

Asia's Dependency Transition: Intergenerational Transfers,
Economic Growth, and Public Policy

Optimal Age Profile of Per Capita Health Expenditure

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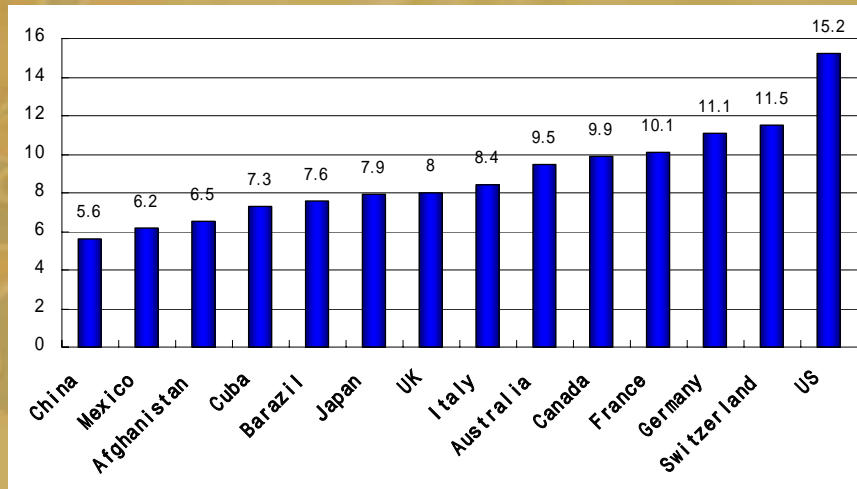
China Center for Economic Research

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Backgrounds

- ◆ 1. Health and health care have become dominant economic and political issues worldwide.
 - ☞ **Rapid increase in health care expenditure**
 - ☞ Increase share of personal income spent on health care
 - ☞ Limited access to health care service
 - ☞ Health Inequality

Total Health Care Expenditure Share of GDP In Some Countries, 2003



Source: WHO, 2006

Backgrounds

- ◆ 2. Health care burdens are increasing because of the Aging
 - ☞ The OECD's most recent projections suggest that, in thirteen countries with available information, population aging will create a rise in age-related social expenditures from an average of under 19% of Gross Domestic product in 2000 to almost 26% of GDP by 2050, with old-age pension payments and expenditure on health care and long term care each responsible for approximately half of this increase (Dang, Antolin, & Oxley, 2001).



Percent Elderly by Age: 2000 to 2030

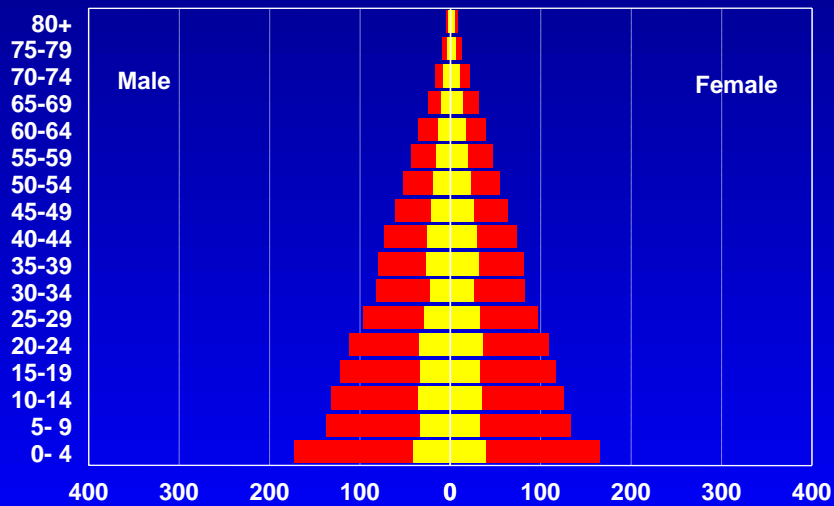
Region	Year	65 years and older	75 years and over	80 years and older
EUROPE	2000	15.5	6.6	3.3
	2030	24.3	11.8	7.1
NORTH AMERICA	2000	12.6	6.0	3.3
	2030	20.3	9.4	5.4
OCEANIA	2000	10.2	4.4	2.3
	2030	16.3	7.5	4.4
ASIA	2000	6.0	1.9	0.8
	2030	12.0	4.6	2.2
LATIN AMERICA/CARIBBEAN	2000	5.5	1.9	0.9
	2030	11.6	4.6	2.4
NEAR EAST/NORTH AFRICA	2000	4.3	1.4	0.6
	2030	8.1	2.8	1.3
SUB-SAHARAN AFRICA	2000	2.9	0.8	0.3
	2030	3.7	1.3	0.6

Source: U.S. Census Bureau

Population, by Age and Sex: 1950

(In millions)

■ Developing countries
■ Developed countries

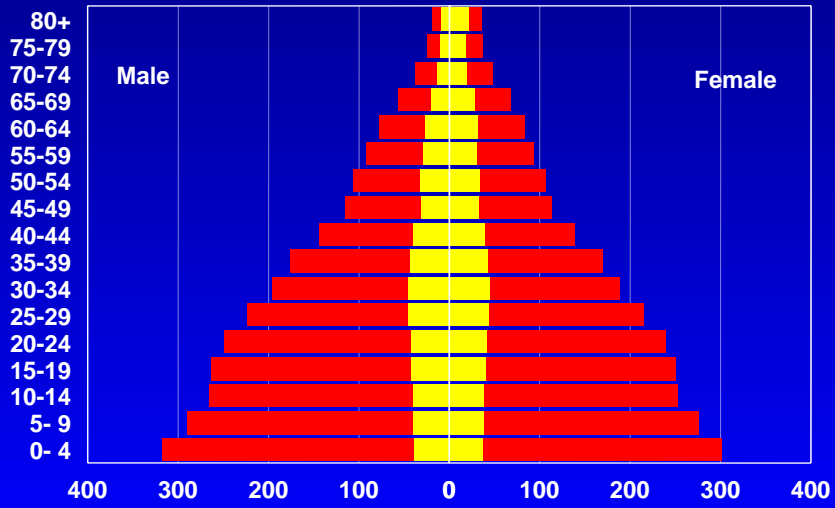


Sources: United Nations 1999 and U.S. Census Bureau 2000.

