SHORT-TERM EARNINGS MOBILITY IN THE CANADIAN AND GERMAN CONTEXT: THE ROLE OF COGNITIVE SKILLS

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INNOVATION • EXPERIMENTATION • EVALUATION

Overview of study

Using data from the Canadian and German longitudinal components of the PIAAC, the study examined the associations between earnings mobility and:

- Cognitive skills
- Skill use and demands in employment
- Educational credentials

A comparison between Germany and Canada provides insight into if and how these associations vary in two distinct contexts:

- Germany: typically identified as a coordinated market economy that promotes job-specific skills
- Canada: typically recognized as a liberal market economy that promotes general skill acquisition

Primary research questions:

- To what extent do individual differences in cognitive skills contribute to differences in short-term earnings mobility?
- How does accounting for skill use and demands at work, education, and additional individual characteristics change this association?
- How do the trends observed differ between Canada and Germany?

Explanation of earnings mobility

Earnings mobility is commonly studied in two ways

- "Intraindividual" mobility measures change in earnings among the same individuals over time (e.g., Shorrocks 1978)
- "Intergenerational" mobility studies earnings growth and variance over time using cross-sectional data (e.g., Gottschalk and Moffitt 2009)

This study focuses specifically on short-term earning mobility over a four-year period among the same individuals

- It mainly measures upward or downward positional change in earnings percentiles
- Change in an individual's relative position in the earnings distribution

Types of mobility

- **No positional change** if earnings among all people increase or decrease to the same extent
- **Positive change** when people experience an increase in earnings relative to others
- **Negative change** when people experience a decrease in earnings relative to other

Human capital and earnings mobility

When it comes to the determinants of positional change, human capital is seen as a key driver

- Individuals with higher levels of education experience more upward mobility in their prime working years and less variation in earning (Heckman et al. 1998; Connolly and Gottschalk 2006; Rauscher and Elliott 2016)

Education is just one aspect of human capital that may generate differences in earnings mobility. In this study, we also consider:

- **Cognitive skill level**
- **Skill-based activities at work**
    - Broadly, activities that are non-routine and require information-processing skills are known to be associated with higher earnings (Green 2012; Ederer et al. 2015; Mane and Miravet 2016; Mainert et al. 2018)

Other factors contributing to positional change: Age and other individual factors, job switching and loss, change in hours, contract and collective agreements, firm characteristics

ANALYTICAL APPROACH

Data and samples

Main data:

- Survey responses and assessment data from Canadian LISA-PIAAC and German PIAAC-L
- Respondents who participated in the 2012 and 2016 surveys in both countries

All analyses excludes (in 2012 and 2016):

- Individuals who were unemployed, self-employed, or in school
- Did not report earnings
- The top and bottom 1% of the earnings distribution
- People with a small amount of missing information at the covariate level

With these exclusions, the final sample sizes are:

