Fertility Transition: Why Do Birth Rates Fall?
(Weil CH #4, R&W CH #4)

1. Last time: Malthus
2. Mortality transition and fertility transition
3. Why would birth rates fall?
4. Contraceptive Technology
5. Decreased infant mortality
6. Children Desired I: The Becker Model
7. Children Desired II: quality-quantity tradeoffs
Adult population grew from 55m adults in 1960 to 188m in 2001. Annual growth rate of 3.0%.
Malthusian equilibrium

Y/P  \( P^* \)  \( P \)  \( P^{*'} \)

\( Y/P \) with Tech. Advance

Subsistence level of \( Y/P \)

\( P^* \) - equilibrium level of population

Dismal because in equilibrium people eat (and live) at subsistence only.

"The Dismal Profession."

\( Y = F(P) \)  \( F' > 0 \)  \( F'' < 0 \)

Y

Subsistence with improved public health.
The Breakdown of the Malthusian Model in Western Europe

Source: Weil Figure 4.6
The Relationship Between Income per Capita and Population Growth

Source: Weil Figure 4.1, from World Development Reports
Demographic transition

(very stylized)

(WESTERN EUROPE)

DR

↑

Birth rate per thousand

↓

Maltrusive

↑

t →

Fertility Transition

Modern

Pop

Malthusian

↑

t →

Fertility Transition

Modern
2. Demographic Transition: Mortality

Mortality Transition: A modern miracle

- Defn: Survivorship \( \pi(i) \) – probability of being alive at age \( i \)
- Figure for Swedish history
- Defn: Life Expectancy = \( \sum_{i=0}^{T} \pi(i) \)
- Much faster in developing countries than in developed (see figures)
  - e.g., French LE increases from 28 to 57 (1755-1930)
  - Indian LE increases from 27 to 56 (1930-1980)
- Achieved at lower levels of GDP/capita
  - France 1930: $5000, India 1980: $1200 (2000 $s)
Swedish Survivorship

Source: Weil Fig 4.13
Life Expectancy in Developed Countries

Source: Weil Fig. 4.8
Life Expectancy in Developing Countries

Source: Weil Fig. 4.9
Life Expectancy in MENA
1960-2001
2. Demographic Transition: Fertility

- Defn: $F(i) -$ probability of giving birth at age $i$
- Figure comparing U.S. and Nigeria

- Defn: Total Fertility Rate $= \sum_{i=0}^{T} F(i)$
- Figure on U.S. History

- Defn: Net Reproduction Rate $= \beta \sum_{i=0}^{T} \pi(i)F(i)$
- Figure on Swedish History
Age-Specific Fertility

Source: Weil Fig 4.14
Historic U.S. Fertility

Source: Weil. Fig 4.10
Fertility, Mortality and NRR
Sweden 1750-2000

Source: Weil, Fig 4.11
NRR for India and Nigeria - mortality can matter

Table 4.1: Demographic Data for India

<table>
<thead>
<tr>
<th>Period</th>
<th>Total Fertility Rate</th>
<th>Life Expectancy at Birth</th>
<th>Net Rate of Reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955-1960</td>
<td>5.92</td>
<td>42.6</td>
<td>1.75</td>
</tr>
<tr>
<td>1965-1970</td>
<td>5.69</td>
<td>48.0</td>
<td>1.87</td>
</tr>
<tr>
<td>1975-1980</td>
<td>4.83</td>
<td>52.9</td>
<td>1.73</td>
</tr>
<tr>
<td>1985-1990</td>
<td>4.15</td>
<td>57.4</td>
<td>1.61</td>
</tr>
<tr>
<td>1995-2000</td>
<td>3.45</td>
<td>62.1</td>
<td>1.43</td>
</tr>
</tbody>
</table>

Table 4.2: Demographic Data for Nigeria

<table>
<thead>
<tr>
<th>Period</th>
<th>Total Fertility Rate</th>
<th>Life Expectancy at Birth</th>
<th>Net Rate of Reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955-1960</td>
<td>6.90</td>
<td>38.2</td>
<td>1.97</td>
</tr>
<tr>
<td>1965-1970</td>
<td>6.90</td>
<td>42.0</td>
<td>2.12</td>
</tr>
<tr>
<td>1975-1980</td>
<td>6.90</td>
<td>46.1</td>
<td>2.28</td>
</tr>
<tr>
<td>1985-1990</td>
<td>6.70</td>
<td>50.2</td>
<td>2.38</td>
</tr>
<tr>
<td>1995-2000</td>
<td>5.92</td>
<td>52.5</td>
<td>2.20</td>
</tr>
</tbody>
</table>

Age-old Traditions?
TFR in MENA
Who wrote this?

"In October 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved and unfavourable ones to be destroyed. The result of this would be the formation of a new species. Here, then, I had at last got a theory by which to work."
Mortality Transition and Fertility Transition

• Mortality transition is easy to explain:
  - technological improvements
  - income effects
  - ubiquitous urge to preserve duration of life
    - note exceptions: infanticide, gender-specific

• Fertility transition is harder to explain
TFR in MENA

Malta, Lebanon, Qatar, Iran, Iraq, Kuwait, Israel, Morocco, Algeria, UAE, Egypt, Jordan, Syria, Oman, W. Bank, Gaza, Saudi Arabia, Yemen.

