Untapped work capacity among old persons and their potential contributions to the “longevity demographic dividend” in Japan

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Figure 4: Senior Population in Asia and the Pacific, 1950–2100

Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.
Aging marathon, 2085

65p / total (%) vs. 20-64 / total (%) for various countries:
- Cambodia
- China
- India
- Indonesia
- Japan
- Mongolia
- Republic of Korea
- Lao PDR
- Malaysia
- Philippines
- Sri Lanka
- Thailand
- Vietnam
Aging marathon, 2095

65p / total (%)

20-64/total (%)

- Cambodia
- China
- India
- Indonesia
- Japan
- Mongolia
- Republic of Korea
- Lao PDR
- Malaysia
- Philippines
- Sri Lanka
- Thailand
- Vietnam
Aging marathon, 2100
The NTA system will provide important new information relevant to the following four issues:

1. Intergenerational equity and poverty
2. Aging policy
3. Childbearing incentives
4. Analysis of the two demographic dividends

three
Demographic changes and implication on growth
Sequential gains from demographic dividends

**First demographic dividend** through the expansion of the workforce

**Second demographic dividend** through investing in human capital, leading to higher productivity

**Third demographic dividend** or longevity dividend, i.e. the gains from investing in longevity and longer working life
(1) Generation of the first demographic dividend
Economic support ratio for Japan, 1950-2050

First demographic dividend

Population aging

Year

1986

1996

2009

1996

0.82

0.77

1986

1996

Population aging

First demographic dividend
Most important graph in 17 Asian countries

Normalized by mean yl ages 30-49
First demographic dividend in 17 Asian countries

Year


Population: UN2015
(2) Generation of the second demographic dividend
The second demographic dividend arises when individuals increase demand for wealth to support their consumption in old age, particularly when the life span is prolonged!
Financial literacy score vs. GDP per capita (PPP), in log

Source: Morgan and Trinh (2016)
Higher financial literacy is likely to boost the demand for human capital
(3) Generation of the third demographic dividend
“Work Capacity”

• “Work capacity”: the extent to which older adults can potentially extend their work lives

(1) Milligan-Wise method: The relationship between mortality and employment

(2) Cutler-Meara method: The relationship between health and employment at prime age

(3) Over/under employment (Usui, Shimizutani and Oshio, 2015) presentation in 2015 by Usui
Data

- JSTAR (Japanese Study on Aging and Retirement)
- 1st wave in 2007 in 5 cities, 2nd wave in 2009 (5+2 cities) and 3rd wave in 2011/12 (7+3 cities)
- 4th wave (2013-2014) in 10 cities completed and now in data cleaning process
- The sample size in the baseline (5 cities in 2007, 2 cities in 2009, and 3 cities in 2011) is about 8,000 with a response rate of 60%
- Comparable with HRS/ELSA/SHARE
“Untapped Work Capacity”

- we have attempted to quantify the untapped work capacity in Japan in terms of health status
- We do not include a number of factors that affect labor-force participation (e.g., wages), but focus on health and disability to examine to what extent the labor supply of the elderly is limited
“Untapped Work Capacity”

- We employ a linear probability model to regress a binary variable of employment, which is equal to 1 if the individual is in the labor force (both working and looking for a job) and 0 if the individual is out of the labor force, with the following explanation...
“Untapped Work Capacity”

Variables:

1. Dummy variables for self-reported health status (five-point scale)
2. Prevalence of limitations on instrumental activities of daily living (IADLs)
3. CESD depression scale
4. Nagi physical ability index
5. Limitations in sensory organs (eyesight, hearing and chewing)
6. Individual attributes, such as sex, educational attainment and marital status. In addition, dummy variables for each municipality and survey years are included
“Untapped Work Capacity”

• We pool all the observations from the first to third waves of JSTAR collected in 2007, 2009, 2011 and 2013

• We use the sample of individuals aged 50 to 59 and combine both sexes for the baseline regression

• We implicitly assume that adults aged 50 to 59 are likely to be in the labor force unless their health is impaired. We have a sample of 4,350 person-year observations
“Untapped Work Capacity”

