Socioeconomic Impacts of Demographic Change

Edited by

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KIHASA Korea Institute for Health and Social Affairs

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Foreword

Byongho Tchoe
President, Korea Institute for Health and Social Affairs

From the late 20th-century on, East Asian countries have undergone demographic transitions much more rapid than those in European countries. The East Asian demographic transitions, involving low birth rates and low mortality rates, have led to the rapid ageing of population. The demographic change may in turn bring about labor shortage and a fall in consumer demand, leading to decreases in jobs, a slowdown in growth, and economic recession, while increasing the demand for social security and health care.

Many countries in Europe and North America have long made efforts to cope with population change, depopulation and population aging. Some of these countries are considered to have succeeded in raising their fertility rates and others are not. In recent years, Korea has also made efforts to raise its fertility rate, which had remained below 1.3 for more than 10 years, and to prepare for further aging of the population. If such efforts are to succeed, they need to be based on theoretical and empirical evidence.

A number of experts were brought together for the Fourth East West Center (EWC)-Korea Institute for Health and Social Affairs (KIHASA) Joint Conference to discuss emerging population issues in Asia and the Pacific region. Held during June 16~19, 2013 at the East-West Center, Hawaii, under the theme of "Socioeconomic Impacts of Demographic Change," the Joint Conference provided an important opportunity to delve into what we have to do for a sustainable future in times of rapid population change.

The participants of the conference presented a total of 11 papers. "Sustainable Society in the Era of Centenarians" proposed a paradigm shift for longevity increases and labor shortage. Three

papers that followed were devoted to discussing demographic changes, forecasting fertility level trends, measuring the contributions of each of demographic components, and estimating the optimum population in harmony with economic growth and welfare. These were, in order, "A Qualitative Understanding of Future Drivers of Fertility in Pacific Asia," "Contributions of Demographic Factors to Future Population Change," and "Estimation of Optimal Population in Korea.

Four papers dealt with old-age income security. Their titles are: "Bridge-job is a "must" in Response to Insufficient Retirement Income Protection in Korea"; "Japan's Pension Reform, Labor Market Responses, and Savings"; "Intergenerational Transfers in China," and "Support System over the Lifecycle in Korea: the Role of Intergenerational Transfers."

Three presenters discussed ways of helping people lead a healthier and better life in an aging society, with their papers entitled "Immigrant Heterogeneity and Mental Health among Asian and Latino Immigrants," "Changes in Disease Patterns and Health Expenditure in Korea," and "Self-Stated Reasons for Suicidal Ideation among Youth: Different Predictors?"

The papers were deemed policy-relevant and, therefore, worthy of publication for a wider audience of experts and policy-makers.

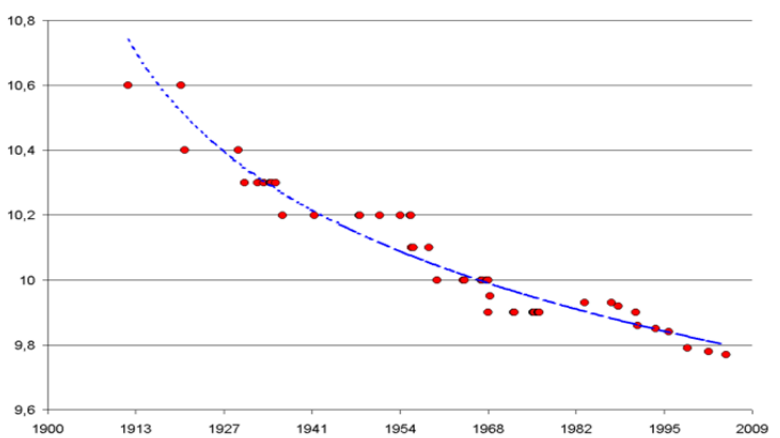
We extend sincere appreciation to EWC and KIHASA for their efforts in this important project. Our thanks go also to the presenters, discussants and participants. We are profoundly grateful to Dr. Minja Kim Choe of EWC and Dr. Samsik Lee of KIHASA for their contribution to the making of this volume.

Sustainable Society in the Era of Centenarians

Byongho Tchoe
President, Korea Institute for Health and Social Affairs, Seoul, Korea

The official world record for the men's 100-meters in 1912 was 10.6 seconds, set by American sprinter named Donald Lippincott. It took 56 years since then for the world to see American Jim Hines become the first man ever to run the 100 meters under 10 seconds in 1968. Of course, there is this great Jamaican, Usain Bolt, who set in 2009 a new world record, one as yet unbroken, of 9.58 seconds. That's a reduction of 1 second in a little shy of 100 years. However slight it may sound, anyone who has run the 100 meters must know that cutting 1 second off in the race is a feat next to impossible. But records are there to be broken, and the history of record-breaking achievements goes on, pushing the envelope of what we thought the human race was capable of doing.

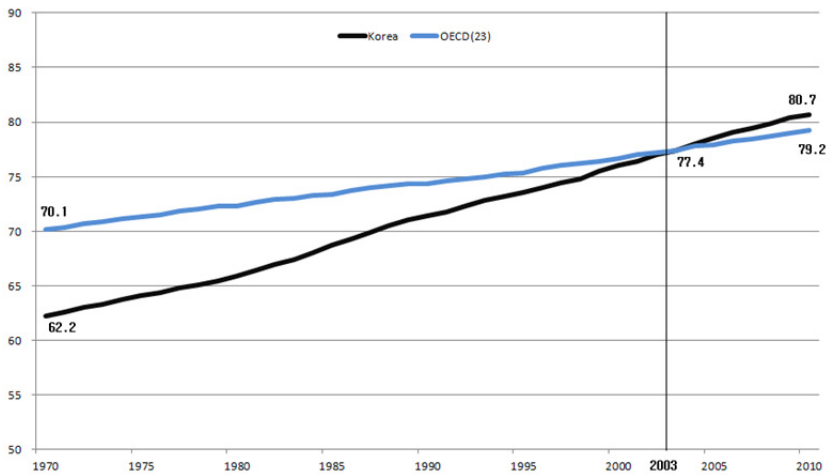
Figure 1. World record for men's 100-meters



Source: Wikimedia Commons

If running a 100-meter race is about running it in a shortest possible time, the race of longevity is about extending the time we live. Among the foremost in this race is Korea. The average life expectancy in Korea increased at a remarkable pace, from 53 years in 1960 to 60 years in 1969, to 70 years in 1988, to 80 years in 2009 and to 81 years in 2011. If the current trend is something to go by, it will be a matter of time before Korea's average life expectancy will overtake Japan's, which is the longest in the world at 83 years.

Figure 2. Korea's life expectancy in contraposition with the OECD average



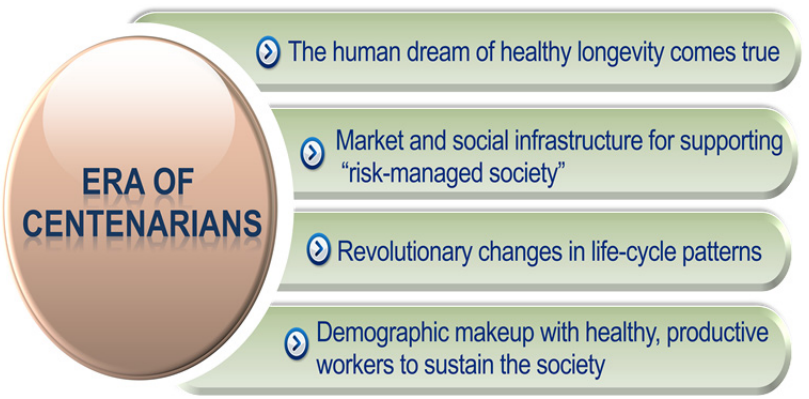
Source: OECD STAT

Today the actuarial life expectancy does not mean much to older workers. When someone of the Korean baby boomer generation is reminded of his nearing retirement, his response would likely be something in the line of "But I'm too young to be taken out of the labor force." In barely 18 years between 1990 and 2008, life expectancy at 65 for Korean women gained from 16.3 years to 21.0 years and for Korean men from 12.4 years to 16.6 years. He would be in denial about his age, thinking that, given the advancement of

healthcare and medical technologies, shooting for 100 is by no means unreasonable.

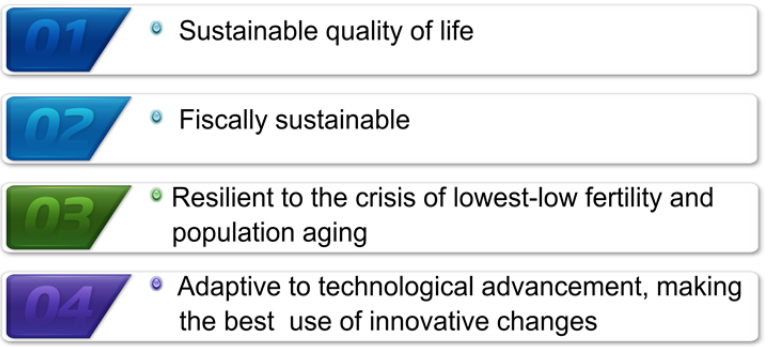
What does the upcoming era of centenarians mean? What will it involve? Firstly, it means that we are closer than ever to what the human race has always dreamed of. Secondly, healthy longevity should be undergirded by the right economic and social infrastructures with which to help people enjoy the benefits of culture, promote healthy lifestyle, have access to innovative medical services, and reduce their stress levels. In short, it's a risk-managed society. Thirdly, with increases in longevity, there should and will be tectonic changes in the segments of our life course—which we devote to education, work and retirement, respectively. Fourthly, the era of centenarians will need a large cohort of healthy, productive workers to sustain the population as a whole.

Figure 3. What does the era of centenarians signify?



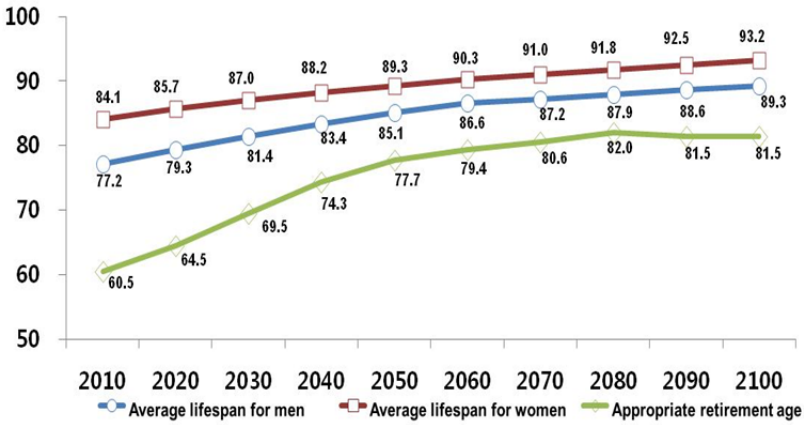
A sustainable society must be financially sustainable, as it has to sustain the quality of people's lives. It should be flexible and capable enough to be able to respond to large-scale risks posed by such crises as lowest low fertility and population aging. In addition, a sustainable society must be seen conjunction with technological advancement and innovation.

Figure 4. What is sustainable society?



Now, I will close by suggesting a new segmentation of life course that I see fit for the era of centenarians. In the time of a life expectancy of 80 years, retirement at the age of 60 was entirely reasonable. First 25 years were spent for education, the following 35 years for work and the last 20 years in retirement. This is how a life course of 80 years is segmented.

Figure 5. Appropriate retirement age for sustainable society in the era of centenarians



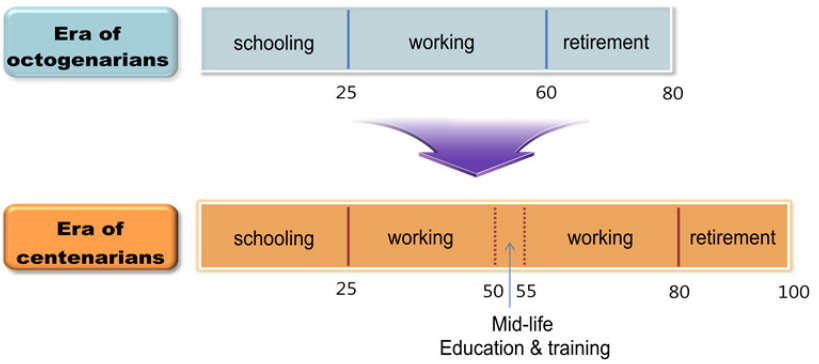
Note: 1. Life expectancy estimated by Korea Statistics

2. Appropriate retirement age ARA is such that

(population aged between 25 and ARA / (Population older than ARG) = 1/4

I suggest that we spend more years working after the first 25 years of formation and education, say, until the age of 80. Here, the middle segment of 55 years will need to include 5 years of mid-life training and education.

Figure 6. New segmentation of life course in the era of centenarians



A Qualitative Understanding of Future Drivers of Fertility in Pacific Asia

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Introduction

The ongoing transition to low fertility is, alongside the long-term expansion of life expectancy, the key force reshaping populations around the world. It has sweeping economic and social repercussions as it affects labour markets, intergenerational ties, gender relations, and public policies. Many middle income countries including China, Brazil, Iran, and Turkey have joined the expanding list of low fertility countries. Consequently, low fertility is no longer an exclusive feature of rich Western societies. As close to half of the global population now live in regions with below replacement fertility (Wilson and Pison 2004), low fertility has become a truly global phenomenon.

Fertility decline in Pacific Asia

Fertility decline in Asia began in the late 1940s in Japan where the TFR dropped from 4.5 in 1947 to 2.0 in 1957. It continued a slow decline to 1.5 in 1994 and 1.3 in 2002 (Retherford and Ogawa 2006). Fertility was high in Singapore, South Korea, and Taiwan in 1960 with TFRs of around 6.0, but declined rapidly in the 1970s and 1980s (Tsuya et al. 2009). In Singapore, fertility dropped to replacement level by 1975, to below 1.5 in 1998 and to below 1.3 in 2003 (Yap 2009). TFR in South Korea and Taiwan reached below replacement level about a decade later than in Singapore, in 1983 and 1984

respectively. The decline then proceeded rapidly reaching below 1.5 in the next 15 years, at about the same time as Singapore (Choe and Park 2006; Tsuya et al. 2009; Yap 2009). The total fertility rate in these four countries dipped below 1.3 in the early 2000s. Since then TFR in Japan climbed slightly to 1.4 in 2010 but it remained at ultra-low level in other countries, reaching 1.2 in Singapore and South Korea and 0.9 in Taiwan (statistical offices, various countries and years). Indeed, national statistical offices in the region assume that fertility in the region will stay very low (Basten 2013a).

Rapid economic development, increasing level of education among women leading to increasing labour force participation and effective national family planning programs initiated in the 1960s (excluding Japan) are considered to be major forces behind the rapid fertility decline in all of these countries (Choe 2006; Tsuya et al. 2009; McDonald 2009; Yap 2009). Fertility declines in recent decades are mostly due to delayed onset of childbearing, resulting in part from increasing age at first marriage combined with still low levels of non-marital births (Frejka et al. 2010; Jones 2007; Rindfuss et al. 2010). Persistent gender inequality marked by limited involvement of men in household work and childrearing have contributed to these trends (see Box 1).

Box 1: Living arrangements, gender roles, and their relationship to fertility in Pacific Asia

Current family behaviour including marriage, childbearing, gender roles, and living arrangements in Japan, China, South Korea, Singapore, and Taiwan reflect both the influence of the Confucian family tradition and the rapid economic and social changes of the second half of the 20th century.

The family system based on Confucian ideals emphasises proper roles and relationships based on gender, generation, and age. The basic purpose and function of the family was preservation of lineage and prosperity. Under a family system based on patrilineal descent, the most important obligation of a person was to marry and produce a son. Marriage was mandatory, and early marriage was common. Co-residence with parents was the norm for

both men and women until marriage, and for the eldest sons even after marriage. A woman's position in a family changed drastically from being a daughter to being a daughter-in-law with low status upon marriage; however a married woman attained a high status within the family by bearing and rearing a son (Choe 2006; Choi 1970; Tsuya et al. 1991).

Meiji restoration in Japan in the 19th century and the establishment of republics in other Pacific Asian countries in the twentieth-century provided the legal basis for equal rights for women. It took until the second half of the 20th century, however, for substantial changes in family behaviour and gender roles to occur, in tandem with rising levels of education for women, rapid economic growth, urbanization, and greater geographic mobility. Now, women and men are marrying at increasingly later ages, and the proportion of people who never marry is increasing (Jones 2007). Typical family size has decreased to two or fewer children and it has become less common for grown children to reside with their parents. Most women work outside home before marriage, and a substantial proportion continue to work after marriage and having children.

However, the persistence of traditional norms in Pacific Asian countries has resulted in patterns of family behaviour different from those experienced in the West. The strong patrilineal and patriarchal family traditions, for example, have kept out-of-wedlock childbearing at very low levels (Bumpass et al. 2004; Bumpass et al. 2009; Jones 2007), with the civil code in Japan requiring registration of a birth of a child in his/her father's family registry. In South Korea, the family law was changed in 2005, abolishing the household headship system and making birth registration a stand-alone document. However, it is not yet possible to see whether this has had a large effect on the attitude and behaviour of the general public. A child whose father is unidentified experiences serious social stigma. The divorce rate was low until the 1990s. Although women, including married women, are participating in paid employment at increasingly higher levels, men rarely take on domestic roles (McDonald 2009; Rindfuss 2004; Tsuya et al. 2005). In addition, long-standing preferences for boys combined with very low fertility and the spread of sex-selective abortion led to an emergence of distorted sex ratios at birth on China, Korea, and Taiwan. Finally, participation in housework and childcare responsibilities has remained persistently low among Asian men, which some scholars have suggested plays a role in discouraging

partnership formation and childbearing for (increasingly better educated) women (Ishii-Kuntz et al. 2004).

The importance of having a son while fertility levels were falling to below replacement level, combined with modern medical technology that allowed parents to identify the sex of fetus, and easy access to induced abortions produced an unusually high sex ratio at birth in South Korea, Taiwan, and Singapore before the preference began to weaken. In contrast, fertility behaviour in Japan is not associated with son preference (Chung and Gupta 2007; Park and Cho 1995).

In Japan, South Korea, Taiwan, and Singapore, higher education for men is associated with higher probability of marrying, but also results in a slower pace of marriage. Among women, higher education is associated with lower probability of ever marrying and slower pace of marriage. As a result, a large proportion of men with low levels of education and women with high levels of education remain unmarried into their late 30s. [1] Education differentials in marriage notwithstanding, fertility decline proceeded almost simultaneously in most social groups. Especially in South Korea there was a remarkable convergence in fertility by education, indicating that rising education level contributed only a little to the observed fertility decline (Yoo 2013). At the same time, Andersson and Kohler (2012) argued that under competitive conditions typical for Pacific Asia, the desire of parents to provide their children with top education makes children very costly in terms of both time and money. This "education fever" constitutes an important force behind very low fertility in the region.

China

While a notable fertility reduction had already been observed in some Chinese cities in the 1950s and 1960s (Lavely and Freedman 1990),

[1] Since the late 1990s new marriage behaviour has emerged in Taiwan, Singapore, and South Korea where men, especially with lower levels of education, are incr easingly marrying foreign-born women (Kim 2007).

nationwide fertility decline did not begin until the early 1970s under the 'later, longer, fewer' family planning policy. During that decade, China's TFR fell from about 6.0 to about 2.5 children per woman. In the 1980s, following the enactment of more proscriptive family planning regulations, the TFR fluctuated between 2.3 and 2.9 (Yao 1995). These fluctuations were largely observed in period TFR, whereas cohort fertility continued to decline during this period (Guo 2008; Zhao and Guo 2010). China's fertility recorded another sharp reduction in the early 1990s when the TFR fell to below replacement. Since then it declined further to around 1.6 in 2000. While many studies have suggested that China's fertility has remained that low or fallen to a lower level in the first decade of the 21st century (Cai 2008 and 2010; Guo 2009; Retherford *et al*. 2005; Scharping 2005; Zhao and Zhang 2010; Zheng *et al*. 2009), there is some controversy over the 'true' fertility rates of China. This confusion arises partly from the fact that China's demographic data were often collected by different government departments for different purposes, which resulted in some inconsistencies. In addition, the sharp fertility reduction in the early 1990s was not expected at the time, which led government officials and researchers to believe that the reported low fertility was caused by serious under-registration (Zeng 1996). Morgan et al (2009) estimate that the 1976–80 birth cohorts will reach fertility well below replacement threshold and will have about 1.7 births per woman.

China's unique history of family planning regulations has undoubtedly impacted its recent demographic history. The *later, longer, fewer* family planning programme played a major part in driving down fertility in the 1970s. However, recently some scholars have argued that the macro-level effect of the restrictive 'one-child policy', introduced in 1978 and applied in 1979 has been overstated (Cai 2010). Firstly, the policy was not universally implemented, with many exceptions made for rural areas, ethnic minorities, or couples with a daughter. Indeed, Gu et al (2007) show that in the late 1990s 11 percent of couples were allowed to have two or three children and as many as 54 percent were allowed a second child if their only child

was a girl.[2] Second, the fertility decline seen in much of China echoes that seen elsewhere in much of Pacific Asia. As such, economic and social development can be argued to be a major driver as much as policy (Wang et al. 2013). Despite this, there is currently a significant policy debate regarding ending or at least reforming the family planning restrictions.

In Pacific Asia and in China in particular, growing evidence suggests a deviation from the two-child norm prevalent in Europe and North America. In China, 2001 national data suggest a mean desired number of children among married women aged 20-29 of 1.50 for urban areas and 1.75 for rural women (Zhang 2004). A number of surveys in both urban and rural settings have reported ideal family sizes well below 1.84 (Basten 2010, Basten et al. 2013, Hou 2010). In Taiwan and Hong Kong, surveys of young people indicate levels similar to China, of around 1.5-1.7 (Basten 2013b). This suggests that while it has been argued that deliberate under-reporting in fertility ideals is widespread in China, the similarities to Hong Kong and Taiwan are indicative of the possibility of such low ideals being 'genuine' in China.

China's fertility is likely to stay at current low levels—or decline further—even if family planning restrictions are relaxed (Zheng et al. 2009). Like many other populations in Pacific Asia, China is experiencing a significant change in its reproductive culture. China's traditional marriage patterns are going through a great transition, with age at marriage and proportion remaining single having increased and likely to increase further. Divorces, sex outside marriage, and same sex partnering are likely to become ever more acceptable (Wang and Zhou 2010). These changes are likely to spread from urban to rural areas. All of these factors could lower fertility, although some of the

[2] This has not prevented, however, the spread of sex-selective abortion, leading to skewed sex ratios at birth (SRB, males per hundred females), estimated at around 120 in 2005-7 (Gupta et al. 2009: Figure 1). Mini-census data for 2005 show that in 5 out of 31 provinces there were over 125 males per 100 females born as of 2005, while only three provinces reported "normal" SRBs around 105 (Eberstadt 2011).

fertility declines may be caused by the temporary effect of rising age at childbearing.

When we look to the future, however, how can we discern the likely track of fertility rates? While most demographers as well as the global projection scenarios by the United Nations expect that fertility will continue declining in countries with currently higher fertility rates, there are many uncertainties about the future of fertility in the low fertility world. Some of these uncertainties have been addressed in the Wittgenstein Centre for Demography and Human Capital [WIC] global survey of population experts, which included a module on the future of fertility in low fertility countries and the main factors likely to drive these future trends. In this paper, therefore, we outline the *raison d'etre* for the Expert Survey, its design and evaluation, and present the results of the qualitative element of the survey—namely the subjective appraisal of a series of forces shaping future trends of fertility in Pacific Asia.

The Survey

The *Low Fertility Module* (LFM) of the survey sought to gather information regarding numeric estimates of future fertility as well as its underlying determinants in countries defined as having low fertility. For a full discussion of the selection procedure as well the list of countries involved, see Basten et al. 2013. Firstly, respondents were presented the baseline TFR estimate for 2010 as published by the Population Reference Bureau (PRB 2011) and asked to provide estimates for the TFR in 2030 and 2050 as well as an 80 percent confidence interval (CI) range (not presented here). Secondly, respondents were asked to assess the impact and validity of a series of qualitative statements regarding future drivers of fertility. Finally, respondents were asked whether they wished to reassess their initial TFR forecasts after performing the qualitative exercise. Experts could add additional countries or regions for which their assessment was valid as well as comment on the survey or on individual arguments.

In this section we outline the design and construction of the LFM, followed by a description of the characteristics of respondents. We then introduce the qualitative statements regarding likely drivers of future trends of fertility and analyse the responses for East Asia as a region in comparison with other global sites of low fertility; and then examine arguments by particular countries.

Survey design

The broad tenets and workings of the survey are outlined in Basten et al. 2013. Here we briefly outline the main concepts and how they have been adapted for use in this low fertility module.

Each module of the expert survey comprised of numerous arguments. These arguments took the form of a statement on future trends that might affect population dynamics. The statements were formulated in a neutral way, without explicitly referring to their likely consequence on fertility, mortality, or migration. It was deemed important not to give respondents preconceived judgments about the way diverse social, cultural, biomedical, health, policy and economic developments may affect population. For instance, one argument in the LFM of the survey reads: "Men and women will increasingly share the burden of housework and childcare".[3] Each argument is grouped into a series of forces.[4] These forces (and respective number of arguments) in the LFM were:

- Cultural and social forces in fertility ideals, norms, and desires (9)
- Partnerships, living arrangements and gender differences (9)
- Role of policies (9)
- Employment and economy (9)

[3] For a complete list of all of the arguments, please see Table 2 below

[4] The order of the arguments was randomised within the forces, and the order of the forces was also randomised in order to minimise any fatigue effect.

- Biomedical and timing of parenthood (7)
- Education (3)

For each argument, respondents were asked to gauge its expected future likelihood or validity and its impact pertaining to the year 2050. These are defined and interpreted as follows:

1. *Validity*, ranging from 0 to 1, gives an indication whether a given argument is likely to be true, based on five predefined response options and the validity score attached to them. The complete phrasing and response options are illustrated in the example below:

Module: Low fertility countries **Force:** Role of policies **Argument:** Government will take an increasingly pro-natalist stance (e.g. through communication campaigns and family policies)				
Based on your knowledge of the empirical evidence and the validity of the reasoning involved, and with reference to the selected country and the period up to 2050, do you think the above argument is:				
Very likely to be wrong (0.0)	More wrong than right (0.25)	Ambivalent (0.5)	More right than wrong (0.75)	Very likely to be right (1.0)

2. *Impact*, also called *conditional impact*, represents an assessment of the hypothetical influence of a given trend on fertility (mortality, migration). The predefined range was from -1 (strongly negative) to +1 (strongly positive). Specifically, the respondents were asked

Regardless of your answer above, if the above argument were completely true, what effect would this have on future levels of cohort fertility in *country*?				
Strongly decreasing (-1)	Moderately decreasing (-0.5)	None (0)	Moderately increasing (0.5)	Strongly increasing (1)

3. Finally, *validity* and *conditional* impact are assessed in combination to define a *net impact*. This was computed in two steps. Firstly, the validity score and conditional impact score were multiplied resulting in a net impact which is, by definition, smaller or equal to the conditional impact and can range from -1 (strongly negative) to +1 (strongly positive), with the results presented on-screen.[5] Subsequently, the experts were allowed to adjust the net impact so that it better reflected their expectations. Thus, we have frequently obtained two alternative measures of the net impact for each argument, one computed in a standardized fashion and the other adjusted by the respondent. We use the latter measure in our analyses and further computations as it better reflects respondents' views.

Mean likelihood, mean conditional impact, and mean net impact on fertility are calculated for each argument, with means computed globally, for regions and for selected countries. These are calculated as simple averages over all respondents from a given country or region. Alternative approaches, such as weighting responses of experts by the population size of their countries of expertise, were rejected as this could give disproportionately strong influence to experts from large countries with a very small expert base.

We then analysed experts' estimates pertaining to the future level of period Total Fertility Rates in 2030 and 2050. These mean values are computed for countries and regions, as well as globally. They differ from the indicators above in that they are weighted by population size of the countries in each region in order to better reflect expected regional and global fertility levels. Data pertaining to this element of the exercise are not presented here, but can be found in Basten et al. 2013. Finally, voluntary data regarding respondent's age, gender,

[5] A zero net impact is achieved either because the respondent considered the give n argument invalid („very likely to be wrong") or expected that the argument w ould have no impact on fertility. For the example above, the net impact would be calculated as 0.75*0.5=0.375.

country of origin and place/nature of work were collected as well as comments concerning either missing arguments or the structure of the survey. The survey as a whole was tested extensively in Vienna with an estimated completion time of about 20-30 minutes.

Respondents

Altogether, 184 questionnaires on the low-fertility module of the survey have been completed by more than 170 experts (some experts chose to make two or more assessments; 110 experts revealed their full names). Appendix 1 gives a full breakdown of the respondents' profiles. The vast majority come from an academic background. Altogether, for 14 countries five or more experts have provided assessments, with the United States by far the most popular country (22 assessments), followed by China (14 assessments), Italy (12), and Germany (9). A number of experts have assessed countries outside the traditional low-fertility regions of Europe, Northern America, Japan, Australia and New Zealand. Clearly, despite uneven coverage of some countries—with no expertise provided for France with a population of 64 million and 7 assessments for Sweden with a population of 9 million—the assessments mirror quite well the wide geographical spread of low fertility today, with particularly good coverage of China, Brazil, Japan, Mexico, Turkey, and Iran.

Regional Qualitative Findings

Regional differences in net impact of arguments

Table 1 shows the two arguments that respondents deemed to have the strongest positive and negative impact on future fertility trends for each individual region (for the full breakdown of arguments by region, please see Basten et al. 2013). Table 1 also shows the net impact of all forces combined for each region, i.e. the overall general direction in which the responses suggest fertility will go.

Regional variation concerning "Cultural and social forces in fertility ideals, norms, and desires", and "Partnerships, living arrangements and gender differences" was broadly similar, with respondents for Latin America reporting a strong association between these forces and future rates of fertility compared to Europeans (excluding Central and Eastern Europe), who felt these forces would contribute to either only a small decrease or, in the case of Western Europe, a very small increase. Interestingly, respondents for Japan stated that 'Partnerships, living arrangements and gender differences' was the force which would have the most depressing effect on future fertility—a feature that concurs with our discussion on gender roles in Box 2.

The role of policies was felt to have a potentially depressing effect upon fertility among respondents for North America, but a generally positive effect among respondents for Europe and Asia. We explore the causes of this contrast below. The net impact of employment and economy was generally small across the regions (with the exception of Mexico and Iran), with the opposing impacts of individual arguments largely cancelling out.[6] Biomedicine and the timing of parenthood was held to have a universally depressing effect on fertility across the regions, with Latin America [-0.90] and Western Europe [-0.18] as high- and low-impact extremes.

For Pacific Asia, the two arguments which were deemed (if true) to have the strongest positive effect on fertility were 'Work practices become more flexible' and 'Government will provide universal/kindergarten access'. Both of these clearly play into two key elements which have been described as playing a role in driving – and holding – down fertility in the region, namely poor work life balance and costs/availability of high quality childcare in the context of many women stating a strong desire to remain in the labour force.

[6] However, this small overall impact could also be due to the methodological issu e raised above about the question being based either on the force per se, or on the contributing arguments.

On the contrary, the two arguments which, if true, were deemed to have the strongest negative impact upon fertility were 'Delayed childbearing will become yet more common' and that it would be 'Harder to find the right partner to form a family'. The former is strongly linked to the higher age of childbearing and marriage, but is also linked in with the relatively early ages of marriage in much of China which many demographers envisage will increase sharply thus holding down period fertility rates. The latter argument, regarding the difficulty in finding the right partner is, we believe, intrinsically linked to the gender issue raised in Box 1 above – namely the lack of parity between the public sphere roles of females which have changed beyond recognition in the past three decades compared to their private sphere roles.

Table 1: Top two *arguments* deemed by respondents to have the strongest *mean net impact* on future trends of fertility, either positively or negatively

Region and net impact of all *forces* combined	Code	Abbreviated argument*	Mean net impact
Pacific Asia (-1.47)	**LF-4.4**	**Work practices become more flexible**	**+0.20**
	LF-3.3	**Government will provide universal nursery / kindergarten access**	**+0.19**
	LF-5.2	**Delayed childbearing will become yet more common**	**-0.30**
	LF-2.3	**Harder to find the right partner to form a family**	**-0.31**
North America (-2.20)	LF-4.4	Work practices become more flexible	+0.24
	LF-4.6	Immigration from high fertility countries will increase	+0.20
	LF-1.1	Voluntary childlessness is increasingly socially accepted	-0.32
	LF-4.7	Economic issues mean uncertain life-course planning	-0.32
Latin America (-4.55)	LF-4.6	Immigration from high fertility countries will increase	+0.15
	LF-3.7	Increased family-related policies by local governments & employers	+0.14
	LF-6.1	Ever more years of life enrolled in education	-0.41
	LF-2.4	Women will pursue lifestyles not compatible with motherhood	-0.46

Notes: *See Table 2 for full text of all arguments

Table 1(cont.): Top two *arguments* deemed by respondents to have the strongest *mean net impact* on future trends of fertility, either positively or negatively

Region and net impact of all *forces* combined	Code	Abbreviated argument*	Mean net impact
Middle East (-1.86)	LF-3.2	Government will take an increasingly pro-natalist stance	+0.17
	LF-4.6	Immigration from high fertility countries will increase	+0.13
	LF-4.1	Unemployment and job instability among under-30s will increase	-0.19
	LF-5.4	Broad availability and use of efficient contraception	-0.20
Western Europe (-0.31)	LF-4.6	Immigration from high fertility countries will increase	+0.19
	LF-5.7	ART will allow routine childbearing aged 40+	+0.17
	LF-4.3	Employers will put more pressure on their employees	-0.18
	LF-4.7	Economic issues mean uncertain life-course planning	-0.21
Nordic countries (-0.37)	LF-4.6	Immigration from high fertility countries will increase	+0.23
	LF-2.2	Men and women will increasingly share housework and childcare	+0.22
	LF-6.1	Ever more years of life enrolled in education	-0.20
	LF-4.3	Employers will put more pressure on their employees	-0.20
Southern Europe (-0.32)	LF-2.2	Men and women will increasingly share housework and childcare	+0.39
	LF-4.6	Immigration from high fertility countries will increase	+0.35
	LF-4.1	Unemployment and job instability among under-30s will increase	-0.40
	LF-4.7	Economic issues mean uncertain life-course planning	-0.41
"German speaking" (+0.26)	LF-3.3	Government will provide universal nursery / kindergarten access	+0.32
	LF-6.3	Better educated women will want more children & pursue a career	+0.30
	LF-4.3	Employers will put more pressure on their employees	-0.25
	LF-4.7	Economic issues mean uncertain life-course planning	-0.32
Central Europe (-1.07)	LF-5.7	ART will allow routine childbearing aged 40+	+0.25
	LF-3.3	Government will provide universal nursery / kindergarten access	+0.24
	LF-2.3	Harder to find the right partner to form a family	-0.29
	LF-4.7	Economic issues mean uncertain life-course planning	-0.31
Eastern Europe (-0.89)	LF-4.4	Work practices become more flexible	+0.19
	LF-3.4	Increased provision of affordable housing for families/young adults	+0.18
	LF-3.8	Retrenchment of family support when economic conditions worsen	-0.28
	LF-4.7	Economic issues mean uncertain life-course planning	-0.28

Notes: *See Table 2 for full text of all arguments

Table 2 gives the full list of arguments and their perceived impact upon cohort fertility to 2050. Clearly, there is a significant small number problem, with the number of responses for each setting being relatively low. However, there is a striking consistency between countries and across the different arguments. Certain country-argument combinations do emerge as being particularly pertinent and might be highlighted. In particular, for Korea, the following four arguments appear to be considered especially pertinent in being a likely drag upon fertility going through to 2050.

- 2.1 Men are increasingly reluctant to become fathers, even when they live with a partner
- 2.9 Adults in their 20s and even 30s will spend ever longer periods of life living with their parents
- 3.8 Governments will cut back on family support when economic conditions worsen.
- 4.1 Unemployment and job instability among the under-30s will further increase
- 4.7 Continuing economic unpredictability will make individual life-course planning ever more uncertain

In essence, this information suggests that issues relating to work-life balance, childcare and gender roles (which are all, in themselves, intrinsically linked), are held by demographers to be central to the low fertility issue in Pacific Asia. For Korea in particular, the experts also identified issues relating to economic instability, spending longer periods of time living at home as well as gender issues as being especially pertinent (compared to other Pacific Asian settings).

Table 2: Mean Net impact for all arguments, three Pacific Asia settings

	China [N14]	Rep. of Korea [N4]	Japan [N6]
1. Cultural and social forces in fertility ideals, norms, and desires			
1.1 Voluntary childlessness is increasingly becoming socially accepted	-0.2	-0.325	-0.15
1.2 One-child families will become a dominant cultural norm	-0.271	-0.275	-0.2
1.3 Society will become yet more individualistic	-0.079	-0.125	-0.108
1.4 It is a human constant that people will always desire at least one surviving child in order to 'continue living' in the future	0.057	0.125	-0.067
1.5 The share of population groups with larger families will increase	0.068	0.25	-0.025
1.6 The availability of grandparents for childcare and family care will decline	-0.075	-0.125	-0.158
1.7 Religious views on family and reproduction will gain importance	0.014	0.05	0
1.8 High fertility will become a status symbol among the wealthy.	0.136	0.25	0
1.9 Globally, there will be a convergence of all populations towards a two-child family as an ideal and actual family size.	0.111	0.1	-0.042
2. Partnerships, living arrangements and gender differences			
2.1 Men are increasingly reluctant to become fathers, even when they live with a partner	-0.157	-0.7	-0.2
2.2 Men and women will increasingly share the burden of housework and childcare	0.161	0.175	0.158
2.3 People are increasingly unable to find the right partner to form a family	-0.239	-0.45	-0.342
2.4 Women will increasingly pursue lifestyles and activities not compatible with motherhood	-0.293	-0.4	-0.3
2.5 Marriage will further decline and will become a minority experience	-0.039	-0.375	-0.225
2.6 Partnership dissolution and "re-partnering" will become yet more common among women of reproductive age	-0.061	0	-0.175
2.7 Women will achieve complete equality with men with respect to their education, employment career, and income	-0.125	-0.075	-0.142
2.8 Cross-border partnership and marriage migration will increase in importance	0.104	0.25	0.2
2.9 Adults in their 20s and even 30s will spend ever longer periods of life living with their parents	0.046	-0.4	-0.142

Table 2(cont): Mean Net impact for all arguments, three Pacific Asia settings

	China [N14]	Rep. of Korea [N4]	Japan [N6]
3. Role of Policies (In this case, 'Government' entails national government unless stated otherwise)			
3.1 Government will raise child subsidies and tax benefits or introduce birth bonuses	0.157	0.375	0.042
3.2 Government will take an increasingly pro-natalist stance (e.g. through communication campaigns and family policies)	0.193	0.425	0.017
3.3 Government will provide universal nursery / kindergarten access	0.196	0.25	0.142
3.4 Provision of affordable housing for families and young adults will become an important part of social policies	0.218	0.425	0.092
3.5 New policies will allow young parents to significantly reduce their working hours for several years with some compensation of income	0.132	0.35	0.067
3.6 Mothers will be increasingly expected and encouraged to return to work even when their children are small	-0.046	0.175	-0.017
3.7 Family-related policies, including childcare provision, will be increasingly pursued by local governments and employers	0.168	0.35	0.108
3.8 Governments will cut back on family support when economic conditions worsen.	-0.132	-0.45	-0.067
3.9 As populations age government funds will become increasingly directed toward the elderly and away from the young.	0.011	-0.2	-0.2
4. Employment and economy			
4.1 Unemployment and job instability among the under-30s will further increase	-0.1	-0.45	-0.283
4.2 Increasing average household income will lead to higher fertility	0.046	0.35	0.133
4.3 Employers will put more pressure on their employees in terms of higher working hours and more work commitments	-0.232	-0.075	-0.092
4.4 Work practices will become more flexible in the future (e.g. telecommuting, working from home, flexi-time, part-time)	0.182	0.3	0.233
4.5 Geographical mobility, especially work-related, will further increase	-0.107	-0.2	-0.042
4.6 Immigration from high fertility countries will increase	0.193	0.175	0.075

Table 2(cont): Mean Net impact for all arguments, three Pacific Asia settings

	China [N14]	Rep. of Korea [N4]	Japan [N6]
4.7 Continuing economic unpredictability will make individual life-course planning ever more uncertain	-0.196	-0.45	-0.1
4.8 Informal childcare will shift from grandparents to paid domestic workers	-0.082	0.25	-0.1
4.9 Cities will become more child-friendly	0.061	0.35	0.008
5. Biomedical and the timing of parenthood			
5.1 Men are becoming less fecund due to declining sperm counts or quality	-0.079	-0.2	-0.117
5.2 Delayed childbearing will become yet more common among women	-0.246	-0.25	-0.4
5.3 Having children under the age of 25 will be rare	-0.071	-0.2	-0.15
5.4 The broad availability and use of efficient contraception, including post-coital methods, will make mistimed and unwanted pregnancies rare	-0.104	-0.2	-0.1
5.5 Financial, normative and institutional barriers to Assisted Reproductive Technologies (ART) will keep their application limited	0.029	0	-0.033
5.6 Assisted reproduction and selective abortion will be increasingly used to achieve a desired sex composition as well as other characteristics of children.	-0.064	-0.075	-0.017
5.7 The technology and availability of ART will improve sufficiently that women in their forties who want a child will routinely be able to have one.	0.068	0.35	0.292
6. Education			
6.1 People will spend ever more years of their young adult life enrolled in education and professional training on the job	-0.171	-0.25	-0.158
6.2 Fertility differentials by level of female education will diminish.	-0.05	0	0.083
6.3 There will be a new trend for better educated women to have more children and simultaneously pursue a professional career.	0.029	0.425	0.167

Conclusions

There are a number of limitations to this exercise. Firstly, the number of respondents per country is often limited. This may be related to the

format of the survey, i.e. being in English. It is highly desirable to re-run the survey in translated form in the future. Secondly, we have not paid enough attention to issues of tempo distortion in childbearing – although this appears to be less of a serious issue for Pacific Asia than for Europe.

Despite this, our survey represents a novel way of approaching the design of assumptions for population projections. The principles of designing these assumptions were based upon being 'bottom-up', expert-derived and transparent. A second innovation is the collection of a wide array of qualitative information which should, in theory, inform the projection assumption. The idea that, in ten or even fifty years' time, we will be able to revisit the projections and compare the realized quantitative outcome with the assumptions and be able to see where underlying, constituent drivers differed from those assumed in 2012 means we have a stronger capacity to reflect upon the reasons for divergence. Despite the imperfections outlined above, we feel that such a way of designing projection assumptions has a certain number of benefits which could be either integrated into other projection exercises, or repeated in other settings (perhaps at the national level).

The quantitative element of the exercise, as described in Basten et al. 2013, which required experts to input point-and-range estimates for TFR to 2030 and 2050 strongly suggested a feeling that low fertility was here to stay in Pacific Asia. Indeed, there is a marked divergence between the general assumption by the UN (especially in their 2010 *World Population Prospects*) of a gradual return to replacement rates over the next century with the view of general stagnation suggested by experts. Importantly, this view of stagnation is shared by local statistical offices in the region (Basten 2013a).

Our qualitative exercise here has served to highlight some of the key drivers which population experts working in and on Pacific Asia have identified in shaping the future of fertility in the region. On a regional level, further delayed childbearing was cited as a key negative impact on future childbearing as well as a set of arguments

relating to gender roles, economic uncertainty and other life course issues. There was, however, a degree of confidence that government intervention could play a role in *increasing* fertility. However, the extent to which this can be actionable in the context of relatively weak developmental welfare systems is questionable.

Acknowledgements

We are very grateful to the Korean Institute for Health and Social Affairs and the East West Centre, Honolulu for supporting Basten's travel to present this paper at the Fourth EWC-KIHSA Joint Conference on Low Fertility and Population Aging, June 2013. Basten's contribution was funded by the European Research Council (ERC) Advanced Investigator Grant entitled "Forecasting Societies' Adaptive Capacities to Climate Change" (ERC-2008-AdG 230195-FutureSoc); and the UK Economic and Social Research Council's 'Future Research Leader' Grant, number ES/K001434/1. Sobotka and Zeman's contribution was funded by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC Grant agreement n° 284238.

The completion of this paper, and the associated work (e.g. Basten et al. 2013) would not be possible without the committed involvement of different contributors—researchers, contributing authors, experts participating in the online survey and those participating in the meeting in Vienna—who have organised the survey of experts or contributed to it, were involved in the debates on fertility scenarios presented here, and who have directly contributed to this chapter or helped checking and reviewing it.

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Appendix 1: Profile of respondents and country responses.

Total respondents: 184	Country (and region) of projection:		
Gender: 81: Male 62: Female 41: Blank	Central Europe (15)	Czech Republic	6
		Hungary	3
		Poland	2
		Croatia	2
		Slovenia	1
		Lithuania	1
Field: 135: Academia 14: Government 11: Think tanks/Policy Institute 5: Other 2: National NGO 1: NGO 16: Blank	Eastern Europe (13)	Russia	4
		Romania	3
		Ukraine	2
		Bulgaria	2
		Georgia	2
	Southern Europe (21)	Italy	12
		Spain	6
		Greece	1
		Portugal	1
Country of work: 26: United States 14: Austria 7: Australia, France, Italy, Spain, Sweden 6: Brazil, Germany 5: China, Iran, UK 4: Canada, Netherlands, Turkey 3: Argentina, Japan, Mexico, Romania 2: Belgium, Czech R, Hungary, Poland, Switzerland, Thailand 1: Colombia, Croatia, Finland, Georgia, Greece, Lithuania, New Zealand, Portugal, Russia, Slovenia, Ukraine, Uruguay 34: Blank	Western Europe (9)	United Kingdom	4
		Netherlands	4
		Belgium	1
	Nordic (14)	Sweden	7
		Norway	2
		Finland	2
		Iceland	1
	German speaking (10)	Germany	9
		Austria	7
		Switzerland	3
Age of respondents: 25-29: 8 30-34: 21 35-39: 20 40-44: 20 45-49: 15 50-54: 4	East Asia (including Thailand, 27)	China	14
		Japan	6
		Thailand	4
		Korea (Rep.)	2
		Hong Kong SAR	1
	Latin America (18)	Brazil	7

55-59: 20 60-64: 8 65-69: 16 70-74: 3 75+: 4		Mexico	5
		Argentina	3
		Uruguay	1
		Colombia	1
	North America & Australia (31)	United States	22
		Australia	5
		Canada	4
	Western Asia (14)	Iran	8
		Turkey	5
	Others (2)	Algeria	1
		Israel	1

Contributions of Demographic Factors to Future Population Change

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Introduction

Since 1984, South Korea has experienced low fertility under the TFR of 2.1, specifically the lowest low fertility over 15 years. It was estimated by Korea National Statistical Office that the low fertility, together with continued rise in life expectancy, would push Korea to even over hyper-aged society; the proportion of elderly people (people aged 65 or older) is estimated to grow from 10 percent in 2009 to 20 percent in 2026, to 30 percent in 2037, and to 40 percent in 2060 (Korea National Statistical Office, 2011). The speed of aging in Korea is faster than any other country in the world.

According to the population transition theory, along with the decline in fertility rate, the traditional stage of high fertility-high mortality is transferred to the stage of low fertility-low mortality at which the population growth almost stops. The theory was established on the basis of the population phenomenon observed historically during the last two hundred years in the Western Europe. However, to our utter shock, Korea will undergo the population transition within rather a short period.

It is not surprisingly that in recent years many studies have been carried out to estimate the socio-economic impacts of demographic change in Korea. According to those studies, a reduction in the working-age population following the low fertility trend will have direct effects on the quantity of the labor force and the aging of the labor force following will drag down productivity (KDI, 2006). A rapid increase in the aged population will cost higher social security

expenditures, while the shrunken pool of working-age population who should bear the costs will pose a major challenge to a sustainable social development and realization of welfare. A population aging increases the number of pensioners, whereas the reduced working-age population will bring down the relative increase rate of pension subscribers who pay for the pension; thereby, the total pension payments will exceed the total pension income beginning in 2055, and even the reserves will be depleted by 2060 (National Pension Finance Projection Committee, 2013). Along with population aging, deficit of Public Health Insurance will also increase from 9 billion won in 2011 to 37 billion won in 2030. While low fertility rates and population aging have been quickly raising financial burdens for social security, including medical protection and pensions, economic growth has not been able to keep pace with it. Economic growth rate will fall from 4.7 percent during 1995~2011 to 1.0 percent during 2030~2060 (OECD, 2012). In turn, the social security finance is doomed to get worse.

In making efforts to challenge to such impacts, identifying exact contributors to such a rapid demographic change for the future is of importance. In other words, the best policy-mix can be made on the base of the extent of demographic factors, namely fertility, mortality and international migration. Thus, this paper will devote itself to measuring the contribution of demographic factors to the future change of population in Korea.

Methods and Assumptions

Adopted is mainly the cohort component method as a representative population projection technique. This method is based on the demographic balancing equation, consisting of base population(P), birth(B), death(D) and international migration(M), as follows.

$P_t = P_{t-1} + B_{t-1,t} - D_{t-1,t} + M_{t-1,t}$ (t denotes year)

The base year, the starting year of projection, is 2010. The duration of projection is from 2010 to 2100 to comprise at least the future three generations. The base population is the population in the mid-year of 2010, as estimated, on the basis of 2010 population census, by KNSO for the 2011 national population projection (2010~2060). All assumptions for fertility, mortality and international migration, as adopted in this study, are basically based on those made by KNOS (2011) but with some modifications to reflect recent trends and extension of assumptions from 2060 to 2100.

Both medium-variant and high-variant assumptions for future change in fertility, as estimated by KNSO (20110), are adopted in the study. In details, the medium-variant for fertility is assumed, by time series analysis and adjusted Generalized Log Gamma, that TFR(total fertility rate) change from 1.23 in 2010 to 1.42 in 2045, which will continue to be maintained up to 2100. The sex ratio at birth (the number of male births to 100 female births) is assumed to decline from 106.9 in 2010 to 105.4 in 2025 and continue to be thereafter maintained at that level. The change of mortality in the future is assumed at the medium variant, through applying Li and Lee model, that life expectancy at birth increase from 77.2 years in 2010 to 89.3 years in 2100 for males and from 84.1 years to 93.2 years for females during the same period. International migration is assumed at the medium variant, by applying the Model Migration Schedule by KNSO (2010), that the net international migration rate decrease 1.67 (per 1,000 persons) to 0.53 (per 1,000 persons) in 2060 and the level of 0.53 be maintained up to 2100.

Table 1. Assumptions for Population Projection

	fertility (TFR)	Mortality (life expectancy at birth)		international migration (net migration rate per 1,000 persons)
		male	female	
2010	1.23	77.2	84.1	1.7
2015	1.28	78.2	85.0	0.7
2020	1.35	79.3	85.7	0.7
2025	1.38	80.4	86.4	0.6
2030	1.41	81.4	87.0	0.6
2035	1.42	82.5	87.6	0.6
2040	1.42	83.4	88.2	0.6
2045	1.42	84.3	88.8	0.6
2050	1.42	85.1	89.3	0.6
2055	1.42	85.9	89.8	0.6
2060	1.42	86.6	90.3	0.5
2065	1.42	86.8	90.6	0.5
2070	1.42	87.2	91.0	0.5
2075	1.42	87.5	91.4	0.5
2080	1.42	87.9	91.8	0.5
2085	1.42	88.3	92.1	0.5
2090	1.42	88.6	92.5	0.5
2095	1.42	88.9	92.9	0.5
2100	1.42	89.3	93.2	0.5

Five scenarios are adopted for the population projection. Scenario1 (S1) is that the levels of fertility, mortality and international migration in 2010, reflecting the recent trends, will be continued up to 2100. Scenario2 (S2) is that the fertility will change at its medium variant assumption but both levels of mortality and international migration in 2010 will be maintained up to 2100. Scenario3 (S3) is that the mortality will change at its medium variant assumption but both levels of fertility and international migration in 2010 will be maintained up to 2100. Scenario4 (S4) is that the international migration (net rate) will change at its medium variant assumption but the levels of both

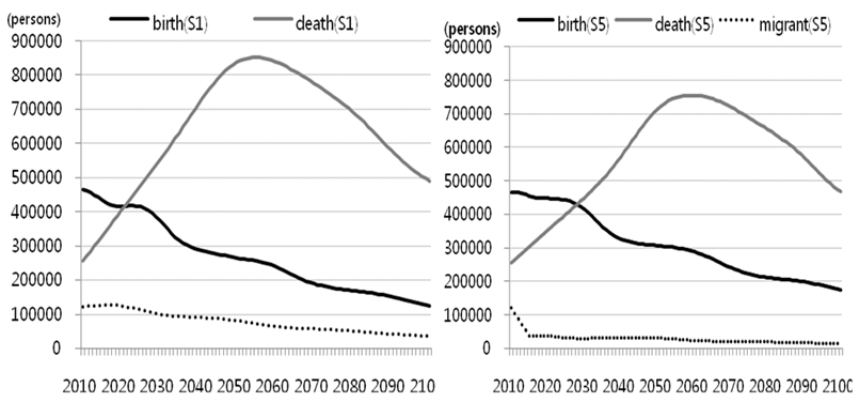
fertility and mortality in 2010 will be continued up to 2100. Lastly, scenario5 (S5) is that all demographic factors such as fertility, mortality, and international migration will change at their medium variants assumptions, respectively.

