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January 3 to 5, 2014
Philadelphia, Marriott and Convention Center
Friday, January 3, 2014, 14:30-16:30 pm
Pennsylvania Convention Center, 203-B
Chair: Heiner Rindermann & Rik Hafer
Discussant: Susan M. Collins
HR: 2., 14:50-15:06-15:10

Session: Cognitive Human Capital, Growth and Wealth – Perspectives of Economics and Psychology
Garett Jones et al., Heiner Rindermann, Eric Hanushek et al., Gerhard Meisenberg, James Heckman et al.

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The Psychology Approach to Macroeconomics

Outline

1 Cognitive human capital research

Human capital research,
the use of psychological attributes to explain economically productive behavior,
started in the late 1950s in economics.

Individual level

Jacob Mincer (1922-2006)	Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy*, *66*, 281-302.
Theodore W. Schultz (1902-1998)	Schultz, Th. W. (1961). Investment in human capital. *American Economic Review*, *51*, 1-17.
Gary S. Becker (*1930)	Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, *70*, 9-49.

National level

In the 1990s began to apply this approach to macroeconomics [a. cross-national differences, b. historical development].

Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, *106*, 407-443.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, *107*, 407-437.

In the first studies **educational measures** (averages of nations in highest degree or years of schooling) were used to predict economic growth.

Eric Hanushek: Use of outcome variables of education, **student assessment test measures**.

Hanushek, E. A., & Kimko, D. D. (2000). Schooling, labor-force quality, and the growth of nations. *American Economic Review*, *90*, 1184-1208.

2 Psychometric intelligence test collection from Lynn and Vanhanen (2002-2012)

Richard Lynn (British psychologist) and
Tatu Vanhanen (Finish political scientist) collected results

- from studies using *different intelligence tests* (Raven, CFT, Wechslers etc.)
- in *different countries*
- at *different measurement points*
- and *standardized* them on one scale (UK, 1979: "**Greenwich-IQ**").

2002 for 81 countries measured data, 104 estimated
(based on neighboring countries with similar ethnic-racial groups).

↓

2012 for 160 countries measured data, 41 estimated.

The measures and the entire approach were criticized for
- small sample sizes,
- low representativity of samples,
- selectivity of sample selection and
- ideological bias

(e.g., Barnett & Williams, 2004; Hunt, 2012; Moreale & Levendis, 2013; Wicherts et al., 2010).

Yes, there were errors (e.g., Equatorial Guinea).

Both authors are together nearly 170 years old.

However, the data were continuously corrected, completed and improved.
The 2002 estimated and 2012 measured data correlate with

r=**.92** (*N*=48, 2012 data only psychometric) or
r=**.89** (*N*=68, 2012 data psychometric + SAS).

Data and causes (evolution vs. other) are two different issues.

Data were successfully used by different authors for different research questions; some examples:

Weede, E. & Kämpf, S. (2002). The impact of intelligence and institutional improvements on economic growth. *Kyklos*, *55*, 361-380.

Jones, G. & Schneider, W. J. (2006). Intelligence, human capital, and economic growth: A Bayesian Averaging of Classical Estimates (BACE) approach. *Journal of Economic Growth*, *11*, 71-93.

Ram, R. (2007). IQ and economic growth: Further augmentation of Mankiw-Romer-Weil model. *Economics Letters*, *94*, 7-11.

Eppig, Ch., Fincher, C. L. & Thornhill, R. (2010). Parasite prevalence and the worldwide distribution of cognitive ability. *Proceedings of the Royal Society B*, *277*, 3801-3808.

Potrafke, N. (2012). Intelligence and corruption. *Economics Letters*, *114*, 109-112.

