Young vs. Experienced Worker Substitutability in South Korea

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[1]The views of this presentation are only the author's own.

Motivation

- Low Fertility & Aging Population
  1. Asymmetric population change
  2. Population change (Size): Issue in trade & politics
  3. Composition (Asymmetric): Working-age population $\downarrow$
     $\rightarrow$ GDP **per capita** $Y/N \downarrow$

- Thus, South Korea has tried to improve
  1. (This paper) Labor force after retirement
  2. Female labor force participation
  3. Youth labor force
  4. Foreign labor force

Background: Experienced employment is deeply related to legal retirement age

- Legal retirement age: 60yrs old in South Korea. Public perceptions in South Korea (and Japan)
  1. "We cannot work after that age, even though we would like to/need to work"
  2. Not exactly same with U.S. or other EU countries

- Thus, improving experienced labor force and changing legal retirement age are related
  1. (This paper) If retirement age $\uparrow \rightarrow$ Concerns for crowding-out for youth employment or other age group
  2. Social insurance: National pension & Health care

- To address the possibility of crowding out
  $\rightarrow$ We first need to know if experienced workers and other group of workers are substitutes or complements

Projection: South Korea, 2025 – 2070

MIDDLE-OF-THE-ROAD SCENARIO

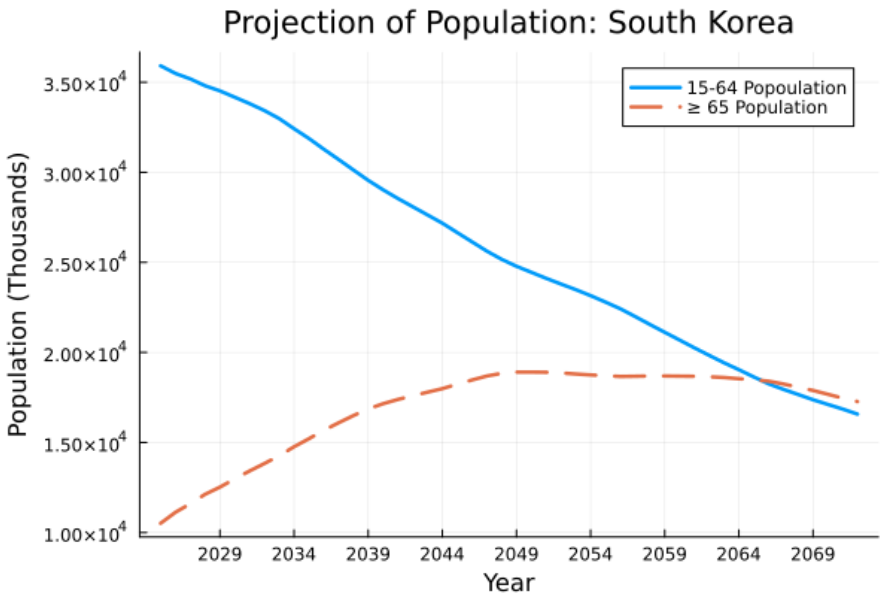

Figure: Working age & $\geq$ 65yr old

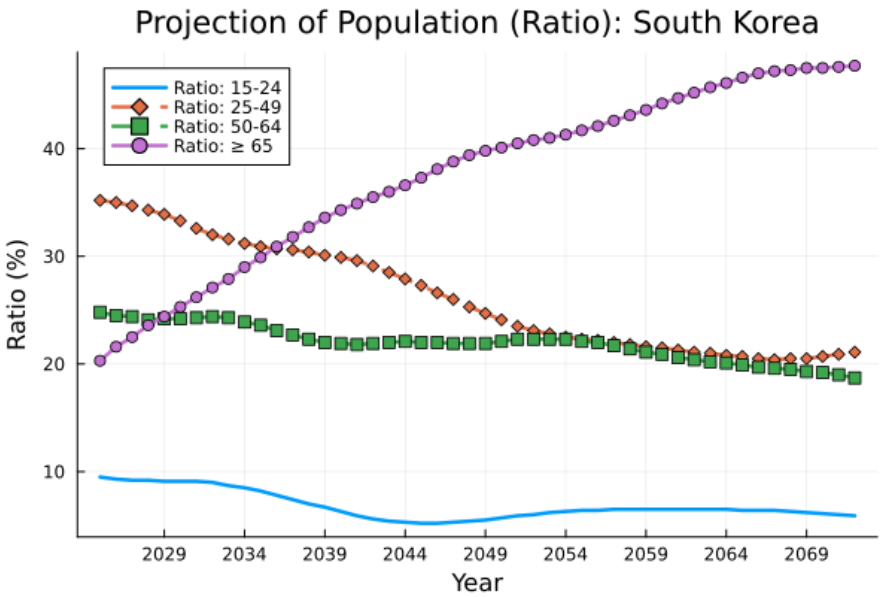

Figure: Ratio: Four groups

We Need More Youth & Experienced & Female

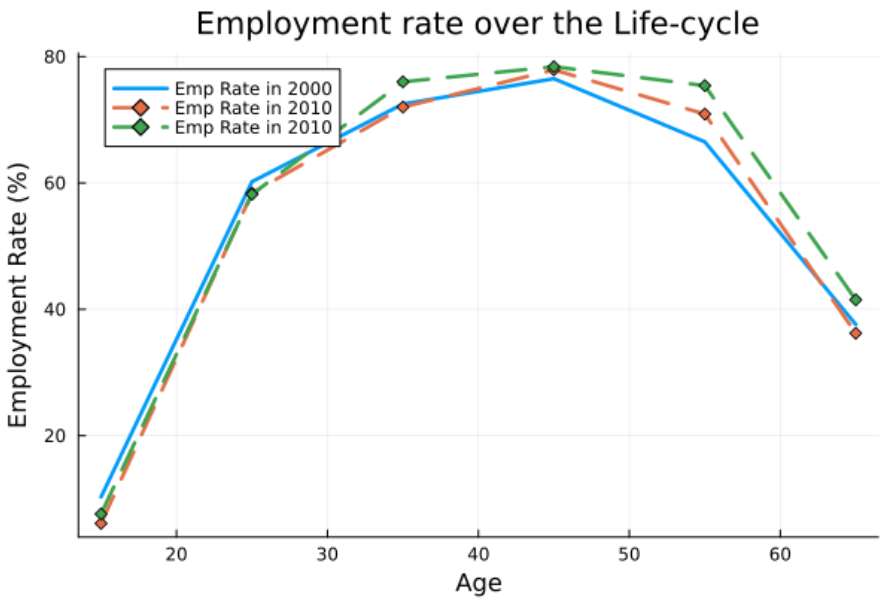

Figure: Emp Rate Profile

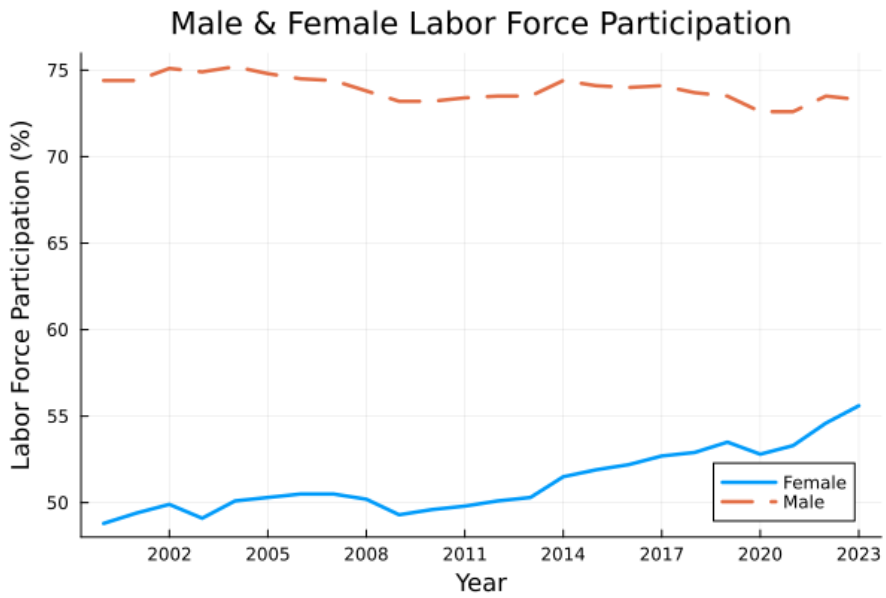

Figure: Female and Male

This Paper

- Research Question
  Are young and experienced workers substitutes or complements?

