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Methods Series

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Online Tutorial on PIAAC Data Analysis

PIAAC(-L) in Applied Economic Research – A Literature Overview

- Goals of this tutorial:
 - Provide a (non-exhaustive) summary of existing economic research that uses PIAAC(-L) data (as of December 2022)
 - Highlight the potential of PIAAC(-L) data in applied research
 - Showcase the resources and best practices readily available in previous papers
- Instructor: Katharina Hartinger, M.Sc.
 - Research associate at the Chair of Public and Behavioral Economics at JGU Mainz
 - PIAAC enthusiast

Agenda

- I. PIAAC(-L) in education economics
- II. Interesting subsamples in PIAAC(-L)
- III. PIAAC(-L) and causality

PIAAC Overview

- Programme for the International Assessment of Adult Competencies
- Administered by the OECD (<https://www.oecd.org/skills/piaac/about/>)
- Large scale assessment of adult skills
 - Numeracy
 - Literacy
 - Problem-solving in technology-rich environments (ICT)
- First cycle: (mostly) 2011/12
- Second cycle: since 2018
- >40 participating countries
 - 5000 participants per country, aged 16-65

- Germany: PIAAC-L
- Administered by GESIS (<https://www.gesis.org/en/piaac/rdc/data/piaac-longitudinal>)
- Longitudinal version of PIAAC with three extra waves (2014, 2015, and 2016)

Part I – PIAAC(-L) in Education Economics

Returns to Cognitive Skills

- Hanushek, E. A., Schwerdt, G., Wiederhold, S., & Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review*, 73, 103-130.
- Focus on the role of cognitive skills in the labor market
- Mincer regression with cognitive skills for 23 countries
- Methodological contributions:
 - Use of PIAAC's cognitive skill measures in applied economic research (PVs, standardization, weights)
 - Focus on numeracy skills
 - PIAAC wage information

Returns to Skills Around the World: Evidence from PIAAC

E. Hanushek, G. Schwerdt, S. Wiederhold, L. Woessmann (2015)

	Pooled	Australia	Austria	Belgium	Canada	Cyprus	Czech R.	Denmark	Estonia	Finland	France	Germany
Numeracy	.178*** (.003)	.200*** (.012)	.179*** (.010)	.149*** (.009)	.193*** (.008)	.138*** (.019)	.124*** (.015)	.137*** (.008)	.179*** (.012)	.142*** (.010)	.174*** (.008)	.235*** (.013)
Experience	.022*** (.001)	.009 (.008)	.009 (.007)	.016** (.006)	.020*** (.004)	.033*** (.008)	.016** (.008)	.001 (.004)	.028*** (.009)	.015*** (.006)	.021*** (.005)	.003 (.008)
Experience ²	-.040*** (.003)	-.014 (.016)	-.012 (.015)	-.024* (.014)	-.030*** (.009)	-.054*** (.018)	-.039** (.019)	-.000 (.008)	-.079*** (.021)	-.032** (.013)	-.030*** (.011)	.008 (.018)
Female	-.149*** (.005)	-.125*** (.025)	-.136*** (.024)	-.020 (.018)	-.115*** (.015)	-.199*** (.036)	-.213*** (.035)	-.088*** (.014)	-.399*** (.024)	-.170*** (.017)	-.092*** (.026)	-.105*** (.026)
R ²	.208	.205	.260	.202	.226	.154	.207	.185	.259	.255	.258	.269
Observations	35,854	1,433	1,115	1,220	7,178	938	1,066	1,875	1,767	1,478	1,715	1,296
	Ireland	Italy	Japan	Korea	Netherl.	Norway	Poland	Slovak R.	Spain	Sweden	U.K.	U.S.
Numeracy	.241*** (.020)	.132*** (.016)	.184*** (.014)	.217*** (.014)	.183*** (.011)	.127*** (.007)	.191*** (.017)	.179*** (.019)	.228*** (.017)	.121*** (.009)	.225*** (.013)	.279*** (.017)
Experience	.028** (.012)	.011 (.008)	.018** (.007)	.033*** (.006)	.019*** (.007)	.021*** (.005)	.046*** (.008)	.011 (.012)	.024*** (.008)	.017*** (.005)	.000 (.009)	.018** (.009)
Experience ²	-.043 (.027)	-.005 (.019)	-.012 (.018)	-.056*** (.016)	-.036** (.015)	-.045*** (.011)	-.095*** (.020)	-.030 (.027)	-.037** (.017)	-.032*** (.010)	-.002 (.018)	-.035** (.018)
Female	.031 (.034)	-.121*** (.028)	-.329*** (.027)	-.384*** (.030)	.013 (.024)	-.119*** (.014)	-.122*** (.033)	-.250*** (.030)	-.023 (.027)	-.090*** (.014)	-.081*** (.0232)	-.176*** (.033)
R ²	.211	.162	.309	.343	.218	.220	.201	.169	.214	.217	.241	.308
Observations	1,031	1,018	1,322	1,441	1,013	1,520	816	1,198	1,191	1,316	1,786	1,105