3 Student assessment and psychometric test combinations

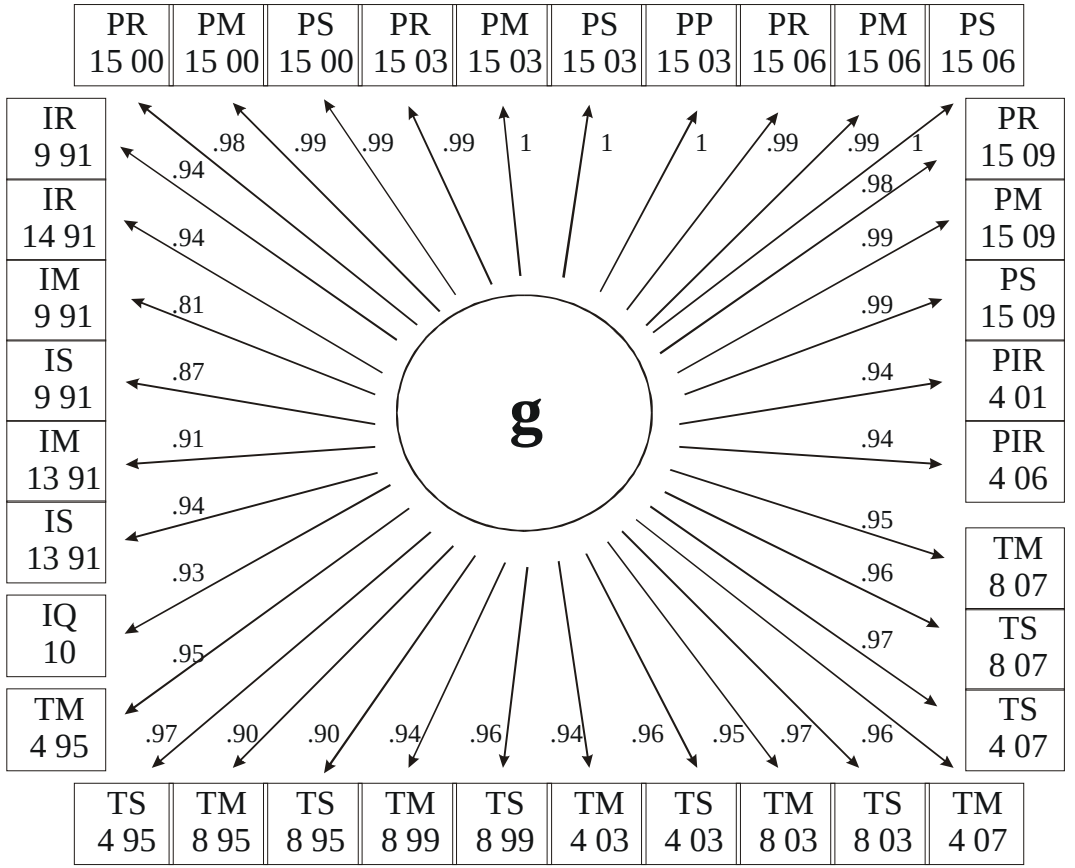
Hanushek & Kimko (2000); Hanushek & Woessmann (2008):

Student assessment study (SAS) results from TIMSS, PISA, PIRLS
(and older or regional studies, additionally IMO;
Pritchett & Viarengo, 2009; Rindermann, 2011).

Both approaches measure cognitive abilities:

- The ability to think (intelligence), knowledge (true and relevant knowledge) and the intelligent use of this knowledge.
- Cognitive demands and processes in solving IQ and SAS tasks are similar.
- At individual and national level the causal determinants for development are similar.
- At individual and national level the empirical correlations are very high (e.g., Kaufman et al., 2012: individual latent r=.83).
- Strong *g*-factor (individual: Rindermann, 2007a; Sonnleitner et al., 2013).

Shown are as a result of factor analysis the loadings (λ) on the first unrotated factor (*g*-factor). λ vary between –1, 0 and +1. At the national level (country differences) the λ are with λ=.90 to 1.00 extremely high.