- What I do
  - Estimate the elasticity of substitution (ES) between young/middle/old age group using the workplace-level data

- Elasticity of substitution
  - % change of relative employment wrt. % change of relative prices
  - Personal view: Most policies have made hiring/searching be cheaper or more expensive

Main Findings & Contributions

1. Young, Middle and Experienced
   - Young & Others, and Experienced & Others: Close to Cobb-Douglas
   - Middle & Others: Substitutes

2. What's new
   - Estimate the CES production function directly & non-linearly using the workplace level data
   - Not stable, but can be directly used in the structural model $\rightarrow$ Allow us to implement policy experiments & counter-factuals

Meaning of Substitutes & Complements

- Perceptions for substitutes: Somewhat aggressive
  (Would I be fired due to other guy's hiring?)
- True, but want to discuss more
- If they are substitutes $\rightarrow$ Since they are substitutes, if one factor is scarce or hard to get, other factors could be used
  $\rightarrow$ Could be aggressive but might be better for efficiency

Background: Elasticity of Substitution in the CES Production Function

Simple example: Firm j at time t with idiosyncratic productivity z, revenue / value-added Y, young employment n_y and old employment n_o

$$Y_{jt} = z_{jt}\left[\alpha n_{y,jt}^{\rho} + (1-\alpha) n_{o,jt}^{\rho}\right]^{\frac{\nu}{\rho}}$$

Elasticity of Substitution: $\frac{\Delta\%\text{Rel. Emp}}{\Delta\%\text{Rel. Wage}} = \sigma = \frac{1}{1-\rho}$

1. If $\sigma > 1 (0 < \rho \leq 1)$: Substitutes
2. If $\sigma = 1 (\rho = 0)$: Cobb-Douglas
3. If $\sigma < 1 (\rho < 0)$: Complements

Estimation Method: Direct & Non-Linear

- Most of literature
  1. Indirect: Use FOCs $\rightarrow$ Linear estimation. Most of literature to estimate the ES between capital and labor using it
  2. Direct: Taylor 1st order (=linear) approximation (Kmenta, 1967)

- This paper: Estimate CES production function directly & non-linearly
  1. vs. Indirect: Assumption free. It usually assumes perfect competitive market, no adj. costs and etc.
  2. vs. Approximation: Approximation works well only if $\rho \rightarrow 0$
     $\rightarrow$ In other words, it works only when the production function is close to Cobb-Douglas, what we are not interested in

Data

- Workplace Panel Survey (WPS) from 2005 to 2019 (bi-annual data)
- Why WPS?
  1. Production function $\rightarrow$ We need firm-level panel data
  2. Workers for each age group: Only data publicly accessible
- Employment
  1. From 2005 to 2013: $<$ 30yrs old & $>$ 50yrs old
  2. From 2015 to 2019: $<$ 35yrs old & $>$ 55yrs old
- Other variables
  1. Revenues
  2. Capital: Property, Plant and Equipment (PPE)
  3. Others: Cost of Goods Sales (COGS) and Selling, General and Administrative Expenses (SG&A)

Results: Elderly and Other Workers

Estimation: $Y_{jt} = z_{jt}\left[\alpha n_{o,jt}^{\rho} + (1-\alpha) n_{-o,jt}^{\rho}\right]^{\frac{1}{\rho}}$				
	Model 1	Model 2	Model 3	Model 4
Elasticity of Substitution: $\sigma = \frac{1}{1-\rho}$	1.0823	1.0409	0.9935	0.9630
Control at the First Stage: PPE	Yes	No	Yes	No
Control at the First Stage: COGS	Yes	Yes	Yes	Yes
Control at the First Stage: SG&A	Yes	Yes	Yes	Yes
Workplace Level Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	No	N0	Yes	Yes
# of Samples	10,492	10,557	10,492	10,557

Table: Benchmark Result: Estimates of CES Production Function using WPS. PPE means Property, Plant and Equipment, COGS means the Cost of Goods Sold, and SG&A means Selling, General and Administrative Expenses.

