1 A first look at geography, trade, and development

1.1 Introduction

It happened on October 12, 1999, at least according to the United Nations (UN).[1] From that day more than 6 billion people have inhabited the planet Earth. Of course, given the inaccuracy of the data, the UN could have been off by 100 million people or so. Every day some 100 million billion sperms are released[2] and 400,000 babies are born, whereas "only" 140,000 persons die. Consequently, the world population has been growing rapidly, especially over the second half of the twentieth century.

Given the average population density in the world, about 44 persons per square kilometer, if you are part of a family with two children, your family could have about 9 hectares (or 22.5 acres) at its disposal. The large majority of our readers will probably look around in amazement to conclude that they do not own an area close to this size. The reason is simple: the world population is unevenly distributed. But why?

There may be many reasons why people cluster together: sociological – you like to interact with other human beings; psychological – you are afraid to be alone; historical – your grandfather already lived where you live now; cultural – the atmosphere here is unlike anywhere else in the world; geographical – the scenery is breathtaking and the beach is wonderful. At best we will discuss the above reasons for clustering only cursorily, because our attention in this book will be focused on the *economic* rationale behind clustering or agglomeration.

In a sense, an economic motive behind population clustering might be a prerequisite for other motives. Psychological, sociological, cultural, and historical motives may have developed largely in response to an economic motive that brought people together to live in villages and cities. Before elaborating in the next chapter on how the mainstream of the economics profession until recently has dropped the ball with respect to providing a simple consistent explanation for the spatial dimensions of the economy,

[1] The data in the first paragraph are from http://www.popexpo.net/english.html. Unless otherwise specified, all other empirical information in chapter 1 is based on our own calculations using data from the World Bank Development Indicators CD-ROM, 1999.
[2] Apparently, the UN is familiar with our sexual habits.

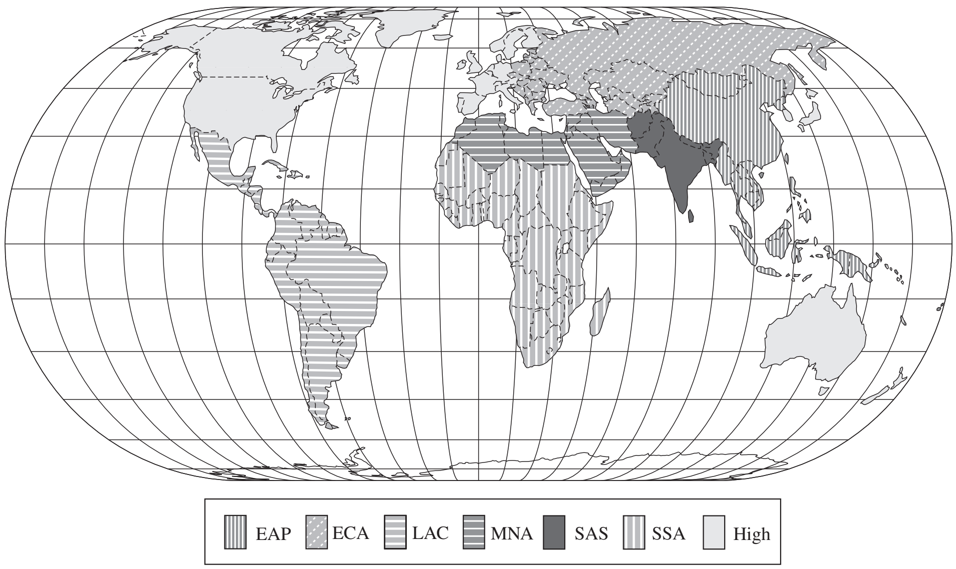

Figure 1.1. World Bank regional classification (EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MNA = Middle East and North Africa; SAS = South Asia; SSA = Sub-Saharan Africa; High = high-income countries).

we will first briefly describe some of the characteristics of clustering of economies in space and their interactions.

1.2 Clusters in the world economy

In describing clustering, it is useful to distinguish between various levels of aggregation at which clustering occurs:

- the global level (subsection 1.2.1, world-wide distribution of activity and resources)
- the continental level (subsection 1.2.2, population density in Europe)
- the country level (subsection 1.2.3, urban agglomeration in India)

The main reason for looking at these different levels of aggregation is that in explaining clustering, geographical economics shows that to a large extent the same basic forces apply at all levels of aggregation.

