Student Worksheet 2.6 Name:

Activity 2.6 The Demographic Transition over Time and Space

In this activity you will take a critical look at the demographic transition theory, its stages, how one can study it, and how well the theory describes the experience of different countries. You may do it in groups with one-half of the class completing Part 1, and the other half completing Part 2. At the end, be ready to explain what you did to those students who worked on the other part.

Part 1: Longitudinal Analysis and Comparison of Developed and Developing Countries' Demographic Experiences

There are different ways of dividing up the demographic transition into stages: some use a three stage model, with the middle stage sometimes divided into 2a and 2b, while others use four stages. This is largely a matter of semantics. In this activity, we identify four stages:

Stage	Name	Crude Death Rate	Crude Birth Rate
preindustrial / Stage 1	High Stationary	High and fluctuating	High and stable
transitional / Stage 2	Early Expanding	Falling markedly	High (perhaps inching downward)
industrial / Stage 3	Late Expanding	Leveling off low	Falling markedly
post-industrial / Stage 4	Low Stationary	Low and stable	Low and fluctuating

A. Based on your readings and classroom activities, summarize the factors responsible for (1) the decline of the death rate and (2) the subsequent decline of the birth rate in the demographic transition.

By its very name, the demographic *transition* theory is a dynamic phenomenon over time. The data that support the theory are historical birth and death rates for a single country. Data for a single place over time are known as *longitudinal data.* Before you plot such data below, let us define two terms:

Crude birth rate (CBR) = The number of births in a single year per 1,000 population; or

$$\text{CBR} = \frac{\text{no. of births (year)}}{\text{total population (year)}} \times 1{,}000$$

Crude death rate (CDR) = The number of deaths in a single year per 1,000 population; or

$$\text{CDR} = \frac{\text{no. of deaths (year)}}{\text{total population (year)}} \times 1{,}000$$

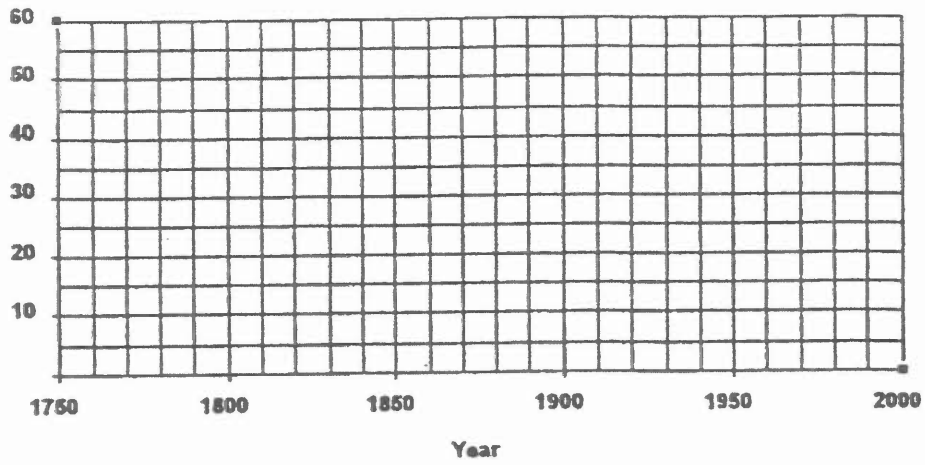
B. Plot the longitudinal data on crude birth rates (CBR) and crude death rates (CDR) for England's demographic transition. Use one color for CBR and a different color for CDR. Draw vertical lines showing approximately where the four stages begin and end and label the 4 stages. (Note that Stage 1 began prior to 1750.)

Table 7: Population Data for England, 1750-1993

England	1750	1800	1850	1875	1900	1925	1950	1975	1993
CBR	40	34	34	33	28	18	16	13	13
CDR	40	20	22	22	16	13	12	12	12
Population	6	9	18	26	32	40	44	49	50

Source: Data extracted from Rubinstein, James M. 1994. *The cultural landscape: An introduction to human geography.* Instructor's manual, 4th ed. New York: MacMillan.

