Demographic and technological change: Two megatrends shaping the labour market in Asia

Rafal Chomik
John Piggott
1. Will ageing inhibit productivity growth
2. Is technology change age-biased in labour markets?
3. How can technologies help with ageing pressures?
4. Which policy and research can help?
But first, some context
Life exp. increasing, in Asia at lower levels of development
And large declines in fertility
Which means ageing workforces

Population aged 50-64 as a share of 20-64, 1950-2050
At the same time, Asia has more tech innovation...
...and technology diffusion

Share of population using the internet, 1990-2016
Ageing prospects and tech-readiness in Asian countries

[Graph showing the relationship between ageing prospects and tech-readiness for various Asian countries, with data points for countries like US, Japan, Singapore, India, Indonesia, China, and others.]

Innovation 2015 vs Tech diffusion 2015 among different countries, highlighting high-ageing-high-innovation and high-ageing-low-innovation categories.
1. Will ageing inhibit productivity growth?
2. Is technology change age-biased?
3. How can technologies help with ageing pressures?
4. Which policy and research can help?
Productivity growth depends on several components

Δ Productivity

Δ Physical capital

Δ Human capital quality

Δ Technology

Infrastructure capital (e.g., transport, communications)

Production capital (e.g., computers, factories)

(e.g., Health, Education, Training, Experience)

Abstract processes (e.g., better legal, scientific, management, org)

Embodied (e.g., better computer, better factory)

Invention (when first discovered)

Innovation (when application developed)

Diffusion (when adopted across economy)
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Life-cycle saving → more investment → 2nd demog. dividend</td>
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<tr>
<td>2</td>
<td>Fewer workers per existing capital → higher productivity per worker</td>
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<tr>
<td>3</td>
<td>Slower growth → less attractive for FDI</td>
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<td>4</td>
<td>Ageing related spending → higher taxes → less attractive for FDI</td>
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## Ageing and productivity: Human capital channel

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<tbody>
<tr>
<td>1</td>
<td>Edu, health, cognition lower for older → avg. quality of labour lower</td>
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<tr>
<td>2</td>
<td>Greater experience of older → quality of the labour input</td>
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<td>3</td>
<td>Demography moving into most productive peak ~ age 40</td>
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<tr>
<td>4</td>
<td>Longer lives → investment in own HC</td>
</tr>
<tr>
<td>5</td>
<td>Fewer children → spending per child is higher → avg. HC higher</td>
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<tr>
<td>6</td>
<td>Healthy life expectancy → ageing retarded in successive cohorts</td>
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## Ageing and productivity: Technology channel

<table>
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<tr>
<th>1</th>
<th>If creativity lower by age $\rightarrow$ lower invention and innovation</th>
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<tbody>
<tr>
<td>2</td>
<td>More 2nd careers + access to credit $\rightarrow$ more entrepreneurs</td>
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<td>3</td>
<td>If older more risk averse $\rightarrow$ less venture capital</td>
</tr>
<tr>
<td>4</td>
<td>If older adoption tech slower $\rightarrow$ Lower diffusion</td>
</tr>
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<td>5</td>
<td>Fewer new workers $\rightarrow$ fewer new ideas invented and diffused</td>
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## Ageing and productivity: Combination of channels

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<tbody>
<tr>
<td>1</td>
<td>Smaller workforce → induce investment in capital and technology</td>
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<tr>
<td>2</td>
<td>Consumption composition → low or high productivity industries?</td>
</tr>
<tr>
<td>3</td>
<td>Ageing → less mobility? Or innovators move to high growth areas?</td>
</tr>
<tr>
<td>4</td>
<td>If older less skilled → skill-intensity of production in older region declines</td>
</tr>
<tr>
<td>5</td>
<td>Age-diversity in workplace → synergistic or polarising?</td>
</tr>
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So, what does the empirical literature say?
Productivity by age at individual level: Psychometric tests

Chomik et al. (2018)
Productivity by age at individual level: Skill tests

Mean numeracy

IT / computer skills
But older people today are not older people tomorrow

Tertiary educational attainment by age group, Singapore, 1990-2015, Cross-section v Cohort
Productivity by age at individual level: Work assessments

Older people more likely to do good things...

Core tasks
- Supervisor
- Peers
- Objective
- Self-rated

Creativity
- Supervisor or objective
- Self-rated

Training
- Supervisor or objective

Org. Citizen Behaviour
- General - Supervisor or peers
- General - self-rated
- Directed at others - Superv. or peers
- Directed at others - Self-rated
- Directed at org - Supervisor or peers
- Directed at org - Self-rated
- Directed at tasks - Supervisor or peers
- Directed at tasks - Self-rated

Safety
- Compliance - Self-rated
- Injuries - Objective
- Injuries - Self-rated

...and less likely to do the bad things...

