Take the example of the State of Qatar. According to the World Bank database, Qatar’s per capita GDP in 2021 was \$61,000.8, and per capita GDP in the US in 2021 was \$61,855.5 (both figures in 2015 constant US dollars).<sup>5</sup> This is about 99 percent of the US per capita GDP. While the citizens US enjoy a democratic and open society, Qatar is a monarchy that has been ruled by the Thani family since early 19<sup>th</sup> century. Citizens of Qatar enjoy few freedoms. So, while having a high per capita GDP is no guarantee for instrumental freedoms, these freedoms are certainly not possible without an economy having higher levels of incomes. In this respect, economic growth is a tool to achieve economic development. Economic growth

<sup>3</sup> A definition of economic Development. (Sen, 1999)

<sup>4</sup> Amartya Sen’s “instrumental freedoms.” Amartya Sen. *Development as Freedom*. Westminister, MD, USA: Alfred A. Knopf Incorporated, 1999. Print.

<sup>5</sup> Qatar’s per capita GDP. Data Source: The World Bank (<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>) Accessed: March 22, 2023.

serves as means to economic development.<sup>6</sup> In this chapter we focus on economic growth, i.e., the means.

## World Per Capita Output Over the Millenia

We are living in such opulence that it is highly unlikely that even the royalty of the yore would have even dreamt of such riches. For the most of human history, humans lived at subsistence levels. It is only around the middle of the 19<sup>th</sup> century that living standards started to grow. Angus Maddison, a British economist, compiled data about per capita GDP going back to year 1 AD. Maddison used various data sources to estimate population and output. He published his findings in a book titled *The World Economy: A Millennial Perspective*.<sup>7</sup> Later on Maddison extended his data to 2008 AD. Maddison used a procedure developed by two statisticians Roy C. Geary and Salem Hanna Khamis. This procedure allows one to compare data across countries and regions, and over time. Table 13.1 provides these data. These data are in 1990 International Geary-Khamis dollars (IGK), a hypothetical unit of currency.

**Table 13.1: World GDP Per Capita—1 AD to 2008 AD (1990 International Geary-Khamis Dollars)**

Year	GDP	Year	GDP	Year	GDP	Year	GDP	Year	GDP	Year	GDP	Year	GDP
1	467	1950	2,111	1960	2,773	1970	3,729	1980	4,512	1990	5,150	2000	6,038
1000	453	1951	2,197	1961	2,831	1971	3,803	1981	4,523	1991	5,137	2001	6,132
1500	566	1952	2,258	1962	2,914	1972	3,904	1982	4,501	1992	5,165	2002	6,262
1600	596	1953	2,329	1963	2,978	1973	4,083	1983	4,541	1993	5,200	2003	6,469
1700	615	1954	2,363	1964	3,130	1974	4,099	1984	4,668	1994	5,304	2004	6,738
1820	666	1955	2,467	1965	3,228	1975	4,087	1985	4,748	1995	5,446	2005	6,960
1870	870	1956	2,534	1966	3,335	1976	4,213	1986	4,833	1996	5,552	2006	7,238
1900	1,261	1957	2,578	1967	3,390	1977	4,309	1987	4,932	1997	5,690	2007	7,468
1913	1,524	1958	2,607	1968	3,505	1978	4,422	1988	5,056	1998	5,709	2008	7,614
1940	1,958	1959	2,675	1969	3,624	1979	4,500	1989	5,130	1999	5,833		

