Trends in skills use and employment income over time

Evidence from the Longitudinal and International Study of Adults

International PIAAC Research Conference 2022
March 24th, 2022

Alexander El-Hajj
Center for Income and Socioeconomic Well-Being (CISWS), Statistics Canada
Objectives

• Summarize the Longitudinal and International Study of Adults (LISA)

• Explore LISA’s wide array of analytical capabilities

• Learn about the limitations of PIAAC data in the Longitudinal and International Study of Adults

• Examine the trends between skills use and employment income over time
Longitudinal and International Study of Adults (LISA)

Target population is Canadians in 2012 living in the ten provinces plus their future descendants

Sub-population 1: Canadians 15 years of age and older in 2012 (LISA sample)

Sub-population 2: Canadians 16 to 65 years of age in 2012 (PIAAC sample)

Sub-populations 1 and 2 form the basis of the LISA and ISA (PIAAC*) longitudinal populations respectively

Exclusions represent approx. 2% of the population and include those living in Canada’s territories, institutions, reserves, or collective dwellings
Longitudinal and International Study of Adults (LISA)

Published LISA Waves:
- 2012 (Wave 1)*
- 2014 (Wave 2)
- 2016 (Wave 3)
- 2018 (Wave 4)
*Integrated with PIAAC

Collects information from around 34,000 Canadians and more than 11,000 households (as of Wave 1)

Topics include: labour, education, health, and family

PIAAC Strategy
Follow the PIAAC respondents (from Wave 1) longitudinally along with the LISA respondents

Stratified multistage, multi-phase sampling design with probability proportional to size and the sample selection at two stages
Linked Administrative Databases

Used in study:
T4 Statement of Remuneration Paid
• Summarizes how much you’ve earned over the past year
• Years available: 2000-2019
• Use the employment income variable

Other Administrative databases linked to LISA:
• Longitudinal Immigration Database (IMDB)
• Pension Plans in Canada (PPIC)
• T1 Family Files (T1FF)

Total employment income before deductions including all salary, wages, bonuses, vacation pay, tips and gratuities, honorariums, director’s fees, and management fees.
Paper content

- Track PIAAC respondents over a four wave period (8 years) and use their PIAAC data in Wave 1 to assess changes over time

- Compares the changes in employment income over a four wave period among those who use the baseline skills in Wave 1 more or less frequently
  - Univariate analysis on skills use and employment income

- Additional analysis comparing the employment income growth among high and low literacy and numeracy proficiency levels

Wave 1 (2012)
- Binary skills use variables (high/low)
- Binary literacy and numeracy scores (high/low)
- Employment income

Wave 2 (2014)
- Employment income

Wave 3 (2016)
- Employment income

Wave 4 (2018)
- Employment income
Describing the PIAAC Skills Use Content

- Survey of Adult Skills (PIAAC)
- Each skill has three variables:
  - **Mean score** (e.g. READWORK);
  - Standard error (READWORK_SE – not in LISA); and
  - Skill use indices in categories 0-5 (READWWLE)
- Mean score and standard errors are standardized with a mean equal to 2 and a standard error equal to 1
- Low index value = rarely used skill
- High index value = frequently used skill
- Indices can be negative and are continuous
## Skills Indices Used to Assess Growth in Employment Income

<table>
<thead>
<tr>
<th>Work/every day life</th>
<th>Variable name</th>
<th>Index name</th>
<th>Group of tasks</th>
<th># of questions used</th>
</tr>
</thead>
<tbody>
<tr>
<td>At work</td>
<td>TASKDISC</td>
<td>Index of use of task discretion at work</td>
<td>Choosing or changing: the sequence of your tasks; how you do your work; the speed or rate at which you work; your working hours</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>LEARNATWORK</td>
<td>Index of learning at work</td>
<td>Learning new work-related things from co-workers or supervisors; learning-by-doing from the tasks you perform</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>INFLUENCE</td>
<td>Index of use of influencing skills at work</td>
<td>Instructing, teaching or training people; making speeches or presentations; advising people; persuading or influencing others; negotiating</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>PLANNING</td>
<td>Index of use of planning skills at work</td>
<td>Planning your own activities (or others); organizing your own time</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>READWORK</td>
<td>Index of use of reading skills at work (prose and document type texts)</td>
<td>Reading directions, memos, forms, or books</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>WRITWORK</td>
<td>Index of use of writing skills at work</td>
<td>Writing letters, memos, articles, or reports</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>NUMWORK</td>
<td>Index of use of numeracy skills at work (basic and advanced)</td>
<td>Make or use calculations, prepare charts</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>ICTWORK</td>
<td>Index of use of ICT skills at work</td>
<td>Use word processing, spreadsheet programs, or an internet browser</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>READYTOLEARN</td>
<td>Index of readiness to learn</td>
<td>Relate new ideas into real life; like learning new things; attribute something new; get to the bottom of difficult things; look for additional information for clarity</td>
<td>6</td>
</tr>
<tr>
<td>Everyday life</td>
<td>READHOME</td>
<td>Index of use of reading skills at home (prose and document type texts)</td>
<td>Reading directions, memos, forms, or books</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>WRITHOME</td>
<td>Index of use of writing skills at home</td>
<td>Writing letters, memos, articles, or reports</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>NUMHOME</td>
<td>Index of use of numeracy skills at home (basic and advanced)</td>
<td>Make or use calculations, prepare charts</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>ICTHOME</td>
<td>Index of use of ICT skills at home</td>
<td>Use word processing, spreadsheet programs, or an internet browser</td>
<td>7</td>
</tr>
</tbody>
</table>

