Human Population
2018

Lecture 4
Demography
Demographic transition theory
Age demographics
Debate 1
Questions on the reading.

pp 37-49
money
investment
feedback
poverty
Demography is the statistical study of populations, especially human beings.
Demography

* **Definition**
* **Indicators**
  - N
  - LEB
  - TFR
  - HDI (or GDP)
  - IMR
  - Gini
  - N = number
  - LEB = Life Expectancy at Birth
  - TFR = Total Fertility Rate
  - HDI = Human Development Index
  - IMR = Infant Mortality Rate
  - Gini = Income inequality index

* **Age**

* **Historical**
Tasks of Demography

Collect data.

Graph data.

Look for regional variation.

Look for historical trends.

Look for interactions between indicators.

For demographers: generate hypotheses, publish, affect public policy.

For human ecologists: build model, connect everything, run predictions, generate hypotheses, publish.
Demographic indicators: LEB

- Life Expectancy at Birth determines Death rate (DR)

- Mortality distribution, USA, 2000. LEB is the median age of death.

- Age cohort death rate:
  - <1 : 0.12
  - 1-14 : 0.0005
  - 15-44 : 0.0010
  - 45-64 : 0.0010
  - 65+ : 0.05

Changes in the Age Distribution of Mortality Over the 20th Century

David M. Cutler and Ellen Meara
NBER Working Paper No. 8556
October 2001
JEL No. I1, J1
Relationship: LEB vs GDP

Figure 8  Life expectancy at birth vs average annual income

Why are some countries off the curve?
Regionality and history: LEB

Demographic indicators: TFR

- Total Fertility Rate determines Birth Rate (BR), mostly

https://ourworldindata.org/fertility-rate
Trends: TFR

How long did it take for fertility to fall from more than 6 children per woman to fewer than 3 children per woman?

<table>
<thead>
<tr>
<th>Country</th>
<th>Year Period</th>
<th>Time to Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>1815-1910</td>
<td>95 years</td>
</tr>
<tr>
<td>Poland</td>
<td>1870-1960</td>
<td>90 years</td>
</tr>
<tr>
<td>USA</td>
<td>1844-1926</td>
<td>82 years</td>
</tr>
<tr>
<td>Greece</td>
<td>1850-1920</td>
<td>70 years</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1962-1999</td>
<td>37 years</td>
</tr>
<tr>
<td>South Africa</td>
<td>1963-1997</td>
<td>34 years</td>
</tr>
<tr>
<td>Turkey</td>
<td>1964-1991</td>
<td>27 years</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1966-1993</td>
<td>27 years</td>
</tr>
<tr>
<td>Brazil</td>
<td>1963-1989</td>
<td>26 years</td>
</tr>
<tr>
<td>Colombia</td>
<td>1968-1993</td>
<td>25 years</td>
</tr>
<tr>
<td>Botswana</td>
<td>1982-2006</td>
<td>24 years</td>
</tr>
<tr>
<td>Morocco</td>
<td>1976-1998</td>
<td>22 years</td>
</tr>
<tr>
<td>Tunisia</td>
<td>1973-1994</td>
<td>21 years</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1982-2002</td>
<td>20 years</td>
</tr>
<tr>
<td>South Korea</td>
<td>1960-1978</td>
<td>18 years</td>
</tr>
<tr>
<td>China</td>
<td>1967-1978*</td>
<td>11 years</td>
</tr>
<tr>
<td>Iran</td>
<td>1986-1996</td>
<td>10 years</td>
</tr>
</tbody>
</table>

* The one-child-policy in China was introduced after the decline of the total fertility rate below 3. It was introduced between 1978 and 1980.

Data source: The data on the total fertility rate is taken from the Gapminder fertility dataset (version 6) and the World Bank World Development Indicators. The interactive data visualization is available at OurWorldinData.org. There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.
Demographic indicators: HDI

Human Development Index (HDI)

influences education, quality of life, consumption. Correlates with LEB

The HDI is the geometric mean of three indices:

$$\text{HDI} = \sqrt[3]{\text{LEI} \cdot \text{EI} \cdot \text{II}}.$$ 

- **Life Expectancy Index (LEI)**
  $$\text{(LEI)} = \frac{\text{LE} - 20}{85 - 20}$$

- **Education Index (EI)**
  $$\text{(EI)} = \frac{\text{MYSI} + \text{EYSI}}{2}$$

- **Income Index (II)**
  $$\text{(II)} = \frac{\ln(\text{GNIpc}) - \ln(100)}{\ln(75,000) - \ln(100)}$$

**LE**: Life expectancy at birth (sometimes LEB)

**MYSI**: Mean years of schooling /15 (MYS=years that a person aged 25 has completed in formal education)

**EYSI**: Expected years of schooling/18 (EYS=years that a child is expected to spend in formal education)

**GNIpc**: Gross national income per capita. (II is 1 when GNI per capita is $75,000 and 0 when GNI per capita is $100.)
Relationship: HDI, GDP

Each point is a country or region.