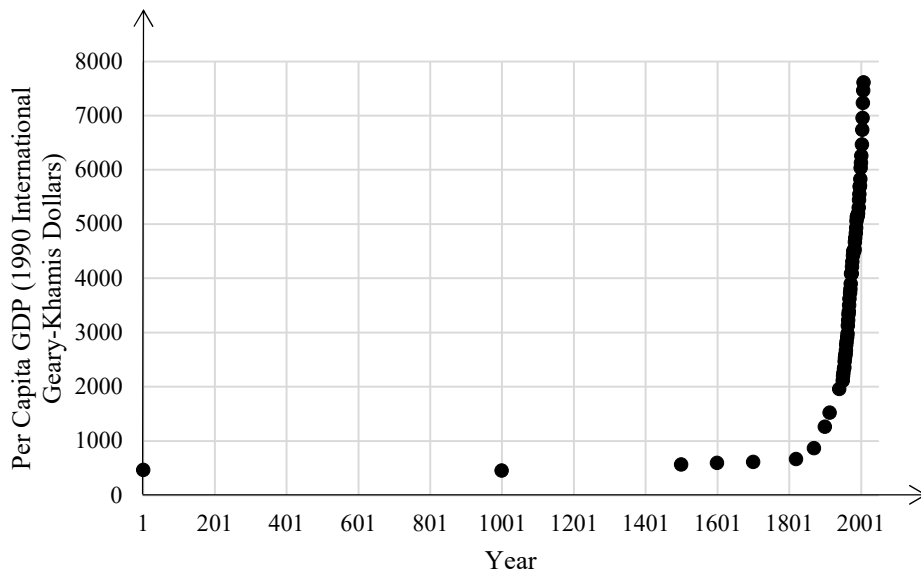
Source: M. Ashraf.

Data Source: Angus Maddison database. <http://www.ggdnc.net/maddison/oriindex.htm>. (Accessed: November 14, 2019). GDP is world average per capita GDP in 1990 International Geary-Khamis dollars. Note that using the “Geary-Khamis” procedure one can compare data across countries and over time.

Often a graphical representation of data is more informative. Figure 13.1 plots these GDP per capita data.

<sup>6</sup> Economic growth to achieve economic development. Amartya Sen. *Development as Freedom*. Westminister, MD, USA: Alfred A. Knopf Incorporated, 1999.

<sup>7</sup> Maddison, A. (2001). *The World Economy: A Millennial Perspective*. Development Centre of the Organisation for Economic Co-operation and Development.



**Figure 13.1: Average World GDP Per Capita From 1 AD to 2008 AD**

Source: M. Ashraf.

Data Source: Angus Maddison database. <http://www.ggdc.net/maddison/oriindex.htm>. (Accessed: November 14, 2019). Note that using the “Geary-Khamis” procedure one can compare data across countries and over time.

Figure 13.1: Horizontal axis shows years from 1 AD to 2008 AD. Vertical axis shows GDP per capita in 1990 International Geary-Khamis dollars. Starting from 1 AD all the way to about mid-1800s GDP per capita values do not change. After around mid-1800s the GDP per capita increases exponentially, forming the shape of a hockey stick.

In Figure 13.1, horizontal axis lists the years, and vertical axis lists average world per capital GDP in 1990 International Geary-Khamis dollars. Each dot on the graph represents an observation. In Figure 13.1, I have also drawn gridlines to make the graph easier to read. Note that from 1 AD to about mid-1800s, the world average per capita GDP did not change much. Indeed, for the first 1800 or years, per capita GDP was about 500 IGK dollars; the living standard from one generation the next remained stagnant. Around mid-1800s, per capita GDP started to increase; it increased from 666 IGK dollars in 1820 to 870 IKG dollars in 1870 to 1,261 IGK in 1900. Per capita GDP kept on increasing at an explosive rate. What caused that increase. We will come back to this question shortly. First, let us look at the variation among countries’ per capita GDP.

### Differences Among Countries’ Per Capita GDP

The data presented so far show the average per capita GDP. Averages, by definition, do not show variations. Table 13.1 present data for 30 countries. Of course, most of these countries did not even exist in 1 AD. It is more accurate to state that the regions in which present-day countries

exist. For the ease of exposition, however, in the text that follows we will use the terms “country” or “countries.”