Counter-productive behaviour
- Supervisor or peers
- Self-rated

Workplace aggression
- Self-rated

Workplace substance abuse
- Self-rated

Tardiness
- Supervisor or peers
- Self-rated

Absenteesm
- General - Objective
- General - Self-rated
- Sickness - Objective
- Sickness - Self-rated
- Non-sickness - Objective
- Non-sickness - Self-rated

Correlation with age (meta-analysis 400+ studies)
Productivity by age at team, plant, and firm level

- Aubert and Crepon 2004 (71k French firms)
- Crepon et al. 2002 (12k US manuf. firms)
- Gelderblom and de Kooning 2002 (78k French firms)
- Grund & Westergard-Nielsen 2008 (30k Danish firms)
- Haegeland and Klette 1999 (7k Norwegian firms)
- Hellerstein and Neumark 1995 (1k Israel firms)
- Hellerstein and Neumark 2004 (3k US firms)
- Hellerstein et al. 1999 (3k US firms)
- Ilmakunnas et al. 2004 (4k Finnish firms)
- Prskawetz et al. 2005 (95k Swedish firms)
- Prskawetz et al. 2007 (34k Austrian firms)
- Schneider 2006 (1k German manuf. firms)
- Lallemand and Rycz 2009 (500 Belgian ICT firms)
- Ours and Stoeldraijer 2011 (14k Dutch manuf. firms)
### Productivity by age at the aggregate level

<table>
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<tr>
<th>Study</th>
<th>Coverage</th>
<th>Result</th>
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<tr>
<td>Lindh and Malmberg (1999)</td>
<td>OECD 1950-1990</td>
<td>50-64 age group affects labour productivity positively</td>
</tr>
<tr>
<td></td>
<td>Teams in HR company. 2013-2016</td>
<td>Share of 65+ affects wage of team negatively</td>
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In fact, we may be seeing induced technological change.
And we’ve seen health (education & IQ) improvements
Interim conclusions

1. Asia is experiencing rapid ageing and technological change

2. These can affect productivity growth via physical and human capital and technological change

3. Evidence of productivity by age is mixed and confounded by changes in cohorts and selection
1. Will ageing inhibit productivity growth?
2. Is technology change age-biased?
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4. Which policy and research can help?
Skill-biased technological change

Annual average change in employment share, by occupation skill, 1990-2012

- Low-skilled occupations (intensive in nonroutine manual skills)
- Middle-skilled occupations (intensive in routine cognitive and manual skills)
- High-skilled occupations (intensive in nonroutine cognitive and interpersonal skills)
# Age-biased technological change: Empirical findings

<table>
<thead>
<tr>
<th>Study</th>
<th>Coverage</th>
<th>Effect of technological change</th>
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</table>
| Peng et al          | Employee-employer data 8 EU countries 1970-2007 | Older (and younger) high skill gain wage-share  
Older low skill gain empl-share  
Collective bargaining reduces age-bias of tech |
| Hujer and Radic     | Employee-employer data West Germany mid-1990s | Older high skill lose employment share  
Older low skill gain employment share |
| Beckmann            | Employee-employer data West Germany mid-1990s | Older lose empl-share |
| Aubert et al        | Employee-employer data France mid-1990s | Older more likely to leave, less likely to be hired  
Older lose wage-share |
| Ahituv and Zeira    | HRS individual data USA mid-1990s | Drives many older people to retire  
Drives those with wage gains to retire later |
Conceptualising age-biased technological change

People affected by skill biased tech change

People that find skill updating more difficult

Age biased tech change?

Older people
Skill types overall: More non-routine; less routine.
Skill intensity changes by cohort

Evolution of skills intensity of jobs for cohort born <1955, MYS 2001-2010

Evolution of skills intensity of jobs for cohort born >1974, MYS 2001-2010
Employment automation potential by age

Share of employment subject to potential automation, by age, 2016 or latest
Interim conclusions

1. Relationship between technology and employment is complex

2. The overall adverse effect of technology on employment is overstated

3. Technology often impacts the employment and wages of middle and lower skilled workers

4. The pattern of employment among older cohorts suggest that they will be disproportionately caught up in this impact

5. Non-adaptability of a relatively aged workforce may slow growth and lead to displacement
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Specific technologies and ageing pressures

Long Term Care
- Increasing demand, highly labour intensive
- Tech could free up formal & informal labour
- Examples include AT, ICT, Robots
- Functions include Monitoring, Connectivity, Perform tasks
- Tech inducement externalities to contribute to productivity growth

Healthcare
- Health tech and ageing intimately related
- Fiscal challenge
- Example includes Telehealth in NCD (chronic disease) management

Digital Identification Technology
- Cheaper/easier/safer than traditional centralised record keeping
- Induced by social protection/insurance requirements
- Likely large externalities via formalisation
1. Will ageing inhibit productivity growth?
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Policy needs

Production and infrastructure
- Sources of capital
- Technology infrastructure
- Narrow infrastructure inv. gaps in Asia

Human resource policies
- Education, training, and lifelong learning
- Getting foundation right
- Targeting lifelong learning
- Migration policy

Addressing inequality
- Life course approach to intervention
- Social protection

A new program:
Technology Adjustment Assistance
Research needs

Data and modelling capability
  • Asia lacks the data available in OECD
  • Examples include employee-employer data, skills data by age
  • New modelling needed on demog. effects on production, consumption, trade

Workplace and job design
  • Work-related factors promoting/inhibiting successful ageing
  • Job/task design and cognitive ability

Links between demography and productivity
  • Strength of inducement effect
  • Strength of consumption composition and endowment effect (e.g. G-Cubed)
  • Effectiveness of re-training programmes to offset age-biased tech change

Cost and benefit analysis of specific tech
  • Physical and tech infrastructure (e.g., DIT)