THEORETICAL OVERVIEW OF THE INTERRELATIONSHIP OF THE ECONOMIC GROWTH AND POPULATION

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How much more accurately can population be forecast if its economic determinants are modeled? How much more accurately can economic change be forecast if its demographic determinants are modeled?

Interlinkages between Population and Socio-Economic Development

According to the development theories: The major factors in economic growth in any society are capital accumulation, growth in population and technological progress. Various interactions taken place among population and socio-economic variables in any society. Therefore population is playing one of the key role in the overall socio-economic development planning. In recent years, many countries have started to pay greater recognition to the importance of feedbacks from socio-economic variables to population changes.

Growth theory and demographic change

The theory of economic growth developed by Solow, Burmeister & Dobell 1970: Wan 1971 attempts to describe and to explain the long run development of an economic system. An economic system is essentially dynamic in nature. The major components of dynamics in economics are capital accumulation (investment), population growth (labor) and technical change (technological progress). These dynamic forces are endogenous to the economic system. The order in which these sources of dynamics have been given roughly corresponds to the chronological order in which growth theorists have studied them. With the notable exception of Malthus (1798-1870), who was a first demographic economist, the economics profession has for a long time almost exclusively directed its attention to the accumulation of physical capital vas the principal driving force behind economic growth. These efforts culminated in the seminal formulation of the neoclassical growth model by Solow (1956) and Swan (1956_ simultaneously.

A central concept within growth theory is the concept of the steady state. A steady state is a situation of economic development in which all variables grow at a constant rate. It should be pointed out that a necessary, though by no means sufficient, condition for a steady state to occur is that the relevant ex0ogenous variables (such as population) grow at a constant rate. Population, which grows at a constant rate, is called stable population. The main characteristic of a stable population is that it has a constant age composition. Due to concentration on steady states, in growth theory population plays only a minor role, during 1960s.

Also it was recognized that the growth rate of the population could be partly dependent on economic conditions, leading to growth models with endogenous population. But the obvious fact that, first, demographic change exist, and second, once they occur, by their very nature have long-lasting effects has not been taken into account. Empirical studies prove that it takes quite a long time for a change in the fertility pattern to work its way all through the age structure. Thus the aging of the population of Japan that accompanies the present fertility decline will be a major social and economic problem until at least the year 2060. Numerous observations illustrate that population can be an important source of dynamics in economic development. The main reason for the wavering interest in growth theory stems from the simple observation that many countries began to experience a considerable change in the size and age composition of the population in the mid 1970s. The percentage of youngsters often sharply decreases while that of the elderly increases. Traditional growth theory with its emphasis on the steady state is not capable of handling these dramatic deviations from exponential population growth. Understanding the economic consequences of the demographic change requires the construction of growth models that explicitly recognize demographic forces as a potential source of non-stationarities in economic development. A natural way of incorporating the demographic structure into growth models is to make the model one of overlapping generations. Such an extension of the traditional growth models moves growth theory into thew realm of demographic or population economics.

Economic-Population models

Numerous economic-population related models considered as a miniature version of a complex economy bring together the main relationships among population and socio-economic variables expressed in a quantitative form. As below mentioned models are studied optimal models for economic-demographic comparative analysis:

Kelley and Williamson model (long term econometric model)
Minami and Ono (Japanese econometric model)
Coale and Hoover (Dependency rates model)
Gunter Steinmann and Julian Simon (The optimum rate of Population growth model)
The aim of this model is to produce a more general and realistic model of population growth and thereby to analyze the optimum rate of population growth. The middle rates of growth of the labor force show faster growth of product per head than do both lower and higher rates of the labor force.
Phelps's model (higher labor force growth implies higher consumption without limit)
Carol Greenberg and Charles Renfro (An econometric-demographic model)
EDM is an initial attempt to integrate the explanation of population change into an econometric model and to specify at least some of the economic implications of this change, taking into account the effects of both the composition and size of the population at each point of time. The specific approach involves linking a demographic cohort survival model

to an econometric model of net migration and fully integrating the population and economic sectors into simultaneous system. Also measures the impact of changes in the level and composition of population on economic activity by sector.
United Nations (Economic-Demographic model)
This model distinguishing feature is the linking of sophisticated demographic accounts with sophisticated structural econometric model.
ILO (Population change and economic growth: A long term Econometric Model)
UN ESCAP (Modeling Economic and Demographic Development)
Evert Van Imhoff (Optimal economic growth and non-stable population model)
NU (Simulation Model and System analysis in Economic-Demographic planning)
Solow and Swan (Neoclassical Simultaneous Growth Model)