• We do not use the longitudinal feature of the JSTAR sample
• We are interested in the prevalence of work capacity (factors that determine the level of work capacity at a particular time) by age, rather than the incidence (i.e., factors that change work capacity over time) along with age
<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>S.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Coefficient</td>
<td>S.E</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.226</td>
<td>0.011**</td>
</tr>
<tr>
<td>Female (reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior high school graduates (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Senior high school graduates</td>
<td>0.036</td>
<td>0.018**</td>
</tr>
<tr>
<td>College graduates</td>
<td>0.033</td>
<td>0.019**</td>
</tr>
<tr>
<td>University graduates</td>
<td>0.069</td>
<td>0.020**</td>
</tr>
<tr>
<td>Currently married</td>
<td>-0.081</td>
<td>0.013**</td>
</tr>
<tr>
<td>Currently married x male</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Self-rate health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>0.041</td>
<td>0.014**</td>
</tr>
<tr>
<td>Very good (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Good</td>
<td>-0.005</td>
<td>0.013**</td>
</tr>
<tr>
<td>Fair</td>
<td>-0.060</td>
<td>0.020**</td>
</tr>
<tr>
<td>Poor</td>
<td>-0.276</td>
<td>0.043**</td>
</tr>
<tr>
<td>CESD&gt;=16</td>
<td>0.015</td>
<td>0.013**</td>
</tr>
<tr>
<td>IADL&gt;=1</td>
<td>0.001</td>
<td>0.011**</td>
</tr>
<tr>
<td>Nagi index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty in any activities&gt;=1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Walking 100 meters</td>
<td>-0.166</td>
<td>0.064*</td>
</tr>
<tr>
<td>Sitting continuously for two hours</td>
<td>-0.080</td>
<td>0.045**</td>
</tr>
<tr>
<td>Standing up from a chair after sitting for a long time</td>
<td>0.000</td>
<td>0.038**</td>
</tr>
<tr>
<td>Climbing several steps without using the handrail</td>
<td>-0.065</td>
<td>0.046**</td>
</tr>
<tr>
<td>Climbing one step without using the handrail</td>
<td>-0.023</td>
<td>0.058*</td>
</tr>
<tr>
<td>Squatting or kneeling</td>
<td>-0.040</td>
<td>0.035**</td>
</tr>
<tr>
<td>Raising hands above the shoulders</td>
<td>-0.022</td>
<td>0.054*</td>
</tr>
<tr>
<td>Pushing and pulling a large object such as a living-room chair or sofa</td>
<td>-0.048</td>
<td>0.052*</td>
</tr>
<tr>
<td>Lifting and carrying an object weighing more than 5kg</td>
<td>-0.124</td>
<td>0.052*</td>
</tr>
</tbody>
</table>
Regression Result 1
(SES)

- University graduates
- College graduates
- Senior high school graduates
- Junior high school graduates (reference)
- Not Married (reference)
- Married
- Female (reference)
- Male
Regression Result 2
(Health Status 1 IADL, CESD, Self-rate Health Status)

IADL=0
IADL>=1
CESD<16
CESD>=16
Poor
Fair
Good
Very good (reference)
Excellent
Regression Result 3  
(Health Status 2 (NAGI Index))

- Picking up a small object such as a one-yen coin with fingers
- Lifting and carrying an object weighing more than 5kg
- Pushing and pulling a large object such as a living-room chair or sofa
- Raising hands above the shoulders
- Squatting or kneeling
- Climbing one step without using the handrail
- Climbing several steps without using the handrail
- Standing up from a chair after sitting for a long time
- Sitting continuously for two hours
- Walking 100 meters
Regression Result 4
(Health Status 3 (Sensory Organ))

- Chewing ability problem
- Chewing ability no problem
- Hearing problem
- Hearing no problem
- Eyesight problem
- Eyesight no problem
“Untapped Work Capacity”

- The estimated regression for those 50-59 was applied to those aged 60-79 to compute the additional work force to be generated
Actual working and estimated work capacity in Japan
Actual working and estimated work capacity in Japan

More than 9 million workers
“Longevity (Silver) Demographic Dividend”

• Applied three different wage levels:
  • Case1: NTA’s age-specific labor income profile
  • Case2: Market wage rates
  • Case3: Minimum wages
Trends in economic support ratios in Japan
Trends in economic support ratios in Japan

Year:
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010
- 2020
- 2030
- 2040
- 2050

Economic support ratio:
- 0.50
- 0.55
- 0.60
- 0.65
- 0.70
- 0.75
- 0.80
- 0.85

Cases:
- Standard Case
- CASE I
- CASE II
- CASE III
Trends in economic support ratios in Japan

Economic support ratio

Year

Standard Case

CASE I

CASE II

CASE III
Trends in economic support ratios in Japan

- Standard Case (blue)
- CASE I (red)
- CASE II
- CASE III


Economic support ratio: 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85
Trends in economic support ratios in Japan

Economic support ratio

Year


Standard Case  CASE I  CASE II  CASE III  Series5
Trends in economic support ratios in Japan

Economic support ratio vs Year

- Standard Case
- CASE I
- CASE II
- CASE III
Trends in economic support ratios in Japan

- Standard Case
- CASE I
- CASE II
- CASE III
- Series 5

Year:
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010
- 2020
- 2030
- 2040
- 2050

Economic support ratio:
- 0.50
- 0.55
- 0.60
- 0.65
- 0.70
- 0.75
- 0.80
- 0.85

Legend:
- Standard Case
- CASE I
- CASE II
- CASE III
- Series 5
In Case II, the labour income to be generated by the additional elderly workers corresponds to 4.8% of Japan’s real GDP in 2014.