Notes: Least squares regressions weighted by sampling weights. Dependent variable: log gross hourly wage. Sample: full-time employees aged 35–54 (Canada includes part-time employees). Numeracy score standardized to std. dev. 1 within each country. Experience² divided by 1000. Pooled specification includes country fixed effects and gives same weight to each country; R² refers to within-country R². Robust standard errors in parentheses.

Vocational Training

- Hampf, F., & Woessmann, L. (2017). Vocational vs. general education and employment over the life cycle: New evidence from PIAAC. *CESifo Economic Studies*, 63(3), 255-269.
- Focus on the labor market success of people with vocational versus general training in 16 countries
- Trade-off: early advantage and late disadvantage for people with vocational education – particularly strong in countries with apprenticeship systems
- Methodological contributions:
 - Makes use of PIAAC's extensive education and labor-market information, and the age structure
 - Cognitive skills used to account for (differential changes in) selection into education type over time

Central Exams

- Leschnig, L., Schwerdt, G., & Zigova, K. (2022). Central exams and adult skills: Evidence from PIAAC. *Economics of Education Review*, 90, 102289.
- Focus on the incentive structure associated with central exams: Accountability versus teaching-to-the-test?
- Variation in exam type over time and between school systems for 30 countries
- Positive skill implications of central exams – but: results suggest fading-out effect
- Methodological contributions:
 - Makes use of PIAAC's age structure
 - Cognitive skills used as the main outcome of the education production function
 - PIAAC merged with extensive data on (changes in) examination procedure in each country

Education and the Labor Market: Skill Mismatch

- Are employees well prepared for the jobs they do?
- Methodological contributions:
 - Cognitive skills in combination with detailed information on occupation (ISCO-08)
 - Key challenge: What are the required skills for a given occupation in a given country?
- Pellizzari, M., & Fichen, A. (2017). A new measure of skill mismatch: theory and evidence from PIAAC. *IZA Journal of Labor Economics*, 6(1), 1-30.
 - *Self-reported mismatch, skill proficiency, & skill use at work*
- Pérez Rodríguez, S., van der Velden, R., Huijts, T., & Jacobs, B. (2021). Identifying literacy and numeracy skill mismatch in OECD countries using the job analysis method.
 - *Job analysis method*

Part II – Interesting Subsamples

Early-Career Workers

- Arellano-Bover, J. (2021). Who gets their first job at a large firm? The distinct roles of education and skills. *AEA Papers and Proceedings*, 111, 465-69.
- Focus on the career prospects of young workers in 31 countries
- Positive selection into large firms based on education and skills
 - Interesting differences in the relative role of formal education and skills between Europe and other continents
- Methodological contributions:
 - Makes use of PIAAC's job and age information
 - Cognitive skills used as a main observable characteristic that selection into large firms is based on