Results: Middle and Other Workers

Estimation: $Y_{jt} = z_{jt}\left[\alpha n_{m,jt}^{\rho} + (1-\alpha) n_{-m,jt}^{\rho}\right]^{\frac{1}{\rho}}$				
	Model 1	Model 2	Model 3	Model 4
Elasticity of Substitution: $\sigma = \frac{1}{1-\rho}$	5.952	5.181	3.8168	3.6101
Control at the First Stage: PPE	Yes	No	Yes	No
Control at the First Stage: COGS	Yes	Yes	Yes	Yes
Control at the First Stage: SG&A	Yes	Yes	Yes	Yes
Workplace Level Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	No	N0	Yes	Yes
# of Samples	10,492	10,557	10,492	10,557

Table: Benchmark Result: Estimates of CES Production Function using WPS. PPE means Property, Plant and Equipment, COGS means the Cost of Goods Sold, and SG&A means Selling, General and Administrative Expenses.

Results: Young and Other Workers

Estimation: $Y_{jt} = z_{jt}\left[\alpha n_{y,jt}^{\rho} + (1-\alpha) n_{-y,jt}^{\rho}\right]^{\frac{1}{\rho}}$				
	Model 1	Model 2	Model 3	Model 4
Elasticity of Substitution: $\sigma = \frac{1}{1-\rho}$	2.9940	2.7624	4.9261	4.1322
Control at the First Stage: PPE	Yes	No	Yes	No
Control at the First Stage: COGS	Yes	Yes	Yes	Yes
Control at the First Stage: SG&A	Yes	Yes	Yes	Yes
Workplace Level Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	No	N0	Yes	Yes
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Main Takeaway

1. Experienced and Other groups: Close to Cobb-Douglas

2. Middle & Young workers: Substitutes & Structural changes
   - From other analysis: Middle and Experienced are more substitutes than Young and Experienced
   - Consistent with event-study analysis: Jung and Kang (2022) and Lee and Kang (2023) show that no significant effect on employment of young workers from the extension of legal retirement age

3. Implications
   - At this stage: More elderly workers $\rightarrow$ Labour costs $\uparrow$ $\rightarrow$ Firms: Incentive to reduce the next highest-paid workers
   - Issue 1. Seniority in South Korea
   - Issue 2, Vulnerability and Productivity

Policies

- (Again) Retirement age & National pension: Tightly linked
  - National pension: Keep delaying the starting point of getting $\rightarrow$ Adjustment of retirement age should be also considered

- Short-term issue: Higher labor costs from raising retirement age
  - 1st order discussion: Subsidy
    $\rightarrow$ Would be helpful for middle age workers
  - Benchmark: Policies in Japan
    Nowadays: Discussing keep hiring with re-contract. In this case, wages will be changed, the ES might be differently interpreted

- Long-term issue: Structurally, $n_y/n_o \downarrow$
  - If they are substitutes $\rightarrow$ Inequality $\uparrow$ but output loss $\downarrow$
  - If they are complements $\rightarrow$ Inequality $\downarrow$ but output loss $\uparrow$
    $\rightarrow$ Theoretical predictions. There are many things in practice, of course

What Can We Do More?

- We can use them in the structural model, which allows us to simulate the laboratory economy & counter-factual/ policy experiments

- Examples
  - Ex-ante experiments: Changes of legal retirement age
  - If the share of young/old workers changed, what are aggregate and distributional effects?
  - What would expected effects of subsidy wrt. legal retirement age?

Thank You!