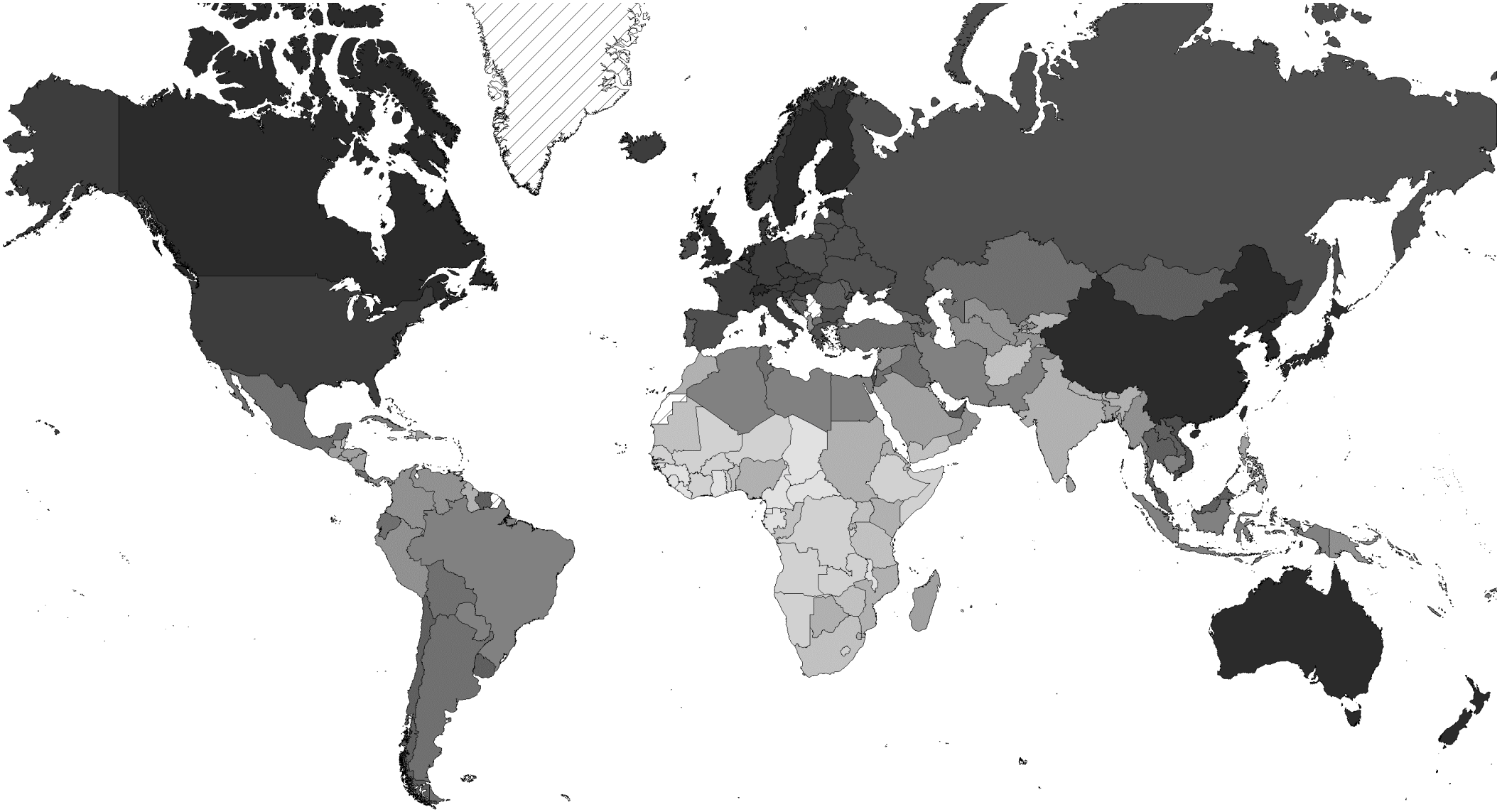


G-factor of cognitive competences at national level (Rindermann, 2007b, updated; uncorrected data, *N*=106 used by FIML, 1991-2009/2010) (PR: PISA Reading, PM: PISA Math, PS: PISA Science, PP: PISA Problem Solving, first number age; PIR: PIRLS Reading, first number grade; TM: TIMSS Math, TS: TIMSS Science, first number grade; IR: IEA Reading, IM: IAEP Math, IM: IAEP Science, first number grade; IQ: Lynn & Meisenberg/Vanhanen collection 2010; except for IQ the last number always the survey year)

Best, their combination, higher representativity, reliability and validity, more countries covered,
correlation of cross-country differences:

- *r*=**.85** (*N*=88, measured, uncorrected values) and
- *r*=**.86** (*N*=107, including estimated, corrected values).

IQ-SAS-combinations by Rindermann (2007b),
Lynn & Meisenberg (2010) and Meisenberg & Lynn (2011) and
Lynn & Vanhanen (2012).



Map with corrected cognitive competence sum means
(*N*=201 countries, darker means higher competence, hachured: no data)

4 Economics and psychology: Terms

Skill vs. intelligence/ability/competence

Economists use the terms “skill”, “skills” or “human capital”.

Psychologists use the terms “intelligence”, “*g*”, “IQ” or “cognitive ability”.

Educational researchers use the terms “literacy” or “competence”.

“Name is but sound and smoke” (Goethe, Faust).

However:

"Skill" connotes a narrow ability, what is not the case.

