Consequences of the Demographic Transition

Econ/Demog c175
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Week 6, Lecture B
UC Berkeley
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Agenda

- A bit more “Social Security
  - Transitional windfalls and costs
  - Rates of return
  - The US case (and abroad)
- Demographic Transition
  - Some facts
  - Impact on age-structure
- What population growth rate is best?
  - Excerpts from the lab

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In Malthus tech advance → no long-term progress. What holds for Solow?

A. Progress also impossible. (Short term improvement in living standards, long term reversion to previous steady state.)

B. Progress ratchets. (each 1-time improvement is permanent)

C. Impossible to say

More iClicker

The effects of population growth on public education financing are

A) Just like public pensions

B) The opposite of public pensions

C) Nothing like public pensions

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In the formula

t = b/y * N(old)/N(working)

A) “t” stands for transfers

B) “t” stands for taxes

C) “b” stands for births

D) “b” stands for benefits

E) Exactly 2 of the above

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A PAYGO pension system is a good deal in

(a) A rapidly growing population

(b) A rapidly shrinking population

(c) A stationary (r = 0) population

(d) None of the above (Pop growth doesn't matter)

Transitions

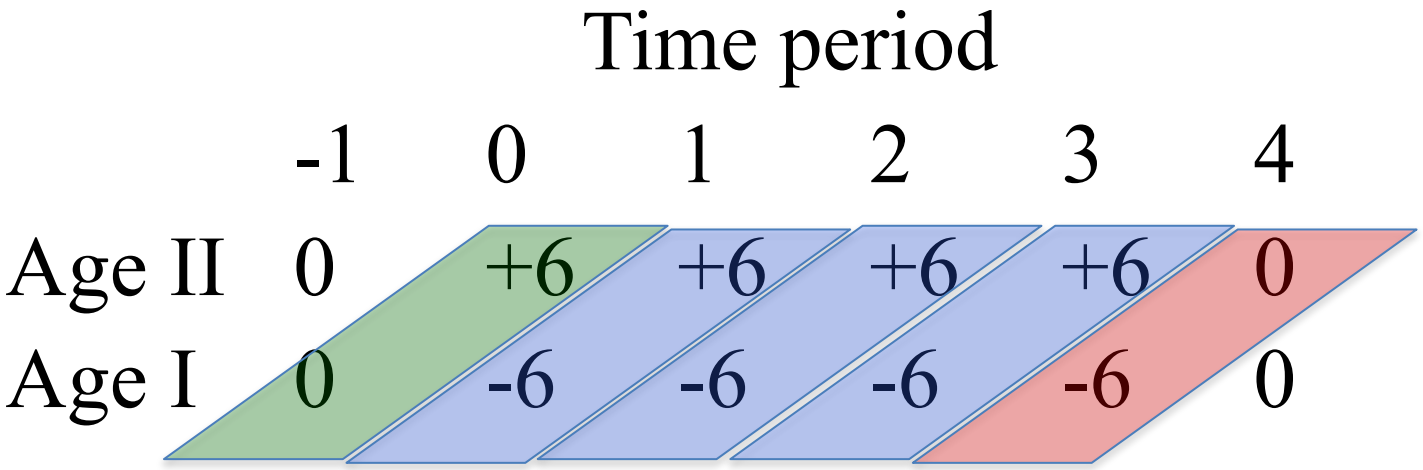
	Time period					
	-1	0	1	2	3	4
Age II	0	+6	+6	+6	+6	0
Age I	0	-6	-6	-6	-6	0

What happens by birth cohort?

Who wins? (“Windfall”)

Who loses? (“Transition costs”)

Transitions



Who wins? ("Windfall gain")

Who loses? ("Transition costs")

Almost impossible to leave a PAYGO system

Implicit rate of return

- To simplify, imagine that all taxes are paid at age 40 and all benefits received at age 70
- Then, implicit return on PAYGO contribution

P = log(benefit * chance still alive / tax)/ time

e.g., in our generational doubling example

Benefit = 8, tax = 4, and survival was 1.0, and time was 30 years,

P = log(8 * 1.0/ 4) / 30 =

Estimated rates of return: real calculation based on history of taxes and benefits and survival

Table 1
Redistribution across cohorts in the US Social Security system (OASI)[a]

Birth cohort	Internal rate of return (%)	Aggregate lifetime net intercohort transfer evaluated in 1989 (billions of 1989 dollars)
1876	36.5	12.1
1900	11.9	112.0
1925	4.8	99.6
1950	2.2	14.0
1975	1.9	−8.0
2000	1.7	−15.2

[a] Source: Leimer (1994). Intercohort transfer calculation uses 2% real discount rate.