Findings: Contributions of Change in Demographic Factors

Prospects for Births, Deaths, and International Migrants

For all scenarios, the number of births and international migrants will continue to decrease but the number of deaths will increase up to around 2060 and thereafter decrease. The year at the peak in the number of deaths will be 2055 for S1 and 2058 for S5. For all scenarios, the number of international migrants will be smallest among the demographic factors throughout the projection period. For all scenarios, the number of births will be greater than that of deaths until around 2025 but thereafter it will be opposite. The year of peak will be 2021 for S1 and 2029 for S5.

Figure 1. Births, Deaths, and International Migrants by Scenario



The number of births for S5 will be greater than that for S1 (Figure 2). The gap between S5 and S1 will continue to increase throughout the projection period, implying that the fertility change at the medium

variant will push up that of births. The number of deaths for S5 will be less than that for S1. The gap between S5 and S1 will continue to increase until 2041 but thereafter decrease, implying that the mortality change at the medium variant will play a role in decreasing the number of births at the high pace of mortality improvement but such contribution will decrease at the slow pace of mortality improvement due to the extremely high level of population aging. The number of international migrants for S5 will be quite less than that for S1 although the gap between S5 and S1 will continue to decrease throughout the projection period, implying that the change in migration rates at the medium variant will play a role in decreasing the number of international migrants.

Figure 2. Comparison of Births, Deaths, and International Migrants between S1 and S5

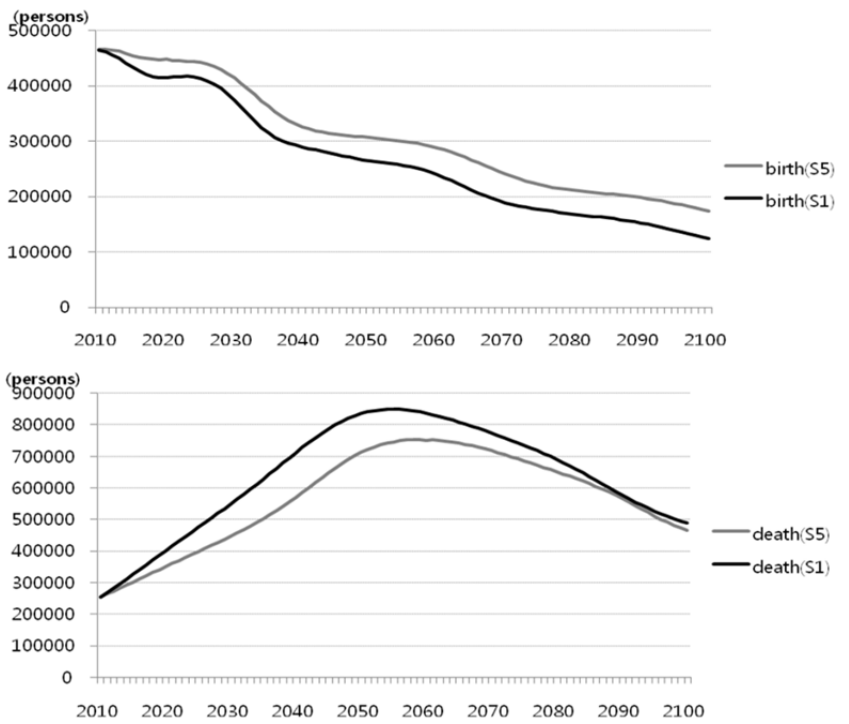
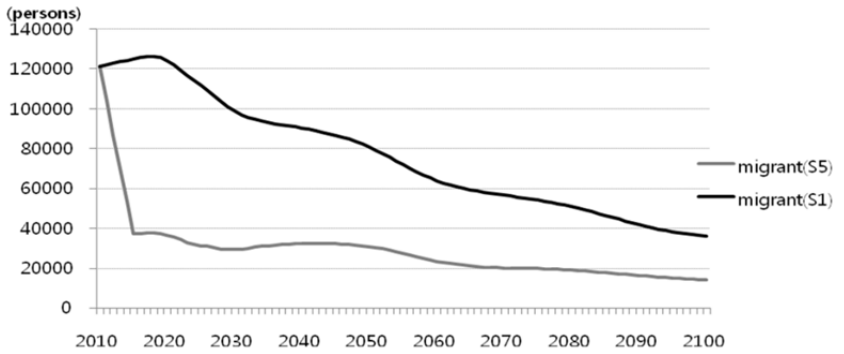


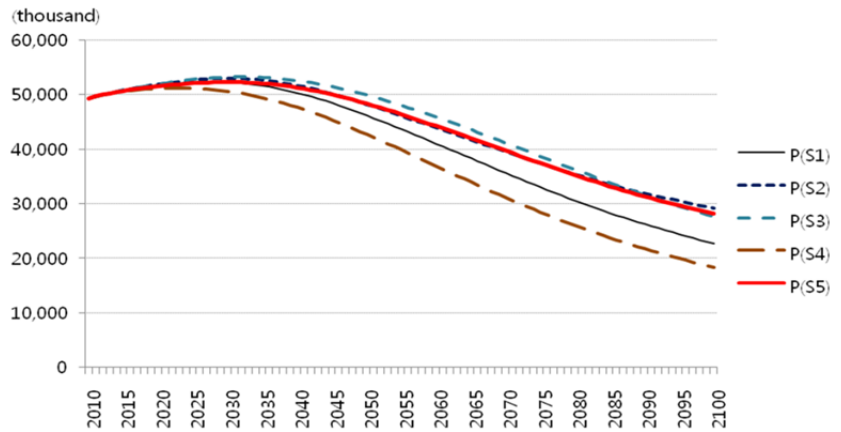
Figure 2(cont). Comparison of Births, Deaths, and International Migrants between S1 and S5



Contribution to Population Size

The population size will decrease after reaching its peak at 2020s or 2030s for all scenarios; the year of peak will be 2028 for S1, 2030 for S2, 2032 for S3, 2022 for S4, and 2030 for S5 (Figure 3). However, there will be gaps in population size among scenarios. The population size will be the biggest for S3 (due to mortality change) until 2087 but thereafter it will be the biggest for S2 (due to fertility change). The population size for S4 will be smaller than that for S1, indicating that the future change in international migration will have a decreasing impact on population size. Due to the effect of change in international migration, the population size for S5 will be smaller than those for S2 (due to fertility change) and S3 (due to mortality change).

Figure 3. Population Size by scenario



The net gain in population due to change in demographic factors can be calculated by subtracting the population for S1 from that for S5. In this way, the net gain in population due to change in fertility, mortality and international migration in future can be calculated by subtracting the population for S1 from populations for S2, S3 and S4, respectively. It needs to be noted that '-(minus)' net gain in population means loss of population due to changes in demographic factors, compared with no change.

The total net gain due to change in all demographic factors will be negative until 2029 but thereafter will be positive increasingly, since the effects will be cumulated(Table 2). By 2100, the total net gain will increase to 5,477 thousand. This total net gain is decomposed by three demographic factors such as fertility, mortality, and international migration. The net gain in population size due to fertility change (S2) will be always positive, increasing with time by 2100 but at a slower speed. The net gain in population due to mortality change (S3) will be positive, with its volume increasing until 2079 but thereafter decreasing. The net gain due to mortality change will be bigger than that due to fertility change until 2087 but thereafter it will be opposite. Since the change in fertility is assumed to be not big from 1.23 to 1.42, the contribution of mortality change will surpass that of fertility

change. However, when the gap of rise in life expectancy considerably reduces in the late 21 century, the contribution of mortality change will be less than that of fertility change. The net gain due to international migration change will be always negative, because the levels of net migration rates in future, as assumed, will be less than the level of 2010, reflecting the recent trends. The negative contribution of change in international migration in future will be exaggerated until 2077 but thereafter will decrease. Interaction effect among demographic factors will be always positive, increasing with time.

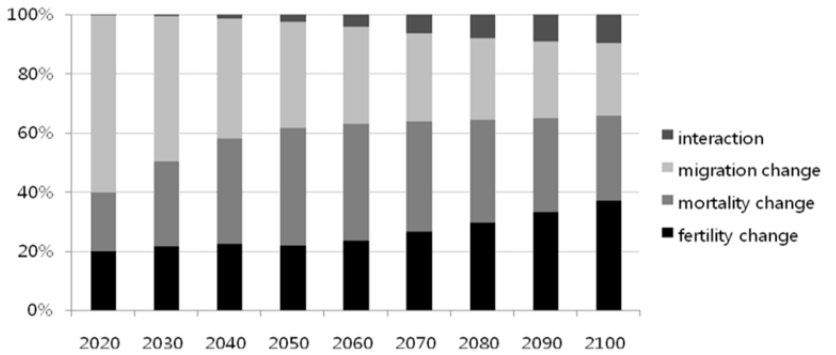
Table 2. Contribution of Change in Demographic Factors to Population Size

		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
population for scenario5		49,410	51,615	52,379	51,382	48,443	44,302	39,759	35,298	31,348	28,183
population for scenario1		49,410	51,838	52,367	50,343	46,213	41,040	35,669	30,601	26,264	22,706
net gain in population (reference year=2010)	total		-224	11	1,038	2,230	3,261	4,090	4,696	5,084	5,477
	due to fertility change		221	753	1,466	2,114	2,946	3,934	4,820	5,666	6,469
	due to mortality change		224	1,002	2,313	3,814	4,943	5,546	5,701	5,392	4,992
	due to migration change		-670	-1,727	-2,645	-3,453	-4,108	-4,461	-4,506	-4,415	-4,291
	interaction		-1	16	96	245	520	928	1,319	1,558	1,693

In order to look into the magnitude of contribution of each of demographic factors, those absolute values of net gains due to demographic factors are summed up and the absolute value of net gain of each demographic factor is divided by the sum (Figure 4). The relative contribution to the population size by mortality change will be the biggest until 2077, followed by international migration change and fertility change, in that order. After 2077, the relative contribution by

fertility change will be the biggest, followed by mortality change and international migration change, in that order.

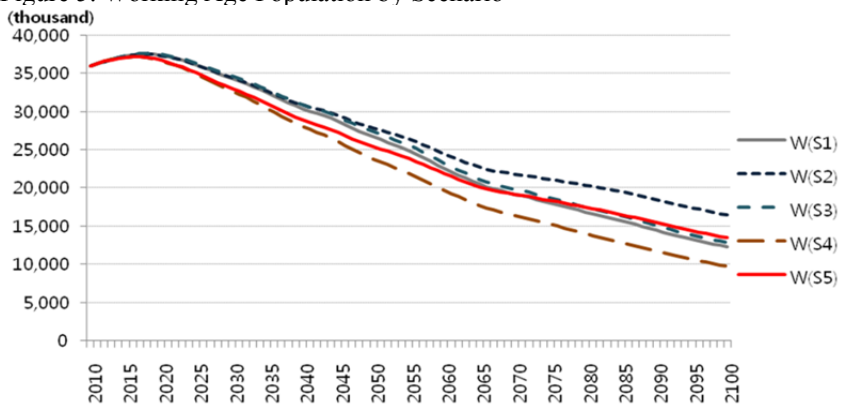
Figure 4. Relative Contribution of Change in Demographic Factors to Population Size



Contribution to Working Age Population

The working age population will decrease after reaching its peak at the latter of 2010s for all scenarios; the year of peak will be 2018 for S1, S2 and S3, and 2016 for S4 and S5 (Figure 5). The working age population size will be the biggest for S2 (due to fertility change) throughout the projection period, followed by those for S3 (due to fertility change), S1 (no change in all factors) and S4 (due to international migration). The working age population size for S5 will be in-between.

Figure 5. Working Age Population by Scenario



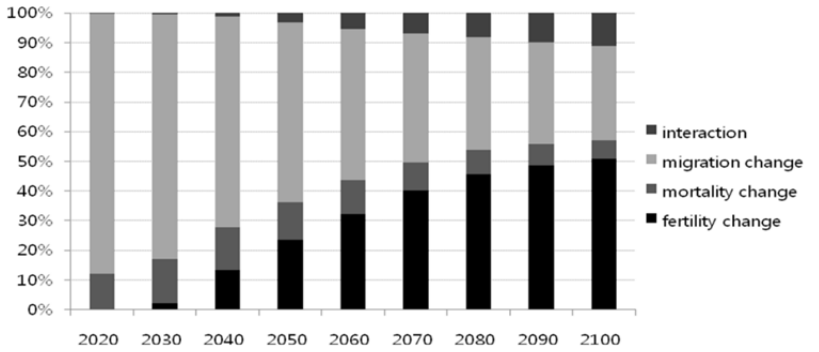
The total net gain of working age population due to change in all demographic factors will be negative until 2070 but thereafter will be positive (Table 3). By 2100, the total net gain will increase to 1,172 thousand. This total net gain is decomposed by three demographic factors such as fertility, mortality, and international migration. The net gain in working age population size due to fertility change (S2) will be always positive, increasing with time but at a slower speed. The net gain due to mortality change (S3) will be positive, with its volume increasing until 2056 but thereafter decreasing. The net gain due to mortality change will be always less than that due to fertility change, implying that the working age population size will be more affected by fertility change rather than the mortality change. The net gain due to international migration change will be always negative, because the levels of net migration rates in future at the medium variant assumption will be less than the level of 2010, reflecting the recent trends. The negative contribution of change in international migration in future will be exaggerated until 2082 but thereafter will decrease. Interaction effect among demographic factors will be always positive, increasingly with time.

Table 3. Contribution of Change in Demographic Factors to Working Age Population

		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
population for scenario5		35,983	36,752	33,043	28,941	25,391	21,865	19,147	17,446	15,445	13,472
population for scenario1		35,983	37,392	34,403	30,451	26,726	22,590	19,198	16,876	14,480	12,300
net gain in population (reference year=2010)	total		-639	-1,359	-1,510	-1,335	-724	-51	570	965	1,172
	due to fertility change		0	44	458	1,155	1,861	2,612	3,488	4,008	4,159
	due to mortality change		103	311	488	618	657	618	617	586	522
	due to migration change		-741	-1,703	-2,414	-2,949	-2,935	-2,832	-2,900	-2,804	-2,587
	interaction		1	12	42	159	308	450	635	825	922

In order to look into the magnitude of contribution of each of demographic factors, those absolute values of net gains in the working age population due to demographic factors are summed up and the absolute value of net gain of each demographic factor is divided by the sum (Figure 6). The relative contribution to the working age population size will be the biggest due to international migration change, mortality change, and fertility change, in that order until 2040, since those births cannot enter in working age population before reaching 15 years old. During the period between 2041 and 2072, the relative contribution will be the biggest due to international migration change, followed by fertility change and mortality change, in that order. After 2072, the relative contribution by fertility change will be the biggest, followed by international migration change and mortality change, in that order.

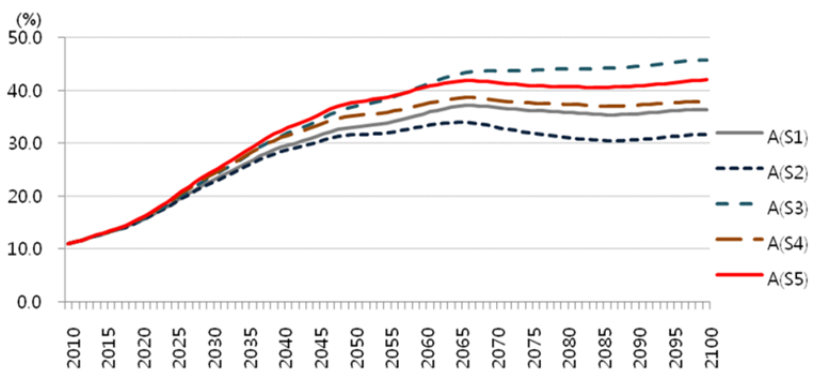
Figure 6. Relative Contribution of Demographic Factors' Change to Working Age Population



Contribution to Population Aging

The population aging can be measured by the proportion of the elderly (65 years or older) to total population (Figure 7). The proportion of the elderly will continue to increase for all scenarios, but with some irregularities by scenario in the latter of 21 century. The proportion of the elderly will be the highest for S3 (due to mortality change), followed by S5 (due to change in all demographic factors), S4 (due to international migration change), S1 (no change in all factors), and S2 (due to fertility change), in that order.

Figure 7. Proportion of the Elderly (65 years or older) to Total Population by Scenario



The total net gain of the proportion of the elderly due to change in all demographic factors will be always positive (Table 4). By 2100, the total net gain will increase to 5.68 percent point. This total net gain is decomposed by three demographic factors such as fertility, mortality, and international migration. The net gain in the proportion of the elderly due to fertility change (S2) will be always negative, increasingly with time but at a slower speed. The net gain due to mortality change (S3) will be positive, increasingly with time but at a slower speed. The net gain in the proportion of the elderly due to international migration change (S4) will be always positive but in a smaller degree. It implies that changes in mortality and international migration in future, in that order, will push up the population aging but the change in fertility will draw down the population aging.

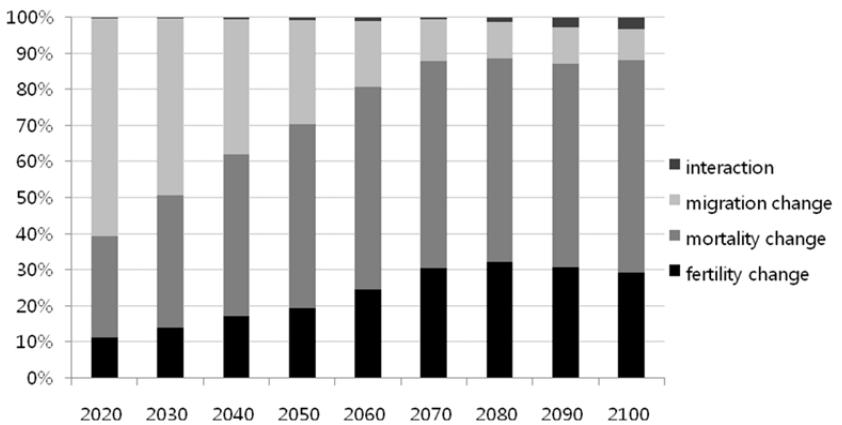
Table 4. Contribution of Change in Demographic Factors to Proportion of the Elderly

		2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
population for scenario5		11.04	15.71	24.41	32.44	37.69	40.55	41.57	40.77	40.89	42.11
population for scenario1		11.04	15.27	22.75	29.31	33.11	35.65	36.87	35.95	35.64	36.43
net gain in population (reference year=2010)	total		0.44	1.65	3.13	4.58	4.90	4.70	4.81	5.25	5.68
	due to fertility change		-0.06	-0.32	-0.83	-1.45	-2.39	-3.66	-4.76	-4.91	-4.68
	due to mortality change		0.16	0.84	2.14	3.81	5.42	6.91	8.26	8.99	9.44
	due to migration change		0.35	1.13	1.80	2.16	1.78	1.40	1.50	1.60	1.42
	interaction		0.00	0.00	-0.02	-0.05	-0.09	-0.06	0.18	0.43	0.50

In order to look into the magnitude of contribution of each of demographic factors, those absolute values of net gains in the proportion of the elderly due to demographic factors are summed up and the absolute value of net gain of each demographic factor is

divided by the sum (Figure 8). The relative contribution to the population aging will be the biggest for international migration change, mortality change, and fertility change, in that order until 2036. During the period between 2037 and 2057, the relative contribution will be the biggest for mortality change, followed by international migration change and fertility change, in that order. After 2057, the relative contribution by mortality change will be the biggest, followed by fertility change and international migration change, in that order.

Figure 8. Relative Contribution of Change in Demographic Factors to Proportion of the Elderly



Concluding Remarks

Because of low fertility and population aging, Korea is to face many challenges in future. According to the result of study, the future changes of demographic factors such as fertility mortality and international migration at the medium variants, as assumed by KNSO, will affect the population size, working age population size and the proportion of the elderly in different ways. The change in fertility will play a role to increase population size, specifically the working age population size, and to decrease the population aging. The change in mortality will play a role to increase population size and working age

population size, but to increase the population aging. The change in international migration will play a role to decrease population size and the working age population size, but to increase the population aging.

After all, it is most desirable to handle fertility rather than mortality and international migration, in terms of both labor force and population aging. Fertility behaviors are closely intertwined with overall socio-economic phenomena. That is why efforts should first be made to bring about changes in the overall aspects of economy and society in fostering environments favorable to marriage, childbirth and child-rearing. The efforts should include balancing work and family, improvement in childcare leave system, expansion of flexible work-type, fostering family friendly work environments, alleviating economic burden of child-rearing, support for safe and healthy pregnancy and childbirth, establishing diverse and high quality childcare infra, establishment of safe environments of child-rearing, etc. in an integrated manner. Nothing is, however, more important than recognizing that the current low fertility is not a transitory phenomenon and building a popular consensus that public interest and active responses are required to cure the symptoms unfavorable to the Korean families and individuals.

Reference

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Estimation of Optimal Population in Korea: Macroeconometric Modeling and Simulation

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Background and Objectives

Although the discussion of the optimum population in Korea has persisted in wake of the acceleration of the low birth rate and the aging population in terms of the economy and environment, the concept of optimum population depends on which factors can be highlighted. That is, the optimum population can likely be considered a flexible concept rather than a fixed one in the sense of specific conditions. Recently, related to the optimum population, international political sides have also been emphasized, in which the nation`s place in the international community is another important factor.

Meanwhile, previous studies related to optimum population had limitations considering population as an exogenous variable, although population endogenously changes because of socioeconomic factors. Emphasizing only one factor among several factors, the previous studies were also problematic in the sense that they were not realistic, which showed that the studies could not reflect the points of various socioeconomic and environmental views.

This study aims to estimate the optimum population and the structure in Korea taking into account Korea's national power, which means the global positioning of Korea, and considering the relationship between population and socioeconomic variables. Especially, scenario simulations for the optimum population and structure will be conducted with a macroeoconometric model that is built with a macroeconomy, labor market, and fiscal and social security sectors.

Trends on the discussion of optimum population

The existing discussion of optimum population

In the 20th century, various viewpoints related to optimum population have become mainstream in the field of economics. The discussion can be divided into four factors as follows. The first is the research about the growth rate of optimum population to gain maximum utility. Ramsey(1928) began with the theory of dynamic optimization growth and then Harrod(1939), Domar(1946), Spengler(1951), and Solow(1956) developed the theory. This research focused on the dynamic perspective that considered the relationship between capital, labor, and economic growth. The second is the research about a change in population by net reproduction rate. Diamond(1965), Dasgupta(1969), Samuelson(1975), and Gigliotti(1983) represented this research. The net reproduction rate theory focused on the point that there exists a change of utility in the process of giving and taking goods or services between generations so that the goods and services transferred from previous generations to the next are calculated, and is the standard to analyze the change of population.

The third is the research about simulating relationships between demographic variables and the process of socioeconomic development. During the decades of the 1970s and 1980s, the simulation models such as the Bachue models1, the ESCAP models[2] have been created for developing countries based on the large scale statistical data-base from international organizations, and focused on enlightening the population movements which are needed to set short and long-term

[1] The original Bachue model constructed for the Population and Employment Project of the World Employment Programme initiated in 1972 by the International Labour Office, with financial support from the United Nations Fund for Population Activities. Bachue is the goddess of love, fertility and harmony between nature and man in Colombian mythology(Blandy and Wery(1973)).

[2] The models is originating at the Economic and Social Commission for Asia and the Pacific.

development plans. The fourth is the research about forecasting birthrate and life expectancy. The UN and individual national statistical offices played a major role in analyzing replacement level of fertility and in developing an incentive policy able to maintain optimum population.

This economic perspective of optimum population has been academicized on standards such as per capita income or production maximization. However, because the standards have been affected by new technology, the change of natural resources, and the change of societal structures, there have been criticisms that the standards could not support the reality.

Meanwhile, in terms of the environment, it is the basic premise that the growth of population is able to cause increasing consumption, deplete natural resources, pollute the environment, and have negative effects on the well-being of future generations (Cole and Neumeyer(2005)). Also, the discussion about how much environmental deterioration is associated with economic growth or population growth can be represented by IPAT (Impact = Population * Affluence * Technology) by Ehrlich-Holdren(1971) or by the ecological footprint[3] proposed by Rees(1992), Wackernagel(1994).

These standards measure the degree of environmental deterioration and of resource depletion by pollution and population growth. It is the environmental point of view about optimum population that population growth could lead to environmental deterioration and resource depletion. Activities to prevent environmental deterioration and resource depletion could lead to the loss of social welfare. However, some criticize that this environmental perspective underestimates social and technical development; furthermore, a

[3] The ecological footprint is a measure of human demand on the Earth's ecosystems. It is a standardized measure of demand for natural capital that may be contrasted with the planet's ecological capacity to regenerate. Although the term ecological footprint is widely used and well known, it goes beyond the metaphor. It represents an accounting system for biocapacity that tracks how much biocapacity there is, and how much biocapacity people use.

decline in population because of low birth rate and an aging population would support the environmental-friendly consumption of the elderly generation so that there would be some chance for the ecosystem to be recovered.

New approach to optimum population and aging population

In the 1980s, acceleration of the growth of the aging population and the low birthrate has tarnished the discussion about optimum population for sustainable growth of the population and highlighted the problems about society and economy stemming from the aging population. Although the effects on the economy resulting from the aging population are very complicated, major factors focused on in many studies have been represented by the supply, demand, and fiscal sides.

On the supply side, the aging population has negative effects on the potential growth rate by decreasing the input of labor force, which comes from a decrease of economically active people and a decrease in the accumulation of capital caused by a decline in savings which came from the increase in the amount of dependent people (Auerbach-Kotlikoff(1987), Hviding and Merette(1998), Miles(1999)). On the other hand, the decline of the youth population caused by a low birthrate can lead to a higher rate of savings from the decrease of educational expenses and health expenditures, which can make accumulation of capital in the short run and the increase of educational investment per person support the improvement of Total Factor Productivity (TFP), which can relieve the negative effects on the potential growth rate(Fougere and Merette(1999), Sadahiro and Shimasawa(2003)). Altogether, these opinions suggest that not only the quantitative input of labor and capital, but also the qualitative parts have to be considered at the same time.

On the demand side, reduced demand by a decrease in population comes from low birthrates and aging populations, which have negative effects on economic growth; but an increase in aged people having

purchasing power can have positive effects on economic growth. A decrease of rate of savings by the aging population shrinks investment demand, which can negatively affect total demand (Feldstein-Horioka(1980).

On the fiscal side, a decrease of economically active people because of the aging population can lower tax revenue and increase fiscal expenditures for social welfare, which can hinder economic growth(Atkinson(1995)).

Recently, aging populations and low birthrates have been magnified as major issues in terms of economics, society, and politics. Especially, the population in Korea is expected to decrease around 2030 due to a low birth rate and an increasing life expectancy. Korea is also expected to enter into an aged society around 2017, in which the ratio of people aged over 65 is greater than 14%, and into the super aged society around 2026, in which the ratio of people aged over 65 is greater than 20%. Considering the decrease in population and the rapid trend of an aging population, research for optimum population is important in supporting sustainable economic and social development. It is time to establish national objectives and a strategy consisting of population policies to overcome the disjunction between optimum population and the aging population in terms of a new approach for the aging population

Table 1. Fertility rates and Ratios of Aging Population

	Fertility rate			Ratio of Aged population		
	1995-00	2000-05	2005-10	2010	2020	2030
Korea	1.51	1.22	1.17	11.0	16.0	24.2
Japan	1.37	1.30	1.32	22.7	28.4	30.3
German	1.34	1.35	1.36	20.4	23.0	28.0
Italy	1.22	1.25	1.38	20.4	22.8	26.4
France	1.76	1.88	1.97	16.8	20.3	23.1
UK	1.74	1.66	1.83	16.6	18.7	21.1
Canada	1.56	1.52	1.65	14.1	18.1	23.0
USA	1.96	2.04	2.07	13.1	16.2	19.9
G7 Average	1.56	1.57	1.65	17.7	21.1	24.5

Sources: Korea Statistics Office(2006), population projection, medium level.
United Nations(2011), World Population Prospects: The 2010 Revision.

Macroeconometric modeling for the estimation of Optimal Population

Among general methodologies to estimate optimum population, one sets population up as the objective variable with socioeconomic factors as constraints, and another, called the general equilibrium method, interact factors such as the economy, society, and environment mutually. The former has limitations which can cause a mono-directional effect from the constraint variables, so the latter method is chiefly used in Computable General Equilibrium(CGE) models or macroeconometric models.

CGE model has merits reflecting rational behavior of economic units which show theoretically completion. But many parameters showing the inter-relationship among variables are not estimated but assumed as well as the complexity of CGE model can cast difficulties to interpret the results.

Macroeconometric model has merit in that they are more realistic since they set up a causal relationship among economic variables

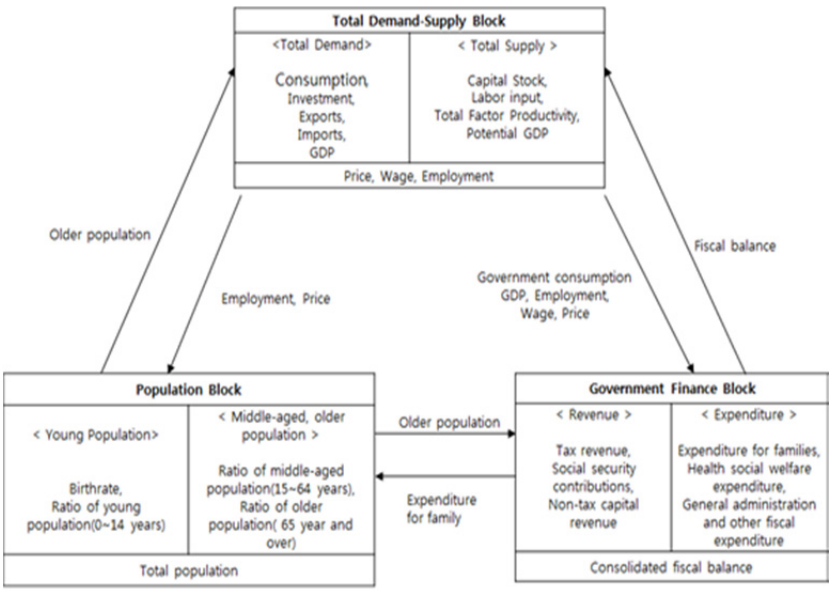
based on macroeconomic theory and estimation using real data. However, this model has difficulties in reflecting changes in technology and systems in the long run that can have effects on the relationships among the variables.

Thus, it is difficult to say which method is better because these methods are different in terms of objective. In the logical view, the results from methods reflecting the causal relationships could have reliability and utilization. This research aims to estimate optimum population under economic perspectives such as maintaining a certain level of economic growth and maintaining stable fiscal balance. Hence, this research develops a macroeconometric model able to show the relationships among population, social welfare, and the macroeconomy including national fiscal measures.

This model consists of three blocks which are total demand-supply, government finance, and population blocks. The total demand-supply block is such that GDP is measured by private and government consumption, investment, exports, and imports in the total demand and potential GDP is given by potential capital stock, potential labor input and Total Factor Productivity in the total supply. The gap between GDP and potential GDP has an effect on prices, wages, and employment. The government finance block is composed of tax revenue, social security contributions, non-tax revenue, fiscal expenditures for families, public health and welfare, and the gap between other expenditures and fiscal expenditure. In the population block, birthrate, the ratio of youth population(0~14), the ratio of people aged 15~64, and the ratio of aged people who are over 65 are calculated and then the total population is derived. The expenditure for families in the government finance block affects the birth rate in the population block and those who are over 65 affect the fiscal payments for public health and welfare. Those who are over 65 also have effects on private consumption and the number of employment and price cast effects in the population block. Thus, endogenous variables are decided in simultaneous systems reflecting inter-

relationships among the total demand-supply, government finance and population blocks.

Figure 1. Basic Structure of Macroeconometric Model



This model is a medium scale econometric model consisting of 21 estimated equations and 11 identities with 32 endogenous variables and 15 exogenous variables. Except the population block, there are 17 estimated equations which are relatively small scale models compared with the model of KDI or the Bank of Korea. This simultaneous model is designed to conduct projection and policy experiments at the same time.

The period of projection with this model is set to be 2005~2080 based on data projected by the Korea Statistical Office, KIHASA(Korea Institute for Health and Social Affairs), and Global Insight. In estimating equations based on previous data, since the estimated coefficients could not reflect the structural changes over a very long term, forward-looking estimation methods using projection

data from major research institutes is adopted. Each equation is estimated by OLS(Ordinary Least Square) and chosen by statistical and economic significance, which are in the appendix. The suitability of the total model(simultaneous model) composed of each estimated equation is also tested by RMSPE(Root Mean Square Percent Error) and Theil′s U(Inequality Coefficient) comparing the gap between predicted value and actual value. The test results are in Table 2, which shows that there are several variables with low explanation ability but there are no big problems in conducting simulations.

Table 2. Test for suitability of model

	RMSPE(%)	U
BR(birth rate)	4.6510	0.0503
CG(government consumption)	1.7630	0.0168
CGE(consolidated fiscal expenditure)	8.2254	0.0612
CGEEO(general administration·other fiscal expenditure)	10.6744	0.0676
CGEHS(health·social welfare expenditure)	13.9239	0.1083
CGR(consolidated fiscal revenue)	4.8755	0.0531
CGRO(non-tax capital fiscal revenue)	4.6778	0.0554
CP(private consumption, real)	6.0306	0.0815
GDP(real)	11.1049	0.1226
GDPV(nominal)	1.8515	0.0146
IFT(investment expenditure, real)	2.6161	0.0159
IFT_E(potential investment expenditure, real)	6.7004	0.0982
KSS_E(potential capital stock)	2.4314	0.0155
LET(employment)	3.1124	0.0226
LET_E(potential employment)	1.9159	0.0162
MM(import, real)	0.8352	0.0080
PGDP(GDP deflator)	1.0697	0.0104

Table2 (cont)	RMSPE(%)	U
POP(total population)	3.0045	0.0080
POP14(population under 14)	6.6473	0.0910
POP14R(ratio of population under 14)	1.0987	0.0116
POP15OV(population over 15)	5.7158	0.0787
POP15OVR(ratio of population over 15)	5.1300	0.0654
PPGDP(potential GDP, real)	0.8353	0.0080
SSC(Social security contributions)	3.0862	0.0182
TAX(fiscal tax revenue)	2.6066	0.0148
WAGE(average wage for non-agricultural sectors)	2.0272	0.0209
XX(export, real)	6.7557	0.0943

note: $RMSPE = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\frac{Y_t^a - Y_t^p}{Y_t^a}\right)^2} \times 100$, $U = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(Y^a - Y^p)^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}Y^p} + \sqrt{\frac{1}{T}\sum_{t=1}^{T}Y^a}}$

p=predicted value, a=actual value

Scenarios and projection for optimum population

Scenarios for optimum population

As mentioned before, optimum population could be different in terms of point of views, which means that optimum population could depend on the structure or scale of the population under specific conditions. In this chapter, some scenarios will be built to estimate optimum population considering domestic and international economic environments that are faced by Korean society.

First of all, in terms of the economy, the scenarios will consider the structure and scale of the population to maintain the Korean economy, which can be achieved through decision making processes so as to lead and support international communities through

domestically sustainable economic growth and internationally retaining Korean national power. In addition, the condition of maintaining stable national fiscal measures will also be considered. Recently, the global financial crisis has shown that unstable national finances cannot guarantee sustainable economic growth and weak national finances can attenuate the real economy and lead to a national crisis. It is the final condition that government expenditure will be expanded to the level of developed countries to maximize social welfare. Considering these conditions totally, three scenarios are built to estimate the optimum population which could maintain social welfare at the level of developed countries and the scale of economy supporting Korea's place in the international community.

The quantitative standards in each scenario are set up as in the table below(3) to apply the scenarios into the model. The first scenario assumes that the proportion of Korean to world GDP will stay at a certain level. Korean real GDP is $1.167 trillion(reference year 2005), 2.1% of world GDP, and twelfth in the world economic ranking in 2010[4].

Table 3. Scenarios, targets and assumptions

	Target	Assumptions
Scenario1	Population to maintain economic national prestige	‣ Korean GDP keeps at a certain level of world GDP - 2.2% in 2021 and remain constant until 2080 - 3.2% economic growth rate continuing after 2021
Scenario2	Population to maintain economic national prestige and stable national fiscal measures	‣ Scenario1 and stable national finances - 2.2% in 2021 continuing until 2080 - balanced national finances after 2021
Scenario3	Population to maintain economic national prestige and expansion of the level of social welfare	‣ Scenario1 and expanded welfare expenditures - 2.2% in 2021 continuing until 2080 - 5% of GDP(current) increment transferred to social security(2.5%) and welfare(2.5%)

[4] Global Insight, Macroeconomic Data base.

Global Insight supports the long term projection that Korean GDP will be expected to increase towards 2.2% of world GDP in 2021 and decrease somewhat after that. Research institutes in Korea project that Korean GDP will be around 3% in the 2020s and then decrease to around 1% in the 2040s by considering the low birthrate and aging population[5]. Hence, this scenario assumes that Korean GDP will maintain the 2.2% level in world GDP from 2021 to 2080, which means that the Korean economy will show 3.2% economic growth in the projection period. Scenario 2 assumes balanced national fiscal measures along with scenario 1 in which consolidated fiscal balances keep stable after 2021. Scenario 3 assumes that 5% of the GDP increment based on scenario 1 will transfer to social security and welfare to increase the level of social welfare, where 2.5% will be used to promote childbirth and the other half to general social welfare expenditure.

Changes in structure and size of population in scenarios

Through the simulated results from the model consisting of population, economy, and social welfare sectors by each scenario, it is necessary to have 50 million in 2040 and 43 million in 2080 to maintain around a 3% economic growth rate towards 2080. This result supports that Korea needs 2 million more in 2040 and 13 million more in 2080, against the baseline population projection from the Korea National Statistical Office considering low birthrate and the aging population in Korea. It requires that the size of the population has to be at a certain

[5] Projection for Korean GDP(real) by major research institutes in Korea

(unit:%)

	2010-19	2020-29	2030-39	2040-49
National Assembly Budget Office(2010)	3.42	2.00	1.23	0.83
Korea Development Institute(2007)	4.00	2.70	1.80	1.40
Korea Institute of Public Finance(2006)	4.22	2.90	1.56	0.93

note: Numbers in parenthesis mean projection year respectively.

level to get a higher economic growth rate than the present trend under the same level of productivity, which means that a higher birth rate is needed. The difference between scenario 1 and scenario 2 considers that balanced national finances are estimated to be 80 thousand in 2040 and 860 thousand in 2080. The relatively small gap between scenarios 1 and 2 come from the smaller possibility of deterioration of fiscal balances from increased tax revenue based on the economic growth of scenario 1. In scenario 3, transferring 5% of GDP increment to social welfare, the increased ratio of the youth population from the higher birth rate leads to the expansion of the total population. The difference between scenario 3 and 1 and 2 is 600 thousand in 2040 and 2 million in 2080.

Table. 4. Changes in variables related to population

Variables and scenarios		2010	2020	2030	2040	2050	2060	2070	2080	2011 -2040	2041 -2080
Real GDP (trillion won)	Baseline	1,042	1,563	2,081	2,629	3,212	3,799	4,346	4,813	3.1%	1.5%
	Scenario1			2,136	2,908	3,975	5,459	7,537	10,346	3.5%	3.2%
	Scenario2			2,122	2,885	3,947	5,426	7,481	10,238	3.5%	3.2%
	Scenario3			2,134	2,892	3,921	5,338	7,313	9,980	3.5%	3.1%
Population (Ten thousand)	Baseline	4,888	49,326	4,956	4,792	4,454	3,975	3,452	2,958	-0.07%	-1.20%
	Scenario1			5,019	5,039	4,944	4,753	4,529	4,312	0.10%	-0.39%
	Scenario2			5,010	5,031	4,938	4,747	4,520	4,299	0.10%	-0.39%
	Scenario3			5,024	5,091	5,037	4,877	4,680	4,490	0.14%	-0.31%
Crude birth rate (%)	Baseline	0.90	0.77	0.75	0.60	0.56	0.58	0.56	0.54		
	Scenario1			0.76	0.62	0.60	0.66	0.69	0.74		
	Scenario2			0.75	0.62	0.60	0.66	0.69	0.74		
	Scenario3			0.77	0.70	0.73	0.84	0.91	1.00		
Youth population ratio (%)	Baseline	16.1	12.7	11.7	10.7	9.3	9.2	9.6	9.3		
	Scenario1			11.7	11.0	9.9	10.3	11.4	12.2		
	Scenario2			11.7	10.9	9.8	10.3	11.4	12.1		
	Scenario3			11.8	12.0	11.8	13.0	14.8	16.2		
Young adults and middle-aged population ratio (%)	Baseline	72.2	71.9	64.1	57.1	53.2	50.4	49.1	50.5		
	Scenario1	72.2	71.9	64.1	57.0	53.2	51.1	50.9	53.2		
	Scenario2	72.2	71.9	64.1	57.0	53.2	51.0	50.9	53.2		
	Scenario3	72.2	71.9	64.0	56.5	53.4	53.1	54.2	56.1		
Aged population ratio (%)	Baseline	11.0	16.0	24.2	32.1	37.6	40.4	41.4	40.2		
	Scenario1	11.0	16.0	24.2	32.0	36.9	38.6	37.7	34.6		
	Scenario2	11.0	16.0	24.2	32.0	37.0	38.7	37.8	34.7		
	Scenario3	11.0	16.0	24.2	31.5	34.7	33.8	31.0	27.7		

Generally speaking, some extra inputs of labor and capital are needed to gain extra economic growth under the assumption of fixed productivity. In the short term, capital could be raised from foreign countries and increase investment domestically, and then the positive cycle of economic growth and investment can repay capital loans from foreign countries.

The labor force can also be invited from foreign countries; however, it could be impossible for the invitation to remain long term and one fourth of the total population has to be invited. There could be various problems in inviting the labor force from foreign countries from the point of a sociocultural view, which could lead to large societal costs that could have negative effects on economic growth. Thus, it is desirable that higher birth rate be the means to control the aging population and to increase labor input to achieve sustainable economic growth.

Changes in fiscal and social welfare expenditure in scenarios

In terms of fiscal balance and social welfare expenditure, the first scenario is expected to maintain the trend of surplus in fiscal balance by higher economic growth, although the amount of fiscal surplus is somewhat lower than the expectations of major research institutions. This result supports that, as mentioned before, increased tax revenue from higher economic growth can lead to the surplus in fiscal balance and the amount of increase in the fiscal balance is relatively small because the growth of the size of the economy can lead to an increase in tax revenue but also in fiscal expenditures. Especially, in scenario 1, the ratio of public health and welfare expenditures to GDP would decrease because the increasing rate of public health and welfare expenditures is relatively lower than the rate of economic growth. On the other hand, the ratio of expenditures for family to GDP would increase. However, the ratio of expenditures for family and public health and welfare in fiscal payments would increase. Conclusively the result of scenario 1 supports that in the former, the increasing rate

of public health and welfare expenditures is relatively lower than the economic growth rate, but in the latter, the ratio of expenditures for family and public health and welfare increase.

There is no big difference between scenario 1 and scenario 2, which overlaps with economic growth in scenario 1. There are little changes in economic growth and population because the second scenario is linked with scenario 1 and especially, the tax revenue from economic growth would be relatively distributed to the expenditures for family and social welfare in balance; whereas in the third scenario, the fiscal balance shows a deficit because of the increasing expenditure for social welfare since some part of the increase in GDP is intentionally transferred to social welfare. Each transfer of 2.5% of the increase of GDP to the expenditure for family and public health and welfare causes their ratio to GDP to double. In addition, in the fiscal payments, the ratio of public health and welfare increase from 5% in 2040 to 20% in 2080 and the ratio of expenditures for family increases from 1% point in 2040 to 4% point in 2080. This has something to do with the previous results of scenario 3 in which the population is bigger and younger than in other scenarios.

Table 5. Changes in variables related to fiscal and welfare

Variables and scenarios		2010	2020	2030	2040	2050	2060	2070	2080
Consolidated fiscal balance (ratio to current GDP)	Baseline	1.4	3.0	1.5	0.5	3.0	5.7	7.0	8.1
	Scenario1			2.1	1.9	1.4	1.3	2.3	3.7
	Scenario2			-0.2	-0.1	-0.1	-0.1	-0.1	-0.2
	Scenario3			1.6	-0.6	-3.9	-6.7	-8.4	-9.1
Expenditures for public health and welfare (ratio to current GDP)	Baseline	5.1	5.6	7.3	9.0	10.8	12.6	13.4	14.1
	Scenario1			7.1	8.2	9.3	9.9	9.6	9.2
	Scenario2			7.1	8.3	9.3	9.9	9.7	9.2
	Scenario3			7.5	10.7	14.4	17.6	20.0	21.6
Expenditures for family (ratio to current GDP)	Baseline	0.6	0.6	0.7	0.7	0.7	0.7	0.7	1.0
	Scenario1			0.7	0.8	0.9	1.0	1.1	1.3
	Scenario2			0.7	0.8	0.9	1.0	1.1	1.3
	Scenario3			0.8	1.2	1.7	2.2	2.8	3.4

Table 5(cont). Changes in variables related to fiscal and welfare

Variables and scenarios		2010	2020	2030	2040	2050	2060	2070	2080
Expenditures for public health and welfare (ratio to fiscal expenditures)	Baseline	23.6	27.6	33.1	33.6	34.1	34.2	34.8	47.9
	Scenario1			33.3	38.5	43.4	47.3	49.5	50.9
	Scenario2			33.2	38.5	43.4	47.3	49.5	50.9
	Scenario3			34.6	44.6	54.1	61.1	66.6	70.6
Expenditures for family (ratio to fiscal expenditures)	Baseline	2.6	3.1	3.1	3.1	3.1	3.2	3.2	3.4
	Scenario1			3.2	3.6	4.0	4.7	5.7	7.2
	Scenario2			3.2	3.6	4.0	4.6	5.7	7.1
	Scenario3			3.6	4.9	6.3	7.8	9.4	11.0

Conclusion and Implications

Conclusion

This research develops the macroeconometric model to estimate the optimum population able to maintain national power and social welfare at the level of developed countries in terms of the economy. This model is a medium scale econometric model consisting of 21 estimated equations and 11 identities with 32 endogenous variables and 15 exogenous variables in which three sectors, macroeconomic, fiscal and welfare, and population, are mutually interacted. Three kind of scenarios were conducted with the model where the first scenario assumes a ratio of 2.2% of Korean GDP to world GDP, the second scenario assumes that the stability of the fiscal balance based on the conditions of scenario 1, and the third scenario assumes that fiscal payments expand at the level of developed countries based on the conditions of scenario 1. The conclusion from the simulated results shows that the Korean economy needs a population of 43 million to maintain the Korean national prestige in terms of economy in which there would have to be 13 million more than the baseline considering low birthrate and aging population. However, there is no big difference between scenarios 1 and 2 in the sense of population and expenditures for social welfare. Scenario 3 focuses on social welfare to increase birthrate and the level of welfare shows that the increased ratio of the

youth population leads to the increase of more than 2 million in the total population. The fiscal balance, however, would switch from surplus to deficit, which puts a burden on national finances.

Implications

It is necessary that the population be at the level of 43 million in the long run to maintain the economic national prestige of Korea. To achieve this objective, the economic growth rate has to be around 3% continuously, which can lead to fiscal stability through a surplus in the fiscal balance from the increases in tax revenue. Whereas considering economic national prestige and stable fiscal balances simultaneously, the ratio of expenditures for welfare is expected to decrease; and focusing on the expansion of expenditures for welfare, the deterioration of fiscal balance would be induced, which could lead to a slow down in the economic growth rate. Conclusively, it would be better to pursue aggressive economic growth policies to overcome the fiscal deterioration by the aging population rather than the expansion of fiscal expenditure.

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<Appendix 1> The Structures and Estimated Results by Block

1. Total Demand-Supply Block

<Total Demand>

▸Private consumption(real)

log(cp) = 0.92410*log(cp.1) + 0.07142*log(gdp-(tax-bsd)/pgdp)
(63.7967) (3.96971)
- 0.00567*log(pop65ov) + 0.14035 R Sq = 0.9999
(1.45415) (4.37326) Period : 2005-80

▸Government consumption

log(cg) = 0.87337*log(cg.1) + 0.09460*log(gdp) + 0.23524 R Sq = 0.9999
(30.0312) (3.52061) (8.12065) Period: 2005-80

▸Investment expenditure

log(ift) = 0.71113*log(ift.1) + 0.26781*log(gdp-(tax-bsd)/pgdp) - 0.02612 R Sq = 0.9997
(23.5832) (8.97918) (0.63228) Period: 2005-80

▸Exports(goods and service, real)

log(xx) = 1.17418*log(movavg(2,wgdp))
(49.5660)
+ 1.42392*log(movavg(2,(pwgdp*er)/pgdp)) - 9.5330 R Sq = 0.9765
(7.34048) (6.17397) Period : 2005-80

▸Imports(goods and service, real)

log(mm) = 0.56603*log(mm.1) + 0.56622*log(gdp)
(9.03849) (6.52646)
- 0.08666*log(pwmm*er/pgdp) - 1.55652 R Sq = 0.9994
(3.43718) (4.08504) Period : 2005-80

▸Real Gross Domestic Products(GDP) : gdp = cp + cg+ ift + xx - mm + stdis

▸Nominal Gross Domestic Products(GDP) : gdpv = gdp*pgdp

<Total Supply>

▸Potential GDP(real)

log(ppgdp) = alpha*log(let_e*hwn_e)*(lqsx*lqed*lqef))+(1-alpha)*log(kss_e)+13.7449

▸Potential capital stock(real) : kss_e = kss_e.1*(1-depr)+ift_e

▸Potential investment

log(ift_e) = 1.10783*log(ift) - 1.05646 R Sq = 0.9975

(170.268) (12.1570) Period : 2005-80

▸Potential employment

log(let_e) = 0.81574*log(let_e.1) + 0.17836*log(let) + 0.06925 R Sq = 0.9999

(90.7525) (24.7807) (3.03768) Period : 2005-80

<Price, Wage and Employment>

▸GDP deflator

log(pgdp) = 0.5*log(movavg(5,gdp/ppgdp))+0.48268*log(wage)-6.99091 R Sq = 0.9856

(NC) (69.6307) (61.8743) Period : 2005-80

▸Average wage for non-agricultural sectors

log(wage) = 0.76833*log(wage.1) + 0.30941*log(movavg(5,gdp/ppgdp))

(13.1889) (1.47170)

+ 0.31328*log(gdp/let) + 2.28504 R Sq = 0.9999

(3.94986) (4.07118) Period : 2005-80

▸Employment

log(let) = 0.82072*log(movavg(4,gdp/ppgdp)) - 0.00020*tr**2
(2.13325) (36.0866)
+ 0.01931*tr - 0.03035*d08+d09 + 9.6589 R Sq = 0.9942
(22.7173) (2.08631) (313.839) Period : 2005-80

2. Population Block

▸Employment

log(br) = 0.31587*log(movavg(5,cgehh/pgdp)) + 0.00022*tr**2
(2.32810) (5.47372)
- 0.05056*tr − 1.10337 R Sq = 0.9406
(4.94990) (1.34577) Period : 2008-80

▸Ratio of young population(0~14 years)

log(pop0014r) = 0.98774*log(movavg(6,br)) + 2.79311 R Sq =0.9494
(37.2781) (237.419) Period : 2005-80

▸Ratio of older population(65 years and over)

log(pop65ovr) = - 0.90519*log(movavg(33,br)) - 0.00024*tr**2
(3.01959) (3.91674)
- 0.04243*tr + 1.40158 R Sq = 0.9973
(3.16090) (2.47768) Period : 2007-80

▸Middle-aged and older populations(15 years and over) : pop15ov = let/remp

▸Young populations : pop0014 = pop0014r*pop

▸Older populations : pop65ov = pop65ovr*pop

▸Total populations : pop = pop0014 + pop15ov

3. Government Finance Block

▸Tax revenue

log(tax) = 0.99270 * log(movavg(2,gdpv)) - 1.72844 R Sq = 0.9998
(645.834) (72.0487) Period : 2005-80

▸Social security contributions

log(ssc) = 0.40440*log(let*wage) - 0.00028*tr**2 + 0.07707*tr − 2.25100 R Sq = 0.9999
(6.75897) (20.0195) (18.9544) (1.67295) Period : 2000-80

▸Non-tax capital fiscal revenue

log(cgro) = 1.94936*log(movavg(5,gdpv)) - 0.05997*tr − 13.6336 R Sq = 0.9943
(49.7256) (33.9162) (28.3979) Period : 2005-80

▸Consolidated fiscal revenue : cgr = tax + ssc + cgro

▸Fiscal expenditure for families

log(cgehh) = 1.19810 * log(movavg(3,gdpv)) - 7.93600 R Sq = 0.9952
(123.828) (52.6231) Period : 2005-80

▸Fiscal expenditure for non-family health·social welfare

log(cgeho) = 0.88303 * log(cgeho.1) + 0.11080 * log(movavg(3,gdpv))
(20.7721) (1.86427)
+ 0.06843 * log(movavg(3,pop65ovr)) - 0.36549 R Sq = 0.9999
(3.83061) (0.96313) Period : 2005-80

▸Fiscal expenditure for health·social welfare : cgehs = cgeho + cgehh

▸general administration·other fiscal expenditure

log(cgeeo) = 0.81966 * log(cgeeo.1) + 0.17975 * log(movavg(5,cg*pgdp))
(13.9181) (2.88122)
+ 0.07623 R Sq = 0.9971
(0.80166) Period : 2005-2080

- Consolidated fiscal expenditure : cge = cgehs + cgeeo
- Consolidated fiscal balance : bsd = cgr - cge - nbpi

<Appendix 2> The definition for Other variables, coefficients and functions in equations

items	definition
alpha	share of labor income alpha
wgdp	world gross domestic products(2005 year US $ base)
er	exchange rate(Korean Won/ US $)
pwmm	world import price index(2005=100 US $ base)
hwn_e	potential work hours per capita
lqsx	employment quality index with regarding sex
lqed	employment quality index with education
lqef	employment quality index with efficiency
nbpi	public non-financial corporation revenue
x.n	n lag for x variable(X_{t-n})
log(x)	natural logarithm of x variable
dlog(x)	logarithmic difference for
movavg(n, x)	simple moving average of x with n lag
D??	Dummy variable for “1” for 20?? and others “0”
tr	Time trend variable
**	power operator

Bridge Job is a “must” in Response to an Insufficient Retirement Income Protection System in Korea

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Background

Bridge job is a job that workers engage in just after retirement from a career job until complete withdrawal from labor market. It is quite common in labor market that workers change jobs for their career development. Career job is usually defined as a job that workers maintained for the most of their career, or the longest employment period. Workers tend to choose gradual withdrawal from labor market by taking a bridge job or bridge jobs.

