

**Workshop on the Impact of Changing
Demographics on Productivity**

25-28 Nov., 2014 in Singapore

by Asia Productivity Organization

Changing Demographics and Its Impact on Productivity

Hanam Phang

Yonsei University

hnphang@naver.com

Issues and Topics to be Addressed

- Trends and Patterns of Demographic Transition and/or Population/Labor Force Ageing in member countries
 - in comparison to other advanced economies: i.e., Europe
- Prospects: what will be the plausible direction of future development?
 - esp. fertility, age-composition, dependency, etc.
- Consequences of those developments
 - esp. labor force and productivity, social security and welfare, and economic growth

Issues and Topics (cont.)

- Definition and Measurement of Productivity
- Levels: Macro - aggregate economic productivity vs. Micro - individual-based productivity
- Growth vs. Level: growth = rate; level = output (aggregate)
- What, Why and How? : of the impact of population /labor force ageing on productivity and economic growth
- Theoretical views and Empirical research results
 - How these would apply to the specific situation of the APO member countries

Issues and Topics (cont.)

- Challenges facing our member countries, esp. in relation to productivity and growth, quality of living
- What have been and should be done?: Policy responses and initiatives needed for the future (short-term, long-term)
- Tasks remaining: issues or questions unsolved remaining for further research

1-1. Population Ageing as a Global Issue

- Demographic Changes, esp. Population Ageing is a Global Issue
- More Developed APO Countries at the heart of the issue
- Review Theoretical Debates, Methodologies, and Empirical Findings on the Issue
- Main Topic: The Impact of Population Ageing on Productivity and Economic Growth and Social Well-being

1-2. Demographic Dividend and Economic Growth

- ‘Demographic Dividend’ :
 - the opportunity for economic growth that demographic transition offers to developing countries
 - through changing age structure of the population through the proportion of the workforce rising
- Bloom, Canning and Sevilla (2002)
 - while population growth has a negative effect on per capita income growth, this effect is counteracted by the positive effect from growth in the share of the population that is economically active.
- The economic benefits
 - (1)increased labor supply, (2)savings and human capital and, therefore, (3)increased resources for production and distribution (Rajgopalan, 2008)

[Demographic Transition: Korean Case]

- Demographic Transition: 1950~2000
- Rapid decline in fertility and a consistent and gradual decrease in mortality
- Started with a very high fertility rate at around 5.0-6.0 in the early 1950s right after the Korean war
- Extended life expectancy at birth from about 23 years in 1905-1910 to about 50 years in the same time period (now approaching 79)
- Baby-boom Generation: 1955~1963 (around 7.5 M (as of 2000)) - Retiring 2015~2025

