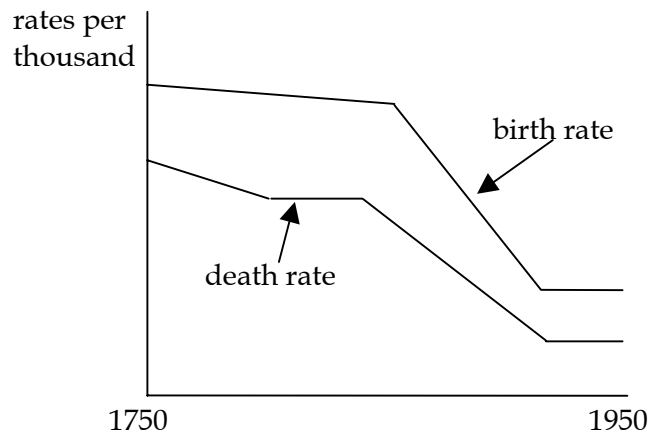


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- two questions underlie this chapter:
  1. is population growth a threat to economic development?
  2. what should be done about population growth?
- population growth and development:
  - the Solow growth model suggests faster population growth leads to a lower per capita income
  - however, the effect of population growth on development is uncertain; although most economists believe population growth is bad for development, the empirical evidence is unclear
  - economic development leads to lower population growth; however, it is unclear if lower population growth leads to greater development
  - developing countries could offer family planning as a health measure, which could reduce population growth
- the history of human population can be divided into 4 epochs:
  1. the pre-agricultural era (until about 10,000 years ago):
    - in this era, the population was limited by the hunting, gathering, and fishing carrying capacity of the environment; the invention of agriculture allowed the land to support a greater number of people
    - it is estimated that there were between 10 million to 100 million humans living at the end of the pre-agricultural era
    - it is estimated that there were at least 60,000 years or as much as 3 million years of human history in the pre-agricultural era, depending on where one draws the line between anatomically modern humans and similar ancestors
    - population densities were low during this era
  2. from the invention of agriculture to the beginning of the Industrial Revolution (around 1800):
    - agriculture developed at different rates in different parts of the world
    - as agriculture spread, population densities increased
    - by the beginning of the Industrial Revolution, the human population had increased to 1.7 billion (about 17 times greater than it was 10,000 years before)
  3. the Industrial Revolution to World War II (1945):
    - the world population growth rate during this period was higher than it was during the first two eras
    - by 1945 the world population was about 2.5 billion
  4. post-World War II:
    - the world population doubled to about 5 billion by 1990 and increased to about 6 billion in 2000
    - by some estimates, most people who have lived are alive today
- will the world population continue to grow rapidly?
  - if the world population continues to grow rapidly, in 100 years the world population would be about 30 billion
  - however, various factors will probably eventually stop the human population from growing further; according to Malthus, when income per person is greater than the subsistence level, the population grows because families that have an income level greater than the subsistence level will have more children; the additional children reduce income per person back to the subsistence level

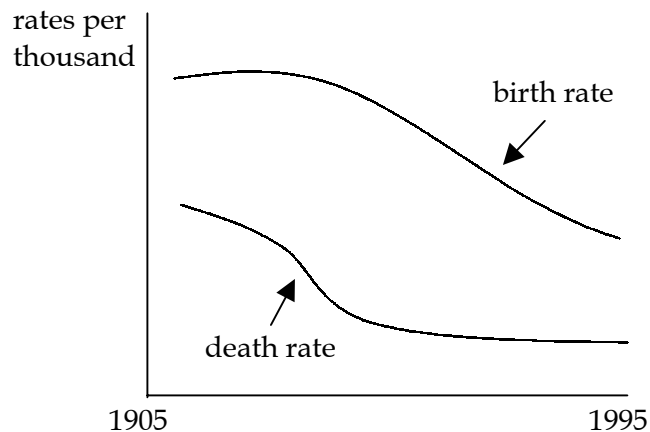
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- however, population growth slows without Malthusian checks; empirically, the opposite of what Malthus expected is observed – groups with higher incomes have lower fertility rates
- the demographic transition:
  - the crude birth rate is defined as the number of births per thousand people
  - the crude death rate is defined as the number of deaths per thousand people
  - the rate of natural increase is defined as the crude birth rate minus the crude death rate; the rate of natural increase is usually adjusted to percent terms (that is, it is adjusted to per hundred people); for example, if the birth rate is 38 per thousand and the death rate is 28 per thousand, then the rate of natural increase is  $(38-28)/1000 = 10/1000 = 1/100 = 1\%$ ; the rate of natural increase is the rate at which the population grows, excluding immigration and emigration
  - as a society become richer, the death rate declines; the decline in the death tends to precede that in the birth rate
  - page 250, figure 7-1 – the birth and death rates in England and Wales from 1750 to 1950