From a human capital perspective, individual level and national level, transition from a career job toward a bridge job is a very desirable phenomenon since human capital could be fully utilized leaving little room for waste.

Bridge job is characterized by less pay and less responsibility than career job. Generally, workers could have choices on the level of pay and the strength of work by staying in the same industry or moving to different industries. Many factors could have influence on workers’ choices over bridge jobs including types of human capital they cumulated through career jobs and pension benefits. As human capital is more specific, workers choices of bridge job should be limited with respect to industry and type of work. Workers with general type (administrative work or sales) of human capital might have little difficulty in finding similar types of bridge job with less pay.

Pension benefits, both private and public, might influence workers' choice of bridge jobs especially in terms of timing, type, and duration. Other things being equal, workers tend to retire when their pension benefits maximize in value. In other words, workers consider cost of deferring pension benefit comparing to value increase. Cost of deferring pension benefits includes not only monetary value but stresses from working. Until the early 1990s, the age of 60 was the most common pensionable age for public and private pensions in major developed economies. If a worker is allowed to work until 60, then a bridge job starts on or after age 60. For some reason, if a worker is not allowed to work up to age of 60 a worker retires from career job and engage in bridge job if successful. By the mid-1990s, the issue of sustainability of public pension system emerged throughout the world. Many countries were forced to introduce reform proposals including fixing benefit formulae. As a result of reform, age of 65 has become the most common pensionable age today. Worker's reservation wage from bridge job depends on the level of pension benefit he or she receives or expect to receive from career job. Thus workers with high pension benefits tend to choose a bridge job that requires low level of job strength or not to take bridge job at all.

Patterns of bridge job might be quite different from those of major developed economies with mature pension system when pension system is not mature or absent. When pension system is not present or mature workers have to continue to work to generate retirement income in lieu of pension. Then bridge job becomes a "must" not an "option". National Pension System of Korea has been introduced in 1988 leaving most of old generation uncovered. If a person retires in 2013, the maximum covered year should be 25 or less. The mandatory private pension was introduced in 2005 in Korea. The Retirement Pension Act of 2005 provided employers and employee an option to switch to retirement pension from severance lump sum. The effect of Retirement Pension Act of 2005 is still meager and workers tend to choose severance lump sum. According to the monthly report on retirement pension (1st quarter of 2013) by the Ministry of

Employment of Employment and Labor, among the retirement benefit claimants aged 55 or over, only 3% (1,489) chose pension over lump sum severance payment, even as tax benefit is available only for those who choose pension benefits. After a series of parametric reforms, current pension replacement ratio for a new participant is adjusted down to 40% of career earnings with a 40-year contribution history, which is well below the OECD average. Considering retirement income protection system in Korea, the patterns and characteristics of bridge jobs for current old generation could be repeated for the baby boomers and future generations in Korea. The effect of pension on the behavior of retiring workers with respect bridge job is and will be very limited. The bridge job will still be a "must" rather than an "option".

This paper presents evidence that pension systems, public and private, play a major role in employment of old workers. Private retirement benefits are paid out as lump sum and workers are forced to start small businesses. Since success rate of small business is very low retirement income protection is threatened in Korea. This paper concludes that it is important that private pensions be further developed as the fully-functioning second pillar of the post-retirement income protection in Korea.

Public Pension System in Korea

Coverage

Korea's public pension is represented by the National Pension which was introduced in 1988, and currently 25.9% of old population (65+) is receiving pension benefits. Another main retirement scheme is civil servant & private school teachers' pension plans which were introduced in the late-1960s and early 1970s, respectively, with recipients over 230,000. Only 30% of the old population (65+) receives old-age pension benefits as of 2010. The rest, 70 % of old population (65+), is practically excluded from the contributory public pension system. Most of these 70% population (65+) were excluded or

not required (mandatory) to be covered due to the age ceiling in 1988. Non-contributory basic pension was introduced to target current old population who were not given chances to participate in the public pension system.

Table 1. Share of beneficiaries (65+) by public scheme in Korea

	Number of people (10,000)	Share (%)
Population(age 65+)[1]	551	100
National pension (old-age pension)	143	25.9
Non-contributory basic pension[2]	371 (289)	67.4 (52.6)[3]
Civil servant & private school teachers' pension	23	4.1
Excluded from public pension system	96	17.4

Source: Ministry of Health and Welfare of Korea

As of 2011, over 19.8 million people are covered by the Nation Pension. Even though National Pension is a universal system intended to cover every economically active people, 4.9 million people are classified as the "contribution suspended" due to economic hardships. In 2009, 20 year after the introduction of the National Pension System, the number of pensioners increased to more than 2.1 million.

[1] As of year 2010
[2] Means tested: 70% of 65(+) targeted, and currently 94,300 KW is paid.
[3] Excluding recipients of both national pension and non-contributory basic pension

Table 2. Number of Participants and Beneficiaries of National Pension System

Year	Number of participants (thousand)	Number of beneficiaries (old-age) (thousand)
1988	4,432	
1999	16,261	
2009	18,624	2,149
2011	19,886[4]	2,490[5]

Source: *Monthly Statistics*, National Pension System of Korea

In 2011, only 25.9% of the old population received national pension benefits, but the figure will rise to 42.1% in 2020 and to 75.1% in 2060.

Table 3. Future Benefit Recipients

Year	Population 65(+) (thousand) (a)	Beneficiaries of old-age pension 65(+)	
		Number of people (b)	Proportion(%) (b/a)
2020	8,100	3,407	42.1
2040	16,377	10,721	65.5
2060	17,934	13,471	75.1

Source: KIHASA

Pension amount of National Pension System (old-age)

Table 4 shows breakdown of level of pension amount, and a good portion (40.9%) of beneficiaries receive pension in an amount between KW 100,000~200,000. People who belong to the KW 200,000~300,000 bracket account for 23.8% which is the second biggest share. The average pension benefit is around KW 300,000 ($ 268[6]). Even though the National Pension is the main pillar of Korea's public pension, benefit level is far below the OECD average due to the

[4] This figure includes 4.9 million participants who do not contribute due to econo mic hardships including unemployment and close-down of small businesses.
[5] Includes beneficiaries below 65 years old
[6] Exchange rate: $ 1: 1,119 KW

immaturity of the system. In 2013, maximum possible covered years for a pension claimant is only 22 years. Since the coverage expanded gradually from big firms to medium/small businesses, average year of coverage is much less than 22 years. In case a worker experiences career interruption or a self-employed closes down small business, his/her covered year gets shortened. Immaturity of pension system and series of pension reform could explain insufficient old-age income protection for current old population and retiring population.

Table 4. Benefit level of National Pension System of Korea

Pension amount (10,000 KW)	Number of beneficiaries (10,000)	Share (%)
Below 10	11	4.3
10~20	102	40.9
20~30	59	23.8
30~40	28	11.3
40~50	16	6.5
50~60	11	4.5
60~70	8	3.2
70~80	6	2.3
80~90	4	1.5
90~100	2	1.0
100 and over	2	0.7
Total	249[7]	100

Source: National Pension Service http://www.nps.or.kr

Note: As of December, 2012

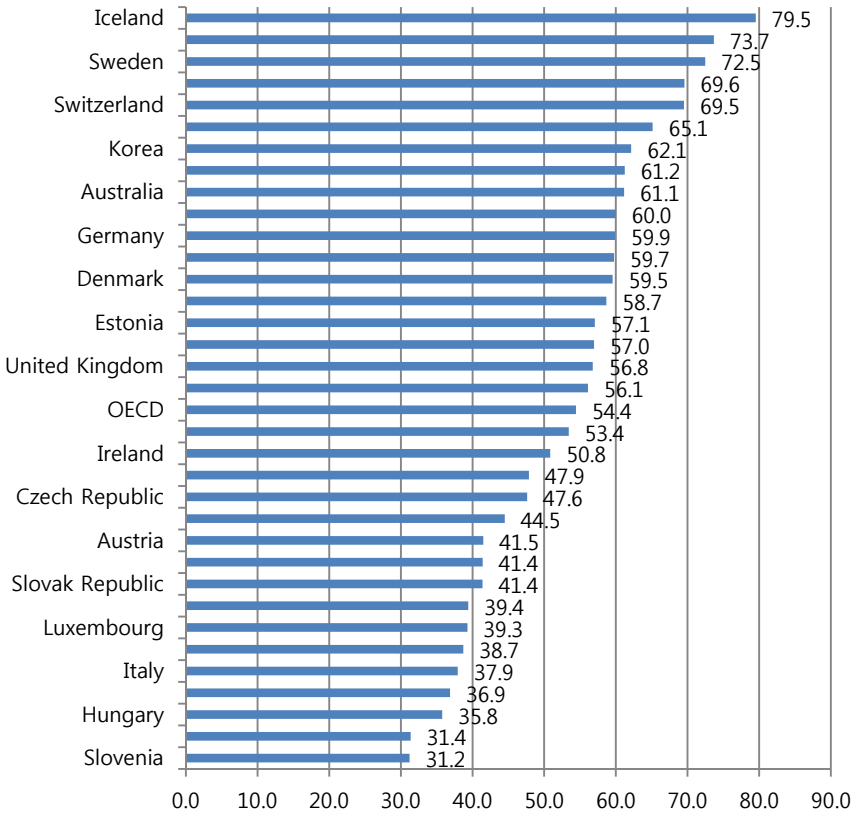
[7] This figure represents total recipients of age over 55.

Employment Status of Old Population and Retiring Population of Korea

Employment rate

The employment rate for Koreans aged between 55 and 64 is 62.1%. This figure is relatively high comparing to other OECD countries and the OECD average of 54.4%. Employment rate for old workers are influenced by many factors including pension systems. Timing of peak in pension benefit, especially true for private pension system, and the generosity of pension benefit both influence retirement behavior of workers. When the marginal cost of deferring pension receipt becomes higher than marginal benefit, workers decide to retire and claim pension benefit. Explaining differences in employment rates for OECD countries need thorough investigation beyond simple tabulation. Presence of well-developed corporate pension system is a factor in explaining differences in employment rates. Workers, if situation allowed, tend to delay their retirement until their corporate pension benefits get maximized in value. As an effect of pension reforms in many OECD countries, age of public pension entitlement has increased significantly to 65 and beyond. Workers have to delay their complete retirement from labor market until pension entitlement age. Delaying retirement from career job or engaging in bridge job could be possible options for old workers.

Figure 1. Employment rates of OECD countries (55-64)



Source: Fact book 2012, OECD

However relatively high employment rate (62.1%) for current old population and retiring population of Korea cannot be explained by effect of pension system, private or public. As explained above, due to relative short history of National Pension System and under-developed private retirement pension system, pension benefit or pensionable age do not influence choice of retirement. Simply, Korean old workers retire late in their lifetime to make a living in lieu of pension. Since average salary workers' retirement age from career job is well below 60, they need to find any job or start small business to replace pension.

In this sense, bridge job for Korean old worker is a "must", not an "option".

Table 5 shows the effective age of retirement and the official retirement age for OECD countries. Effective age of retirement is the average at which old cohorts retire completely from the labor market. The official retirement age is entitlement age for public pension system.

Table 5. Effective age of retirement & Official retirement age

	Effective age of retirement	Official retirement age	Difference
Luxembourg	58.0	65	-7.0
Belgium	59.6	65	-5.4
Austria	60.4	65	-4.6
Italy	60.8	65	-4.2
Poland	61.5	65	-3.5
Finland	61.8	65	-3.2
Greece	61.8	65	-3.2
Germany	61.9	65	-3.1
Norway	64.2	67	-2.8
Spain	62.3	65	-2.7
Ireland	63.3	66	-2.7
Hungary	60.4	63	-2.6
Slovak Republic	60.4	62	-1.6
Denmark	63.5	65	-1.5
Netherlands	63.6	65	-1.4
United Kingdom	63.6	65	-1.4
Slovenia	61.7	63	-1.3
Canada	63.8	65	-1.2
France	59.1	60	-0.9
United States	65.2	66	-0.8

Table 5(cont). Effective age of retirement & Official retirement age

	Effective age of retirement	Official retirement age	Difference
OECD-34 avg.	63.9	64	-0.1
Australia	65.2	65	0.2
Switzerland	65.5	65	0.5
Czech Republic	62.6	62	0.6
Israel	67.7	67	0.7
New Zealand	65.9	65	0.9
Iceland	68.2	67	1.2
Portugal	66.2	65	1.2
Sweden	66.3	65	1.3
Estonia	64.5	63	1.5
Chile	68.1	65	3.1
Turkey	63.5	60	3.5
Japan	69.3	64	5.3
Mexico	71.5	65	6.5
Korea	71.4	60	11.4

Source: Pension at Glance 2012, OECD

Thus the difference between the two figures represents how early or how late old workers retire comparing to public pension age. Figure for Korea is 11.4 years, the highest in OECD countries. This figure supports a claim that Korean old workers have to work late in their lifetime to replace or to supplement (significantly) pension. Table 6 shows employment status of old workers by age groups and more than 1.8 million people aged between 65 and 79 are still working and classified as “economically active”. Considering the fact that the population aged 65 or older was 5.5 million in 2010, a working population of 1.8 million aged between 65 and 79 seem very large for an OECD country. This figure explains the 11.4-year difference between effective retirement age and the official retirement age of Korea.

This fact illustrates well that old workers are forced to work harder and longer in the state of no pension or immature pension system.

Table 6. Job types for old workers by age cohort

Type of job	55~64		65~79	
	2005. 5 (thousand)	2012. 5 (thousand)	2005. 5 (thousand)	2012. 5 (thousand)
Managerial/specialist	250	386	57	95
Office work	84	187	19	25
Service/Sales	572	839	181	250
Farming/Fishery	533	451	705	673
Operator(machinery)	478	912	85	164
Manual work	652	881	337	633
Total (employed)	2,569	3,656	1,383	1,840
Employment rate		63.1		37.7

Source: "Economically Active Population Survey", Statistics Korea, May 2012.
Reproduced in "Employment Trend Brief", Korea Employment Information Service, May 2013

Difference in employment status and motive for old workers by cohort

For the old workers born before 1954, older than baby boomers, only 16.1% of employed are maintain regular jobs while this figure goes up to 36% for baby boomers. Statistics shows that little decline in share of "temporary" and "daily" from 20.9% to 17.8% and from 10.7% to 8.6% respectively. Another notable difference between two cohorts is share of self-employed. For the cohort born before 1954, 36.2% are reported as self-employed while baby boomers share is 21.8%. It is presumed that baby boomers are more educated and tend to engage in jobs that are related to their career jobs. The fact that thirty-six percent of baby boomers engage in regular jobs could support the presumption.

Table 7. Employment status of old workers in Korea

	Baby boomer (1963-1955)		Born before 1954	
	Number of people (thousand)	Share (%)	Number of People (thousand)	Share (%)
Regular	1,986	**36.0**	703	**16.1**
Temporary	982	17.8	910	20.9
Daily	473	8.6	468	10.7
Head of business	496	9.0	234	5.4
Self-employed	1,204	**21.8**	1,581	**36.2**
Unpaid Family business employee	376	6.8	470	10.8
Total employed	5,517	100	4,366	100

Source: "Economically Active Population Survey", Statistics Korea, May 2012.
Reproduced in "Employment Trend Brief", Korea Employment Information Service, May 2013

Table 8 presents survey results on intension of continuing work and motive of working for old workers age 55~79. Fifty-nine percent of old population has intention to continue working and forty-one percent has no intension to continue working. Among those who have intention to continue to work, fifty-four percent of old people have to work for economic purpose. In Korea, it is safe to assume that old workers are forced to work not for pleasure or other reasons, but for making living, in lieu of retirement income protection system through public pension or private pension system.

Table 8. Motive for working of old workers in Korea

		2005.5	2007.5	2009.5	2011.5	2012.5
Age 55~79 (thousand)		8.099 (100%)	8,594 (100%)	9,111 (100%)	9,953 (100%)	10,511 (100%)
Will continue to work	For pleasure & other	2,200 (46.2%)	2,161 (43.7%)	2,277 (43.4%)	2,627 (45.1%)	2,827 (45.6%)
	For economic purpose	2,566 (53.8%)	2,784 (56.3%)	2,974 (56.6%)	3,192 (54.9%)	3,371 (54.4%)
	total	4,766 (58.2%)	4,945 (57.5%)	5,251 (57.6%)	5,819 (58.5%)	6,198 (59.0%)
Will not continue to work		3,333 (41.2%)	3,649 (42.5%)	3,860 (42.4%)	4,134 (41.5%)	4,313 (41.0%)

Source: "Economically Active Population Survey", Statistics Korea, May 2012.

Reproduced in "Employment Trend Brief", Korea Employment Information Service, May 2013

Importance of Pension System in Retirement Behavior of Old workers

Pension expenditure and employment rates in OECD countries

Employment rate and pension scheme are closely related in terms of timing of retirement from career job and choice of bridge job. The size of pension expenditure relative to GDP implies the maturity of the pension system. It also illustrates depth of pension system such as replacement ratio. Italy, France, Austria, Greece, Portugal, Poland, Germany, Denmark, Finland, Slovenia report pension expenditure of over 10% of GDP. For example, pension expenditure in Italy is 15.68% of GDP, the highest in all OECD countries. When this figure is related to employment rate difference (33.17%) between two age groups (age 25~54 vs. age 55~64) we could infer that effect of pension system might have influenced employment rate. A similar trend can be found in Austria, Belgium, France, Greece, Poland, and Slovenia.

On the contrary, relatively low level of pension expenditure is related to smaller change in employment rate between two generations. For Australia, pension expenditure is 7.95% of GDP, and the

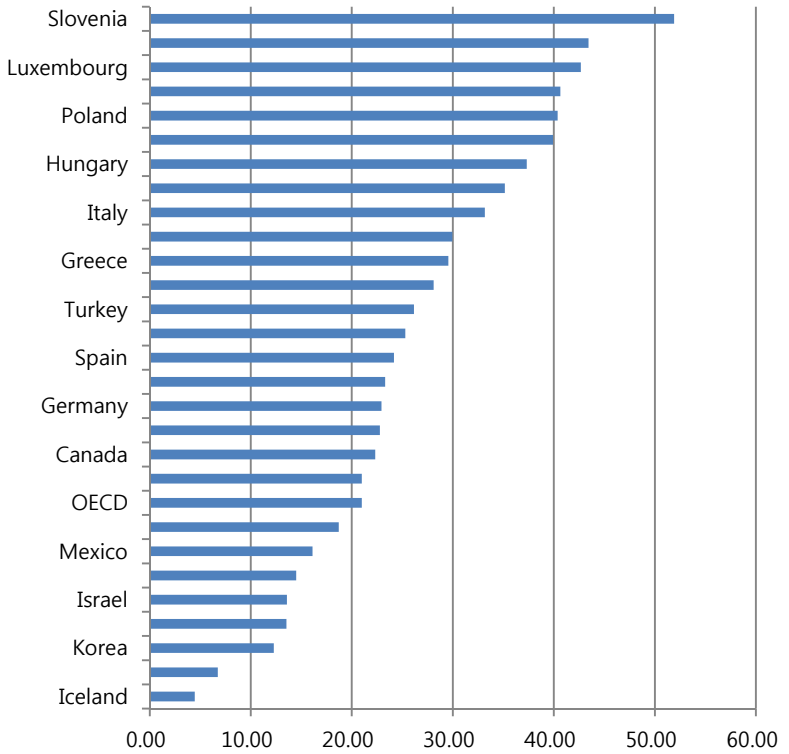
employment rate difference between two generations is only 18.71%. Since it is safe to presume that age group of 55~64 is regarded as pension entitlement ages significant difference in employment rates between two generations implies that workers decided to retire from job to claim pension. As level of pension benefit gets higher, cost of continuing work increases. New Zealand and Iceland show similar trends as Australia with relatively low level of pension expenditures and smaller change in employment rates. Pension expenditure can be broken down to public pension and private pension. For countries with pension expenditures of more than 10% of GDP, one common feature is the dominance of public pension. For Italy, private pension expenditure account for only 0.24% of GDP. This trend is found in France with 0.38%, Austria 0.24%, Finland 0.62%, 0.17% Germany, 0% Greece, 0.6% Hungary, Poland 0.01%. It is quite interesting to find that countries with pension expenditures little less than 10% report significant contribution of private pension expenditure. Australia reports private pension expenditure of 4.46% of GDP, Denmark 4.54%, Iceland 5.50%, the Netherlands 4.0%, and the UK 3.32%. Iceland has a private pension system with expenditures taking up as much as 5.5% of GDP, with total pension expenditure accounting for 7.25% of GDP. Another private pension dominant country is Australia of 4.46% of private pension expenditure with 7.95% of total pension expenditure. It can be concluded that pension expenditure and dominance of private pension have relevance in employment rate of old workers (55~64). OECD average of employment rate for old workers (55~64) is 54.4% while private pension dominant countries report well above OECD average.

Table 9. Pension expenditure and employment rate

	Pension expenditure (%GDP)			Employment rate (%)	
	Public (2009)	Private (2010)	total	55-64 (2011)	25-54 (2011)
Australia	3.49	4.46	7.95	61.14	79.85
Austria	13.47	0.24	13.71	41.50	84.94
Belgium	10.04	2.92	12.96	38.71	79.35
Canada	4.55	2.50	7.05	58.68	81.00
Chile	4.88	2.07	6.95	59.74	74.24
Czech Republic	8.32	0.47	8.79	47.63	82.77
Denmark	6.11	4.54	10.65	59.54	82.32
Estonia	7.95	0.02	7.97	57.07	78.07
Finland	9.95	0.62	10.56	56.96	82.25
France	13.73	0.38	14.11	41.41	81.33
Germany	11.25	0.17	11.43	59.89	82.83
Greece	13.05	0.00	13.05	39.41	68.97
Hungary	9.94	0.16	10.10	35.78	73.09
Iceland	1.75	5.50	7.25	79.53	83.98
Israel	5.02	1.72	6.74	61.25	74.83
Italy	15.44	0.24	15.68	37.94	71.11
Korea	2.15	1.39	3.53	62.15	74.42
Luxembourg	7.66	0.11	7.77	39.29	81.95
Mexico	1.26	0.34	1.60	53.42	69.53
Netherlands	5.11	4.00	9.11	56.10	84.19
New Zealand	4.69	1.33	6.02	73.68	80.41
Poland	11.78	0.01	11.79	36.86	77.24
Portugal	12.32	0.71	13.03	47.86	77.81
Slovenia	10.87	0.03	10.91	31.21	83.12
Spain	9.28	0.60	9.88	44.49	68.66
Sweden	8.23	1.36	9.58	72.47	86.00
Turkey	6.82	0.07	6.89	31.37	57.53
United Kingdom	6.19	3.32	9.51	56.79	80.09
OECD	7.83	2.12	9.94	54.44	75.43

Source: Pension Markets in Focus, No.8 July 2011 OECD

Figure 2. Difference in employment rate between age groups (25-54 vs. 55-64)



Source: OECD 2012

Table 10 reports average difference of employment rates between two generations by the level of dominance of private pension for countries with pension expenditure more than 9% of GDP. From Greece to Spain, contribution of private pension expenditure to total pension expenditure is below 7%. From Sweden to the Netherlands, contribution of private pension is more than 14% even up to 43.8%. It is quite evident that two groups of countries show difference in employment rates of 34.3% and 25.6% respectively. One other observation to be made is that low employment rates for working age group (25~54) have relevance on pension expenditure in terms of level and dominance of private pension system. The OECD average employment rate for cohort of age between 25 and 54 is 75.4%. Spain,

Mexico, Italy, Israel, Hungary, Greece, Korea, and Chile report an employment rate below the OECD average. The common feature of pension system of these countries, except for Chile, is the dominance of public pension. Countries with relatively high contribution of private pension expenditure to total pension expenditure show high employment rates for working age population. Based on OECD statistics, we could conclude that pension expenditure relative to GDP of nation and contribution of private pension to total pension expenditure might have influence on employment rates of both working population (25-54) and old workers (55-64).

Table 10. Difference in employment rate (25-54 vs. 55-64) and total pension expenditure by country group

Difference in emp. Rate (%)	Average of total pension expenditure (%)
Below 20%	6.2
20~30%	9.9
Over 30%	11.7

Source: Pension at Glance 2012, OECD

Table 11. Contribution of private pension expenditure on difference in employment rate (countries with exp. more than 9% of GDP)

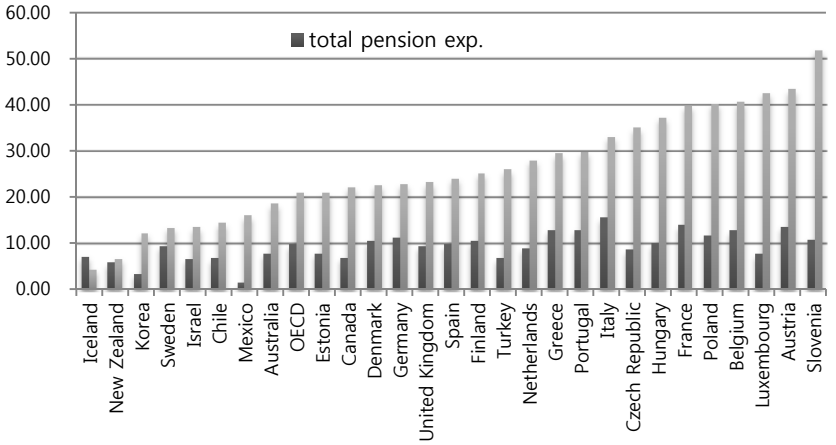
	contribution of private pension expenditure to total pension expenditure (%)	difference in emp. rate (%)	Average: difference in emp. rate (%)
Greece	0.01%	29.55	
Poland	0.07%	40.37	
Slovenia	0.32%	51.90	
Germany	1.50%	22.94	
Italy	1.50%	33.17	
Hungary	1.58%	37.32	34.37
Austria	1.74%	43.44	
France	2.67%	39.92	
Portugal	5.48%	29.95	
Finland	5.85%	25.29	
Spain	6.03%	24.17	

Table 11(cont). Contribution of private pension expenditure on difference in employment rate (countries with exp. more than 9% of GDP)

	contribution of private pension expenditure to total pension expenditure (%)	difference in emp. rate (%)	Average: difference in emp. rate (%)
Sweden	14.15%	13.53	
Belgium	22.53%	40.64	
UK	34.91%	23.31	25.67
Denmark	42.66%	22.78	
Netherlands	43.86%	28.09	

Source: Pension at Glance 2012, OECD

Figure 3. Total Pension expenditure and difference in employment rate



Source: Data from Pension at Glance and Pension Markets in Focus, No.8 July 2011 OECD

Pension replacement ratio and employment rate

So far, we have examined the effect of two pension variables such as official retirement age and pension expenditure for their influence on employment rate for old workers. One more variable that is worth observing is replacement rate of pension benefit. Replacement rate coupled with other measures such as premium rate and age of entitlement represents index for generosity of pension system. Pension replacement ratios show high level of variance throughout the OECD

countries. Iceland and Greece report above 90% of replacements while contribution of public and private is quite opposite. Replacement ratio of mandatory private pension is 81.9% for Iceland, and 0% for Greece. Netherlands, Denmark, Hungary, Israel, Poland, Sweden, and Australia report high level of replacement ratio of mandatory private pension. The U.S., Canada, the U.K., and Ireland report high level of replacement ratio for their voluntary DC plans. Ranking of pension expenditure and ranking of replacement ratio do not seem as related. Italy reports the highest level of pension expenditure relative to GDP while total replacement ratio is 64.5% which is much lower than Greece of 95.7%. France, Portugal, and Belgium spend well above 10% of GDP on pension, but the total replacement ratios are around 50%. Greece could be classified as high level of pension expenditure and high level of replacement ratio contributing significant difference in employment rate between working age group (25-54) and old worker group (55~64).

Table 12. Pension replacement ratio (average earners) as percentage of earnings

	Public	Mandatory Private	Voluntary DC	Total
Iceland	15.02	81.91		96.93
Greece	95.71			95.71
Netherlands	29.23	58.91		88.14
Luxembourg	87.37			87.37
Spain	81.18			81.18
Denmark	28.93	50.75		79.68
United States	39.43		38.78	78.21
Austria	76.61			76.61
Hungary	44.43	31.41		75.84
Canada	38.88		30.78	69.66
Israel	19.43	50.15		69.59
United Kingdom	31.91		36.73	68.64
Ireland	28.96		37.57	66.54
Norway	46.06	7.02	11.97	65.05
Italy	64.54			64.54

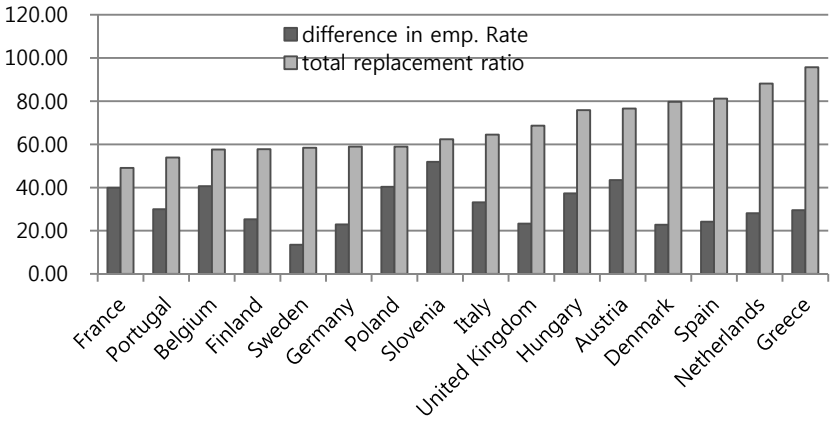
Table 12(cont). Pension replacement ratio (average earners) as percentage of earnings

	Public	Mandatory Private	Voluntary DC	Total
Turkey	64.54			64.54
Slovenia	62.39			62.39
Czech Republic	50.23		11.27	61.49
Poland	28.74	30.25		58.99
Germany	42.03		16.94	58.96
Sweden	35.79	22.66		58.45
Switzerland	34.51	23.41		57.92
Finland	57.77			57.77
Belgium	42.04		15.57	57.61
Slovak Republic	25.97	31.56		57.53
Portugal	53.94			53.94
New Zealand	38.74		14.64	53.39
France	49.08			49.08
Estonia	25.52	22.53		48.05
Australia	11.85	35.44		47.29
Chile	3.20	41.66		44.85
Korea	42.05			42.05
Japan	34.45			34.45
Mexico	4.02	26.92		30.95

Source: OECD Pension model, Pension at Glance 2011, OECD

On the contrary, France shows high level of pension expenditure with low level of replacement ratio contributing to the large difference in employment rates between the two age groups. It is reasonable to think that high level of pension replacement ratio is related to high level of pension expenditure. But some countries show irrelevance between two parameters. Pension replacement ratio as a proxy for generosity of pension benefit is examined whether it could contribute to shortening the years of labor market participation.

Figure 4. Total replacement ratio (public+ mandatory private+ voluntary DC) & difference in employment rate (25-54 vs. 55-64)



Correlation of pension variables and employment rate

Since there is no official data on bridge jobs for OECD countries it is hard to evaluate effect of pension variables on choice and duration of bridge jobs. Throughout Chapter 4, with series of tabulation and figures, authors made an effort to present indirect evidence of retirement behavior differences in OECD countries with diverse backgrounds in pension system. Authors infer that retirement behavior differences could imply different patterns of bridge jobs. Authors ran a simple correlation analysis to test our inference. The test result shows that total pension expenditure is highly correlated (0.629**) with change in employment rate between working age population (25-54) and old workers (55-64). It implies that maturity of pension system is factor for workers in making decision to retire. An interesting finding is that total pension expenditure relative to GDP is negatively correlated (statistically significant: -0.709**) with difference in retirement age (effective vs. official). It implies that maturity of pension system or possibly generosity of pension system make workers to retire near or even earlier than official retirement age for public pension system. Evidence that generosity of pension benefit could shorten the duration of labor market participation is well

presented by negative correlation (statistically significant: -0.537**) between total pension replacement ratio and difference in retirement age (effective vs. official).

Table 13. Correlation Matrix of pension parameters (27 countries)

	Total pension exp	Difference in emp. rate	Total replacement ratio	Difference in retirement age
Total pension exp	1	0.629**	0.285	-0.709**
Difference in emp. rate	0.629**	1	0.153	-0.606**
Total replacement ratio	0.285	0.153	1	-0.537**
Difference in retirement age(official vs. effective)	-0.709**	-0.606**	-0.537**	1

**: correlation is significant at the 0.01 level (2-tailed)

Findings from correlation analysis show that pension system (public and private) definitely influence workers' decision on when to retire. Maturity and generosity are key factors in retirement behavior of workers in most of OECD countries. Then what happens if there is no mature pension system and/or benefit level is not high enough to maintain living. Korea is a good example. OECD data shows that difference in retirement age between effective and official of Korea is 11.4 years, which is the longest in OECD countries. It implies that old workers have to work much longer than official pension entitlement age (65) to make a living. Smooth transition from career job to complete withdrawal from labor market with choice of bridge jobs in between is not feasible for Korean old workers.

Conclusion

Throughout the developed countries, sustainability of public pension system has been controversial policy agenda beginning of 90s. Many countries introduced reform proposals that reduce benefits and/or increase insurance premium (payroll taxes). Korea was not the exception. Replacement ratio has been reduced from 70% to 40% (gradually) and entitlement age will be 65 in year 2033. Considering a fact that reforms have started well before maturity of public pension system, next generation of Korean old workers will face similar retirement environment to that of current generation. In other words, pension system will not be a factor in making decision to retire. But, if private retirement pension system is to work properly, there is a hope. Currently, most of retiring old workers chooses lump sum retirement benefit rather than pension benefit. It does not operate as the second pillar of old-age retirement income protection system in Korea. Since it is paid out as lump sum old workers tend to open small business to make a living for the rest of lifetime in lieu of pension. However success rate for small business is extremely low in Korea many retired population face an economic hardship by failing businesses.

In 2005, the Korean government introduced retirement pension system to change a tradition of paying out lump sum benefits. Korean government simply provides tax benefits for choosing pension benefit over lump sum benefit. Retiring workers still have choice between traditional lump sum benefits and pension benefits. Since private pension scheme is voluntary a worker still can choose lump sum payment, forgoing tax benefit. Table 14 shows the most current statistics on private pension benefit. In 1st quarter of 2013, only 3% of legitimate[8] retiring workers chose pension benefits over lump sum benefits. In terms of value of benefits, 99.9% (KW 15, 689 million KW) of benefits were paid out in lump sum. It implies that private pension system is not working properly and might even be regarded as

[8] Workers who satisfy requirement for years of service and age(55 and over)

nonexistent. According to a study[9], total value of private retirement pension reserve will be KW 233,598 billion in 2020 from KW 67,346 billion in 2012, which is 3.4 times increase in less than 10 years and its share to GDP will be 13.2%.

Table 14. Breakdown of Retirement Benefits

	Lump sum Benefit		Pension Benefit		Grand Total	
	Number of Recipients	Amount (100 million)	Number of recipients	Amount (100 million)	Number of recipients	Amount (100 million)
1st quarter 2013	48,532 (97%)	15,689 (99.9%)	1,489 (3.0%)	17 (0.1)	50,021 (100%)	15,706 (100%)
4th quarter 2012	35,563 (96.3%)	4,200 (99.5%)	1,362 (3.7%)	19 (0.5%)	36,915 (100%)	4,219 (100%)
Increase	12,979	11,489	127	-2	13,106	11,487

Source: Monthly report on retirement pension (1st quarter of 2013) by Ministry of Employment of Employment and Labor of Korea

[9] "Projection of Private Pension Reserve", Jinho Oh(Statistics of Korea), Dubin Lim(Department of Economics, Sungkyunkwan Univ.), Yongil Chun(Department of Economics, Sungkyunkwan Univ)

Table 15. Projection of Retirement Pension

	DB		DC		IRP		Total	
	Value of Reserve (billion KW)	Share (%)	Value of Reserve (billion KW)	Share (%)	Value of Reserve (billion KW)	Share (%)	Value of Reserve (billion KW)	Share of GDP (%)
2012	49,699	73.8	11,956	17.8	5,692	8.5	67,346	5.3
2013	55,516	71.0	12,101	15.5	10,604	13.6	78,221	5.9
2014	62,645	69.8	13,413	14.9	13,708	15.3	89,767	6.5
2015	71,376	68.8	15,157	14.6	17,189	16.6	103,723	7.2
2016	81,854	68.0	17,449	14.5	21,151	17.6	120,454	8.0
2017	93,871	66.5	21,203	15.0	26,135	18.5	141,211	9.0
2018	108,128	65.0	26,111	15.7	32,017	19.3	166,257	10.2
2019	124,964	63.6	32,512	16.5	39,048	19.9	196,524	11.5
2020	144,930	62.0	40,980	17.5	47,687	20.4	233,598	13.2

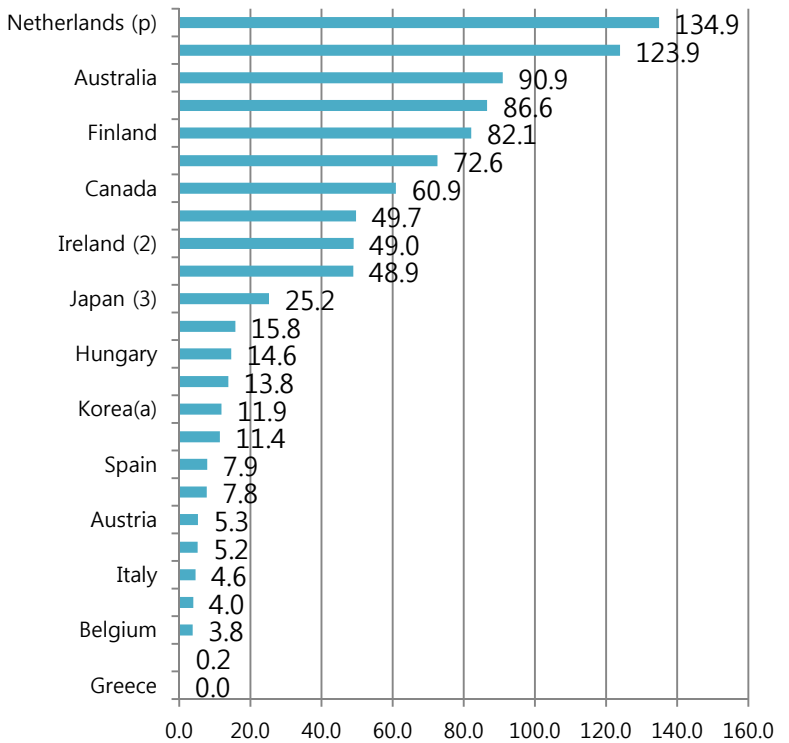
Source: "Projection of Private Pension Reserve", Jinho Oh(Statistics of Korea), Dubin Lim(Department of Economics, Sungkyunkwan Univ.), Yongil Chun(Department of Economics, Sungkyunkwan Univ), Paper presented at the spring conference of Korean Pension Association, June 5th 2013

According to estimation10 by the Ministry of Employment and Labor of Korea, the book value of retirement benefit is about 152.1 trillion KW. Since current total value of retirement pension reserve is 67.3 trillion KW, the reserve ratio of retirement pension benefit is 41.6%. If total book value of benefit is reserved its share to GDP could be 11.97% in 2013. If it is assumed that total book value of retirement benefit increases in line with GDP growth, its share to GDP in 2020 is expected to be 16.63%. Figure 5 illustrates sizes of private pension funds relative to GDP for OECD countries. It ranges from 0% of Greece to 134% of the Netherlands. Countries with dominant DB

[10] Monthly report on retirement pension (1st quarter of 2013) by Ministry of Employment of Employment and Labor of Korea, 2013

public pension system show relatively low level of Assets compared to countries with dominant DC private pension system. As of 2011, Korea reports private pension reserve of 4% of GDP. If all book value of retirement benefits are put in reserve its figure goes up to 11.9% as shown in Korea(a) in Figure 5. This figure is still much lower than the most of OECD countries.

Figure 5. Importance of Private Pension Assets to Economy (% of GDP)



Source: Pension Markets in Focus, No. 8 July 2011, OECD

Under the circumstance of dwindling public pension benefit as a result of pension reforms, it is very unlikely that public pension system will operate as a main pillar in retirement income protection system in Korea. Therefore, private retirement benefit system should

transform into legitimate second pillar system to secure old-age retirement income. Two things have to be done to transform current lump sum dominant retirement benefit system of Korea into the full-pledged second pillar. First, workers' additional contribution should be motivated. Currently, only 8.3% of employees' wage is either to put in reserve or be accounted in book value of firms. Considering that premium rate for public pension system is 9% (4.5% each for employee and employer), which replaces only 40%[11] of average earnings with 40 years of coverage, the 8.3% should be raised through worker participation.

Second, more tax incentives should be given for workers choosing pension benefits over lump sum benefits. Retiring workers try to secure old-age income through opening up small businesses. However survival rates of small shops and businesses are extremely low, they fail to secure old-age income. The levels of tax incentive vary according to the annuitization period that workers choose. Somehow, locking mechanism for retirement benefit should be strengthened to prevent disastrous retirement life of old workers engaging in a bridge job of "must" not "option".

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OECD, *Fact book 2012*,

[11] 40% of replacement ratio is for average income earners

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Reproduced at "Employment Trend Brief", *Korea Employment Information Service*, May 2013

Japan's Pension Reform, Labor Market Responses, and Savings

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Introduction

The experience of rapid population aging and low fertility rate is of great concern to the Japanese government as it implies an increased dependency burden on the working age population and threatens fiscal sustainability in the field of pension and medical care. As regards the public pension system, Japanese government has been implementing a series of changes in the pension programs, such as a reduction in the pension benefit multiplier,[1] raising the premium rate, and extending pension eligibility ages.

This paper specifically focuses on the economic impacts of the increase in pension eligible age in Japan. There are two major pensions in Japan, one the Employment Pension Insurance, and the other the National Pension Insurance. The NPI is flat rate. The eligibility age for male workers in the employee pension program was set to 60 in 1973 and remained at that age up to year 2000. However, in 2001 it was decided that the eligibility age for the flat-rate component should be increased by one year every three calendar years to age 65 in 2013, while the eligibility age for the wage-proportional component would be raised by one year every three calendar years

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[1] In particular, the 1985 pension reform was revolutionary in that it incorporate d the reduction in the benefit multiplier and flat-rate benefit for the first tim e, aiming to hold down an increase in total pension benefits.

from 2013, reaching 65 in 2025. For female beneficiaries the eligibility age was 55 until 1999 when it was raised to 60 to catch up with men. The female eligibility age is now set to further increase, starting from 2006 for the flat-rate benefit and from 2018 for the wage-proportional benefit. Also, the law enables firms to raise the targeted retirement ages through the adoption of one of the following options: 1) to abolish the mandatory retirement age altogether, 2) raise the mandatory retirement age to 65, or 3) introduce the continued employment system (under which those employees who wish to continue to work beyond the mandatory retirement age are rehired under revised employment conditions).

The effects of these policy changes have been hotly debated in the Japanese mass media, but empirical evidence is lacking, particularly in terms of the short-run and long-run economic effects. For example, the increase in EPI age might have affected some workers and hence could have eased the financial pressures on the social security system. The policy makers in Japan have been concerned about the declining trends in the labor force and saving rates too. Labor force and savings trends in the recent past, taken together, suggest that Japan's economy is likely to grow at a slower pace in the future than it did during much of the postwar period.

How much does a rise in the EPI age make the old stay longer in the workplace? How have these policy targets affected age earnings profiles in Japan? What would be the fiscal and the economic effect of this policy change in the long run? This paper tries to answer these questions.

Individuals could have responded to the policy in several different ways. Individuals may delay their retirement. This possibility is supported by previous studies on the link between pay-as-you-go retirement pension benefits and earlier retirement practices (e.g., Gruber and Wise 1999). The size of the behavioral response, however, has little been examined. There have been some studies on this issue for the U.S., especially in the late 1980s. Almost all previous studies found that even a substantial change in the social security program

would cause only small changes in the actual retirement age. For example, Burtless and Moffitt (1985) first showed that increasing the normal retirement age for social security benefits from 65 to 68 would delay retirement by about 4 months, suggesting that this elasticity is only 0.11 on average. Although Mastrobuoni (2009) shows a largest elasticity with 0.6, a few existing studies concluded that they are not more than 0.2 if we restrict the policy change to the increase in normal retirement age (Krueger and Pischke 1992; Bloom, Canning, Fink, and Finlay 2009). To our best knowledge, there is no study on this effect for Japan, which is one motivation for the present study.

In the long run, there could be effect on savings due to individual's behavioral responses to the policy. In a simple lifecycle model, workers might accumulate wealth in anticipation of future needs to support consumption for longer periods of retirement without pension benefits. This response initially leads to higher savings and lower consumption, but the additional capital is growth enhancing, and eventually income per worker rises. But if workers delay their retirement substantially in response to the policy change, then aforementioned effect on savings can be attenuated, since the future need to support consumption for retirement decreases. Although this is also an interesting research questions, there is no systematic studies which examine this for Japan either. This paper simulates the effect of the increase in the retirement age on savings for Japan, built upon the simulation model by Mason and Lee (2007).

The study uses two types of data sets. To estimate the effect of the increase in EPI age on employment by age, we use time series data since 1968. The information on employment by 5-year age groups is obtained from the *Annual Report on the Labour Force Survey*, published by the Statistics Bureau of Japan. Other macroeconomic indicators are obtained from the World Development Indicator (WDI). UN World Population Prospect 2010 is used for population projections. To estimate its impact on earnings, pension benefits, and savings, we use six selected years (i.e, 1984, 1989, 1994, 1999, 2004, and 2009) of National Transfer Accounts (NTA) database of Japan.

These data base are constructed from the six rounds of the *National Survey of Family Income and Expenditure* (NSFIE) from 1984-2009, carried out by the Statistics Bureau of Japan, and public-sector information for the corresponding five years, gleaned from various government publications. The NTA data measure the reallocations of economic resources across age that respond to the economic lifecycle. With its age component, the NTA enables us to measure the intergenerational reallocation of economic resources in comprehensive detail, such as intergenerational transfers and assets, both public and familial. The estimates, when aggregated, are consistent with the National Income and Product Accounts (NIPA). More detailed information on methodology is available from Lee, Lee, and Mason (2008), Mason, Lee et al. (2009), or on the project website: http://www.ntaccounts.org.

The paper is organized as follows. The next section describes Japan's old age pension system and its reform. This is followed by a section describing a model. Background in the Japan's labor market conditions for older workers is described in the next. This is followed by a section which compares the employment pattern of Japan for 1968-2010 and predicts the effect of the retirement policy change. Then, we proceed to present the NTA estimates of Japan for 1984-2009 estimates and discuss the fiscal impact of the policy as well as the long-run effects of the policy change on the savings. The final section summarizes the main results and provides a few policy implications of the findings.

Japan's Old-Age Pension Schemes and Reform

Japan's social security system encompasses old-age pension schemes and medical plans, as well as the long-term care Insurance scheme and some other smaller programs. Japan's old-age pension schemes were initially established for specific occupational groups, with some groups covered earlier than others. Currently the two major insurances, the Employees' Pension Insurance (EPI) and the National Pension

Scheme (NPS), cover slightly less than half of the work force, respectively.[1] The EPI was established in 1941, while the NPI was established in 1961 to cover workers not covered by other public pension schemes. Thus, 1961 marks the onset of universal pension coverage for workers in Japan. A major difference between the EPI and the NPI is that paid employees working for a firm with at least five regular workers belong to the EPI, whereas farmers, other self-employed workers, employees of small firms with less than five regular workers, and certain other categories belong to the NPI. The two insurances also differ in levels and methods of contribution. In the EPI in 2011, 16.4 percent of a worker's total annual earnings including bonuses is contributed to the government, evenly split between the employee and the employer. In the NPI, the government collects a flat contribution from the members, most of whom are self-employed. In 2011, this contribution is 15,020 yen (about US$188) per month. Because of lower contributions, benefits paid to NPS recipients are considerably lower than those paid by the EPI. In both the NPI and the EPI, benefits have been automatically linked to changes in the consumer price index only since 1999.

The share of pension benefits of total social security increased from 22 percent in 1965 to 53 percent in 2008, while medical benefits decrease from 57 percent to 32 percent during the same period (National Institute of Population and Social Security Research, 2010). The major shift toward pension benefits has occurred largely because of population aging because pension benefits are concentrated only on older population while medical benefits are provided to the entire population regardless of age. Of course, other factors such as maturation of the pension system and major reforms in medical plans to restrict to health costs.

When the old-age pension schemes were initially established, they were organized under the principle of reserve financing. As the social

[1] The Mutual Aid Insurance (MAI) covers most of the others, employees in the public sector and private schools.

security system evolved, however, the reserves accumulated turned out to be insufficient to cover current benefit payouts, thus requiring the government to shift away from reserve financing toward pay-as-you-go financing by gradually increasing subsidies from general tax revenues. Unlike reserve financing, pay-as-you-go financing is directly affected by the age composition of the population. The reserve funds accumulated in the past have been diminishing in recent years as the proportion of the elderly population has increased. The EPI's reserve funds are a salient example. Moreover, various calculations have shown that intergenerational equity considerations will become an increasingly divisive social issue as population aging accelerates in Japan during the next few decades (Ogawa and Retherford, 1997). Mainly due to such gloomy long-term prospects, an increasing proportion of the population enrolled in the NPI is discontinuing contributions: 42 percent of the participants did so in 2010 (In the case of Okinawa prefecture, which is the worst among all the prefectures in Japan, 64 percent of the participants are not making contributions to the NPI at the present moment).

In order to maintain financial solvency, Japan's pension schemes have been periodically reviewed and reformed. One of the major pension reforms was carried out in 2004 with the primary objective of addressing the sustainability of pension schemes, which in effect meant the reduction of benefits to a considerable extent. To accomplish this, the 2004 pension reform built in the adjustment factor called macroeconomic indexation in which, aside from earnings, the effects of population aging such as the prolongation of life span and the fall in the number of contributors are reflected. The law also raises the retirement age to a level comparable with the pensionable ages by implementing the Law Concerning Stabilization of Employment of Older Persons. This law requires Japanese firms to raise the Employee's Pension Insurance (EPI) age based on the following schedule: between April 2006 and March 2007 to 62 years; between April 2007 and March 2010 to 63; between April 2010 and March 2013 to 64, and from April 2013 onwards to 65. Also, the law

enables firms to raise the targeted retirement ages through the adoption of one of the following options: 1) to abolish the mandatory retirement age altogether, 2) raise the mandatory retirement age to 65, or 3) introduce the continued employment system (under which those employees who wish to continue to work beyond the mandatory retirement age are rehired under revised employment conditions).

Effect of Aging on Labor Market

Like many other countries, Japan has been aged very rapidly primarily due to rapid decline in fertility rates. Japan's fertility declined remarkably shortly after the end of World War II, after a short period of baby boom during 1947-1949. Japan's total fertility rate (TFR) declined from 4.54 in 1947 to 2.04 in 1957, 55% reduction during in just 10 years. By the mid-1990s, it declined below 1.5 children per woman. It recorded 1.26 in 2005, lowest in postwar time, before a slight rebound to 1.39 in 2010. A rapid increase in Japanese life expectancy contributed to rapid population aging too. Japan's life expectancy at birth was only 65.3 years for men and 70.2 years for women in 1960, the lowest among the OECD countries. By the mid-1970s, however, Japanese life expectancy for both sexes was one of the highest among the OECD countries. In 2009, Japan reached the second highest life expectancy at birth for men (79.6 years), and the highest life expectancy at birth for women (86.4 years). As a result of declining TFR and increasing life expectancy, the share of older population increased substantially, while that of young population decreased. The proportion of young people under 15 decreased from 23.9% in 1970 to 18.2% in 1990, and it further decreased 13% in 2010. The share of older population 65 and above increased rapidly, from 7.1% in 1970 to 12.1% in 1990, and to 23.0% in 2010.

It is not surprising to observe that the very rapid population aging in Japan has led the Japanese labor market aging. Young workers under age 30 accounted for about one third of the workforce in 1970, but it declined to 23% in 1990, and further declined to 17% until 2010. The

share of prime age adult ages 30 to 49 has changed little. It ranges from 44 to 46 percent over the last 4 decades. The share of workers ages 50 and older has increased rapidly, from about 22% in 1970 to 31% in 1990 and 38% in 2010. In particular, older workers ages 60 and older increased rapidly, from about 9% in 1970 to 11% in 1990, and to 18% in 2010. Thus, the 7 percentage point increase in the share of workers ages 50 and older between 1990 and 2010 is entirely due to the increase in the share of workers 60 and older.