1.2.1 The global view

The World Bank collects and processes statistical information from virtually all countries in the world. To characterize various regions at a global scale the World Bank aggregates country data into the seven groups (Figure 1.1):

(i) East Asia and Pacific (e.g. China and Indonesia),
(ii) (East) Europe and Central Asia (e.g. Russia and Turkey),

(iii) Latin America and Caribbean (e.g. Brazil and Mexico),
(iv) Middle East and North Africa (e.g. Egypt),
(v) South Asia (e.g. India),
(vi) Sub-Saharan Africa (e.g. Nigeria and South Africa), and
(vii) the high-income countries (e.g. the United States, the countries of the European Union, and Japan).

We will use this grouping to describe regional diversity at the global level.

Figures 1.2 and 1.3 illustrate some key economic data for the above global regional classification. These data are listed in the appendix to this chapter (Table 1A.1). There is considerable variation in land area (Figure 1.2a), from 4.8 million km^2 (4% of the world total) for South Asia to 31.0 million km^2 (25% of the world total) for the high-income countries. This can, of course, simply be an artifact of the classification method. The same holds, necessary changes being made, for the large differences in population size (Figure 1.2b), ranging from 280 million people (5%) for North Africa to 1,751 million people (30%) for East Asia. The variation becomes more striking when we investigate the ratio of these two measures, that is the population density (Figure 1.3c). The number of persons per km^2 varies from 20 for Europe and Central Asia to 263 for South Asia, which is more than ten times as high. There is thus an enormous difference in the distribution of the population, even at such a high level of aggregation. We return to this issue in the next section. For now, we concentrate on some of the other characteristics of the World Bank regions.

Figure 1.2c clearly shows that the distribution of economic mass, as measured by the total value of all goods and services produced in each global region, is very skewed: the gross national product (GNP) of the high-income countries accounts for 78% of world production calculated in current United States dollars, but uses only 16% of the world population. Measured similarly, Sub-Saharan Africa accounts for 1% of world production using 11% of the world population. These production levels translate into enormous differences in per capita income (Figure 1.3b), ranging from $380 per year in Sub-Saharan Africa to $25,890 per year for the high-income countries. A word of caution, however, is in order at this point. If we want to compare GNP, that is the value of production, in different countries we have to express this in a common unit of measurement, usually the US dollar. Since exchange rates tend to fluctuate widely, the World Bank calculates an average over three years for conversion (the "Atlas" method). These are the statistics reported above. However, price levels for non-tradable goods and services differ considerably between countries. Going to a movie in the United States may cost you $8, while going to the same movie in Tanzania may cost you less than $1. Getting a haircut in Amsterdam will cost you at least $10, rather than the $2 you will pay in Manila. To correct for these differences in purchasing power the United Nations devotes a lot of time and effort, gathering data on the prices of thousands of goods and services in virtually all countries, to calculating as accurately as possible "Purchasing Power Parity" (PPP) exchange rates.

A better estimate of the economic size of a region is therefore given when we use PPP