Figure 1. Korean Population Change: 1950-2050

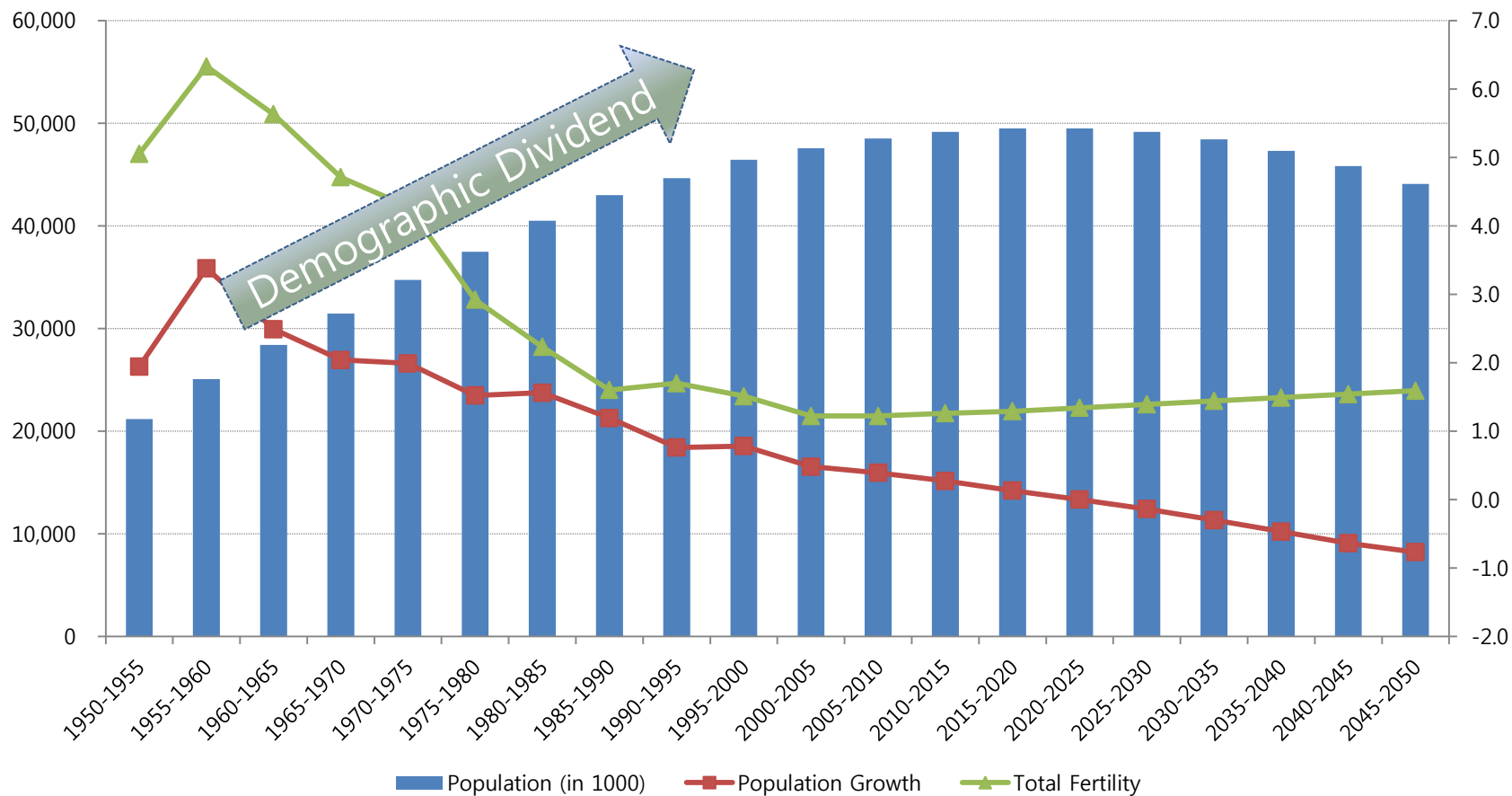
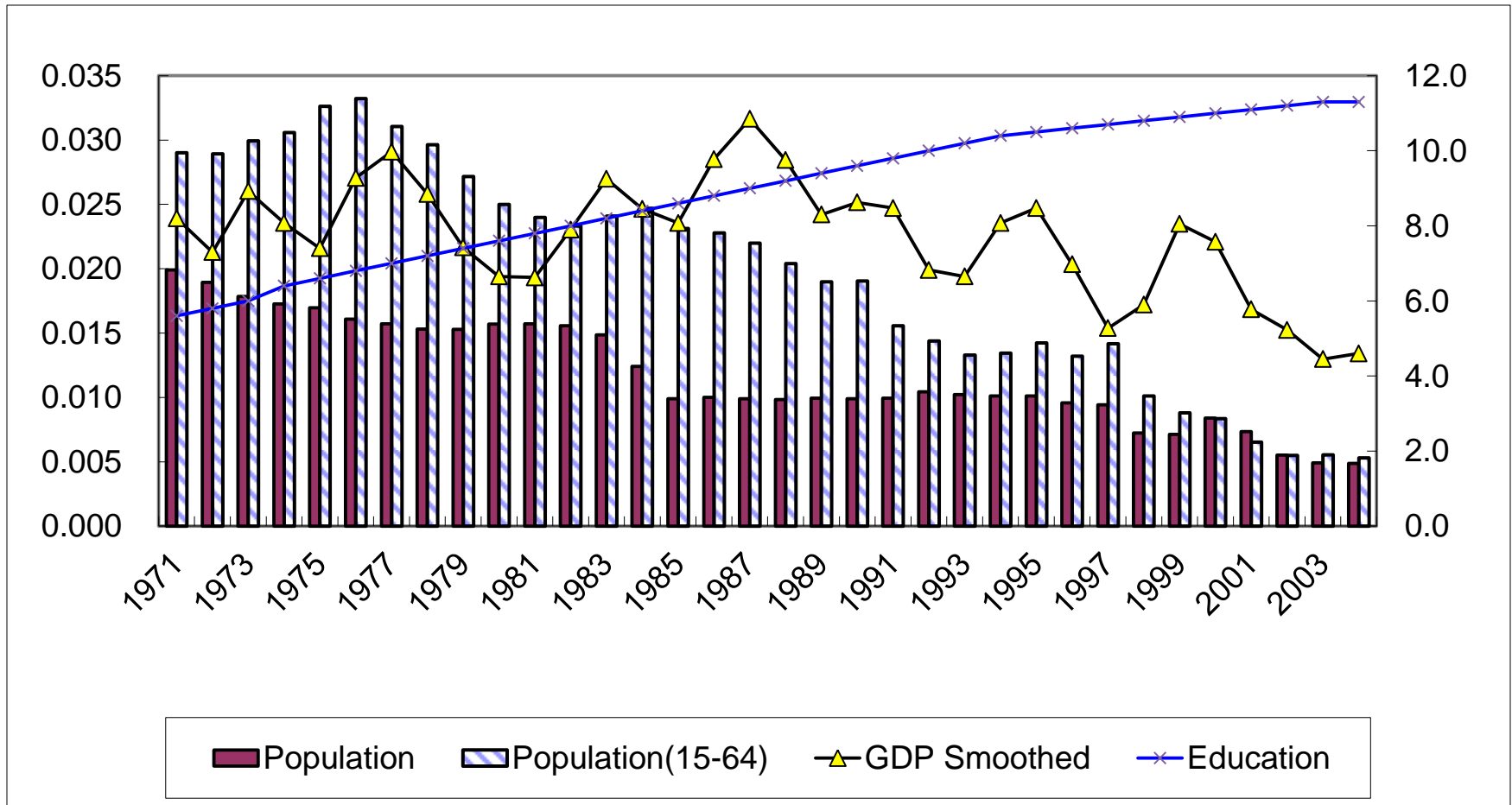