Note: assumes PAYGO balance in future, Accounts for inflation, Mixes rich and poor

Source: Feldstein

Is 2% a good deal?

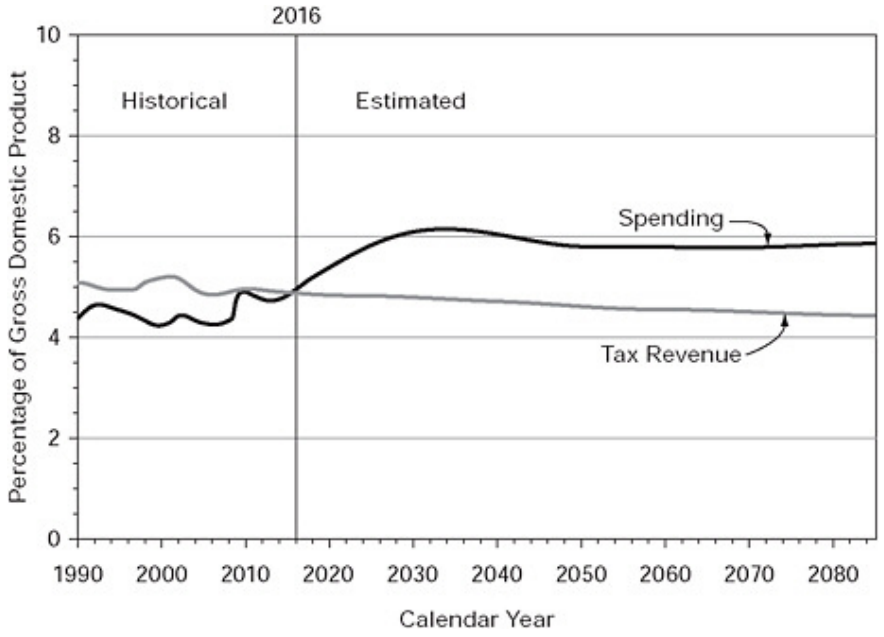
- Something like you would earn on a risk free investment like treasury bills
- Less than stock market average
- BUT insures against many risks
  - annuity against longevity risks (dying too early, too late)
  - mis-timing the market (e.g., retiring in 2008)
  - individual variation in investments

How much of your savings would you choose to invest in SocSec (if you were allowed to choose)?

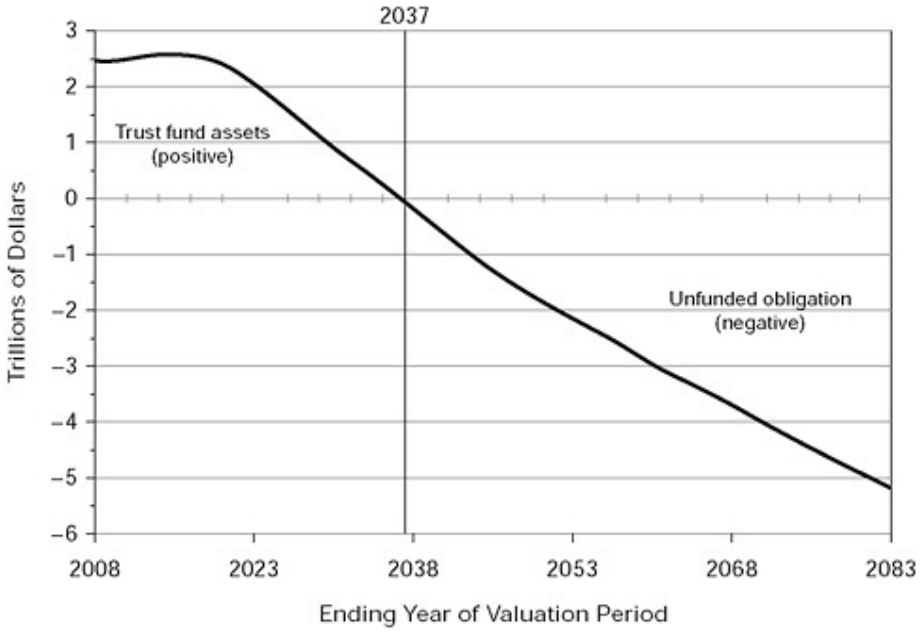
A. Nothing
B. 1-29 %
C. 30-59 %
D. 60-89%
E. > 90%