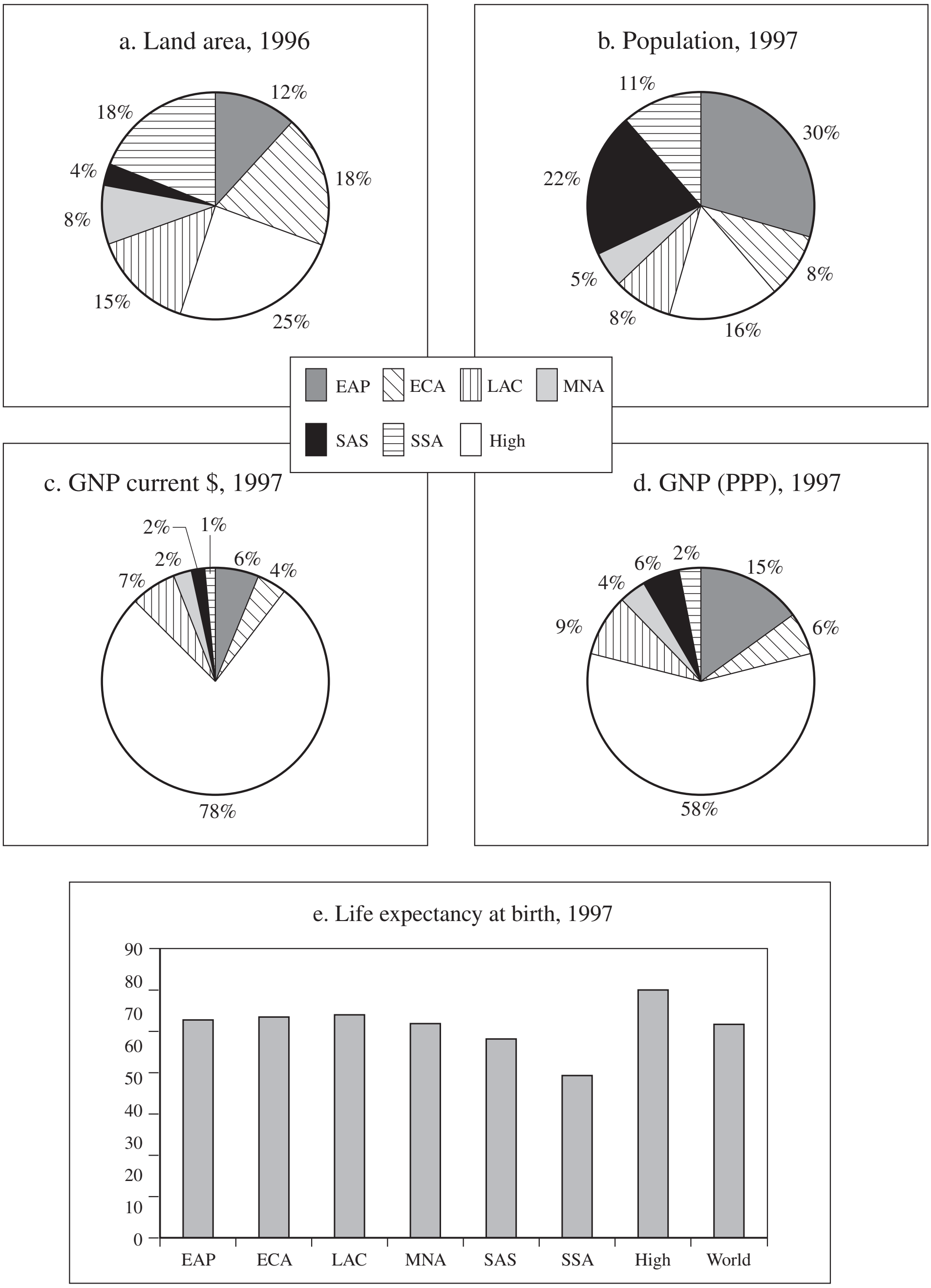

Figure 1.2. Life expectancy and regional shares of population, land, and income (EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MNA = Middle East and North Africa; SAS = South Asia; SSA = Sub-Saharan Africa; High = high-income countries).