Figure 12: Plot of Longitudinal Population Data



Below are longitudinal birth and death rate data for India. We use them here to typify the demographic transition experience of a developing country and to compare it to that of England.

England is the main part of the United Kingdom (UK) of Great Britain and Northern Ireland, containing about five-sixths of the UK's population. England is where the Industrial Revolution began. India is the world's second most populous country and is expected to surpass China in the 21st century for the top spot. India is the world's largest democracy, though it is troubled by Hindu-Muslim-Sikh ethnic strife. And, of course, India was an English colony until 1947. For more background, refer to encyclopedias, regional geography textbooks, and maps.

C. On the same graph you created for England, plot India's CBR and CDR. Use the same colors as for England's CBR and CDR, but use dotted lines for India. Indicate with vertical lines approximately where India's demographic transition stages begin and end. Label the stages India-Stage 1, India-Stage 2, and so on to distinguish them from England's stages.

Table 8: Population Data for India, 1911-1994

India	1911	1921	1931	1941	1951	1961	1971	1981	1994
CBR	49	48	46	45	40	41	41	33	29
CDR	43	47	36	31	27	23	19	14	10
Population	252	251	278	318	361	439	548	684	912

Source: Data extracted from Rubinstein, James M. 1994. *The cultural landscape: An introduction to human geography*. Instructor's manual, 4th ed. New York: MacMillan. (Note: Data for earlier years not available.)

Now let's compare the demographic experiences of England and India on several aspects.

D. What differences do you notice in the speed at which their death rates declined? What might account for the difference?

E. What differences do you see in their rates of natural increase (the vertical gap between CBR and CDR)?

F. Plot the total populations of England and India over time on the graphs provided below. Draw smoothed population growth curves for each.

Figure 13: Total Population of India

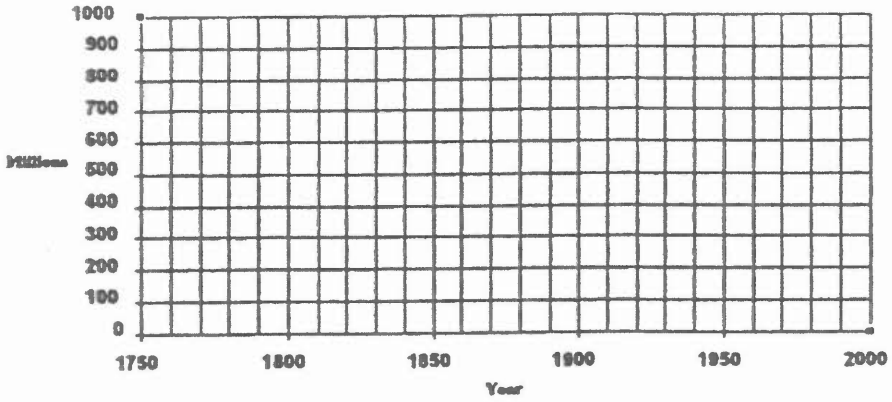
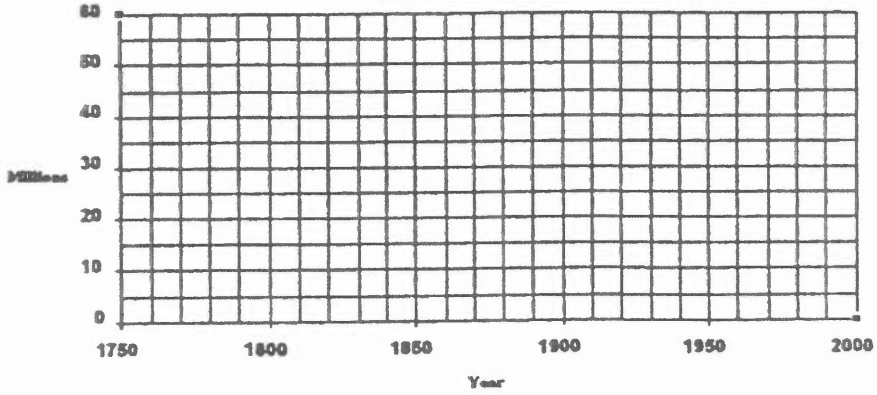


Figure 14: Total Population of England



G. Using the graphs you created above and those you created for questions B and C, compare the total populations of England and India at stimilar stages of the demographic transition. What options did England have at its disposal to deal with its changing population size that India has not had? What role did migration play in each country?

