# ECONOMIC DEMOGRAPHY

**C.Y. Cyrus Chu**
*Institute of Economics, Academia Sinica, Taiwan*

**Keywords:** Malthusian model, supply-side paradigm, fertility demand, assortative mating, modernization hypothesis, marriage matching, resource hypothesis of household power, parent-adults co-residence, cohabitation, quantity-quality tradeoff, birth duration, son preferences, demographic transition, Easterlin cycles, population ageing, cohort model, period model, dynastic cycles, intergenerational transfers, social security, Ricardian equivalence, life history, economic bio-demography.

## Contents





## Summary

This Chapter addresses selected topics where economics and demography intersect and interact with each other. We start with the Malthusian model, where the population size is constrained by the economic carrying capacity. In this classical model, technological changes only increase the equilibrium population size, but not the wage level. After the industrial revolution, improved hygiene and medical knowledge have reduced the mortality rate, and the ensuing fertility transition has been characterized by a fertility rate decrease and an increase in parental investment in children, within the financial capability of the parents; a phenomenon known as a quantity-quality tradeoff by

researchers. For poor families, however, children are still treated by their parents as labor help, especially in agricultural countries. This dichotomy of family behavior in well-to-do and poor countries has created some global economic problems related to family fertility decisions.

The demographic transition has affected the economic behavior at both the micro and the macro levels. At the micro family level, economic modernization after the industrial revolution has increased the age of first marriage, lessened the characteristic asymmetry of the couple, and increased cross marriages. At the macro level, the demographic transition has also created various fertility cycles and population ageing. These phenomena are then compared with the traditional dynamics of population theory, such as predator-prey cycles, dynastic cycles, and capitalism cycles. Finally, since the period of child dependency is long for human beings, parental transfer has also become an important factor in explaining the various features of life history, such as age-specific U-shape mortality, human longevity, and menopause.

## 1. Introduction

The standard definition of demography is the study of vital statistics, mainly birth and death rates, age and population structures to name just a few. These statistics, of course, can be studied from different perspectives; for instance one can study the mortality rates of different age groups (age-specific), or the fertility rates of different educational and ethnic groups (class-specific), or rates of distinct regions (region-specific), etc. Whenever these dimension-specific vital rates involve economic decisions, they become potential topics of economic demography. For instance, family fertility and human capital investment by parents (in child education) are both typical economic decisions; hence the study of the relationship between fertility (quantity) and child education (quality) is a topic of economic demography.

The standard definition of economics is the study of the allocation of scarce resources among alternative uses to achieve some given objectives, which calls for the examination of either micro individual decisions or macro social phenomena. In the *Journal of Economic Literature,* demographic economics primarily covers the area where demography and economics overlap, such as marriage and divorce, family structure, fertility, family planning, economics of ageing, discrimination, public policy and others. In this Chapter, I shall basically follow these accepted definitions without repeating what has been covered elsewhere in this volume, such as the health-related issues in Chapter 9, topics on family and household demography in Chapter 15, and migration-related analyses contained in Chapter 19. Some of the issues connected to both demography and economic development are analyzed in Chapter 13 (population ageing) and Chapter 22 (population policy). My focus, therefore, will be on topics covered in *A Treatise on the Family* by Becker (1991) and in *Handbook of Population and Family Economics* by Rosenzweig and Stark (1997) in an effort to update the literature to the present.

In the following five sections we will first introduce, in section 2, the classical model outlined by Malthus, give an overview of the modern theory of marriage and fertility in sections 3 and 4, followed by an exposé on the dynamic implications of these modern

decisions in section 5, and finally an analysis of intergenerational transfers in section 6. The last section also contains a discussion part.

## 2. The Classical Malthusian World

There is no doubt that the earliest theory of economic demography originated with Thomas Malthus (1798). The Malthusian model was a typical macroeconomic framework, and it can also be viewed as a classical theory of economic growth before the industrial revolution. The following is a simple adaptation of the Malthusian theory.