**Table 13.1: Per Capita GDP (1990 International Geary-Khamis dollars), 1 AD and 2008 AD**

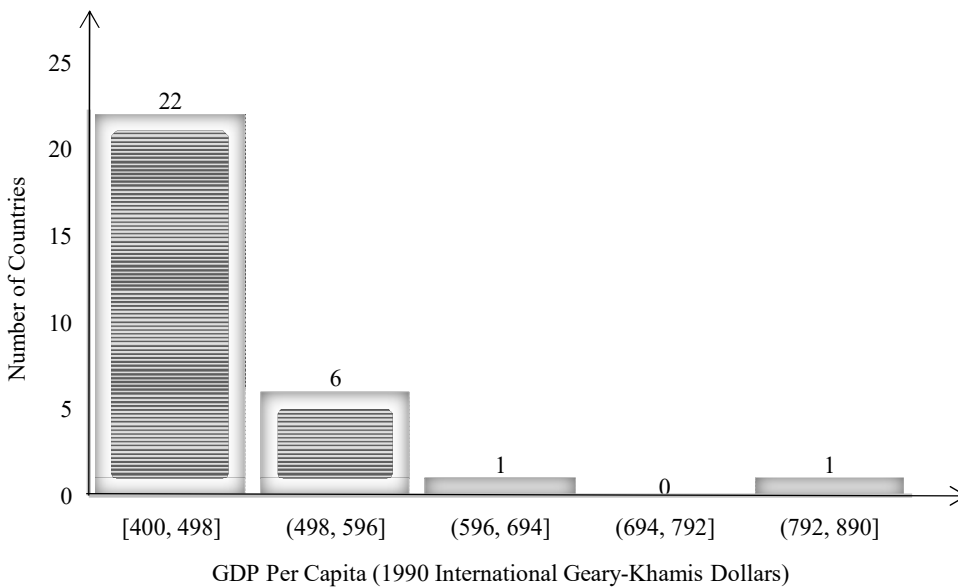
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Country	1 AD	2008 AD	Country	1 AD	2008 AD	Country	1 AD	2008 AD
Austria	425	24,131	Switzerland	425	25,104	India	450	2,975
Belgium	450	23,655	United Kingdom	400	23,742	Japan	400	22,816
Denmark	400	24,621	Greece	550	16,362	Iran	500	6,944
Finland	400	24,344	Portugal	450	14,436	Iraq	500	1,049
France	473	22,223	Spain	498	19,706	Turkey	550	8,066
Germany	408	20,801	Australia	400	25,301	Algeria	450	3,520
Italy	809	19,909	Canada	400	25,267	Egypt	600	3,725
Netherlands	425	24,695	United States	400	31,178	Libya	550	2,994
Norway	400	28,500	Mexico	400	7,979	Morocco	450	3,465
Sweden	400	24,409	China	450	6,725	Tunisia	550	6,103

Table prepared by the author.

Data Source: Angus Maddison database. <http://www.ggdgc.net/maddison/oriindex.htm>. (Accessed: November 14, 2019). Note that using the “Geary-Khamis” procedure one can compare data across countries and over time.

The data reported in Table 13.1 are in 1990 International Geary-Khamis (IGK) dollars. Recall that the Geary-Khamis procedure allows one to compare standards of living across countries and over time. When we compare per capita GDP in 1 AD with per capita GDP in 2008 AD, we note that even the residents of the poorest country in 2008 AD, i.e., Iraq, were better off than the residents of the richest country in 1 AD, i.e., Italy. The per capita GDP of Italy in 1 AD was 809 IGK dollars, whereas the per capita GDP of Iraq in 2008 AD was 1,049 IGK dollars.

Often it is informative to view the data in the form of a diagram. To visualize these differences per capita GDPs between 1 AD and 2008 AD, I plot these per capital GDP data in 1 AD and 2008 AD in Figures 13.2 and 13.3, respectively.



**Figure 13.2: GDP Per Capita in 1 AD**

Source: M. Ashraf.

Data Source: Angus Maddison database. <http://www.ggd.net/maddison/oriindex.htm>. (Accessed: November 14, 2019). Note that using the “Geary-Khamis” procedure one can compare data across countries and over time.

Figure 13.2: Figure 13.2 plots GDP per capita (in 1990 International Geary-Khamis dollars) in 1 AD. GDP per capita is on the horizontal axis, and the number of countries on the vertical axis. Most countries’ per-capita GDP is around 450 IGK dollars. There are 22 countries with per capita GDP between 400 and 498 IGK dollars, six countries with GDP per capita between 499 and 569 IGK dollars, one country with GDP per capita between 597 and 694 IGK, and one country with GDP per capita between 793 and 890 IGK.