Relationship is log-linear

HDI = 0.134 \cdot \ln(GDP_{pc}) - 0.55

R^2 = 0.920
Reduced to rankings, GDP and HDI are strongly correlated.

Outliers have high GDP, low HDI. (High Gini?)
Demographic indicators: IMR

- Infant mortality rate ➔ Increases replacement value

- As infant mortality increases, the number of children reaching child bearing age goes down as a fraction of births. Increases replacement value.
Relationships and Trends: IMR, TFR, history, regionality

As IMR goes to zero, TFR also decreases, with no exceptions noted, over time, over regions.

Does this mean that the determinant of one is also the determinant of the other?
Demographic indicators: Gini coefficient

- Measure of income inequality.
- Area over curve, under diagonal.
- $0 \leq G \leq 1$
- $G=0$ represents perfect equality
- $G=1$ represents a perfect inequality.

$$G = 1 - 2 \int_0^1 L(X) \, dX$$
Historical trends: Gini

US businesses became more unequal in the period from 1979 to 2007.
Decreased income inequality in Brazil under Lula, is a recent example of decreasing Gini, going against the trend.
Cycle of poverty

The rich get richer, the poor get babies.

LtG p.45

Is this the model behind increasing Gini?
Relationship: GDP, TFR
Historical trends: HDI, TFR

Each point is a country or region.

Sometimes called the "J-curve". TFR seems to turn up at very high HDI.

Trends show increases in HDI, decreases in TFR, with exceptions.

http://demographymatters.blogspot.com/2009/08/
1. As technology increases, death rate decreases.
2. As death rate decreases, population increases.
3. As population increases, birth rate decreases.
4. As birth rate decreases, population stabilizes.
5. Population stabilizes or declines

https://en.wikipedia.org/wiki/Demographic_transition
Demographic transition: Why?

Why does birth rate decrease as death rate decreases and population increases?

1. Because women decide to have fewer babies knowing survival rates are better?

2. Because the economy gets better with increasing population and higher life expectancy, so children are more expensive?

3. Because the economy gets better with increasing population, escaping the cycle of poverty?

4. Because the food supply becomes limiting as the population increases?
Demographic indicators: age

Population may be broken down by age and sex, sometimes called "population pyramids", since they usually get smaller towards the top. Age demographics are useful for predicting future growth/decline and for comparing between nations or regions.
Japan, 1960, 2010 and future

Japan's birth rate and death rate both became low after WW2 with the subsequent economic and quality of life improvements.
Age demographics of Europe
Family from growing population

photo from blogs.redcross.org.uk.

age pyramid for Mali 2015
Family from shrinking population

Chinese family
Stock type: conveyer

Diagram of a Conveyor Stock With Fixed Delay

Number In Overflow bucket = [people]
Total Number In all buckets = [[people]]

If you plot a conveyer stock, you see only the Overflow. Create a variable and link it to [[stock]], plot that instead.

Read about Stocks: https://insightmaker.com/stocks
in class exercise

IM 3: age demographics using "conveyer" stocks

\[
\text{birth rate} = \text{Fix}(\text{RandNormal}([\text{mean birth rate}], [\text{uncertainty in birth rate}]))
\]

child = 100 (delay=25), adult = 50 (delay=30), old = 20, people = [[child]] + [[adult]] + [[old]]

death rates = sliders.
simulate for 200 years. Do sensitivity test.
Age demographics of a shrinking population

![Age demographics graph]

- **Population**
- **Time (Years)**
- **Year**: 0, 25, 55, 80, 150
- **Child**, **Adult**, **Old**
Age demographics of a growing population

Year 0

Year 25

Year 55

Year 80

Year 150
Are we "in the weeds"

To determine if we are in the weeds, consider whether the questions that we are asking require the added detail (e.g. of age demographics.) Do they? Is there a simpler, "proxy metric"?
HUMAN Pop 2018 -- Debate description

Instructions for debaters:

First week of classes
Go to Sign-Up Genius to select which dates you would like to debate, on which team (Affirmative or Negative) and which presenter role (1N, 2N, 3N, 1A, 2A, 3A). On the other debate days you will be a Panelist.

One week before -- announcement of debate topic, affirmative and negative.
Within 2 minutes of the announcement of the debate topic, enter your "naive verdict" on the debate topic: Select Affirmative (A) or Negative (N), and select a confidence level in the range 50 (no idea, toss-up) to 100 (absolute certainty).