Trust fund

Scheduled spending and revenue



Trust fund balance

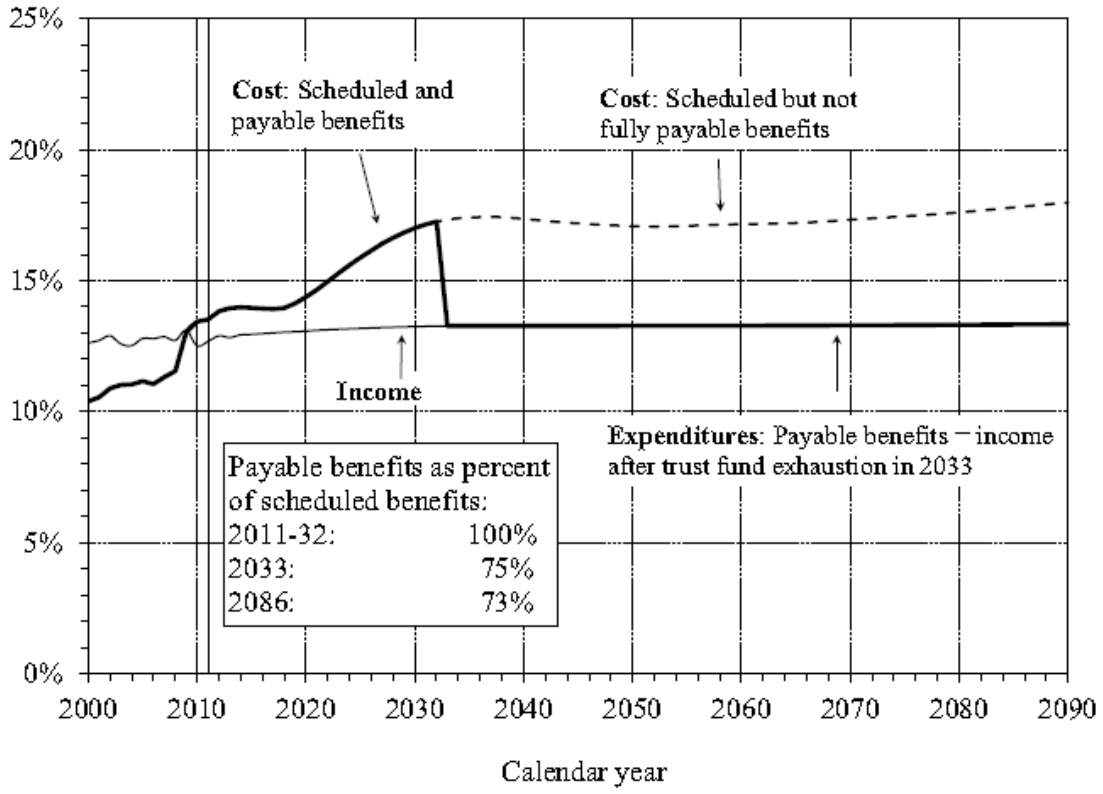


Currently trust fund invests in treasury debt, some propose to diversify into stocks (controversial)

When trust fund runs out?

What happens when trust fund runs out?

Figure II.D2.—OASDI Income, Cost, and Expenditures as Percentages of Taxable Payroll
[Under Intermediate Assumptions]



For other countries , a different story

- Demography is less favorable
- Benefits are higher

Examples for industrial nations, OADR projected to 2050.

Country	Replace-ment rate	Old Age Dep Ratio	Implied payroll tax rate
France	.91	.55	.50
Italy	.75	.58	.44
Spain	.63	.60	.38
Japan	.54	.59	.32
US	.41	.41	.17

Ron's calculations from data in Gruber and Wise.

The Demographic Transition

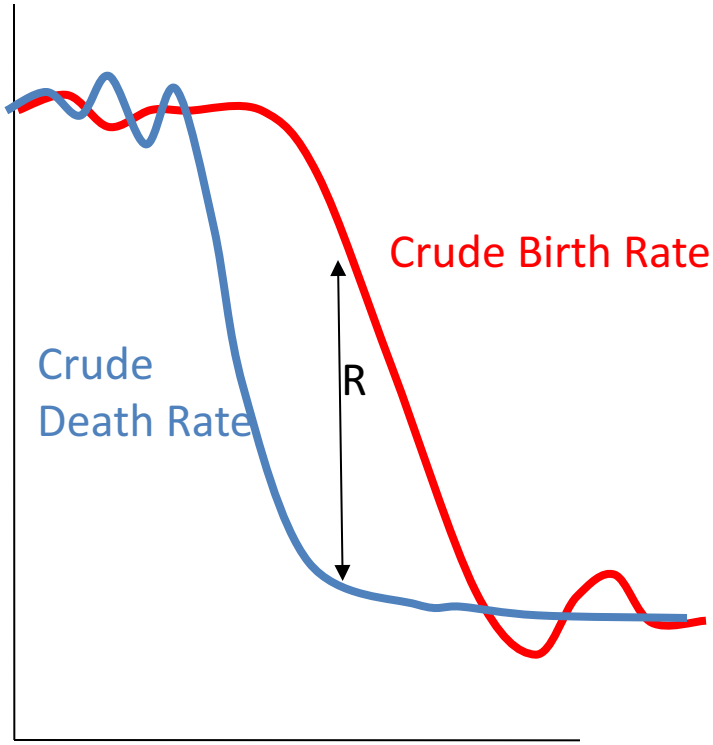
A story of changing birth and death rates