In Figure 13.2, we have GDP per capita (in 1990 International Geary-Khamis dollars) on the horizontal axis, and the number of countries on the vertical axis. Most countries’ per-capita GDP is around 450 IGK dollars. There are 22 countries with per capita GDP between 400 and 498 IGK dollars, six countries with GDP per capita between 499 and 569 IGK dollars, one country with GDP per capita between 597 and 694 IGK, and one country with GDP per capita between 793 and 890 IGK.

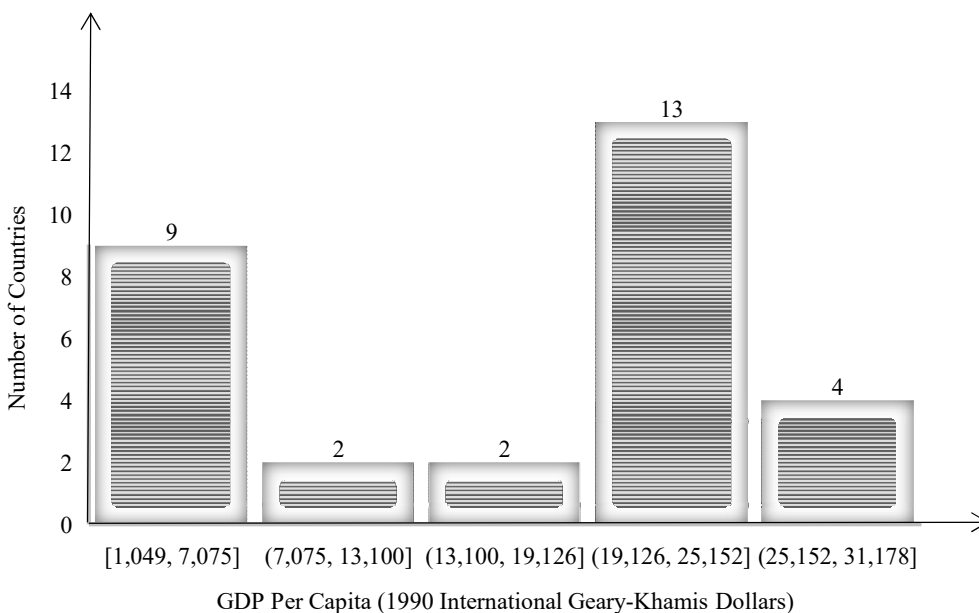
Before we move on, an explanatory note on Figure 13.2 (and Figure 13.3) is in order. These types of graphs are called histograms. As you know, the horizontal axis lists per capita GDP in 1990 IGK dollars. Look at Figure 13.2 first. The horizontal axis is divided into five “bins.” These are [400, 498], (498, 596], (596, 694], (694, 792], and (792, 890]. Note also that the first bin has two square brackets “[],” and the remaining bins have one round bracket “(” and one square bracket “].”

Recall from your high school math classes that square bracket “[ ]” indicate that the end value is included in that bin. Whereas round brackets “( )” indicate that the end value is not included in that bin. In Figure 13.2, we see that both brackets are square brackets for the first bin, whereas the remaining bins have one round bracket and one square bracket. This indicates values from 400 to 498 are included in the first bin. Values included in the second bin are from 499 to 596. While Figure 13.2 lists the value, 498, in bin two, this value is already included in the first bin. So, it cannot also be part of the second bin as well—see the round bracket on the left-hand-side of the second bin; values included in the second bin are 499 to 596. Similarly for the remaining bins—the third bin includes values from 597 to 694, the fourth bin includes values from 695 to 792, and the fifth bin includes values from 793 to 890.

Furthermore, the number of bins is up to the researcher. Each bin has (approximately) equal range (i.e., maximum value – minimum value). In Figure 13.2, for instance, the range of the first bin is 98. The ranges of the remaining bins are 97.

