The Demand for Older Workers: The Role Of Technology And Skill

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Demand for Older Workers and Technology

• Demand for older workers is “demand for composition of skills embodied in older workers”

• Some questions to answer along the way:
  – How does skill mix differ across older/younger workers?
  – How does technology differ across businesses with greater share of older workers?
Basic Approach

- Production relationship at firm level as function of skill composition for firm $j$ with technology $Z$:

$$y_{jt} = F(Z_{jt}, L_{1jt}, ..., L_{Hjt})$$

- Treating $Z$ as quasi-fixed, cost minimization (Shepherd’s lemma) yields for workers of type $s$ (where $S$ is share of type $s$ workers):

$$S_{sjt} = S(Z_{jt}, y_{jt}, w_{1jt} / w_{Hjt}, ..., w_{sjt} / w_{Hjt}, ...)$$

Joint Distribution of Skill and Age

- Aggregating across firms yields:

$$S_{at} = \sum_{j} (L_{jt} / L_{t}) S_{sjt}$$

- The accounting relationship between share of workers of age $a$ ($\lambda_{at}$), the demand for type $s$ workers, and the share of age $a$ workers with type $s$ skills ($\lambda_{ast}$), is given by:

$$\lambda_{at} = \sum_{s} \lambda_{ast} S_{st}$$

- We can characterize both the firm level relationships and the joint distribution:
  - The latter depends upon both supply and demand factors.
Theoretical Framework

• The general human capital of an employee is represented by $h$, which is estimated from the portable part of the individual’s wage rate.
• The firm-specific part of the wage rate is used to model compensation design issues.
• The un-normalized distribution $f(h)$ measures the firm’s human capital choices.
• We estimate the normalized distribution of human capital, $g(h)$.
• For details see Abowd, Lengermann and McKinney (2003).

Measuring of Human Capital: Estimation

$$\ln w_{it} = \theta_i + x_i \beta + \psi_{J(i,t)} + \varepsilon_{it}$$

• We use a decomposition of the log real annualized full-time, full-year wage rate ($\ln w$) into person and firm effects.
• The person effect is $\theta$.
• The firm effect is $\psi$, where $J(i,t)$ is the employer of $i$ at $t$.
• Continuous, time-varying effects are in $x\beta$, where some of the $x$ variables are human capital measures (labor force experience) and some correct for differential quality in our measure of full-time, full-year wage rate.
Human Capital: Individual Measure

\[ \hat{h}_{it} = \hat{\theta}_i + \text{labor force experience part of } x_{it} \hat{\beta} \]

- Individual human capital, \( h \), is the part associated with the person effect and the measurable time-varying personal characteristics (labor force experience).
- Our human capital measure is not a simple ranking by wage rate because of the removal of the firm effect and residual.
- In what follows, we exploit overall \( h \) but also components.
- Firm human capital measures, \( H \), are based on statistics computed from the distribution of \( g(h) \).

Data: Workforce Composition

- Two time periods: 1992 and 1997
- LEHD infrastructure dataset for three states
- Human capital measure: overall \( h \)
- Create shares of workforce in each skill quartile (1992 base)
- Linked to businesses at the pseudo-establishment level
- Summarized by kernel density estimate for each time period at each establishment
Data: Technology Measures

• Physical capital intensity (capital per worker) 1992/1997 ASM, 1992 BES
• Expenditures on computer investment as a fraction of total equipment investment, 1992 ASM/BES
• Ratio of inventories to sales 1992/1997 ASM/BES
• Ratio of purchases of computer software to sales 1992/1997 ASM/BES
• Two principal components of technology measures estimated for 1992
  – First component increases in each type of IT investment
  – Second component is increasing in software and decreasing in hardware
• Firm effect

Data: Selection Equation

• Log labor productivity (Sales/Employment)
• Log change in population of the county in which the business is located between 1992 and 1997
• Log change in sales in the two digit SIC industry in that county between 1992 and 1997
• Establishment size, location, legal form of organization (business)
Key Findings on Technology and Demand for Skills

- Technology principal component implies higher $h$
- Software relative to hardware component implies mixed effects on $h$, generally favors lower $h$
- Higher capital intensity implies higher $h$
- Higher inventory/sales implies higher $h$
- Higher firm effect implies higher $h$
- Higher probability of surviving (selection control) implies higher $h$
- All of above controls for establishment age, output of firm (scale) and local county relative wages

Demand Estimation Results

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- Technology Index
- Software Relative to Hardware
- Capital Intensity
- Inventory/Sales
- Mills Ratio
- psi
Explanation of Graphs

- Scatter plots by 2-digit industry (1992)
  - X-axis: proportion of individuals in industry who work at an establishment above median for the technology variable
  - Y-axis: \( \frac{\text{Proportion Human Capital} > \text{median}}{\text{Proportion Human Capital} < \text{median}} \)

- Human capital demand distributions
  - Effect of one standard deviation increase in the two technology components
Older Workers in Our Data

- Workers age 50+ account for about 17 percent of sample employment in 1992 and 18 percent in 1997.
- 10 percent of workers are at firms with no older workers in 1992 and about 9 percent of workers are at firms with no older workers in 1997
  - This percent varies substantially across industries with more than 25 percent of workers in personal services or misc. repair services working at a firm with no older workers.
  - The zero older worker firms pose an interesting measurement/estimation challenge given non-trivial fraction of zeroes.
Older Workers and Skill Mix

• Older workers have higher measured $h$
  – In 1992, 56% of older workers above median $h$ (1992 based median) and 44% of younger workers above median $h$
  – In 1997, 66% of older workers above median $h$ (1992 based median) and 54% of younger workers above median $h$
  – Older workers have higher $h$ in every 2-digit industry but gap varies considerably:
    • Relatively high gap in air transportation (SIC 45)
    • Relatively low in legal services (SIC 81)
    • Gap in 1997 in SIC 45 is 24% and 6% in SIC 81

Older Workers and Technology

• Workers at businesses with at least some older workers have:
  – Greater computer intensity (58% of workers at businesses with at least one older worker have computer intensity above median in 1992 vs. 47% for workers with no older co-workers)
  – Greater software intensity (45% of workers at “older co-worker” businesses have software intensity above median vs. 25% for workers with no older co-workers)
  – Greater capital intensity (51% above median for older coworker businesses vs. 43%)
Older Workers and Technology: Industry Variation

- These patterns vary greatly by industries:
  - Industries where workers with zero older coworkers are more computer intensive include:
    - Textile Mills (22), Transportation equipment (37), Instruments (38), Furniture and Equipment Stores (57)
  - Industries where workers with zero older coworkers are more software intensive include:
    - Chemicals (28), Instruments (37), Furniture and Equipment Stores (57), Business services (73)
  - Industries where workers with zero older coworkers are more capital intensive include:
    - Chemicals (28), Instruments (38), Business Services (73)
Younger v. Older Workers: Software Relative to Hardware

Change in Demand for Younger v. Older Workers: Manufacturing
Change in Demand for Younger v. Older Workers: Services