The employment-to-population ratio (ER) is affected by both population age structure and economic growth.[2] Figure 1 shows the ER and the GDP growth rate during 1968-2010. The figures show that the ER has declined substantially during 1968-1975, from 65.0% to 61.7%. The ER changed little during 1975-1991, while it declined slightly in the mid-80s and bounced back to 62.4% until 1991. Thus, although Japan was constantly aging during 1975-1991, the other factors muted the effect of aging in the labor market and kept the ER almost constant until 1991. However, the ER is on a downward trend 1992, recorded 56.9% in 2009, the lowest ER since 1968, while the GDP growth rate has not kept decreased at least until 2007. It appears that the ER follows the GDP growth rate only in terms of its movement. That is, the movement of the ER depend on whether the growth rate is higher or lower than its previous years. However, the ER does not follow the GDP growth rate in terms of its trend, which means the trend of the ER follows the change in population age structure. The change in population age structure thus has had a significant impact on the ER in large part because the ER varies substantially by age. In general, young and older workers have lower ER than prime age adults.

<Figure 1 here>

[2] We focus on the employment-to-population ratio (ER) instead of labor force par ticipation rate (LFPR) for our analysis because the unemployed do not have lab or income. Thus to simulate the change in labor income profiles, using the ER is more appropriate for our analysis.

To roughly net out the impact of population aging on employment, the ER for each year is re-computed using the age distribution from a base year and the actual ER for each age group in each year. Specifically, the age-constant ER in year t, denoted $e_{0,t}$, is the weighted average of the ER for each age group 'a' in year t, denoted e_t^a, where the proportion of the population in age group 'a' in the base year, denoted P_0^a, are the weights. We chose 1975 as the base year since it appears to be a turning point in ER.

$$e_{0,t} = \sum_a P_0^a e_t^a \qquad (1)$$

The result is shown in Figure 2 together with the actual ER. This calculation yields an age-constant ER of 64.2% in 2009, instead of the actual rate of 56.9%. The change in the ER from 1975 to 2009 with a constant 1975 age distribution is thus predicted to be an *increase* in 2.5 percentage points, as opposed to a decrease in 4.8 percentage points with the actual age distribution. If we look at the period of 1992-2009, a period of slow growth, then the change in the ER from 1992 to 2009 with a constant 1992 age distribution is predicted to be a decrease in 1.3 percentage points, as opposed to a decrease in 5.6 percentage points with the actual age distribution. Thus, over three quarter of the declining trend in the ER from 1992 to 2009 appears to be due to the aging of the workforce, while the rest is likely due to other macro-economic conditions, especially the burst of bubble economy in the 1990s.[3]

[3] See Shimer (2001) for an analysis of the direct and indirect effects of a change in the share of young workers on the labor market. The analysis presented here does not attempt to assess the indirect effects of a change in an age group's size on employment of that age group, which Shimer finds can be quite important.

<Figure 2 here>

The results are quite different by gender. The same calculation shows that the change in the ER from 1975 to 2009 with a constant 1975 age distribution for men is predicted to be a decrease in 6.1 percentage points, as opposed to a decrease in 11.3 percentage points with the actual age distribution. Thus, slightly less than half of decline in the male's ER from 1975 to 2009 appears to be due to the aging of the workforce, while the rest is due to other economic factors. For women, the actual ER increased by 1.4 percentage point during the same period. But if we apply a constant 1975 age distribution, then it is predicted to be an increase in 10.2 percentage points of ER. If we look at the period of 1992-2009, then the change in the ER from 1992 to 2009 with a constant 1992 age distribution is predicted to be a decrease in 5.2 percentage points for men and an increase in 2.3 percentage point for women, as opposed to a decrease in 7.9 percentage points for men and a decrease in 3.3 percentage point for women. Thus, about one third of the change in ER is due to the change in the population age structure for men, while the decrease in ER is purely explained by the change in the population age structure for women.

Figure 3 shows the ER by 5 year age group and also by gender. For 1968-1975, the ER has not increased for almost all age groups, but it has been declining most rapidly for the young ages under 25 and for the old ages 60 and over. Thus, the substantial decline in ER in this period is due to the declining ER for all age groups, especially due to the young and the old. But the ER increased during 1975-1991 for all age groups except for the young ages 15-19 and the old ages 70 and older. Again, this changing pattern by age group differs by gender. Generally speaking male ERs are more in a downward trend than female ERs for all age groups. It could be because substitution between male and female workers. In fact, due to the diminishing supply of male workers in absolute terms beginning from 1998, the demand for female workers, both full-time and part-time, has been on

an upward trend since then, particularly in the service and retail/wholesale industries (Matsukura, Ogawa, and Clark, 2007). A notable case is the male ER for ages 55-59. The ER for this group has increased somewhat substantially around1985 and it did not decrease much even after the burst of the bubble economy. It is far from clear why this is the case, but the increase in pension eligibility age could have affected the ER for this age group.

<Figure 3 here>

Effect of Pension Reform on Retirement and Pension Benefit

An increase in pension eligible age is believed to partly slow the downward trend in labor force participation for older workers. What would be the impact of delaying retirement on older people's labor force participation rates? We are examining this issue by finding the correlation between the ER and the EPI. The employment series may be affected by other macroeconomic changes during the period. To adjust the employment series for macro changes, we make adjustment following Gruber and Wise (2010). That is, we regress the ER on the EPI, GDP per capita, growth in GDP, and the percent of the economy in manufacturing. Unlike Gruber and Wise, we use two different series for this adjustment, one series for 1968-1990 and the other 1990-2009. The obvious reason is the Japanese depression in 1990, so called the beginning of lost decade. Our method might further remove a potential structural change happened after 1990. Then each subsequent year is adjusted based on the change in the independent variables between 1990 and the comparison period. That is, macro shocks to the economy affect employment at all ages and in the same direction and hence the variation over time in each of the series is typically reduced when the change associated with economic output per capita is controlled for.

The results show that even after adjusting for economic growth and the manufacturing share, much of the relationship between the

employment of the old and the pension reform remains. That is, the policy change might have created some incentives for older people to delay retirement. Our regression results show that 2 years increase in EPI (for both men and women) increases average retirement age by 0.8 years. The employment to population ratio increases by 2.24 percentage points for people ages 55-59, 5.92 percentage points for 60-64, and 1.9 percentage points for ages 65-69. The regression results show that the increase in EPI does not affect workers employment, ages 50-54 or people ages 70 and older. The larger behavioral response is in contrast with much smaller responses found in Europe and the U.S. This could be due to the absence of early retirement pension benefits in Japan. The labor income increases by 6.5 percent due to this change. Again, the biggest change is for ages 60-64, where their labor income increases by 13.9 percent. We predict that the labor income for ages 55-59 and 65-69 increase by 3.4 percent and 6.1 percent respectively. The actual change in labor income must be small since Japanese companies have adopted a plan which makes elderly employees accept a significant decline in wages and bonuses in order to continue to work.

Many researchers also construct average ages of retirement (AAR), which is a function of age-specific labor force participation rates and the age structure of population. Although there are several different measures of these and these measures lead to somewhat different results, we decide to use the Blöndal and Scarpetta (1997).[4] Figure 4 shows the trend of EPI and predicted AAR. The male-female combined EPI is calculated by weighting the employment share of workers ages 55 to 69; i.e.,

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[4]

$$\overline{R} = \frac{0.5*47(LR_{45,49} - LR_{40,44})P_{40,44} + \sum_{x=9}^{12}(5x+5)(LR_{5x+5,5x+9} - LR_{5x,5x+4})P_{5x,5x+4}}{0.5(LR_{45,49} - LR_{40,44})P_{40,44} + \sum_{x=9}^{12}(LR_{5x+5,5x+9} - LR_{5x,5x+4})P_{5x,5x+4}}$$

$EPI\ age = EPI_{male} * Share_{male55-69} + EPI_{female} * (1 - Share_{male55-69})$. The figure shows that the AAR increases from 61.9 in 2010 to 62.6 in 2018 based on our regression results.

<Figure 4 here>

How much an increase in normal retirement ages would have an effect on earnings of the older people? This is calculated by the changes in ER of the older people weighted by the productivity of each age group provided by the NTA database of Japan.[5,6] According to the calculation, the change in EPI by two years increases the labor income of the people ages 55-69 by 6.5 percent.

To calculate the fiscal impact of the increase in EPI, we regress the age specific pension transfer inflows on the EPI for people ages 55-69

[5] There are two issues of simulating the delayed retirement, though. First, the proportion of working population at each age and the labor income of the working population are not estimated separately for the NTA. But activity rates by age are available from different sources, and hence, it is possible to calculate the productivity of the working population by dividing the per capita labor income by activity rates by age. While this procedure may not provide very accurate decomposition results, it provided some useful insights. Second, activity rates are also available by five-year age groups for most countries. In order to get the average productivity profile by single year of age, we have smoothed the activity rates profile using the population age structure as a weight. The employment to population ratio, activity rates, and unemployment rates by age groups for Japan by gender are available from the Japan's Ministry of Labor.

[6] It should be also noted that the real world is much more complex than theory. Most of all, the decision to work and the productivity of workers are not indep endent, because the productivity of older workers conditional on working is clos ely related to the decision to work. For example, it is not surprising to see that declining productivity of labor due to poor physical and mental health leads a p erson to retire. On the other hand, those who are going to retire soon are less li kely to invest in their human capital, which leads to lower productivity of work ers. Because of this interdependence, the productivity of labor conditional on w orking may not appear to decrease from a certain age, especially around retirem ent age, if only those who have high productivity remain in the labor market.

who are affected by the policy. As Figure 5 indicates, in general, the peak age of pension inflows for the productive age population as a whole tends to shift right-ward (to higher ages) over time, which reflects the influence of population aging and the policy changes. The results based on 1984-2004 NTA data also confirm the shift of age profiles of pension benefit toward older age groups due to the reform. Pension benefits for people ages 55-69 decreases by 12.8% due to the increase in EPI by 2 years. The projection does show improvement of fiscal support ratio up to 2050 due to the current policy change and future planned pension reforms. Table 1 summarizes the economic impact due to an increase in EPI by two years on labor income and pension benefits for people 55-69.

<Figure 5 here>

<Table 1 here>

The change in EPI also has an impact of financing public transfers; Miller (2011) calculates the fiscal support ratio to assess the pressure those transfers exert on fiscal sustainability. The ratio is calculated holding age-specific public transfer inflows and outflows constant while allowing the population's age structure to change in accordance with historical estimates and projections. The effective number of taxpayers is calculated by weighting the population in each year using the age profile of per capita taxes paid. The effective number of beneficiaries is calculated using per capita benefits in the base year to weight the population age distribution. The ratio was set at 100 in the base year of 2010. The projection does show improvement of fiscal support ratio up to 2050, from 74.0 to 75.1, due to the current policy change and future planned pension reforms.

<Table 2 here>

Effect of Pension Reform on Savings

Model

The basic theoretical model draws upon Mason and Lee (2007). One of the main innovations of this paper is to simulate the model using different policy parameters. That is, the parameters are allowed to change according to a policy change. Most of all, all parameters and estimates are calculated based upon actual age profiles of labor income, consumption, net public transfers, and net public pension transfers from the NTA database. The sketch of the model is as follows.

The economy is subject to an aggregate budget constraint on flows that determines the time path of assets, transfer wealth and implicit debt, and income. If the profiles of consumption and labor income follow a given path, then we can calculate a life-cycle wealth that all adults must hold in year t in order to achieve the path over the remainder of their life. Life-cycle wealth thus defined can be decomposed into a portion that funds consumption in retirement and another portion that funds consumption by children. The first is called "pension wealth" and the second "child wealth." Pension transfer wealth is the present value of net transfers that year t adults will receive from year t children and from future generations. Child wealth is defined similarly. These transfers may be familial transfers or public transfers.

Lee (1994) postulates that this wealth can take several different forms. For the elderly, the reallocation can take any form of public transfers (e.g., social security), familial transfers, or asset-based reallocation (property income, dis-saving), while the asset-based reallocation is not important for children. Following this distinction, Mason and Lee (2007) distinguish private and public pension transfer wealth as the component of general transfer wealth that is used to fund retirement. The other component of general transfer wealth will be funded from asset-based reallocation. The impact of demographic change on asset accumulation and consumption growth depends on

the extent to which the economy in question relies on pension transfer wealth versus capital accumulation to support consumption in old age.

Mason and Lee (2007) project the effect of future demographic change on the future demand for pension wealth. The demand for capital depends on population change as well. Holding the age profiles of asset income and savings, the changes in age distribution over the demographic transition would clearly lead to a rising ratio of capital to income. However, the demand for wealth by age also depends on fertility and mortality in their model. Couples with fewer children assign a greater share of their life-cycle earnings to their own consumption, and therefore have a greater demand for wealth to provide for higher consumption in retirement. People who expect to live longer have a greater demand for wealth to finance their longer period of post-work consumption. These changes associated with the demographic transition and changes in age structure are also reflected in our analysis.

A brief mathematical formulation is as follows. The share of total life-cycle wealth that is held in the form of pension transfer wealth in some future year t is called $\tau(t)$, which is equal to $T_p(t)/W_p(t)$, where $T_p(t)$ represents pension transfer wealth and $W_p(t)$ the pension wealth. The pension wealth is the sum of assets and pension transfer wealth. The relative size of child transfer wealth is called $\tau_k(t)$, which is equal to $T_k(t)/W(t)$, where $T_k(t)$ is child transfer wealth and $W(t)$ is total life-cycle wealth. The total life-cycle wealth is the sum of pension wealth and child transfer wealth.

For our simulation model, the value of τ is still treated as an exogenous variable as Mason and Lee (2007). One innovation of this paper is that τ is allowed to change due to change in policy (R). That is, I treat τ a function of pension reform (R). Ignoring the year index t, the value of τ can be rewritten as

$$\tau(R) = \frac{T_p(R)}{T_p(R) + A(R)} \qquad (2)$$

where *R* is government policy, such as pension reform or long-term healthcare reform. The derivative of Equation (2) with respect to *R* yields

$$\tau'(R) = \frac{T_p' A - T_p A'}{[T_p + A]^2} \qquad (3)$$

Arranging Equation (3) yields

$$\frac{\tau'}{\tau} = (1-\tau)\left(\frac{T_p'}{T_p} - \frac{A'}{A}\right) \qquad (4)$$

The final equation (4) suggests that reduction in public transfers (Tp) decreases τ . On the other hand, if people decreases their savings (A) by working more, then it increases τ. If people respond more sensitively to the change in policy, then it enforces the increase in τ . The country effect depends on the level of τ , changes in T_p, and A. The combined effect of increase in normal retirement age on the change in τ is ambiguous.

According to the budget constraint, the change in assets from one period to the next must equal saving during the period. The change in assets are determined by total labor income in year *t, Y(t)*, and by total consumption in year *t, C(t)*. *Y(t)* is also determined by the total number of effective producers and labor productivity, and *C(t)* is determined by the total number of effective consumers and consumption index. This leads to a mathematical formulation of

$$
\begin{aligned}
&(1+r)A(t)+(1+r)[Y(t)-C(t)]=A(t+1)\\
&Y(t)=\overline{y}(t)L(t)\\
&C(t)=\overline{c}(t)N(t)
\end{aligned}
\tag{5}
$$

where r is the rate of interest, $\overline{c}(t)$ and $\overline{y}(t)$ respectively represent the consumption index and the labor productivity index, and $L(t)$ and $N(t)$ are respectively the effective number of producers (workers) and the effective number of consumers.

In the steady-state, assets grow at the same rate as total labor income, and thus the following condition should hold:

$$
\begin{aligned}
&A(t^*)=\frac{1+r}{r-g_y}[\overline{c}(t^*)N(t^*)-\overline{y}(t^*)L(t^*)]\\
&\frac{\overline{c}(t^*)}{\overline{y}(t^*)}=\frac{L(t^*)}{N(t^*)}\left[1+(r-g_Y)(1-\tau(t^*))w_p(t^*)\right]
\end{aligned}
\tag{6}
$$

where g_Y is the growth rate. Equation (5) tells us the level of consumption that can be sustained in the steady-state, given any level of labor income. It is clear from the equation that a high level of consumption can be achieved for a smaller τ, as long as r is greater than g_Y, holding other variables constant.

This model relies on the assumption that the cross-sectional shapes of the labor income and consumption age profile are given and constant. However, the levels of labor income and consumption profiles are assumed to change. They shift at exogenously given rates. Hence, variations in the relative levels of the consumption and earnings profiles, as well as variations in the population age distribution, lead to different aggregate saving rates and therefore determine the trajectory of asset accumulation. If the shape of cross-sectional age profiles of labor income and consumption do not change,

then we can calculate the change in life-cycle wealth for each period that is necessary to sustain the life-cycle needs in the future. In addition, we have to make a certain assumption about private transfers. If private transfers and public transfers are independent, then public transfers are a perfect substitute for asset-based reallocation. On the other hand, if private transfers respond to the change in public transfers, then public transfers and asset-based reallocation do not have to substitute on a one to one basis. In this paper, we assume that that public transfers and asset-based reallocations are perfect substitutes.

For our simulation, the τ is treated as a policy variable calculated from data based on different policy scenarios. The demand for capital depends not only on values of τ and τ_k, but also on the future consumption needs and the shape of labor income. In addition to τ, calculations are based on the actual age profiles of labor income, consumption, net public transfers, and net public pension transfers, which are constructed from the Japan NTA datasets. The new value of τ is governed and calculated by Equation (4).

The steady-state results are used to present dynamic simulation results from 1950 to 2300. The year 2300 is chosen since it is sufficiently far enough in the future to reach a steady-state. In addition, it is possible to project up to 2300 due to the availability of UN long-range projections.

The baseline assumptions are as follows. Productivity growth is 1.5 percent per annum. The interest rate is 6 percent until 2000 and decrease linearly to 4.75 percent between 2000 and 2300. Two-thirds of the cost of children is met through familial transfers. The analysis is carried out by constructing populations with medium projections about fertility and mortality, based on the UN *World Population Prospects* (2010 revision). The UN long-range projection to 2300 is used for additional calculations. The baseline pension transfer wealth is computed by measuring the product of the annual flow and the difference between the average age of inflow and outflow.

Simulation Results

Panel A of Figure 6 provides a summary of the steady-state results for partial effects of varying policy parameters. Although the changes in interest rate, labor productivity growth, and level of consumption also have substantial effects on steady-state values, our focus is on the effect of delayed retirement and the increase in EPI. The figure provides three simulation results. The baseline τ is set at 0.494. The partial effect on the asset to labor income ratio as a result of delaying retirement by two years increases the ratio to 0.530. If net transfers do not change, then the decrease in the life-cycle deficit should reduce the life-cycle wealth, leading to an increase in the value of τ, i.e., the share of total life-cycle wealth that is held in the form of pension transfer wealth. In general, a bigger increase in τ can decrease the asset to labor income ratio more, but the effects vary by country depending on other factors. The third one shows the combined effect of the increase in EPI by two years on the asset to labor income ratio, by considering the decrease in pension benefit. The values of τ are recalculated accordingly, leading to 0.506. Thus, the policy in Japan appears to decrease the asset-to-labor income ratios slightly.

How do demographic changes affect our simulation results? By using backward recursion, governed by Equation (5), we plot the simulation results in Panel B of Figure 6. The results are reported only for the baseline τ to show the shape, because the shapes of other simulation results are similar. Although the results are available for the entire period from 1950 to 2300, only the results up to 2100 are presented in the figure to make it more easily readable. The results are presented for some components: assets (A), child transfer wealth (T_k), pension wealth (W_p), and life-cycle wealth (W). In order to compare the results across countries, all components are normalized, as a ratio of labor income (Yl). Child transfer wealth is plotted as a positive value to make it more readily readable in the figure.

<Figure 6 here>

The changing patterns of the simulated results are related to the demographic change. For example, the child transfer wealth (T_k), the net wealth required to finance the life-cycle deficit for children, is closely related to the baby boom. The child transfer wealth for Japan peaked after the World War II. As the baby boom ended, child transfer wealth began to decline steadily to less than 4 times labor income in 2010. Pension wealth (W_p), the net wealth required to finance the old-age life-cycle deficit, is related to an increase in life expectancy and changing age structure. The pattern of total life-cycle wealth of adults (W) reflects the pattern of both child transfer wealth and pension wealth, because it is the sum of two. Finally, the figure shows that the substantial rise in wealth as form of assets (A) depends on the extent to which the elderly rely on transfers. Given the current transfer policy, assets should rise much faster in Japan than European countries, because Japan relies much less on transfer wealth than European countries do.

Conclusion

Japan tried to respond to population aging in several ways. One possibility is that members of the population can work longer. Despite rapid improvements in health and life expectancy that enable people to continue to be productive longer than in the past, however, many countries have been slow to adjust normal retirement ages upward. In fact, the positive correlation between rising levels of economic development and earlier retirement suggests that many people are spending longer in retirement because they can afford to do so, relying on their own resources or on public resources.

An increase in pension eligible age is believed to partly slow the downward trend in labor force participation for older workers. The result show that the policy change created some incentives for older people to delay retirement. Our regression results show that 2 years increase in EPI (for both men and women) increases average retirement age by 0.8 years. The employment to population ratio

increases by 2.24 percentage points for people ages 55-59, 5.92 percentage points for 60-64, and 1.9 percentage points for ages 65-69. The regression results show that the increase in EPI does not affect workers employment, ages 50-54 or people ages 70 and older. The larger behavioral response is in contrast with much smaller responses found in Europe and the U.S. This could be due to the absence of early retirement pension benefits in Japan. The labor income increases by 6.5 percent due to this change. Again, the biggest change is for ages 60-64, where their labor income increases by 13.9 percent. We predict that the labor income for ages 55-59 and 65-69 increase by 3.4 percent and 6.1 percent respectively. The actual change in labor income must be small since Japanese companies have adopted a plan which makes elderly employees accept a significant decline in wages and bonuses in order to continue to work.

The evidence gained by using the decomposition technique suggests that the increase in employment for men ages 60-64 is due to a change in the age structure and labor force participation of that age group. However, the increase in employment for men 65-69 is entirely explained by the change in age structure of the population during the study period, suggesting that only men ages 60-64 are affected by the amendment. On the other hand, the increase in employment of older women ages 60-64 and 65-69 are explained by both changes in the age structure and labor force participation.

The results based on 1984-2004 NTA data also confirm the shift of age profiles of pension benefit toward older age groups due to the reform. Pension benefits for people ages 55-69 decreases by 12.8% due to the increase in EPI by 2 years. The projection does show improvement of fiscal support ratio up to 2050 due to the current policy change and future planned pension reforms.

The effects of the policy change on savings and economic growth depend on several factors, such as the age structure of population, the pension structure, productivity of older workers, behavioral response of older people, etc. Our simulation results suggest that, with the estimated labor market responses in the study, the policy change will

decrease savings in the long-run in Japan, although the effect will be quite modest.

There are numerous limitations in this paper. Some result from the assumptions of the NTA approach, whereas others originate from the assumptions of the simulation model. Assumptions such as the exogenous interest rate, fixed shape of cross-sectional consumption and labor profile needs to be improved. The parameter of the older workers market response is also exogenously given in the model. A better form of model is needed for this parameter, which is left for future studies. The budget constraint implicitly assumes that there is no bequest, which is not properly addressed in the paper.

Nonetheless, the results are suggestive and interesting. Most of all, the results demonstrate that the economic effect depends on several factors, such as Japan's old-age support system , the level of pension benefits, and the productivity of older workers. As Japanese government's efforts to encourage later retirement are important policy initiatives, the government needs to consider these factors.

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Figure 1. Real GDP growth rate and employment to population ratio

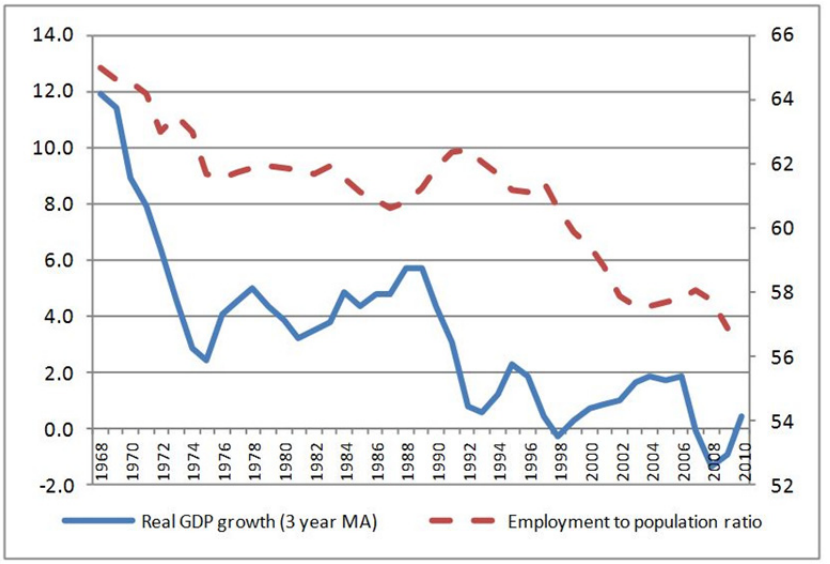


Figure 2. Effect of population age structure on employment to population ratio

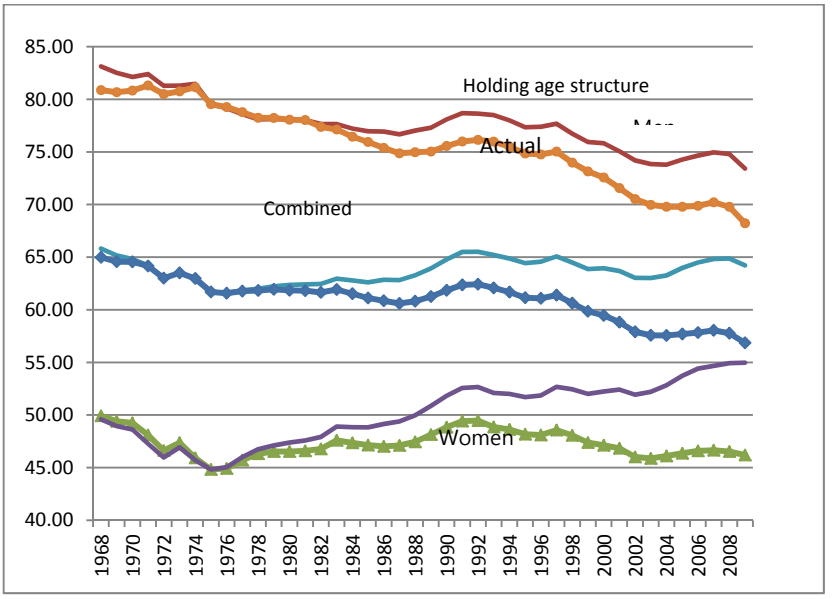
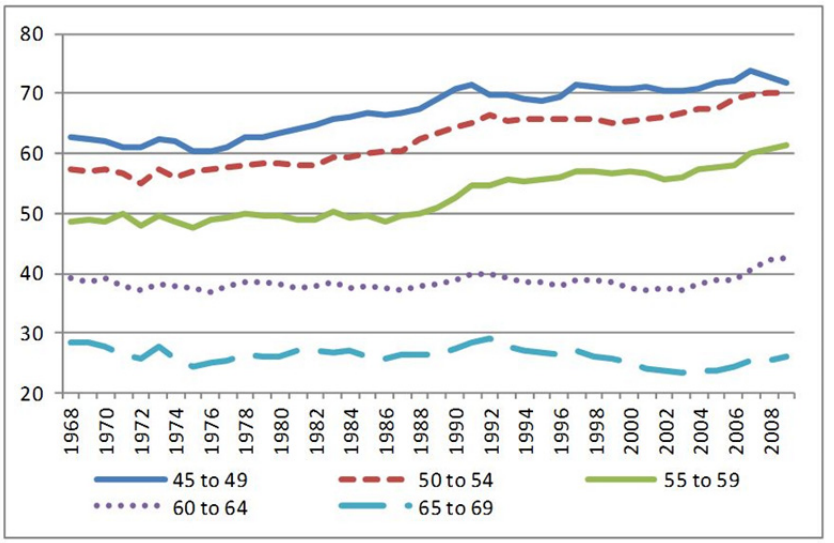


Figure 3. 5-year age group employment to population ratio by year.



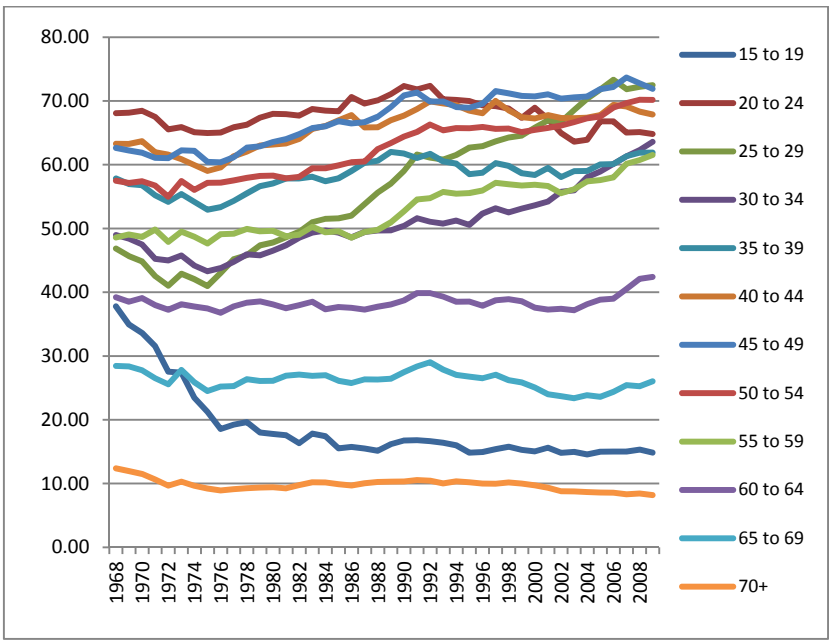


Figure 4. Predicted average age at retirement and combined-EPI age for 1968-2009. 2010-2020 are projected based on the regression results.

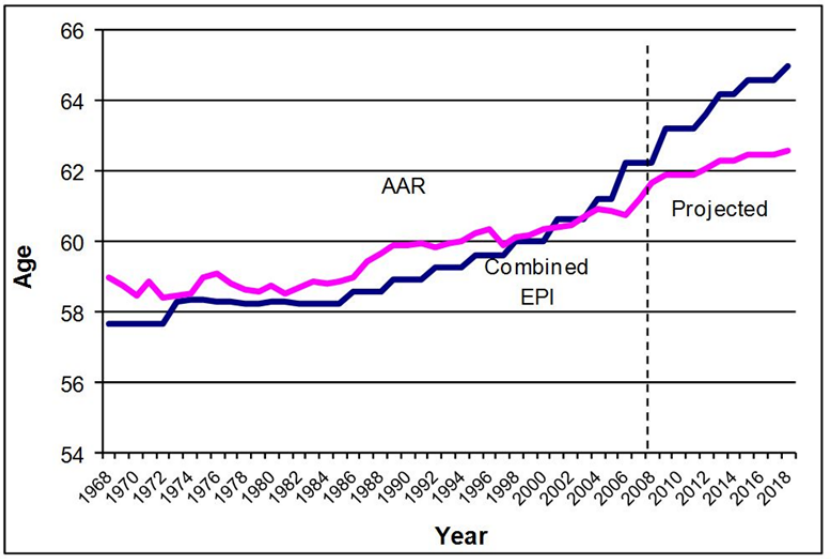
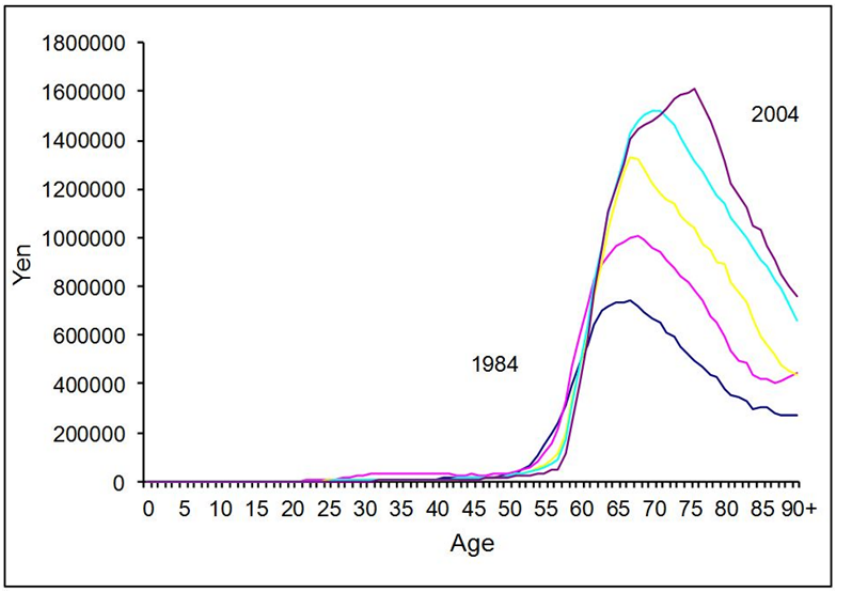
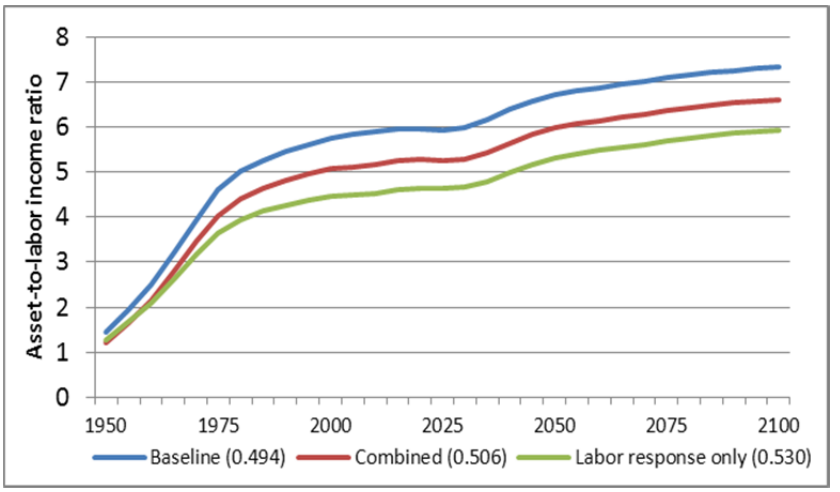


Figure 5. Per capita pension transfer inflows in Japan. 1984-2004 by 5-year

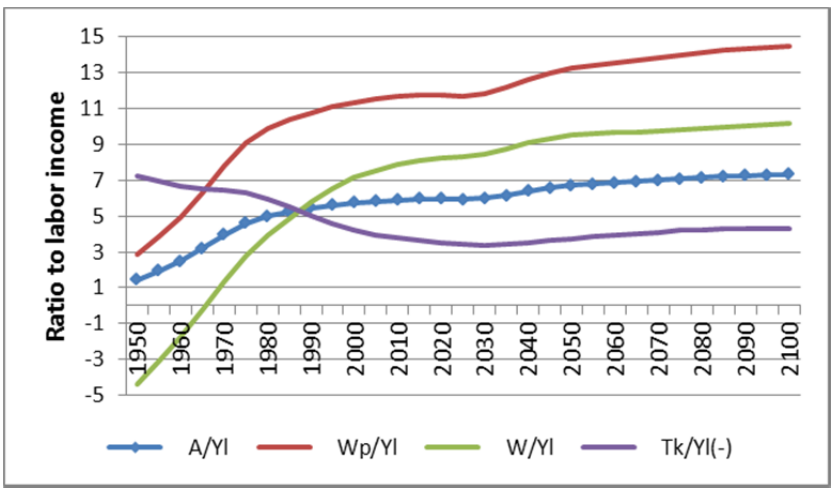


Panel A. Simulation results with different policy scenarios. Asset to labor income ratio.



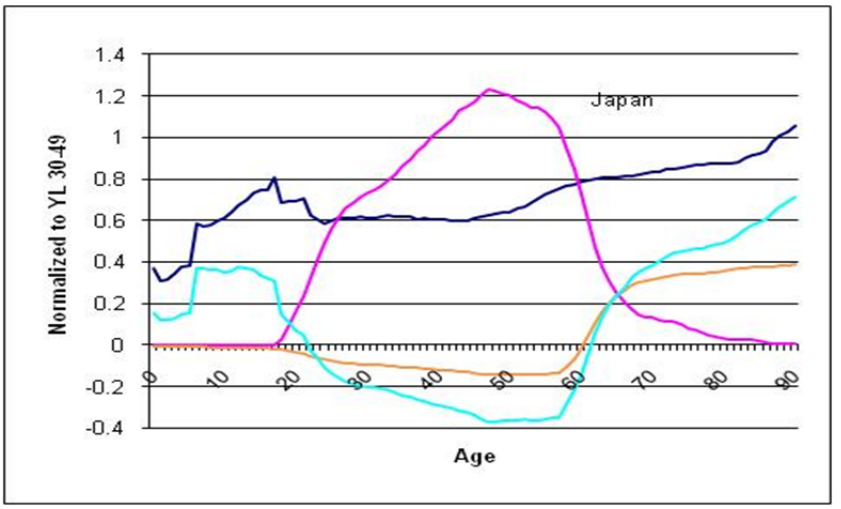
Note: Numbers in parenthesis is the estimated share of pension wealth in total life-cycle wealth.

Panel B. Simulation results for assets, pension wealth, life-cycle wealth, and child transfer wealth for Japan with baseline scenario (no policy change), 1950-2100



Note: A, Wp, W, Tk, and Yl refer to assets (A), pension wealth (Wp), life-cycle wealth (W), child transfer wealth (Tk), and labor income (Yl), respectively. Steady state populations.

Figure 6. Simulation results



Appendix Figure. Age profiles of labor income, consumption, net public transfers, and net public pension transfers.

Source : www.ntaccounts.org database.

Note : All profiles are expressed as the ratio of average labor income ages 30-49.

Table 1. Effect on labor earnings and pension benefits due to change in EPI by two years

	A	B
	% increase in labor income for 55-69	% decrease in pension benefits for 55-69
Japan	6.5	12.8

Table 2. Change in fiscal support ratio due to change in EPI by 2 years (2010-2050)

	2010	2020	2030	2040	2050
Before	100.0	92.1	87.4	78.8	74.0
After	100.0	93.5	88.7	80.0	75.1

Intergenerational Transfers in China

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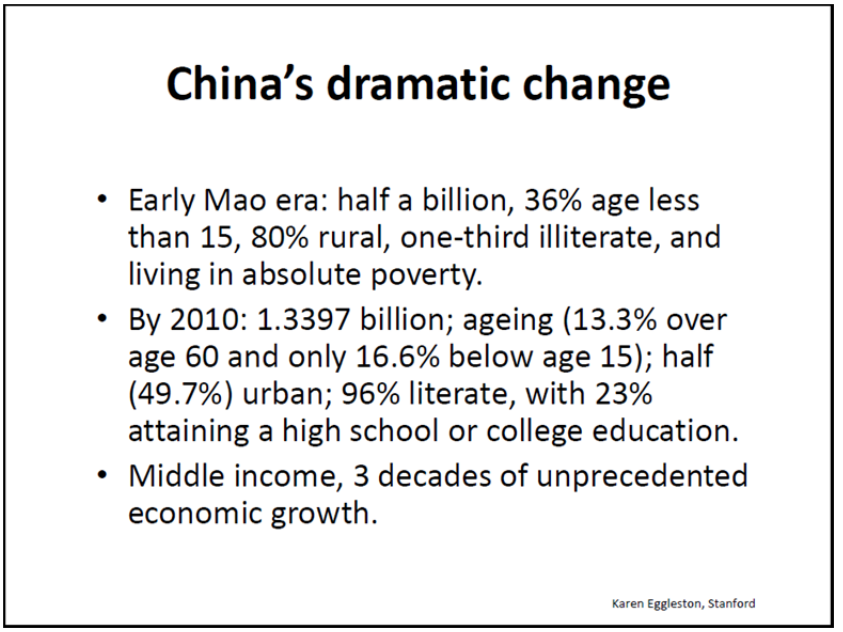
Shorenstein Asia-Pacific Research Center, Stanford University,
California, USA

**Based on research by *Qiulin Chen*[1], *Ling Li*[2], and NTA team (including *Chen Eggleston Li* 2012)

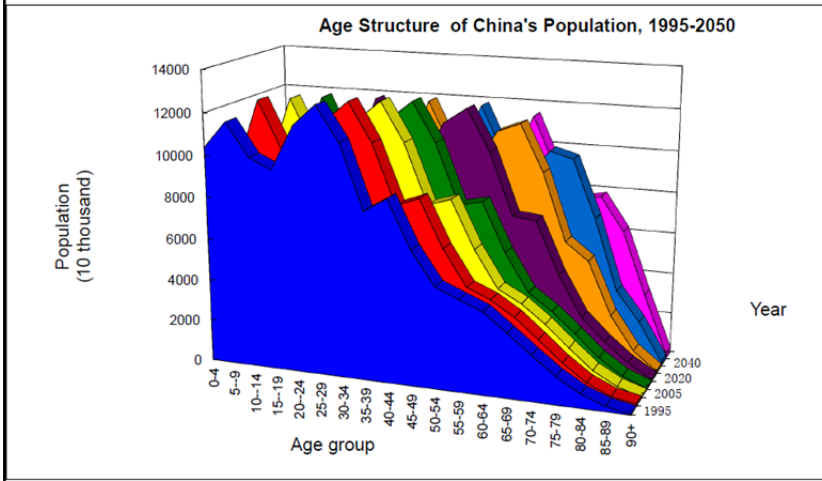
[1] Chines Academy of Social Sciences, Beijing, China

[2] National School of Development, Peking University, Beijing, China



*karene@stanford.edu

Largest Population, with Rapid Aging



Sources: NBS, China (projected from Census 2000, assuming TFR=1.65)

3

Intergeneration Support based on Families and a Growing Social Protection

Before 1980s

- Urban: SOEs / Work Unit（国有企业、单位）
- Rural: People Commune/ Village Collective economy （村集体）

Since 1980s

- Social Insurance （社会保险）
  - *Unemployment Insurance （since 1988)*
  - *Old-Age Insurance （since 1994）*
  - *Medical Insurance (since 1994）*
  - *Insurance for Work-related Injuries （since 2003）*
  - *Maternity Insurance （since 1994）*
- Social Welfare （社会福利）
- Social Relief （社会救助）
- Affordable Housing （住房保障）

Research Questions

- Intergeneration support patterns
  - The structure and the burdens of the lifecycle support system
- Demographic effect (DE)
  - How much will demographic change affect the burdens on families and public support systems, such as pensions and health care financing, *assuming the current level of transfers for each age group?*
- Transition effect (TE)
  - How will reform of pensions and health care *change the level of transfers for each age group?* The case of health care reform
    - Lifecycle health care expenditure and health insurance system
    - China's health care reform: supply side or demand side

China NTA

- Methodology
  - NTA Project led by Ronald Lee, Andy Mason et. al.
  - About 40 countries and regions involved
  - See website: http://www.ntaccounts.org
- Data
  - Estimating age files: Survey data
    - CHIPs 1995 (Rural: 34728 individuals, 6931 households
      Urban: 21689 individuals, 7996 households)
    - CHIPs 2002 (Rural :37969 individuals, 9200 households
      Urban: 20548 individuals, 6835 households)
  - Aggregate control: Published Statistics

The NTA Flow Account Identity

- Inflows
  - Labor Income
  - Asset Income
  - Transfer Inflows
- Outflows
  - Consumption
  - Saving
  - Transfer Outflows

$$\underbrace{Y^l(a)+Y^a(a)+\tau^+(a)}_{\text{Inflows}}=\underbrace{C(a)+S(a)+\tau^-(a)}_{\text{Outflows}}$$

$$\underbrace{C(a)-Y^l(a)}_{\text{Lifecycle Deficit}}=\underbrace{Y^a(a)-S(a)}_{\text{Asset-based Reallocations}}+\underbrace{\tau^+(a)-\tau^-(a)}_{\text{Net Transfers}}$$

Age Reallocations

Three components of Lifecycle deficit

Family Transfer | Public Transfer

Source: Mason, Lee, et al., 2009; Lee, Lee, and Mason, 2008.

General Rule: Equation Version

1. Estimate per capita age profile

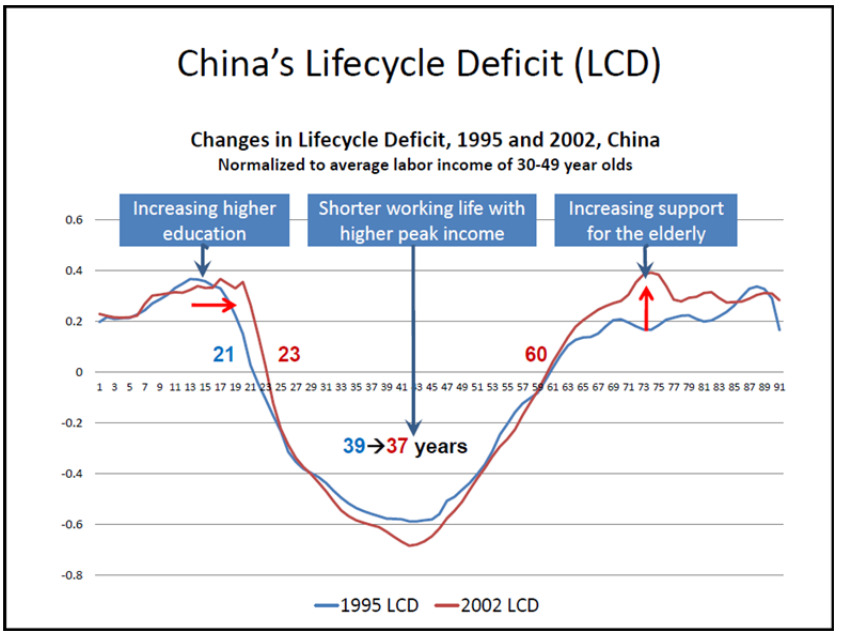
2. Multiply by the population

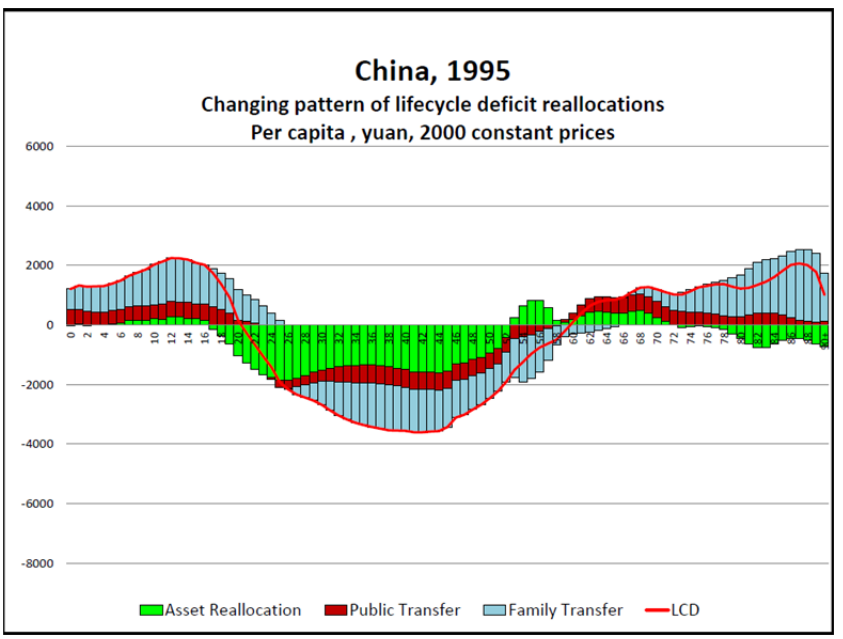
$$X^p(a)=\beta\bar{X}^p(a)N(a)$$

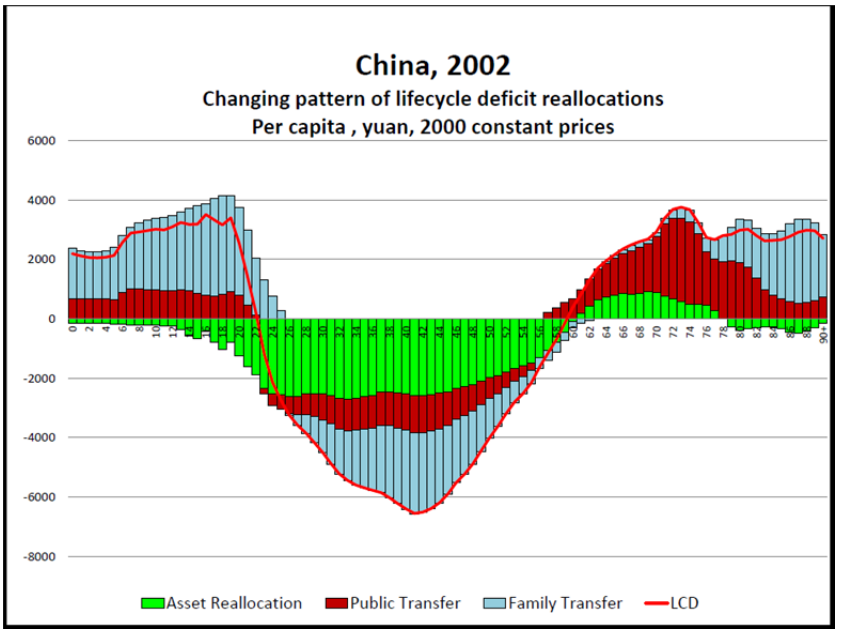
$$\beta=X^p_{NIPA}/\sum_a \bar{X}^p(a)N(a)$$

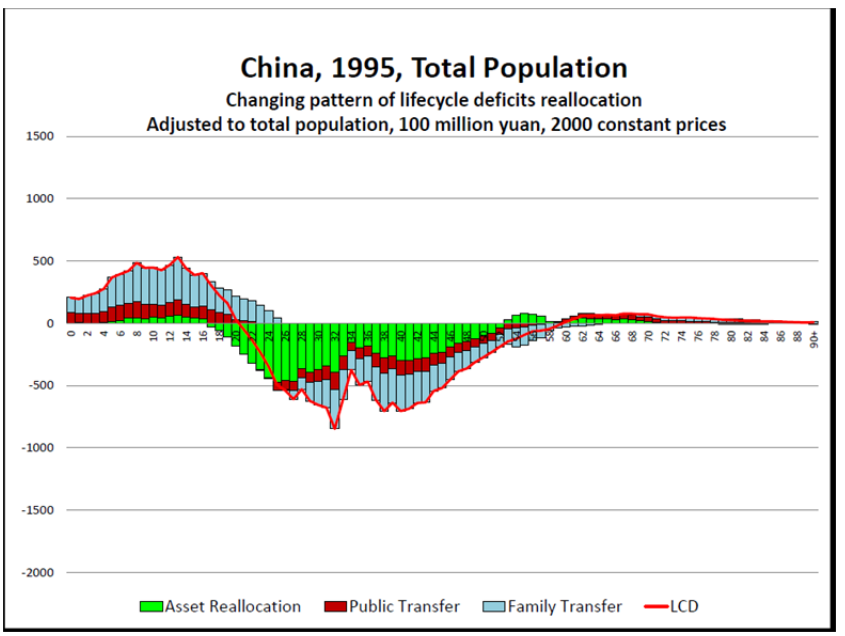
3. Adjust to National Income and Product Account (NIPA) total.

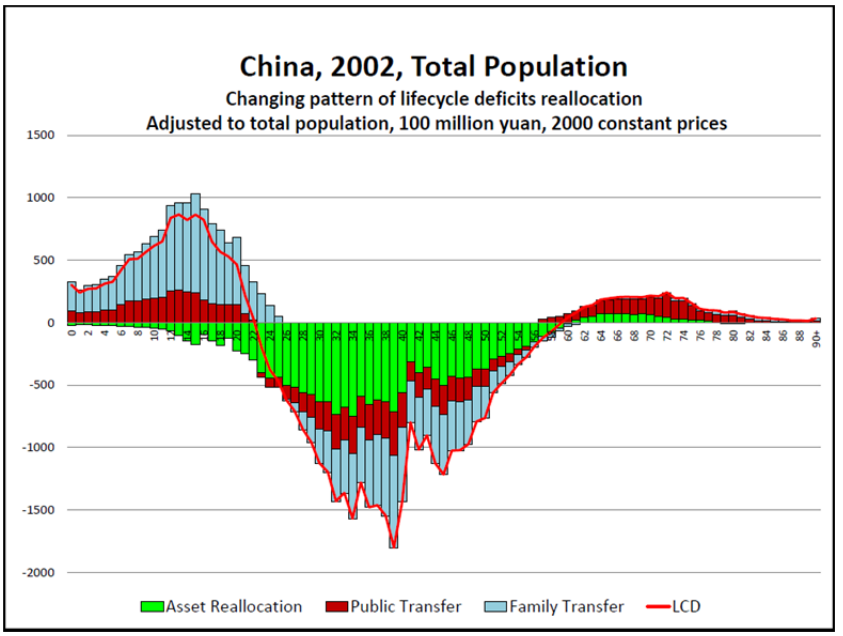
Source: Mason, Lee, et al., 2009; Lee, Lee, and Mason, 2008.