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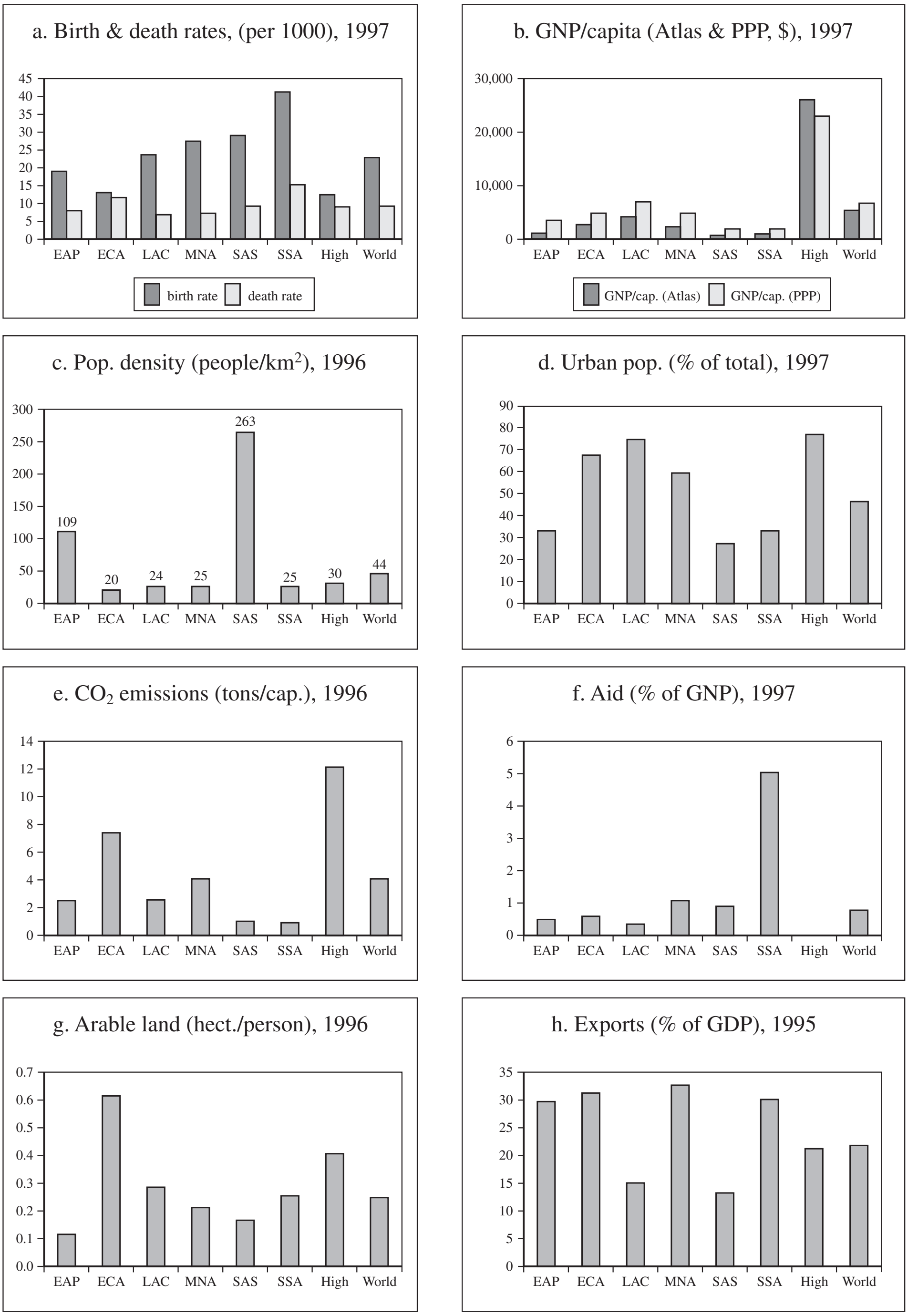

Figure 1.3. Characteristics of global regions (see Figure 1.2 for key to regions).

exchange rates rather than current dollars (or the Atlas method). It turns out that $1 in China or India will deliver you approximately the same consumption basket as $4 in the USA or more than $6 in Japan. Figure 1.2d shows that, even after correction for PPP, the high-income countries still produce most goods and services (roughly 58% of world production), leading to somewhat smaller, but still sizeable differences in per capita income (Figure 1.3b).

Most other characteristics are correlated with income per capita; see Table 1.A2 in the appendix to this chapter. People with higher incomes tend to live longer (Figure 1.2e), have more arable land at their disposal (Figure 1.3g), have fewer children (Figure 1.3a), live in cities (Figure 1.3d), receive little foreign aid (Figure 1.3f), and pollute more, especially with greenhouse gases (Figure 1.3e). Of course, there are some noteworthy exceptions. For example, (East) Europe and Central Asia has (relative to PPP income per capita) a lot of arable land available (Figure 1.3g), is highly urbanized (Figure 1.3d), and pollutes heavily (Figure 1.3e). Similarly, Latin America and North Africa and the Middle East are also highly urbanized.

Other variables are only weakly correlated with per capita income. Although death rates, for example, are particularly high in poor Sub-Saharan Africa (in part as a result of the AIDS epidemic, which may explain the high inflow of foreign aid), they are lower in Latin America and North Africa and the Middle East than in the high-income countries, which are confronted with rapidly aging populations. Remarkably, perhaps, the openness of the global regions, as measured by the percentage of GDP exported, is hardly correlated with per capita income. We will get back to this issue in chapters 8 and 9.