Figure 2. Population and Economic Growth Rates: 1971-2003 (Korea)



From Demographic Dividend to Demographic Deficit?

- We can see that
 - GDP growth rate moves more in parallel with the growth rate of the productive population than of the total population.
- The two trend lines (i.e., growth rate of the productive population and of GDP) have about a 10-year time lag:
 - the former was peaked in 1977 (at 3.3%) and then decreased, while the latter was peaked in 1987 (at about 11.0%) and then decreased thereafter.
- Particularly interesting and noteworthy is
 - the parallel trend in the decreasing growth rates of the productive population and the GDP since the late-1980s.

A Century of Demographic Transition

- During the same time period, the educational level of the population had linearly increased from less than 6.0 years to almost 12 years.
- In sum, population growth and changing age structure as a result of the demographic transition seem to have successfully worked as a population dividend to spur economic growth in Korea during the 2nd half of the 20th century.
- The entire demographic transition process in Korea, including ageing stage, can be divided into 4 major periods: (1) early transition period (1955-1985), (2) late transition period (1985-2000); (3) early ageing period (2000-2020), and (4) mature ageing period (2020-2050)

| Early Demographic Transition | Late demographic transition | Early ageing period | Mature ageing period |
|------------------------------|-----------------------------|---------------------|----------------------|
| 1955-1985 | 1985-2000 | 2000-2020 | 2020-2050 |

[Baby-boom Generation]

- Through the whole process of the demographic transition,
 - the baby-boom generation has been a major ‘momentum’ or deriving power for demographic transition, economic growth, and social change.
- Born at the onset of the first demographic transition
 - they grew up to become a young and growing labor force, which, in turn, contributed to a ‘miracle’ economic growth during the latter part of the 20th century.