China's Lifecycle Deficit (LCD)
Changes in Lifecycle Deficit, 1995 and 2002, China
Normalized to average labor income of 30-49 year olds
Increasing higher education
Shorter working life with higher peak income
Increasing support for the elderly
21
23
60
39→37 years
1995 LCD
2002 LCD


China, 1995
Changing pattern of lifecycle deficit reallocations
Per capita , yuan, 2000 constant prices
Asset Reallocation
Public Transfer
Family Transfer
LCD


China, 2002
Changing pattern of lifecycle deficit reallocations
Per capita , yuan, 2000 constant prices
6000
4000
2000
0
-2000
-4000
-6000
-8000
Asset Reallocation
Public Transfer
Family Transfer
LCD


China, 1995, Total Population
Changing pattern of lifecycle deficits reallocation
Adjusted to total population, 100 million yuan, 2000 constant prices
1500
1000
500
0
-500
-1000
-1500
-2000
Asset Reallocation
Public Transfer
Family Transfer
LCD



Three Main Findings from China NTA

(1) Increasing higher education, with no increase in retirement age, so shorter working life; increasing support for elderly; resulting in increasing total LCD.

(2) Family transfers still play an important role compared to other countries and regions.

→ Probably one of the reasons for China's high savings rate and comparatively low consumption.

(3) Increasing public transfers: compared to family transfers and asset reallocations

→ Transition in public finance: from a focus on economic growth to balance with broader social welfare

Lifecycle Deficit Changing in China and Some Asian Countries

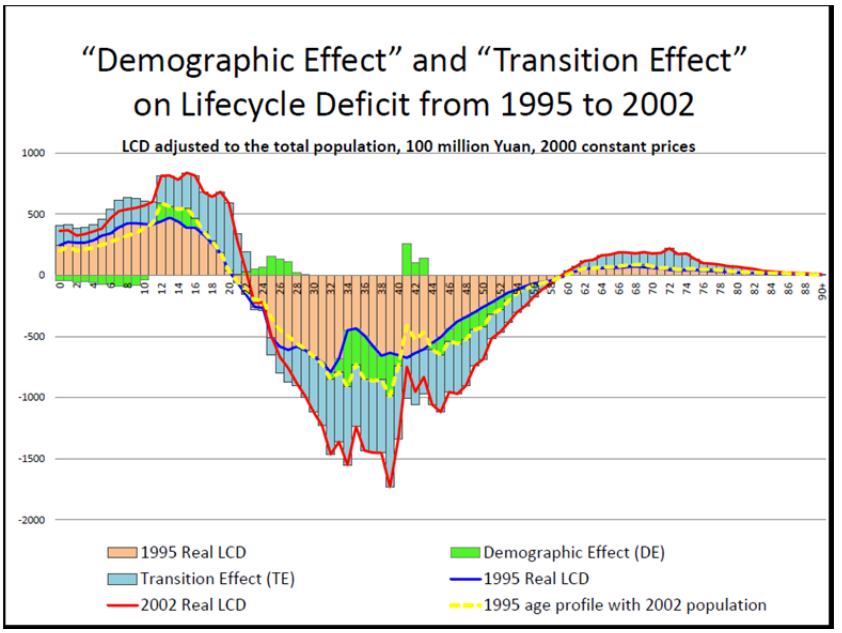
	1995			2002			
	Cutting Ages		Working Life	Cutting Ages		Working Life	
Lifecycle Deficit	21	60	39	23	60	37	2 ↓
Public Transfer	23	59	36	23	56	33	3 ↓
Family Transfer	26	67	41	26	63	37	4 ↓
- Intra Household	26	70	44	26	67	41	3 ↓

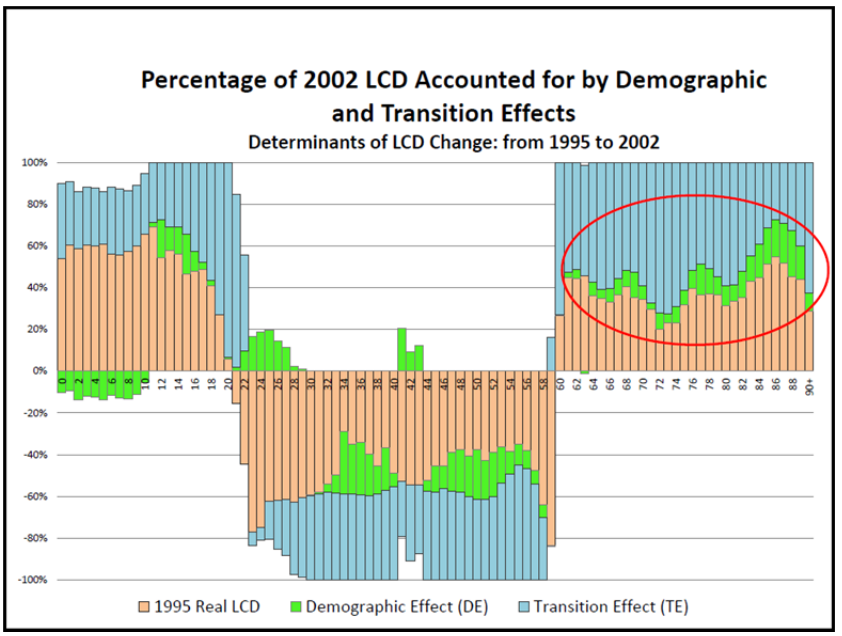
The working life is getting shorter as in some other Asian NTA countries, but it Is still longer than in these countries.

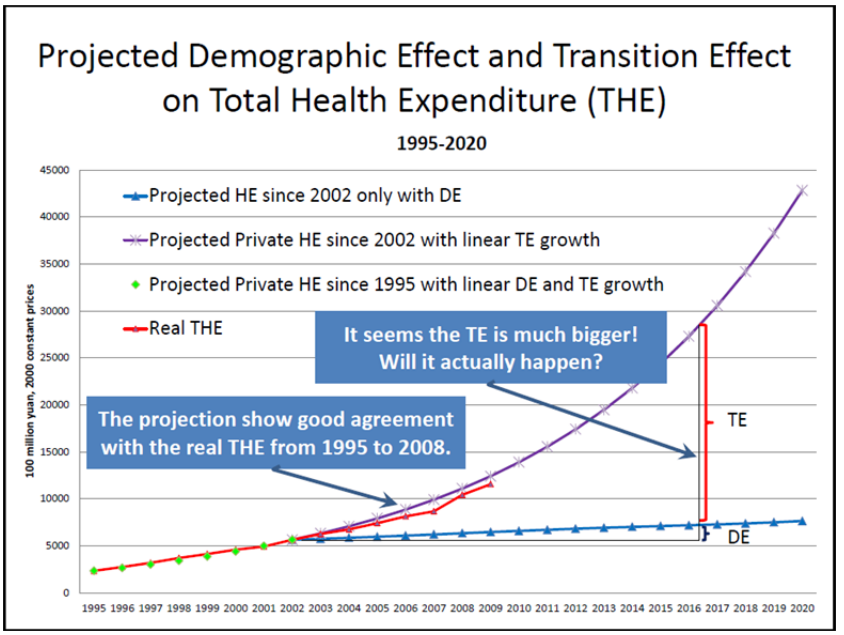
Lifecycle Deficit	Cutting ages		Working Life	Lifecycle Deficit	Cutting ages		Working Life
Japan 2004	26	60	34	Thailand 1996	25	59	34
S. Korea 2000	24	56	32	Thailand 2004	26	58	32 ↓
U.S. 2003	26	59	33	Philippines 99	27	60	33
India 1999	27	63	36	Indonesia 99	28	59	31 ↓
India 2004	27	59	32 ↓	Indonesia 05	29	58	29

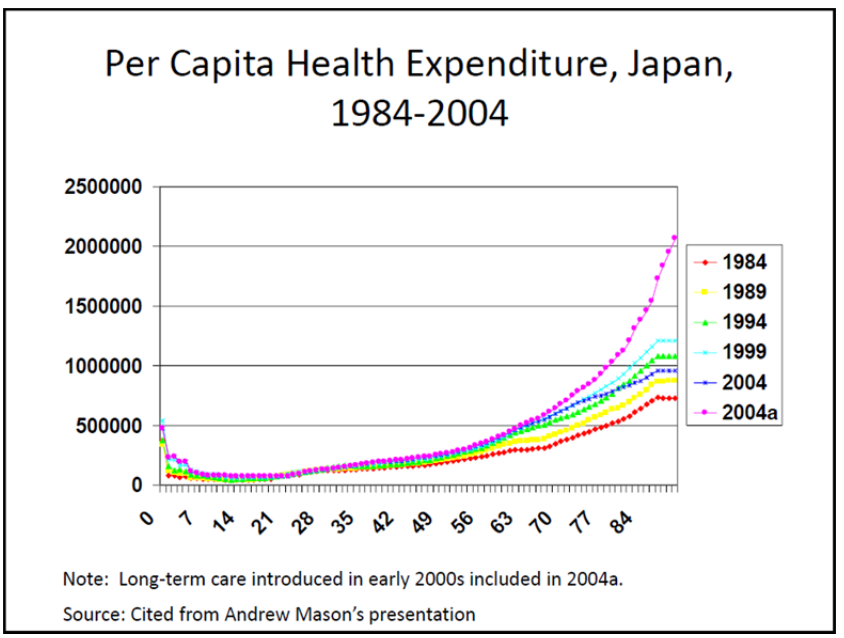
Recall: "Demographic Effect" and "Transition Effect"

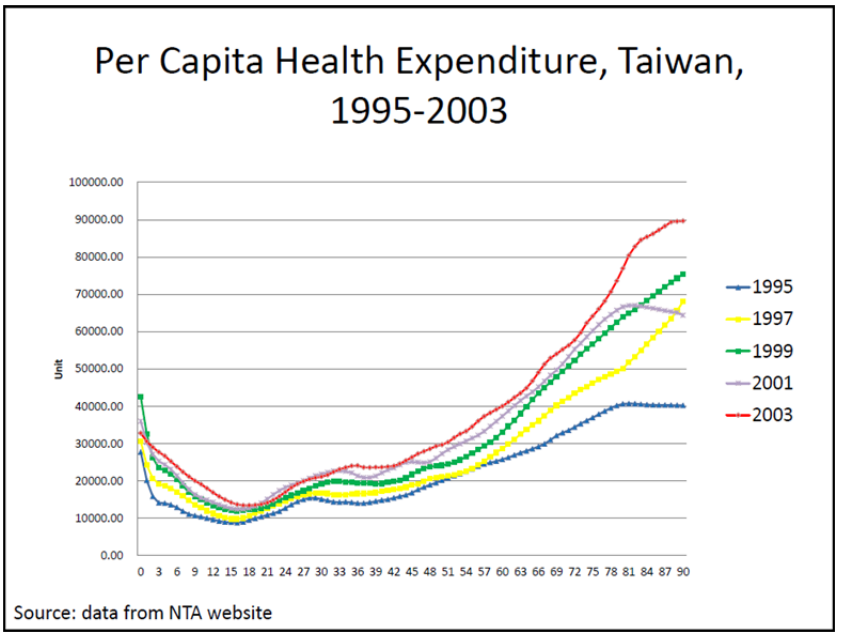
- Demographic effect (DE)
  - How much will demographic change affect the burdens on families and public support systems, such as pensions and health care financing, *assuming the current level of transfers for each age group?*
- Transition effect (TE) – System change effect
  - How will reform of pensions and health care *change the level of transfers for each age group?* The case of health care reform
    - Lifecycle health care expenditure and health insurance system

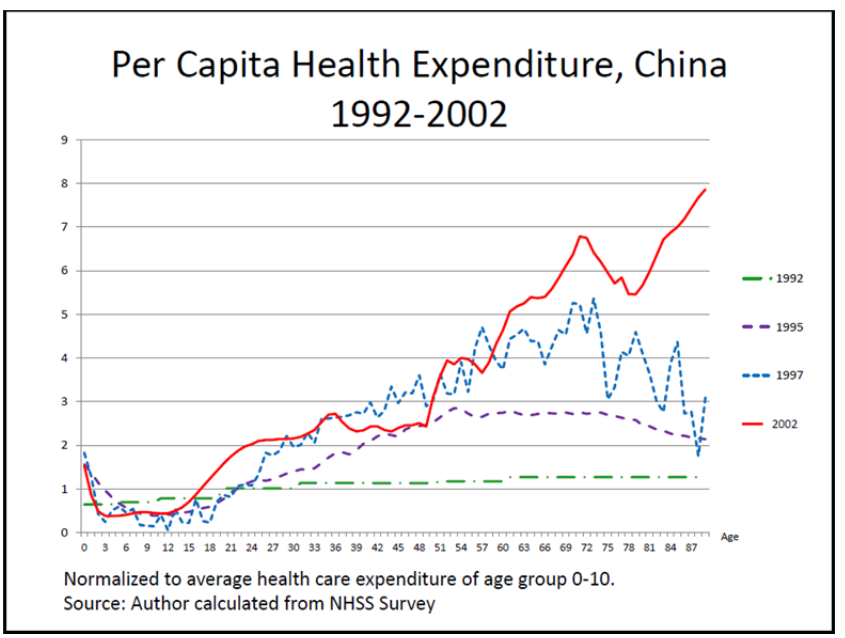

"Demographic Effect" and "Transition Effect"
on Lifecycle Deficit from 1995 to 2002
LCD adjusted to the total population, 100 million Yuan, 2000 constant prices
1000
500
0
-500
-1000
-1500
-2000
1995 Real LCD
Demographic Effect (DE)
Transition Effect (TE)
1995 Real LCD
2002 Real LCD
1995 age profile with 2002 population


Percentage of 2002 LCD Accounted for by Demographic and Transition Effects
Determinants of LCD Change: from 1995 to 2002
100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
-100%
1995 Real LCD
Demographic Effect (DE)
Transition Effect (TE)


Projected Demographic Effect and Transition Effect on Total Health Expenditure (THE)
1995-2020
Projected HE since 2002 only with DE
Projected Private HE since 2002 with linear TE growth
Projected Private HE since 1995 with linear DE and TE growth
Real THE
100 million yuan, 2000 constant prices
It seems the TE is much bigger! Will it actually happen?
The projection show good agreement with the real THE from 1995 to 2008.
TE
DE
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020


Per Capita Health Expenditure, Japan, 1984-2004
2500000
2000000
1500000
1000000
500000
0
0 7 14 21 28 35 42 49 56 63 70 77 84
1984
1989
1994
1999
2004
2004a
Note: Long-term care introduced in early 2000s included in 2004a.
Source: Cited from Andrew Mason's presentation


Per Capita Health Expenditure, Taiwan, 1995-2003
Unit
100000.00
90000.00
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90
1995
1997
1999
2001
2003
Source: data from NTA website


Per Capita Health Expenditure, China 1992-2002
9
8
7
6
5
4
3
2
1
0
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87
Age
1992
1995
1997
2002
Normalized to average health care expenditure of age group 0-10.
Source: Author calculated from NHSS Survey

Social Health Insurance Coverage in China

(Million people)

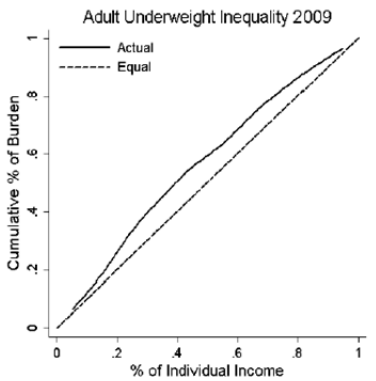
	1999	2001	2003	2004	2005	2006	2007	2008
Basic Medical Insurance System for Urban Employees	20.653	72.859	109.017	124.036	137.829	157.318	180.203	199.956
Medical Insurance for Urban Residents							42.911	118.26
Rural Cooperative Medicare System				80	179	410	726	815

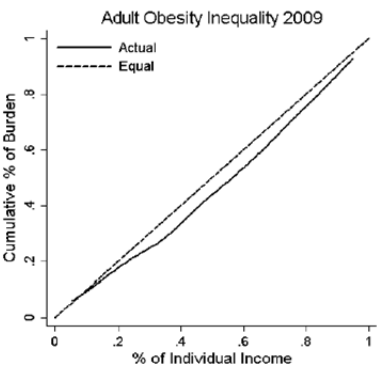
By the end of 2010, 1.260 billion people in China have been covered by at least one social health insurance program.

Source: China Labor Statistic Yearbook 1999, China Health Statistic Yearbook 2009.

Health and Income Inequalities in China

Goldhaber-Fiebert and Eggleston 2012



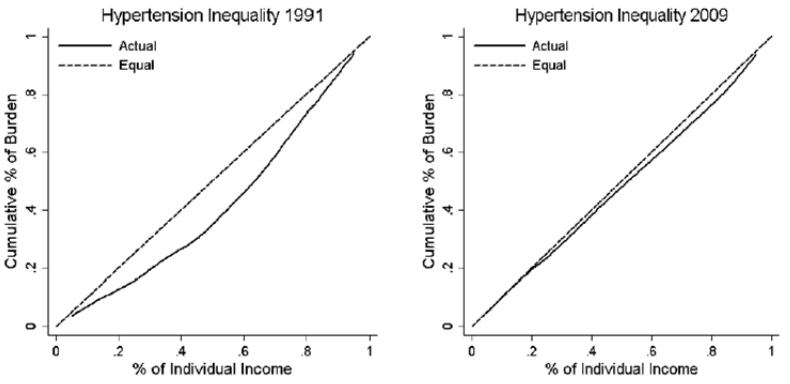


Underweight: mostly among the poor (declining over time)

Obesity: mostly among the rich (but increasing overall...)

Goldhaber-Fiebert and Eggleston, 2011

Epidemic of Chronic Disease: China's Poor Are "Catching Up"



Goldhaber-Fiebert and Eggleston, 2012

Recent Evidence from CHARLS

(China Health and Retirement Longitudinal Study)

- Nationally representative baseline 2011-12
- 45 years of age or older and their spouses (totaling 17,708 individuals), 450 villages/urban communities 150 counties/districts, 28 provinces
- ~45% of the sample are elderly (60+)
- Among the elderly, only 44.7% completed primary school and only 9.4% completed high school.

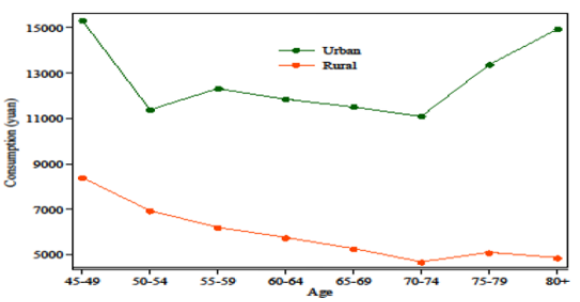
Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS baseline: Health of elderly

- 31.8% reported having poor health;
- 38.1% of the elderly reported a disability, defined as having any difficulty completing basic daily activities on their own;
- 23.8% reported requiring assistance with basic daily activities; and
- 33.4% experienced bodily pain.
- Physical exams revealed that 10.7% of the elderly were underweight; 28.0% were overweight, of which 4.5% were obese based on WHO standards; and
- 54.0% had hypertension (30-40% undiagnosed).

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

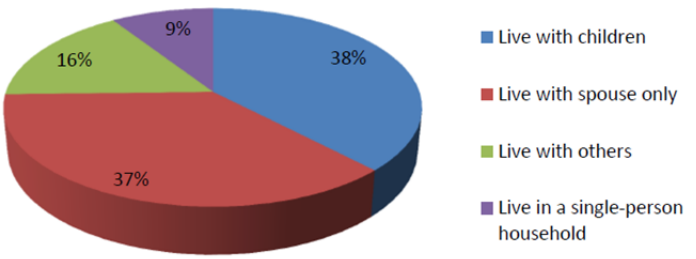
Figure 5.2. Consumption per Capita by Age Group and Hukou Type



Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Living arrangements

Older adults in China, CHARLS 2011-12 baseline



Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Living Arrangements

- ***Although many elderly do not live with their children, the vast majority of elderly have at least one child living in the same immediate neighborhood or if not, the same county or city.*** The 62.2% of the elderly not living with children include 37.4% who have a child living in the same neighborhood and 15.4% who have a child living in the same county or city.
- Among those living with others, 19.0% live with children-in-law (but not children), and 59.8% live with grandchildren but no children or children in law. ***Thus a large number of elderly play the role of primary caretaker of grandchildren when children and their spouses migrate.***

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Family Support for the Elderly

- ***Just less than half of the elderly (46.9%) received transfers in the past year from children who did not live with them.***
- Only 19.0% of the elderly give transfers to their children – although many provide childcare services
- Resources flow upward from children to parents, similar to other Asian and developing countries where due to rapid growth younger cohorts are often able to accumulate more wealth than older cohorts.
- For those receiving positive net transfers from non-coresident children, the median amount of the transfers in the past year is 1,700 yuan and the median share of expenditures financed by transfers is 37.3%.
- Among those elderly who don't live with children and who have children, only 53.3% receive transfers from children, which suggests that there is a significant share of the elderly who do not receive any financial support from children.

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Intergenerational transfers

- **For those with rural hukou, financial support from other household members and private transfers (mainly from children) play a key role in reducing consumption poverty.**
  - the poverty rate based only on the income of respondents and spouses (including pensions) is 65.1%,
  - which falls to 46.1% using pre-transfer household income per capita (after pooling income with other household members),
  - and further to 40.3% with private transfers.
  - Public transfers reduce poverty by 3.3 percentage points, and
  - savings reduces poverty from 37.0% (post-transfer income poverty) to 28.9% (for consumption).

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Pensions

- ***Expansion of the rural pension program could play an important role in reducing elderly poverty.***
- 25.6% of those with rural hukou reported receiving pensions under the new rural social pension program.
- These individuals reported a poverty rate of 29.6% based on income including transfers, but their poverty rate would have been over 37.0% if they had not received the pensions, assuming no change in other sources of income.
- However, if children reduce the amount of transfers to their elderly parents when pension becomes available, it could offset the beneficial impact of the program.

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

CHARLS: Assets and Poverty

- ***The vast majority of the wealth of the older population (age 45+) is in the form of housing (72.9% for those in the middle wealth per capita quintile).***

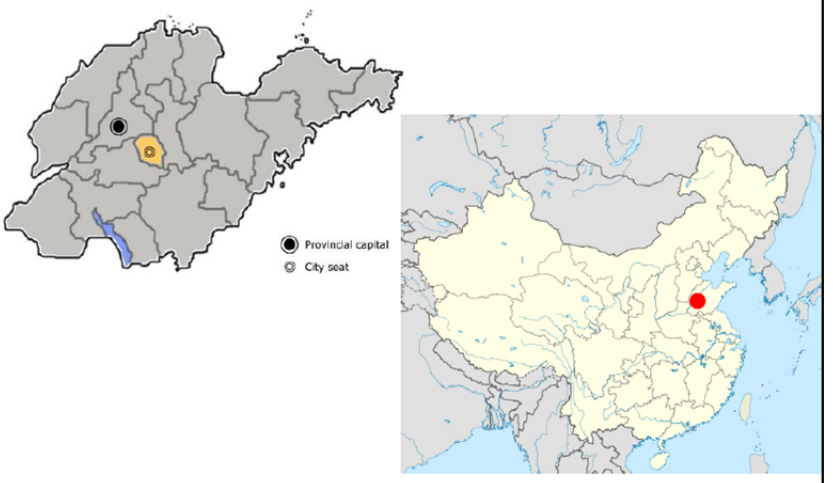
- Even with public and private assistance, consumption levels decline with age in China, leading to higher consumption poverty rates for the elderly, especially among the rural elderly.
- This suggests that greater policy attention should be paid to identifying and assisting the elderly who are materially vulnerable.

Source: CHARLS Team, May 2013, **Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)**

The Economic Impact of Rural Pensions in China on Living Arrangements, Migration and Off-farm Employment of Adult Children

Ang Sun, Renmin University of China
Karen Eggleston, Stanford University

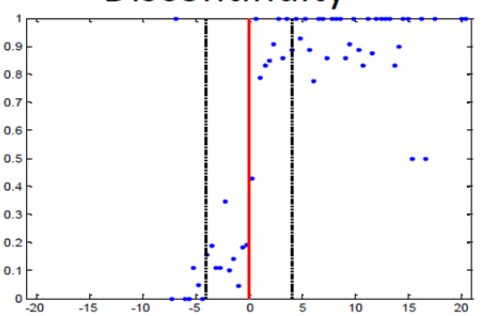
Laiwu County, Shandong



How Representative? (2010)

	Laiwu	Shandong	National average
GDP per capita (RMB)	8767	6990	5919
Off-farm employment	67.65%	64.55%	63.3%
Population structure			
Pct. >60	16.74%	15%	13.26%
Natural growth rate	0.63‰	5.39‰	4.79‰

Research Design: Fuzzy Regression Discontinuity



The sample mean by normalized age

Preview of Main findings

- The family size of the elderly decreased and the male adult children are more likely to move out from the house of their parents who are pension eligible
- The adult children are more likely to migrate and have off-farm jobs if their parents are pension eligible
- At pension eligibility threshold, there is no discontinuity in self-reported health, but pensioners report feeling more confident they can use hospital services when needed

Our Interpretation

- The pension income enables older adults to substitute hired services and independent living for co-residence and family care-giving;
- This change in turn enables adult children to seek off-farm jobs in a broader labor market, including migration for work.

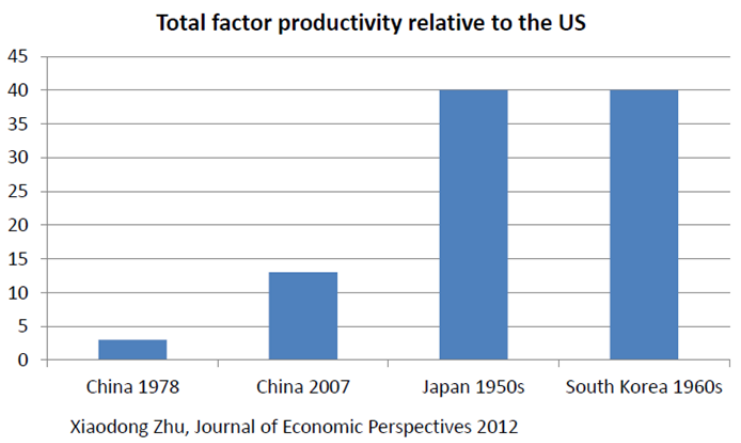
Will Demographic Change Slow China's Rise?

Karen Eggleston, Ang Sun, Jean Oi, Scott Rozelle, Andrew Walder, Xueguang Zhou *Journal of Asian Studies*, August 2013

- We analyze how population ageing, gender imbalance, and their interaction with rapid urbanization has shaped China's reform era development and will strongly shape China's future.
- We organize the analysis according to the proximate determinants of economic growth:
  - labor input and its productivity
  - capital investment and savings
  - multi-factor productivity, including social stability and governance.

<Extra Slides>

Opportunities to raise productivity



Xiaodong Zhu, Journal of Economic Perspectives 2012

3. Elderly Care

City	Private Sector Engagement	City	Private Sector Engagement
Cangnan	No legal private participants	Jianshi	No private participants
Mianyang	Government subsidy	Yidu	Independent operation
Tai'an	government subsidy	Shapingba	Not enough data
Yichun	Government subsidy	Lianyungang	Government subsidy
Ninghai	Not enough data	Jiading	Government subsidy
Changyi	Government subsidy	Cixi	Receiving subsidy
Xishui	No private participants	Harbin	Receiving subsidy
Pudong	Contract outsourcing	Ningguo	Receiving subsidy
Cangzhou	Government subsidy	Yan'an	Independent operation

Photo credit: Chris Lee

Karen Eggleston, Stanford

Representative Quotes: Long-term Care

- “困难首先是引进企业。因为要一个企业按国家标准建养老院并且盈利几乎是不可能的。”——苍南县官员
- “The biggest obstacle is attracting private firms, for it is almost impossible for a private company to run a profitable nursing home according to the national standard.” – Government officer, Cangnan county, Zhejiang Province.

- 民办养老院弥补了一些不足，分担了一些压力，但由于资金有限，设施简陋，存在这样那样的问题，使得整体效果一般。——伊春市官员
- “Admittedly, private nursing homes have ameliorated the shortage of supply and alleviated some of the pressure on the public sector. However, due to their limited budgets, low quality facilities, and other problems, overall effectiveness is limited/moderate.” – Government officer, Yinchun, Heilongjiang Province.

- “不鼓励民营加入养老行业……养老行业应该由政府投入承担。养老行业不赚钱，是亏钱的。”——嘉定县官员
- “We do not encourage the private sector to be involved in the elder care (long term care) industry… Elder care should be undertaken by the government, since it is a costly activity, not a profitable business.” – Government officer, Jiading County, Shanghai.

Karen Eggleston, Stanford

Support System over the Lifecycle in Korea: the Role of Intergenerational Transfers

Namhui Hwang
Population Policy Research Department, Korea Institute for Health and Social Affairs, Seoul, Korea

Abstract

The purpose of this study is to grasp how paid market work and unpaid household work are produced and consumed in each age group and how the gaps between production and consumption are redistributed to each generation. Therefore, this study uses NTA in 2000 and 2005 for paid market work. And it estimates the NTTA in 2004 as the unpaid household work satellite accounts of NTA for the first time in Korea.

The main findings of this study are as follows. First, from the results of reallocation system including unpaid household work, the elderly is also playing the productive role of unpaid household work, and it is not desirable to recognize the elderly as the supported group who only consume by simply limiting to the market production if considering unpaid household work. It is needed to positively change into the recognition that the elderly also is a productive group that contributes to the national economy. Second, this study empirically analyzes the role of unpaid household work as the answer to the retirement-consumption puzzle. Considering unpaid household work, the drop in consumption after retirement greatly decreases, and the level of consumption on the lifecycle remains smoother and the level of consumption after retirement ages seems to be slightly more constant.

Introduction

As population aging goes on globally, the interest on intergenerational equity is on the rise. The intergenerational equity can be grasped through intergenerational transfer, and here, transfer means that an individual who produces more than what he or she consumes generates resource allocation to another individual without exchange of money for goods or services. Accordingly, transfer becomes the main financial resources for consumption for those with more consumption than production such as children and the elderly. However, intergenerational transfer is hard to grasp with the current National Accounts which measures the economic scale with aggregate market value. If we can clarify the scale of consumption and financial resources by life-cycle, we would be able to provide useful information for grasping and predicting the changes in social welfare due to the changes of population structure.

Therefore, Lee et al. (2011) attempted to measure intergenerational transfer by dividing the National Accounts with the unit of age to develop the National Transfer Accounts (NTA). The NTA can macroscopically measure the production, consumption, and transfer of paid market work by age group to agree with the aggregate value of National Accounts, and has greatly contributed to the studies on intergenerational resource allocation. This methodology of NTA can be expanded and applied to unpaid household work to construct the National Time Transfer Accounts (NTTA) as the unpaid household work satellite accounts of NTA. That is, NTTA is a new methodology that can measure the social welfare of unpaid household work by developing the NTA.

Actually unpaid household work such as household care and family care has been of interest because unpaid household work increases the consumption of goods and services and can be seen as an implicit income (Becker, 1965). If unpaid household work is disregarded, the contribution of women to the national economy cannot be evaluated desirably, and wrong information on distribution of income and

poverty can be provided (Abraham and Mackie, 2005). With the same household income, the single-income households have more implicit income than the double-income households to have a higher social welfare (increase in disposable income). Frazis and Stewart (2011) showed that the equity in income gets improved when the distribution of income is grasped with the extended income including implicit income as the standard.

There is a consensus that unpaid household work should also be included in the economic scale in order to grasp the true level of welfare of a nation from this point of view. Accordingly, the studies to measure unpaid household work with the satellite accounts of National Accounts have been actively conducted. However, as of yet, there is no attempt has been made to estimate unpaid household work by age. As our society is going through many changes due to population aging, it is needed a more advanced study to measure the scale of production of not only paid market work but also unpaid household work by age.

Therefore, this study aims to measure the production, consumption, and transfer of both works by age group using the NTA and NTTA respectively, and to explore support systems focusing on intergenerational transfer including unpaid household work for the first time in Korea. In particular, I use two data years1., 2000 and 2005, for NTA. The year 2000 is chosen because it was the year when Korea became an “aging society”. The year 2005 begins to increase significantly social concern and government burden related to the elderly. Thus, this study grasps the changes of intergenerational resource allocation in the market. And I estimate one period of data 2004 for NTTA. The year 2004 is chosen because it was the closet year providing information on unpaid household work to compare with results of NTA considering the availability of data.

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[1] NTA of Korea has constructed using three data years, 1996 and 2000, 2005, by An et al. (2010).

This study is composed as follows. Chapter II reviews the previous studies related to this study, and Chapter III briefly examines the data and the method of estimation for NTA and NTTA. Chapter IV presents the results of estimation of NTA and NTTA. And the final chapter concludes.

Previous Studies

Intergenerational transfer has been dealt with as the main subject of study in many advanced countries in the world because transfer is the main financial resources for consumption among supported groups. As the weight of supported groups changes due to the population aging, transfer is receiving more attention due to the increase in interest in burden of economic support. The studies on intergenerational transfer have been mainly conducted with interest in the motives of private transfer and crowding-out relationship between the private transfer and public transfer. The motives of private transfer include the altruistic motive and the exchange motive. By the altruistic motive, the increase in public transfer generates the decrease in private transfer. That is, the crowding-out effect between private transfer and public transfer appears (Becker and Tomes, 1986; Willis, 1980; Kotlikoff and Spivak, 1981). Whereas, by the exchange motive, there exists no crowding-out effect between the public transfer and private transfer because the private transfer is conducted wishing for a responding price (Bernheim et al., 1985; McGarry and Schoeni, 1995).

However, the studies on the existing intergenerational transfer have been conducted with only the inter-household transfers between parents and adult children who do not live together because there was no way to measure the intra-household transfers occurring between family members living together. However, Lee et al. (2011) attempted to measure the inter-generational transfer including not only the inter-household transfers but also the intra-household transfers across age. In the same study, he divided into the public and private sectors to agree with the aggregate value of National Accounts by reflecting the

changes of population structure, and developed NTA. NTA can measure the production, consumption, and transfer of paid market work by age group. Also, in Korea, An et al. (2010) has examined the impacts of financial crisis in 1998 on the intergenerational resource allocation by using the NTA. However, the NTA has its limitations in that it only grasps the economic flows between generations on paid market work excluding unpaid household work.

Meanwhile, since Mitchell (1921) pioneered the discussion of the contribution to GNP of unpaid household work conducted in households, the studies that measure the appropriateness of unpaid household work to be included in the economic scale of a nation and the range and economic value of unpaid household work have been actively conducted (Reid, 1934; Moon, 2001; Hamdad, 2003; Kim, 2003; Kwon, 2009). And the US and so on also recommend to measure the unpaid household work by applying the specialist replacement cost method when framing the unpaid household work satellite accounts (Abraham et al., 2005)[2]. The reason why is that the method coincides with the third party criterion[3], which is the standard for division of unpaid household work presented by Reid (1934). According to Hamdad (2003), the economic value of unpaid household work of Canada in 1998 was 33% of GDP, and according to Moon (2001), unpaid household work of Korea in 1999 reached 28% through 48%.

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[2] In 2005, Beyond the Market (Abraham et al., 2005) Recommendation 3.4, which is a National Research Council panel report, clearly stated to apply the specialist replacement cost method, which is one of the input approaches (Unpaid household work should be valued using replacement cost. For household time input to production this would be a replacement wage-the market wage of a specialist adjusted for differences in skill and effort between nonmarket household and market production.).

[3] The third party criterion means including only the activities for which wage should be paid if someone but I conducted the unpaid household work in the range of unpaid household work.

All the while, the studies on unpaid household work have been conducted only to measure the economic scale focusing on the aspect of production, not paying enough attention on how the products of unpaid household work are distributed and consumed. The main reason is that it is difficult to measure the scale of household commodities[4] increased due to the time spent in unpaid household work, and it is even harder to divide the scale of consumption increased in each household member.

In fact, there have been only incomplete studies not only on household commodities but also on market commodities in the distribution between household members. However, the household commodities generated the by unpaid household work have the personality of public goods, and all the scholars agree that all the household members come to enjoy the benefits (Becker, 1965; Nelson, 1988; Pollak, 2005). And, recently, Lee et al. (2011) empirically showed that the consumption can be distributed by the NTA and it is possible to expand the methodology of NTA to unpaid household work as the unpaid household work satellite accounts of NTA. Donehower (2012) showed that the results of estimation of unpaid household work in U.S. and she called it National Time Transfer Accounts (NTTA).

Therefore, this study attempts to measure the production, consumption, and transfer of paid market work and unpaid household work across age using the NTA and NTTA respectively, and to explore support systems focusing on intergenerational transfer for the first time in Korea by combining the results of these estimations.

[4] It has included one person households since 2006.

Application of NTA and NTTA in Korea

Data

We used various data but the primary sources of micro-data sets used in our analysis are the Household Income and Expenditure Survey (HIES) and the Korean Labor and Income Panel Study (KLIPS) of 2000 and 2005 for NTA. And the used data to estimate NTTA is the 2nd Time Use Survey (TUS) of 2004.

The HIS, released every year since 1963, contains information on income, expenditures, assets, and liabilities of households. But it excludes one person household[5], farmer's and fisherman's households. The KLIPS provides the information on labor income of each individual, consumption of each household, and the absence or presence and amount of private transfers, and is a useful data for measuring the production, consumption and private transfer of paid market work. The labor panel has been investigating the personal data at the time of survey, the consumption and income of the previous year of survey. Thus the personal data of the 3rd (8th) Study and the consumption and income matters of the 4th (9th) Study are combined to utilize as the data for 2005 (2000).

The TUS is the core and only data that can presume unpaid household work into monetary value on the basis of the data on how Koreans spend their time and when they conduct certain behaviors. It is conducted every 5 years from 1999 and all the household members aged 10 years and over are asked to record in the time diary structured in 10 minutes intervals for the designated two days. Therefore, data on time spent on unpaid household work can be used for the valuation of household work.

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[5] The third party criterion means including only the activities for which wage should be paid if someone but I conducted the unpaid household work in the range of unpaid household work.

Methodology

National Transfer Accounts for paid market work

NTA is to measure at the aggregate level, in a manner consistent with National Accounts, the economic resource reallocations across age. These reallocations occur because at some ages individuals consume more than they produce, while at other ages individuals produce more than they consume. The reallocation system consists of a set of complex institutions and practices by which the young and the old, those with the positive values of lifecycle deficits, draw on economic resources generated during prime working ages, those with the negative values of lifecycle deficits. An individual facing a positive lifecycle deficit can consume by age reallocation. And age reallocation is composed of asset reallocation and transfer. Typical examples of asset reallocation are saving and credit transactions. And private transfer is divided into inter-household transfers and intra-household transfers.

In addition, the age profile of the NTA is made of two sectors. The first sector is the aggregate value of paid market work, and the second sector is the per capita value by age group. The aggregate value is obtained by obtaining the per capita age profile by using the survey data and multiplying by the actual population. This paper does not discuss the methodology in detail. For a detailed discussion on these methods, see Mason, Lee *et al*. (2009), and the website of NTA, http://www.ntaccounts.org. Table 1 shows briefly the estimation methods and source of data used for NTA.

Table 1. Estimation Methods and Data Source of NTA

Category		Method	Source
Consumption	Education, Public	Age- & education level-specific enrollment rate	OECD education
	Health, Public	Age distribution of benefits	NHISY
	Others, Public	Per capita basis	NA
	Education, Private	Regress on enrollment and age	HIES
	Health, Private	Regress on age	HIES
	Others, Private	Equivalence scale	HIES
Labor Income	Compensation of employees	Wage of wage workers	KLIPS
	Entrepreneurial income	Income of non-wage workers	KLIPS
Asset Allocation	Asset income, private	Net property income of households	HIES
	Savings, private	Residuals	
	Asset income & financial asset Accumulation, public	Age distribution of tax burden	NA
	Capital and land accumulation, public	Age distribution of population	NA
Transfer	Social insurance & tax	Generational accounting	Auerbach, Chun
	Inter-household transfers	Private subsidy and remittance of households	HIES
	Intra-household transfers	Net transfers=consumption - disposable income	KLIPS

Note : NHISY is National Health Insurance Statistics Year.

National Time Transfer Accounts for unpaid household work

This section basically follows the NTTA methodology described in Donehower (2012). As mentioned above, the method of NTTA has borrowed the idea of NTA as it is. However, there are huge differences between NTA and NTTA. Firstly, the NTA is made of

private sector and public sector by institutions, but the NTTA is made of only private sector. Secondly, the age reallocation of NTA is made of asset reallocation and transfer, but the NTTA has no asset reallocation because unpaid household work is not saved. For these reasons, it is easier to estimate NTTA than NTA.

On the other hand, the range of unpaid household work includes household care, family care, participation and volunteering, and the travel related to these activities in the classification of activities in the TUS according to “third party criterion”. The average hourly wage rates by types of occupation need to take into account the economic value of unpaid household work using the specialist replacement cost method. Here, the data of Survey on Wage Structure in 2004 provided by Ministry Korea Labor[6]. For the occupations performing a similar function to the activities in the classification of activities of TUS, the responding types of occupation from the 5th revision of 'Korean Standard Occupation Classification (Notice of Statistics Korea on January 7th, 2000)' were matched[7]. The wage of unpaid household work is lower than the average hourly wage rates of all types of occupation (8,355 won), and that of family care is 6,547 won, which is higher than that of participation and volunteering of 5,982 won and that of household care of 5,897 won (see appendix table 2).

When the average hourly wage rates which is applicable by type of activities of unpaid household work is selected, the per capita age profile is estimated, and it can be seen that from this stage the NTTA

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[6] 「Survey on Wage Structure」 provides the information on wage and working hours by type of occupation. The average hourly wage rate is applied by calculating through 'monthly wage/monthly total working hours'

[7] They were matched by referring to the matching data applied when Kim (2003) converted the economic value of unpaid household work of housewives with the specialist replacement cost method.

is actually constructed. For the production[8], the per capita age profile is estimated by multiplying the inputted time by the average hourly wage rates for each item of unpaid household work of TUS. Consumption and transfer cannot be directly measured by using the TUS, and thus the methods of estimation are more complicated than the labor income, and more assumptions are needed. However this paper also does not discuss the methods of NTTA in detail. For a detailed discussion on these methods, see Hwang (2012). Table 2 presents briefly the methods of estimation of NTTA.

Table 2. Estimation Methods of NTTA

Category		Method	Remark
Production (=Labor Income)	Household care	To directly calculate with the amount of time of household care of each individual	
	Family care	To directly calculate with the amount of time of family care of each individual	
	Participation and volunteering	To directly calculate with the amount of time of participation and volunteering of each individual	
Consumption	Household care	To equally distribute to the household members for each household	
	Family care	To equally distribute to the entire population of the pertinent age	
	Participation and volunteering	To equally distribute to the entire population	

[8] It is more appropriate to use production instead of labor income in NTTA because there is no monetary compensation for unpaid household work. I mainly use production in NTTA as much as possible in this paper.

Table 2(cont). Estimation Methods of NTTA

Category			Method	Remark
Transfer	Inter-household	Family care	To divided into inflows and outflows and to equally distribute to the entire population of the pertinent age	
		Participation and Volunteering	The outflows are equal to the production of participation and volunteering, and the inflows are equal to the consumption of participation and volunteering.	
	Intra-household	Household care	To calculate the inflows and outflows with the difference between 'consumption-production' of household care	Identical Equation
		Family care	To calculate the inflows and outflows with the difference between 'consumption-net inter-household transfers-production' of family care	Identical Equation

Note: It is used production instead of labor income in NTTA because there is no monetary compensation for unpaid household work.

Results of Estimation

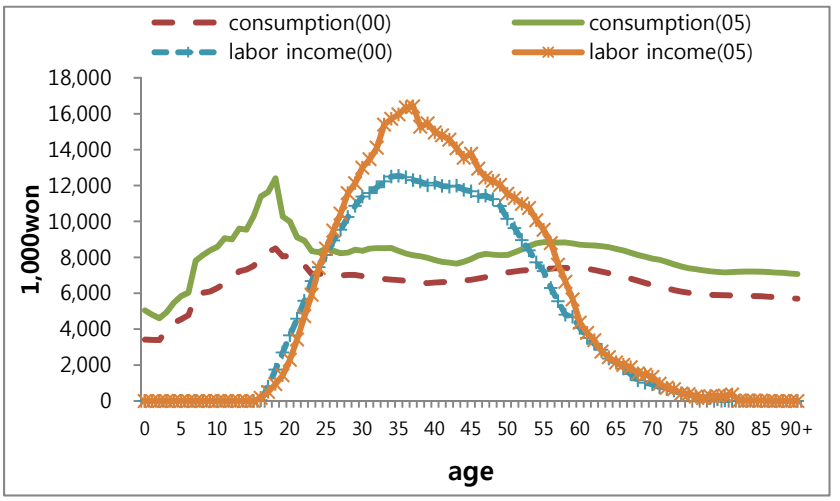
Changing in intergenerational transfers of paid market work

Figure 1 shows the age profiles of labor income and consumption in 2000 and 2005, using real prices as expressed in year 2005 Korean won. This study mainly explains using per capita age profiles. The reason why is that the results of per capita estimation is useful in that the analysis can be conducted by excluding the impacts of population of the pertinent age unlike the results of aggregate value estimation.

The labor income reached the peak at the age of 35 in 2000, but the figure slightly increased to 37 in 2005. It also considerably increases the labor income profile between 2000 and 2005. At the same time, consumption peaks in the late teens and decreases until one reached in their 40s. This result may be related to high level of private education

consumption in high school students. In 2005, the peak of consumption for the older eldely is much more prominent.

Figure 1. Labor Income and Consumption, Per capita

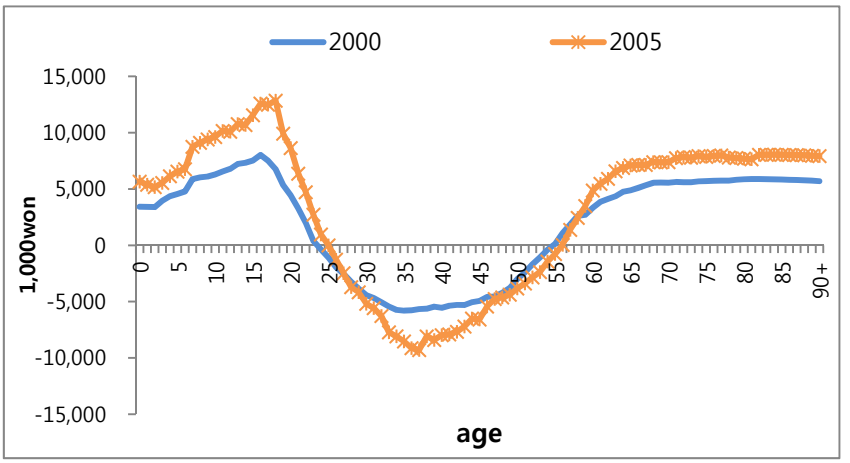


Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

Lifecycle deficit, which is divided into three parts, takes on a positive or negative net value depending on age. Figure 2 presents these age profiles are divided into three parts whether they are positive or negative. Negative ages of lifecycle deficit are slightly shifted on the right from age 24 to 54 in 2000 and age 25 to 55 in 2005, respectively. The gap between labor income and consumption is larger over the time. It might be related to many factors in Korea, such as increase in education consumption for children, increase in the age of entrance to the labor market, and increase in medical expenditure by the elderly.

Figure 2. Lifecycle Deficit, Per capita

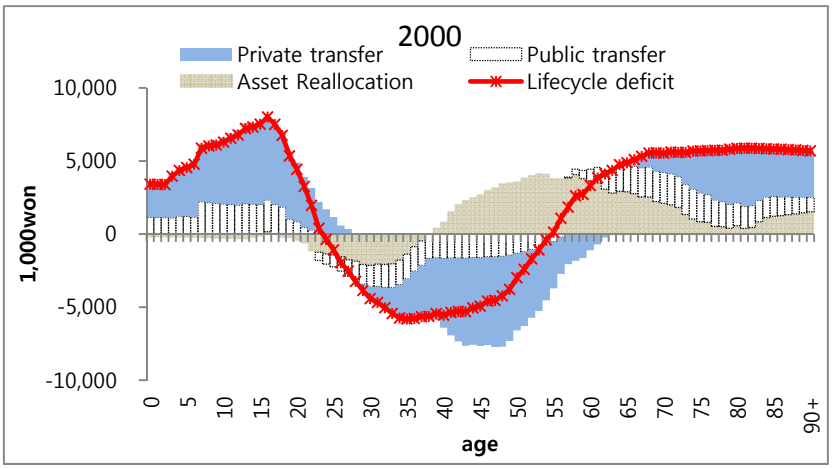


Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

Lifecycle deficit is supported by age reallocation, which is composed of asset allocation, public transfer and private transfer. Private transfer dominates the age reallocations for children and this pattern is not changed between 2000 and 2005, although public transfer slightly increases. However, age reallocations for the elderly are changed during these periods. Private transfers for the older elderly are most important in 2000, but age reallocations are most important in 2005 excluding the oldest elderly. The reason why is that it might be the real estate bubble in Korea. In 2005, the Korean government carried out policy to stabilize real estate prices which soared after recovering currency crisis. Recently, the prices of real estate are lower level under the slow economy, regardless of the effectiveness of the policy. Thus the big increases in reallocation system for the elderly are likely to be a special case of a particular year.

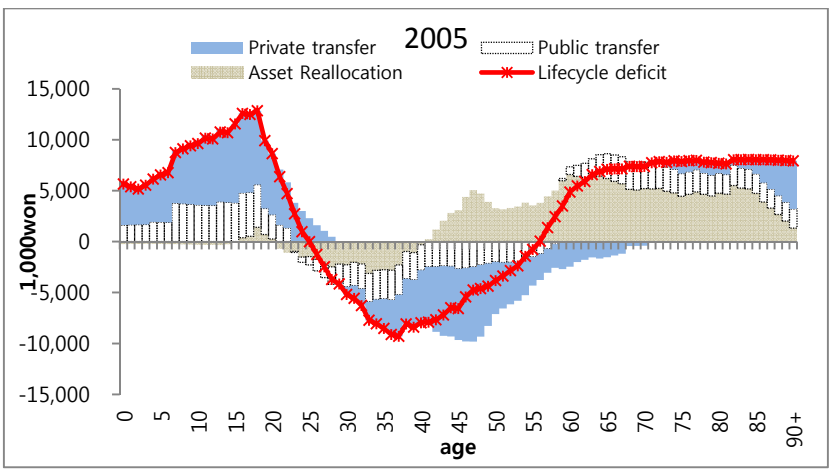
Figure 3. Lifecycle Deficit and Age Reallocation, 2000, Per capita



Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

Figure 4. Lifecycle Deficit and Age Reallocation, 2005, Per capita



Note: It is expressed in year 2005 Korean won.

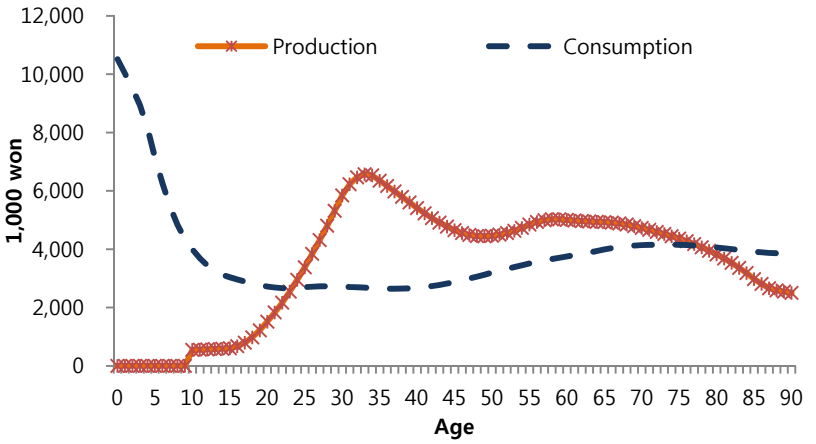
Source **:** Author's own calculation

Intergenerational transfers in unpaid household work

The scale of consumption and production of unpaid household work about 173,350 billion won reaching about 21% of the GDP (826,893 billion won) in 2004 and about 40%[9] of market production (see appendix table 3). The age reallocation of 15,880 billion won is generated in the inter-household transfers, and that of 59,620 billion won is generated in the intra-household transfers, which are around inter-household transfers by 4 times. Considering by age group, children is the only group lifecycle deficit is positive, consumption is more than production, and it means children is beneficiary in home production. In prime working ages and the elderly, lifecycle deficit is negative. It is the most interesting point of NTTA, looking at the per capita age profile, Figure 5 shows the elderly produces in unpaid household sector as much as prime working ages, which is a level 92% of prime working ages. That is, the elderly is also playing the productive role of unpaid household work, and it is not desirable to recognize the elderly as the supported group who only consume by simply limiting to the market production if considering unpaid household work.

[9] The production of NTA in 2004 is 431,127.7 billion won.