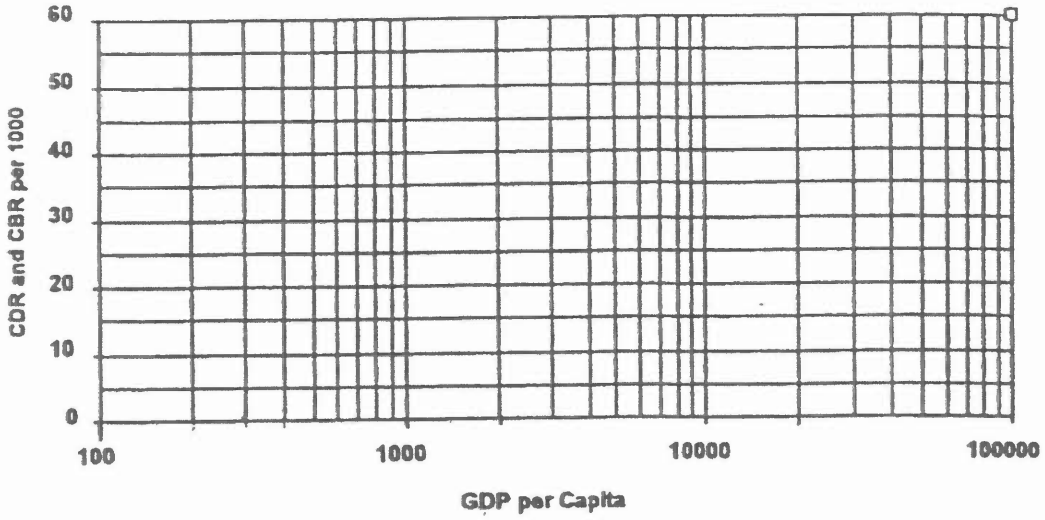
Part II: Cross-Sectional Analysis: Can a Country Make the Demographic Transition without Development?

In this part of Activity 2.7, we look at birth and death rate data differently than we did in Part I. Instead of looking at one country over time, let's look at many countries at a single point in time. This is known as *cross-sectional* analysis. The idea is that different countries around the world are at different stages in their own development, and so we should see some countries at different stages of their own demographic transition. On the X-axis of the graph on the next page, we'll use Gross Domestic Product (GDP) per capita instead of time, based on the assumptions that (1) it is development rather than the passage of time *per se* that initiates the transition, and (2) that GDP per capita is a reasonable indicator of a country's level of development.

From the *World Population Data Sheet* or some other source of demographic data (such as the World Bank's *World Development Report),* choose a random or stratified random sample of 30 countries. A **sample** is a subset of the entire set (or, in statistical terms, the *population*) of members. In this case, a sample is a selection of 30 countries from the population of around 190 countries. A **random sample** is one in which every country has an equal chance of being selected, thus removing any conscious or subconscious bias the researcher may have in drawing a sample. The first step involves developing a **sampling frame**, or list, from which to choose. Then, a random sample can be generated by writing names of countries on strips of papers and pulling 30 out of a hat; by assigning each country a number and generating random numbers between 1 and 190; or by alphabetizing the countries and taking every 6th or 7th one (190/30 = 6.33). A **stratified sample** would contain a representative portion from each region or from each level of development, thus *ensuring* that all regions or income levels are fairly represented. Taking a stratified sample involves subdividing the sampling frame into subpopulations (e.g., continents or groups of countries according to average income level), figuring out what percentage of the total sample should be drawn from each subpopulation, and then devising a method to draw the required number randomly from within each sublist.