Population, by Age and Sex: 1990

(In millions)

■ Developing countries
■ Developed countries

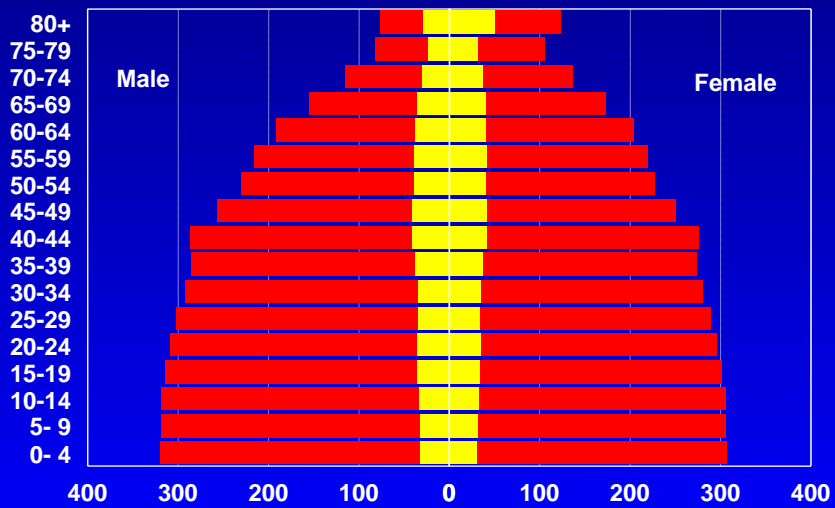


Sources: United Nations 1999 and U.S. Census Bureau 2000.

Population, by Age and Sex: 2030

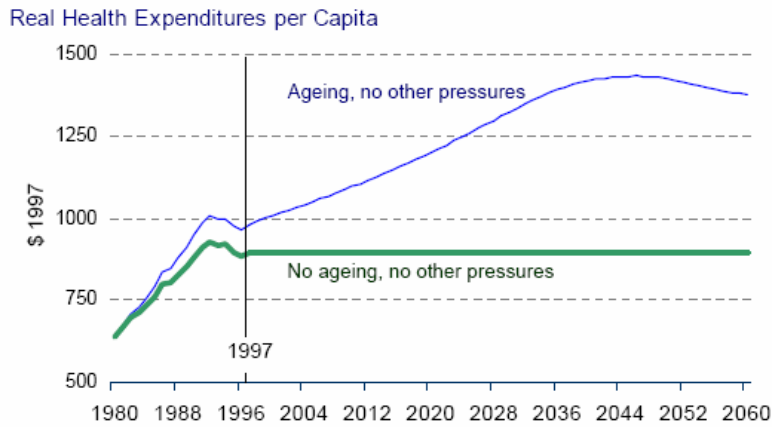
(In millions)

■ Developing countries
■ Developed countries



Sources: United Nations 1999 and U.S. Census Bureau 2000.

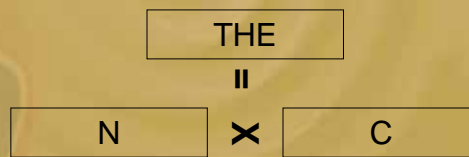
FIGURE 4: Ageing and Health Expenditures



Source: Health Canada (2002).

Seamus Hogan and Sarah Hogan, How Will the Ageing of the Population Affect Health Care Needs and Costs in the Foreseeable Future?, IHSPR DISCUSSION PAPER, 2002

Motivations



- ◆ Demography
 - ↳ Scale: population
 - ↳ Structure: Aging
- ◆ Health care Cost
 - ↳ Scale: Average cost
 - ↳ Structure: Aging

Motivations

- ◆ Many literatures have focused on the increasing total health care expenditure. e.g. Health Care Expenditure Projection
 - ↪ Cutler & Sheiner, 1998; Reese, 2000; Dang, Antolin, & Oxley, 2001; Miller, 2001; Jonan J. Polder, Luc Bonneux, Willem Jan Meerdering, Paul J. Van Der Maas, 2002; Monika Riedel and Maria M. Hofmarcher, 2003
- ◆ R. Busse (2001): When examining factors responsible for health expenditure, the "usual suspects" are:
 - ↪ Demography/ageing
 - ↪ Economic growth/rising GDP
 - ↪ Health care resources (hospital beds, staff, high technology, etc.)
 - ↪ New technologies and medical progress
 - ↪ Health care system (especially Bismarck vs. Beveridge)
- ◆ Alastair Gray (2005) reviews the evolution of research in Population Ageing and Health Care Expenditure

Motivations

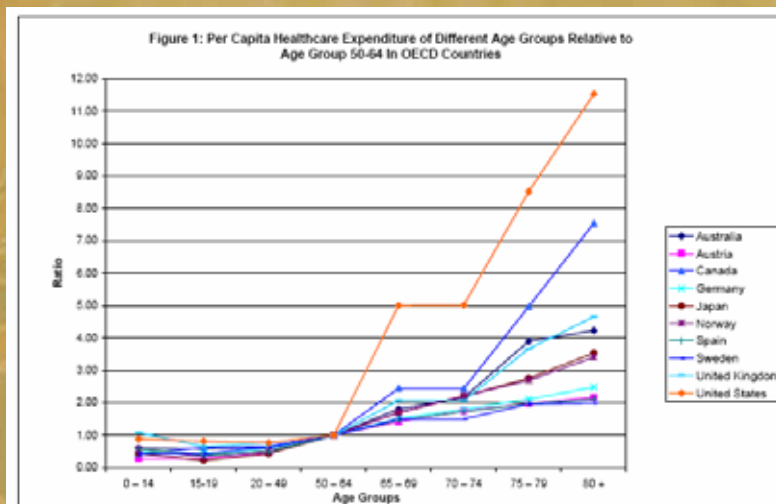
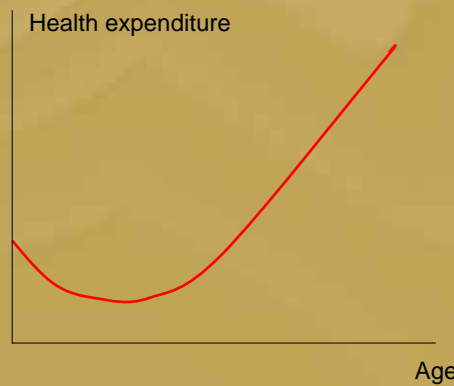
- ◆ But more are focused on the demographical changing and the rising health expenditure of the elderly people.
- ◆ What's more, The age profiles are assumed given.
- ◆ Fewer researches have paid attention to the age profile of per capita health expenditure itself.

>>>

- ◆ What is the optimal distribution of the age profile?
- ◆ What should and can we do something to change the structure?

