POPULATION GROWTH AND ECONOMIC DEVELOPMENT: SOME LESSONS FROM THE HISTORY OF ADVANCED NATIONS

Abstract

Population growth is closely related to the factors of demand, production and supply and furthermore to distribution of income, and the conditions of quality of life. Today, the «population burden» is a «common characteristic» for developing and mainly the less developed countries. There is a close relationship between demographically experienced in developed countries in the past and the currently being experienced in developing countries. This paper analyses the relationship between population growth and economic development. What feature of the social and economic environment affect the household level decisions? and In particular, how does economic development affect fertility choices and what are the main implications of population growth to economic development?

Περίληψη

Η πληθυσμιακή αύξηση σχετίζεται άμεσα με τους παράγοντες που αφορούν την ζήτηση, την παραγωγή και την προσφορά της οικονομίας, και περαιτέρω με αυτά της διανομής του εισοδήματος και των συνθηκών της ποιότητας ζωής. Σήμερα το βάρος της πληθυσμιακής ανάπτυξης αφορά περισσότερο τις αναπτυσσόμενες και κυρίως τις υποανάπτυξες χώρες. Επίσης υπάρχει μια στενή συσχέτιση μεταξύ της δημογραφικής εμπειρίας που αντιμετώπισαν οι αναπτυσσόμενες χώρες κατά το παρελθόν και της εμπειρίας που αντιμετωπίζουν οι αναπτυσσόμενες χώρες στην τρέχουσα φάση. Το άρθρο αυτό στοχεύει στο να αναλύσει την συσχέτιση που υπάρχει μεταξύ της πληθυσμιακής και της οικονομικής ανάπτυξης και να εξετάσει ποιοι είναι οι κοινωνικοί και οικονομικοί παράγοντες που επηρεάζουν τις αποφάσεις των νοικοκυριών στα θέματα αυτά. Τέλος θα εξετάσει με ποιο τρόπο η οικονομική ανάπτυξη επηρεάζει την γονιμότητα αλλά και τις γυναικείες επιπτώσεις και τα αποτέλεσμα της πληθυσμιακής αύξησης στην οικονομική ανάπτυξη.

JEL Classification (0,01)

key words: Population growth, fertility, distribution, convergence, economic growth
1. Introduction

In recent years economists have begun to focus increasingly on the relationship between economic development and population growth. The most difficult problem for such an analysis is to be able to separate cause from effects.

Today the population of the world has increased rapidly with an exponential growth. According to the United Nations, the total population will be double in the next fifteen years. It took 123 years (1800) for the world population to increase from one million to two billions (1920). The next billion took 30 years, while the following two billions took 13 years and 12 years respectively.

Does economic development accelerate or retard population growth rates? Does rapid population growth rate contribute to or retard economic development? The question is how population growth affects development? and how do we compare the fact that a larger number of people are enjoying the «poor or moderate circumstances» with the alternative in which luxuries are available to a smaller number? This article attempts to examine the effects of population growth to economic development and furthermore to analyse the patterns of population growth across different countries.

2. Population: Some basic concepts

According to the basic population-statistic of the United Nations, there is an apparent increase of the world’s population, mainly for the less developed countries (or the so-called «third world countries»). In particular, since 1700 the population of Europe and North America (most of the modern developed world) grew only in absolute terms, but also the population of the developing world has been already tripled during the last centuries (U.N.: Human Development Report).

The population growth rate is the birth rate minus the death rate. The high rates of population growth lead to a younger population and then to high birth rates and low death rates. This creates an «echo-effect» that keeps population growth high. One important consequence of this is that population growth possesses an enormous degree of inertia. For instance, imagine a country that has a high population growth rates and implements a policy to bring down total fertility rates. The point is that even if this policy were to be successful, the population size would probably overshoot the desired limits before settling down at an acceptable level. The reason is the following, because the high population growth rates in the past lead to a young age distribution. A large fraction of the population continues to be at the age where they are just to marry and have families. Even if the total fertility rates were reduced the sheer numbers of young people would lead to a large number of births as a fraction of the entire population, according to an inertia of population growth.
2.1 Population Development: an historical approach

The rapid population increase in the 19th century was followed by slower growth rates in the 20th century. Since 1950 on the world's population increased by 3 billion people, while Europe's share of world population declined from around 16% to 9%.