Optimal economic and population growth

The theory of optimal economic growth assumes that one or more variables in the economic system can be controlled. The theory is concerned with determining these control variables in such a way that the resulting economic development is optimal in respect to some objectives or welfare function. The most famous result of optimal economic growth is the so-called Golden Rule of Capital Accumulation (Phelps 1961, Robinson 1962_. This concept was originally derived within the context of comparative statics. The golden rule states that the steady state with the highest level of consumption per capita is characterized by the equality between the marginal productivity of capital and the growth rate of the population. The main limitation of the Golden Rule concept is the its tight link with the notion of the steady state. Although the latter is very appealing from a theoretical standpoint, it is hardly relevant to actual economic development. At noted above, steady state can come only if the exogenous variables grow at a constant rate. Clearly, this condition is not satisfied in reality. This is most obvious for population, the population growth rate is falling in almost all countries. In this study assume that demographic variables re completely exogenous to the economic system.

A population has a constant age-structure (stable_ if the age-specific mortality rates are constant and if the growth rate of the number of births has been constant for at least n years, where n are the maximum lifespan (100 years). Obviously, since the age structure of the population is an important economic variable, a temporary change in the birth growth rate during m year's results in a departure of the economic growth path from steady state for at least m+n years. The period during which the age structure of the population is non-constant (when the population itself is non-stable) can be labeled a period of demographic transition. The economic growth path during such periods of demographic transition denotes by the term non-stationary. This term should be understood to indicate any economic growth path that is not a steady state.

The effect of the steady-state rate of population growth on long-run consumption per capita in equation is expressed in two terms. The first term on the right of the equality sign is negative. Thus, if the ratio L/P (labor/population) does not change with g, i.e. if the age/labor-efficiency profile is uniform, then consumption per capita is inversely related to the rate of population growth. This would suggest that an optimal population policy consist of choosing as small as possible, preferably negative.

A higher growth rate of population increases (decreases) the labor force/population ratio if and only if the mean age of the population is higher (lower) than the mean age of the labor force. This result makes sense: since a fast-growing population has a relatively young age-structure, the relative productivity of the population will increase with g if labor efficiency is concentrated in the younger age groups, and vice versa.

How g affects the difference between the mean ages of the population and of the labor force. If this mean is equal, particular value of g, then the sign of the effect depends on the relative variances of the two age distribution. The unimodality of the age-efficiency profile h(.) guarantees that the variance of the age of the population is larger than the variance of the age of the labor force.

The non-stationary optimal growth path

This section explores the nature of the optimal growth path during periods of demographic transition. The steady state will serve as the starting point for the analysis. The non-stationary of the population is induced by a gradual change in the dynamic path of the growth rate of births $g^B(t)$, causing $g^P(t)$ and $g^L(t)$ to change as well. The economy will only return to a new steady-state growth path if the growth rate of birth stops changing and remains constant for at least n periods. Typically $g^B(t)$gradually decreases over time, this being the present demographic experience in most developed countries.

After some time the decreasing growth rate of births will have pushed itself further and further into the age structure of the population. Gradually g^P will return towards zero, while at the same time g^L becomes negative and approach g^P in absolute value. For positive ρ and/or σ smaller than unity this will result in the third term becoming negative. The net effect on s is ambiguous: it might be negative, zero or positive during the middle phases of the transition period. Whatever may be the case, it is certain that the rise of s decreases over time.

Finally, the decreasing in the birth rate comes to a half. g^P becomes gradually zero, g^P being positive and g^L lagging behind g^P. Ultimately the economy will reach a phase in which the first and third terms on the RHS of (65) are negative and more than offset the positive second term which becomes less important as g^P approach zero. Thus before returning to steady-state the optimal growth path will exhibit a falling savings rate.

Here conclusion is that during a period of demographic transition with the growth rate of birth falling, the curve of the optimal savings rate follows an inverted U-shaped pattern. Also, a falling birth growth rate generally causes a steady rise in consumption per capita, expect for a possible slight decline during a short initial interval as well as just before the economy settles back to its new steady-state growth path.