This subsection has shown, *inter alia*, that the world population is very unevenly distributed when viewed on the large scale at which only seven regions are identified in the world. Economic activity is even more unevenly distributed than population, measured using either the Atlas method or Purchasing Power Parity. Moreover, we indicated that at this large scale there is a strong correlation between the degree of urbanization and per capita income (Table 1.A2). The next two subsections "zoom in" on the distribution of activity in two stages, first to the continental level for nations and then to the national level for cities. The latter concludes by drawing attention to a remarkable empirical regularity known as the *rank–size distribution*.

1.2.2 Population distribution in Europe

Figure 1.4 illustrates the first "zooming in" step, where we pick the continent of Europe as an example. In terms of the regional classification of subsection 1.2.1 about half of the countries in the figure, mainly in the west, belong to the region of high-income countries (High), while the other half is part of the (East) Europe and Central Asia (ECA) region. The figure illustrates the large variation in population density at the national level for both of these global regions. Among the ECA countries the number of people per square kilometer ranges from 9 for Russia to 134 for Armenia. Among the high-income countries the variation is even larger, from a low of 3 for Iceland to a

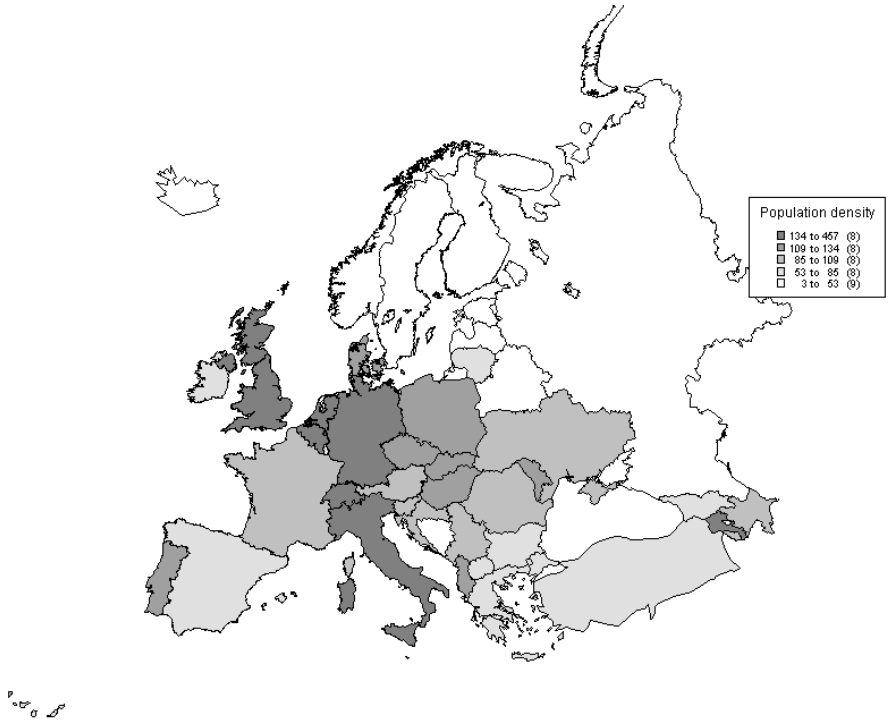

Figure 1.4. Population density in Europe.

high of 457 for the Netherlands. The main question is, of course, why do people choose to cluster so closely together at the national level? Why do the Dutch not move *en masse* to France, which is equally wealthy but has a lot more living space available?

It is also apparent from Figure 1.4 that the clustering of activity tends to cross national boundaries. Clearly, there is a densely populated group of countries in the center of Europe, consisting of the United Kingdom, Belgium, the Netherlands, Germany, Switzerland, and Italy. This is bordered on both sides by somewhat less densely populated countries, and beyond these there are the scarcely populated countries in the north-east. This suggests some form of economic interaction among those countries which gives rise to such a coherent distribution of activity. At the same time (not shown here), we also know that within most European countries both population and economic activity are not distributed evenly. Think for instance of the differences between eastern and western Germany or between the northern and southern parts of the UK and Italy.