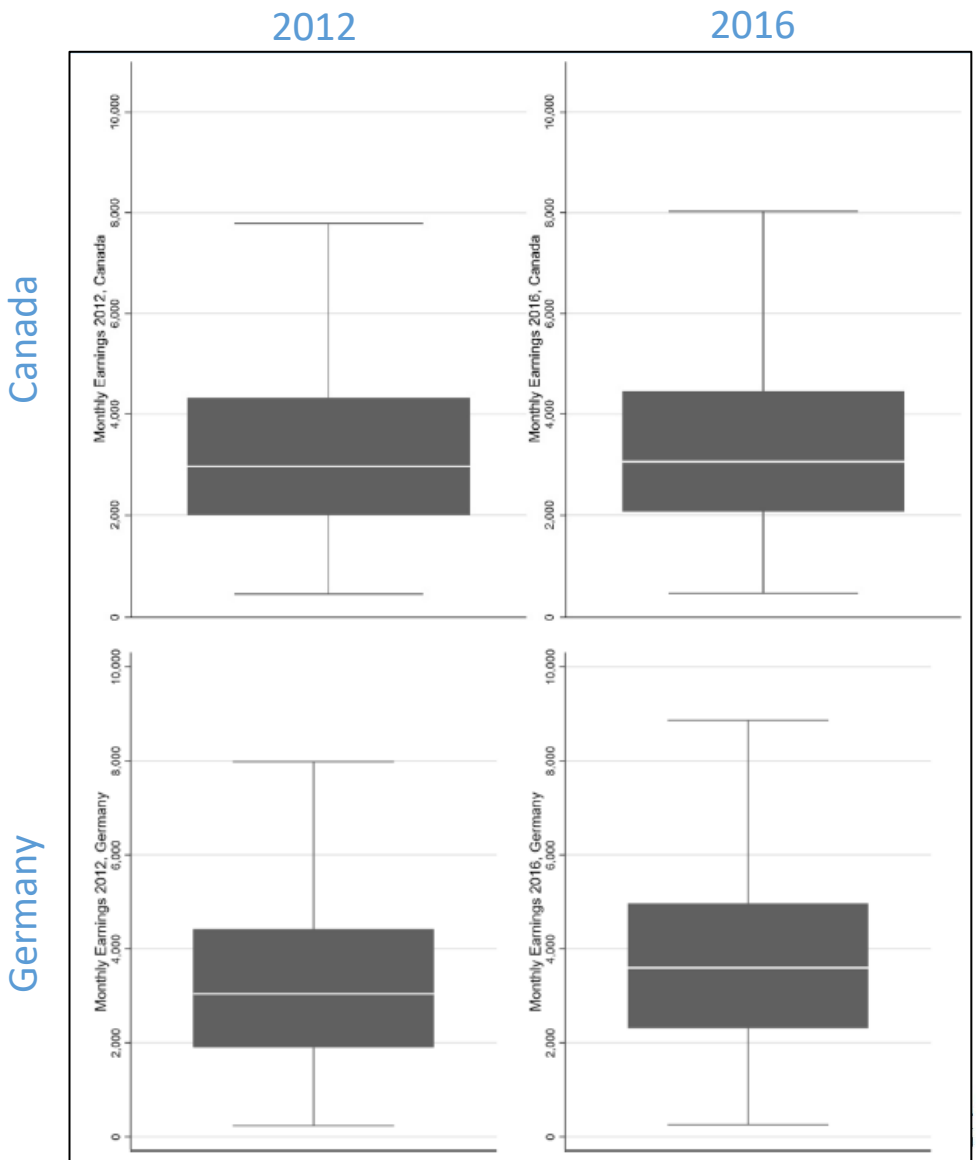
- 1,320 individuals in Germany
- 1,938 individuals in Canada

Dependent variable

Adjusted self-reported before-tax earnings (not including bonuses) in 2012 and 2016

Descriptive inequality and mobility indices use the original **continuous measure** of adjusted monthly earnings

Regression analysis transforms earnings information into **deciles to capture an individual's relative position** in the distribution of earnings in 2012 and 2016



Key explanatory variables

Numeracy skills in 2012

- In the descriptive index-based analyses, scores are transformed into three categories representing assessed skill level
- In the regression-based analyses, numeracy scores are included as a continuous measure

Education level in 2012

- High-school diploma or less (i.e., ISCED level 3 and under)
- Vocational post-secondary education below the bachelor's degree level (i.e., ISCED levels 4 & 5 with a VET specialization)
- Non-vocational post-secondary education below the bachelor's degree level (i.e., ISCED levels 4 & 5 without VET specialization)
- Bachelor's degree level or above (ISCED level 5A/6 +)

Skills at work in 2012

- Advanced math: simple algebra, formulas, advanced math, or statistics at work at least once a month
- Advanced reading: reading professional journals, publications, or books at least once a month
- Self-reported discretion at work

Analysis approach

Descriptive overview of earnings mobility

- The **Gini index** estimates the level of earnings inequality within each country in 2012 and 2016 – *higher values signal greater inequality*
- The Fields and Ok **mobility index** estimates the average overall level of change in monthly earnings between 2012 and 2016 – *higher values signal greater mobility*
- Fields **equalization index** measures of the extent to which mobility equalizes the distribution of earnings over time – *higher values signal greater equality*
- **Earnings decile transitions** – the proportion of respondents in Canada and Germany who changed their earnings decile between 2012 and 2016

Regression-adjusted overview of earnings mobility

- OLS regression models capture individual change in earnings percentile between 2012 and 2016
    - For example, an individual who moved from the 50th percentile in 2012 to the 65th percentile in 2016 would have upward mobility of 15 percentiles
- Separate analysis for Canada and Germany