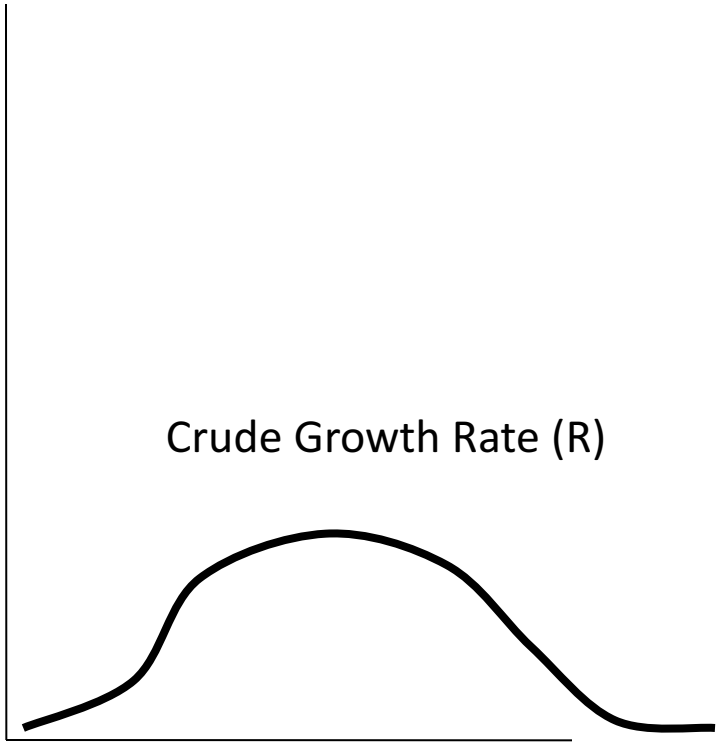
The puzzle of the demographic transition

- The Demographic Transition seems obvious today
  - Birth and death rates used to be high, now both low
- Put ourselves in the position of 1970s
  - World population growth accelerating
  - Energy prices skyrocketing
  - Environmental worries
  - Economic slowdown
- What is the next number in the sequence
- 1, 1, 1, 1, 2, 3, …?

An idealized portrayal of the D.T.

Note crude rates are per capita (e.g., CBR = births / population)