The height of a histogram represents the number of the number of countries that fall in each range. In Figure 13.2, there are 22 countries whose per capita GDP is between 400 and 498 IGK dollars. There are six countries whose per capita GDP is between 499 and 596 IGK dollars, and so on. You should confirm this by counting the number of countries using the data provided in Table 13.1.

Now that we understand how to interpret histogram graphs, let’s plot data for 2008 AD. Figure 13.3 plots these data.



**Figure 13.3: GDP Per Capita in 2008 AD**

Source: M. Ashraf.

Data Source: Angus Maddison database. <http://www.ggdcd.net/maddison/oriindex.htm>. (Accessed: November 14, 2019). Note that using the “Geary-Khamis” procedure one can compare data across countries and over time.

Figure 13.3: The figure plots GDP per capita (in 1990 International Geary-Khamis dollars) in 1 AD. GDP per capita is on the horizontal axis, and the number of countries on the vertical axis. There are nine countries on the lower end of the per capita GDP distribution; their per capita GDPs are between 1,049 IGK dollars and 7,075 IGK dollars. There are four countries whose per capita GDPs are between 7,076 IGK dollars and 19,126 IGK dollars. Most countries’ per-capita GDP is around between 19,127 and 31,178 IGK dollars. There are thirteen countries whose per capita GDP is between 19,127 IGK dollars and 25,152 IGK dollars. Four countries have per capita GDP between 25,153 IGK dollars and 31,178 IGK dollars.

In Figure 13.3, again, we have per capita GDP in IGK dollars on the horizontal axis and the number of countries on the vertical axis. Like Figure 13.2, in Figure 13.3 we have five bins. These are [1,049, 7,075], (7,075, 13,100], (13,100, 19,126], (19,126, 25, 152], and (25,152, 31,178].

Note, however, that while the widths of bins in Figure 13.2 and Figure 13.3 *look* the same, range of each bin in Figure 13.3 is much wider; it is 6,026 for the first bin, and 6,024 for the second bin, and 6,025 for the remaining bins.

### Comparing per Capita GDP in 1 AD with Per Capita GDP in 2008 AD

We start by looking at the per capita GDP data for year 1 AD. Notice that most countries had very low per capita GDP. The means (i.e., average) per capita GDP for year 1 AD is 465.5 IGK dollars; present-day Italy has the highest per capita GDP—809 IGK dollars, and the lowest per capita GDP is shared by ten present-day countries. Indeed, Italy is an outlier.

Now look at the GDP per capita data for 2008 AD. First note that a large majority of countries have GDP per capita over 19,126 IGK dollars—thirteen countries have GDP per capita between 19,126 and 25, 152 IGK dollars, and four countries have GDP per capita between 25,152 and 31,178 IGK dollars. The mean GDP per capita in 2008 AD is 16,491.5 IGK dollars. This is over 35 times larger than the mean GDP per capita in 1 AD. Even countries that have the lowest level of GDP per capita (nine countries) in this group of countries, have GDP per capita higher than the GDP per capita of the richest country, Italy, in 1 AD.

Another difference to note between per capita GDP in 1 AD and per capita GDP in 1008 AD is that in 1 AD most countries were stacked at the lower end of the GDP per capita distribution. In 2008 AD, the distribution is bimodal; most countries, out of this group of countries, fall on the higher end of the GDP distribution. This point is ocularly clearer by comparing Figure 13.2 and Figure 13.3. This further strengthens the point that, as measured by per capita GDP, most countries were better off in 2008 than they were in 1 AD.

Let us now look compare the distribution of per capita GDP in 1 AD and 2008 AD. A measure of dispersion is sample standard deviation. Recall from your basic statistics course, in calculating sample standard deviation, first we calculate the mean of the sample data. Then we calculate



difference between the mean of the sample data and each value in the data, square the difference, sum it up, divide this quantity by the number of observations minus one, and take the square root of this value. Equation 13.1 presents this formula.

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n-1)}} \quad (13.1)$$

In equation (13.1),  $s$  represents the sample standard deviation,  $\bar{x}$ , is the sample mean, and  $n$  is the number of observations in the sample. Further discussion of this statistic is beyond the scope of this textbook.