ICT: Information and Communication Technologies
Methodology

- **Study sample:** Longitudinal PIAAC respondents with employment income (n=2,554)
  - Longitudinal respondent: Must be a respondent in all past and current waves (Wave 1, Wave 2, Wave 3, and Wave 4)
- **Skills use indices** are derived into binary variables:
  1. Frequently: When skill use index > 2.5
  2. Less frequently: When skill use index <= 2.5
- **Literacy and numeracy** proficiency levels are derived into binary variables:
  1. High proficiency: Level 5 and Level 4
  2. Low-moderate proficiency: Level 3, Level 2, Level 1, and Level 0

Calculating Employment Income

1. Convert employment income values to constant 2018 dollars
2. Sum employment income for each tax filer
3. Average the total income for the two tax years associated with each wave
   - Wave 1, tax years: 2011 and 2012
   - Wave 2, tax years: 2013 and 2014
   - Wave 3, tax years: 2015 and 2016
   - Wave 4, tax years: 2017 and 2018
   *Only needed income in one of the two tax years
4. Must have employment income in all waves to remain in sample

Longitudinal sample: 10,640
Longitudinal PIAAC sample: 4,032
Longitudinal PIAAC sample with employment income: 2,554
Employment Income Over Time by Skills Used At Work (High Use)

- **Task discretion** had the highest growth (18.1% or $14,529)
- **Planning** skills had the lowest growth (2.9%)
- **Decrease** in earnings growth between Wave 2 and Wave 3 among the reading, influencing, and planning skills
- **Planning skills** sees slight decrease between Wave 2 and Wave 4
- Skills cluster into three groups:
  - **Top and bottom** clusters show moderate growth
  - **Middle** cluster shows stagnant growth
Employment Income Over Time by Skills Used At Work (Low Use)

- **Influencing** skills had the **highest** growth (19.8% and $10,114)
- **Planning** skills had the **second highest** growth (18.5% or $9,826)
- By Wave 4, earnings among those who used **planning skills** less frequently surpasses those who used **ICT skills**, **task discretion**, and **readiness to learn skills** less frequently
- **ICT skills** had the **lowest** growth (9.4%)
• **Numeracy** skills had the **highest** growth (32.1% or $16,981) over the four waves

• **Reading** skills had the **lowest** growth (24.6% or $12,278) over the four waves

• **Numeracy** and **ICT skills** follow a more similar pattern in growth compared to **reading** and **writing skills**
Employment Income Over Time by Skills Used In Everyday Life (Low Use)

- **ICT skills** had the **highest** growth (12.9% or $7,303)
- **Numeracy skills** had the **lowest** growth (7.7% or $4,250)
- **Writing skills** and **ICT skills** follow a similar trend
- **Numeracy skills** stagnates after Wave 2 and slightly decreases from Wave 3 to Wave 4
Employment Income Over Time by Derived Literacy and Numeracy Proficiency Levels

<table>
<thead>
<tr>
<th>Literacy Score</th>
<th>Numeracy Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0: 0-175</td>
<td>Level below 0 to Level 3</td>
</tr>
<tr>
<td>Level 1: 176-225</td>
<td>Level 4 to Level 5</td>
</tr>
<tr>
<td>Level 2: 226-275</td>
<td>Level below 0 to Level 3</td>
</tr>
<tr>
<td>Level 3: 276-325</td>
<td>Level 4 to Level 5</td>
</tr>
<tr>
<td>Level 4: 326-375</td>
<td>Level below 0 to Level 3</td>
</tr>
<tr>
<td>Level 5: 376-500</td>
<td>Level 4 to Level 5</td>
</tr>
</tbody>
</table>

- **19.5% or $15,933 growth in income**
- **13.8% or $9,853 growth in income**
- **16.8% or $8,271 growth in income**
- **14.8% or $7,070 growth in income**
Key Findings

• Those using learning, task discretion, readiness to learn, and ICT skills more frequently at work saw a larger increase in employment income over a four wave period.

• Using task discretion skills more frequently at work resulted in the highest growth in employment income over the four wave period.

• Skills used more frequently at work were overall earning more by Wave 4 than any other skills category.

• Using skills outside of work more frequently translated to larger growth in employment income compared to other skills categories, not accounting for confounding factors.

• High numeracy scores resulted in the largest growth in employment income over the four wave period, compared to high literacy scores.
Discussion

• Linking LISA with the T4 tax slips provided granular and accurate employment income data.

• Multivariate analysis could help explain the clustering seen in the skills used at work frequently chart:
  - Possibility that some skills are correlated with each other (i.e., those who use ICT skills frequently at work also use numeracy skills frequently at work).

• LISA provides the potential to extend the analysis to examine the changes in employment income among skills used by various socioeconomic traits such as age, education level, and occupation.

• Consistent with the current literature, those who scored higher in the literacy and numeracy tests earned more in employment income (Heisz et al., 2016):
  - Explains the large gap in employment income between those who scored high and those who scored low-moderate in the literacy and numeracy tests.
References

Questions?

Thank you!