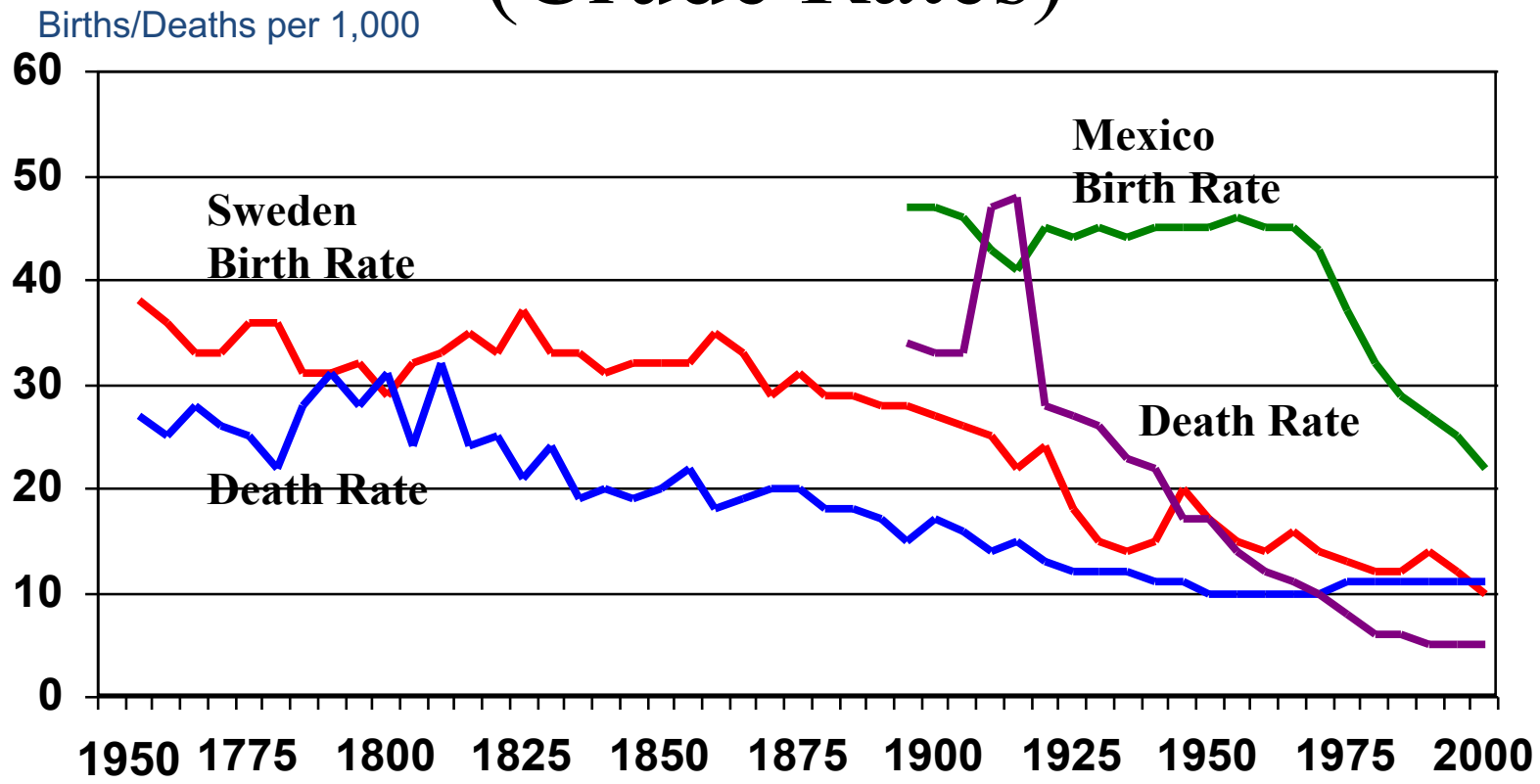




Idealized description

- Pre-transition
  - High fertility, high mortality
  - mortality fluctuating due to random shocks
- Transition
  - Mortality falls first, fertility decline lags
  - Result is “transitional growth”
- Post-transition
  - Fertility finally falls
  - Fluctuations in growth are due to fertility
  - Sub-replacement demography?

Demographic Transition in Sweden and Mexico (Crude Rates)



Sources: B.R. Mitchell, *European Historical Statistics 1750-1970* (1976): table B6; Council of Europe, *Recent Demographic Developments in Europe 2001* (2001): tables T3.1 and T4.1; CELADE, *Boletin demografico* 69 (2002): tables 4 and 7; Francisco Alba-Hernandez, *La poblacion de Mexico* (1976): 14; and UN Population Division, *World Population Prospects: The 2002 Revision* (2003): 326.