1-3. Population Ageing and Productivity

- Population Ageing: Participation, Dependency, and ‘Capital Deepening’ effects
- Conventional neoclassical growth model predicts
 - a negative “participation effect” on aggregate output,
 - a negative “dependency effect” on output per capita
 - an increase in output per worker – *i.e., in labor productivity* – through “*capital deepening*”
- There is more capital per worker (capital deepening effect) than with a higher rate of labor-force growth, and labor productivity increases
 - In terms of aggregate output, however, the negative participation effect of slower growth of the labor force always dominates the (second-order) effect of capital deepening

[Population and Economic Growth Model]

- Population Change and Economic Growth (Solow, 1956; Swan, 1956)
 - Solow, R.M. (1956), “A Contribution to the Theory of Economic Growth”, *Quarterly Journal of Economics* 70, 65–94.
- Classic Production Function
 - Capital(K), Labor(L) and Total Factor Productivity(A) are the main components.

$$Y_t = \underline{A}_t K_t^\alpha (L_t^e)^{1-\alpha}$$

- Population ageing (and consequent decreasing labor force)
 - could affect not only labor input(L) but also capital deepening(K) and total factor productivity(A) on the societal level.

- Conventional neoclassical growth model predicts
 - a negative “participation effect” on aggregate output,
 - a negative “dependency effect” on output per capita
 - an increase in output per worker – *i.e., in labor productivity – through “capital deepening”*
- During demographic transition (population ageing) period,
 - there is more capital per worker (Capital Deepening) than with a higher rate of labor-force growth, and labor productivity increases.
- However, the negative participation effect
 - (of slower growth of the labor force) always dominates the (second-order) effect of capital deepening

Brandner and Dowrick (1994)

- They find that the capital-deepening effect is weak and insignificant and find a much stronger impact of the working age share of population which is both positive and significant.
- Yet, the most important source of variation in output and growth appears to be a productivity indicator taken to reflect the current stage of technological progress in each country.
- Brandner, J.A. and S. Dowrick (1994), “The Role of Fertility and Population in Economic Growth: Empirical Results from Aggregate Cross-National Data”, *Journal of Population Economics* 7, 1–25

2-1. Definition of Productivity

- Productivity :
 - defined and measured at the aggregate (economy-wide), firm or individual level and these are different concepts
- Labor productivity :
 - the amount of goods and services that a laborer produces in a given amount of time.
- The [OECD](#)(2002) defines it as
 - "the ratio of a volume measure of output to a volume measure of input"
Volume measures of output are normally [gross domestic product](#) (GDP) or [gross value added](#) (GVA), expressed at constant prices i.e. adjusted for [inflation](#)

2-2. Individual Productivity

- Productivity
 - is a system attribute and individual productivity cannot be separated from its social context(Thomas Lindh)
- Productivity
 - is multidimensional and age affects various skills differently
- the outcome of a complex interaction with other workers and other factors of production
 - which takes place within a certain economic environment constituted by the available technology, public infrastructure, characteristics of a given firm and sector, and many other things beside.

Individual Productivity (cont.)

- The productivity effects of ageing
 - depend on the extent to which age-induced changes in cognitive and non-cognitive abilities are relevant for work performance.
- The structure of work has changed a lot
 - therefore the relationship between age and productivity is also changing.
- Productivity at work is monotonously decreasing with age
 - but this decline in productivity can be compensated if workers remain in the same plant and accumulate job-specific experience.

Is Labor Productivity Age-dependent?

- If labor-productivity is age dependent,
- Then, a shift in the age structure will also bring about a change in aggregate productivity - even if age-specific productivity were to remain constant
- But reliable data on age-productivity not easily available nor accessible

Empirical Research: on Ageing and Productivity

- *Pekka Ilmakunnas (Helsinki School of Economics, Finland) et al (2003)*
- They conclude that individual productivity deteriorates if no investments are made to keep human capital up-to-date.
- The decline of productivity with age is partly endogenous and subject to policy influence.
- The main lesson: labor market behavior is more important than demographic changes.

3-1. Two Dimensions of Population Ageing

- Two Forces of Demographics: (1) Increasing Life expectancy, (2) Declining Fertility
- **Increasing Life-Expectancy**: + effect on labor supply; - effect on social security thru. Increasing old-age dependency
- **Declining Fertility**: - factor for labor force growth; - effect on productivity (if age – productivity correlates negatively)
- Population Ageing is an outcome of the Two Forces -> the Net impact is open, undetermined
 - Which force is dominating?