Longevity (Silver) demographic dividend
Trends in LABOR and WR (65p/25-29)
## Results of regression analysis for aged 60-64 versus various age groups

<table>
<thead>
<tr>
<th>WR(Age group)</th>
<th>Intercept</th>
<th>LABOR</th>
<th>CYCLE</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR(60-64/25-29)</td>
<td>1.136 *</td>
<td>-0.229</td>
<td>0.600 *</td>
<td>0.319</td>
</tr>
<tr>
<td></td>
<td>(0.067)</td>
<td>(0.116)</td>
<td>(0.170)</td>
<td></td>
</tr>
<tr>
<td>WR(60-64/30-34)</td>
<td>0.897 *</td>
<td>-0.112</td>
<td>0.436</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.093)</td>
<td>(0.169)</td>
<td></td>
</tr>
<tr>
<td>WR(60-64/35-39)</td>
<td>0.769 *</td>
<td>-0.057</td>
<td>0.251</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.081)</td>
<td>(0.159)</td>
<td></td>
</tr>
<tr>
<td>WR(60-64/40-44)</td>
<td>0.749 *</td>
<td>-0.107</td>
<td>0.061</td>
<td>0.066</td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td>(0.083)</td>
<td>(0.162)</td>
<td></td>
</tr>
<tr>
<td>WR(60-64/45-49)</td>
<td>0.794 *</td>
<td>-0.227</td>
<td>-0.192</td>
<td>0.220</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td>(0.089)</td>
<td>(0.151)</td>
<td></td>
</tr>
</tbody>
</table>

Values in parentheses below each coefficient are standard errors.

* is 5% significant level.
Malaysia
Malaysia’s silver demographic dividend

- Data source: 2011 *National Health and Morbidity Survey* (Institute of Public Health)

- Specification of regressions comparable to the Japanese case
<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Coefficient</th>
<th>S.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.278</td>
<td>0.034***</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.404</td>
<td>0.017***</td>
</tr>
<tr>
<td>Female (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethnic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malay (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chinese</td>
<td>0.046</td>
<td>0.020**</td>
</tr>
<tr>
<td>Indian</td>
<td>-0.013</td>
<td>0.029</td>
</tr>
<tr>
<td>Other Bumiputeras</td>
<td>0.006</td>
<td>0.031</td>
</tr>
<tr>
<td>Others</td>
<td>0.126</td>
<td>0.047***</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Primary education</td>
<td>0.040</td>
<td>0.030</td>
</tr>
<tr>
<td>Secondary education</td>
<td>0.097</td>
<td>0.031***</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>0.228</td>
<td>0.039***</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Single</td>
<td>0.049</td>
<td>0.042</td>
</tr>
<tr>
<td>Widow/Widower/Divorsee</td>
<td>0.034</td>
<td>0.027</td>
</tr>
<tr>
<td>Self-rated health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>0.041</td>
<td>0.020**</td>
</tr>
<tr>
<td>Moderate (reference)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bad</td>
<td>-0.119</td>
<td>0.061*</td>
</tr>
<tr>
<td>Depression scale</td>
<td>0.007</td>
<td>0.005</td>
</tr>
<tr>
<td>Difficulty in work and daily activities</td>
<td>-0.023</td>
<td>0.021</td>
</tr>
<tr>
<td>Eyesight</td>
<td>0.007</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Adjusted R squared = 0.193
The work capacity increased by 2.14 times

- The increased amount of labour income ranges from 0.55% (based upon NTA labour income) to 0.95% (based on minimum wages) of Malaysia’s GDP in 2011.

- The proportion of those 65 and over was 5.1% in Malaysia. In contrast, Japan’s 2009 population ageing level was 22.7%. The application of Japan’s 2009 population aging level to the Malaysian result pertaining to the labour income growth leads the growth rates from 2.5% to 4.2%.

- This range is highly comparable to the Japanese computational results.
Figure 4: Senior Population in Asia and the Pacific, 1950–2100

Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.
Caution! Increased income may affect consumption. This needs complex modelling work.
AGE AND PRODUCTIVITY
Age and productivity

*Work performance*

Estimates based on approaches from supervisors’ ratings, productivity records, and firm-level analyses tend to find a flat or hump-shaped relation (Skirbekk 2008, Warr 2004)

These are mainly measures of output, typically cross-sectional evidence, and some are based on subjective assessment

*Academic output, innovations and entrepreneurship*

Output is highest for academics and researchers in their 20s to 40s (Stephan and Levin 1988, Oster and Hamermesh 1998, Jones 2004)

Average ages for highest levels of creativity (musicians, writers, painters) are in the 30s and 40s (female authors write slightly more in their 50s) (Miller 1999). Entrepreneurship may peak in 20s and 30s (GEM 2007)
Causes of age-variation in productivity

Health impairments (mobility restrictions, back problems, reduced physical strength) decreasingly pose a hurdle for work. e.g., only 15% of 65-year-old Canadians have a health condition that justifies their exit from the workforce (Michaud et al. 1996).