According to this measure, in 1 AD the standard deviation was about 87.3. Compare this to the standard deviation of GDP per capita in 2008 AD; it is 9595.6. By this measure, GDP was much equally distributed among individuals in 1 AD than it is in 2008 AD. A main reason is that there was not much to distribute in 1 AD; pretty much everyone was barely surviving.

### World Per Capita Output in the Recent Past

Looking at what the world per capita GDP was in 1 AD and comparing it with per capita GDP in the present can be disorienting. Let us look at the per capita GDP data over the past 60 plus years. Figure 13.4 plots world per capita GDP annual data from 1960 to 2021. The data are in 2015 US dollars.

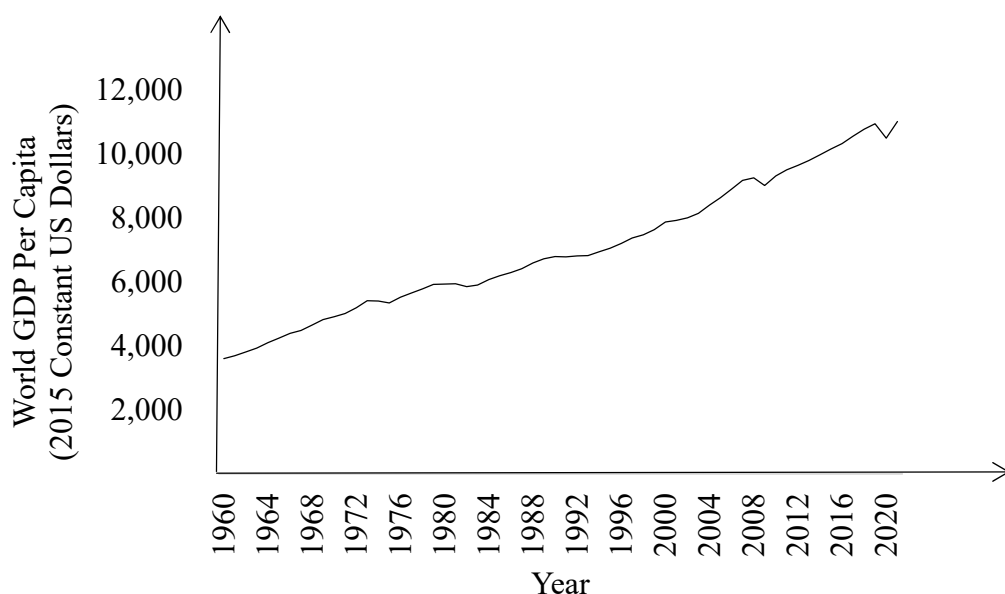


Figure 13.4: World GDP Per Capita in 2015 Constant US Dollars.

Source: M. Ashraf.

Data Source: The World Bank (<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>)  
Accessed: March 22, 2023.

Figure 13.4: The horizontal axis in Figure 13.4 lists years. The horizontal axis lists per capita GDP. The data are in 2015 US dollars. While there are ups and downs in the plot, there is a clear upward trend in the data.

Figure 13.4 plots world per capita GDP. These are annual data in 2015 US dollars. The horizontal axis lists years, and the vertical axis lists world per capita GDP.

When we look at the data on world GDP per capita, we see that there has been a significant increase in per capita GDP. While there have been ups and downs, and there remain disparities among countries' GDPs, the trend across the world is certainly positive.

### World Poverty

Another variable that helps shed light on human wellbeing is the poverty rate, i.e., the percentage of world population that is living at or below poverty level. The World Bank defines someone living at or below \$2.50 per day as living in poverty. This figure is 2017 Purchasing Power Parity (PPP) adjusted. While a detailed discussion of Purchasing Power Parity is beyond the scope of this textbook, PPP-adjusted figures correct for geographic differences in the purchasing power of a dollar. According to the data provided by the World Bank, there has been a significant decline in the proportion of individuals living below poverty. Figure 13.5 plots these data from 1981 to 2019.