Stylized facts

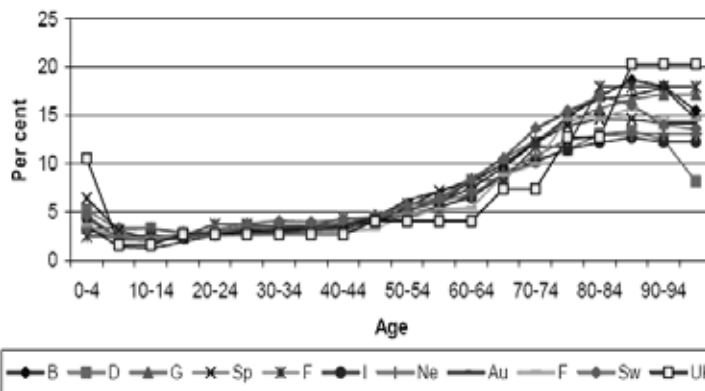
- ◆ Health expenditures are strongly age dependent
- ◆ Average health expenditures by age group are relatively high for young children; they decrease and remain stable for most of the prime-age period, and then start to increase rapidly at older ages
- ◆ like a “J curve”
 - ↳ The high costs at birth
 - ↳ The Cost-of-Dying
- ◆ Literatures
- ◆ NTA Project Results



Source: Hagist and Kotlikoff (2005) Table 2. See their paper for the original sources of their data.

Figure 5.1 European health expenditure^a

Health expenditure as a proportion of per capita GDP



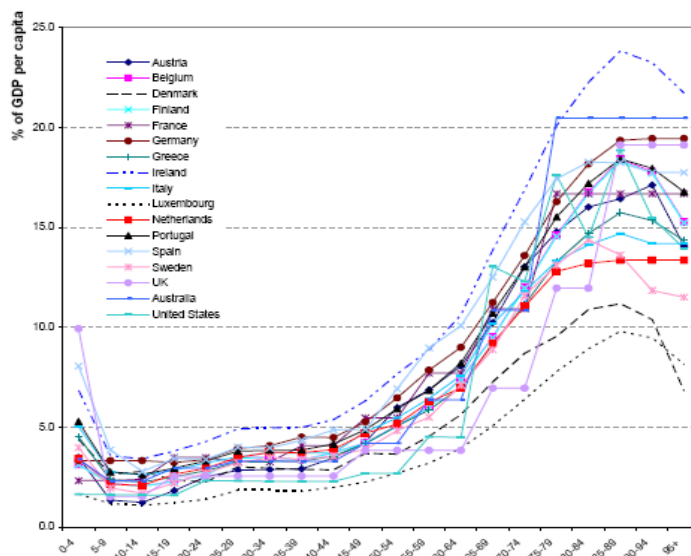
^a B=Belgium; D=Denmark; G=Germany; Sp=Spain; F=Finland; I=Italy; Ne=Netherlands; Au=Austria; F=France; Sw=Switzerland; UK=United Kingdom. Profiles are drawn using data from the year 2000 except France, 1997; Belgium, Denmark, Spain and United Kingdom, 1998; and Italy, 1999.

Data source: Bains (2003).

(“Aggregate studies of age and health expenditures”,

<http://www.pc.gov.au/study/ageing/finalreport/technicalpapers/technicalpaper05.pdf>)

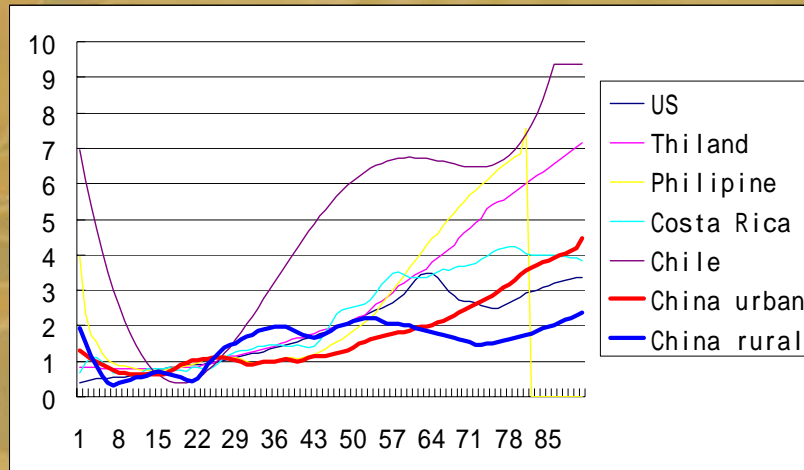
Figure 2.1 Public health care expenditure by age groups ¹



1. Expenditure per capita in each age group divided GDP per capita.
Source: ENPRI-AGIR, national authorities and Secretariat calculations.

(“Projecting OECD Health and Long-term Care Expenditures: What are the Main Drivers?”, Economics Department Working Papers No. 477)

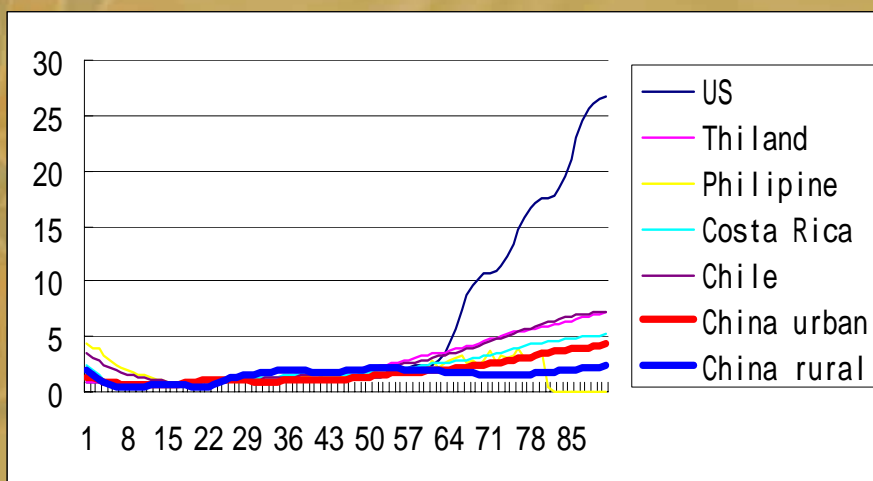
NTA Results: Private Health Expenditure



Source : NTA Project, 2007.

Average consumption of 20-29 years is normalized to 1

NTA Results: Public Health Expenditure



Source : NTA Project, 2007.