Source: PRB

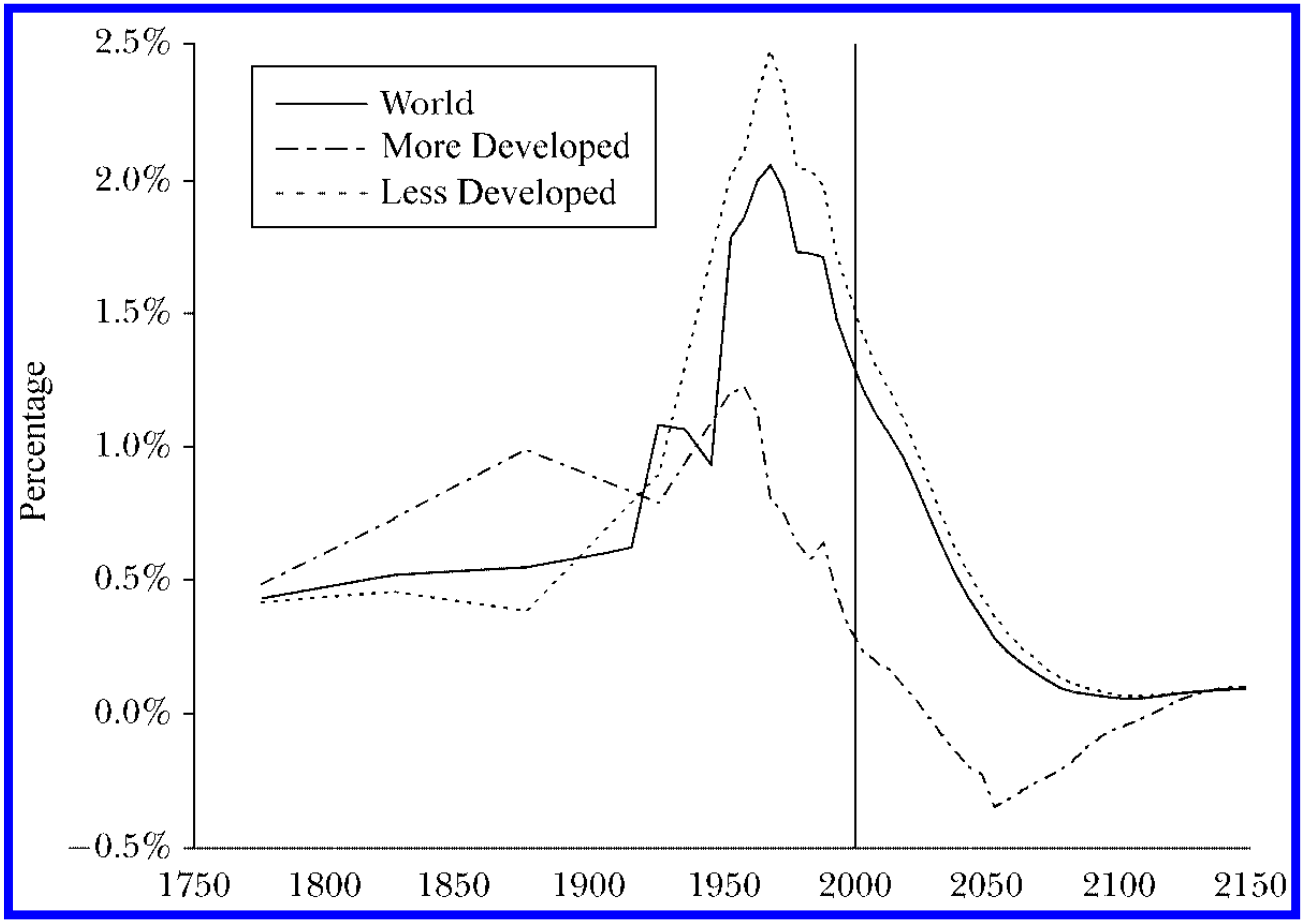
Transition statistics

- Pre-transition
  - TFR greater than 6
  - life expectancy about 40 to 50
  - Korea (1950): CBR – CDR = .037 - .032 = .005
- Transitional growth
  - crude growth rates reach 1-2% in historical Europe, 3-4% in Africa
  - Iraq (1985): CBR – CDR = 42/1000 – 8/1000 = .034
- Post-transition
  - TFR about 2
  - life expectancy 70 or 80
  - Belgium (1984): CBR – CDR = .012 - .011 = .001

Population growth rates over the course if the dem trans.DT

Figure 4

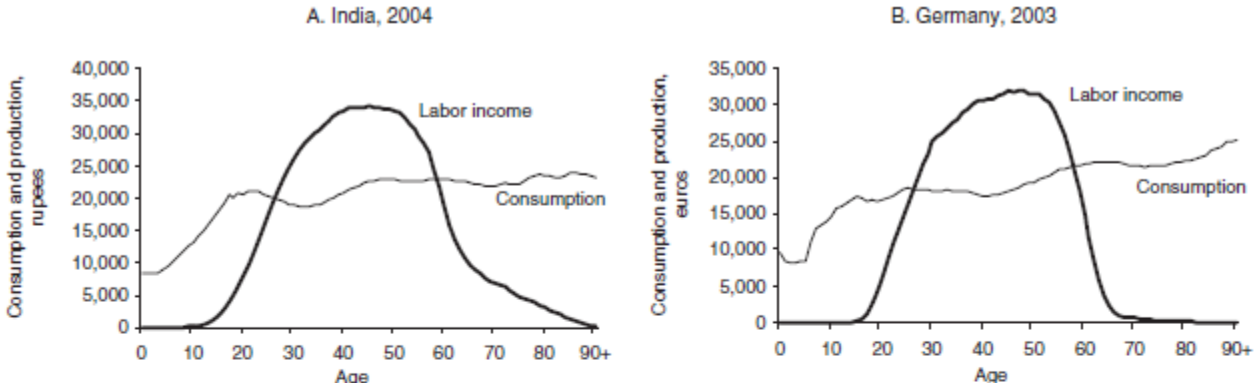
Population Growth Rates, 1750–2150



Consequences of the Demographic Transition

Not just population size,
also age structure

Life cycle profiles of income and consumption



Dependency ratios a shortcut, giving ratios of those in dependent ages (<15 & >65) to those of working ages