FINDINGS

Earnings inequality (Gini) index

Higher values suggest greater earnings inequality

Overall, the results are:

- Similar across both time periods
- Slightly lower overall in Canada

Typically, in both context the Gini:

- Decreases at the highest numeracy levels
- Lowest among individuals with a BA degree or higher
- Lower among people who self-report performing advanced tasks at work

	Gini			
	Can		Ger	
	2012	2016	2012	2016
Overall	0.288	0.287	0.323	0.313
Numeracy Skills in 2012: Level 0/1	0.290	0.276	0.290	0.328
Numeracy Skills in 2012: Level 2/3	0.270	0.276	0.308	0.293
Numeracy Skills in 2012: Level 4/5	0.237	0.232	0.284	0.257
Advanced math at work in 2012	0.245	0.251	0.285	0.273
No advanced math in 2012	0.291	0.286	0.323	0.314
Advanced reading at work in 2012	0.265	0.258	0.289	0.274
No advanced reading in 2012	0.276	0.289	0.333	0.327
Low discretion at work in 2012	0.297	0.288	0.316	0.313
High discretion at work in 2012	0.267	0.277	0.317	0.302
Education: HS or less	0.265	0.278	0.299	0.299
Education: VET PSE (below BA)	0.263	0.282	0.305	0.272
Education: non-VET PSE (below BA)	0.293	0.265	0.281	0.249
Education: BA degree or above	0.248	0.237	0.265	0.250

Earnings mobility (Field and Ok) index

Examines overall level of earnings mobility between 2012 and 2016

Slightly higher in Canada, suggesting greater earnings mobility

In both countries:

- Individuals with lower numeracy levels, lower skill use at work, and lover education levels experience greater upward or downward mobility

	Fields and Ok	
	Can	Ger
	12–16	12–16
Overall	0.296	0.261
Numeracy Skills in 2012: Level 0/1	0.396	0.353
Numeracy Skills in 2012: Level 2/3	0.292	0.261
Numeracy Skills in 2012: Level 4/5	0.252	0.236
Advanced math at work in 2012	0.271	0.227
No advanced math in 2012	0.316	0.307
Advanced reading at work in 2012	0.268	0.239
No advanced reading in 2012	0.334	0.305
Low discretion at work in 2012	0.302	0.309
High discretion at work in 2012	0.289	0.240
Education: HS or less	0.325	0.293
Education: VET PSE (below BA)	0.292	0.255
Education: non-VET PSE (below BA)	0.297	0.223
Education: BA degree or above	0.278	0.241

Earnings equalization (Field) index

Positive and higher values signal that mobility had an equalizing effect on earnings inequality

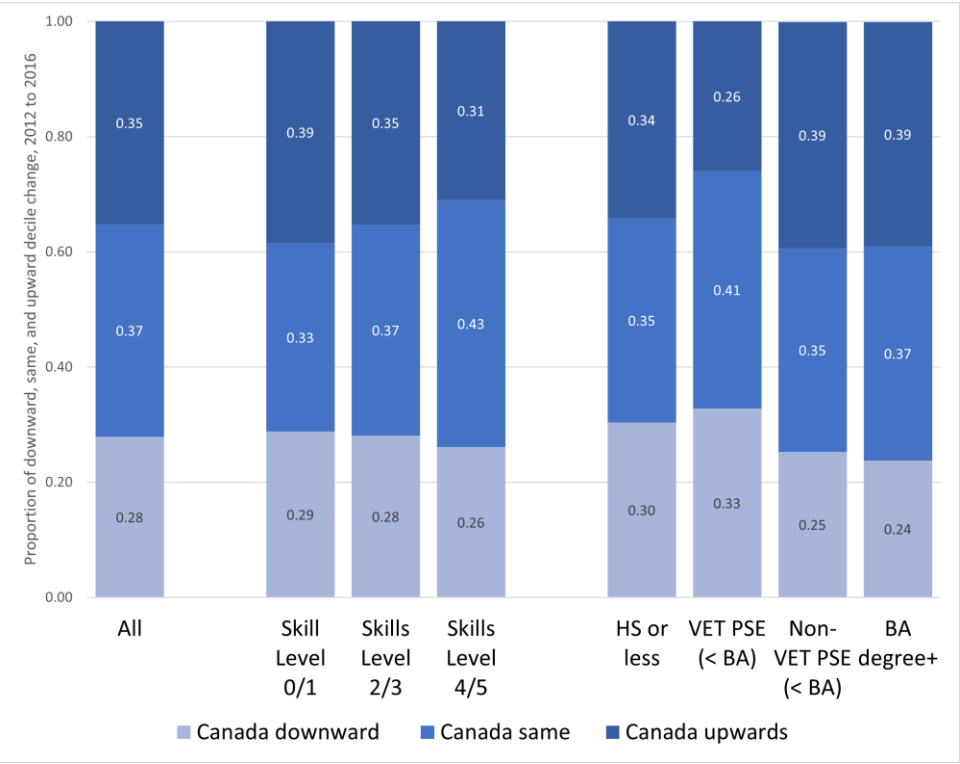
Mobility equalized earnings to a similar extent in Canada and Germany