The 1960s «baby-boom» (around to 6 million births) was followed by a decrease from 13% to 15.4% of populations' elderly people. In the following years the population growth slowed a lot, and more precisely in numbers: 2.1 to 1.7. The Western and Northern part of Europe grew 0.4% more slowly than Eastern and Southern Europe. Figure 1 illustrates population growth since 1950.

In 1988 life expectancy, the most representative indicator for human development, was 74.9 years, lowest rates occurred in Central and Eastern Europe. These countries have shown only a little increase in the past ten years. If we look back to 1980, we see that it increased annually by 0.2 years. Fertility rates showed low levels in Southern Europe in 1980s. In comparison, the Eastern Europe fertility rate declines more slowly than in Southern Europe. Between 1985 and 1990 some regional growth rates increased from 0.3% to 0.5%, because of increased international migration towards Western and Northern Europe and decreased birth rate in Eastern and Southern Europe (World Bank, World Development Report).

In the 1990s the world population increased more rapidly than ever before. 12.8% of all 6 billion people in the world were living in Europe, 351.6 millions in EU countries. About 150 million people (around 2.5%) at this time were living outside of their country of origin, net migration was peaking in the EU with 1 million/years (conducted by a decline in the middle of the 1990s and climbing afterwards again).

In 1997 Spain had the highest unemployment rate with 22%. In birth rates and natural growth there was a slight increase compared with 1995 and 1996. A slight drop is even predicted for the number of births for the following years. In 1999 we had an EU population increase of 2.6% (around 70% due to net migration).

Natural population growth was highest in Luxembourg (around 15%) and Ireland (around 10.7%), as a result of net migration, which is also the prime factor in France, Ireland, Netherlands and Finland. Negative rates in natural growth were registered in Germany, Italy, Sweden, Greece and Austria. In the year 2000 less than around 7% of mankind was located in Europe.

According to Eurostat (2002), the highest rates were in Luxembourg (around 1.6%), Ireland (at about 1.3%) and Netherlands (around 0.7%), compared with lowest in Germany (at about 0.1%). With 4.05 million life births the percentage was 1.3% higher than in 1999. Lowest birthrates occurred in Ireland (14.6 live births/1000 inhabitants), France (13.1 live
births/1000 inhabitants), Luxembourg and the Netherlands (13 live births/1000 inhabitants), compared to the lowest in Germany (9.2 live births/1000 inhabitants) and Austria (around 9.7 live births/1000 inhabitants). Every country increased in birthrates in comparison with 1999, except Belgium (around -0.1%), Germany (around -0.7%), UK (around -2.9%) and Finland (around -3.1%). The number of deaths remained almost unchanged for 30 years, with 3.7 million in total EU. The highest mortality rates occurred in Denmark and Portugal (10.8/1000 inhabitants), while the lowest in Ireland (8.0/1000 inhabitants), Luxembourg (8.5/1000 inhabitants) and Netherlands (8.8/1000 inhabitants). The average difference in life expectancy between male and female is 6.8 years. The unemployment rate in the EU 15 is 8.1%, lowest rates occurred in Luxembourg (2.1%), Netherlands (2.8%) and Austria (3.2%), highest in Spain (13.6%). Relative falls in unemployment were recognized in Ireland (5.2% to 4.1%), France (from 10.7% to 8.9%) and Sweden (from 6.8% to 5.6%).

Figure 1: Population growth since 1950-2030

Source: Human Development Report
Table 1: Population change in the European Union

<table>
<thead>
<tr>
<th>Population (2001)</th>
<th>Live Births (1000)</th>
<th>Deaths</th>
<th>Natural Increase</th>
<th>Net Migration</th>
<th>Total Increase</th>
<th>Total Increase</th>
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<td>United Kingdom</td>
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</tr>
</tbody>
</table>

Source: Eurostat

Figure 2: Population Growth, 1960-980
Figure 3: Population Growth, 1980-1988

Figure 4: Population Density, 1989
On the 1st of January 2001 Eurostat announced 377.6 million people in Europe. Until 2025 population is expected to grow more slowly. Furthermore, the working population (20-64 years) will decline, while over 65-years age groups will continue to rise. Natural growth rates are forecasted to be high for Finland, France, Ireland and Netherlands, and negative for Denmark, Italy and Sweden. For the year 2025 966.8 million people are expected to live in Europe, 6% of the whole world's population. In the following years the population-decline is expected to continue, and in 2050 no more than 4% of mankind will live in Europe. Figure 2 and Figure 3 illustrate population growth for time-periods 1960-1980 and 1980-1988, respectively, while Figure 4 showing population density for 1989.