3-2. Population Decrease: **Size or Rate?**

- Population ageing could proceed without a significant decrease in the absolute size of the population and the labor force
 - Ex) ROK => would become ‘aged society’ by around 2020, while her population and labor force will be still growing by then (Taiwan, about the same)
- More critical is Rate!
 - decreasing rate of growth (population or labor force), more closely related to economic growth
 - Esp. the proportion of the economically active population (15-64)

3-3. Definition of the ‘Old-aged’: who are the ‘old-aged’ anyway?

- Varies by country and between population and labor statistics
- 65+ in most population statistics
- 50+ or 55+ in labor statistics of many countries
- As the human life-expectancy ever increasing, we may need to redefine ‘the old-aged’ in the near future
 - Many European countries: plan to raise up their pensionable age (65 -> 67 -> 70?)
 - Improvement of health => biological age becoming younger
 - Social recognition of ‘being old’ => 70+ in social surveys

3-4. Does Population Ageing Matter?

1. Yes – negative impact of ageing population on labor market and economy
2. No – positive impact of ageing population
3. Depends – could be either negative or positive depending on the context, institution and responses
4. Not sure – wait to be seen

3-5. Population Ageing and Productivity

- Does population ageing lead to lower or higher productivity growth?
 - High growth rate in the 20th century – demographic dividend – and much lower growth rate in the 21st century – demographic deficit?
- The impact of population ageing on productivity
 - is conceived and discussed at both micro- and macro-level.
- At micro-level,
 - the central issue is how ageing affects labor productivity, at macro-level, how population ageing affects aggregate productivity is the main concern.
- Ageing population could affect economic output
 - not only through changes in labor productivity but also through total factor productivity which hinges more on the social organization of production and innovation.

(1) Pessimistic View

- Population ageing has negative effects on economic growth through a set of inter-related mechanisms:

(1) decreasing labor input

- due to low population growth and ageing;

(2) decreasing savings rate and capital accumulation

- due to increasing dependency ratio and social cost of caring the old-aged;

(3) decreasing investment into the human capital

- of the young generation due to increasing social welfare cost

(4) lower level of innovation and renovation

- due to ageing population

* (Bloom et al, 2002; Borsch-Supan, 2002; OECD, 1998; World Bank, 1994)

Ex: Researchers on Korea

- Many researchers (Choi and others, 2003; Kim, D. S., 2004; Lee, 2001) in Korea put out **negative scenarios**.
- Labor input was one of the most important source of fast economic growth in the Korean past history
- Extremely low fertility -> decreasing growth of productive population -> low growth of labor input
- It is predicted the **potential economic growth** rate will be down from 8.8% (2000) to 4.1% (2010) -> 3.1% (2020) -> 2.2% (2030) -> 1.3% (2040) -> 1.0% (2050)

(ref) Pessimistic

- Bloom, D. e., D. Canning, and J. Sevilla (2002). *The Demographic Dividend: A New Perspective on the Economic Consequences of Population Change*. RAND.
- Borsch-Supan, A. (2002). *Labor market effects of population ageing*. Discussion Paper 11-2002, Mannheim Institute of the Economics of Ageing.
- OECD (1998). *Work force ageing: consequences and policy responses*. Working paper AWP 4.1.
- World Bank (1994). *Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth*. Oxford, Oxford University Press.

(2) Optimistic View

- On the positive side, in contrast, scholars point out the positive effects of population ageing on economic growth such as

(1) development of labor-saving technology and

(2) increased investment into human capital

- which will compensate for the lost growth rate

- **If labor will become a scarce resource** → wage will rise → capital will increasingly substitute for labor,
 - i.e., **capital intensity** will rise and with it **labor productivity**

* Cutler and others(1990): decreasing labor force growth results in increasing labor productivity (cross-national panel study)

Some Macroeconomic Effects of Population Aging on Productivity Growth and Living Standards (Scarth, 2007)

- Lower population growth is not always bad!
- Lower population growth frees up a larger proportion of each year's output to be used for current consumption instead of accumulating capital
- This freeing up permits higher living standards, and acts as a partial counter-balance for the depressing effect that stems from the higher dependency ratio