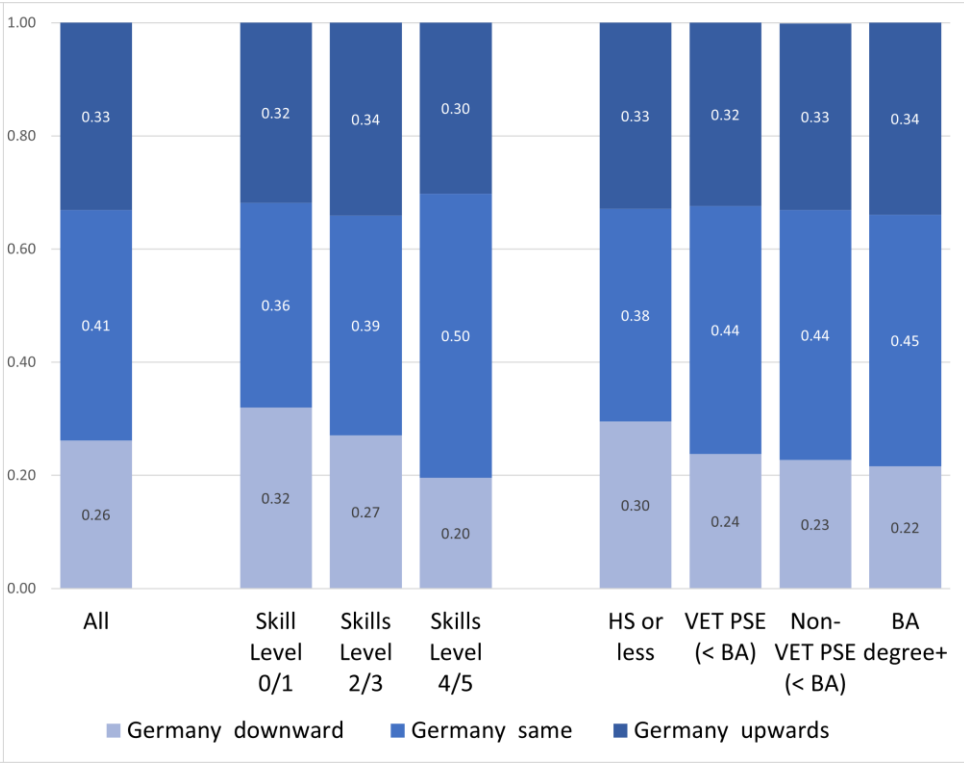
Mobility had a larger equalizing effect among individuals with:

- The lowest numeracy levels in Canada
- The highest numeracy levels in Germany

	Fields	
	Can	Ger
	12–16	12–16
Overall	0.061	0.056
Numeracy Skills in 2012: Level 0/1	0.117	0.054
Numeracy Skills in 2012: Level 2/3	0.052	0.062
Numeracy Skills in 2012: Level 4/5	0.073	0.080
Advanced math at work in 2012	0.047	0.053
No advanced math in 2012	0.071	0.066
Advanced reading at work in 2012	0.071	0.061
No advanced reading in 2012	0.047	0.065
Low discretion at work in 2012	0.070	0.056
High discretion at work in 2012	0.047	0.056
Education: HS or less	0.059	0.061
Education: VET PSE (below BA)	0.036	0.930
Education: non-VET PSE (below BA)	0.109	0.860
Education: BA degree or above	0.082	0.074

Proportion of downward, same, and upward decile change, 2012 to 2016





People with higher numeracy skill levels experience greater stability in Canada and Germany