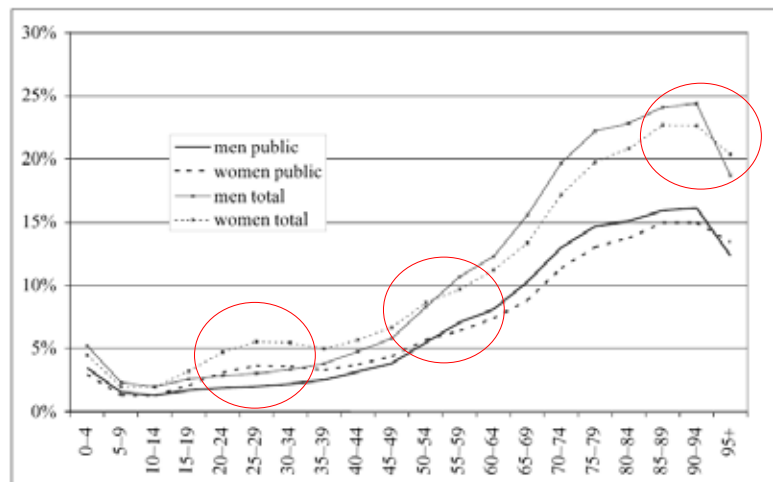
Average consumption of 20-29 years is normalized to 1

What shapes the “J Curve ”

◆ Epidemiological Reasons

- ☞ Expenditures mainly associated with birth and pregnancy cause a difference in spending between young men and women.
- ☞ Higher expenditures on male compared to female senior citizens
- ☞ the average cost per individual in oldest age groups should fall over time:
 - ◆ Longevity gains are assumed to translate into additional years of good health (“healthy ageing)
 - ◆ Major health costs come at the end of life and such “costs of dying” are usually lower for the oldest age groups compared to the middle aged. (Monika Riedel and Maria M. Hofmarcher, 2003)

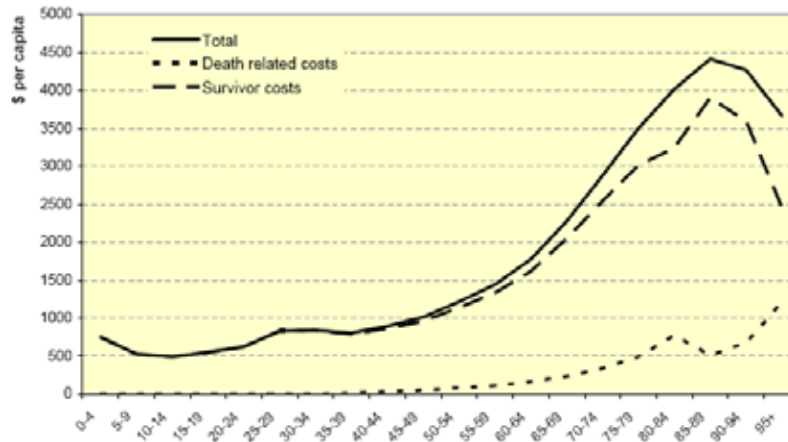
Figure 2: Per capita total expenditures on health according to age groups in percent of GDP 2000



Source: IHS HealthEcon 2002

(Monika Riedel and Maria M. Hofmarcher, “Australian health expenditures exhibit an age profile”, Vienna Yearbook of Population Research 2003, Vol. 1, pp. 197-213)

Figure 2.2 Breakdown of the health care cost curve ¹
(Finland)

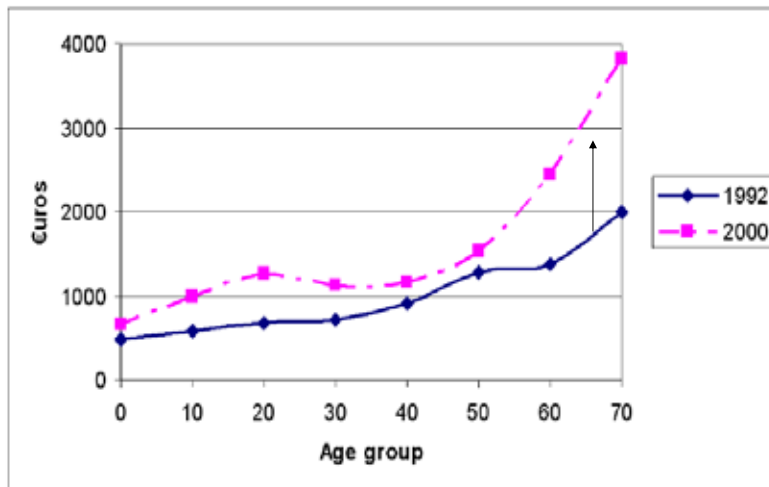


1. Expenditure per capita in each age group.
Source : ENPRI-AGIR and Secretariat calculations.

Projecting OECD Health and Long-term Care Expenditures: What are the Main Drivers?", Economics Department Working Papers No. 477

What shapes the “J Curve ”

- ◆ Technological and Economical Reasons
 - ☞ Technological change has obviously been an important driver of both health expenditures and health outcomes.
 - ☞ There is a rather high correlation between income per capita and healthcare expenditure per capita for the EU15 countries as well as the EU11 countries. (AHEAD Policy Brief June 2007 “Work Package VIB on Determinants of Aggregate Health Expenditure Focusing on Age Composition”)



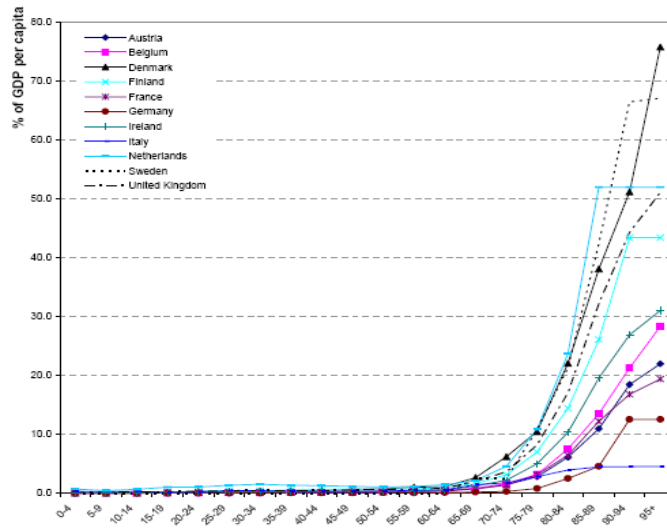
Graph 1: Average individual health care expenditures by age group, years 1992 and 2000

Brigitte DORMONT, Michel GRIGNON and Helene HUBER, "Health expenditure growth: reassessing the threat of ageing"

What shapes the "J Curve"

- ◆ Institutional reasons
 - ☞ The design of the system
 - ◆ Bismarck vs. Beveridge (R. Busse, 2001)
 - ☞ Special projects
 - ◆ Nominal cost increase among women is higher than for men due to more institutionalized care, especially in the long-term care sector (nursing homes and elderly homes) and other care (maternity services). (Jonan et al, 2002)
 - ◆ Medicare in the US
- ☞ Fang Hanming(2007)