Teachers

- Hanushek, E. A., Piopiunik, M., & Wiederhold, S. (2019). The value of smarter teachers: International evidence on teacher cognitive skills and student performance. *Journal of Human Resources*, 54(4), 857-899.
- Focus: Relating teacher skills in a country to student performance in 31 countries
- Variation in teacher skills within-country and between-subject
- Teachers' cognitive skills strongly related to student performance
- Methodological contributions:
 - Cognitive skills (numeracy and literacy) of teachers as the key explanatory variable
 - PIAAC-based teacher skills measure combined with PISA student outcomes
 - Canada as a benchmark due to sample size

Migrants

- Hartinger, K., Resnjanskij, S., Ruhose, J., & Wiederhold, S. (2021). Individualism, human capital formation, and labor market success.
- Hartinger, K. (In progress). Individualism, creativity, and innovation.
- Focus on the role of culture in human capital investments and innovation-conducive behavior in 22 countries
- Epidemiological approach: Comparison of migrants from different cultural origins within the same destination country
- Strong positive effect of individualism on skill investments and innovation
- Methodological contributions:
 - Make use of PIAAC's country of birth & language information
 - Numeracy skills used as the main outcome or an important mechanism
 - Region-level analysis
 - PIAAC-L value added approach

Migrants and Natives in a Specific Destination Country

- Richwine, J. (2022). Skill deficits among foreign-educated immigrants: Evidence from the US PIAAC. *PLoS ONE*, 17(8).
- Focus on the migrant-native wage gap in the United States
- Differences in *marketable skills* explain a large share of the income differences between migrants and natives of similar age and formal education
- Methodological contributions:
 - Zooming in on one specific country
 - Cognitive skills used as the mechanism of interest behind the migrant-native wage gap

- Gauly, B., & Lechner, C. M. (2019). Self-perfection or self-selection? Unraveling the relationship between job-related training and adults' literacy skills. *PLoS ONE*, 14(5).
- Selection into job-related training based on literacy skills – but no increase in skills after training
- Gauly, B., Daikeler, J., Gummer, T., & Rammstedt, B. (2020). What's my wage again? Comparing survey and administrative data to validate earning measures. *International Journal of Social Research Methodology*, 23(2), 215-228.
- Discrepancies between self-reported and administrative wages

Part III – PIAAC(-L) and Causality

Labor Market Conditions

- Arellano-Bover, J. (2022). The effect of labor market conditions at entry on workers' long-term skills. *Review of Economics and Statistics*, 104(5), 1028-1045.
- Focus: Effect of career-entry labor-market conditions on long-term skill development in 19 countries
- Workers who *enter* the labor market in times of higher unemployment, have lower skills later in their career
- Exogenous variation in timing of recessions
- Methodological contributions:
 - Makes use of PIAAC's age structure and education information
 - Cognitive skills used as the main outcome
 - International evidence combined with PIAAC-L-based findings

Returns to ICT Skills

- Falck, O., Heimisch-Roecker, A., & Wiederhold, S. (2021). Returns to ICT skills. *Research Policy*, 50(7).
- Focus on the role of ICT skills in the labor market in 19 countries
- Substantial wage returns to ICT skills internationally and in Germany
- Two instrumental-variable approaches to isolate exogenous variation in ICT skills through internet availability.
- Methodological contributions:
 - Cognitive skill dimension: problem solving in technology-rich environments
 - IV strategies in PIAAC

PIAAC(-L) in Applied Economic Research – Summary

- PIAAC(-L) is used in many different economic contexts
 - Returns to skills (numeracy & ICT skills; teacher skills)
 - Evaluation of education systems (vocational training, entrance exams)
 - Labor market (skill mismatch, recessions, on-the-job training)
 - Migration and culture
 - Survey methodology (self-reported wage information)
- Existing literature provides important guidance for PIAAC data analysis
 - Dealing with skill measures (PVs, weights, standardization)
 - Handling key variables (wage and education information, migration status)
 - Subsample analysis
 - Combining PIAAC with other data sources
 - Incorporating PIAAC-L

Thank you for participating in this
online tutorial!

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