Chapter 4: Population and Economic Growth

The main link between the population size, the population growth and economic growth is that an increase in the population will increase the input factor labour but also the need for the supply of natural resources.
Population growth needs to be distanced from population size; a high growth rate is always dependent on the population base; if a small population size experiences an accelerated growth rate, the total population would be still small.
Furthermore the growth rate is negatively correlated to the GDP per capita.(See figure 4.1 on page 103)

Population and output over the long run

Population figures grew worldwide in a significantly slow pace before the growth rates took off around 1800, from 0,09 % (from 1st century 18th century) to 1,8 % (19th century). Therefore, the high population growth rate trend is a rather recent phenomenon.

Thomas Malthus (1766-1834) observed that, without resource or health (fertility) constraints population will grow unlimited. Therefore, growth is only constraint by limiting circumstances, like poverty and fertility. In the inversion of that argument, the **Malthusian model** states that population growth will eventually reduce income per capita because the population size has increased. Thus population growth will not improve the standard of living. People are not healthier, happier or richer; there are just more of them.

The graphical conversion of the model can be seen in figure 4.4 on page 109.

- Part a) of the graphical model describes the influence of the population size on Income per capita. Since a high population size puts pressure on Income and resources, the relationship is negatively related; the higher the population size, the lower is the Income per capita. Thus, the curve is sloping downward.
- Panel b) translates the income per capita from above into a growth rate. Please recall that populations grow fast in this mode, if they are not facing constraints regarding resources or fertility. Consequently, a high Income per Capita, due to small population size, is translated in a positive growth rate and vice versa. That relationship therefore is graphed as a upward sloping curve; the more income per capita available, the higher the growth rate.

This model will lead to a steady-state of population growth, i.e. “0” population growth through the following mechanism. Starting at a point with a low population size, as above described it leads to a high level of population growth. However, as soon as the population growth increases, the size of the population will increase. Therefore, we start again with a slightly larger population size, a slightly smaller income per capita, and thus a smaller but still positive growth rate.

That mechanism will repeat the effects until the growth rate has reached the value “0, then nothing will alter anymore; the population is at a steady-state. When starting at a high population size, the associated low growth rate will gradually reduce the population size until the growth rate is again equal to “0”.

The introduction of new resources will shift the curve relating population size and income per capita outwards, since the constraining resources are now less limited.
The only solution Malthus offers is that only reduced fertility (through “moral constraint”) will lead to a higher living standard. “**Moral constraint**” implies that the growth rate curve will shift downward and therefore connect the same level of income per capita with a lower growth rate.
The Malthusian model clearly does not apply to the world today. This can be seen from evidence from the living standards nowadays. The assumption that a high level per income

will automatically lead to higher fertility does not hold. Developed countries with the highest level of income have also the lowest population growth rates.
Nevertheless, the Malthusian model recognizes the influence of constraining resources on the population, which still holds today (even though not in the historical scale).

Solow model and Population Growth

The capital-based theory of growth focuses on the role of capital, therefore we have to assess the influence of population growth on capital rather than the population size in the Malthusian model.

As the population grows rapidly but the capital stock stays constant, the capital available per worker will decrease. That mechanism is called **capital dilution**. Please recall the Solow

model that incorporates the growth rate of investment (γ) and depreciation (δ) to describe

the change in capital per worker (output):

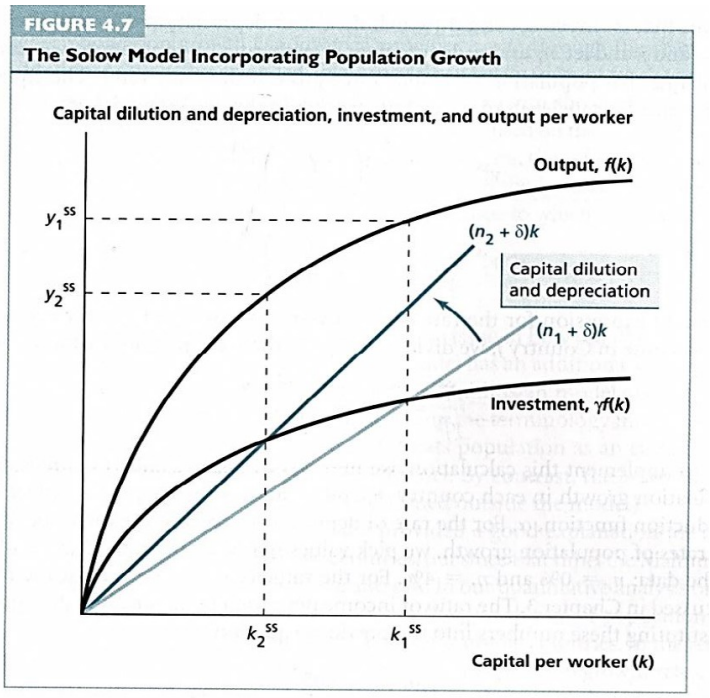
$$\Delta k = \gamma * k - \delta * k$$ (Change in Capital = investment*capital - depreciation*capital)

Capital dilution (i.e. less capital due to more workers with a fixed amount of capital available) works in the same way as capital depreciation. If investment does not simultaneously increase the change in capital will be lower than before and thus lead to a lower steady-state, and therefore to lower output. That mechanism might explain why countries with a high growth rate are worse off than countries with low population growth rate.