1.2.3 Urban agglomeration in India

Table 1.1 illustrates the second "zooming in" step, where we take the urban agglomerations in India as an example. The table lists just the ten largest urban agglomerations

Table 1.1. *Ten largest urban agglomerations in India*

	Population	Rank	Ln(rank)	Ln(population)
Bombay	12,596	1	0.0	16.3
Calcutta	11,022	2	0.7	16.2
Delhi	8,419	3	1.1	15.9
Madras	5,422	4	1.4	15.5
Hyderabad	4,344	5	1.6	15.3
Bangalore	4,130	6	1.8	15.2
Ahmedabad	3,312	7	1.9	15.0
Pune	2,494	8	2.1	14.7
Kanpur	2,030	9	2.2	14.5
Lucknow	1,669	10	2.3	14.3

Source: See chapter 7 (data for 1991). Population × 1,000.

in India, but Figure 1.5 is based on the 165 largest agglomerations. Even if we restrict attention to the ten largest agglomerations, we are again confronted with a considerable variation in size, and thus of population density, at the national level, ranging from about 12.5 million people in Bombay, the largest agglomeration, to about 1.7 million in Lucknow, the tenth largest.

We illustrated the large variation in density of population and economic activity at the global, continental, and national levels. It appears that the highly uneven distribution of economic activity across space has a fractal dimension, that is it repeats itself at different levels of aggregation. An important question is whether the spatial similarities between different levels of aggregation imply (at least partly) that the same clustering mechanisms are at work at the global, continental, and national levels. Another crucial question that we will address in this book is why there is clustering of economic activity at all. Finally, we will address the *regularity* of the distribution of economic activity, mainly in chapter 7. In fact, the distribution follows a remarkable pattern throughout the world. We illustrate this using the city-size distribution in India. Table 1.1 orders the ten largest urban agglomerations, first Bombay, then Calcutta, then Delhi, etc. In columns 3 and 4, we take the natural logarithms of rank and population. We do this for all 165 agglomerations in India with at least 100,000 people. Finally, we plot the log of the rank and the log of the size in Figure 1.5. The outcome is an almost perfect straight line.

Obviously, there is a negative relationship between size and rank by construction. The puzzling feature is why this is an almost perfect log-linear straight line. If, based on the data plotted in Figure 1.5, one performs a simple regression for India the estimation results yield the following rank-size distribution:

$$\ln(\text{population}) = 16.938 - 1.0482 \cdot \ln(\text{rank}) \tag{1.1}$$

This regression explains 99.16% of the variance in city size. Based on this estimate of the rank-size distribution for India we would predict the size of the population of

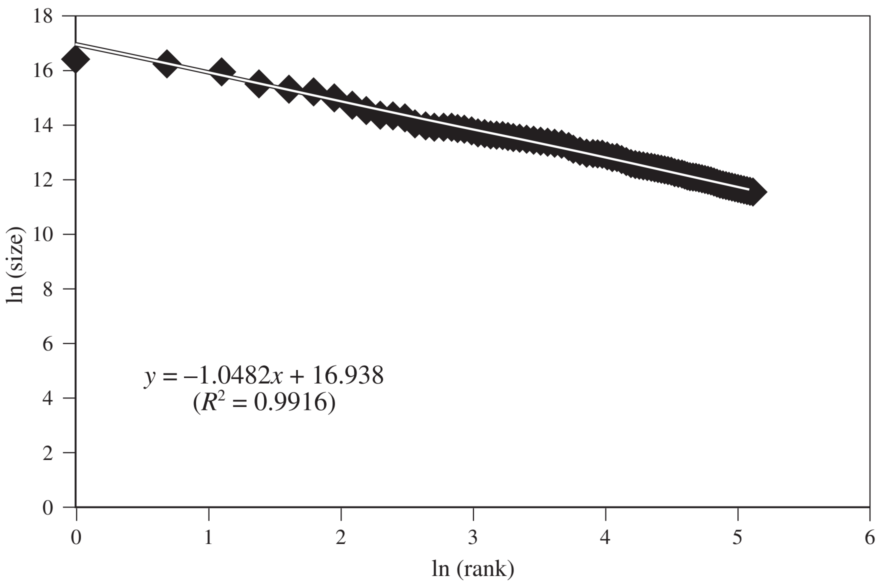

Figure 1.5. The rank–size distribution for India (urban agglomerations, 1991).

urban agglomeration number 100, for example, to be 182,000 people. This is very close to the actual size of number 100 (Tumkur), which has 180,000 people. By far the largest deviation between predicted and actual size, as evident from Figure 1.5, is for the largest urban agglomeration (Bombay). The fact that the largest agglomeration, the so-called "primate city," usually does not perform well for the rank-size distribution is a well-known problem which will be further investigated in chapter 7. All in all, the empirical success of the rank-size distribution for many countries, indicating a well-ordered pattern underlying the distribution of economic activity, poses an economic modeler the formidable task of constructing a coherent model in accordance with this empirical regularity.