2.2 Population and Macro and Micro inertia

The distribution of the population by age plays an important role. According to the macro-inertia, the fact that both birth and death rates are extremely high in poor countries makes the net population growth rate low, just as in rich countries. However, there is a second implication that is quite different, on average the population of the former types of countries will be very young that means the overall birth rates will be very high even if fertility rates are reduced at different age groups. The sheer inertia of age distribution will imply that the young people of reproductive age continue to enter the population. Except the macro-inertia there is also the micro-inertia, at a household level, in conjunction with the operation of sectoral norms and socioeconomic factors that keeping birth rates high.

**Figure 5: Private Cost, Social Cost and Fertility**
Population growth, implying a cost and also some benefits (Romer, 1996). Figure 5 illustrates the costs and benefits from population growth. For simplicity, we consider the cost curve as a straight line, such that each new child costs the same additional amount, even there are diminishing returns to obtain more children. The benefit function has a familiar concave shape. The thick straight line shows the private costs of an additional child and the thinner line shows the social cost of an additional child. Usually, the private cost is less than the social cost. In Figure 5 the curve of social-cost is steeper than the private cost line. The socially optimum number of population is found by maximising the vertical distance between the benefit and the social cost line, where marginal benefit is equal to the marginal social cost, (point A, yielding a number of population n*). Additionally, the optimum number of children corresponds to point B, (yielding a number of population n**), maximising the vertical distance between the benefit and the private cost line.

3. Population Growth and Economic Development

Economic development has direct implications for the pace of population and on the same direction, population has some implications for the rate of economic development. This relationship seems to be negative. Sometimes, a large population means less per capita income, however, we can say that more people not only consume more but they produce more as well, (Todaro, 1985).

Table 2: Unemployment rates (as%) in October and November 2000

<table>
<thead>
<tr>
<th></th>
<th>November</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU15</td>
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<td>Euro-zone</td>
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<tr>
<td>Luxembourg</td>
<td>2.1</td>
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<td>Netherlands</td>
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<tr>
<td>Austria</td>
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<td>Portugal</td>
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<tr>
<td>Ireland</td>
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<tr>
<td>Sweden</td>
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</tr>
<tr>
<td>Germany</td>
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<tr>
<td>Belgium</td>
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<tr>
<td>France</td>
<td>8.9</td>
<td>9.1</td>
</tr>
<tr>
<td>Finland</td>
<td>9.6</td>
<td>9.6</td>
</tr>
<tr>
<td>Spain</td>
<td>13.6</td>
<td>13.6</td>
</tr>
</tbody>
</table>

Source: Eurostat
Population is the key element in human impact on environment. Many times population growth is element to be the root cause of environmental problems, but interactions between population, economic development and environmental change are too complex to prove this. What's more, there is no linear relationship between population growth, density and environmental degradation. Also distributional patterns, migration and living standards play a major role in the impact of population on natural resources and environment. Furthermore, the impact of population growth underload with trends as mobility and urbanisation. Movement is cause and effect of environmental change. Figure 6 illustrates the distribution of per capita dollars in a selected numbers of countries for 1999. With the increase in population goes along a greater demand on natural resources worldwide. The impact on environment depends on regional concentrations, population density, the level of economic development, per capita consumption of natural resources, (Harris and Todaro).

Population is closely related to the subject of human resources and in particular to employment and unemployment problems. Table 2 shows the unemployment rates for a selected number of countries. The forecast for the next 10 years is a depopulation in Europe. For 2050 a number of inhabitants close to that of 19950 is estimated. In addition to that, effects of market transition towards much older population were recognized in the first half of this century. First effects are already visible in retirement and health plans (Comission's demographic report 1997). When there are four person in the working population supporting one pensioneer now, in 2040 it will only be two. It will be difficult to meet increasing demands of state pension legislation. In workforce female participation is growing, while a fall in births is obvious.