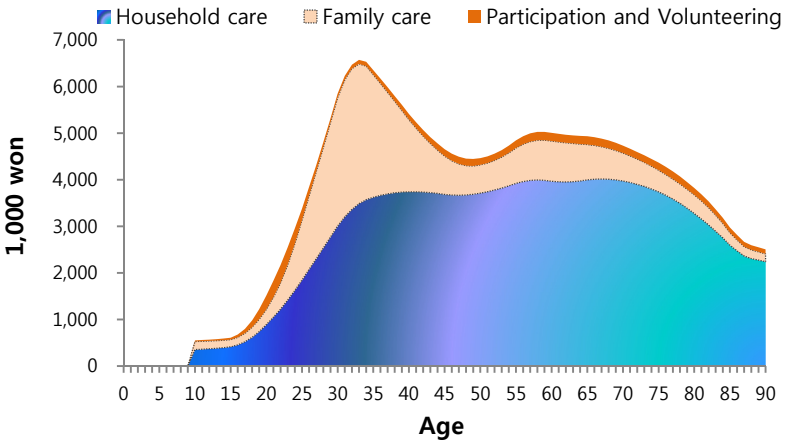
Figure 5. Production and Consumption of Unpaid Household Work, Per capita



Source **:** Author's own calculation

Adults and the elderly between their 30s and early 80s show a great scale of production of household care of 30 million won or more considering of component in Figure 6. And labor income of family care accounts for 20 million won or more in late 20s through late 30s when adult women mainly give birth to and rear their children. In addition, participation and volunteering has a small scale regardless of age, but the peak ages are in early and mid-20s, which seems to be related to the obligatory military service of men. The reason why is that in general, the men who joined the army are not included in the respondent of survey, but those who perform their obligatory military service working at public institutions or defense industry enterprises are included. Therefore, it can be guessed that the actual scale of participation and volunteering of men in their early 20s is expanded further if the cases of joining the army are included.

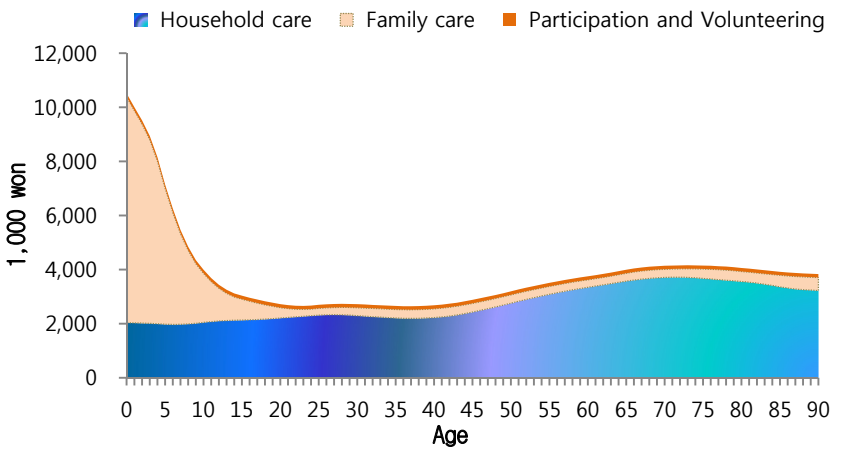
Figure 6. Components of Production in Unpaid Household Work, Per capita



Source : Author's own calculation

Figure 7 presents consumption is the greatest scale in the infant-age, and it is caused by family care. Household care has a great impact on the increase in consumption of the elderly, but family care also accounts for a certain ratio. In addition, participation and volunteering is at an insignificant level in all ages.

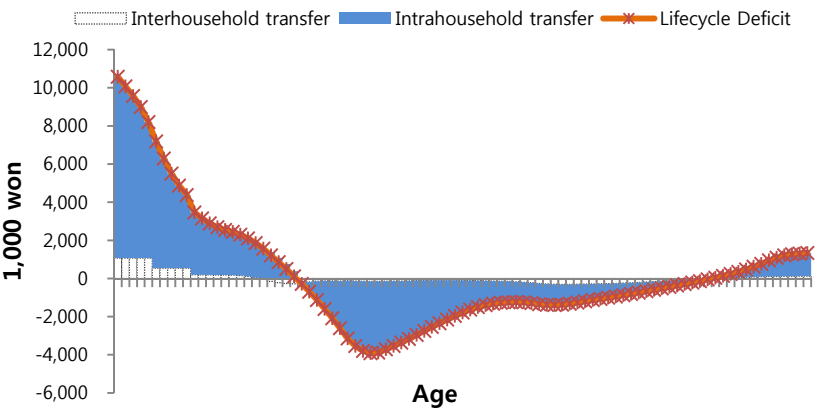
Figure 7. Components of Consumption in Unpaid Household Work, Per capita



Source **:** Author's own calculation

While lifecycle deficit is a negative value in the ages of 25 through 55 years in market as of 2005, it shows a negative value in the ages of 24 through 77 years, which are longer in the market. And it is mainly related to intra-household transfer.

Figure 8. Lifecycle Deficit and Age Reallocation in Unpaid Household Work, Per capita



Source **:** Author's own calculation

Intergenerational transfers including unpaid household work

When combining the NTA and NTTA, the intergenerational resource allocation can be grasped including not only the paid market work but also the unpaid household work. This study attempts the combination of production, consumption, and transfer using the results of NTA in 2005 and NTTA in 2004. It is converted the age profiles of NTTA into in 2005 year price using the GDP deflator because the year of date used in this study are different.

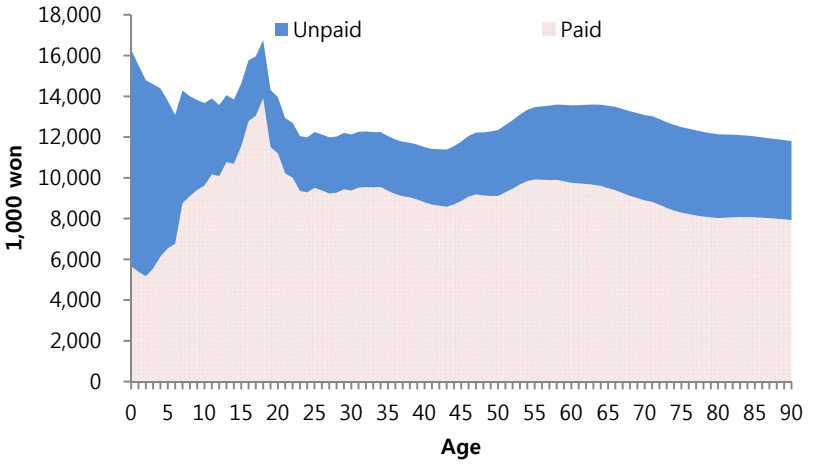
Figure 9 shows that consumption per capita is expanded more and especially, those who are 5 years old and under show the consumption of unpaid household work is larger than the consumption of paid

market work. However the consumption of those who are 18 years old is the highest figure at 16.8 million won and it seems that one of the reasons is the highest private education expenditure in Korea.

Anyway, it means that the burden of support of adult parents for their children is increased when including unpaid household work. In other adult ages, the scale of total consumption is around 12 million won and the level of consumption after retirement ages seems to be slightly more constant.

What should be paid attention through the combination of NTA and NTTA is that the answer to the dispute over the life-cycle hypothesis and retirement-consumption puzzle can be provided. Banks *et al*. (1988), Bernheim *et al*. (2001), Hurd and Rohwedder (2003), Haider and Stephens (2004), and so on argued that when analyzing the level of consumption before and after retirement, the consumption rapidly decreases after retirement and the discontinuity of consumption is discovered, and thereby raised a question on the establishment of life-cycle hypothesis. However, these studies have limitations in that they examine consumption in the market. A different result can be shown when analyzing the level of consumption before and after retirement considering unpaid household work. The consumption of paid market work measured in the NTA decreases in old age more than in prime working ages, but the consumption of unpaid household work increases more in old age than in prime working ages. As a result, it can be identified that the total consumption is smoothed over the life-cycle.

Figure 9. Age Consumption Profiles Including Unpaid Household Work, Per capita

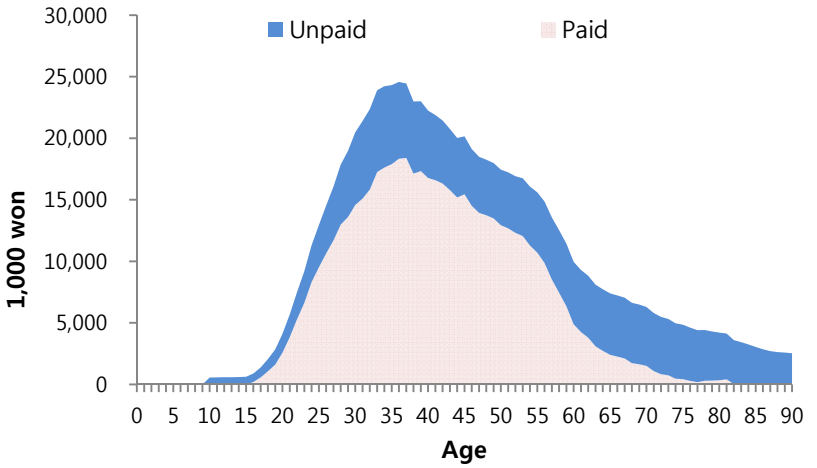


Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

The greatest characteristic of age production profile is that it increases greatly not only in prime working ages but also in the elderly, and it can be identified that the scale of lifecycle deficit is expanded in the infant period as the characteristics of each age group of consumption and production are reflected as they are. It greatly increases relatively in the entire school-age, and the scale of negative value of lifecycle deficit is also expanded in those who are 80 years old and over by unpaid household work. In prime working ages, production increases more greatly than consumption, and negative value is expanded.

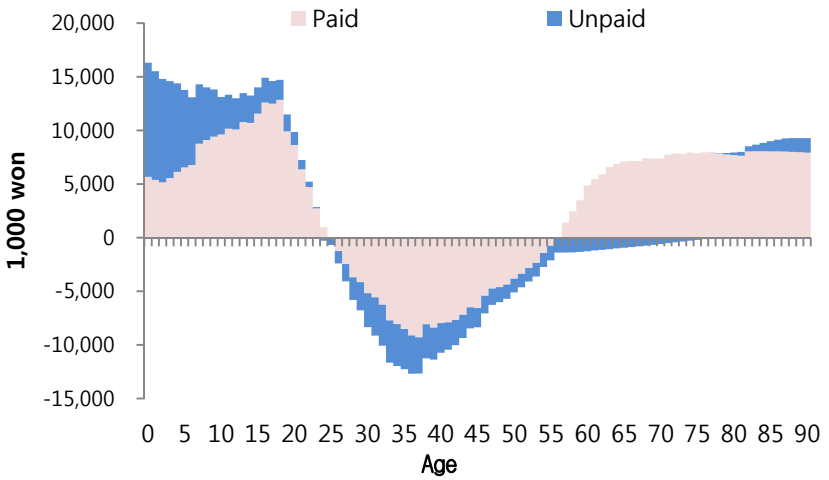
Figure 10. Age Production Profiles Including Unpaid Household Work, Per capita



Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

Figure 11. Lifecycle Deficit Including Unpaid Household Work, Per capita



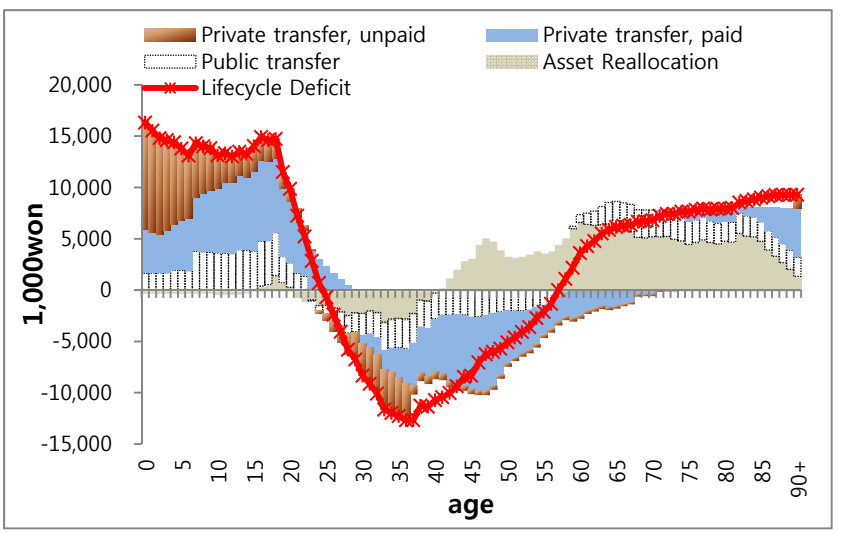
Note : It is expressed in year 2005 Korean won.

Source **:** Author's own calculation

Figure 12 shows how lifecycle deficit that is more expanded is supported by age reallocation. Children are mainly financed by private

transfers that can be guessed it mainly flowed in from prime working ages. When looking at private transfers by work type, it is known that there is a difference among children. Private transfer of unpaid household work is the highest in preschool-ages, while private transfers of paid market work is the largest in school-ages. In prime working ages, not only the scale of lifecycle deficit and age reallocation is larger but also ages of negative value are younger. The elderly are mostly supported by asset reallocations, but private transfers, especially, in paid market work, play a large role for those aged at 75 and over.

Figure 12. Lifecycle Deficit and Age Reallocation Including Unpaid Household Work, Per capita



Note : It is expressed in year 2005 Korean won.

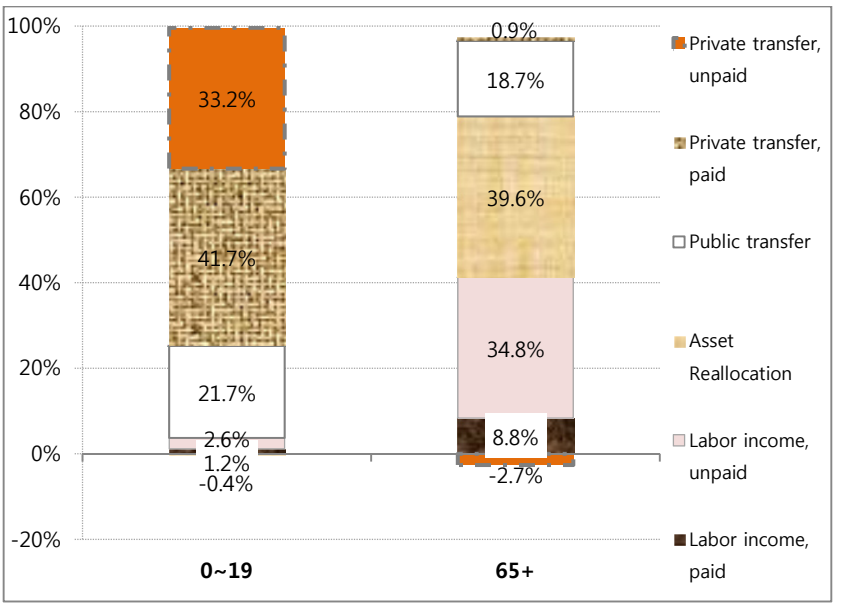
Source **:** Author's own calculation

Figure 13 illustrates how consumption for dependent populations is funded. All consumption for children is mostly financed by transfers which are around 97%. In particular, private transfer of paid market work dominates totaling of 42% of consumption. And private transfer of unpaid household work and public transfer are the second largest

which is accounting for 33%, and the third largest which is accounting for 22%, respectively.

Asset reallocations are most important source of consumption for the elderly, accounting for about 40%. And the second largest is production of unpaid household work, accounting for 35%. It means consumption for the elderly is financed by themselves, while public transfer is only 19%. However, it is expected that the current elderly rely more on public transfer because it has provided by welfare policies for the elderly such as the basic old-age pension and the long-term care insurance since 2008.

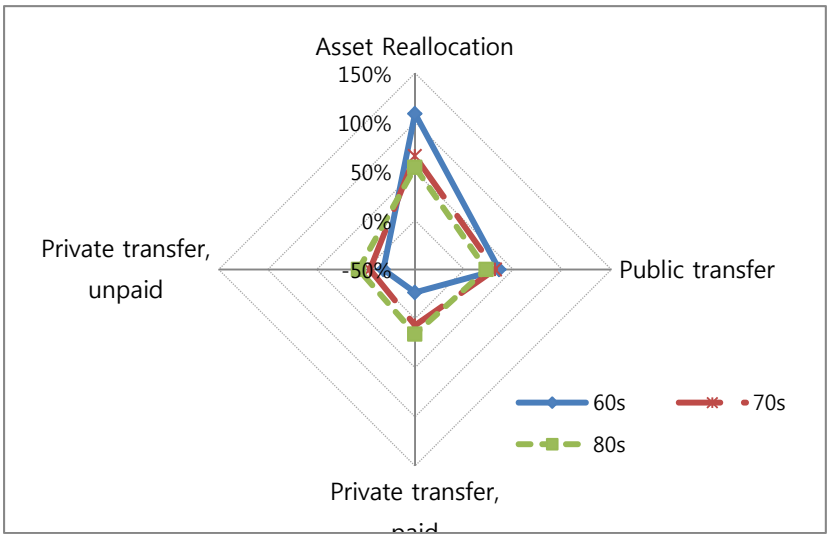
Figure 13. Support System of Dependent Populations Including Unpaid Household Work



Note : It is calculated after being expressed in year 2005 Korean won.

Source **:** Author's own calculation

Figure 14. Old-age Reallocation System for Support Including Unpaid Household Work at Various Ages



Note : It is calculated after being expressed in year 2005 Korean won.

Source **:** Author's own calculation

There is old-age reallocation system for support including unpaid household work by three age groups which are composed of those in their 60s, 70s and 80s in Figure 14. The importance of asset reallocations are decreased but the importance of private transfer of both paid and unpaid work is increased as getting older. However, asset reallocation is even the largest among these age groups. In particular, for those in their 60s, asset reallocations are almost 100% and private transfers of paid market work and unpaid household work are negative values which is accounting for -27% and -18%, respectively. It means those in their 60s generated private transfers to other individuals through private transfers.

Conclusion

The purpose of this study is to grasp how paid market work and unpaid household work are produced and consumed in each age group and how the gaps between production and consumption are redistributed to each generation. Therefore, this study uses NTA in 2000 and 2005 for paid market work. And it estimates the NTTA in 2004 as the unpaid household work satellite accounts of NTA for the first time in Korea.

As the result of estimation of paid market work, the negative ages of lifecycle deficit are slightly shifted on the right and the gap between labor income and consumption is larger between 2000 and 2005. It might be related to many factors in Korea, such as increase in education consumption for children and increase in the age of entrance to the labor market. Considering by age groups, private transfer dominates the age reallocations for children and this pattern is not changed during two periods, although public transfer slightly increases. However, the asset reallocation of the elderly increased considerably. Private transfers for the older elderly are most important in 2000, but age reallocations are most important in 2005 excluding the oldest elderly. According to An et al.(2010), the increase in asset reallocation was mainly due to a decrease in saving (an increase in dis-saving) between 2000 and 2005.

From the result of estimation of unpaid household work, the scale of unpaid household work reaches about 40% of paid market work in 2004. And it is the most interesting point of NTTA, looking at the per capita age profiles, the elderly produces in unpaid household sector as much as prime working ages, which is a level 92% of prime working ages. Therefore, the elderly gives considerably unpaid household work to other individuals through private transfers.

As the result of estimation of combining paid and unpaid work, it greatly increases relatively in the entire school-age, and the scale of negative value of lifecycle deficit is also expanded in the elderly who are 80 years old and over by unpaid household work. In prime

working ages, production increases more greatly than consumption, and negative value is expanded. In addition, it was clarified that there are huge differences among elderly groups. The younger elderly has an economic power in terms of not only paid market work but also unpaid household work, thus 60s still play a productive role through private transfer unlike the older elderly.

Therefore, the main findings of this study are as follows. First, from the results of reallocation system including unpaid household work, the elderly is also playing the productive role of unpaid household work, and it is not desirable to recognize the elderly as the supported group who only consume by simply limiting to the market production if considering unpaid household work. It is needed to positively change into the recognition that the elderly also is a productive group that contributes to the national economy. Second, this study empirically analyzes the role of unpaid household work as the answer to the retirement-consumption puzzle. Considering unpaid household work, the drop in consumption after retirement greatly decreases, and the level of consumption on the lifecycle remains smoother and the level of consumption after retirement ages seems to be slightly more constant.

Meanwhile, this study is significant in that it is the first attempt to grasp the reallocation of economic resources of each age group including the unpaid household work, and leaves that as a research task from now on. And as the population ages, NTA including NTTA will play a role as a useful economic tool such as the National Accounts. Finally, the results of estimation of this study is preliminary, and it would be able to be generalized after going through the process of elaboration of study methods, expansion of compared nations, and so on.

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Appendix

Table 1. NTA, aggregate values by age groups

(Unit: Korean billion won)

2000	Total	0-19	20-64	65+
Life Cycle Deficit	**21,299**	**79,505**	**-76,930**	**18,725**
Consumption	314,706	83,887	209,161	21,658
Public	70,098	27,608	37,358	5,133
Private	244,609	56,280	171,804	16,525
Labor Income (Less)	293,407	4,382	286,092	2,933
Age reallocation	**21,299**	**79,505**	**-76,930**	**18,725**
Transfer	644	82,629	-94,698	12,713
Public	0	23,326	-29,746	6,420
Private	644	59,303	-64,952	6,294
Asset reallocation	20,655	-3,124	17,768	6,012
Public	-49,731	-4,729	-42,624	-2,378
Asset income	9,047	860	7,754	433
Saving (Less)	58,777	5,589	50,378	2,810
Private	70,386	1,605	60,392	8,389
Asset income	125,337	30	108,075	17,231
Saving (Less)	54,951	-1,575	47,684	8,842
2005	**Total**	**0-19**	**20-64**	**65+**
Life Cycle Deficit	38,405	101,112	-92,255	29,549
Consumption	399,109	103,036	262,116	33,958
Public	102,452	38,315	54,843	9,294
Private	296,657	64,720	207,273	24,664
Labor Income (Less)	360,704	1,924	354,371	4,409

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Table 1(cont). NTA, aggregate values by age groups

2005	Total	0-19	20-64	65+
Age reallocation	38,405	101,112	-92,255	29,549
Transfer	-2,267	101,684	-113,699	9,747
Public	0	34,795	-44,116	9,321
Private	-2,267	66,890	-69,583	426
Asset reallocation	40,672	-573	21,444	19,801
Public	-50,380	-3,604	-44,192	-2,583
Asset income	8,661	620	7,597	444
Saving (Less)	59,040	4,224	51,790	3,027
Private	91,051	3,031	65,636	22,384
Asset income	171,600	69	147,179	24,352
Saving (Less)	80,549	-2,963	81,543	1,968

Note : 1. It is expressed in year 2005 Korean won.
2. Some figures of individual categories may not be equal to the total because of individual rounding off.

Source **:** Author's own calculation

Table 2. Classifications of Unpaid Household Work Responded Types of Occupation and Average Hourly Wage Rates in 2004

(Unit: Korean won)

Activities of Time Use Survey		Types of Occupation	Average hourly wage rate
Household care			5,897
Food preparation	Meal preparation, dish-washing	Cooks and foods services workers	5,510
	Snack preparation/preserving	Food processing and related trades workers	5,174
Clothes care	Laundry, folding and storing clothes, Ironing/sewing/care of clothes, clothes repair/laundry services	Domestic and related helpers, cleaners and launderers	4,065
	Handicraft	Textile, garment and related trades workers	5,155

Table 2 (cont). Classifications of Unpaid Household Work Responded Types of Occupation and Average Hourly Wage Rates in 2004

(Unit: Korean won)

Activities of Time Use Survey		Types of Occupation	Average hourly wage rate
Household care			5,897
Cleaning and arrangement	Arrangement	Domestic and related helpers, cleaners and launderers	4,065
	Cleaning dwelling, other cleaning and arrangement	Building caretakers, watch persons and related workers	3,077
House upkeep	Repairing services, other house upkeep activities	Building caretakers, watch persons and related workers	3,077
	Vehicle maintenance and services	Transport machinery mechanics	7,336
Purchasing goods for household care	Daily necessities/groceries, semi-durable goods, purchasing via media	Domestic and related helpers, cleaners and launderers	4,065
	Capital goods	Stock, production and transport related clerks	8,220
Household management	Book-keeping	Numerical clerks	8,542
	Planning and budgeting	Business and finance associate professionals	12.529
	Administrative service	Cashiers, tellers and related clerks	7,681
Other household care activities		Domestic and related helpers, cleaners and launderers	4,065
Family care			6,547
Care for infant		Teaching associate professionals	6,793
Care for school-age child		Teaching associate professionals	6,793
Care for spouse, parents, other family care		Health and medical associate professionals	6,055

Source : Statistics Korea (2005), Ministry of Korea Labor (2005)

Table 2 (cont). Classifications of Unpaid Household Work Responded Types of Occupation and Average Hourly Wage Rates in 2004

(Unit: Korean won)

Activities of Time Use Survey		Types of Occupation	Average hourly wage rate
Participation and Volunteering			5,982
Helping neighbors, participation		Personal services related workers	5,688
Volunteering activities	For national or local events	Personal services related workers	5,688
	For school education of household children	Teaching associate professionals	6,793
	For non-household children, the aged, the disabled	Health and medical associate professionals	6,055
	Natural disaster relief activities, other voluntary services	Personal services related workers	5,688
Travel (by purpose)	Household care	average on household care	5,897
	Family care	average on family care	6,547
	Voluntary services	average on voluntary services	5,982

Source : Statistics Korea (2005), Ministry of Korea Labor (2005)

Table 3. NTTA, aggregate values by age groups

(Unit :Korean billion won)

2004	Total	0~19	20~64	65+
Lifecycle deficit	**0**	**60,314**	**-58,856**	**-1,458**
Consumption	173,350	64,980	91,355	17,015
Household care	118,918	26,006	77,814	15,098
Family care	48,254	37,353	9,519	1,382
Participation and volunteering	6,178	1,621	4,021	536
Labor Income(less)	173,350	4,665	150,211	18,473
Household care	118,918	3,012	100,392	15,514
Family care	48,254	1,192	44,761	2,301
Participation and volunteering	6,178	461	5,057	659
Age reallocation	**0**	**60,314**	**-58,856**	**-1,458**
Interhousehold transfer	0	5,631	-5,141	-490
Inflows	15,880	6,336	8,377	1,167
Outflows(less)	15,880	705	13,518	1,657
Intrahousehold transfer	0	54,684	-53,715	-969
Inflows	59,620	54,684	4,504	432
Outflows(less)	59,620	0	58,219	1,401

Note : Some figures of individual categories may not be equal to the total because of individual rounding off.

Source **:** Author's own calculation

Immigrant Heterogeneity and Mental Health among Asian and Latino Immigrants

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Introduction

Within the health literature, especially that of mental health, an extensive body of research has underscored the diversity among immigrants (Guarnaccia, et al., 2007; Takeuchi, Alegria, Jackson, & Williams, 2007); however, immigrant heterogeneity in multiple dimensions of the social and cultural experiences of immigration has rarely been tested directly in the empirical health research. Despite increasing theoretical speculations of the multifaceted experiences of immigrants (Portes & Rumbaut, 2006; Waters & Ueda, 2007), researchers have not extensively investigated the multiple dimensions that capture diverse immigration experiences nor how to characterize immigrant heterogeneity. This is a critical research gap that needs to be addressed by identifying and exploring heterogeneity among immigrants. Research studies, using multiple dimensions of immigration, that identify diverse groups among immigrants are needed to better understand immigrants' adaptation and adjustment processes. Identifying such diverse immigrant groups and exploring the possible group associations with mental health outcomes may shed light on factors involved in diverse immigrant experiences and how they influence immigrants' well-being.

The goal of this study is to explore the nature of immigrant heterogeneity and to ascertain the possibility of examining mental health associations with immigrant heterogeneity. It will contribute to the mental health literature by providing a more comprehensive understanding of immigrants' emotional well-being, taking into account multiple dimensions of immigrants' experiences. Using data

from the National Latino and Asian American Study (NLAAS), I first sought to investigate immigrant heterogeneity by identifying immigrant subgroups through conducting a Latent Class Analysis (LCA) based on the frequently examined dimensions of immigration. It is important to understand key indicators of difficulties and stressors immigrants may face as they adapt to a new society, which may influence various mental health outcomes. Second, I sought to explore which facets of immigration account for the observed heterogeneity of immigrants and which are unique and robust for Asian and Latino immigrants. Third, I sought to examine whether immigrant heterogeneity is associated with mental health outcomes.

This current research will contribute to the mental health field by improving methods for early identification of immigrants who are at risk for different mental health outcomes and by helping to disentangle the mechanisms through which diverse immigration experiences influence the emotional well-being or mental illness of Asian and Latino immigrants in the U.S.

Background: immigration, critical demographic changes in the U.S.

One of the most significant demographic developments in the last few decades in the U.S. has been the substantial increase in the numbers of people who have left their home countries to live in the U.S. According to the 2007 American Community Survey (ACS), a yearly estimation of the U.S. population that complements the decennial Census, the number of immigrants (i.e., people who were not U.S. citizens at birth) was estimated to be 38.1 million in 2007. At this point, immigrants constituted 12.6% of the total U.S. population (U.S. Census Bureau, 2008). Since the Immigration and Nationality Act Amendments of 1965, large numbers of people from around the world have settled in the U.S., with the majority coming from South American and Latin American countries and over 24 Asian countries. In particular, of the current 38.1 million immigrants, 31% (11.7 million people) were born in Mexico, followed by China (1.9 million),

the Philippines (1.7 million), and India (1.5 million). Most of the top 10 birth countries of U.S. immigrants are in Latin America and Asia (U.S. Census Bureau, 2009), including the aforementioned countries, along with Vietnam, Korea, El Salvador, Cuba, and the Dominican Republic. Furthermore, immigrants constitute over 67% of the Asian Americans and almost 40% of Latinos in the U.S., the two fastest growing racial/ethnic groups in the U.S. (U.S. Census Bureau, 2007).

Researchers have highlighted the importance of clarifying social and cultural factors and elucidating the etiological role of social contexts in the mental health of immigrants (Alegria, et al., 2004; Escobar & Vega, 2000; Takeuchi, Alegria, et al., 2007; Takeuchi, Zane, et al., 2007). Furthermore, U.S. government agencies have also strongly supported research and the development of policy/practice guidelines to improve immigrants' and their descendents' mental health. For example, the Surgeon General report, *"Mental health: Culture, race, and ethnicity—A supplement to mental health"* discusses mental health needs and problems of racial/ethnic minorities in the U.S. (U.S. Department of Health and Human Services, 2001). Mental well-being of the population is critical for "the economic well-being of the nation" (Williams, et al., 2007). For example, the U.S. government spends more than $80 billion a year for depression treatment costs for the entire U.S. population (Rush, et al., 2004).

Theoretical linkages: immigration and mental health

Migration, moving to a foreign country, is not an easy life event and may cause diverse social stresses: leaving personal relationships, needing to adapt and adjust to a new culture and society, and sometimes learning a new language. Why do people continue to leave home for a new country? The existing literature contains several theoretical speculations on the mechanisms by which immigration takes place and includes reports on immigrants' experiences of the adaptation and adjustment process within a new

country (Alba & Nee, 2003; Bohon, 2001; Hunt, Schneider, & Comer, 2004; Portes & Rumbaut, 2006; Rumbaut, 1999; Salant & Lauderdale, 2003; Takeuchi, Hong, Gile, & Alegria, 2007; Waters & Ueda, 2007). Many researchers have explored various theoretical concepts related to immigration, such as acculturation (Chun, Organista, & Marin, 2003), assimilation (Alba & Nee, 2003), segmented assimilation (Portes & Zhou, 1993), or accumulative disadvantage (Rumbaut, 1999). Although extensive empirical studies have examined these theoretical constructs and their associations with immigrants' mental health, the findings have suggested inconsistent patterns across various measures of these constructs as correlates of mental health among various immigrant groups (Rudmin, 2009; Takeuchi, Alegria, et al., 2007; Takeuchi, Hong, et al., 2007).

"*Relative deprivation*," an established concept in Sociology, but new in the mental health field, may provide an overarching theoretical explanation of various mental health statuses of immigrants; even though, immigrants' experiences are diverse. Relative deprivation can be defined as "the conscious experience of a negative discrepancy between legitimate expectations and present actualities" (Schaefer, 2008, 69). This term can be used to explain the economic or social deprivation that people feel as relative rather than absolute. Cattell (2001) suggested that individuals see themselves "as deprived or privileged by comparing their own situation with that of other groups, *reference groups*" (p. 1502). I elaborate on how this deprivation explanation may work in influencing the mechanisms for immigrants' mental health.

Except for cases involving refugees and asylum seekers, unemployment and hardship in the country of origin may be the most common reason for migration; however, not only working-class labor immigrants come to the U.S. as professionals, skilled workers, and entrepreneurs emigrate as well (Bohon, 2001; Portes & Rumbaut, 2006; Waters & Ueda, 2007). Immigration scholars have asserted that immigrants might have experienced "the gap between life aspirations and expectations" and the lack of the resources and

opportunities to realize them in their countries of origin (Portes & Rumbaut, 1990). We should continue to ask why immigrants come to the U.S.? What would be a common force behind most immigration to the U.S.? Immigration can be the result of motivation and action, thereby seeking to fill this gap and looking for opportunity; it can be found among people with ambition, motivation, and human resources to aid them in the new country.

Researchers have asserted that *relative deprivation* is an essential element of most contemporary immigration (Cattell, 2001; Portes & Rumbaut, 1990). Thus, contemporary immigrants tend to have positive human capital and motivation (Cattell, 2001; Portes & Rumbaut, 1990). Although immigration may come with stressful day-to-day life and chronic strains, the social and psychological satisfaction of immigrants seeking to fill this gap may outweigh the stressors or hardships they confront. Perhaps this factor explains recent empirical findings of recent immigrants' better mental health compared to their U.S.-born counterparts and more established immigrants (Burnam, Hough, Karn, Escobar, & Telles, 1987; Escobar & Vega, 2000; Grant, et al., 2004; Takeuchi, Alegria, et al., 2007; Takeuchi, et al., 1998; Vega, et al., 1998; Williams, et al., 2007), the so called "immigrant paradox" (Burnam, et al., 1987; Escobar & Vega, 2000).

What accounts for the negative mental health outcomes of established immigrants remains unclear; whether this phenomena is true for all racial/ethnic groups or only for certain groups, and whether it is true for all mental health outcomes. Building upon a theory of relative deprivation, emotional well-being or mental health status may vary depending on how immigrants perceive their current situation relative to their main reference groups, either families or friends in the country of origin or people in the U.S.

Immigration per se is not necessarily perceived as a negative or positive experience; however, the actual adapting and adjusting process to the new country may be a major stressful life event unique to immigrants. For example, immigrants' adaptation experiences

may result in many changes to everyday life as their length of residence increases, producing multiple mental-health deteriorating chronic strains for which the immigrant has no prior preparation. When immigration generates strain (e.g., language barriers, financial difficulty, occupational struggles, discrimination, and downward social mobility), it may increase emotional problems leading to mental distress or mental disorders, or it may produce an onset of psychiatric symptoms, especially for established immigrants.

Differentiation of factors influencing immigrant populations can clarify the diversity of immigrant experiences. Some immigrants may experience a status loss or downward mobility; for example, men who had privileged social statuses in their countries of origin and experienced downward social mobility. Other immigrants may gain higher and more secure socioeconomic status compared to what they had in their countries of origin. Consequently, stressors, reactions to stressors, and resources may differ by multiple dimensions of contexts where immigrants are situated. Research has not directly tested, however, if immigrant subgroups based on multiple dimensions of immigration experiences can be identified and whether the adaptation process and subsequent mental health statuses are different or similar for such subgroups.

Multifaceted dimensions may impact experiences of immigrants; divergence could be due to variation in social position, English difficulties, stress from the acculturation process, age of immigration, length of residence, ethnic identification, discrimination, and neighborhood contexts (Chun, et al., 2003; Escobar & Vega, 2000; Finch, Kolody, & Vega, 2000; Guarnaccia, et al., 2007; Leu, et al., 2008; Logan, Alba, & Zhang, 2002; Portes & Rumbaut, 2006; Rudmin, 2009; Salant & Lauderdale, 2003; Takeuchi, Alegria, et al., 2007; Takeuchi, Hong, et al., 2007; Takeuchi, Zane, et al., 2007; Uba, 1994; Waters & Ueda, 2007). Although those living in the U.S. who were born in foreign countries are usually grouped together as immigrants, their experiences as individuals and members of families can be very diverse. For example, English fluency may be easily acquired for

immigrants who came to the U.S. as young children compared to those who emigrated as adults (Rumbaut, 1994). Those who do not speak English or lack fluency may stay in ethnic enclaves for better employment opportunities or access to social and cultural institutions that use their native languages (Logan, et al., 2002; Portes & Rumbaut, 2006). Immigrants who came to the U.S. from high socioeconomic status groups (e.g., professionals) may go through different adaptation paths than those who came from low socioeconomic backgrounds (Portes & Rumbaut, 2006).

Recently, two nationally representative studies, the National Survey of American Lives (NSAL) and the NLAAS, presented their findings on how different immigration-related psychosocial factors are associated with psychiatric disorders across Black, Asian, and Latino populations (Alegria, et al., 2007; Takeuchi, Zane, et al., 2007; Williams, et al., 2007). These studies show that measures of immigration are associated with mental health, but results are inconsistent across the different measures. For example, difficulty with English was associated with mental disorders for Asian immigrant men, whereas English difficulties and generational status were independently associated with mental disorders for Latinos. Most studies, however, have not included multiple dimensions of immigrant experiences.

Multiple dimensions of immigrant experiences and mental health

English language difficulties have been regarded as one of the most important immigration-related factors that contributes to poor mental health (Blank & Torrechila, 1998). Empirical findings of its association with mental health, however, have been inconclusive. Researchers have identified having difficulty with English as a key risk factor for depression (Yen & Kaplan, 1999) and anxiety (Boardman, Finch, Ellison, Williams, & Jackson, 2001). One study examining mental health among Filipinos, however, found no associations with English difficulties (Gong, Gage, & Tacara, 2003).

Age at immigration has been shown to be associated with mental health status, but empirical evidence of this has been inconsistent. One line of research indicates that risk for poor mental health increases when the age of immigration decreases. For example, Asian immigrants who arrive early in life are more likely to have both lifetime and 12-month disorders (Takeuchi, Hong, et al., 2007). When the age of immigration increases, the risk of mental health problems, measured as numbers of depression and anxiety symptoms, decreases among Asian immigrants (Leu, et al., 2008). The other line of research suggests that risk of poor mental health increases when the age of immigration increases. For example, Chinese immigrants who came to the U.S. after 20 years of age are about 1.5 to 3.0 times more likely to have major depression compared to those who came to the U.S. before 20 years of age (Takeuchi, et al., 1998).

Length of residence also has been one popular construct used to evaluate mental health related immigration factors. Researchers have suggested that recent Asian and Latino immigrants are more likely to experience better mental health than more established immigrants (Takeuchi et al., 1998; Vega et al., 1998). The longer immigrants reside in the U.S. the greater their risk for psychiatric disorders (Williams, et al., 2007). Whether these negative outcomes can be attributed to the stressful life experiences of immigrants, exposure to minority status, and/or the experience of discrimination is unclear and needs further investigation.

Discrimination and *neighborhood contexts*—racial density and neighborhood poverty—are important dimensions for better understanding of various immigrants' experiences, which may directly or indirectly influence their mental health status. Several studies have indicated that the experience of discrimination is associated with adverse mental health outcomes (Bhui, et al., 2005; Finch, Kolody, et al., 2000; Rumbaut, 1994; Williams & Williams-Morris, 2000). Recently, researchers have argued that discrimination should be taken into account when examining the mental health of racial/ethnic minority groups (Rudmin, 2009; Williams & Jackson, 2005; Williams,

Yu, Jackson, & Anderson, 1997). For example, many researchers have emphasized that discrimination is strongly associated with psychological stress, and that it needs to be included as an independent measure in acculturation studies (Krieger, Smith, Naishadham, Hartman, & Barbeau, 2005; Paradies, 2006; Phinney, Madden, & Santos, 1998). Some researchers asserted that the boundaries of immigrants' neighborhoods seem to be settled by proportions of immigrants or by their income and education, rather than by race, especially within metropolitan regions (Logan, 2007). Other evidence suggests that neighborhood contexts are associated with mental health outcomes, such as racial density (Boydell, et al., 2001; Finch, Boardman, Kolody, & Vega, 2000; Halpern & Nazroo, 2000; Ostir, Eschbach, Markides, & Goodwin, 2003) and neighborhood poverty (Boardman, et al., 2001; Yen & Kaplan, 1999). It is imperative to take into account discrimination and neighborhood contexts when examining immigration and mental health associations.

In this current study, I will address the following questions: (a) Can immigrants from a particular racial/ethnic group be classified into subgroups based on immigration-related psychosocial factors? (b) Do these classified subgroups show similar or different characteristics related to demographics (i.e., age and gender); socioeconomic contexts (i.e., education and household income); developmental contexts (i.e., age at immigration and length of residence); discrimination (everyday and perceived discrimination); and neighborhood contexts (i.e., neighborhood racial density and poverty)? (c) Are these classified subgroups associated with mental health outcomes, after taking into account other characteristics that are not incorporated into the subgroups (i.e., demographics, discrimination, and neighborhood contexts)?

Methods

This study involves secondary analysis of data from the NLAAS, the first study on the mental health conducted for a nationally

representative sample of Latinos and Asian Americans. A detailed description of the NLAAS protocol and sampling methods is documented elsewhere (Alegría et al., 2004a; Pennell et al., 2004, Heeringa et al., 2004).

Sample

Subjects of the NLAAS were non-institutionalized persons of Asian and Latino ancestry who were 18 years of age or older and resided in any of the 50 states or Washington DC. A total of 2095 Asian American and 2554 Latino participants were recruited between May 2002 and November 2003. NLAAS respondents self-reported their membership in the Asian or Latino group. Asian Americans respondents were further categorized as Chinese (n=600), Filipino (n=508), Vietnamese (n=520), and Other Asian (n=467). The "Other Asian" category includes individuals who identified as Japanese (n=107), Korean (n=81), Asian Indian (n=141), and a number of other Asian ethnic/national designations (n=138). Mexican (n=868), Puerto Rican (n=495), Cuban (n=577), and "Other" (n=614) were the four ethnic subgroups of the NLAAS Latino sample. Individuals from the "Other Latino" category reported more distinct groups as their main ethnic origins than did individuals from the "Other Asian" category: 50 groups in other Latino category vs. 35 groups in other Asian category. Most ethnic subgroups listed in the "Other Latino" category had small sample sizes, mostly fewer than three respondents. Ethnic subgroups with relatively large sample sizes were Spaniard (n=70), Dominican (n=64), Colombian (n=22), and Salvadorian (n=18). The final weighted response rate for the Asian American sample was 65.6%, and the rate for the Latino sample was 75.5%. This study only included data from foreign-born Asian American participants (N=1466) and Latino participants (N=1494) as immigrants. The NLAAS received human subjects approvals from the Human Subjects Review Committees, institutional review boards (IRBs), at the University of Washington, Cambridge Health Alliance, Harvard University, and the University of Michigan. Of the total

NLAAS sample, 175 Asians and 136 Latinos were not included in the sub-sample for the current study, because they had at least one missing data item of the five items used for LCA (see details for the measures section). This results in a final analysis sample size of 1,466 Asians and 1,494 Latinos.

Measures

Mental health outcome measures. I used two mental health outcome measures: self-rated mental health and 12-month major depression. *Self-rated mental health* was measured using the question, "How would you rate your overall mental health?" The response categories are (1) poor, (2) fair, (3) good, (4) very good, or (5) excellent. Higher ratings indicated better perceived overall mental health. I dichotomized this measure and compared respondents describing their mental health as fair/poor (recoded as 1) with those describing their mental health as good/very good/excellent (recoded as 0). To assess *12-month major depression* (the occurrence of major depression within 12 months of the interview), the World Health Organization Composite International Diagnostic Interview (WMH-CIDI) (Kessler & Ustun, 2004) was used as a diagnostic instrument, with criteria from the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). The presence of 12-month major depression was dichotomized as yes (coded as 1) or no (coded as 0).

Immigration-related psychosocial measures. I used 15 items in my preliminary analyses as immigration-related psychosocial measures available in the NLAAS (see the next section, data analyses, for the details). I primarily describe 5 items used in the main analyses in this section. *English difficulties (ED)* is assessed using the item "How well do you speak English?" The response categories are (1) poor, (2) fair, (3) good, and (4) excellent. I separated responses into two categories, fair/poor (coded as 1) or excellent/good (coded as 0). I used three items from acculturative stress (AS):

"*Difficulties interacting with others because of ED*: Do you find it hard interacting with others because of difficulties you have with the English language?"
"*Unfair treatment because of poor ED/accent*: Do people treat you badly because they think you do not speak English well or speak with an accent?" and
"*Job difficulties because of Asian/Latino descent*: Do you find it difficult to find the work you want because you are of Asian/Latino descent?"

These items were drawn from the Hispanic Stress Inventory (Cervantes, Padilla, & Salgado de Snyder, 1990, 1991), originally designed to measure the psychological stress experiences of Latinos. Because these questions referred to the immigration experience, they were only asked of immigrants. The response categories are yes (coded 1) or no (coded 0). *Ethnic identification* is measured using the item "How closely do you identify with other people who are of the same racial and ethnic descent as you?" The response categories are (1) very closely, (2) somewhat closely, (3) not very closely, and (4) not at all. Responses were dichotomized as very closely (coded as 1) or somewhat closely/not very closely/not at all (coded as 0).

Socioeconomic contexts. I used two measures for this domain: education and household income. *Education* is measured using the highest grade of school or college completed and is split into four categories: 0-11 years, 12 years, 13-15 years, and 16 years or more. *Household income* consists of four categories: $0-14,999, $15,000-34,999, $35,000-74,999, and ≥$75,000.

Developmental contexts. I used age of immigration and length of residence in the U.S. for this domain. *Age of immigration* is based on the question "How old were you when you first came to this country?" *Length of residence in the U.S.* is found by subtracting age of immigration from chronological age. Both measures are continuous variables.

Discrimination. I used two measures for this domain: perceived racial and ethnic discrimination, and perceived everyday

discrimination. The *perceived racial and ethnic discrimination* measure is based on three items: "How often do people dislike you because you are (self-described ethnic/racial group)?"; "How often do people treat you unfairly because you are…?"; "How often have you seen friends treated unfairly because they are…?" (Vega, Zimmerman, Gil, Warheit, & Apospori, 1993). The response categories are (1) never, (2) rarely, (3) sometimes, and (4) often. I used both a summed scale (ranges 3-12) and the averaged scale (ranges 1-4). The *perceived everyday discrimination* measure is based on nine items, such as "You are treated with less courtesy than other people," and "People act as if they think you are not smart" (Jackson & Williams, 1995; Williams, et al., 1997). The response categories are (1) never, (2) less than once a year, (3) a few times a year, (4) a few times a month, (5) at least once a week, and (6) almost everyday. I used a summed scale (ranges 9-54). Higher scores represent higher levels of perceived discrimination for both measures.

Neighborhood contexts. This domain consists of two measures: neighborhood racial density and neighborhood poverty. I used census tracts as proxies for the neighborhood. *Neighborhood racial density* is measured using the proportion of Asians in the population of the census tract for the analyses of the Asian sample (ranges 0-0.69) and the proportion of Latinos in the population of the census tract for the analyses of the Latino sample (ranges 0-0.97). Neighborhood *poverty* is measured using the proportion of the population of the census tract that lives below the poverty line (ranges 0-0.49 for Asians; 0-0.55 for Latinos). I divided both measures into quartiles for the analyses to increase the ease of interpreting results: low, medium low, medium high, and high. Quartiles have been used in other neighborhood and health studies (Datta, Subramanian, Colditz, Kawachi, Palmer, and Rosenberg, 2006).

Demographics. I used age and gender as demographic characteristics to control for their potential associations with self-rated mental health. Age consists of four categories: 18-29 years, 30-44 years, 45-59 years, and 60+ years.

Analysis plan

The latent class model

LCA is a method of identifying latent groups, especially in social science (Bartholomew, Steele, Moustaki, & Galbraith, 2002; Lazarsfeld, 1950; Lazarsfeld & Henry, 1968). Latent class models assume local independence in the sense that, conditional on an object belonging to a given class, the observable variables are independent. Assuming J latent classes with p binary variables observed, π_{ij} = Pr (x_i=1 | class j) is the notation for the probability that a randomly selected subject from class j will answer positively to item i, when i=1,…, p; j = 1, …, J. In other words, π_{ij} is the conditional probability of responding positively to item i, conditional on membership of class j. η_j is the notation for the prior class probabilities of belonging to class j, P (class j), when j = 1, …, J. Latent class analysis provides posterior probabilities that show the probability that a subject with a particular response pattern falls into a particular class. The notation of the posterior probability is Pr (object is in class j | x_1, …, x_p), when j = 1, …, J. Using the estimated posterior probabilities, subjects can be allocated to the identified class using their response patterns. The latent class model is useful in reducing the complicated nature of the data by illuminating the associations between the observed variables using membership of a small number of unobserved latent classes. Furthermore, it is useful to allocate subjects to identified classes based on the values of the observed variables (i.e., response patterns) of those subjects (Bartholomew, et al., 2002). This paper uses the likelihood ratio and chi-squared test statistics after grouping (i.e., grouping response patterns to have more than five observations per cell). The goodness-of-fit statistics after grouping are provided, because when the sample size is small, the χ^2-distribution is no

longer an appropriate distribution, and hence may give invalid estimated results.

Data analysis procedures

I used three types of analyses in this current study to address the three research questions elaborated above in the Introduction. First, I applied LCA to examine the extent to which this method identifies immigrant subgroups distinguished by different immigration-related psychosocial factors. I compared estimated conditional response probabilities and prior class probabilities from the fitted models for both Asians and Latinos to examine if Asians and Latinos are similar or different in identified immigrant subgroups. Second, I conducted multiple t-tests and chi-square tests to identify the characteristics of those individuals belonging to different immigrant subgroups (i.e., Class 1 through Class 4). To identify factors that distinguish groups from one another, I focused on five domains: demographic domain (i.e., age and gender); socioeconomic contexts (i.e., education and household income); developmental contexts (i.e., age of immigration and length of residence); discrimination (i.e., perceived racial and ethnic discrimination and everyday discrimination); and neighborhood contexts (i.e., neighborhood poverty and racial density). Third, I applied a series of multivariate logistic regression models to identify any associations between immigrant subgroups and poor self-rated mental health/12-month depression and to determine if such associations are influenced by discrimination and neighborhood contexts. Socioeconomic contexts and developmental contexts were not included in multivariate logistic regression models because of a high confounding with immigrant subgroups.

LCA allows unobserved heterogeneity in the sample, assuming different individuals can belong to different subgroups. In LCA, subgroup membership is inferred from the data rather than observed. This approach is important for comprehensive examination of immigration because it allows subgroup identification, using multiple dimensions rather than just one, such as nativity. I used LAtent

Model Interface (LAMI) software (Gylfason, 2002) to fit a standard *j*-latent class model to binary data. For all other analyses, I used Survey Data Analysis (SUDAAN) software (Research Triangle Institute, 2008) to adjust for sample weights and sample design effects. I presented weighted percentages and means for demographics and social characteristics of immigrant subgroups, and odds ratios for estimated coefficients from multiple logistic regressions.

In applying LCA, I took multiple steps to identify the models that are parsimonious and conceptually make sense at the same time, with a good fit to the data. I started with 15 different items that are related to immigration from the following dimensions: language (6 items on speaking, reading, and writing in English and other languages); AS (3 items on the difficulties in interacting with others, unfair treatment, and finding jobs—I excluded other AS items, because they were only applicable for immigrants with particular experiences (e.g., undocumented immigrants or refugees: "Do you think you will be deported if you go to a social or government agency?"); discrimination (2 items: "How often do people dislike you because you are (ethnic/racial groups)?" and "How often do people treat you unfairly because you are (ethnic/racial groups)?"; ethnic identification (1 item "How closely do you identify with other people who are of the same racial and ethnic descent as yourself?"); age of immigration (1 item, came to the U.S. before or after the age of 18 years); length of residence (1 item, calculated by subtracting age of immigration from current age; 15 years cut-off point was used for dichotomizing this variable while fitting the models); and social upward mobility (1 item, using two subjective social status measures: social status in the U.S. minus social status in the country of origin and upward mobility vs. no change/downward mobility). These are comprehensive immigration-related psychosocial measures available in the NLAAS data. The following 5 items are the ones that provide the latent class models with a good-fit for the data. The procedure for selecting items was to try multiple runs from two- to six-class models with different combinations of items, taking off items that presented the poorest fit.

The selection of the variables to be used for LCA (e.g., removing unnecessary variables) to improve the accuracy of estimating parameters and carrying out the classification procedures is a topic of current research in Statistics (Dean & Raftery, 2008).

Results

My approach was exploratory, because I did not have an a priori hypothesis for the number and nature of latent classes. I started by fitting a two-class model and then proceeded to add further classes as necessary.

Fitting the model

Table 1 shows the likelihood ratio and chi-squared test statistics for latent class models for Asian and Latino immigrants. Latent class models with two-, three-, and four-classes were fitted to the five items. For both Asians and Latinos, two-class and three-class models do not give a satisfactory fit judging by the overall measures of goodness-of-fit, and they are rejected (G^2 =100.98, X^2 = 120.22 on 20 degrees of freedom; G^2 =95.27, X^2 = 112.77 on 14 degrees of freedom, respectively for Asian immigrants; G^2 =164.71, X^2 = 178.58 on 14 degrees of freedom, G^2 =123.08, X^2 = 154.63 on 8 degrees of freedom, respectively for Latino immigrants).