- the vertical distance between the birth rate and the death rate is the rate of natural increase; the smaller the gap between the birth rate and the death rate, the lower the population growth rate
- as a country develops, the population growth rate increases; with further development, the population growth rate decreases as the birth rate approaches the death rate; this trend is illustrated in the figure above by the gap between the birth rate and death rate
- page 251, figure 7-2 – illustrates the birth and death rates in Ceylon (Sri Lanka) from 1905-1995:

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- the death rate drops because of improved healthcare technology (immunizations, antibiotics, etc.) and better sanitation
- why does the birth rate decline after the decline in the death rate?
  - perhaps families have an ideal family size in mind; when death rates are high, they will have more children to meet this target; for example, if the infant mortality rate is 1/3, then parents might have 3 or more children to ensure that at least one survives into adulthood to take care of the parents in old age; however, if children have a 95% chance of survival into adulthood, then the parents might have only one child
  - as larger families become less necessary, cultural norms could still encourage people to have many children; cultural norms that encourage large families could change slowly over time
- the rate of natural increase in a country increases as the gap between the birth rate and the death rate grows; this could be why the population growth rate in some developing countries is so high; extrapolating to where the birth rate is about equal to the death rate suggests that the population size will stabilize close to the replacement rate
- there is cross-country evidence that suggests the population growth rate in a country will eventually stabilize; for instance, some European countries have a fertility rate below the replacement level
- there is a negative correlation between the level of income and the population growth rate in intercountry and intracountry data: the population growth rate is highest in the poorest countries; in countries with high inequality, the poorest households and the poorest regions have the highest fertility
- population growth decline because of greater average income per capita (and possibly because of higher levels of education)
- a change in the structure of the economy contributes to the decline in the birth rate because people are employed for wages instead of in subsistence agriculture or in household activities:
  - this might especially affect women who enter the labor force; having children to care for might not impact women's household or agricultural productivity (for example, they could tie young children to their back and work); however, they cannot take care of children while in the modern sector labor force; thus, when

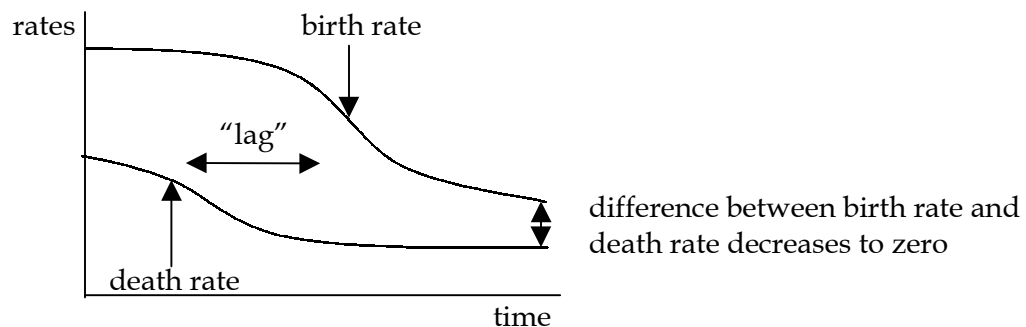
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women work for wages, the opportunity cost of having children increases because they must forego income