Figure 6: Per Capita Dollars (1999)
Except the main common economic indicators, like GDP, and per capita income, that illustrate economic growth, we can also consider some other social indicators that present a more precisely measure of socio-economic development. Moreover, the most important of social indicators is the Human development index (HDI) which incorporates most important capabilities, like:

- living a long and healthy life
- being knowledgeable
- enjoying decent standard of living

Figure 7 and Figure 8 illustrate the Human Development Index (HDI) and the percentage of annual growth rate of urban population.

**Figure 7: Population Density, 1989**

**Figure 8: Population Density, 1989**

![Graph](image-url)
Urbanisation is closely linked to economic growth. The largest urban populations are usually located in largest economies. The higher the per capita income of a country, the higher the level of urbanisation. Lowest income nations are least urbanized. As cities grow rapidly they attract a large number of migrants. All economic, social, political changes underly rapid growth. Economic change dominant influence on urbanisation and size of cities. The increase in proportion of population reflects increase in size of economy increasing important urban-based manufacturing and services. Difference in stages of urbanisation: Western European countries have reached stabilisation. Southern and east rural-to-urban migration is still important. Urban problems are mostly failure of governments and aid agencies to develop appropriate policies.

4. Population and Growth Models

The population, like investment and saving, is one of the main variables on the growth models. The rate of savings determines via investment the growth rate of the capital stock (Baro and Sala-i-Martin). The latter determines, via the capital-output ratio, the growth rate of national income. Population is growing and is connected with per capita growth, according to the following equation:

\[ \frac{s}{\theta} = (1 + g^*) (1 + n) - (1 + \delta), \]

where, s is the rate of savings, \( n \) is the rate of population growth and \( \delta \) is the rate of depreciation of the capital stock and \( g^* \) is the rate of growth of per capita income. According to the above Harrod – Domar model, population has a direct negative effect on the rate of growth and according to this equation if all parameters remain constant while the rate of population growth \( n \) increases, then the per capita growth rate \( g^* \) must fall. According to the Harrod – Domar model, the capital-output ratio treated as exogenous and consequently makes no allowances for the fact that an increased in population raises output. If capital-output ratio its assumed to be constant, then an increased in population has no-effect on output at all. In the Harrod-Domar model, there is an implicit assumption that labour and capital are not substitutes in production. In the Solow model (1956), population growth contributes to productive potential as the extra labour is absorbed into productive activity through a change in the capita-labour ratio. Solow model assumes that capital and labour can be substituted for each other indefinitely and because of this population growth has no ultimate effects on the rate of growth. This does not mean that an increase in the rate of population growth has no-effect at all in the Solow model. Population growth means that a given level of output must be divided among an increase number of people that affecting negatively the per capita income.
Figure 9 illustrates that an increase in the rate of population growth lowers the steady-state level of per capita capital stock and the level of per capita income. Figure 9 illustrates the Solow model with steady-state of growth $k^*$, including technical progress. The equation of Solow model with technical progress is given by:

$$(1 + n)(1 + g)k^*(t + 1) = (1 - \delta)k^*(t) + sy^*(t).$$

In the Solow model, the population growth affects the national product and output, while increases the demand for the national output and at the same time expanding the ability of capital to produce the national output. Solow assumed that there are diminishing returns to very input that means an increase in population growth reduces the long-run per capita level of output relative to efficient units of labour and due to this the net effect of long-run per capita growth rates is zero.

A large population is a diverse population and the chances are higher that someone will be lucky enough or smart enough to come up with an idea that benefits everybody else. The larger the population, the larger would be the number of people that have useful ideas and so the higher is the rate of technical progress. According to the «demand driven view» population growth may spur technical progress out of the pressures created by high population density. While according to the «supply driven view» population growth creates a large stock of ideas and innovations that can be put to economic use and technical progress should increase with population size (Romer, 1996). If technical chance is «supply driven» by population, then population growth should initially be an increasing function of population itself, but this trend should reverse itself after some stage.
Kremer argues that the endogenous growth of knowledge predict that technological change is an increasing function of population size. As we have see, the larger the population, the more people there are to make discoveries and thus the more rapidly knowledge accumulates. Kremer's model consists of three equations. Output depends on technology, labour and land:

\[ Y(t) = R^A(t)L(t)^{1-\alpha} \]

where \( R \) denoted the fixed stock of land. Capital is neglected for simplicity and land is included to keep population finite. The growth rate of knowledge is proportional to population:

\[ \frac{\dot{A}(t)}{A(t)} = BL(t). \]