3. Why Would Birth Rates Fall?

- Improved Contraceptive Technology Improvements
- Children born vs. children surviving: Declining Infant Mortality
- Desired number of surviving children
  - CULTURAL CHANGE
  - INCOME SECURITY (CHILDREN AS RETIREMENT FUNDS)
  - DECLINE IN RELIGIOSITY (WHICH IS PRONATALIST)
  - URBANIZATION
  - EDUCATION \( \Rightarrow \) EARNINGS (ESPECIALLY FOR WOMEN) \( \Rightarrow \) HIGH OPPORTUNITY COST OF TIME
  - QUALITY / QUANTITY TRADEOFF
4. Contraception

History of Techniques and Attitudes

- Ancient Egyptians used vaginal suppositories (don’t ask)
- Withdrawal – condemned in Bible
- Greeks had potions, barriers, suppositories, rhythm method and abortion
  - Greeks also practiced infanticide
  - Condemned in Bible
- Preindustrial EU and Japan used delayed marriage & prohibition on premarital sex
Contraception: technologies (cont.)

- Breastfeeding – common currently and through history
- Condoms – through history (but price dropped with vulcanized rubber in 1844)
- Cervical cap 1844, diaphragm 1882, IUD 1909, “pill” 1950s (available in US in 1960s)
Contraception Policy

- EU and US governments were hostile to family planning through most of the 20th century.
  - F. P. bans declared unconstitutional in U.S. only in 1965
- Many governments in developing countries since WWII encourage contraception use: e.g. China, Indonesia
- Contraceptive Policies in MENA: Turkey, Tunisia (since 60s); Iran & Egypt (since 60s with interruption)
- Anti-contraceptive policies: Iraq, Saudi Arabia
How Important is Contraception in Reducing Fertility?

- Estimates in developing countries vary
- Contraceptive use has increased dramatically: e.g., from 9 to 55% of married couples in UK between 1960 & 1998.
- *But* most of EU and US reduction in TFR took place *before* family planning & widespread use of new contraceptive technologies (see figures)
- Most of international variation in fertility is in *desired* fertility (see figure)
Fertility, Mortality and NRR Sweden 1750-2000

Source: Weil, Fig 4.11
Historic U.S. Fertility

Source: Weil, Fig 4.10
Desired Fertility vs. TFR
1970s and 1980s

Source: Weil, Fig 4.12
5. Decreased Infant Mortality

- If couples have a target number of *surviving* children, then fertility should decline as infant mortality declines.
- Applies to gender-specific targets as well
- Recall the NRR calculation
- Evidence from MENA
Fertility, Mortality, and NRR

Sweden 1750-2000

Source: Weil, Fig 4.11
Regression slope = -.10
6. Children Desired I: Becker

What Influences Desired # of Surviving Children?

• Income
  - puzzling negative correlation (see figure)

• Productive value of children
  - & old age security
  - urban vs. rural

• Opportunity cost of Mom’s time (I) / “Career Concerns”

• Cultural preservation motive

• Desired amount of consumption per child (II)
The Relationship Between Income per Capita and Population Growth

Source: Weil Figure 4.1, from World Development Reports
Becker I: Opportunity Cost of Mom’s time

- PPC in k-# of children, Y- family income

- Children are time-intensive:
  - If \( H_K \) are hours spent on kids, \( K=\alpha H_K \)
  - Home production \( Y=f(H_Y) \)
  - \( H_K + H_Y = T \)

- \( U(k,Y) \)

- Introduce market work \( H_M \) at wage \( w \).
  - rising \( w \) increases the opportunity cost of children
  - income vs. substitution effects of \( w \) on fertility
$W > f'(H_w)$ at $A$

New PPC is union of black line & blue curve segment.

$\Rightarrow T_w$ has 2 effects.

1) LESS $H_w$ (worked hours) UNAMBIGUOUS.
2) $2a) \uparrow \text{Income} \Rightarrow \uparrow \text{More } k$
   $2b) \downarrow T_w \Rightarrow \text{less } k$ because $\downarrow$ opp. cost.

At $A+B$ Mom switches out of house work ($H_w$) and into worked work.
TFR and Women’s LF Participation: MENA 2000
Life Expectancy > 65

Regression slope = -.05
Evidence for Becker’s Opportunity Cost Mechanism

• Rural fertility exceeds urban when farming is intensive in unskilled labor

• Comparing families: Mom’s wages, education and LF participation all predict lower fertility, whereas Dad’s earnings often predict higher fertility (the income effect)
7. Children Desired II: Becker’s Quantity-Quality Model

- \( U(Y/k, k) \)
  - quality is food/child or education/child
- Diagram look familiar?
- Can give rapid fertility transitions (see diagram)
Age-old Traditions?
Fertility in MENA

![Bar chart showing fertility rates in MENA countries for years 1960, 1980, and 2001.]