H. Begin by selecting a sample of 30 countries as described above. You may choose to select a random or a stratified sample of the countries of the world. On the following graph, plot the birth and death rates of the countries in your sample (using a different color each, for CBR and CDR) on the Y (or vertical) axis and the per capita GDP on the X (or horizontal) axis. Thus, for each country, you'll have two dots, whose (x, y) coordinates are: (GDP per capita, CBR) and (GDP per capita, CDR). Write the country names above the dots so you will be able to identify which country is which. Note that the X-axis for per capita GDP is logarithmic so as not to compress all of the poorer countries into the far left of the diagram. Starting at the left, the vertical lines are at $100, $200, $300, . . . $900, $1000, $2000, $3000, . . . $9000, $10000, $20000, $30000, . . . $90000, $100000.

Figure 15: CBR and CDR of Selected Countries



I. Draw two smoothed curves, one that fits the general trend of the CBRs and the other that best fits the CDRs. Do not simply connect the dots, nor simply draw a straight line through the dots. Instead "eyeball" a curve that best approximates your dots. Most of your dots will not be on the curves themselves which is to be expected: there are other factors besides GDP that drive the transition. Draw it in pencil. Draw a curve from left (less developed) to right (more developed) with approximately equal number of dots on both sides of the curve. Then, do the same for the other curve. Finally, try to divide the graph into the different stages of the demographic transition (all four stages won't necessarily be represented in your sample of countries).

J. Now assess how well the demographic transition theory fits your cross-sectional data. Do CBR and CDR have the expected relationships with respect to development, as measured by GDP per capita? Does your data support the Third World's claim that "development" is the best contraceptive?

The next two questions focus on the general pattern (i.e., the smoothed curves) and the exceptions to this pattern.

K. Are there any low-income countries that have managed to achieve a low CBR despite their low level of economic development? Speculate (or do some research) on how they may have acheived it.

L. Are there any high-income countries that have not yet experienced the drop in CBR expected of developed countries? If so, what might explain their lag?

M. Many of the least-developed countries have low or even negative GDP per capita growth rates; what does the cross-sectional graph suggest about when *low-income countries* may complete the demographic transition and stop their population growth?

Country	Crude Birth Rate	Crude Death Rate	GNP Per Capita
Egypt	26.00	6.20	1290
Benin	45.30	17.00	380
Guinea	42.00	18.20	530
Nigeria	41.60	13.20	300
Eritrea	42.80	13.00	200
Mozambique	40.70	18.80	210
Uganda	48.10	19.50	310
Chad	50.00	17.10	230
Botswana	32.20	16.70	3070
United States	14.50	8.70	29240
Mexico	23.90	4.40	3840
Jamaica	22.20	6.70	1740
St. Vincent/Grenadines	18.80	7.10	2560
Columbia	26.00	5.90	2470
Suriname	25.80	6.90	1660
Kiribati	33.20	8.30	1170
Papua-NewGuinea	34.00	10.00	890
Azerbaijan	14.90	5.90	480
Jordan	33.30	4.60	1150
Saudi Arabia	35.10	4.70	6910
Bangladesh	26.50	8.40	350
Maldives	35.00	4.70	1130
Uzbekistan	23.00	5.80	950
Malaysia	25.00	4.50	3670
China	15.23	6.46	750
Mongolia	20.49	6.60	380
Ireland	14.50	8.50	18710
Austria	10.00	9.70	26830
Hungary	9.40	14.20	4510
Ukraine	8.30	14.30	980
Italy	9.30	10.00	20090
Spain	9.19	9.09	14100

Source: http://www.prb.org/pubs/wpds2000/wpds2000_Population2000-PopulationProjected.html and http://www.prb.org/pubs/wpds2000/wpds2000_GNP-Capital.html