Because the fit for two- and three-class models was not good enough, I decided to fit a four-class model. A four-class model gives a satisfactory fit judging by the overall measures of goodness-of-fit for both Asian and Latino immigrants. For the Asian immigrant sample, the log-likelihood-ratio statistic is G^2 =7.30, and the chi-squared test statistic is X^2 = 7.55 on 8 degrees of freedom, indicating that the four-class model is a good fit to the data. For the Latino immigrant sample, the four-class model is a good fit to the data, showing the G^2 =0.66 and the X^2 = 3.98 on 2 degrees of freedom. In addition to goodness-of-fit measures, the chi-squared residuals for the two- and

three-way margins in the four-class model are all close to zero, showing the fit is very good.

(Table 1)

Latent class models for Asian immigrants

Table 2 shows the estimates of the model parameters for two-, three-, and four-class models for Asian immigrants. Although the fit is unsatisfactory with the two- and three-class models, they provide a meaningful picture of how latent classes are constituted. In a two-class model, Class 1 is composed of individuals who have a low probability of having ED ($\hat{\pi}_{i1}$=0.24) and very low probabilities (all close to zero) of AS on all three dimensions ($\hat{\pi}_{21}$=0.03, $\hat{\pi}_{31}$=0.08, $\hat{\pi}_{41}$=0.08). Compared to Class 1, individuals in Class 2 have much higher estimated probabilities of having ED and AS. The probability of ethnic identification for Classes 1 and 2 are similar. The latent class proportions, $\hat{\eta}_j$ in the last row of Table 2, show that about 61% of Asian immigrants belong to Class 1 and 39% to Class 2. The three-class solution is very similar to the two-class solution. One exception is an additional one class with very high probabilities on all items. The two- and three-class solutions show that Asian immigrant populations may be divided into two primary groups: one with low probabilities of ED and AS and the other with high probabilities of ED and AS.

Similar to the previously described solutions, the four-class solution shows a clear distinction with low and high probabilities of ED: Class 1 and Class 2 represent the groups with low probabilities of ED ($\hat{\pi}_{11}$ = 0.17 and $\hat{\pi}_{12}$=0.14), and Class 3 and Class 4 represent the groups with high probabilities ($\hat{\pi}_{13}$ = 0.84 and $\hat{\pi}_{14}$=1.00). Class 2 and Class 4, newly created in the four-class model, however, show nuanced patterns. Asian immigrants of Class 2 have low

probabilities of ED, similar to members of Class 1, but they have higher probabilities on three AS items ($\hat{\pi}_{22}$ = 0.23 vs. $\hat{\pi}_{21}$=0.04 on interaction difficulties, $\hat{\pi}_{32}$ = 0.53 vs. $\hat{\pi}_{31}$=0.0 on unfair treatment, $\hat{\pi}_{42}$ = 0.39 vs. $\hat{\pi}_{41}$=0.03 on job difficulties). Class 2 represents Asian immigrants who speak English fluently but experience AS: medium-low interaction difficulties, medium unfair treatment, and medium job difficulties. Asian immigrants of Class 4 have high probabilities of ED, similar to members of Class 3, but they have lower probabilities of the three AS items ($\hat{\pi}_{24}$ = 0.51 vs. $\hat{\pi}_{23}$=0.87 on interaction difficulties, $\hat{\pi}_{34}$ = 0.01 vs. $\hat{\pi}_{33}$=0.72 on unfair treatment, $\hat{\pi}_{44}$ = 0.06 vs. $\hat{\pi}_{43}$=0.66 on job difficulties, respectively). Class 4 represents Asian immigrants who do not speak English fluently but do not experience much AS: medium interaction difficulties, very low unfair treatment, and low job difficulties. It is estimated that the majority (47%) of Asian immigrants fall into Class 1, followed by Class 3 (26%), and Class 2 and Class 4, consisting of 15% and 12% of the population, respectively.

(Table 2)

Latent class models for Latino immigrants

Table 3 shows the parameter estimates of the two-, three-, and four-class models for Latino immigrants. The two- and three-class solutions for Latino immigrants show that Latino immigrant populations may be divided primarily into two groups: one with medium probability of ED and low probabilities of AS; the other one with high probability of ED and medium to high probabilities of AS. In the two-class solution, 52% of Latino immigrants belong to the first class with low to medium probabilities, while 48% belong to the second class with high probabilities of ED and AS.

The four-class model, however, identifies latent classes showing medium vs. high probabilities of ED: Class 1 and Class 2 represent the groups with medium probabilities of ED ($\hat{\pi}_{11}$ = 0.42 and $\hat{\pi}_{12}$ =0.46), and Class 3 and Class 4 represent the groups with high probabilities ($\hat{\pi}_{13}$ = 0.95 and $\hat{\pi}_{14}$ =1.00). Similar to the four-class solution for Asian immigrants, the four-class model of Latino immigrants creates Class 2 and Class 4, which are distinguished from the two main groups (i.e., low to medium vs. high probabilities). Latino immigrants in Class 2 have medium probabilities of ED, similar to those in Class 1, but they have higher probabilities of two AS items compared to Class 1 ($\hat{\pi}_{32}$ = 0.39 vs. $\hat{\pi}_{31}$ =0.02 on unfair treatment, $\hat{\pi}_{42}$ = 0.41 vs. $\hat{\pi}_{41}$ =0.04 on job difficulties, respectively). Class 2 represents Latino immigrants who have medium probabilities of ED and experience some AS: medium unfair treatment and medium job difficulties. Latino immigrants in Class 4 have high probabilities of ED, similar to members of Class 3, but they have lower probabilities for two AS items ($\hat{\pi}_{34}$ = 0.00 vs. $\hat{\pi}_{33}$ =0.96 on unfair treatment, $\hat{\pi}_{44}$ = 0.28 vs. $\hat{\pi}_{43}$ =0.75 on job difficulties, respectively). Class 4 represents Latino immigrants who do not speak English fluently but do not experience much AS: very low unfair treatment and low job difficulties. The estimated latent class proportions ($\hat{\eta}_j$) show that the majority of Latino immigrants belong to Class 1 (45%) and Class 4 (30%), followed by Class 3 and Class 2 (19% and 6% respectively).

(Table 3)

Four identified Asian and Latino immigrant classes: comparison of two -class models

Table 4 shows four-class models for both Asian and Latino immigrants, illustrating similarities and differences among the identified subgroups. Asian and Latino immigrants show similar patterns in identified subgroups from the four latent-class model:

Class 1 with overall low probabilities of ED and AS; Class 2 with a low probability of ED but higher probabilities of AS; Class 3 with overall high probabilities of ED and AS; and Class 4 with a high probability of ED but lower probabilities of AS. In more detail, Asian and Latino immigrants who belong to Class 1 and Class 2 have lower probabilities of ED than do those who belong to Class 3 and Class 4 (ranges 0.14-0.17 vs. 0.84-1.00 for Asians, ranges 0.42-0.46 vs. 0.95-1.00 for Latinos, respectively). Second, both Asian and Latino immigrants in Class 3 have the highest probabilities of AS (ranges, 0.66-0.87 for Asians and 0.75-0.96 for Latinos), followed by those in Class 2 and Class 4, whereas those in Class 1 show the lowest probabilities of AS (ranges, 0.00-0.04 for Asians and 0.02-0.04 for Latinos). Third, the probabilities of ethnic identification are highest in Class 4 for both Asian and Latino immigrants ($\hat{\pi}_{44}$=0.73 and 0.72, respectively). Fourth, most Asian and Latino immigrants belong to Class 1 ($\hat{\eta}_1$=0.47 and 0.45, respectively).

Asian immigrants and Latino immigrants show differences in their four-class models. First, they are distributed differently across the four classes: Asian immigrants show a larger latent-class proportion for Class 2 than Latino immigrants do ($\hat{\eta}_2$=0.15 vs. 0.06); Latino immigrants show a larger latent-class proportion than Asian immigrants do for Class 4 ($\hat{\eta}_4$=0.30 vs. 0.12). Second, Asian immigrants in Class 1 and Class 2 have low probabilities of ED ($\hat{\pi}_{11}$ =0.17 and $\hat{\pi}_{12}$=0.14), whereas Latino immigrants in Class 1 and Class 2 have medium probabilities of ED ($\hat{\pi}_{11}$=0.42 and $\hat{\pi}_{12}$=0.46). Third, Latino immigrants in Class 3 present higher probabilities of AS than do Asian immigrants in Class 3 (ranges, 0.75-0.96 vs. 0.66-0.87, respectively).

(Table 4)

Figures 1 and 2 present the pattern of the estimated conditional probabilities for each class. I provided class names for each,

building on the examined patterns: For Asians, (1) Low ED/Low AS, (2) Low ED/Mid AS, (3) High ED/High AS, and (4) High ED/Low AS; For Latinos, (1) Mid ED/Low AS, (2) Mid ED/Mid AS, (3) High ED/High AS, and (4) High ED/Low AS.

(Figures 1 and 2)

Descriptive statistics of assigned four immigrant subgroups

For further analyses, I assigned individuals to the immigrant subgroup (i.e. identified latent classes) with the highest posterior probability. Tables 4 and 5 show descriptive statistics of four subgroups for Asian and Latino immigrants that are identified by the four latent class models. I conducted separate chi-square tests and t-tests with six pairs of classes (e.g., Low ED/Low AS and Low ED/Mid AS) to determine if the identified immigrant subgroups differed from each other in terms of the following five domains: (1) demographics (i.e., age and gender), (2) socioeconomic contexts (i.e., education and household income), (3) developmental contexts (i.e., age at immigration and length of residence), (4) discrimination (i.e., everyday discrimination and perceived racial and ethnic discrimination), and (5) neighborhood contexts (i.e., neighborhood racial density and poverty).

As shown in Tables 4 and 5, both Asian and Latino immigrants show some significant subgroup differences across the five contexts. In *demographics*, Asian immigrant subgroups differ significantly by age. Specifically, Asian immigrants who belong to the High ED/Low AS class are significantly older than members of the other three classes (mean age 46.8, compared to a range of 40.0-43.6 for other groups). Immigrant subgroups for Latinos do not differ in age. No gender differences exist for either Asian or Latino immigrant subgroups. In the socioeconomic contexts, immigrant subgroups are significantly different from each other. The Low ED/Mid AS class of Asians and the Mid ED/Mid AS class of Latinos were the groups with the highest education and household income, whereas the High

ED/Low AS class was the group with the lowest education and income.

(Tables 4 and 5)

Developmental contexts—age at immigration and length of residence—show significant associations across immigrant subgroups. Asian immigrants who belong to the Low ED/Low AS class show unique patterns: they came to the U.S. when they were younger (mean age of 22.7) and had resided in the U.S. longer (mean years of 17.9) than the other groups. Asians who belong to the High ED/Low AS class came to the U.S. when they were older (mean age of 34.3) and had resided in the U.S. for the shortest time period (mean years of 12.5) compared to the other groups. Latino immigrants who report Mid ED came to the U.S. when they were younger (average during childhood) than those who report High ED (average during young adulthood). As for the length of residence, Latinos who report Mid ED had resided in the U.S. longer (21-22 years on average) than had those who report High ED (13-14 years on average).

In *discrimination* for Asian immigrants, the High ED/High AS class reports the highest everyday discrimination and perceived racial and ethnic discrimination, whereas the High ED/Low AS class reports the lowest scores for the discrimination measures. Among Latino immigrants, the Mid ED/Mid AS class was the group with the high discrimination scores, followed by the High ED/High AS class. Similar to Asian immigrants, the High ED/Low AS group had the lowest discrimination scores.

Neighborhood contexts—racial density and neighborhood poverty—do not show significant associations with immigrant subgroups, unlike the socioeconomic contexts, developmental contexts, and discrimination. There are, however, some unique differences in neighborhood contexts among some groups: Asian immigrants in the High ED/Low AS class live in neighborhoods with higher proportions of Asians than do those in the Low ED/Low AS class (27.8% versus. 23.0%), whereas Latino immigrant subgroups

are not different in the levels of Latino density of their neighborhoods. As for neighborhood poverty, Asian immigrants who report High ED live in poorer neighborhoods than do those who report Low ED. While about one-third of the Latino Mid ED/Mid AS class live in poorer neighborhoods, over 60% of the Latino High ED/Low AS class live in poorer neighborhoods (medium-high and high quartiles).

Mental health outcomes show significant associations with identified immigration subgroups. The rates of poor self-rated mental health were the highest in the High ED/Low AS class for both Asian and Latino immigrants, followed by the High ED/High AS class (18.5% and 13.7% for Asians, and 18.7% and 15.7% for Latinos, respectively). As for 12-month depression, the Asian High ED/High AS class and the Latino Mid ED/Mid AS were the groups at most risk (8.0% and 16.8%, respectively).

(Tables 5 and 6)

Testing immigrant subgroups as potential predictors for mental health

Tables 7 and 8 present the results of multiple logistic regression analyses that examined the associations between immigrant subgroups and mental health outcomes (i.e., poor self-rated mental health and 12-month depression), controlling for age, gender, discrimination, and neighborhood contexts. As shown in Table 7, Asian immigrants who belong to the High ED/High AS class are more than 2.5 times likely to experience 12-month depression than are those who belong to the Low ED/Low AS class (OR=2.75, $p<.05$), after controlling for demographics, discrimination, and neighborhood contexts. Although Asian immigrant subgroups show significant associations with poor self-rated mental health (i.e., higher odds of reporting poor self-rated mental health among those who report Low ED when comparing them to the Low ED/Low AS class), the associations are no longer significant, after controlling for neighborhood contexts (see Model 4).

Type of Latino immigrant subgroups is associated with mental

health outcomes. Specifically, Latino immigrants who belong to the Mid ED/Mid AS class are significantly less likely to report poor self-rated mental health than are those who belong to the Mid ED/Low AS class, after controlling for age, gender, discrimination, and neighborhood contexts (OR=0.09, $p<0.01$). The High ED/Low AS class shows different patterns: Latino immigrants in this class are more than 1.5 times more likely to report poor self-rated mental health than are those who in the Mid ED/Low AS class, again after controlling for age, gender, discrimination, and neighborhood contexts (OR=1.79, $p<0.01$). Twelve-month depression is associated with the membership in Latino certain immigrant subgroups; compared to Latino immigrants in the Mid ED/Low AS class, those in the Mid ED/Mid AS class are about three times more likely to experience 12-month depression, after controlling for age and gender (OR=2.83, $p<.05$). This association, however, is no longer significant when discrimination, neighborhood density, and poverty are taken into account (Models 3 and 4).

(Tables 7 and 8)

Discussion

The main objectives of this study were to identify immigrant subgroups—as examples of immigrant heterogeneity—for Asians and Latinos, based on immigration-related psychosocial factors, and to test whether these classified immigrant subgroups can be used to examine the association between immigration and mental health outcomes. This study tested latent class models and found four latent classes each for Asians and Latinos. The data indicate plausible phenomena of immigrant heterogeneity by identifying four immigrant subgroups with similar patterns for both Asians and Latinos. Asian and Latino immigrants showed similar patterns in the identified subgroups, and type of immigrant subgroups was associated with socioeconomic status and developmental contexts. Finally, type of immigrant

subgroups for both Asians and Latinos was associated with mental health outcomes.

Specifically, findings from this study indicate that immigrants can be classified into subgroups based on immigration-related psychosocial factors. Four Asian and four Latino immigrant subgroups were classified based on ED, AS (i.e., interacting difficulties and unfair treatment because of ED, and difficulties in finding jobs), and ethnic identification: for Asians, Low ED/Low AS, Low ED/High AS, High ED/High AS, and High ED/Low AS; for Latinos, Mid ED/Mid AS, Mid ED/High AS, High ED/High AS, and High ED/Low AS. The data on the characteristics of classified immigrant subgroups are compelling, showing commonalities across Asians and Latinos: socioeconomic contexts and developmental contexts distinguish the four classified subgroups: Low and Mid ED/High AS groups are of the highest socioeconomic status, and High ED/Low AS groups are of the lowest socioeconomic status. A unique pattern, especially for Asian immigrants, was found between immigrant subgroups and developmental context variables (i.e., age at immigration and length of residence). Immigrants who belong to High ED groups immigrated when they were younger and had resided in the U.S. longer compared to those who belong to Low or Mid ED groups. Finally, type of classified immigrant subgroup was associated with mental health outcomes, indicating further use of this type of immigrant subgroup classification to develop potential predictors for emotional well-being of immigrants.

Another compelling finding is that, except for slightly higher conditional probabilities of ED for Latinos (two Low ED groups of Asians versus two Mid ED groups of Latinos), the four Asian and four Latino subgroups show similar patterns. A taxonomy such as that shown in Table 9 can be proposed based on this finding. One may question the advantages of employing LCA, by observing that this taxonomy can be simply obtained creating a 2×2 cross-tabulation between two variables of ED and AS (i.e., a scale by summing or averaging three items used in LCA). The key advantage of using

LCA is to take into account multiple ways of interactions among variables in the model. Knowledge of different types of immigrant subgroups with similar patterns across Asians and Latinos could help target appropriate social and health services for better client health and well-being (regardless of race and country of origins).

(Table 9)

This study shows that type of classified immigrant subgroup may play a role for immigrants' mental health outcomes. For example, Asian immigrants who belong to the group with high AS along with ED were at increased risk for 12-month depression, after controlling for age, gender, discrimination, and neighborhood context, whereas Latino immigrants who belong to the group with low AS with ED were at risk of experiencing poor self-rated mental health. The analyses presented here, however, are unable to explain why the differences in the log odds of having poor mental health outcomes occurred between subgroups. Subsequent studies can directly examine the predictors that may help to distinguish differences in mental health outcomes within each subgroup by applying the same multiple logistic models to separate samples of each subgroup. Furthermore, knowledge of what accounts for distinctive immigrant subgroups and how they are associated with certain mental health outcomes can lead to providing immigrants with effective early mental health preventive interventions. For example, Asian immigrants who report having ED and perceiving AS may get the most benefit from depression prevention services.

Examining the factors differentiating characteristics between High ED and Low or Mid ED groups should be high on the future research agenda. ED seems a very strong indicator for identifying immigrants' subgroup membership. Although education levels and perceived discrimination were significant indicators for distinguishing two groups with the same ED level, some other factors, such as downward or upward social mobility and employment status, may provide better

understanding of different immigrant subgroups and their possible relations with mental health outcomes.

Asian immigrants and Latino immigrants presented somewhat different patterns in the associations between immigrant subgroup membership and mental health outcomes. As indicated earlier, the Asian High ED/High AS class was at risk for 12-month depression, whereas the Latino High ED/Low AS class was at risk for poor self-rated mental health, after controlling for demographics, discrimination, and neighborhood contexts. Examination of why these associations differ between Asians and Latinos was beyond the scope of this study, but needs further research. Investigating these unique patterns and how they differ by race (or ethnicity) may provide insights to help identify modifiable foci for preventing mental health risks that may differ by race.

This study has several limitations. I was not able to control for education and household income when conducting multiple logistic regression models because of a high confounding with immigrant subgroups. The concept of relative deprivation was introduced as a possible mechanism that may explain the diverse immigrants' experiences; however, because of the unavailability of measures, this construct was not examined in the empirical investigation of this study. Relative deprivation may play a key role in distinguishing whether or not immigrants perceive AS, even when they indicate similar levels of ED. Measuring and directly testing the construct in empirical research may shed light on associations between immigration and mental health. This study conducted individual-level analysis, not taking into account clustering effects of living in neighborhoods with similar characteristics—similar levels of racial density and poverty at census-tract levels. Employing multilevel analysis may provide a better snapshot of how neighborhood contexts influence immigrant subgroups and mental health associations.

This study contributes to the immigration literature by providing a classification scheme for the heterogeneity of immigrants. Findings from these analyses—examining the estimates from the latent class

models and testing descriptive statistics of classified groups—highlight multiple dimensions of immigration and how they might influence the mental health of immigrants. Additionally, this study contributes to mental health prevention efforts for immigrants. Empirical evidence from this study—classified immigrant subgroups and posterior probability of response patterns—can be used as a tool to assess possible risks of immigrants for poor mental health outcomes based on their response patterns. Individuals may furnish certain response patterns that show high posterior probability for the class with high log odds of having 12-month depression. Mental health practitioners may use the response patterns and type of subgroups to provide appropriate mental health prevention for their clients' mental well-being in responses to his or her mental health risk profiles.

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Table 1. Goodness-of-fit measures for Latent Class Models

	Two-class	Three-class	Four-class
Asian immigrants			
Likelihood-Ratio	100.98	95.27	7.30
Chi-Squared	120.22	112.77	7.55
Degrees of freedom	20	14	8
Latino immigrants			
Likelihood-Ratio	164.71	123.08	0.66
Chi-Squared	178.58	154.63	3.98
Degrees of freedom	14	8	2

Table 2. Estimated conditional probabilities ($\hat{\pi}_{ij}$) and latent class proportions ($\hat{\eta}_j$) for the two-, three-, and four-class models, Asian immigrants (n=1466)

Item	Two-class		Three-class			Four-class			
	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i4}$
1. English difficulties	0.24	0.76	0.23	1.00	0.73	0.17	0.14	0.84	1.00
2. Interaction difficulties	0.04	0.82	0.03	1.00	0.79	0.04	0.23	0.87	0.51
3. Unfair treatment	0.07	0.57	0.07	1.00	0.53	0.00	0.53	0.72	0.01
4. Job difficulties	0.07	0.54	0.07	1.00	0.50	0.03	0.39	0.66	0.06
5. Ethnic identification	0.58	0.66	0.59	1.00	0.64	0.56	0.63	0.65	0.73
$\hat{\eta}_j$	0.61	0.39	0.59	0.02	0.38	0.47	0.15	0.26	0.12

Table 3. Estimated conditional probabilities ($\hat{\pi}_{ij}$) and latent class proportions ($\hat{\eta}_j$) for the two-, three-, and four-class models, Latino immigrants (n=1494)

Item	Two-class		Three-class			Four-class			
	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i4}$
1. English difficulties	0.45	0.97	0.43	1.00	0.96	0.42	0.46	0.95	1.00
2. Interaction difficulties	0.01	0.86	0.00	1.00	0.81	0.02	0.00	0.90	0.81
3. Unfair treatment	0.05	0.39	0.05	1.00	0.30	0.02	0.39	0.96	0.00
4. Job difficulties	0.08	0.48	0.07	1.00	0.40	0.04	0.41	0.75	0.28
5. Ethnic identification	0.66	0.70	0.66	1.00	0.66	0.68	0.47	0.68	0.72
$\hat{\eta}_j$	0.52	0.48	0.49	0.05	0.46	0.45	0.06	0.19	0.30

Table 4. Estimated conditional probabilities ($\hat{\pi}_{ij}$) and latent class proportions ($\hat{\eta}_j$) for four subgroups of Asian and Latino immigrants

Item	Asians				Latinos			
	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i4}$	$\hat{\pi}_{i1}$	$\hat{\pi}_{i2}$	$\hat{\pi}_{i3}$	$\hat{\pi}_{i4}$
1. English ifficulties (ED)	0.17	0.14	0.84	1.00	0.42	0.46	0.95	1.00
2. Difficulties interacting with others because of ED	0.04	0.23	0.87	0.51	0.02	0.00	0.90	0.81
3. Unfair treatment because of ED /accent	0.00	0.53	0.72	0.01	0.02	0.39	0.96	0.00
4. Job difficulties because of Asian/Latino descent	0.03	0.39	0.66	0.06	0.04	0.41	0.75	0.28
5. Ethnic identification	0.56	0.63	0.65	0.73	0.68	0.47	0.68	0.72
$\hat{\eta}_j$	0.47	0.15	0.26	0.12	0.45	0.06	0.19	0.30

Table 5. Descriptive statistics for Asian immigrants by four latent classes

(Means/%)

	Total (n=1466)	Low ED /Low AS (n=812) 57.1%	Low ED /Mid AS (n=158) 11.5%	High ED /High AS (n=377) 25.0%	High ED /Low AS (n=119) 6.4%	LL vs. LM	LL vs. HH	LL vs. HL	LM Vs .HH	LM vs. HL	HH vs. HL
Demographics											
Age (years)	41.7	40.6	40.0	43.6	46.8			***	*	***	
18-29	22.3 %	26.4 %	23.3 %	15.1 %	12.3 %			*		*	
30-44	38.7 %	37.6 %	38.9 %	41.9 %	35.3 %						
45-59	27.0 %	24.5 %	31.1 %	29.9 %	30.1 %						
60+	12.0 %	11.5 %	6.7 %	13.2 %	22.3 %						
Gender											
Male	47.4 %	46.5 %	53.8 %	49.1 %	37.8 %					*	
Female	52.6 %	53.5 %	46.2 %	50.9 %	62.2 %						
Socioeconomic contexts											
Education (years)	13.6	14.0	15.1	12.8	11.0	**	***	***	***	***	*
0-11	16.4 %	12.1 %	6.5 %	24.4 %	41.0 %		**	***	***	***	
12	15.9 %	14.8 %	9.1 %	19.7 %	22.9 %						
13-15	23.2 %	25.3 %	20.8 %	22.0 %	13.5 %						
16 or more	44.5 %	47.8 %	63.6 %	33.9 %	22.6 %						
Household Income	80.9K	86.2K	102.1K	67.3K	48.7K		**	**	*	***	
$ 0-14,999	17.2 %	14.0 %	13.3 %	23.4 %	27.4 %		**	***	**	***	
$ 15,000-34,999	13.2 %	11.2 %	5.9 %	17.8 %	26.6 %						
$ 35,000-74,999	29.1 %	30.0 %	26.9 %	29.0 %	25.0 %						
$ 75,000+	40.6 %	44.8 %	53.9 %	29.8 %	20.9 %						

* $p<.05$, ** $p<.01$, *** $p<.001$

Table 5 (cont)	Total (n=1466)	Low ED /Low AS (n=812) 57.1%	Low ED /Mid AS (n=158) 11.5%	High ED /High AS (n=377) 25.0%	High ED /Low AS (n=119) 6.4%	LL vs. LM	LL vs. HH	LL vs. HL	LM vs. HH	LM vs. HL	HH vs. HL
Developmental Contexts											
Age at immigration (years)	25.5	22.7	24.5	30.0	34.3		***	***	**	***	*
Length of residence (years)	16.2	17.9	15.5†	13.5	12.5		***	***		*	
Discrimination											
Everyday discrimination	15.99	15.99	15.40	16.78	13.56	***				**	**
Perceived discrimination	5.33	5.33	4.77	6.32	4.85	***	***			**	***
Never	34.3 %	44.3 %	11.4 %	19.2 %	44.9 %	***	***			***	***
Rarely	37.7 %	37.7 %	47.4 %	34.4 %	32.5 %						
Sometimes	25.9 %	25.9 %	35.8 %	43.2 %	21.2 %						
Often	2.2 %	2.2 %	5.4 %	3.3 %	1.4 %						

* $p<.05$, ** $p<.01$, *** $p<.001$

Table 5 (cont)	Total (n=1466)	Low ED /Low AS (n=812) 57.1%	Low ED /Mid AS (n=158) 11.5%	High ED /High AS (n=377) 25.0%	High ED /Low AS (n=119) 6.4%	LL vs. LM	LL vs. HH	LL vs. HL	LM vs. HH	LM vs. HL	HH vs. HL
Neighborhood contexts											
Asian density (means)	23.6 %	23.0 %	22.3 %	24.3 %	27.8 %			*			
Low	34.8 %	34.7 %	37.1 %	35.2 %	30.4 %						
Medium low	25.2 %	27.6 %	25.3 %	21.3 %	17.9 %						
Medium high	24.2 %	23.3 %	24.5 %	25.4 %	26.5 %						
High	15.8 %	14.3 %	13.2 %	18.2 %	25.1 %						
Neighborhood poverty (means)	12.5 %	12.1 %	10.2 %	14.1 %	13.2 %				**		
Low	23.8 %	26.8 %	30.6 %	16.5 %	12.4 %		*	*	*	*	
Medium low	21.6 %	20.1 %	25.5 %	21.4 %	29.3 %						
Medium high	26.3 %	24.7 %	24.8 %	29.7 %	29.9 %						
High	28.3 %	28.4 %	19.1 %	32.4 %	28.4 %						
Mental health outcomes											
Self-rated poor mental health	9.4 %	7.5 %	4.3 %	13.7 %	18.5 %		**	*	***	**	
12-month depression	4.0 %	2.7 %	2.6 %	8.0 %	3.0 %		*				

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$

Table 6. Descriptive statistics for Latino immigrants by four latent classes (Means/%)

	Total n=1494)	Mid ED /Low AS (n=739) 46.1%	Mid ED/ Mid AS (n=64) 4.2%	High ED /High AS (n=266) 20.0%	High ED /Low AS (n=425) 29.7%	ML vs. MM	ML vs. HH	ML vs. HL	MM vs. HH	MM vs. HL	HH vs. HL
Demographics											
Age (years)	38.2	38.6	35.8	36.7	38.7						
18-29	29.9%	28.6%	36.3%	30.0%	31.0%					***	
30-44	42.3%	42.6%	34.9%	49.0%	38.3%						
45-59	19.1%	20.1%	25.1%	13.3%	20.6%						
60+	8.7 %	8.7 %	3.8%	7.7%	10.1%						
Gender											
Male	53.8 %	58.7 %	51.1 %	52.3 %	47.6 %						
Female	46.2 %	41.3 %	48.9 %	47.7 %	52.4 %						
Socioeconomic contexts											
Education (years)	9.9	11.1	12.9	8.7	8.5	***	***	***	***	***	
0-11	54.0%	39.2%	29.7%	69.1%	70.3%		***	***	***	***	
12	20.6%	25.1%	22.6%	16.5%	16.0%						
13-15	16.4%	22.9%	22.3%	11.1%	9.1 %						
16 or more	9.0 %	12.8%	25.4%	3.4 %	4.6 %						
Household Income	40.7K	52.0K	51.1K	31.1K	28.2K		***	***	**	**	
$ 0-14,999	29.1%	23.3%	19.6%	33.8 %	36.3 %		***	***		*	
$ 15,000-34,999	31.8%	25.8 %	22.5%	36.4 %	39.4 %						
$ 35,000-74,999	26.1 %	30.8 %	35.1%	22.7 %	20.0 %						
$ 75,000+	12.9 %	20.2 %	22.7%	7.1 %	4.3 %						

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$

Table 6 (cont.)	Total (n=1494)	Mid ED Low AS (n=739) 46.1%	Mid ED/ Mid AS (n=64) 4.2%	High ED High AS (n=266) 20.0%	High ED Low AS (n=425) 29.7%	ML vs. MM	ML vs. HH	ML vs. HL	MM vs. HH	MM vs. HL	HH vs. HL
Developmental contexts											
Age at immigration (years)	20.2	16.6	14.2	23.5	24.5		***	***	***	***	
Length of residence (years)	17.9	21.9	21.6	13.2	14.2		***	***	***	***	
Discrimination											
Everyday discrimination	15.05	14.73	21.09	18.03	12.68	***	***		***	***	***
Perceived discrimination	5.53	5.06	7.02	7.22	4.91	***	***			***	***
Never	32.2%	36.6%	11.6%	11.0%	42.5%	**	***			**	***
Rarely	35.3%	40.3%	34.7%	25.3%	34.3%						
Sometimes	27.7%	21.1%	40.0%	50.4%	20.8%						
Often	4.9%	2.0%	13.7%	13.3%	2.5%						

* $p<.05$, ** $p<.01$, *** $p<.001$

Table 6 (cont.)	Total (n=1494)	Mid ED/ Low AS (n=739) 46.1%	Mid ED/ Mid AS (n=64) 4.2%	High ED/ High AS (n=266) 20.0%	High ED/ Low AS (n=425) 29.7%	ML vs. MM	ML vs. HH	ML vs. HL	MM vs. HH	MM vs. HL	HH vs. HL
Neighborhood contexts											
Latino density (means)	55.5%	54.9 %	46.3 %	55.0 %	58.3 %						
Low	22.0%	23.1 %	35.0 %	21.5 %	18.9 %						
Medium low	26.5%	25.7 %	22.1 %	29.1 %	26.5 %						
Medium high	24.9%	25.0%	26.9 %	26.3 %	23.6 %						
High	26.6%	26.2 %	16.0 %	23.1 %	31.1 %						
Neighborhood poverty (means)	23.0%	22.2 %	19.9 %	24.2 %	23.9 %			*			
Low	19.1%	22.6 %	32.4 %	12.6 %	15.9 %	**		*	***	**	*
Medium low	25.1%	26.1 %	34.6 %	27.1 %	20.9 %						
Medium high	29.3%	26.0 %	7.9%	30.0 %	37.1 %						
High	26.6%	25.4 %	25.1 %	30.3 %	26.1 %						
Mental health outcomes											
Self-rated poor mental health	13.8%	10.9 %	1.2%	15.9 %	18.7 %	***		***	**	***	
12-month depression	7.3%	6.3 %	16.8 %	10.0 %	5.5 %						

$^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$

Table 7. Odds ratios for Multivariate logistic regression models predicting poor self-rated mental health and 12-month depression by four latent classes for Asian Americans (N=1,466)

Variables	Self-rated mental health				12-month depression			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
LC (Mid ED/Low AS)								
Mid ED/High AS	0.55	0.56	0.48	0.50	0.95	0.99	0.67	0.60
High ED/High AS	1.96***	1.84**	1.60*	1.45	3.09**	3.66**	2.71*	2.75*
High ED/Low AS	2.81**	2.32*	2.28*	1.92	1.11	1.42	1.33	1.32
Demographics								
Age (18-29)								
30-44		1.49	1.49	1.54		0.55†	0.56	0.58
45-59		2.89*	2.99**	3.04**		0.15***	0.16***	0.15***
60+		3.75**	4.08**	4.09**		0.34	0.38	0.34
Gender (Male)								
Female		1.36	1.39	1.45		0.81	0.80	0.77
Perceived Racial/Ethnic Discrimination (Never)								
Rarely			1.14	1.26			5.04***	5.02**
Sometimes			1.72	1.78*			4.64**	4.62**
Often			1.78	1.64			9.83***	12.12***
Neighborhoods								
Latino density (Low)								
Medium low				0.72				1.17
Medium high				1.32				0.29*
High				1.78				0.47
Poverty (Low)								
Medium low				2.07				1.58
Medium high				1.65				1.32
High				2.50*				0.72

* p < .05, ** p < .01, *** p < .001

Table 8. Odds ratios for Multivariate logistic regression models predicting poor self-rated mental health and 12-month depression by four latent classes for Latinos (N=1,494)

Variables	Self-rated mental health				12-month depression			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
LC (Mid ED/Low AS)								
Mid ED/High AS	0.10**	0.10**	0.09**	0.09**	3.00*	2.83*	2.18	2.23
High ED/High AS	1.54	1.59	1.30	1.27	1.64	1.62	1.21	1.13
High ED/Low AS	1.89**	1.90**	1.86**	1.79**	0.87	0.79	0.78	0.76
Demographics								
Age (18-29)								
30-44		0.91	0.90	0.89		0.81	0.78	0.78
45-59		1.11	1.09	1.12		1.26	1.23	1.21
60+		1.80	1.79	1.80		1.10	1.08	1.11
Gender (Male)								
Female		0.84	0.86	0.84		2.26**	2.33**	2.26**
Perceived Racial/Ethnic Discrimination (Never)								
Rarely			0.64	0.65			0.88	0.87
Sometimes			1.32	1.33			1.39	1.40
Often			1.56	1.67			3.13*	3.22*
Neighborhoods								
Latino density (Low)								
Medium low				0.94				0.89
Medium high				1.19				1.21
High				1.04				0.84
Poverty (Low)								
Medium low				1.24				2.03
Medium high				1.64				1.94
High				1.17				2.24

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 9. Taxonomy based on conditional probabilities of English difficulties (ED) and acculturative stress (AS) of classified immigrants' subgroups

	Low AS	High AS
Low or Mid ED	Low or Mid ED/Low AS	Low or Mid ED/High AS
High ED	High ED/Low AS	High ED/High AS

Figure 1. Four latent classes for Asians

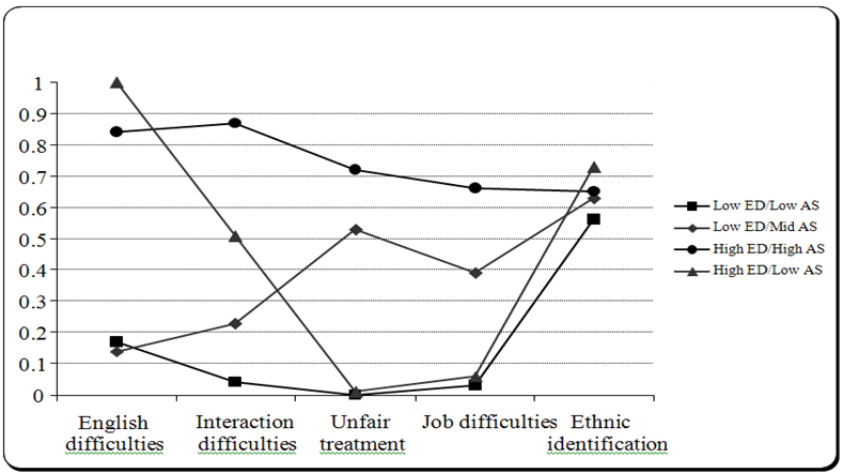
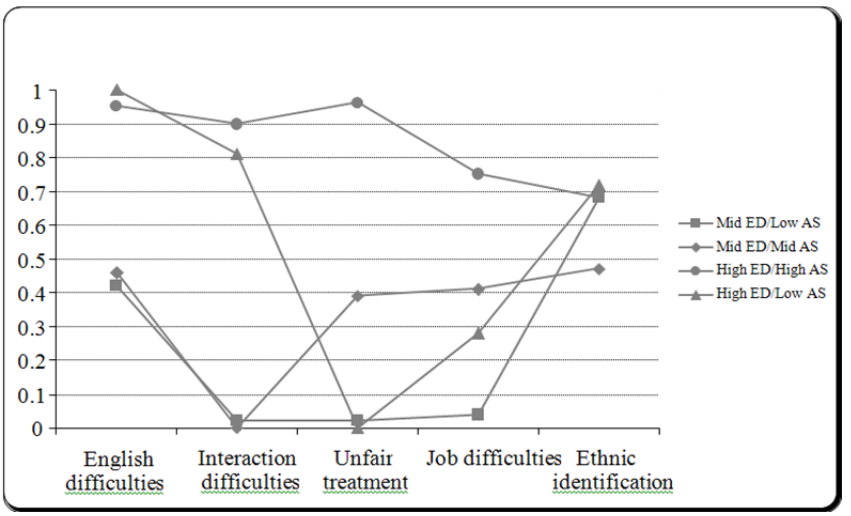


Figure 2. Four latent classes for Latinos



Changes in Disease Patterns and Health Expenditures in Korea

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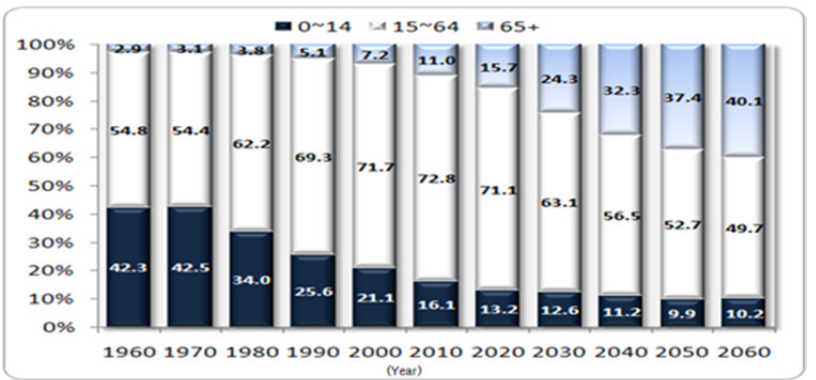
Structural Changes in Population

The recent rapid changes in the age structure are expected to bring significant changes to the wide aspects of politics, economy, society, culture, etc. In particular, population aging is expected to cause an explosive surge in the demand for the health services. According to the population statistics released by the National Statistical Office, those aged 15-64 as of 2010 are 35,980,000 persons, accounting for 72.8% of the entire population. Those aged 65 or over are 5,450,000 persons (11%), while children (aged 0-14) are 7,980,000 (16.2%). The population at working ages(15-64) is estimated to increase continuously up to 37,040,000 by 2016, but to decrease to 21,870,000 by 2060, 49.7% of the whole population.

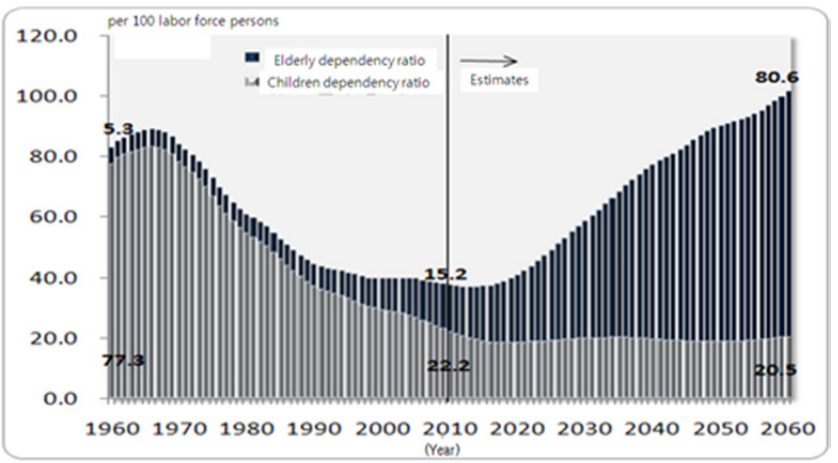
Figure 1. Proportions of the populations by Age groups



Source: National Statistical Office

As for the dependency ratios, the total dependency ratio is increasing after it decreased from 37.3% in 2010 to 36.8% in 2012, and is expected to increase further to 77.0% in 2040 and 101.0% in 2060, which means the number of dependents will exceed the population at working ages.

Figure 2. Dependency Ratios in Korea

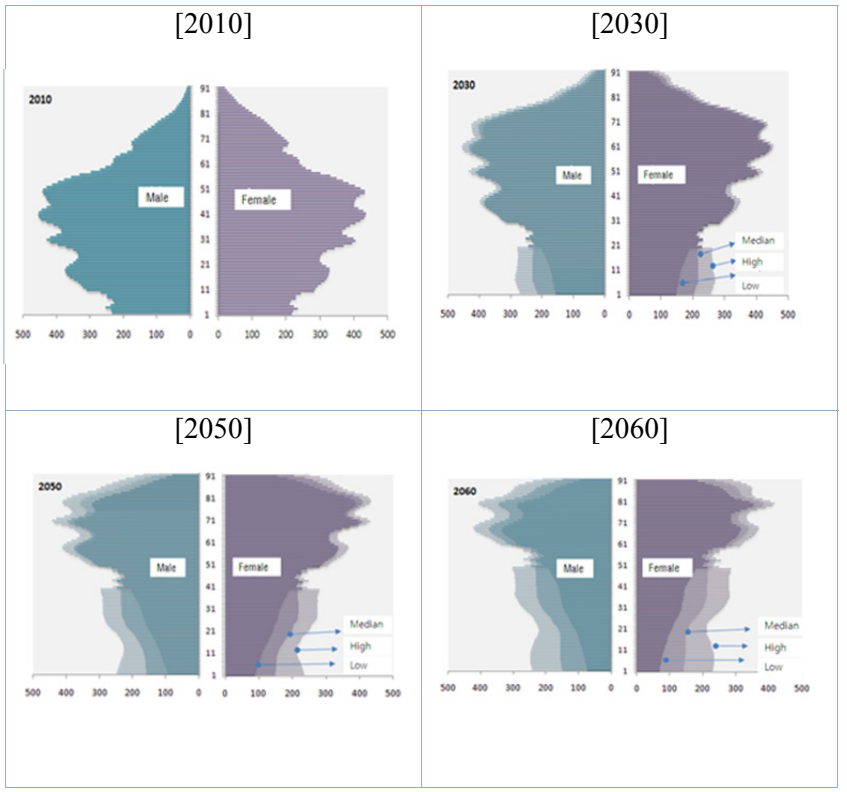


Source: National Statistical Office

The current population pyramid as of 2010 is bell-shaped, with those under age 20 comprising 37.3% of the entire population, those in their 30s-50s 47.2% and those aged 60 or over 15.5%.

However, as those in their 20s are expected to decrease to less than 21.8% in 2060, this shape is expected to change gradually to an inverted triangular one, in which the lower part of the pyramid gradually narrows and the upper part becomes larger.

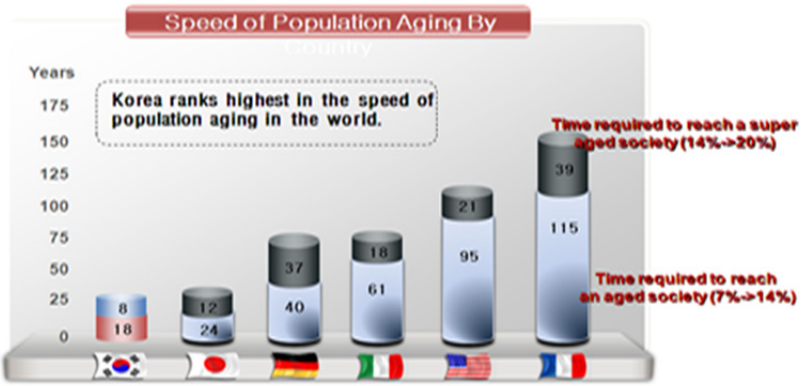
Figure 3. Population Pyramids of Korea



Source: National Statistical Office

The periods of time for major countries to have reached the aged and super-aged societies are as follows. As for the period of time to reach an aged society, it took 115 years for the United Kingdom, 95 years for the United States and 40 years for Germany and 24 years for Japan. But it is expected to take only 18 years for Korea, and also Korea will need the shortest period of time for reaching a super-aged society.

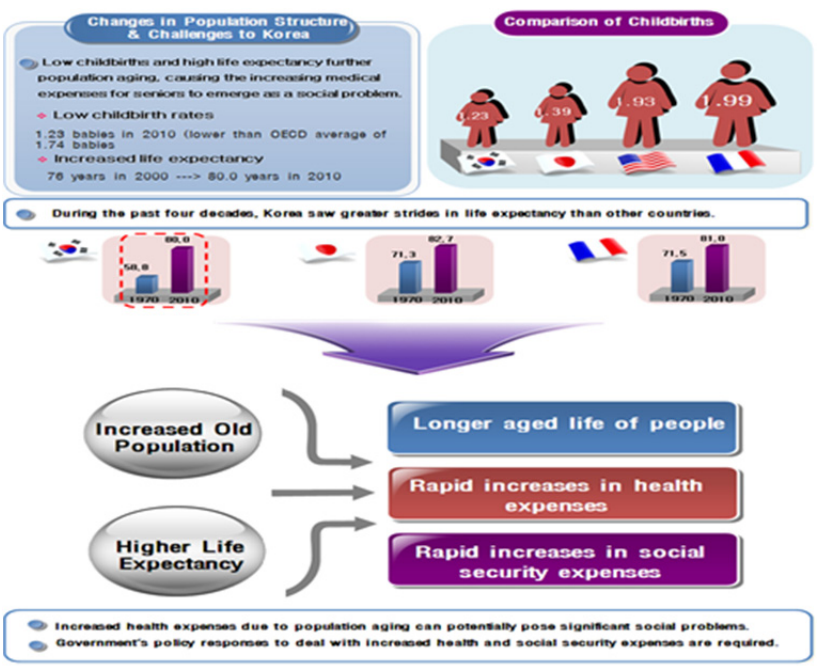
Figure 4. Speed of Population Aging by Country



Source: National Health Insurance Corporation

Low fertility rates and rapid population aging will cause rapid increases in the health expenditures and social insurance expenses in Korea.

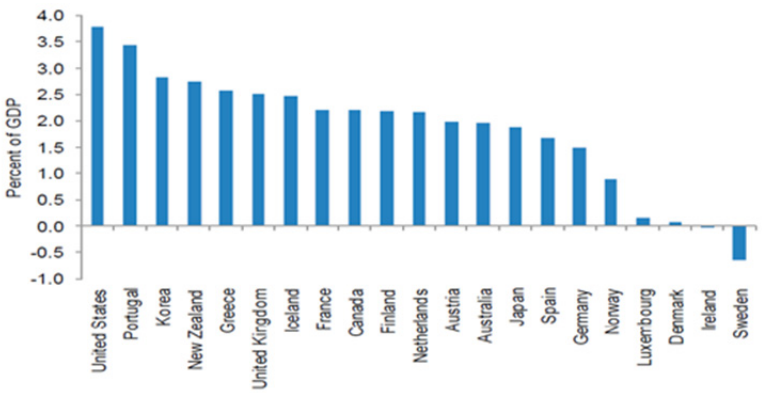
Figure 5: Changes in Population Structure and Problems



National Health Expenditures

The increase rate of the national health expenditures in Korea over the past three decades is relatively higher than those of major countries.

Figure 6. Increases in the Medical Expenditures in Major Economies During 1980-2008

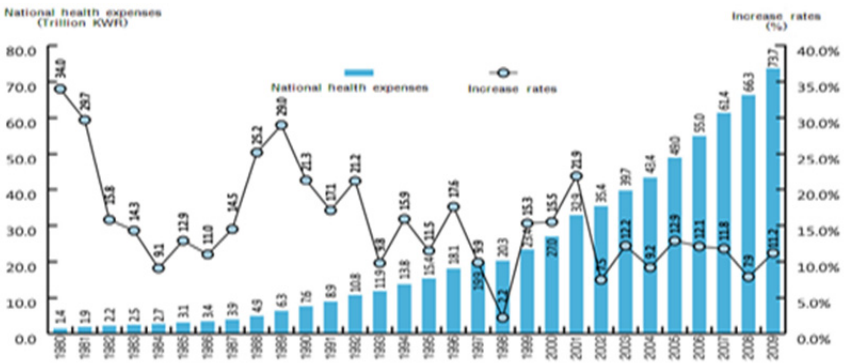


Source: IMF conference, Public Health Care Reform, June 2011.

The national medical expenditures in Korea rapidly rose from KRW 14 trillion in 1980 to KRW 73.7 trillion in 2009. Except for the short period of time when the increase temporarily slowed down due to the economic crisis in 1989, the expenditures continue to increase due to the various factors including the separation of drug prescription and dispensing, increases in the national health insurance payments, and increases in the prices of medical services of the national health insurance.

Increases in medical expenditures are expected to accelerate due to the rapid increase in older generations, which might threaten the stability of the health insurance finance.

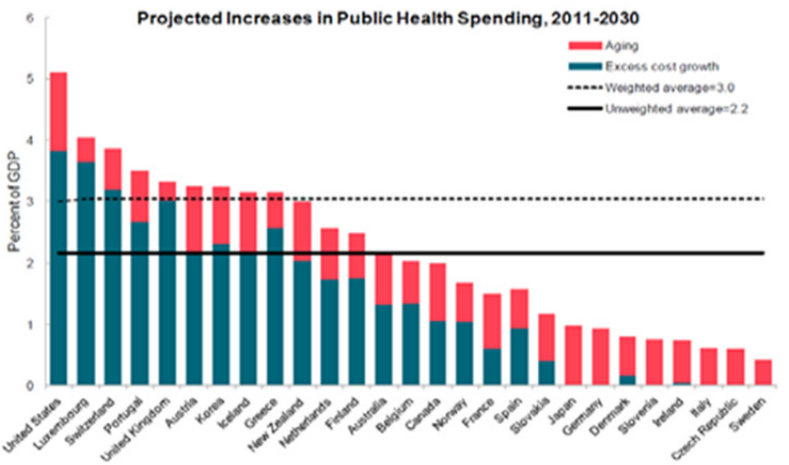
Figure 7. National Health Expenditure of Korea



Source: Ministry of Health & Welfare (2011), National health expenditure and health accounts 2009.

IMF(2009) predicts population aging could be accountable for one third of the total increases in the national health expenditures during 2011-2030 in Korea. Korea is expected to experience significantly higher financial burden due to population aging than other countries.

Figure 8. Prospected Increases in Public Health Spending, 2011-2030



Source: IMF Conference, Public Health Care Reform, June 2011

Financial Status of the National Health Insurance

The current balance of the national health insurance had deficits in 2006, 2007, 2009, and 2010, but as of September 2012, it had a surplus of about 3.4 trillion Won and the accumulated balance around 4.6 trillion Won.

Table 1. Financial Status of the National Health Insurance

(unit: 100 million Won, %)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	annual increase rate
revenue	138,903	168,231	185,722	203,325	223,876	252,697	289,079	311,817	335,606	379,774	418,192	11.65
premium	106,466	131,807	148,745	163,864	182,567	212,530	244,384	259,352	281,629	323,995	358,536	12.91
expenditure	146,510	157,437	170,043	191,537	224,623	255,544	275,412	311,849	348,599	373,766	388,035	10.23
benefits	138,993	149,522	161,311	182,622	214,893	245,614	264,948	301,461	336,835	361,890	376,318	10.47
current account	-7,607	10,794	15,679	11,788	-747	-2,847	13,667	-32	-12,994	6,008	30,157	
cumulative account	-25,716	-14,922	757	12,545	11,798	8,951	22,628	22,586	9,592	15,600	45,757	

Source: National Health Insurance Corporation

Expenditures of the Medicaid

Total expenditure of the Medicaid increased from 1.9 trillion Won in 2001 to 5.1 trillion Won in 2011. The increase rates of the Medicaid expenditures were 21.4% in 2006, 7.6% in 2007, 6.0% in 2008, 6.2% in 2009, and 4.3% in 2010.