Figure 3.1. Public long-term care expenditure by age group¹

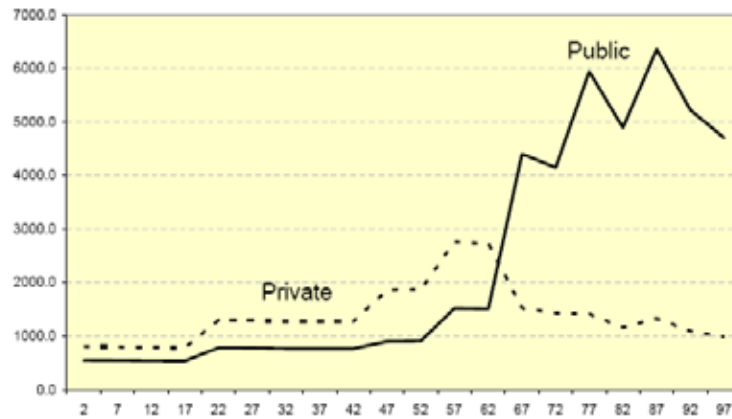


1. Expenditure per capita in each age group divided by GDP per capita.
Source: ENPRI-AGIR and Secretariat calculations.

Projecting OECD Health and Long-term Care Expenditures: What are the Main Drivers?, Economics Department Working Papers No. 477

Figure 4.2 Public and private health expenditure per capita¹

In US\$ PPPs
United States



(1) Excluding long-term care
Source: US Centers for Medicare and Medicaid Services, Office of Actuary, National Health Statistics Group

Brigitte Dormont, Joaquim Oliveria Martins, Florian Pelgrin, "Health expenditures, longevity and growth"

China Case

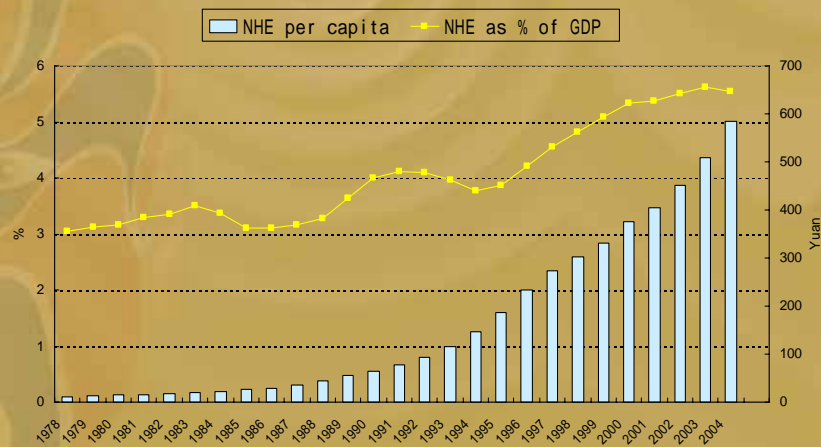
◆ Data

- China Household Income Survey (1995) ; 50000 individuals
- The 2nd and 3rd National Healthcare Service Survey
 - ◆ 2nd(1998): 215668 individuals
 - ◆ 3rd(2003): 193695 individuals

◆ Methodology

- Regression
- Iteration
- Smooth with the width=0.1

Rapid increase in health care expenditure (1978-2004)

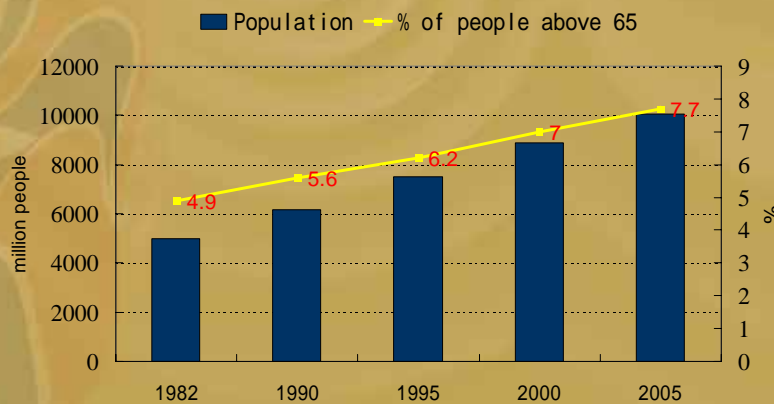


Source: Health Statistic Yearbook. The statistic method of GDP in 2004 and 2005 was different.

Aging in China

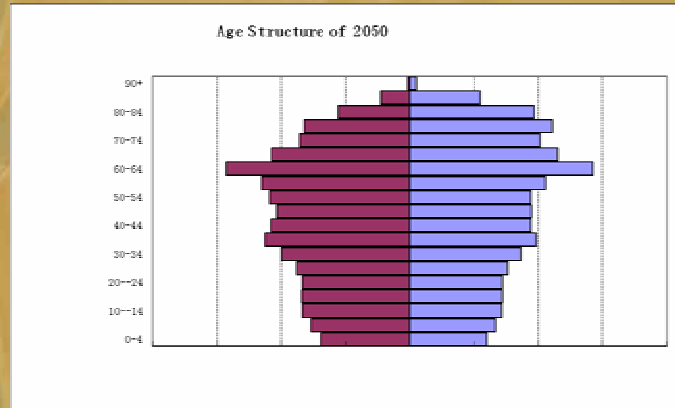
- ◆ China is experiencing rapid population aging. The one-child policy accelerate the aging process and make China's aging problem more serious than any other countries in the world.
- ◆ According to a World Bank report, China's aging population will reach the peak by 2030 (The World Bank, 1994). There will be 0.3 billion people over 60, which will account for 22% of the total population.
- ◆ Old age dependency ratio is expected to rise from currently 3.65 workers for every retired person to only two workers for a retired by 2030.