Germany:

- A slightly higher proportion in the same earnings decile
- Upward mobility is similar across all education levels

Canada:

- Somewhat higher levels of upward and downward mobility
- Higher rates of upward mobility for those with a non-VET PSE credential or BA degree +

Multivariate analysis: Canada

	(1)	(2)	(3)	(4) *Controls Included*
Numeracy	2.433** (0.759)	2.212** (0.760)	1.315 (0.777)	0.449 (0.706)
Initial position				
Earnings decile in 2012[a]	− 2.518*** (0.224)	− 2.696*** (0.255)	− 2.869*** (0.250)	− 2.999*** (0.333)
Work characteristics in 2012				
Advanced math at work[b]		1.102 (1.182)	0.999 (1.170)	0.832 (1.096)
Advanced reading at work[b]		2.549* (1.264)	1.515 (1.193)	2.151* (1.045)
High discretion[c]		− 0.113 (1.094)	0.149 (1.062)	0.696 (0.951)
Education				
VET PSE (below BA)[d]			1.249 (1.730)	1.625 (1.454)
Non-VET PSE (below BA)[d]			5.393*** (1.615)	4.588** (1.491)
BA degree or above[d]			7.329*** (1.509)	5.760*** (1.634)

Model 1: Each standard deviation increase in numeracy scores relates to a 2.4 percentile upward change in the distribution of earnings

- This means that individuals with skill level four (i.e., high skills) are estimated to experience a relative change in earnings of roughly 9 percentiles compared to individuals who scored at level zero (i.e., low skills).

Model 2: Controlling for work characteristics reduces the numeracy coefficient slightly

Model 3: Education level has a large effect on the model and reduces the size and significance of the numeracy coefficient

Model 4: One all control variables are introduced, the association for numeracy is largely explained

Multivariate analysis: Germany

	(1)	(2)	(3)	(4) *Controls Included*
Numeracy	3.011*** (0.630)	2.715*** (0.635)	2.157** (0.675)	0.804 (0.539)
Initial position				
Earnings decile in 2012[a]	− 1.924*** (0.190)	− 2.145*** (0.232)	− 2.330*** (0.240)	− 2.756*** (0.289)
Work characteristics in 2012				
Advanced math at work[b]		0.861 (1.096)	0.829 (1.086)	1.154 (0.906)
Advanced reading at work[b]		3.137** (1.011)	2.337* (1.015)	3.034*** (0.873)
High discretion[c]		0.794 (0.907)	0.750 (0.912)	1.629* (0.817)
Education				
VET PSE (below BA)[d]			0.367 (1.731)	0.305 (1.390)
Non-VET PSE (below BA)[d]			3.318* (1.471)	3.431* (1.404)
BA degree or above[d]			4.761** (1.493)	3.910* (1.545)

Model 1: Similar to Canada, each standard deviation increase in numeracy scores results in a 3 percentile increase in positional earnings between 2012 and 2016

Model 2: Controlling for work characteristics reduces the numeracy coefficient slightly

Model 3: Unlike Canada, education does not totally reduce the significance of the numeracy coefficient

Model 4: One all control variables are introduced, the association for numeracy is largely explained

Other human capital related multivariate findings

In both Canada and Germany, Once all control variables are introduced in Model 4:

- Advanced reading skills at work has a positive relationship with earnings mobility, while advanced math does not
- Those with a non-VET post-secondary credential below or above the BA level have positive earnings change relative to those with a high school diploma or less
- There is no statistically significant difference in earnings mobility between individuals who have a VET PSE credential (below the BA level) compared to those with a high school diploma or less

CONCLUSION

Similarities across both context

The level of overall earnings inequality was slightly lower for those with higher skills and education levels

Those with higher skill and education levels experienced greater earnings stability and/or growth

In the baseline multivariate models, there was a positive relationship between skills and upward mobility

In the final multivariate models, advanced reading at work and non-VET credentials are associated with short-term upward mobility, controlling for all other factors

Differences by context

Canada:

- Earnings became more equal for individuals with lower numeracy levels
- Numeracy and education levels *did not have* distinct associations with upward mobility when modelled together

Germany:

- Earnings became more equal among individuals with higher numeracy levels
- Numeracy and education levels *had* distinct associations with upward mobility when modelled together