Dependency measures

- Old-Age Dependency Ratio (OADR)

  OADR = Pop aged 65+ / Pop aged 15-65

- Youth Dependency Ratio (YDR)

  YDR = Pop aged < 15 / Pop aged 15-65

- Total Dependency Ratio = YDR + OADR

Example: Viet Nam's age-structure during DT

- When is dependency the lowest?
- What is growth rate in 1950? In 2075?
- Why so many kids in 1975?
- Is fertility sub-replacement in 2000?

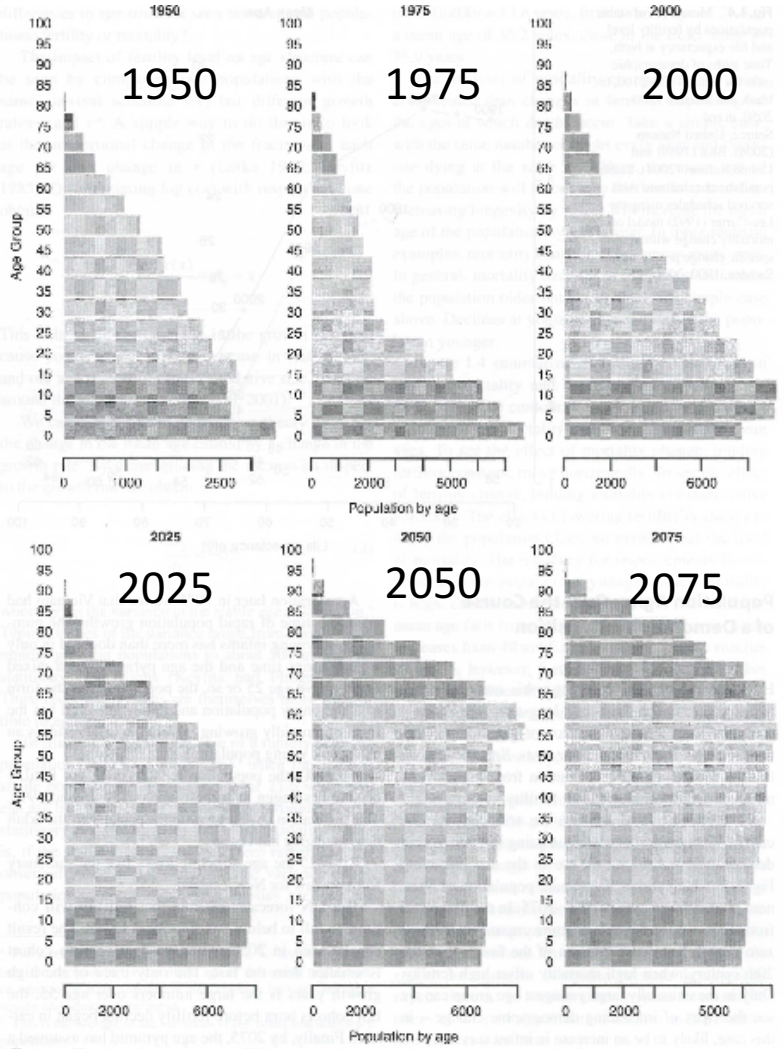
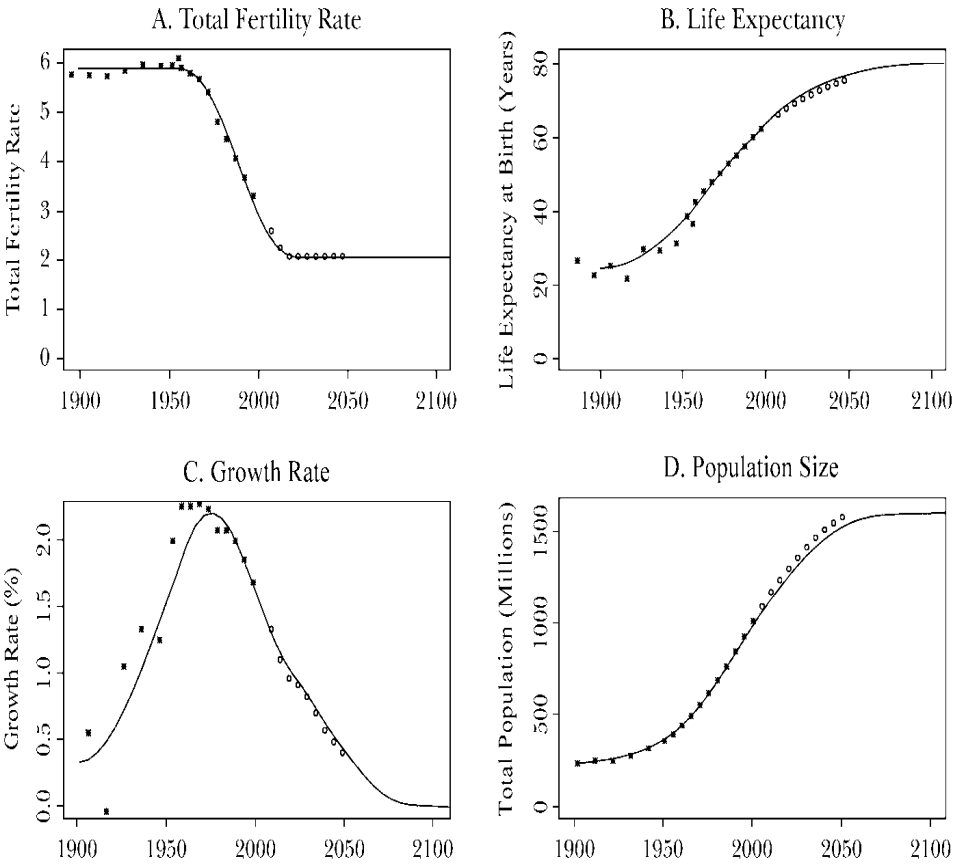