- additionally, the benefits of having children decrease and the cost of children increase as an economy modernizes
- empirical evidence for the demographic transition:
  - page 253, table 7-1 – the total fertility rate by region and GNP per capita:
    - the total fertility rate (TFR) is defined as the number of live births expected in a woman's lifetime (the average number of children a woman bears over her lifetime), this is similar to the birth rate, but the latter is also influenced by the age structure of the population
    - the TFR in all regions decreased from 1970 to 1997
    - by income group, the countries with income less than \$1000 per capita PPP have the highest fertility rate
  - table 7-2 – the rate of natural increase by region and GNP per capita:
    - the rate of natural increase is highly correlated with the fertility rate
    - the rate of natural increase varies from 0% in Eastern Europe and Central Asia to 2.6% in sub-Saharan Africa
    - the world rate of natural increase is 1.4%
- population extrapolations:
  - all models predict the world population will stabilize in 100 to 150 years
  - however, what the population will be and when it will stabilize are uncertain; different estimates suggest the population will stabilize between 10 billion and 15 billion
- an economic model of choice of family size – the Becker model:
  - this model is attributed to Gary Becker from the University of Chicago
  - this model assumes that having children is a rational choice and analyzes the number of children a family has using economic analysis (costs and benefits of having additional children)
  - the benefits of having additional children:
    1. consumption - children can be thought of as a consumer good
    2. economic contributions to household
    3. insurance – in poorer societies without elaborate social security measures, people cannot save towards old age and have children as a way to support them
  - the costs of having additional children:
    1. direct financial costs – the cost of raising children varies with living standards
    2. foregone income during childbearing and child rearing - if a woman leaves the workforce while she is pregnant or in the early years of her children's lives
    3. possible psychic costs
  - the number of children a family has decreases as society becomes more modernized and industrialized and as more production is done outside the household because the benefits of having more children decrease and the costs of having more children increase:
    - the benefits of additional children decrease:
      1. there are fewer ways children can contribute to household income

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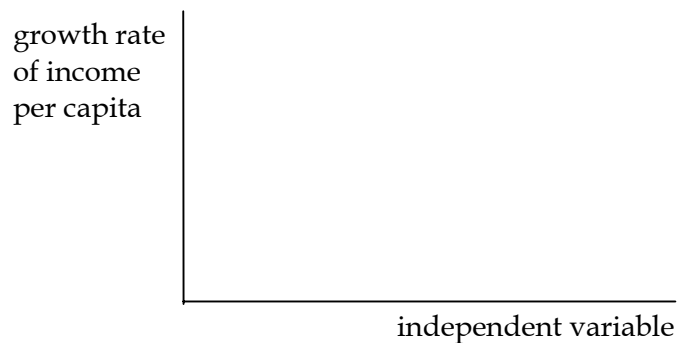
2. the insurance effect of an additional child decreases a) because the existing children have a higher chance of surviving to adulthood and taking care of their parents in old age and b) because public insurance (such as social security) and private insurance become more available as a country's average income increases
- the costs of having additional children increase:
    1. the expected standard of living rises as a country's average income increases
    2. as incomes rise, there is a greater incentive to invest in children's education, and education is expensive (parents can choose between "child quality" and "child quantity")
  - "child quality" vs. "child quantity"
    - parents who have a given amount of resources to use in raising children can choose between having many children or having fewer children
    - if parents choose to have fewer children, these children will have greater human capital, better health and well-being, and greater productive potential than the several children the parents could have had otherwise
    - as incomes rise, parents will choose to have fewer children (who have higher "quality") than before
  - the demographic transition and a declining birth rate:
    - in the demographic transition, the death rate declines before the birth rate; during the "lag" between the declines, the population in a country grows quickly because of the large gap between the birth and death rates:



- during this time lag, people's expectation about how many of their children will survive changes; as the death rate decreases, people realize that a greater proportion of their children will survive and they will have fewer children, so the birth rate will start to decline
- fertility, costs and benefits, and social norms:
  - according to Richard Easterlin, fertility is based on both costs/benefits and social norms
  - however, social norms might be a function of the nature of the economy; for instance, if there is not much investment in children (in their health, etc.) and children have a high chance of death, then a social/cultural norm might encourage having many children
  - social norms change slowly, they could even be considered autonomous
- fertility and female education:
  - the strongest influence on reducing fertility is female education

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- from a policy standpoint, this suggests that promoting the education of female children will help reduce the population growth rate
- some East Asian countries have relatively high female education (and a smaller gap between female and male education) and lower population growth rates; South Asia and sub-Saharan Africa have less female education (and a greater gap between female and male education) and have higher population growth rates
- why might females have fewer children if they are more educated?
  - presumably, educated women have a greater intellectual understanding of costs and benefits of having children, which influences their fertility decisions
  - uneducated women might not understand choice or how to exercise it
  - with education, women's attitudes might modernize and women might be able to play alternative roles
  - educated women earn higher wages – thus, the foregone income from having more children is larger for educated women than uneducated women
- the future of population growth:
  - simple models that predict standing room only are probably wrong because of the pattern shown by history; rapid population growth will probably end eventually
  - rapid population growth will probably end because as economic development occurs, people prefer smaller families and the demographic transition occurs
- is population growth harmful to development?
  - the evidence for population growth harming development is ambiguous
  - regression models can show the correlation between an independent variable (which include initial income, investment rate, income inequality, and population growth rate) and the growth rate of income per capita:



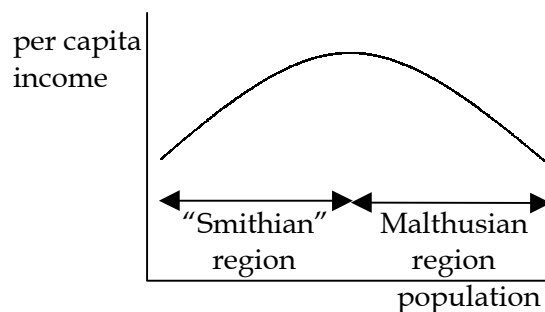
regressions which include the growth rate of population among their explanatory variables and the growth rate of income per capita as their dependent variable do not show a clear relationship

- why might population growth be expected to be harmful to development?
  - for a given saving rate, the greater the population growth rate is, the less capital per worker is available and income per worker is less (this is explained by the Solow model)
  - for a given level of expenditure on education, the higher the population growth rate is, the less education per child is available; the demographic structure of countries with high population growth rates shows a large proportion of the population is less than age 15 – if there are more people of school age (thus, more dependents per worker), then there is less income per person (assuming a given

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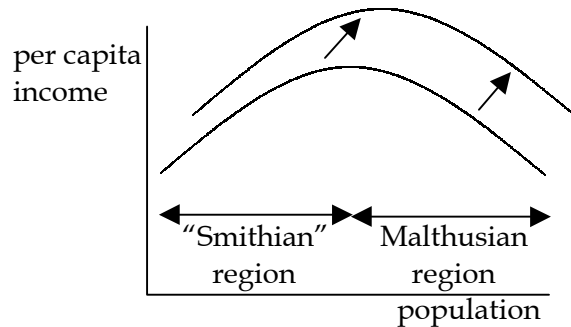
income per worker) than if the demographic structure were more even; thus, there is less education per child (what the working population can afford to spend on education is spread out over more children)

- there is a controversy over whether population growth hurts development:
  1. there is no clear correlation between the population growth rate and the rate of growth of per capita income
  2. however, there is a strong correlation between population density and income growth; East Asia, China, Japan, and Korea and also to a lesser degree India and Southeast Asia have been developing faster than other less densely-populated countries; thus, a high population density is not necessarily bad for development
- the textbook concludes that most economists believe that population growth is harmful to development in the short-run (not all economists agree), but the evidence for this is weak
- the theory of optimum population:
  - this is a theoretical model and is not based on actual data; according to this model, as a country's population increases, its per capita income will initially increase but then decrease beyond a certain population size:



- the first part of this curve is termed the "Smithian" region (named after Adam Smith); in this region, per capita income increases as population increases for two reasons:
  1. greater division of labor (specialization) – the division of labor (specialization) of both firms and workers within the firms is limited by the size of the markets for their goods; firms will not be very specialized and will not use very specialized labor when markets for their products are small; however, if the market sizes increase because population grows, then both the firms and workers within the firms can specialize further, which raises both the firms' and workers' productivity
  2. lower transportation costs – as people live closer to each other, the cost of transportation decreases because it is more efficient to have a dense network of railroads, roads, etc. than have an infrastructure that is broadly spread out
- the second part of this curve is termed the Malthusian region (named after Thomas Malthus); in this region, per capita income decreases as population increases because a country is assumed to have a fixed quantity of resources – as more people are added to the country, marginal productivity of labor decreases because of diminishing returns to the fixed quantity of resources
- it is possible that countries never enter the Malthusian region because of technological change; technological change has the effect of pushing the curve out:

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- according to this model, some countries might be too sparsely populated to have the efficiencies present at higher population sizes; for these countries, population growth could be beneficial to income per capita in the long run (however, population growth should be slow because rapid population growth will still have the negative effects discussed earlier)
- alternatively, some countries might have developed early on both dense populations and centralized government, commerce, agriculture, etc. which led to a social and cultural evolution; their “economic culture” rather than their population density per se may have led to faster economic growth in recent times than in societies that did not develop early on; for example, China vs. New Guinea
- population policy - there are several possible interventions to reduce the population growth rate:
  1. do nothing about population growth itself, except foster development:
    - it could be that the best way to reduce population growth is to increase the standard of living
    - however, it is also possible that lower population growth rates lead to a higher standard of living; for instance, East Asian countries grew partially because they underwent the demographic transition earlier and had a higher income per capita because of a low population growth rate
    - Marxists, radicals, etc. argue “take care of the population and the population will take care of itself”; according to this view, population control policies for developing countries promoted by groups in rich countries (such as the Rockefeller Foundation) are genocidal in nature; instead of using population policies, if the standard of living of poor people is raised, then population growth will decline on its own
  2. improving education, especially of women:
    - especially improving education in primary (also secondary) school in countries where many do not receive enough education to be even literate
  3. offering health education:
    - such as a) offering family planning services and techniques as health care measures and b) disseminating information about family planning
  4. offering incentives to have fewer children:
    - for example, Singapore offered access to government subsidized apartments and tax breaks to people with fewer children; this policy was reversed because the government wanted educated people (who were having fewer children in exchange for these benefits) to have more children
  5. inducements/threats:

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- for example, a campaign under Indira Gandhi in India offered a free transistor radio in exchange for sterilization
- for example, in the early 1980s China decided the optimum population was about 700 million, when it already had over 1 billion people; to reduce the size of the population, China implemented a one child per family restriction and enforced it using penalties and incentives; the fertility rate dropped below the replacement rate for a long time, but not all families adhered to the one family/one child rule (urban families averaged about 1 child per family and rural families averaged about 2 children per family);
- inducements/threats will not be accepted where personal liberties are more respected
- demographic momentum:
  - after implementing the one family/one child plan, the fertility rate in China dropped below the replacement rate; however, the population continued to grow - why?
  - if the proportion of women of child-bearing age is high in a country and the fertility rate is low (such as 2), the number of children born as a fraction of the country's population is still large - thus, the population growth rate remains high, even though fertility is low
  - this population bulge at the younger ages in a population's demographic structure takes a while to settle out - this is referred to as demographic momentum; demographic momentum explains the "echo" of the Baby Boom in the U.S. also