Economists often use a production function to characterize the input-output relationship. The most general specification of inputs includes population $N$, capital $K$, technology $A$, and institution $I$. If we let $Y$ be the aggregate output of the economy, then the production function $f$ can be written as $Y = f(N, K, A; I)$. Leaving aside institutional factors, which are related to custom, politics and culture at distinct stages of human history, the relative roles of $N$, $K$, and $A$ are different. Before the industrial revolution, population was the key variable that dominated the dynamics of the economy. As the industrial revolution began to spread its influence, capital stock started to accumulate, and the key variable dominating economic dynamics became $K$. Starting sometime after World War II, with characteristics becoming increasingly evident in the late 1980s, according to Thurow (1999), we have moved into an epoch in which the invention and transmission of knowledge became the crucial factor dictating the growth of the economy, an epoch he dubbed the *knowledge-based economy*. The essence of the Malthusian theory of population is best understood as a theory of economic growth before industrial revolution. By adopting and modifying the characterization in Schultz (1981), we shall now introduce the key elements of the Malthusian theory of growth as follows:

In the classical world before the industrial revolution, given that capital, technology and institutions were very much exogenous and stable, we may as well write the production function simply as $Y_t = f(N_t)$, where the subscript $t$ indicates period. If there is diminishing return to labor inputs, then the marginal productivity of labor, denoted $w_t = f'(N_t) \equiv g(N_t)$, should be a decreasing function of $N_t$, with $g'(N_t) < 0$.

Furthermore, in the pre-industrial world where the knowledge of hygiene and medicine was primitive, and the practice of fertility control was almost non-existent, the population growth rate, denoted $\hat{N}_t = [dN_t / dt] / N_t$ was very much determined by the wage level $w_t$. Thus, we can write $\hat{N}_t$ as an increasing function of $w_t$: $\hat{N}_t = h(w_t)$ with $h'(w_t) > 0$. The implicit assumption behind this setting is that the fertility in the Malthusian world is more biological; it is very much affected by the *supply-side* relation of population size to the carrying capacity. Parental *demand* for children is relatively not important.

Combining the above two functional relations $g$ and $h$, Schultz (1981) outlined the dynamic relationship between $N_t$ and $\hat{N}_t$ shown in Figure 1. As one can see from

this Figure, the long run equilibrium in the Malthusian model is $N^*$. If $N_t > N^*$, then the population growth rate $\hat{N}_t$ is negative, and hence the population size will decrease. On the other hand, if $N_t < N^*$, then $\hat{N}_t$ is positive, and the population size will increase. The adjustment will continue until the equilibrium $N^*$ is reached, when the corresponding population growth rate is zero.

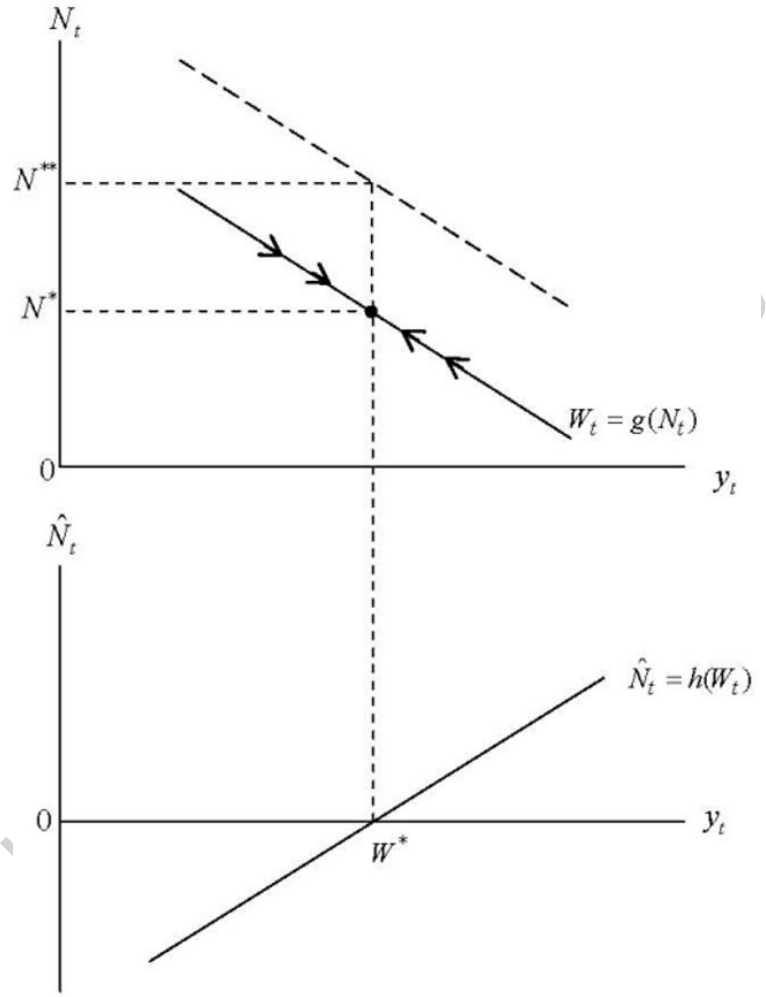


Figure 1. Population Dynamics in a Malthusian World.