One class meeting before the debate -- group discussion.
On the class meeting before debate day, you will have about 30 minutes of debate preparation at the end of the class period. Meet with your team and finalize your three (or 4) principal arguments. Each argument should be one short paragraph, written as clearly as possible. Before the end of the class, give your written arguments to the other debate team. (Panelists can work on something else.)

In the days before the debate, work as a team to find errors, weaknesses, counter arguments or fallacies to refute the arguments of the other side. Develop rebuttal arguments and counter-rebuttals to strengthen your case. Make slides to show data that supports your principle arguments.

Debate day
Please, combine all slides into one file (Powerpoint, KeyNote or PDF) and send to the instructor at the beginning of class on Debate Day. Get slides ready. Go. Instructor will keep time.

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<td>3 minutes</td>
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</tr>
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<td>Affirmative Argument 4</td>
<td>5 minutes</td>
<td>4A</td>
</tr>
<tr>
<td>4th Negative Cross-Examination</td>
<td>3 minutes</td>
<td>1N asks/4A answers</td>
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Instructions for panel: Panel reports.

The Panel members work independently to generate a Argument Diagram of the debate. Write a concise listing of the arguments and label them with letters. Say one or two sentences about how well supported each argument was, in your opinion. Then use the letter labels to build the Argument Diagram. Save as Word or PDF and email or turn in on paper at the first class meeting after the debate. See example.

Argument diagrams: A modified version of Van Heuveln's method
(http://www.cogsci.rpi.edu/~heuweb/teaching/CriticalThinking/Web/Presentations ArgumentDiagrams.pdf)

Use a circle to indicate a statement.

A statement is something that can be true or false. When you write the statement, if you are not sure it is a statement, ask yourself whether it makes sense to say "It is true that X" where X is the statement. If that doesn't make sense, then X is not a statement.

Use a line to associate statements.

Use an arrowhead on a line to indicate support for a statement.

Use a bar-end on a line to indicate refutation of a statement.

Support or refutation can apply to a statement (circle) or to the association of the statement (line). For instance, if A and B are falsely grouped together draw a bar-end line to the line associating A and B. You can also refute a refutation! Or support a refutation, or refute support.
The debate "Technology Will Save the World" consisted of four statements as follows:

A. Technology of war has led to an increased survival rate among soldiers. Presented by 1A. This statement was well founded by graphs and statistics.

B. Improvements in birth control have lowered the fertility rate. Presented by 2A. This statement was well founded by historical records.

C. Population in this century will level off or fall gradually. Presented by 2N. This is a conclusion based on A and B, but was not sufficient.

D. C does not follow from A and B because the death rate must equal the birth rate. Presented by 1N. This refutation is correct because A and B are not sufficient to conclude C.

(In words: D refutes the conclusion that A and B combine to support C.)
Debate 1: Topic

• TBA
reasoning and cognitive control are more active during these longer response times." What's the upshot of all this? People tend to make opposite moral judgments in Switch and in Push because they use different cognitive processes to arrive at their judgments in the two cases.

Greene also experimented with hypothetical conflicts that elicit one response from some subjects, and the opposite response from an approximately equal number of other subjects. He compared brain activity in respondents who made opposite judgments. Consider this terrible moral conflict, called "Crying Baby":

Crying Baby: You and several others are hiding from enemy soldiers when your baby starts to cry. If the baby is allowed to cry the noise will alert the enemies, who will kill all of you, including your baby. Should you smother your baby if this is the only way to silence the baby and avoid alerting the enemies?

In this case, the emotional response—a powerful negative response to the thought of smothering your baby—competes with the reasoned judgment that there's no benefit to not smothering, since the baby will still die. Greene and his colleagues found that the brain areas associated with reasoning, with conflict, and with cognitive control are more active in subjects who give a verdict that it's appropriate to smother the baby than in those who give the opposite verdict. Later experimentation involved giving some subjects an unrelated cognitive task to do—that is, putting them under cognitive load—while they made their judgment about the conflict. In subjects who approved of smothering the crying baby, being under cognitive load was found to slow response time, but in subjects who disapproved, there was no effect on response time, thus suggesting that it's reasoning (which is affected by cognitive load because attentional resources for controlled processes are limited) that leads to an ultimate decision to smother the baby, and an emotional, intuitive process (which is unaffected by cognitive load) that leads to a decision not to do so.

Greene emphasizes the fact that making an intuitive moral judgment feels different from making a moral judgment on the basis of a consequentialist process such as cost-benefit analysis. He proposes metaphors for these two different feelings. He says that the emotions that give rise to at least some intuitive moral judgments are like alarm bells, while the emotions that determine the values and disvalues that can be traded off in a reasoning process are like currency. These two kinds of emotions function differently. Alarm-bell emotions issue non-negotiable commands—"Don't do it!" or "Must do it!"—that automatically trigger a certain behavior. These commands "can be overridden," but "are designed to dominate the decision rather than merely influence it." In contrast, currency emotions tell you what's valuable, and how valuable, so that they can influence a decision, but only in proportion to their value. That is, they are well suited for being weighed (for instance, in a cost-benefit analysis), and potentially out-weighed.