(ref) Optimistic

- Gee, E. M. (2000), “Population and Politics: Voodoo Demography, Population Ageing and Social Policy,”
 - In *The Overselling of Population Ageing: Apocalyptic Demography, Intergenerational Challenges, and Social Policy*. E. M. Gee and G. M. Gutman, eds. Oxford: Oxford University Press
- Scarth, W. (2002). Population Ageing, Productivity and Living Standards.
 - In *The Review of Economic Performance and Social Progress: Towards a Social Understanding of Productivity*, A. Sharpe, F. St-Hilaire, and K. Banting, eds. Montreal: IRPP.
- Cutler, D. M., J. M. Poterba, L. M. Sheiner, L. H. Summers (1990). An Ageing Society: Opportunity or Challenge?
 - *Brookings Papers on Economic Activity*. ABI/INFORM Global.

Multiple Factors need to be considered !

- In projecting
 - the impact of population ageing on economic growth,
 - multiple factors should be taken into account in a more complicated way than is the case in many past studies
- Depending on
 - (1)how future fertility changes are assumed, (2)how labor quality changes are predicted, (3)how participation (economic, labor force) pattern and rates are predicted, and (4)how total factor productivity is estimated,
- the projection result could be wildly different

4-1. Quantity vs. Quality of the Labor Force

- But what is missing in these general perspectives
 - is the quality of the labor force as a critical variable.
- the impact of population ageing on economic growth
 - could be discussed in a balanced manner only when both side of labor input – i.e., quantity and quality – is properly considered
 - (Borsch-Supan, 2003; Skirbekk, 2004).
- Moreover if labor force decrease due to population ageing should be an unavoidable fate in the future,
 - then, policy efforts should be focused more on improving the quality than on the quantity of labor force (Cutler and others(1990))

4-2. Variables and Assumptions

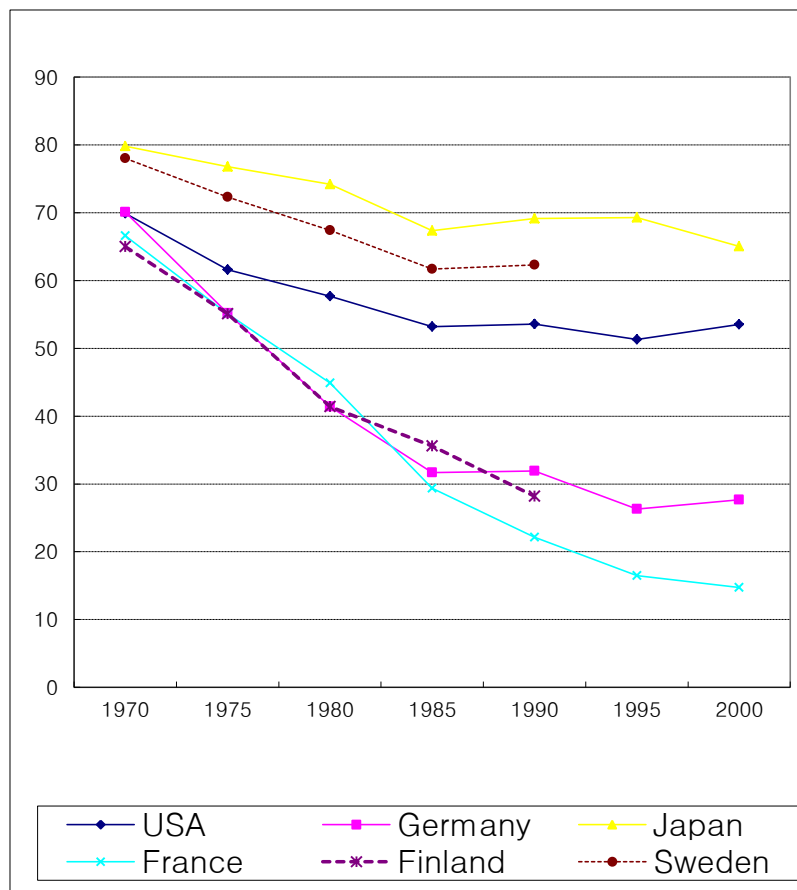
- Labor **Quantity**: future **Fertility** assumptions: U.N. vs. Respective country
- Labor **Quality (Productivity)** changes: esp. investment in education and job training
- Labor Force Participation (**LFP**) variable: Pattern and Rates (esp. female, old-aged, youth)
- Technology and Skill Development: Total Factor Productivity (**TFP**)
- Physical **Capital**: Savings and Investment