Table 2. Expenditures of the Medicaid

(unit: 100 million Won, %)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
medical expenditures	18,922	20,313	22,149	26,111	32,337	39,251	42,238	44,789	47,548	49,582	51,423
(increase rate)		(7.35)	(9.04)	(17.89)	(23.84)	(21.38)	(7.61)	(6.04)	(6.16)	(4.28)	(3.71)

Source: Ministry of Health & Welfare

As of 2011 among those aged 65 or over, 5,184,000 persons were covered by the national health insurance, and 460,000 persons by the Medicaid, with each accounting for 28.6% and 10.5% of the elderly, respectively.

The number of the elderly and their share in the total population eligible for the health insurance and the Medicaid continued to rise. The total population eligible for the national health insurance and the Medicaid rose at an annual average of 0.6% between 2003 and 2011, but those aged 65 or over eligible for the national health insurance and the Medicaid rose at an annual average of 4.6 % between 2003 and 2011.

Those aged 65 or over eligible for the national health insurance rose at an annual average of 4.9% during 2003-2011, while those 65 or over eligible for the Medicaid rose at an annual average of 2.0% during the same period.

Table 3. Beneficiaries of the health insurance and the medicaid among those aged 65 or over

(Unit: 1,000 persons, %)

		2003	2004	2005	2006	2007	2008	2009	2010	2011	Annual average increase rate
Health Insurance	Eligibles	47,103	47,372	47,392	47,410	47,820	48,160	48,614	48,907	49,299	0.6
Health Insurance	Old population	3,541	3,748	3,919	4,073	4,387	4,600	4,826	4,979	5,184	4.9
Health Insurance	Share	7.5	7.9	8.3	8.6	9.2	9.6	9.9	10.2	10.5	4.3
Medicaid	Eligibles	1,454	1,529	1,762	1,829	1,853	1,841	1,577	1,674	1,609	1.3
Medicaid	Old population	392	415	452	469	486	487	460	470	460	2.0
Medicaid	Share	27.0	27.1	25.7	25.6	26.2	26.5	29.2	28.1	28.6	0.7
Total Population for Coverage	Eligibles	48,557	48,901	49,154	49,239	49,673	50,001	50,191	50,581	50,908	0.6
Total Population for Coverage	Old population	3,933	4,163	4,371	4,542	4,873	5,087	5,286	5,449	5,644	4.6
Total Population for Coverage	Share	8.1	8.5	8.9	9.2	9.8	10.2	10.5	10.8	11.1	4.0

Note: 1) The nation's entire population and the number of those eligible for medical coverage may be disparate. (the latter could be larger than the whole population due to those who acquired dual eligibility, etc.)

2) The homeless whose ages were not determined were excluded from the old population.

Source: Statistical Year Book of the National Health Insurance and the Medicaid.

Changes in the Disease Patterns and the Medical Expenditures

Over the last two decades, the incidence of chronic diseases has increased rapidly. When we look at the medical expenses per disease type compared to the total medical expenses, in the 1990s digestive system diseases (20%), respiratory system diseases (20%), and other diseases including poisoning(10%) accounted for a half of the total medical spendings, but in 2010, circulatory system diseases (14%), respiratory system diseases (20%), muscular skeletal diseases (11%) and neoplasm-related diseases (10%) were on top of the list.

Table 4. The Shares of Medical Expenditures by Diseases Type

<1990>			<2010>		
Rank	Diseases	%	Rank	Diseases	%
1	Digestive system	19.75	1	Circulatory system	13.97
2	Respiratory system	19.70	2	Respiratory system	13.22
3	Injuries, poisoning & others	10.01	3	Muscular skeletal & connective tissues	11.12
4	Muscular skeletal & connective tissues	6.88	4	Digestive system	10.09
5	Nervous system & sensory organs	6.37	5	Neoplasm	9.86
6	Urinogenital	5.68	6	Injuries, poisoning & others	7.00
7	Neoplasm	5.44	7	Urinogenital	5.96
8	Circulatory system	5.42	8	Endocrine, nutritional & metabolic	4.56
9	Infectious & parasitic	4.93	9	Mental & behavioral disorder	3.92
10	Complications from childbirth, delivery & puerperium	4.66	10	Eye & adnexa	3.52

Note 1. Based on diagnoses

2. Based on those covered by health insurance (excluding medical benefits); non-covered ones are excluded

Source: National Health Insurance Corporation, internal materials.

As for the changes in the 11 major chronic diseases, medical expenses for chronic diseases from the national health insurance increased 3.4 times in 2011 compared to 2002.

The medical expenses for the 11 major chronic diseases rose from KRW 4 trillion 803.6 billion in 2002 to KRW 16 trillion 384.6 billion in 2011. In 2011, the neoplasm-related medical expenses were on the top of the list with KRW 3 trillion 947.1 billion, followed by those related to hypertension (KRW 2 trillion 552.2 billion), mental and behavioral disorders (KRW 2 trillion 48.0 billion), cerebral vascular diseases (KRW 1 trillion 757.8 billion) and diabetes (KRW 1 trillion 428.3 billion).

Table 5. Changes in the medical expenses for major chronic diseases

(Unit: KRW 100 million)

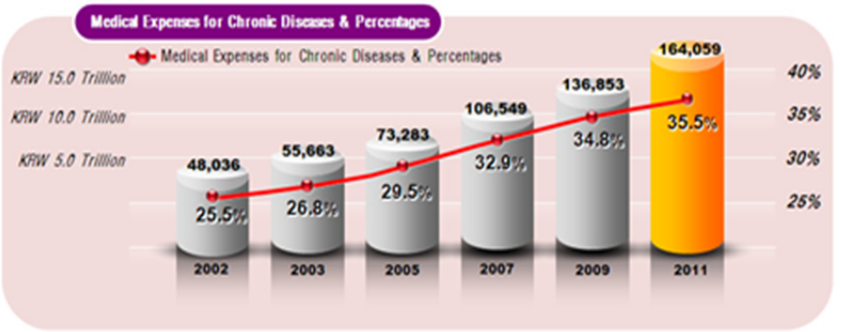
	Total	Hyper-tension	Mental, behavioral disorders	Respiratory system	Heart	Cerebral vascular	Nervous system	Neo-plasm	Thyroid	Liver	Chronic renal failure	Diabetes
2002	48,036	8,581	5,300	645	4,234	4,271	2,493	10,192	787	2,698	3,580	5,256
2011	163,846	25,522	20,480	952	13,720	17,578	11,291	39,471	2,220	6,600	11,729	14,283
Increase rates ('02=100)	341	297	386	148	324	412	453	387	282	245	328	272

Note: Based on diagnoses, figures for 2011 are estimates

Source: National Health Insurance Corporation, internal materials.

The percentage of the expenses spent for chronic diseases out of the total national health expenditures rose from 25.5% in 2002 to 35.5% in 2011.

Figure 9. Medical Expenses for Chronic Diseases



Note : The 11 major chronic diseases: hypertension, diabetes, heart disease, chronic kidney disease, cerebrovascular disease, nervous system disease, respiratory organ TB, malignant neoplasm, thyroidal disease, liver disease, mental disease and behavioral disorder.

Source: National Health Insurance Corporation, internal materials.

Out of the chronic diseases, the national health insurance benefits for the geriatric diseases(dementia, Parkinsonism, cerebral vascular disease, and other degenerative diseases of basal ganglia) from are as follows. Compared to 2005, the number of patients increased 162.8% (683,000 → 1,112,000), and the medical expenses rose 271.0% (KRW 1 trillion 80.0 billion → KRW 2 trillion 930.0 billion) in 2010.

For those aged 65 or over, both the number of patients treated and the medical expenses spent significantly increased 186.4% and 322.0%, respectively during the same period. The number of the treated patients aged under 65 also rose 129.1%, and the expenses 191.2%.

Table 6. Number of geriatric patients and medical expenses by year

(Units: 1,000 persons, 10 million Won)

Year	Total			Geriatric diseases in patients under 65			Geriatric diseases in patients aged 65 & older		
	Population	Actual patients treated	Total medical expenses	Population	Actual patients treated	Total medical expenses	Population	Actual patients treated	Total medical expenses
2002	48,080	499	58,130	44,265	236	26,427	3,815	263	31,703
2003	48,557	560	69,265	44,624	254	29,772	3,933	306	39,494
2004	48,901	621	82,812	44,738	268	34,154	4,163	353	48,658
2005	49,154	683	107,926	44,782	282	42,065	4,372	401	65,860
2006	49,238	759	134,291	44,696	303	48,198	4,543	456	86,092
2007	49,672	847	170,043	44,799	315	54,306	4,873	532	115,737
2008	50,001	952	219,827	44,915	345	66,633	5,086	607	153,194
2009	50,291	1,027	243,869	45,006	355	71,507	5,285	672	172,361
2010	50,581	1,112	292,530	45,132	364	80,443	5,449	748	212,085

Source: National Health Insurance Corporation

The medical expenses for the elderly patients rapidly increased in the entire areas of inpatients, outpatients and pharmacies. As the following table shows, the figures for inpatients rose highest at an annual average increase rate of 19.8% between 2003 and 2011.

Table 7. Changes in the health insurance and medical benefits for elderly patients

(Unit: KRW 1 million, %)

	Year	Total		Inpatients		Outpatients		Pharmacies	
	Year	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65
Health Insurance	2003	4,400,753	21.2	1,545,713	28.2	1,588,912	16.2	1,266,128	23.1
Health Insurance	2004	5,136,414	22.8	1,776,801	29.8	1,801,478	17.4	1,558,135	25.1
Health Insurance	2005	6,073,084	24.4	2,096,436	31.8	2,094,709	18.6	1,881,939	26.8
Health Insurance	2006	7,350,397	25.9	2,637,451	33.6	2,449,842	19.6	2,263,104	28.2

Table 7 (cont.)	Year	Total		Inpatients		Outpatients		Pharmacies	
	Year	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65
Health Insurance	2007	9,118,988	28.2	3,586,341	36.4	2,859,276	21.0	2,673,370	30.1
Health Insurance	2008	10,737,096	30.8	4,308,173	39.6	3,327,021	23.1	3,101,902	32.5
Health Insurance	2009	12,345,806	31.4	4,971,417	40.1	3,836,274	23.6	3,538,115	33.1
Health Insurance	2010	14,134,985	32.4	5,980,381	41.4	4,253,389	24.0	3,901,214	34.0
Health Insurance	2011	15,389,272	33.3	6,563,747	42.5	4,644,807	24.8	4,180,715	34.5
Health Insurance	Annual average increase rate	16.9		19.8		14.3		16.1	

Source: National Health Insurance and Medicaid Statistics

(Unit: KRW 1 million, %)

Table 7 (cont)	Year	Total		Inpatients		Outpatients		Pharmacies	
	Year	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65
Medical Benefits	2003	836,895	37.8	359,509	34.9	269,182	34.3	208,204	52.0
Medical Benefits	2004	994,317	38.1	430,945	34.9	305,026	34.4	258,345	52.6
Medical Benefits	2005	1,242,688	38.4	541,975	35.7	366,939	34.3	333,773	51.9
Medical Benefits	2006	1,525,492	38.9	669,833	37.1	436,508	33.7	419,150	51.0
Medical Benefits	2007	1,656,901	39.2	747,146	37.6	457,304	33.9	452,451	51.0
Medical Benefits	2008	1,834,111	40.9	867,405	40.2	477,725	34.5	488,981	52.0
Medical Benefits	2009	1,966,336	41.4	952,738	40.4	500,148	35.2	513,450	52.7

Source: National Health Insurance and Medicaid Statistics

Table 7 (cont)	Year	Total		Inpatients		Outpatients		Pharmacies	
	Year	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65	expenses	Percentage compared to the expenses of the aged under 65
Medical Benefits	2010	2,084,609	42.0	1,049,490	41.8	488,563	33.6	513,450	52.7
Medical Benefits	2011	2,193,851	42.7	1,128,173	42.7	530,136	35.4	535,541	53.3
Medical Benefits	Annual average increase rate	12.8		15.4		8.8		12.5	

Source: National Health Insurance and Medicaid Statistics

The cared geriatric disease prevalence rates[1] per 100,000 persons increased from 1,039 persons per 100,000 in 2002 to 2,041 persons in 2009. The cared geriatric disease prevalence rates were most noticeable among those aged 65 or over: 6,906 patients per 100,000 persons in 2002 and 12,711 patients in 2009. The rates rose significantly also among those under ages 65, increasing 148.0% between 2002 and 2009.

Table 8. Cared geriatric disease prevalence rates1) by year

(unit: per 100,000 persons)

Year	Total	Under age 65	65 and older
2002	1,039	533	6,906
2003	1,152	568	7,780
2004	1,270	599	8,477
2005	1,389	629	9,173
2006	1,542	678	10,049
2007	1,705	702	10,925
2008	1,884	768	11,935
2009	2,041	789	12,711

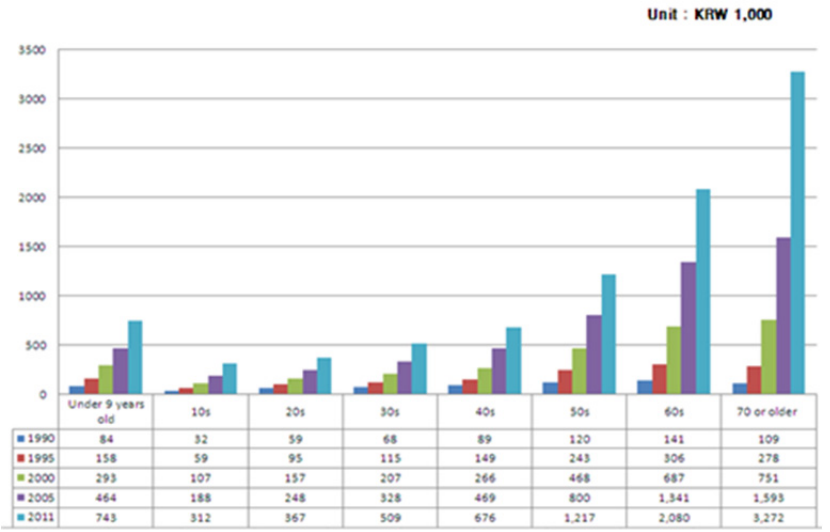
Source: National Health Insurance Corporation

Among those aged 70 or over, the per capita annual medical expenses from the national health insurance increased more than 30 times over the past two decades. The per capita annual medical expenses among those aged under 9 was KRW 740,000, and among those in their teens KRW 310,000, which is the lowest level across the age groups, those in their 20s KRW 370,000, those in their 30s KRW 510,000, those in their 40s KRW 680,000, those in their 50s KRW

[1] Proportion of geriatric disease patients who are treated in medical institutions among total population

1,220,000, those in their 60s KRW 2,080,000, and those in their 70s or older KRW 3,270,000.

Figure 10. Per capita annual medical expenses by age group



	Under 9 years old	10s	20s	30s	40s	50s	60s	70 or older
1990	84	32	59	68	89	120	141	109
1995	158	59	95	115	149	243	306	278
2000	293	107	157	207	266	468	687	751
2005	464	188	248	328	469	800	1,341	1,593
2011	743	312	367	509	676	1,217	2,080	3,272

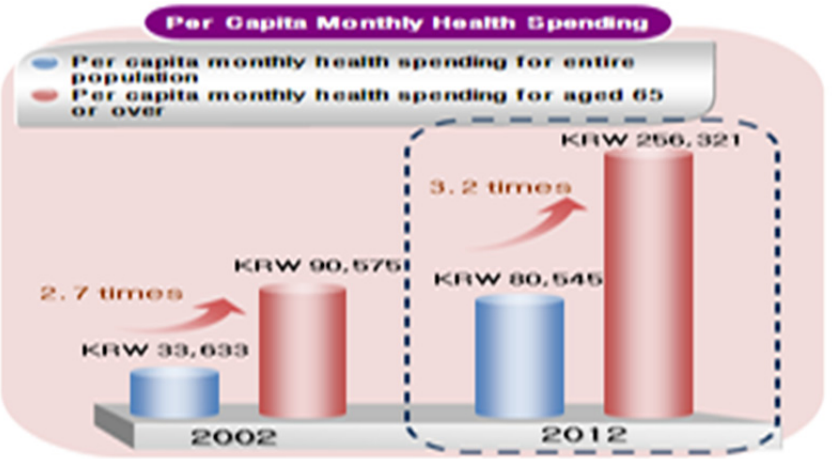
Note: The figures for 1990-1995 are based on the results of reviews, while those for 2000-2011 are based on the payments made (Those for 2011 are estimates)

Source: National Health Insurance Corporation

The per capita monthly average medical expenses for those aged 65 or over from the national health insurance increased significantly due to the increases in the chronic and geriatric diseases.

In 2012, the per capita monthly average medical expenses for those aged 65 or over were 3.2 times higher than those for total population. The per capita monthly medical expenses for those aged 65 or over continues to increase from 2.7 times than those for the entire population in 2002 to 3.2 times in 2012.

Figure 11. Changes in per capita monthly medical spending



Source: National Health Insurance Corporation

Future Outlook

Estimates of the patients of geriatric diseases and the medical expenses

We estimated the number of treated patients of geriatric diseases in the future, multiplying the cared geriatric disease prevalence rates per 100,000 persons by the estimated future population

According to the estimation, in 2015 the other dorsopathies patients will show the highest number, followed by the patients of hypertension, and the chronic lower respiratory tract diseases, but in 2050, the hypertension patients are expected to be on the top of the list.

Table 9. The number of patients treated by disease

(Unit: thousand persons)

Disease group	2015	2020	2025	2030	2035	2040	2045	2050
Hypertension	5,580	6,054	6,771	7,486	8,066	8,519	8,688	8,675
Cerebral vascular	803	895	1,037	1,186	1,299	1,386	1,425	1,426
Osteoarthritis	3,411	3,748	4,291	4,847	5,202	5,457	5,534	5,466
Diabetes	2,051	2,029	2,458	2,691	2,849	2,964	2,982	2,945
Renal failure	121	134	154	164	176	187	188	191
Dementia	229	272	328	400	498	586	650	692
Ischemic heart disease	697	762	861	966	105	1,117	1,146	1,147
Cataract	1,106	1,268	1,517	1,783	2,007	2,191	2,289	2,321
Other dorsopathies	5,661	5,975	6,448	6,905	7,227	7,444	7,459	7,339
Chronic lower respiratory tract infection	5,359	5,478	5,634	5,771	5,836	5,829	5,720	5,536
Parkinson's disease	70	82	98	118	138	155	166	171
Nervous system	429	460	505	553	592	622	633	631
Cancer	2,765	2,851	2,977	3,083	3,131	3,140	3,083	2,986

Source: Shin Eui-Chul et al. (2011). Low Fertility and Population Aging and the Quality of Life, The Korea Institute for Health and Social Affairs

The estimation of the medical expenses by disease shows that in 2015 the expenses spent for cancers will be on the top of the list at KRW 4 trillion 300 billion, followed by those for hypertension at KRW 2 trillion 600 billion and the cerebral vascular disease at KRW 1 trillion 700 billion.

In 2050 cancers are also expected to lead the others at KRW 5 trillion 800 billion, and the expenses for hypertension are projected to rise by approximately KRW 2 trillion to record KRW 4 trillion 400 billion.

Table 10: Estimates of the medical expenses by disease

(Unit: KRW 100 million)

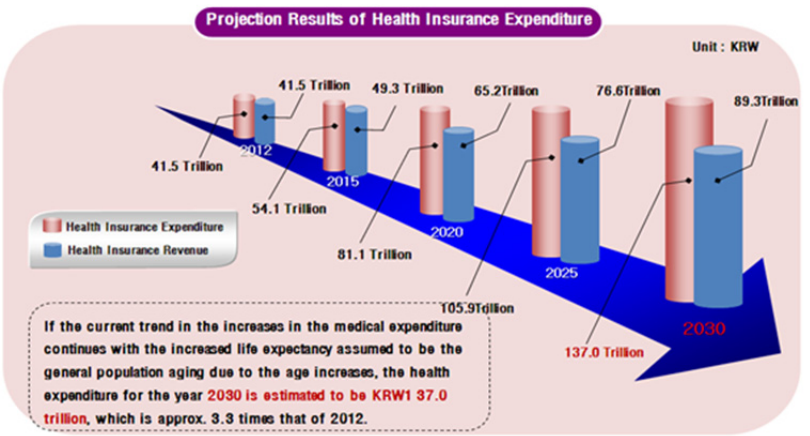
Disease group	2015	2020	2025	2030	2035	2040	2045	2050
Hypertension	26,798	29,333	33,090	36,992	40,457	43,266	44,575	44,874
Cerebral vascular	11,742	19,490	22,107	26,001	302,893	33,853	36,469	37,633
Osteoarthritis	13,073	14,908	17,894	21,092	23,164	24,704	25,369	25,201
Diabetes	12,593	13,956	16,075	18,177	19,817	21,120	21,642	21,674
Renal failure	13,821	14,944	16,771	17,407	18,003	18,639	18,221	18,178
Dementia	9,195	10,810	12,770	15,400	19,195	22,660	25,168	26,885
Ischemic heart disease	9,902	11,008	12,700	14,450	15,885	17,038	17,570	17,667
Cataract	5,635	6,495	7,787	9,243	10,530	11,597	12,219	12,453
Other dorsopathies	14,212	15,657	17,853	20,160	22,043	23,535	24,217	24,294
Chronic lower respiratory tract infection	7,963	8,549	9,352	10,279	11,225	119,990	12,400	12,513
Parkin's disease	1,841	2,148	2,578	3,107	3,668	4,152	4,475	4,644
Nervous system	2,351	2,548	2,831	3,138	3,425	3,655	3,769	3,795
Cancer	43,480	46,325	50,735	54,899	57,699	59,634	59,802	58,880

Source: Shin Eui-Chul et al. (2011). Low Fertility and Population Aging and the Quality of Life, The Korea Institute for Health and Social Affairs

Future National Health Insurance Expenditures

If the current trend in the increases in the medical expenditure continues, the health expenditure for the year 2030 is estimated to be KRW 137.0 trillion, which is about 3.3 times that of 2012.

Figure 12: Projection of National Health Insurance Expenditure



Source: National Health Insurance Corporation

Policy Directions

We have so far examined the structural changes in diseases due to the structural changes in population, the related medical expenses and the future outlook.

The per capita monthly average medical expenses of those aged 65 or over were found to have significantly increased due to the increases in the chronic diseases and geriatric diseases. As of 2012, the per capita monthly average medical expenses of those aged 65 or over are 3.2 times higher than the average of the entire population.

The gap in the per capita monthly average medical expenses between those aged 65 or over and the entire population was 2.7 times in 2002, but continues to widen to reach 3.2 times in 2012.

In order to manage the increased medical expenses for the elderly people efficiently, we need to initiate the consumer-focused management of the use of medical services, the provider-initiated efforts to reduce medical expenses, and the improvement of the management system of the national health insurance.

The consumer-focused management of the use of medical services include reducing the co-payment burden of the elderly people, promoting the health checkups at the age of 66 and exercise programs for the aged, enhancing the post-service management by utilizing the health promotion center and providing counseling on improving health behavior.

The provider-initiated efforts to reduce medical expenses include introducing the DRG system, managing and monitoring the medical institutions that encourage excessive use of the medical services, and converting the use of long-term hospitals to that of the long-term care welfare facilities.

The improvement of the management system of the national health insurance includes trying to distribute resources efficiently through the control and management of the quantity and quality of services and the prices.

Despite the proposed measures deemed desirable for the management of the medical expenditures for the elderly people, there could be difficulties in drawing a social consensus among the various parties interested and stakeholders.

We need to make continued efforts to find solutions to the problems under the social consensus that the sound health insurance system should be maintained to provide medical security to the people. To do this, we should establish the specific goals and directions and implement them in a phased and strategical manner.

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Self-Stated Reasons for Suicidal Ideation among Youth: Different Predictors?

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Introduction

The suicide rate has increased rapidly in South Korea during the 2000s to reach the highest level among OECD countries by 2008 (Figure 1). Related but perhaps more importantly, suicide became a household word. Contributing to this trend are celebrities. A rising young actress in her mid twenties committed suicide in 2005. A very popular actress in her late thirties, a single mother with two young children, committed suicide in 2008. Afterwards, the latter's brother, an actor, and her former husband, a professional baseball player, committed suicide as well within a few years. In 2009, even a recently retired president of South Korea followed the suit.

Celebrity suicides are still happening. These famous suicides not only spark copycat deaths, but may also instill the ideation of suicide in people under stress, especially in emotionally unstable youth who are vulnerable to outside influences. Indeed, the suicide rate has increased most notably among the youth and elderly in the past decade. According to scholars, detailed media coverage plays a big role in spreading the suicide ideation (Song and Jin 2013; Stack 2000).

Hearing about suicides either by celebrities or by close friends or relatives serves as a known predictor of suicide (Baller and Richardson 2009; Bernburg et al. 2009; Song and Jin 2013; Stack 2000; Thompson and Light 2011). Beside this “imitation” factor, the two groups of the more primary causal predictors include internal psychological and structural contextual conditions. Psychological explanations range from ordinary personality characteristics, such as impulsiveness or anxiety, to more pathological conditions, such as

depression or "suicide diseases" (Harris and Barraclough 1997). Sociologists explain suicide with social structural forces, assuming that social forces have their own distinctive effects beyond the effects of individual traits. This study takes the sociological approach.

The sociological literature shows two major theoretical camps. The first one follows the theory of Durkheim, a founder of the discipline of sociology and a pioneering scholar of suicide, emphasizing the role of social integration and regulation, lack of which causes suicide. The second one focuses on the "achievement pressures" in the contemporary society (Girard 1993; Maimon and Kuhl 2008; Thorlindsson and Bjarnason 1998). These two perspectives may be compatible, but no previous study applied them simultaneously. This study refers to both frameworks.

The study focuses on the ideation of suicide, rather than suicide per se, in the thinking process among youth. Although not all persons with suicidal thought actually attempt suicide, ideation serves as a significant predictor of actual suicide attempts for both genders of youth (Thompson and Light 2011). Also, a suicide attempt serves as a significant predictor of eventual suicide (Harris and Barraclough 1997). Many previous studies explore the association between various personal and social traits and suicide (ideation, attempt, or act), but few previous studies directly ask why one considers suicide (Roen et al. 2008). Conducted annually by the National Statistical Office of Korea, Social Statistical Surveys provide unique data on why one contemplates suicide. Using data from the 2010 and 2012 surveys, this study categorizes the reasons into three types and explores whether and how their predictors differ. The study performs the analysis separately for female and male youth for a comparison.

Literature Review: Social Factors Predicting Suicide

Societal Integration and Regulation

According to Durkheim, "the risk of suicide is high when societies' influence over the individual is either excessive or insufficient" (Maimon and Kuhl 2008; Thorlindsson and Bjarnason 1998). Most of his empirical research has focused on the insufficiency of social integration and regulation within religious, familial, and political organizations. Social integration refers to "the intensity of the collective life that circulates within a social aggregate," and social disintegration enhances "individualism" and hence "anomic suicide," an outcome of intrinsic loneliness or the loss of life goals. The social regulation serves as a mechanism restraining individuals' instinctive selfishness, and the lack of it may result in "egoistic suicide," a consequence of finding "the complete emptiness of an egoistic life or the total vanity of limitless ambition" (Maimon and Kuhl 2008).

Scholars assume that social integration serves as the primary construct as it is necessary for regulation but not vice versa. For adolescents, the integrative roles of social institutions, including religion, family, and school context, are particularly important. Studies show that social integration, diversely termed as "attachment," "commitment," or "involvement," is crucial for youths not deviating from acceptable modes of behavior (Maimon et al. 2010; Maimon and Kuhl 2008; Thorlindsson and Bjarnason 1998). On a related note, several studies in Korea confirm the importance of parental attachment and community involvement in predicting suicidal ideation or attempt among youth (Kim and Hong 2012; Kim and Roh 2011; Lee 2007; Lee 2012; Park 2009).

Threatened Identities: Achievement Pressures

In Durkheim's framework, excessive social control may also result in suicide, "fatal" or "altruistic" suicide. However, such types of suicide may not coexist with egoistic or anomic suicides, which are more

likely to occur in the context of insufficient social control. Girard (1993) proposes another theoretical framework that explains "fatal" types of suicide that may be observed in any level of social integration. Girard argues that suicide is chosen when one's self-concept is threatened, perhaps to communicate to significant others and self that life is not sustainable without one's identity. Some of the circumstances or life events making it difficult to replace one's identity supports include an abrupt breakdown of the marriage relationship or declining physical and mental capacities. Girard (1993) notes that as opposed to intrinsic or non-contingent self-identity, a performance-based self-identity, i.e., identity based on assessment of talent, competence, and accomplishment, is particularly conducive to suicide in the cases of achievement failure. He argues that during the process of economic development, achievement becomes more central than ascribed attributes and achievement-oriented self-identity becomes prevalent, increasing the risk of suicide in the society.

Achievement Pressures with Social Disintegration: Korea in the 2000s

The rapid rise in suicide in the past decade in Korea may be a result of the mixture of achievement pressures and social disintegration. From Durkheim's perspective, this mixture may illogically and contradictorily sound like both too much and too little societal influences on individuals. However, as discussed above, achievement-oriented self-identity can prevail in a disintegrating social context. Still, the question of how these seemingly conflicting social conditions simultaneously influence the individuals is rather tricky. For example, parental involvement in their adolescent children may both facilitate and deter youth suicide. On the one hand, strong parental involvement often means high expectations about adolescent performance. Not meeting those expectations may mean the youth's self-concept is not sustainable, which may cause the thought of suicide, in this case "fatal" suicide. At the same time, parental involvement and support may help sustain healthy self-concepts, reducing the risk of suicide, whereas the lack of parental support may increase "anomic" suicide.

In summary, the literature suggests that suicidal ideation may be multidimensional and that the predictors may differ by the dimension. To explore the multidimensionality, this study categorizes the suicidal ideation by type, based on the reasons for such ideation that the respondents confessed.

Typology of Suicidal Ideation: Reasons for Suicidal Ideation

Based on the literature and the categories of answers given in the questionnaire, three types of suicidal ideations are identified: two related to anomic suicide, which may be a result of insufficient social integration according to Durkheim's theory, and the other related to fatal suicide caused by unfulfilled achievement-oriented self-identity. The first type of anomic suicidal ideation refers to the reasons of "family disharmony" and "economic difficulties." For the sample of full-time students enrolled in a high school who are either a child or grandchild of the household head, economic difficulties refer to their family circumstances, not their individual income capacity. So the two are combined to represent family-related issues, labeled as "family disharmony," where it is likely that the process of family disintegration presses youth to be suicidal. The third type of suicidal ideation refers to the reasons of "school grade, school advancement issues," which clearly represent a problem with the achievement-oriented self-identity, which probably is a joint product of the youth's own achievement ambitions and pressures from the parents or teachers.

The second type of suicidal ideation refers to all other reasons, where "loneliness" comprises an overwhelming majority. A distant second reason is "conflicts with or isolation from friends or colleagues" for female youth and "physical or mental health or disability issues" for male youth. The other minimal reasons in this category include "job issues," "partnership issues," and "others." This range of issues seems to represent a coherent theme, i.e., difficulty in establishing a stable "self-identity," where its underlying psychological process may also be linked to either family disharmony or academic performance.

That is, the second type of suicidal ideation related to "self-identity." For example, "loneliness" may develop from any underlying issues including those related to family disharmony or school performance, suggesting overlaps in their predictors. In summary, the first two categories roughly coincide with the concept of insufficient social integration in Durkheim's theory causing "anomic" suicide and performance-based self-identity, when it is difficult to fulfill the achievement expectations, causing the third type. This study hypothesizes that the predictors of suicidal ideation will differ by the types. In some cases, their effects may be in the opposite directions across the types. One must understand the multidimensionality of suicide both for theoretical purposes and for policy implications.

Gender Differences

Statistics across the societies and time periods demonstrate a higher suicide rate among men than women. Despite such stark gender gaps, a few qualifications need to be made. First, gender patterns are quite different for youth; women in teens and in twenties are almost as likely to commit suicide as their male counterparts. In those ages, suicidal ideation or attempts may be more frequent among women than among men.

Research Questions

Three research questions are as follows: whether the distribution of the types of suicidal ideation differs by gender; whether and how the predictors of suicidal ideation differ by the type of ideation; and whether there are any differences in the predictors by gender.

Data and Methods

Social Statistical (SS) Surveys conducted annually by the National Statistical Office of Korea provided the data. The survey consists of several modules, and each year a combination of those modules is selected to construct the questionnaire. The questions on suicidal ideation and its reason serve as part of the Health module. We use data from 2010 and 2012 surveys because they include the Family and Education modules as well as the Health module. Among all the annual data publicly available since 1998, only those two years include the three modules at the same time. The two surveys also include the Safety and Environment modules, and the Labor and Social Participation modules are among those used in other years. The questionnaires of SS Surveys are relatively simple, but the survey has its own advantages. It is based on nationally representative samples of large size, tens of thousands each year. Furthermore, the household serves as the unit of sampling, and all the members age 15 (13 in 2012) or older are interviewed with the same questionnaire, except that household heads are asked additional questions. These questions pertain to the characteristics of the household, including the whereabouts of the spouse and children not living in the household. By linking data for the different members from the same household (e.g. mother, father, and siblings) to that of the adolescent interviewees and using the information on each member's relationship to household head, we can get fuller pictures of the family context.

For the analysis, the sample is restricted to youth aged 15 to 18 currently enrolled in a high school. Among them, about one percent of youth who are not either a child or grandchild of the household head are excluded from the analysis, as it is difficult to identify their family compositions. The remaining numbers of female and male youth were respectively 930 and 1,046 in 2010 and 760 and 944 in 2012. Over a two-year interval, the study combined two years of samples for the multivariate analysis. Table 1 presents the characteristics of the sample by gender and by survey year. The questionnaires of the two

surveys are almost identical, and the variables are made identical. Appendix Table A1 explains the variables.

Findings

Distribution of Suicidal Ideation by Types

In both years, female youth are more likely to have suicidal thought than are male youth (Table 2). The two surveys are only over a two-year interval, yet the percentage of youth who had suicidal ideation increased considerably, especially among male youth: from 14.0 to 16.6 and from 7.9 to 10.9 among female and male youth, respectively. By the types, in both years, "school performance" comprises a majority of suicidal ideation, but its share among those with any type of suicidal ideation declined over time. This is because self-identity related ideation increased substantially for both genders, while the rate of school-performance related ideation in the total sample did not change over the two-year period. The rate of suicidal ideation related to family disharmony also increased for both genders.

Predictors by Types: Gender Comparison

Table 3 presents the results from the multinomial logit analysis of the predictors of the three types suicidal ideation. For parsimony of the models, the model specification is not identical for the two genders. However, the models are identical across the types for each gender, except for one interaction term between single parenting and year in the male models.

The findings overall confirm the expectation that the predictors would differ by the type of suicidal ideation, but there are as many similarities as differences. Between the gender groups as well, both similarities and differences are found.

The effect of single parenting in the male models showed the most contrast. Living with a single parent, as opposed to two parents,

increases the odds of suicidal ideation related to family disharmony only in 2010. However, it significantly decreases the odds of suicidal ideation related to school performance. That is, single parenting, an indicator of family disintegration at least in the structural aspect, tends to decrease the pressure for school performance while increasing anomic suicidal ideation. All other differential effects of the predictors by the types of suicidal ideation are in terms of their magnitudes and significance levels and not in the direction.

Stress with school life overall, as one might expect, increases the odds of suicidal ideation related to school performance, but it also increases suicidal ideation related to self-identity in both gender groups. Stress with school life, however, does not affect suicidal ideation related to family disharmony. Among female youth, dissatisfaction with educational methods increases suicidal ideation not only related to school performance but also related to self-identity and family disharmony. Among eight items measuring satisfaction with school life, only educational method, referring specifically to the methods of teaching and student evaluation, significantly affects suicidal ideation, even only for females. For example, dissatisfaction with relationships with teachers or peers does not have any effect (result not shown).

Understandably, stress with family life in the past two weeks and dissatisfaction with relationships with parents are both positively associated with suicidal thought related to family disharmony. Furthermore, these family relationship factors are also affecting suicidal thoughts related to school performance and self-identity, although these associations are weaker than those with suicidal ideation due to family issues. To summarize, the measures of unsuccessful adjustment to school life and difficulty with family life are positively associated with suicidal ideation related to school performance and the ideation related to family problems, respectively, but they also are associated with the other dimensions of suicidal ideation, although to a lesser extent. In other words, family support eases the pressures of school achievement while a successful school

life helps with coping with family issues, probably both in reducing the incidence of new tensions and in coping with the existing problems.

In contrast to these subjective evaluations of respondents' circumstances, family socioeconomic-status factors distinctively affect suicidal ideation by gender. The college education of both parents significantly increases suicidal ideations related to self-identity and school performance only among female youth. In a preliminary analysis, the daughters of parents who expect their children to receive graduate-level education were more likely to feel suicidal compared to the daughters of parents expecting their children to receive college or less education significantly at $p < .05$ level in 2010 data but not in 2012 data (results not shown).

This was not the case for the sons. That is, the parents' college education or parental expectations of their children's graduate level of education makes the daughters feel stressed with achievement pressures and with their personal self-identity. Among the sons, however, neither of the two variables has an effect, suggesting either that they take such parental expectations for granted or that they feel like they can choose to dismiss them. This gender pattern may reflect increasingly gender-egalitarian role expectations in the society, where young women are struggling with heightened expectations for academic achievement while having to fulfill traditional female roles. Young men may already have internalized such achievement expectations, which do not increase suicidal ideation. Apparently, the achievement pressures among young women take place in families of higher socioeconomic status, namely, parents of college education.

However, high socioeconomic status of the family does not always increase youth's suicidal ideation. Owning or long-term leasing a home as opposed to renting a home on a monthly basis decreases the likelihood of suicidal ideation related to family issues for both genders. Stable housing may help family integration and decreases the likelihood of suicidal ideation related to self-identity among female youth. This decrease indicates once more that the psychological

process of self-identity overlaps with other types of suicidal ideation, in this case an overlap between suicidal ideations related family disintegration and self-identity.

Poor self-rated health increases the suicidal ideation related to self-identity and school performance for both genders, but especially for the self-identity of male youth. The late teens are in a phase of rapid physical development, and poor health may seriously threaten self-identity, especially masculine identity among boys. Also, poor health may hinder academic performance. Poor health, however, is not associated with suicidal thought related to family disintegration.

The effects of personal worries in daily life differ by gender. For female youth, who they consult with when having worries affects their suicidal ideations. However, for male youth, the type of worries affects their suicidal ideations. The female youth who talk to their mothers are least likely to have suicidal ideation, while talking to friends is positively associated with suicidal ideation related to both family disintegration and school performance pressures. Not talking to anyone or trying to solve the problem alone is positively associated with suicidal ideation of all three types, which may be mutually causal. Consulting with the mother may mean a deeply trusting mother-daughter relationship, good relationships in general, or even a stable feminine identity. Such deep bonds with the mother help reduce suicidal ideation independent of general measures of family relationships discussed above, stress with family life or dissatisfaction with relationship with the parents. Previous studies have noticed the dual effects of friendship among youth, where friends may increase or decrease suicidal tendencies.

Among male youth, an emerging trend is a positive association between various personal worries and suicidal ideation across the types, but particularly related to school performance. As shown earlier, the worry about pocket money is independent of worries about family's economic standing regarding tuition or other educational expenditure. Worries about pocket money may indicate the youth's interests in some non-school related activities or controlling child-

rearing attitudes on the part of their parents. Other miscellaneous categories, including worries about computer game addiction or victimization of school violence, may also contribute to the increased level of suicidal ideation although each were reported by the minimal number of students.

Lastly, living with one or both parents having suicidal ideation increases the likelihood of suicidal ideation among youth, in particular, related to family disintegration among female and related to school performance among male youth. Whether due to similar personalities or psychological traits, poor familial relationships initiated by one member's suicidal tendency, or the same destabilizing family circumstances (which are not addressed in the analysis), parental suicidal tendency has an independent effect on youth suicidal ideation after controlling for all those stress, satisfaction, and socioeconomic variables in the model.

Suicidal Ideation Regardless of Types

Table 4 presents the results from the binomial logit analysis predicting suicidal ideation regardless of the types. Basically, the findings are consistent with the results shown in the analysis by types. A few noticeable results concern the effect of single parenting, which had conflicting effects across the types, and the effect of personal worries among male youth. Over a mere two-year interval, single parenting is losing its positive effect on suicidal ideation among female youth. For male youth, in the two years combined, single parenting actually decreases the odds of suicidal ideation. With single parenting as a structural variable of family disintegration, the results may suggest quickly the waning stigma against single parenthood in the society and among the youth themselves. Intriguingly, the worries about pocket money increases suicidal ideation among male youth in the second survey.

Discussion and Conclusion

Based on the theoretical frameworks in the literature and using the data on the youth's disclosed reasons for suicidal thought, this study defines three types of suicidal thought: family disharmony, self-identity, and school performance. They represent two clear dimensions of social disintegration and achievement pressures by the first and third type, respectively, and self-identity partly represents both dimensions. We hypothesized that the predictors of those dimensions of suicidal ideation may differ. The results are mixed. Consistent with the hypothesis, the predictors of suicidal ideation related to family disintegration and the ideation related to school performance show a bigger contrast while most predictors of suicidal ideation related to self-identity overlap with the predictors for either of the other two types. For example, the predictors increasing suicidal ideation related to family disintegration but not to school performance include dissatisfaction with the relationship with the parents among female youth, single parenting (in 2010 only) among male youth, and unstable housing among both female and male youth. The predictors increasing the odds of suicidal ideation related to academic performance but not to family disintegration include college education of both parents among female youth, living with two parents among male youth, and stress with school life and poor self-rated health for both female and male youth.

Still, some predictors—such as dissatisfaction with educational methods and talking to anyone other than the mother (such as friends, self, or others) when having worries among female youth and stressed with family life overall and the dissatisfaction with relationships with parents among male youth—consistently affect all three types or across the first and last types, prototypes of the two dimensions of social disintegration and achievement pressures.

In summary, this study explores the multidimensionality of suicidal ideation, synthesizing different theoretical frameworks in the literature. The differential predictors of those types demonstrate the usefulness

of the approach. The most noticeable substantive findings are as follows. First is the female positive effect of parents' college education on the odds of achievement-related suicidal ideation. This finding was consistent independently for the two years of survey while some other variables had unstable effects across the two surveys, reflecting the difficulty young women face in the context of changing gender-role expectations. Second, living with a single parent decreases the odds of suicidal ideation among youth, particularly male youth. This negative correlation indicates that familial disintegration, at least the structural aspect if not relationship aspects, may actually decrease the achievement pressures among youth.

Lastly, the considerable increase in the rate of suicidal ideation, especially related to self-identity and family disintegration, and some significant interaction effects between the predictors and survey year demonstrate a highly fluid environment of suicidal ideation among youth. Such fluidity may be the nature of suicidal "ideation" per se particularly among youth or may be due to the rapidly evolving social context of Korea. According to the findings, two years is never a short time for suicidal ideation.

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Table 1. Characteristics of the Sample, High School Students Aged 15-18

	Female				Male			
	2010		2012		2010		2012	
Variable	Mean	sd	Mean	sd	Mean	sd	Mean	sd
SCHOOL								
Stressed with school life	1.95	0.66	1.89	0.64	1.84	0.66	1.66	0.66
Dissatisfied, educational methods	2.88	0.90	2.90	0.93	2.81	0.87	2.92	0.94
PARENT(S) AND FAMILY								
Stressed with family life	1.53	0.60	1.54	0.62	1.52	0.61	1.44	0.59
Dissatisfied, relationship with parents	2.14	0.87	2.03	0.93	2.13	0.87	2.04	0.90
Single parent	0.15		0.17		0.15		0.15	
Parents, college educated	0.12		0.14		0.12		0.14	
Home owned or long-term leased	0.84		0.82		0.86		0.81	
PERSONAL								
Poor self-rated health	2.20	0.79	2.11	0.79	2.07	0.83	2.05	0.81
Recently most worried about (study, job, etc.)								
pocket money, deviance	0.21		0.19		0.24		0.23	
Person to consult with about concerns (mother)								
friends	0.53		0.44		0.42		0.39	
self	0.13		0.17		0.20		0.26	
others	0.10		0.14		0.18		0.18	
PERSON WITH SUICIDAL IDEATION								
Either parent with suicidal ideation	0.13		0.15		0.15		0.16	
N	930		760		1046		944	

Table 2. Distribution of Suicidal Ideation by Reasons: By Gender and Year

	female		male		Total	female		male		Total
	2010	2012	2010	2012		2010	2012	2010	2012	
Suicidal Ideation										
None	86.0	83.4	92.1	89.1	88.0					
Any reasons	14.0	16.6	7.9	10.9	12.0					
By reasons:						Those having suicidal ideation				
Family disharmony	3.7	4.5	2.0	3.8	3.4	26.2	27.0	25.3	35.0	28.3
Self-identity	2.3	4.3	1.1	2.4	2.4	16.2	26.2	13.3	22.3	19.9
School performance	8.1	7.8	4.9	4.7	6.2	57.7	46.8	61.5	42.7	51.8
Total	100	100	100	100	100	100	100	100	100	100
n	930	760	1,046	944	3,680	130	126	83	103	442

Table 3. Predictors of Suicidal Ideation among High School Students by the Reasons

Female (n=1690)	Family disharmony		Self-identity		School performance	
	RRR	z	RRR	z	RRR	z
Year 2012	1.27	0.93	3.09**	3.24	1.12	0.60
SCHOOL						
Stressed with school life	0.85	-0.80	2.40**	3.61	2.14**	4.83
Dissatisfied, educational methods	1.43*	2.48	1.33^	1.76	1.38**	3.01
PARENT(S) AND FAMILY						
Stressed with family life	1.78**	2.69	1.28	1.00	1.63**	3.09
Dissatisfied, relationship w/ parents	1.65**	3.21	1.77**	3.35	1.19	1.53
Single parent	1.49	0.92	2.96*	2.22	1.18	0.48
Single parent* Year 2012	0.62	-0.77	0.20*	-2.18	0.48	-1.36
Parents, college educated	1.75	1.58	2.17*	2.01	2.09**	2.92
Home owned or long-term leased	0.59^	-1.82	0.52^	-1.83	0.89	-0.43
PERSONAL						
Poor self-rated health	1.03	0.18	1.44^	1.95	1.48**	3.12
Person to consult with about concerns (mother)						
friends	2.18^	1.82	1.12	0.28	2.71**	3.48
Self	2.43^	1.82	2.06^	1.68	2.26*	2.39
others	2.77*	2.04	0.72	-0.54	1.16	0.33
Either parent, suicidal ideation	1.90*	2.10	1.88^	1.88	1.51^	1.73
Constant	0.00	-7.67	0.00	-9.00	0.00	-11.9

Note: LR chi square(df): Female=252(42) Male=179(31)

Table 3(cont). Predictors of Suicidal Ideation among High School Students by the Reasons

Male (n=1990)	Family disharmony		Self- identity		School performance	
	RRR	z	RRR	z	RRR	z
Year 2012	3.48**	3.54	2.97**	2.87	0.95	-0.21
SCHOOL						
Stressed with school life	0.95	-0.22	1.63^	1.85	2.08**	4.35
Dissatisfied, educational methods	---		---		---	
PARENT(S) AND FAMILY						
Stressed with family life	2.80**	4.59	1.70^	1.79	2.01**	3.88
Dissatisfied, relationship w/ parents	1.42*	2.20	1.31	1.31	1.26^	1.77
Single parent	3.25*	2.52	0.40	-1.43	0.39*	-2.40
Single parent* Year 2012	0.14**	-2.83	---		---	
Parents, college educated	---		---		---	
Home owned or long-term leased	0.42**	-2.84	0.85	-0.34	0.90	-0.35
PERSONAL						
Poor self-rated health	1.13	0.69	2.01**	3.30	1.59**	3.60
Recently most worried about (family, study, job, health, none)						
other personal issues	0.75	-0.51	0.58	-0.69	0.82	-0.57
personal* Year2012	1.95	0.97	2.64	1.05	2.66*	2.04
Either parent, suicidal ideation	1.80^	1.89	1.32	0.63	2.12**	2.98
Constant	0.00	-8.59	0.00	-8.59	0.00	-11.6

Note: LR chi square(df): Female=252(42) Male=179(31)

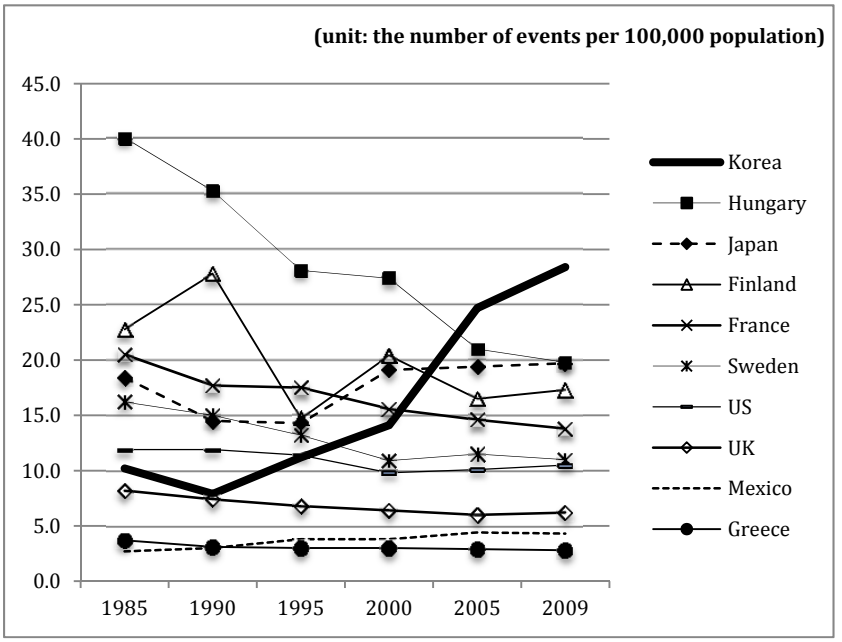
Table 4. Predictors of Suicidal Ideation among High School Students for All Reasons

	Female youth				Male youth			
	Model 1		Model 2		Model 3		Model 4	
	OR	z	OR	z	OR	z	OR	z
Year 2012	1.30^	1.77	1.53*	2.60	1.62**	2.90	1.27	1.23
SCHOOL								
Stressed with school life	1.63**	4.14			1.52**	3.35		
Dissatisfied, educational methods	1.38**	3.91			1.14	1.50		
PARENT(S) AND FAMILY								
Stressed with family life	1.60**	3.81			2.06**	5.27		
Dissatisfied, relationship w/ parents	1.39**	3.73			1.28*	2.47		
Single parent	1.05	0.25	1.57^	1.77	0.62^	-1.89		
Single parent* Year 2012	---		0.41*	-2.32	---			
Parents, college educated	2.04**	3.55			1.15	0.59		
Home owned or long-term leased	0.72^	-1.67			0.68^	-1.82		

Table 4(cont). Predictors of Suicidal Ideation among High School Students for All Reasons

	Female youth				Male youth			
	Model 1		Model 2		Model 3		Model 4	
	OR	z	OR	z	OR	z	OR	z
PERSONAL								
Poor self-rated health	1.32**	2.91			1.46**	3.80		
Recently most worried about (family, study, job, health, none)								
various personal issues	1.18	0.91			1.22	1.07	0.74	-1.04
Personal* Year2012	---				---		2.46*	2.40
Person to consult with, if worries (mother)								
friends	2.05**	3.36			1.08	0.31		
self	2.19**	3.13			1.50	1.56		
others	1.38	1.08			1.29	0.88		
PERSON WITH SUICIDAL IDEATION								
Either parent, suicidal ideation	1.62**	2.62			1.84**	3.16		
Constant	0.00	13.21			0.002	-12.70		
n	1690		1690		1990		1990	
LR chi square (df)	195(15)		200(16)		158(15)		164(16)	
Pseudo R2	0.136		0.139		0.128		0.133	

Figure 1. Trend in the Suicide Rate



Appendix

Table A1. Dependent and Independent Variables Used in the Analysis

Dependent Variable
Suicidal ideation:
During the past year, have you ever felt you would rather commit suicide? 1=yes, 0=no
Reasons for suicidal ideation:
Family disharmony; Economic difficulty
Loneliness; etc. (Friendship/colleague; Health; Job; Partner; Other)
School performance or school advancement
Independent Variables
SCHOOL
Stressed with school life overall, past 2 weeks: 1. no stress, 2=somewhat, 3=very much
Dissatisfied with educational methods: 1=very satisfied, 2=satisfied, 3=so so, 4=dissatisfied, 5=very dissatisfied
PARENT(S) AND FAMILY
Stressed with family life overall, past 2 weeks: 1. none, 2=somewhat, 3=very much
Dissatisfied with relationships with parents: 1=very satisfied, 2=satisfied,
3=so so, 4=dissatisfied
Living with: (two parents)
single parent: 1=yes, 0=no
All parents are college educated: 1=yes, 0=no
The family owns or long-term leases the home living in: 1=yes, 0=no
PERSONAL
Poor self-rated health: Self-rated health is 1=very good, 2=good, 3=so so, 4=poor, 5=very poor
R is recently most worried about: (study, family, job, health, none)
pocket money, friendship, computer games, dating, school violence, smoking/alcohol: 1=yes, 0=no
Person to consult with when R has worries: (mother)
friends: 1=yes, 0=no
self, solving by oneself: 1=yes, 0=no
others: sibling, father, school senior/junior, counselor, or teacher, etc.: 1=yes, 0=no
FAMILY WITH SUICIDAL IDEATION
Either or both parents having suicidal ideation: 1=yes, 0=no