**Figure 13.5: Percent of World Population Living at or Below Poverty Level**

Source: M. Ashraf.

Data Source: Source: M. Ashraf. Data Source: The World Bank

(<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>) Accessed: March 22, 2023.<sup>8</sup>

Figure 13.5: The horizontal axis lists years, from 1981 to 2019. The vertical axis lists the percentage of population that lives at or below poverty level. The graph indicates that over this period world poverty rate has declined from 43.6 percent in 1981 to 8.4 percent in 2019.

Figure 13.5 plots poverty rate data—the percentage of population living at or below poverty level. The horizontal axis lists years, from 1981 to 2019. The vertical axis lists the percentage of population that lives at or below poverty level.

The graph indicates that over this period world poverty rate has declined from 43.6 percent in 1981 to 8.4 percent in 2019. This is a decline of about 80.7 percent over this period. These data, again, lend support to the point made earlier in the chapter that we are living in opulent times. Never in recorded human history have we observed such high standards of living.

<sup>8</sup> A note on World Poverty. "Poverty headcount ratio at \$2.15 a day is the percentage of the population living on less than \$2.15 a day at 2017 purchasing power adjusted prices. As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions." World Bank.

## Causes of Economic Growth

Given the importance of economic growth in human wellbeing, the question of what causes economic growth has been one of the most important economic questions over decades, if not centuries. Scholars want to understand the process and policy makers want to replicate the success stories.

### The Role of Knowledge

Take another look at Figure 13.1. Why did per capita GDP start to increase around 1800s? It is not that the Earth suddenly expanded allowing farmers to plant seeds in a larger area, or that the quantity and quality of mineral and other natural resources suddenly increased. What changed was our understanding of how make use of what the Earth had to offer. Our knowledge increased. We learned new methods to combine the resources. Our pool of knowledge increased. That is, technological advancements led to an increased standard of living.<sup>9</sup>

Recall from Chapter 1 that technology refers to our pool of knowledge, our recipes, our formulae. What makes a laptop a laptop is our ability to combine rather mundane raw materials—sand, petroleum byproducts, various metal ores, etc.—in such a way that these inputs become a laptop.

We learned that in the long run, division of labor,<sup>10</sup> and specialization and trade benefit all.<sup>11</sup> We learned that economies grow not because of war and pillage, but because of increased knowledge and cooperation. We learned that liberal democratic societies are much safer, much healthier, and grow much faster than those societies where equal<sup>12</sup> application of the rule of law is missing and property rights are non-existent. Not only has knowledge increased our per capita GDPs, the increase in our understanding has also made us better and kinder human beings, and not only to fellow humans, but also to other fellow animal species.

I will end this chapter by noting that the main source of economic growth is knowledge. Every other factor that affects economic growth flows from our increase in knowledge. It is only through knowledge that we have been able to understand our place, and the insignificance of our place, in the Universe. A detailed study of how an individual factor promotes economic growth is beyond the scope of this textbook. I do, however, encourage students to read the sources cited in this chapter and follow up on the topic of economic growth.

## Chapter Conclusion

In this chapter we learned that economic growth is an increase in per capita aggregate output. We used GDP to measure aggregate output. We learned that for most of recorded human history, humans have been living at subsistence level. It is only around the 1800s that per capita GDP

<sup>9</sup> Sources of economic growth. (Hudson, 2015)

<sup>10</sup> Division of labor. (Kurz, 2010; Smith, 1776)

<sup>11</sup> Specialization and trade. (Kurz, 2010; Ricardo, 2010)

<sup>12</sup> Decrease in violence, rule of law, property rights. (Pinker, 2011; Pinker, 2018), (Acemoglu & Robinson, 2012) (Sen, 1983; Sen, 1999; Sen, 2009)

started to increase. The chapter also argues that the main source of economic growth knowledge. Every other factor flows from it.

### A Review of Terms

- Economic growth: An increase in per capita aggregate output. A measure of aggregate output is Gross Domestic Product (GDP)).
- *Per Capita GDP* =  $\frac{GDP}{Population}$
- Poverty Rate: Percentage of population living at or below poverty level.