An interesting feature of the Malthusian model is that if the improvement of technology enables the marginal productivity of labor to increase for each level of population input, then the curve $g$ shifts outward. With a new equilibrium population size $N^{**}$, the equilibrium wage level will stay unchanged. Thus, an improvement of technology only increases the carrying capacity of the economy, and sustains a larger population size, but the welfare level of individuals would be the same irrespective of technological changes ($w^*$). Because of economic theory predicting a stagnant welfare level even after technological improvement, economics was described as a *dismal science.* The only

possible way to increase the level of equilibrium wage is to have a continuous increase in $K_t$ or $A_t$, which was not considered in the Malthusian model, but was indeed the case after the industrial revolution.

Despite the fact that the Malthusian model was more or less a correct description of the pre-industrial world, the role of population in ancient times may not be as passive as was described above. Boserup (1981) looked at the long period evidence of human development before the industrial revolution, and found that population size or density was actually highly related to technological changes. Take canals as an example: Boserup found that their construction and maintenance were made possible only by the existence of a sufficiently large population. She also found human agricultural activity to have been very labor (size of population) intensive for thousands of years, and again that was possible only in population-dense areas. A dense population was also a necessary condition for the emergence of city and urban trade centers, which in turn contributed to the efficiency in transaction and hence the division of labor. As Adam Smith told us more than 200 years ago and Yang and Ng (1993) proved rigorously, the division of labor is a key to specialization and subsequent inventions. Thus, Boserup concluded that much of the invented technology could not have been sustained if the population size or density had not been large enough. In short, population, even in the pre-industrial world, played at least an augmenting role of *support* to various technologies and innovations. Technically, population size and technological change are in fact jointly determined in the dynamic economic system.

After the industrial revolution, as Solow (1956) indicated, the key variable dominating the evolution of an economy was no longer population but the accumulation of physical capital. However, the accumulation of physical capital has been accompanied by other advances, such as improved knowledge of medicine, quarantine, and hygiene. These knowledge improvements have reduced the mortality rates for all age groups, in particular infant mortality. As a result, given the same number of parental birth trials, the expected number of survival children increased. Since parents did not have to bear as many children as before to end up with the desired number of children they want, parental fertility control became a subject of interest; and the invention of the condom and oral contraceptives have actually enabled parents to exercise that control and choose the size of their family. The classical *supply-side* Malthusian paradigm of carrying capacity then formally changed to a paradigm of family fertility *demand*. As a consequence, the discussion of family formation and decisions became new topics of research in the 20$^{th}$ century.

Before we move to the discussion of fertility demand and modern family decisions, we need to stress that the transition from the Malthusian regime to an industrial regime is not a uniform process, as our discussion would seem to suggest. Even toward the end of the 20$^{th}$ century, fertility rates in many developing countries were still quite high due to reasons such as religion or the need of extra economic support from child labor, and they sustained high population growth as a result. A working group formed by the National Research Council of the US to study the impact of population growth on economic development concluded in 1986 that slower population growth would be beneficial to economic development for most developing countries, although these benefits are context-dependent and are likely to be conditioned by the quality of markets,

the nature of government policy and other area-specific features. Several other theoretical developments of the Malthusian theory can be found in Section 5 of Chapter 1.

### 3. Marriage and the Modern Family

After the industrial revolution, increased family income, improved personal hygiene and sanitation, and advances in medical knowledge have gradually expanded the domain of family economic decisions. The degree of this expansion, of course, is related to the level of economic development. In the literature, countries being studied were classified as developed countries or developing ones, or perhaps more appropriately, countries with reasonable or poor economic resources. In general, poor countries are mostly agricultural ones and their families are more traditional in nature, where individualism is not as prominent as in the West. Whereas developed countries are mostly industrialized countries where families enjoy more abundant economic resources and their members are more individualistic and are given more latitude for personal decisions. Our analysis here will also follow these two categories respectively.

