Population Growth and Economic Development

27 March 2014
Population Growth

Table: Table 1 World Pop by Billions

<table>
<thead>
<tr>
<th>Billion</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1804</td>
</tr>
<tr>
<td>2</td>
<td>1927</td>
</tr>
<tr>
<td>3</td>
<td>1960</td>
</tr>
<tr>
<td>4</td>
<td>1975</td>
</tr>
<tr>
<td>5</td>
<td>1987</td>
</tr>
<tr>
<td>6</td>
<td>1999</td>
</tr>
<tr>
<td>7</td>
<td>2011</td>
</tr>
</tbody>
</table>
Questions

From the models of economic growth, we’ve seen that an increase in the rate of population growth lowers per capita income (spread economic gain over larger population base).

However shifted focus from economic growth to development, and need not have the same relationship.

★ What is the relationship from population to economic development?

★ What is the relationship from economic development to population growth?
Some Basic Population Concepts

Basic Concepts:

**Crude Birth Rate and Crude Death Rate**

Expressed as number per 1,000 of the population.

For example, Crude Birth Rate of 60 (per 1,000) and Crude Death Rate of 40 (per 1000).

Crude because no adjustment for age distribution.
# CBR and CDR some Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>2010 CBR</th>
<th>2010 CDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>India</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>USA</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Brazil</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Malawi</td>
<td>44</td>
<td>13</td>
</tr>
<tr>
<td>Mexico</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>
Population Growth

In a society closed to migration:
rate of growth = birth rate - death rate

Expressed growth rate as a percentage.

Malawi  CBR 44 per 1000 is 4.4 per 100, CDR 13 per 1,000 is 1.3 per 100, Example just given Malawi:

\[ r = 4.4 - 1.3 \]

\[ = 3.1\% \]
Mexico Has lower Death Rate than USA?

Notice Mexico has a lower CDR than the USA, 5 versus 8.

How can that be?
Age Distribution

Number of births equals the birth rate times the population base.
The age distribution of the population base matters.
Mexico has a younger population than does the United States.
Thus, in USA more elderly than in Mexico (as a share of the population).
If adjust so age distribution then death rate is lower in USA than Mexico.
## Age Distribution Selected Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (millions)</th>
<th>0–14</th>
<th>15–64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,337.9</td>
<td>19</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>India</td>
<td>1,224.6</td>
<td>31</td>
<td>64</td>
<td>5</td>
</tr>
<tr>
<td>USA</td>
<td>309.3</td>
<td>20</td>
<td>67</td>
<td>13</td>
</tr>
<tr>
<td>Indonesia</td>
<td>239.9</td>
<td>27</td>
<td>67</td>
<td>6</td>
</tr>
<tr>
<td>Brazil</td>
<td>194.9</td>
<td>25</td>
<td>68</td>
<td>7</td>
</tr>
<tr>
<td>Malawi</td>
<td>14.9</td>
<td>46</td>
<td>51</td>
<td>3</td>
</tr>
<tr>
<td>Mexico</td>
<td>113.4</td>
<td>29</td>
<td>65</td>
<td>6</td>
</tr>
</tbody>
</table>
Total Fertility Rate

The most important age adjusted demographic rate is the total fertility rate.

The TFR is calculated as the sum of the (five–year) age–specific birth rates.

ASBR is the number of births to women within the age group divided by the number of women in the age group.

If have single–year age groups (say from 10 to 50) and single year birth rates \((f_{10}, \ldots, f_{50})\) then

The total fertility rate is

\[
TFR = \sum_{j=10}^{50} f_j
\]
Usually expressed as number of children (ASBR/1000).

The TFR is the number of children a woman would have if she were to follow the schedule of age–specific birth rates.

Holds age distribution fixed, by assigning equal weight to each age group. (whereas for growing populations, larger share of women at younger ages).
Glacier like Speed

Important to realize that population composition changes with glacier like speed.

Which is to say slowly.

Rates may change quickly, but for births to decline also need to have population stock decline as well.

Called population momentum.
Demographic Transition

Population growth, like economic growth, is a modern phenomenon.

First phase of population history little (minuscule) growth of population until 1700–1750.

Birth rates high as were death rates.

Epoch summarized by Malthus (1798).

Importance of death rates to keep population balanced.

Positive checks: war, famine, pestilence
2nd Phase: Death Rates decline

Same factors that give rise to productivity growth as cause death rates to decline.

Increase in agricultural productivity lowers incidence and severity of famine. And, with increase in per capita income, diet and nutrition improved.

Most common pattern, death rates decline, and fertility rates decline but with a lag.

Hence, population increases \( (b > d) \).
Third Phase: Fertility rates decline

In now rich countries, fertility rates fell slowly.

Population growth slowed, and now in some cases, such as Japan, Russian, Germany, population growth rates are negative.

New equilibrium: low mortality and low fertility rates, with low population growth rates.

With only a few exceptions, all countries of World are in phase three or phase two.
Developing Countries: Transition Time Compressed

The now developed countries took about 100 years to 150 years to go through transition.

Process gradual.

Current developing countries, mortality rates fell sharply after WWII (transfer of technology).

Speed of mortality decline much faster than in Northern and Western Europe.

Population growth among these countries was (is) high.
Importance of Fertility Decline

Everything hangs on birth rate.

How quickly does it follow the death rate on its downward course? On this question hangs the future of the world’s population, and certainly the economic future of many developing countries.
Age distribution important at aggregate level for predicting decline in fertility.

The previously mentioned, population momentum, important.

Birth rates decline to replacement level (TFR=2.1), but need probably 20 years to see an absolute decline in the annual number of births. *Intertia of age distribution*
Now consider micro–inertia as household level. Several mechanisms to consider:

- Fertility Choice and missing markets
- Relationship between mortality and fertility
- Gender bias
- Information, income, and fertility
- Hoarding versus Targeting
- The cost of Children
Fertility and Missing Markets

Children a substitute for various missing markets and institutions.
Developing countries no social security or old–age fund.
Also, generally health insurance or life insurance.
Population is rural and much employment is in informal sector. Hard to monitor, hard to tax.
Children serve as assets that may compensate for these missing markets.
Relationship betw. Mortality and Fertility

What’s the probability a child can support parents?

- Infant mortality rates high.
- Child mortality rates high.
- May earn low income, insufficient to support parents.
- Even if able, child may not support parents. Emigration by kids. Limited care may *increase* fertility to compensate for risk.
Let $p$ overall probability of having child survive to adulthood and look after you.

High rates of infant and child mortality $p = 1/5$. Could be as high as $p = 1/2$.

$q$ an acceptable threshold probability of receiving support from at least one child.

$q$ will vary based on the couple’s attitude to risk.

Most risk averse - expect $q$ to be high, 9 of 10 or 19 of 20.
Thus $p$ and $q$ as given, how children are needed to satisfy $q$?
If you have $n$ children, the probability that none of them will look after you is

$$(1 - p)^n$$

Then the probability that at least one survives and cares is the complement event:

$$1 - (1 - p)^n > q$$
Some Examples

If $q = 0.9$ and $p = 1/2$ then $n \geq 4$.

If $q = 0.95$ and $p = 1/2$ then $n \geq 5$.

Not extreme values, generates moderate to high fertility levels.
What if old age support provided by a son.
Then $n$ may refer to the number of birth of boys.
So instead of four children, now need eight births.
Explains consequence of preferences, not reason for gender preferences.
Son preference sometimes supported by legal rights and land ownership.