1.3 Economic interaction

The uneven distribution of economic activity, and the apparent regularity in this distribution, tempts us to have a first look at the structure of the interaction between different economic centers. Clearly, such interaction takes place in many different ways, most notably in the form of trade of goods and services, but also in the shape of capital and labor flows, or via the various means of modern communication, the exchange of ideas, and the exposure to other cultural influences, etc. Again, we will give two suggestive examples to which we will return later in this book. We start with a mini-case study of the hard disk drive industry, and then move on to the structure of German trade with respect to geographic distance.

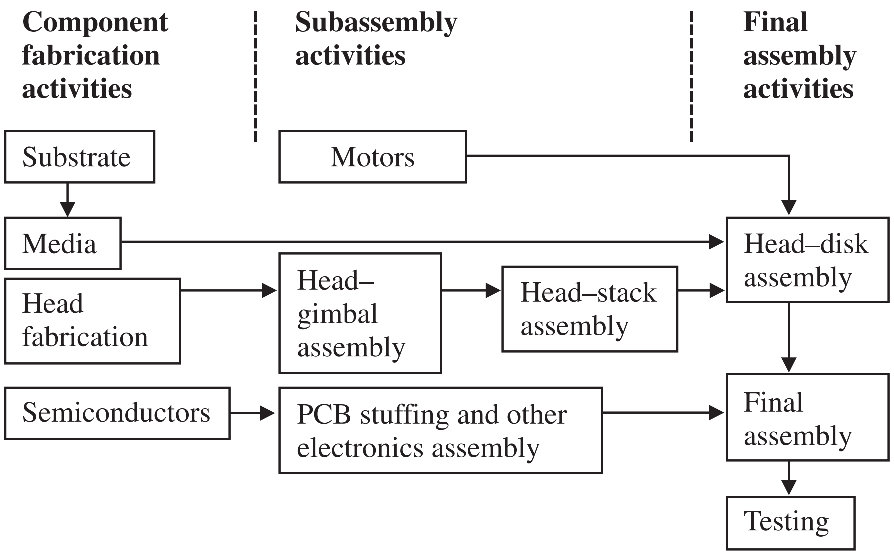

Figure 1.6. The hard disk drive value chain (based on Gourevitch, Bohn, and McKendrick 2000, Figure 1).

1.3.1 An example at the firm level: hard disk drives[3]

The manufacture of hard disk drives (HDD), essential components for the computer industry, is a very dynamic industry, with revenues of more than $30 billion, product life cycles of less than eighteen months, and prices falling at more than 40% per annum for more than a decade. Fifteen years ago not only was 80% of all production done by US firms but the same was true for the assembly activities. As we shall see, the pressure of globalization has rapidly changed the structure of doing business, as measured by the value chain, in this high-tech industry dominated by multinationals (see chapter 8).

Figure 1.6 gives a simplified picture of the main steps in the HDD value chain, the sequence and range of activities that go into making a final product. Ignoring R&D there are four major steps in the value chain: (i) electronics: this includes semiconductors, printed circuit boards (PCBs) and their assembly, (ii) heads: devices that read and write the data, which are manufactured in stages with labor-intensive subassembly activities, such as head–gimbal assembly (HGA) and head–stack assembly (HSA), (iii) media: the material on which the information is stored,[4] and (iv) motors: these spin the media with extreme precision.[5] Producers locate the the many discrete steps in the value chain around the world for various reasons. The final assembly of the disk, which gives

[3] This subsection is based on Gourevitch, Bohn, and McKendrick (2000).
[4] According to Gourevitch, Bohn, and McKendrick (2000, p. 304): "Typically, aluminum blank substrates are nickel-plated and polished before the platters are sputtered and finished. As with heads, media are a very high-technology aspect of HDD production."
[5] The Japanese Nippon Densan company has about a 75 percent world-wide market share in motors.