4-3. Critical Variable(1): Participation

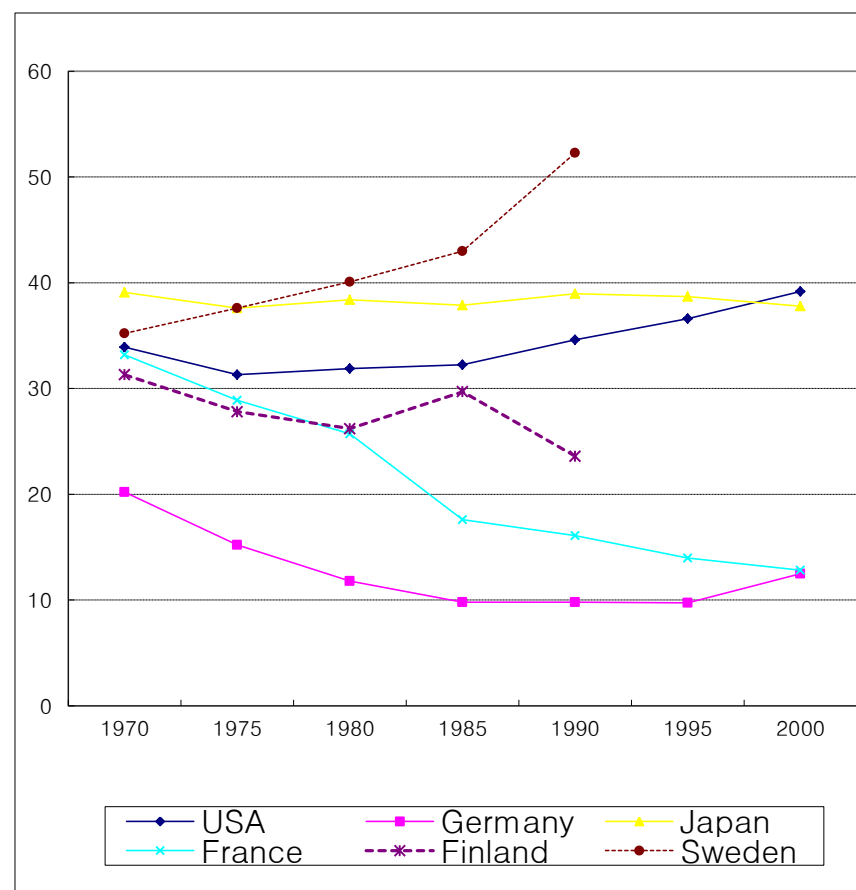
- Especially for female non-active population and the old-aged (early retirees)
- Negative size effect of population ageing on economic growth could be compensated by increasing labor force participation rates
- Policy Intervention and Initiatives - make difference

Figure 3. Labor Force Participation of the Old-aged: International Trends

Male (60-64)