In addition, population adjusts so that output per person equals the subsistence level, denoted by \( y^* \):

\[ \frac{Y(t)}{L(t)} = y^*. \]

Solving this model, we have that:

\[ L(t) = \left( \frac{1}{y} \right)^{1/\alpha} A(t)^{(1-\alpha)/\alpha} R. \]

stating that the population that can be supported is decreasing in the subsistence level of output, increasing in the technology and proportional to the amount of land. Since \( y^* \) and \( R \) are constant, the last equation implies that the growth rate of \( L \) is \((1-\alpha)/\alpha\) times the growth rate of \( A \) and therefore we have that:

\[ \frac{\dot{L}(t)}{L(t)} = \frac{1-\alpha}{\alpha} BL(t). \]

which implying not only that the growth rate of population is rising over time but also that this is proportional to the level of population.

The empirical tests of this population estimates extending back to 1 million B. C. and the results showing a strong positive and a linear approximately relationship between population growth and the level of population. The regression of growth on a constant and population in billions yields:

\[ n_t = -0.0023 + 0.524 L_t, R^2 = 0.92, D. W. = 1.10 \]

(0.0355) (0.026)

where \( n \) is population growth and \( L \) is the population and where the numbers in the brackets are standard errors showing that there is a seriously statistically significant association between the level of population and its growth rate. The model assuming that each region has the same technology and that the initial populations should have been approximately proportional to the land areas of the regions. Moreover, the model estimates that technical progress was «faster» in these regions with the larger populations.
5. Conclusions

This article analysed population growth and its interaction with economic development. Our goals were as follows:

- To understand and to describe the observed patterns of population growth and in particular the phenomenon of «demographic transition».
- To analyse these factors that affecting fertility decisions and consequently determine the major part of population growth.
- To understand the impact of population growth on economic development and to conclude in some policy implications. What are the linkages? How strong are they? and in what direction do they operate?

The theory of demographic-transition attempts to explain why all contemporary developed nations have more or less passed through the same «stages» of modern population history. Before their economic modernisation these countries for centuries had stable or very slow growing population as a result of a combination of high birthrates and almost equally high death rates. According to macro-inertia and also to micro-inertia birth rates remain high even as death rates fall and this consequently leading to a population explosion not only for today's developing world, but also historically as it has happened in Europe. Population growth shifts the age structure of population toward the very young and so doing increases the dependency ratio in families. Usually, the rich part of population saving a higher fraction of their income. The population growth effect works in very much the same as the saving effect. In Harrod-Domar model they reduce the growth rates, while in the Solow model there will be no growth effects and.

Population growth lowers the aggregate rate of savings because the population growth eats into aggregate income. Furthermore population growth needed the necessary infrastructure, like health, education, and public transportation.

From one hand population growth place additional «pressure» on these scarce resources and on the environment and apply to such resources as, the grazing land, fish stocks, ground water, forest cover, pollution and ozone layer.

From the other hand population growth affect both the productive capabilities of a growing population and its consumption demands. The extra labour relative to capital brings down the level of income measured per unit of effective labour on the long run growth path. This is an example of diminishing returns to labour at work on the Solow model, where a higher ratio of labour to capital reduces its average product.

Population grew by several orders of magnitude between prehistoric times and the Industrial Revolution. According to the human history, technological progress has led mainly to increases in population rather than increases in output per person.

In summary, population growth has direct effects on economic development where both negative and positive effects coexist. The simplest
negative effects come from the observation that population growth eats away at a given level of resources or income leaving less per capita to go around. An increased population growth means more labour input which consequently expands the production as happened in the Harrod-Domar model. In the Solow model the negative effects from population growth means that a higher rate of population growth pushes the economy into a lower trajectory of per capita income with the same growth rate as before. Finally, according to the «demand side argument» the population growth creates economic necessity which forces the adoption or creation of new ideas that expand carrying capacity. In other words population growth fosters development because the pressure that it creates reinforce innovation activities. Moreover according to the «supply side argument» population growth fosters development simply because many heads are better off than one leading to more ideas and consequently to more economic benefits for the mankind. Finally on this aspect, Kremer's model showing close relationship and significant association between population and its growth rate. The model predicts that technical progress was faster in the regions with larger populations.

6. References


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