Therefore, the Solow model explains the low income level of fast growing populations, through the channel of Capital dilution.

Assume an exogenous rate of population growth n, which is equal to the growth rate of the labor force. The equation determining the change in capital is now;

$\Delta k = \gamma f(k) - \delta k - nk = \gamma f(k) - (n + \delta)k$



The figure shows how raising the population growth rate from n1 to n2 affects the steady state level of capital per worker, k, and the steady state level of output per worker, y.

Factors of Population growth

The Malthusian model also explains how the size of population is determined. The model treats population as an endogenous variable, whereas the Solow model treats it as a exogenous variable.

The growth rate of any population is defined as the birth-rate–mortality rate. The share of fertility and mortality change as the country economically develops.
Demographic transition is a useful framework for organizing our thinking about population growth. At low stages of the countries development, fertility (with a very high rate) exceeds mortality (also with a relatively high rate).

As the country develops, mortality will decrease first, due to higher hygienic and medical improvements. Fertility will first stay constant and therefore this will lead to a very high growth rate. With increased development, fertility will also fall and with completed developmental status, both fertility and mortality will be at lower rates.

Most developed countries completed the demographic transition stages, whereas the population in developing countries is still transforming.
As stated above, the growth rate is dependent on mortality and fertility, we will therefore analyse the transitions of both factors during the demographic transition.

Mortality transition and **fertility transition**: When the changes in the population growth result from interaction of changing patterns of death and birth.

A common measurement of mortality is the **life expectancy at birth**, the average number of years that a newborn baby is expected to live. In the period of the last 200 years, the life expectancy at birth increased rapidly, depressing the rate of mortality. The rate of mortality decreased more sharply in developing countries over the last few years, than it did at early stages of today developed countries.

As mentioned above, the underlying reasons for a decrease in the mortality rate are based on the improvements in the standard of living. That includes a better nutrition, advanced public health policies, like providing clean drinking water and better medical treatments.

That also explains why Mortality transition was faster in developing countries; they experienced the advantage of profiting from the developed countries technologies to enhance the living standard all at once.

The Total Fertility Rate (TFR): The indicator measuring fertility, by stating the number of children a woman could give birth to when she lived through the potential child bearing years and experienced the current age-specific fertility rates at each age. As the Mortality rate, the Fertility rates also decreased significantly in the last 200 years.

The Total Fertility Rate lacks the possibility of an early death of the woman, since it gives the rate of children, a woman would give birth to if she lives through the childbearing years. Contrary, the **Net Rate of Reproduction (NRR**) gives the numbers of daughters each girl who has born can be expected to give birth to, including the possibility of death before childbearing years. Thus, the NRR combines fertility with mortality. A NRR of "1" implies that the population is growing with a 0 % rate, so the population is constant. Whereas a NRR of "2" means that the populations as a whole will double every generation.

Explaining fertility transaction

The transition of mortality is based on few obvious factors, whereas the reduction of fertility lacks obvious reasons. Explaining fertility is difficult. Over the years many cultures have tried to control family size to control fertility growth.

The idea that economic growth is the best way to reduce fertility was summarized at an United Nations(UN) conference in 1974. What was said is that the higher the developmental statues of an economy, the lower the fertility rate. There are four channels that discuss why development leads to lower fertility:

1. *Effect of Mortality reduction*

The decrease in mortality might actually be one cause of reduced fertility. This is because as the life expectancy of children increases, families might have fewer children because it is not necessary anymore to have more children to secure the survival of few.

2. *Substitution and income effect*

The more income per capita parents have, the higher are the opportunity costs of time for having children, e.g. the wages. When your wage is higher, children are relative more expensive. That phenomenon is called the **substitution effect**.
Another implication of a higher income is the risen living standard, which families want to keep when having children. Therefore the expenditures for children in high income families are higher than for low-income families. The high expenditures might hinder fertility. The latter effect is referred to as **Income effect***;* when you are richer you can afford more of everything.

3. *Resource flows between parents and children*

In developing countries children tend to start working and therefore providing the family at earlier age than in developed countries. Therefore, the costs of child support are significantly larger in developed countries. In addition, in developing countries kids are supporting their parents as a kind of pension, which is not necessary in developed countries. However, \people base their decision of having children not solely on economic reasons, therefore resource flows cannot account for all of the fertility reduction.

4. *Quality-Quantity trade-offs*

Parents hope that the resources devoted to rearing and educating their children will have payoffs that improve the quality of the children. When parents are old it could be that they rely on the support of their children. When the children do not support their parents at old age, they may be happier by their children's happiness. In this way investing in the live/quality of their child will provide them with benefits in the future.