The Aging Problems



Source : 《中国统计摘要》

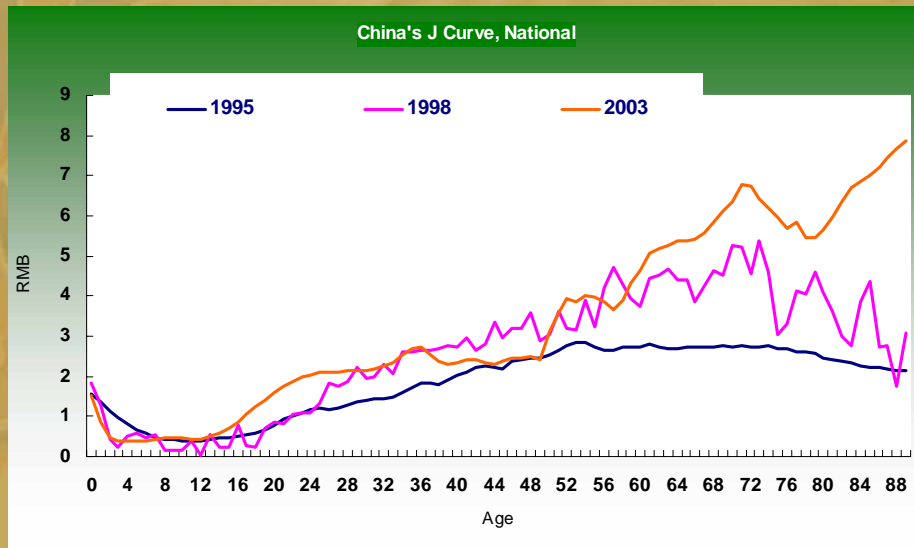
Age Structure



Source: NBS , China ,

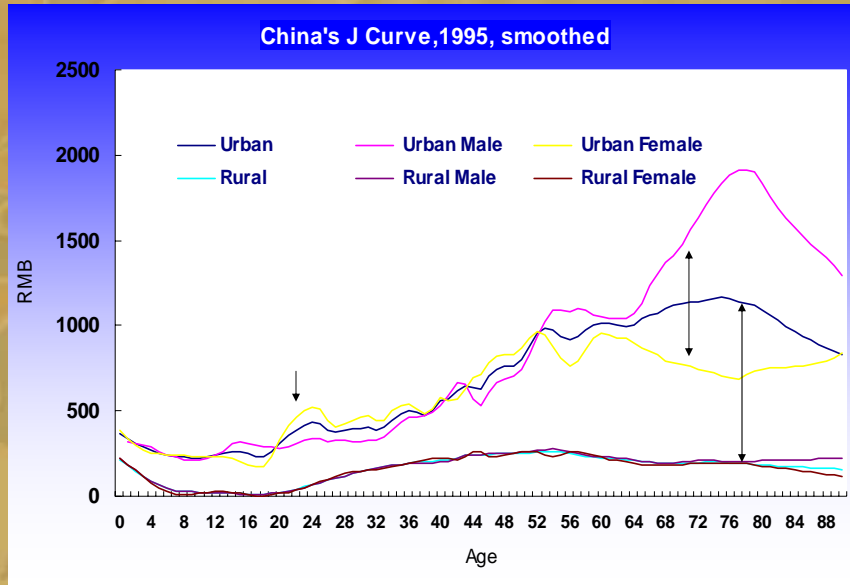
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China Case