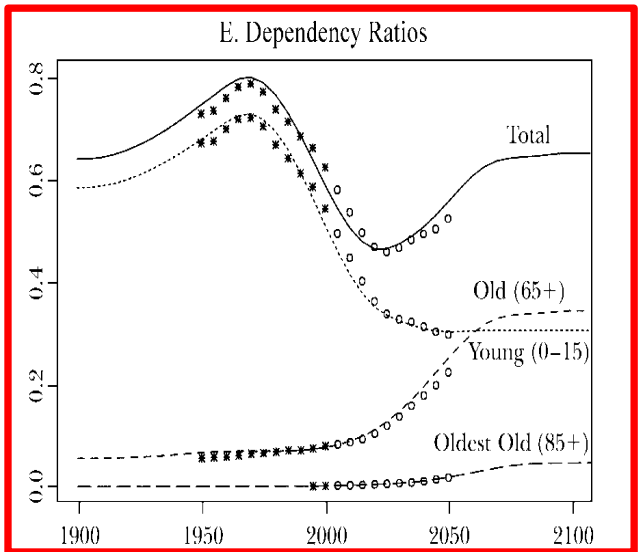
Fig. 1.5 The changing age structure of Vietnam over the course of the demographic transition, females only
Source: United Nations (2006) and author's projection. (Females only)

A Classic Demographic Transition: India 1900-2100 (Lee, 2003)

- YDR increases before it decreases
- OADR increases long after
- A window of low-dependency ("demographic dividend")

est. + 0.5% per capita gdp growth per year





Optimal Population Growth Rates

Three sides of the story

- Pop growth is good because more workers per elderly
- Pop growth is bad because more children per worker
- Pop growth is bad because of capital depletion

Lee et al.

Look at current age-profiles of consumption and production (private and public) to measure effect of age-structure

Use Solow-model + to model capital

Calculate optimal fertility

Age profiles

- [see lab]

Effect of pop growth rate

- [see lab]

Optimal Long-run Total Fertility Rates

	Public (age-structure only)	Public & Private (age –structure only)	Consumption (+ capital effects)	Observed today
Low income countries	1.1	1.8	1.2	4.0
Middle income countries	3.0	2.0	1.5	2.1
High income countries	2.9	2.3	1.8	1.7

Source: Lee et al 2014

Public is higher because child costs born by parents

What is message of last line?

For next time

- Review of labs
  - We'll summarize the take-away message of each one
  - Answer specific questions
- Your task: Review the labs and come w/ Qs.
  - Lab 1 (Exponential growth)
  - Lab 2 (Malthus)
  - Lab 3 (Solow)
  - Lab 4 (TheBet)
  - Lab 5 (none – but we did stable pops in class)
  - Lab 6 (Aging)