Age-specific physical impairments have decreased substantially over time, e.g., Costa (2000) finds a decrease in chronic disease rates by 66% from the early 1900s to the 1970s and 1980s among men aged 50 to 74 for the US.

Cognitive ability scores predict job performance better than any other observable characteristic (Schmidt and Hunter 1998, Jenkins 2001).
Causes of age-variation in productivity

Fluid cognitive abilities (memory, learning, perceptual speed, and reasoning abilities) decline by age, crystallized abilities (vocabulary size and semantic meaning) are age-stable (Schaie 1994, Park et al. 2002). The decline in fluid abilities over the life cycle occurs in a similar fashion between nations and for both genders (Maitland et al., 2000; Park et al., 1999)

Job experience is an important job performance determinant (e.g., Golini et al. 2003). Additional experience benefits productivity only up to a point: It possibly takes 10 years to attain expert performance in analytic work and research (Ericsson and Lehmann 1996, Lesgold 1984). Only 0.6% of employers prefer workers with more than 10 years of experience (Econ 1998)
Age and productivity

<table>
<thead>
<tr>
<th>Experience improves productivity</th>
<th>Ability requirements affected by age reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience does not improve productivity</td>
<td>Ability requirements not affected by age reductions</td>
</tr>
</tbody>
</table>

Productivity vs. Age

Experience improves productivity: Experience improves productivity leads to increased productivity up to a certain age, after which productivity starts to decline.

Experience does not improve productivity: Even without improving productivity, age reductions can still affect ability requirements.
Age-productivity potential estimates

Focusing on determinants of productivity variation by age -> experience raises productivity in the first years in the labour market, cognitive ability decline implies lower productivity in the latter half (Skirbekk 2008).
Weighting abilities by their labor market relevance produces a hump-shaped age productivity curve.
Cognitive abilities by cohort

(Finkel et al. 2007)
Cross-sectional versus longitudinal data

Cross-sectional data

Plus: More datasets (particularly nationally representative), comparability across countries
Minus: Age-variation can be due to cohort effects rather than life cycle effects (e.g., Flynn 1987)

Longitudinal data

Plus: Possible to identify age-variation without cohort influences
Minus: Selective attrition bias, e.g., Seattle Longitudinal Study lost over half of initial sample by third wave (Schaie 1994). Learning effects of repetitions of similar tests, period influences can affect age-variation (Kelemen et al. 2007)
Finding comparable indicators of age productivity potential across nations

Survey responses on health and productivity often not comparable

- Self-assessed health or self-rated abilities differ by cohorts and culture (e.g., Kapteyn et al. 2008, von Gaudecker et al. 2009)

Measures with a high degree of objectivity may include

- Body Mass Index, Grip strength, Vision, Hearing
- Mental abilities that are minimally affected by culture or personal life experiences

Our Analysis:
- Comparable datasets from the US, Europe, Mexico, and China from 2000s
- Verbal immediate and delayed recall (10 words) as measure for cognitive abilities
- Control for “learning effects” and selective attrition
Ageing, defined as a given cognitive functioning level, differs by more than 25 years across countries.
Mean age-group-specific immediate recall scores
Different measures for the burden of aging

<table>
<thead>
<tr>
<th>Region</th>
<th>CADR*</th>
<th>OADR**</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States of America</td>
<td>0.10</td>
<td>0.19</td>
</tr>
<tr>
<td>Northern Europe (Denmark, England, Ireland, Sweden)</td>
<td>0.12</td>
<td>0.24</td>
</tr>
<tr>
<td>India</td>
<td>0.14</td>
<td>0.07</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>China</td>
<td>0.15</td>
<td>0.12</td>
</tr>
<tr>
<td>Continental Europe (Austria, Belgium, Czech Republic, France, Germany, Netherland, Poland, Switzerland)</td>
<td>0.18</td>
<td>0.25</td>
</tr>
<tr>
<td>Japan</td>
<td>0.19</td>
<td>0.30</td>
</tr>
<tr>
<td>Southern Europe (Greece, Italy, Spain)</td>
<td>0.32</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Survey data from HRS, SAGE, SHARE, and JSTAR.
*CADR: Cognition-adjusted dependency ratio
**OADR: Old-age dependency ratio (age 65+ / age 15-64)
Learning effects?
Selective attrition?
Flynn effect?
NTA and HRS

20 countries
GRACIAS