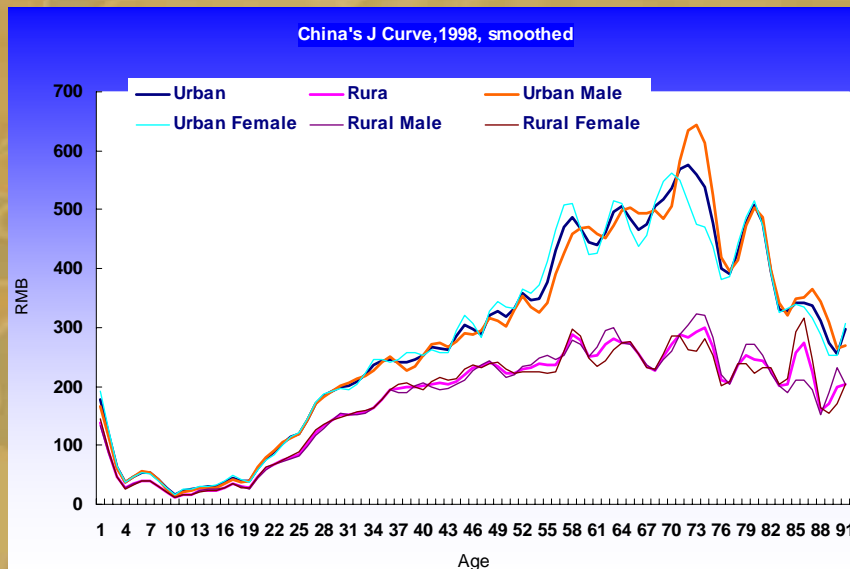


Average expenditure of 0-10 years old normalized to 1

China Case

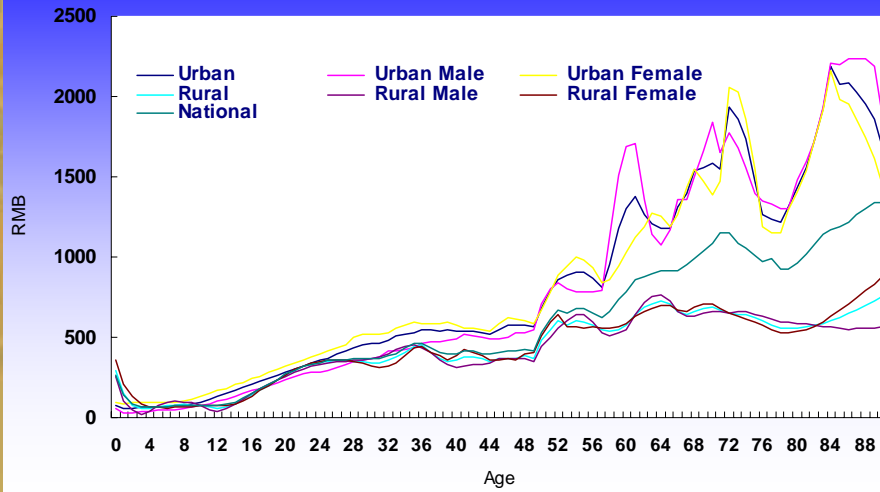


China Case



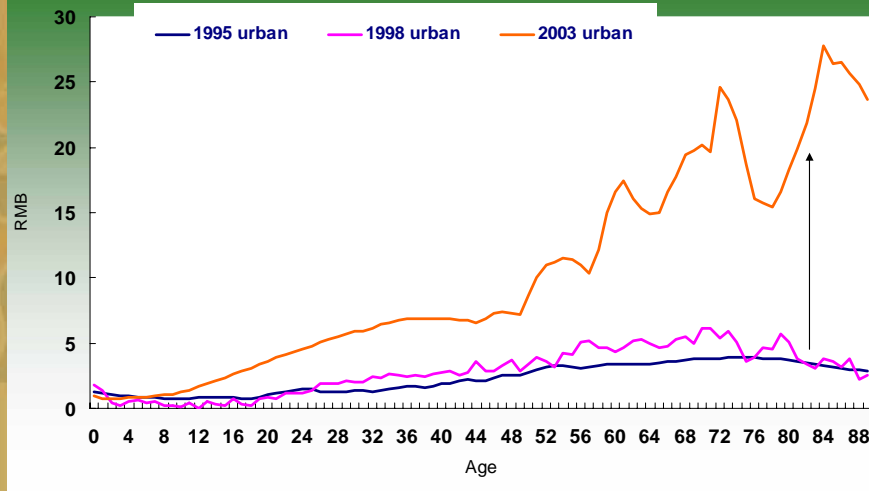
China Case

China's J Curve, 2003, smoothed



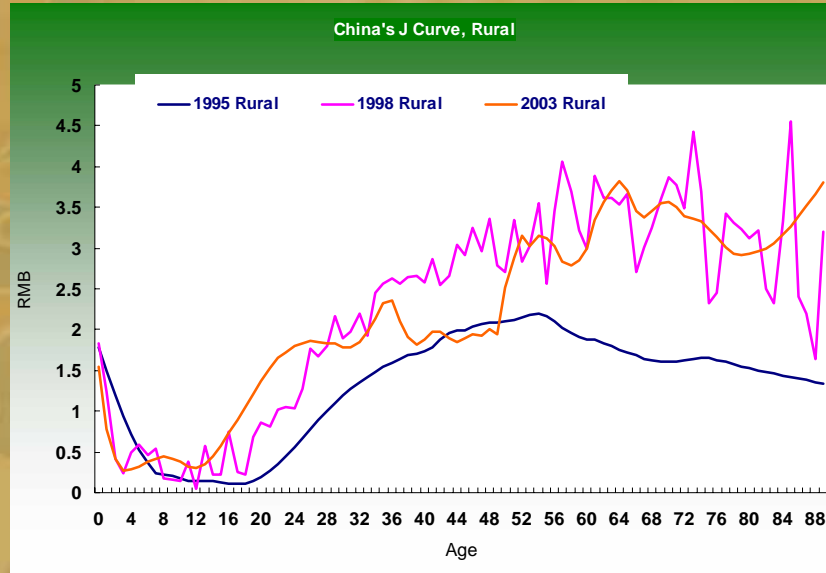
Time-Series

China's J Curve, urban



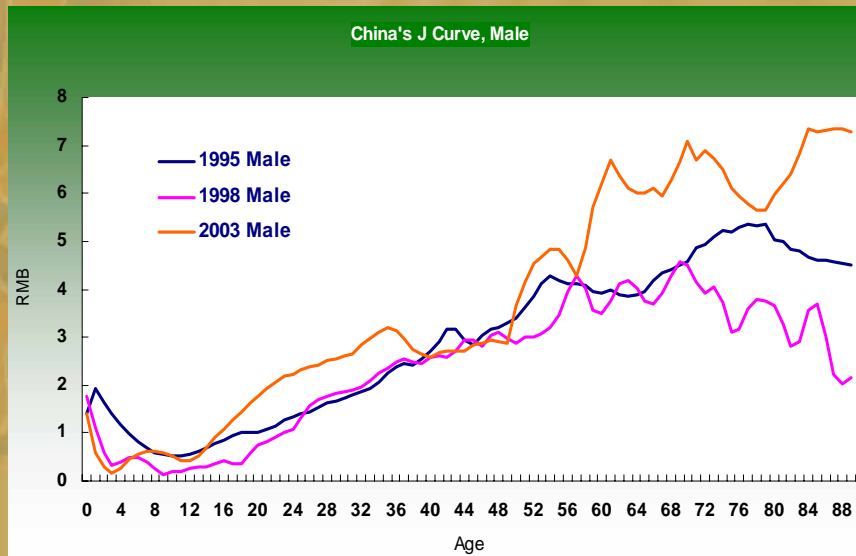
Average expenditure of 0-10 years old normalized to 1

Time-Series



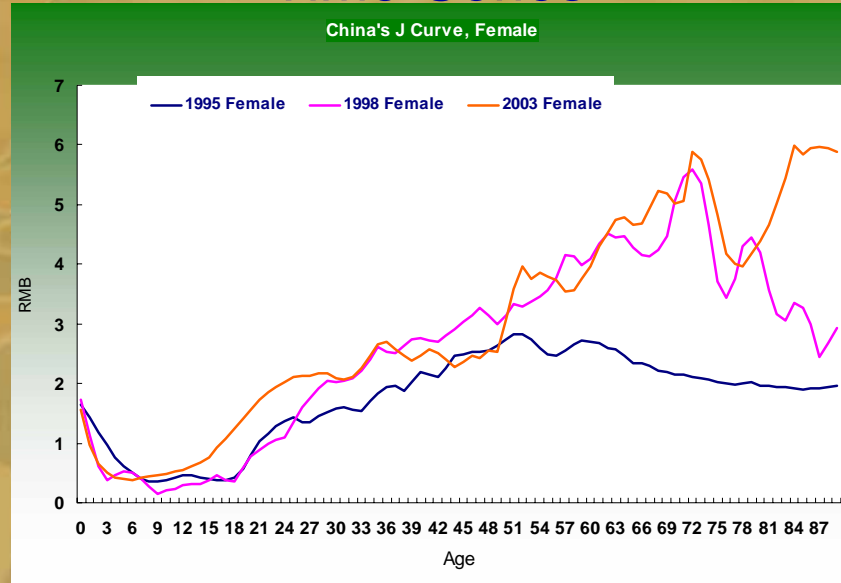
Average expenditure of 0-10 years old normalized to 1

Time-Series



Average expenditure of 0-10 years old normalized to 1

Time-Series



Average expenditure of 0-10 years old normalized to 1

Optimal allocation of the individual lifetime health care expenditure

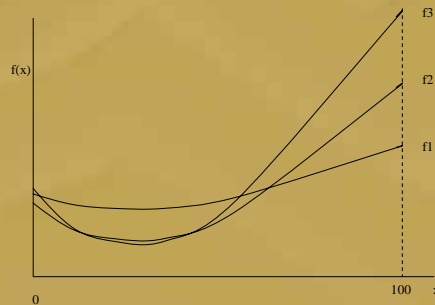
◆ Assumptions

- ☞ Health care resources are scarce. One's total health expenditure is constant.
- ☞ Health status is only related to per capital health expenditure of current year and before.
- ☞ Health Utility Function is well performed.