There's clearly a difference between arriving at a moral judgment through an intuitive process and arriving at it through a reasoning process, particularly when the reasoning process consists of calculations of costs and benefits. The fact that there's this difference suggests a possible way of understanding the different experiences of judging a moral requirement to be either non-negotiable
or negotiable. Remember—even if a moral requirement is non-negotiable, there may still be situations in which the best thing to do is to violate this moral requirement. If two non-negotiable moral requirements conflict with each other, you’ll have no better option than to violate one of them. So the difference is not a difference of which one gets heeded and which one doesn’t. But if a moral requirement is non-negotiable, it cannot be negotiated away, and this means that if you do decide to override it in your decision about what to do, its being overridden doesn’t eliminate it, so you’ll necessarily violate it.

Alarm-bell emotions may be what are behind at least some of the judgments that something is morally required in a non-negotiable way. That is, if a situation triggers alarm-bell emotions for you, then you’ll have the sense that if you choose not to heed the alarm, you’ll be in violation of a moral requirement that remains very much in effect. The action that an alarm-bell emotion tells you is forbidden will feel wrong as long as you still have the alarm-bell emotion, and regardless of your reasons for violating the prohibition against the action. If you see a vulnerable person in danger, for instance, and this immediately provokes an “I must protect!” alarm bell, then you’ll experience the moral requirement indicated by this “I must” as non-negotiable. If you don’t heed it (suppose you’re physically restrained, or that there are several people in danger so that you can’t protect them all), you’ll have the experience of acting in violation of it and this violation will make itself known through even louder alarm bells.

Of course, sometimes a situation will fail to trigger an alarm-bell emotion. For instance, if the person in danger is someone whom you unconsciously—perhaps through something like racial bias—regard as expendable, you might not experience any alarm-bell emotion or judge yourself to be non-negotiably required to help. So the point is not that a certain kind of situation always leads us to judge there to be a non-negotiable moral requirement. The point is that if a situation triggers an alarm-bell emotion, then it will likely lead us to make this kind of judgment.

When we looked at the anti-dilemma positions, we saw that as long as you assume that “ought implies can,” the reasoning process doesn’t lead you to the conclusion that you ought to do something impossible. The principle that “ought implies can” inserts itself into the reasoning process in one way or another. Now, however, we know that there are two different cognitive processes for reaching a moral judgment, and (assuming that psychologists like Haidt are right) that the automatic, intuitive process is actually how most moral judgments are made. Thus, we should further explore the question of whether and how we might make an intuitive judgment that we ought to do something impossible. Maybe the principle that “ought implies can” is unable to insert itself into an automatic, intuitive process, where it would prevent us from reaching the verdict that we’re impossibly required. Then we could judge that we’re required to do the impossible.

One quick note, however, about what we have and haven’t established so far about moral judgments. This chapter has just focused on the question of how people actually make moral judgments, and the next chapter will continue to do this. We must keep in mind, however, that whatever we say about how people do make moral judgments will not translate directly into anything we can say about how people should make moral judgments, or
give a direct answer to the question of which actual moral judgments should be taken as right or true or authoritative. You might already be thinking that some of our emotionally driven judgments are unreliable, and that although we might tend to make our judgments automatically, we should attempt not to. After all, emotions can be very misleading: an alarm-bell type of emotion tells me not to stick a needle in my child’s finger—but it does this even when I’m using the needle to try to get a splinter out. In that case, I should neither heed the alarm nor regard myself as committing any wrongdoing by not heeding the alarm. Later in the book we’ll come back to this problem. First, we’ll try to understand a bit more about the process of automatically judging ourselves to be morally required, and we’ll do this by examining the sort of experience we may have of making this kind of judgment.

Notes

4. Ibid.
5. Ibid.
8. Ibid.

11. Ibid., 64–65.

Notes and Further Reading

First order judgement

• Save the baby!!

Second order judgement

• Smother the baby. :(
First order judgement

- Immediate action
- Trigger
- Input data
Second order judgement

reasoning

input data

slow well-considered action
First order versus second order

Fast versus Slow

No cognitive load versus Cognitive load

Alarm bells versus Currency

Intuitive versus Reasoning

May be non-negotiable versus Never non-negotiable
Types of "Alarm bells"

- Love --> Protect
- Disgust --> Avoid
- Fear --> Flee
Can you turn off the alarm bells?
For Tuesday:

• Study Bram Van Heuveln

• http://www.cogsci.rpi.edu/~heuveb/Teaching/CriticalWisdom/Fallacies.htm

• Debaters, start developing your arguments.