Marriage is the first step in family formation, hence the first decision relevant to modern economic demography. In a traditional marriage, parents or even grandparents are heavily involved in determining when and to whom a child should be married. As Fan and Huang (1998 p.229) pointed out, marriage in a traditional Chinese society serves five functions: 1) to continue the family line, 2) to increase the family labor resource (the wife being a new worker joining the family), 3) to extend the social network (by tying together the families of the bride and groom), 4) to provide old-age security, and 5) to facilitate the transfer of some economic resources (through the bride's price or dowry). Thornton (2005) pointed out that this kind of traditional marriage was actually in general practice in many European countries in the 19$^{th}$ century.

Because a traditional marriage is mainly a means of lineage continuation, it is mostly arranged and facilitated by the parents of the newly-weds. The future husband and wife, paradoxically, do not play a significant role in their own marriage. Furthermore, since another purpose of a traditional marriage is the extension of the social network, it is likely to be an assortative union in which the bride and groom come from families of comparable class, wealth, and social ranking.

Theoretically, as Goode (1963) pointed out, such traditional marriage may change with economic modernization. Universal education and the prevalence of higher education have increased the time span of human capital accumulation, and help push back the age of marriage. The expanded market economy has opened up opportunities for the young, especially young women, which in turn could increase the opportunity cost of getting married, bearing children, and performing domestic work. The social movement toward gender equality also encourages young women to participate in the labor market. The emergence of an economically more independent young generation means that the power and influence of their parents over them will be reduced. In particular, marriage in most modern societies tends to be a decision made by the young people themselves and not dictated by their parents.

Empirically, the above modernization aspects do contribute to the delay of marriage, though to varying degrees. In fact, later marriage age has become a worldwide trend, and the pattern is particularly evident in countries that have gone through a rapid economic transition. This is mainly because marriage and child birth tend to create family obligations, especially for women, that would hinder their labor market prospects. Foreseeing this opportunity cost associated with marriage, people find it to their advantage to delay their marriage. The changing pattern of first-marriage age can be seen in the statistics websites of most countries and needs no further elaboration here.

There are, however, marriage phenomena that remain constant in the process of modernization. The three typical, nearly universal economic phenomena are: i) the husband is almost always older than the wife; ii) the husband and wife almost always are a assortative pair, meaning that people tend to marry their own kind, and iii) the husband always does less housework than the wife. Let us take a closer look at these constants.

### 3.1. Male-Female Age of Marriage

Bergstrom and Bagnoli (1993) proposed a theory to explain the male-female age difference at marriage. They argued that if one group of people possesses some implicit characteristics that increase their odds in attracting a potential mate and if these characteristics take time to be realized or revealed, then some of its members will tend to marry late, in order to use their revealed features to attract more valuable mates. In the context of the male-female age of marriage, they suggest that at least in traditional societies, the male features (e.g. earning capacity) are revealed later than female ones (e.g. fertile capacity), which explains why the average marriage age of males is a few years older than that of females.

In the modern world, a modified implication of the above argument is that people with promising future prospects tend to marry late, because waiting can provide them with promising rewards and because they need time to prove to their prospective mates their earning capacity. Bergstrom and Schoeni were among the earliest to suggest in a paper in 1994 a possible positive correlation between earnings and marriage age. In that paper, the authors ran a regression of earnings and incomes using dummy variables to capture different ages of marriage. They found that the age of marriage indeed positively affects the intercepts of the earnings equation.

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**Biographical Sketch**

**C. Y. Cyrus Chu** received his BA degree from the National Taiwan University in 1978, and his MA and PhD from the University of Michigan in 1985. He was an Olin Foundation Law and Economics Fellow at

Stanford Law School (1991), a Rockefeller Foundation population Science Fellow at UC Berkeley (1992), and an Olin Visiting professor of Law and Economics at the University of Chicago in 1998. Starting from 2000 he became a Distinguished Research Fellow at the Institute of Economics, Academia Sinica, and an adjunct professor of Economics and Accounting at the National Taiwan University. He serves as a member of the Editorial Board of *Demographic Research* since 1999, *Journal of Asian Economics* since (2004) and *International Review of Law and Economics* since 2008. In 1998, he was elected as a member of Academia Sinica. His research interest includes economic demography, law and economics, family economics, and applied microeconomics.