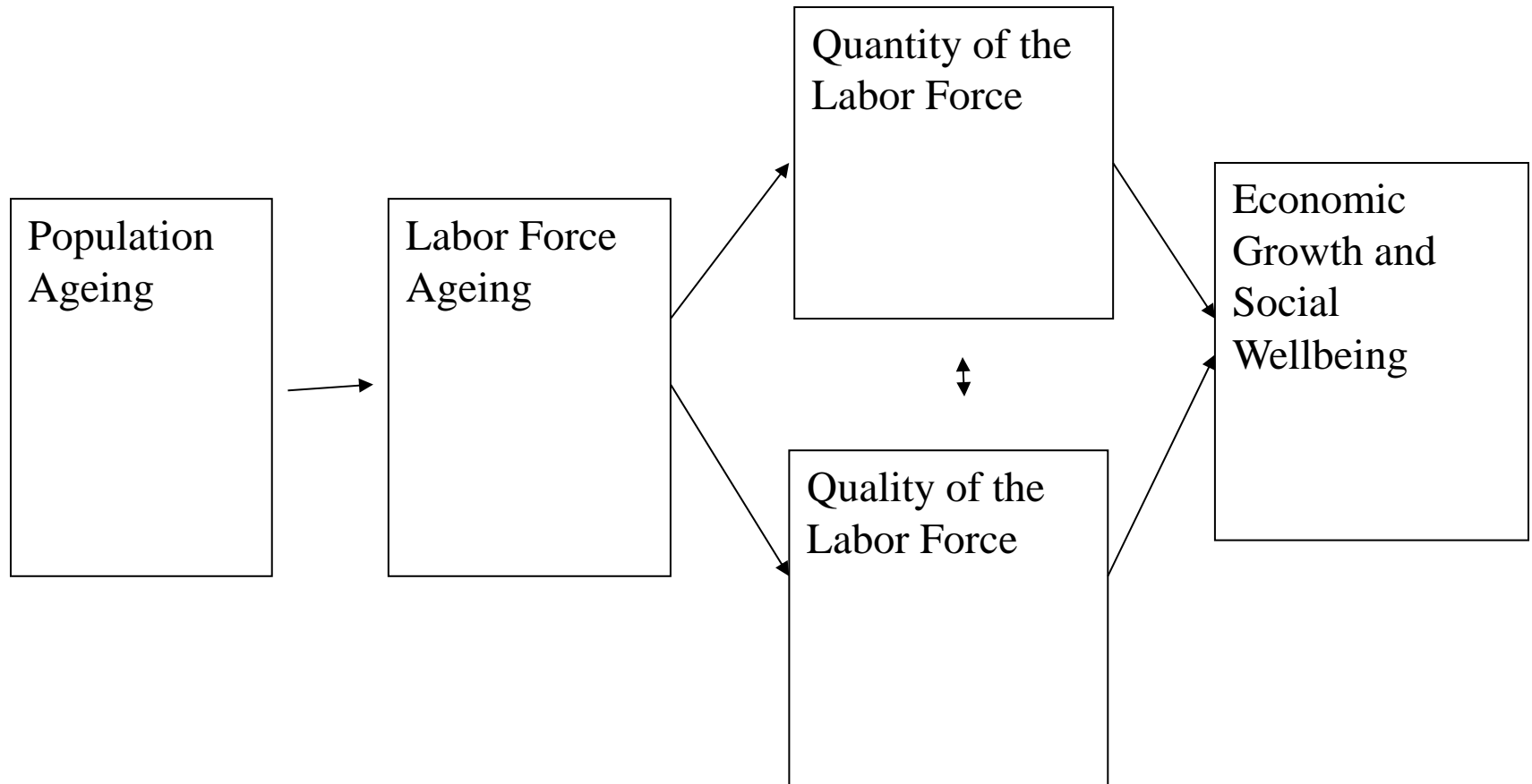
Female (60-64)



4-4. Critical Variable(2): Labor Productivity

- **the productivity of the labor force**
 - one of **the fundamental measures** against the adverse effects of ageing population and shrinking labor force will be improving
- **Increasing labor productivity is**
 - recommended as an effective policy alternative to solve for the problem of labor shortage and stagnant economic growth
 - “If consistent growth in labor productivity and increasing labor force participation among women could be achieved in coming decades, then, the negative effect of population ageing could be much mitigated” (Cho, 2000).

[Figure 4] The Impact Path of Population Ageing on Economic Growth



5. Policy Responses and Initiatives

- Quantity Issue:
 - How to boost up LFP of each stratum of work force
- Quality Issue:
 - How to boost up the Productivity of the participating labor force
- Reform Issue:
 - Education and Job Training system, Labor market institutions and industrial relations, social security (esp. pension) system
 - Social institutions and culture

Policy Initiatives Needed

- Increasing labor productivity by promoting investment in human capital and education
 - Upgrading the Quality of Input (i.e., productivity), more effective, than Increasing the Quantity of Factor Input
 - Reforming higher education system and positively investing in R&D needed
- Promoting sectoral labor mobility
 - (changing age-structure -> changes in consumption behavior and industrial change)
- “Capital Deepening” effect of Population Ageing will depend on social security system (contributions and benefits) and social policy
 - Need to reduce the contribution and tax burden by social security reform