Optimal Allocation-A Theoretical Model

Find a optimal distribution of $F(X)$ to $Max(\sum_{i=1}^n U_i)$

While
$$\begin{cases} U_i = U(f(X_i), f(X_{i-1}) \dots f(X_1)) & \text{for } i = 1, 2, \dots, n \\ \sum_{i=1}^n f(X_i) = const \end{cases}$$



A tentative results– Numerical Simulation

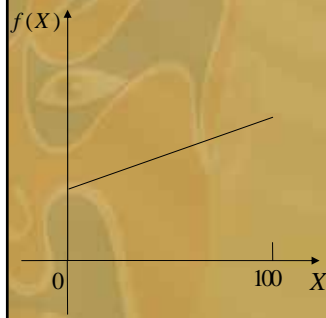
Suppose

$$n = 100$$

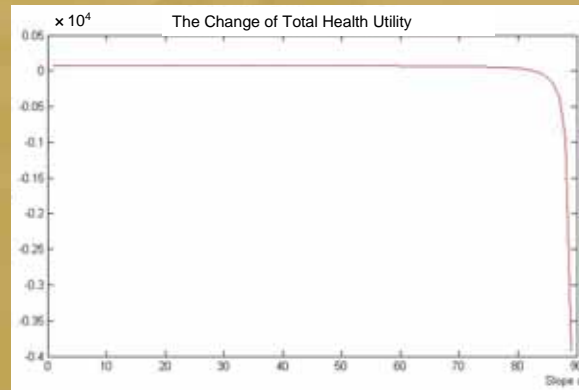
$U_i = U(f(X_i))$ $F(X)$ follows a linear distribution	$U_i = U(f(X_i))$ $F(X)$ follows a quadratic distribution
$U_i = U(f(X_i), f(X_{i-1}))$ $F(X)$ follows a linear distribution	$U_i = U(f(X_i), f(X_{i-1}))$ $F(X)$ follows a quadratic distribution

A tentative results– Numerical Simulation

$U_i = \sqrt{f(X_i)}$ $F(X)$ follows a linear distribution $f(X) = aX + b$
 A smaller a means a flatter distribution of lifetime health expenditure

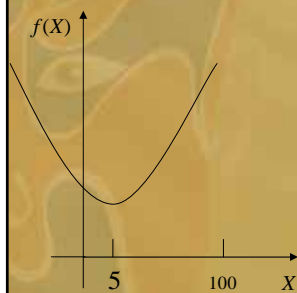


RESULT

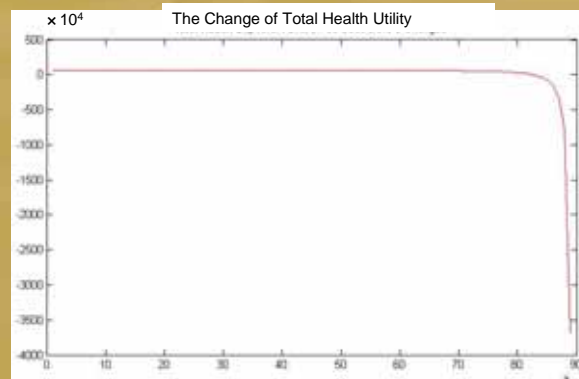


A tentative results– Numerical Simulation

$U_i = \sqrt{f(X_i)}$ $F(X)$ follows a quadratic distribution $f(X) = aX^2 - 10aX + c$
 A smaller a means a flatter distribution of lifetime health expenditure



RESULT

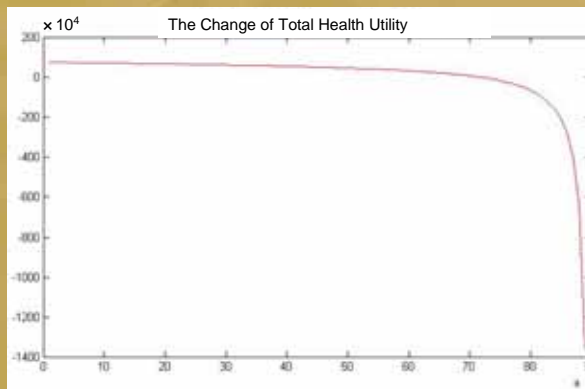
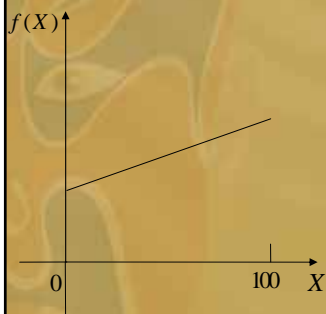


A tentative results– Numerical Simulation

$$U_i = [f(X_i)]^{\frac{3}{4}} [f(X_{i-1})]^{-\frac{1}{4}} \quad F(X) \text{ follows a linear distribution } f(X) = aX + b$$

A smaller a means a flatter distribution of lifetime health expenditure

RESULT

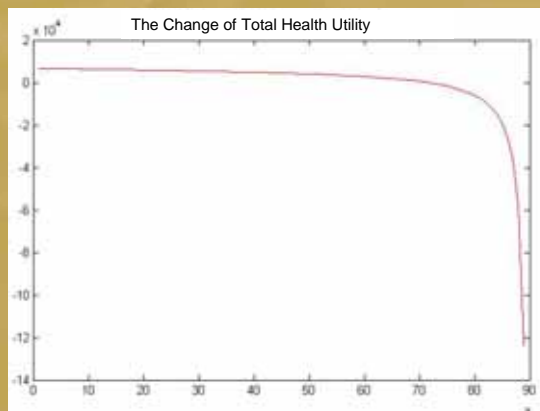
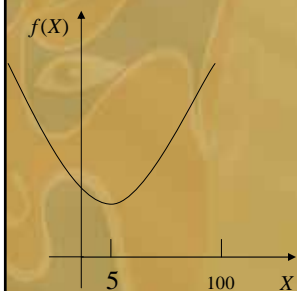


A tentative results– Numerical Simulation

$$U_i = [f(X_i)]^{\frac{3}{4}} [f(X_{i-1})]^{-\frac{1}{4}} \quad F(X) \text{ follows a quadratic distribution } f(X) = aX^2 - 10aX + c$$

A smaller a means a flatter distribution of lifetime health expenditure

RESULT



Policy implications

- ◆ Adjust the projection of THE
- ◆ Rethink the government investment
- ◆ Rethink the distribution of lifetime health care consumption
 - ☞ Health care delivery system
 - ◆ 医防结合、重心下移
 - ☞ Medical Model
 - ◆ “3Ps”
 - ◆ “圣人不治已病，治未病；不治已乱，治未乱，此之谓也。”--《黄帝内经》

Discussions

- ◆ The NTA project provides a great opportunity to do empirical analysis on this important issue based on the international cooperation.
- ◆ The challenges for international comparison
 - ☞ Companionability of data
 - ☞ Definition of institutional variables



Thanks!

Comments are very welcome!