"Intelligence" connotes excluding knowledge.
However, all tests cover at least some knowledge content.

"*g*" is no definition and no construct, only the first unrotated factor in a factor analysis (without a definition of anything goes).

"IQ" is only a scale metric with *M*=100 and *SD*=15 (however short).

"Literacy" connotes only reading and dealing with text which are both too narrow.

"Human capital", "ability" and "competence" are extremely broad concepts covering e.g. also eyesight, strength and health.

"Cognitive ability" and "cognitive competence" cover the *ability to think* (intelligence), *knowledge* (true and relevant knowledge) and the *intelligent use of this knowledge*.

"Cognitive human capital" covers the application of "cognitive ability" and "cognitive competence" in (economic) prediction and explanation studies.

These terms bear no statement on development of levels and differences.

We recommend using these terms.

5 Economics and psychology: Measures

Education

Years spent attending school (from primary to tertiary);

or highest achieved degree (primary, secondary, tertiary);

or literacy rate.

Problems:

- Difficult to compare (e.g., German speaking countries with vocational training vs. countries with same professions educated at universities; e.g., "frequently absent pupils", Glewwe & Kremer, 2006),
- mistakes in national statistics (e.g., repeaters, e.g., Norway 116% in secondary schools; Beaton et al., 1996, p. 14),
- fraud in national statistics (e.g., Yemen; Barro & Lee, 1993, p. 366f.),
- usually lower correlations compared to ability measures,
- not formal levels of education (titles) are decisive, but what are persons able and willing to do, education is only a proxy of ability and personality,
- education is only one important determinant of human capital, human capital (cognitive ability, personality and health) depend on more factors,
- literacy is for modernity a much too basic competence.

Cognitive ability test results (psychometric tests or SAS)

Psychometric cognitive ability or student assessment tests.

Problems:

- Many do not like for political or ideological reasons “intelligence” or “IQ” (“elitist”, “classist”, “ethnocentric”, “racist”, “Western”, “imperialist”, “outdated”, “right”, “bourgeois”, “exploitist”, “testistic”, “not holistic”).
  → Other terms gain easier acceptance.
  → Empirical-like reproaches are at odds with results of research.
  → Scientific (epistemic) statements have to be evaluated in their approximation of truth and finding new truth. Political, ideological or ethical criteria cannot substitute criteria of truth.
  → Understanding causes is a prerequisite for improvement.
- IQ test samples frequently rather small and not representative.
  → Combination with other psychometric studies.
  → Combination with larger student assessment studies (SAS).
  → Corrections.

- Usually only children and only youth at school measured.
  → Coming workforce and adults.
  → Cross-country differences are highly stable across decades.
  → Corrections.

- For some countries only regional (Shanghai for China, Indian states) or strange results (TIMSS 4th grade 2007 for Kazakhstan).
  → Corrections; delete; average across studies.

- No older data.
  → In longitudinal studies education as proxy (r=.75; N=167).

Test measures are theoretically more convincing and empirically more reliable and valid national ability (cognitive human capital) measures.

Ability level of intellectual classes or size of smart fractions especially important
(Hanushek & Wößmann, 2009; Rindermann, Sailer & Thompson, 2009; Wai, 2013).

Growth vs. productivity/income/wealth

In economics growth is preferred.

Problems:

- Growth depends on achieved productivity and wealth level (advantages of backwardness, beta-convergence).
  → Only residuals (former GDP controlled) usable.
  → Better productivity, income or wealth indicators.
- Growth is volatile.
  → Better long-term growth.
  → Productivity, income or wealth indicators.

In psychology productivity/income (per capita GDP, GNI) are preferred.
To maintain productivity/income/wealth cognitive ability is necessary!

Problems:

- Some variations across sources and methods (ppp etc.).
  → Better averages.
- GDP and GNI cover only parts of broader wealth concepts.
  → Further measures as wealth (assets; Credit Suisse).
  → Further measures as longevity, height, happiness.
- GDP and GNI depend on past growth (e.g. special case, China).
- GDP and GNI less reflect present development (e.g., China).
  → Growth as further measure.

6 Economics and psychology: Analyses

Unstandardized coefficients vs. standardized coefficients

In economics (and student achievement research) unstandardized coefficients and significance tests are preferred.

In psychology standardized coefficients and frequently significance tests are preferred.

The effect sizes of unstandardized coefficients across different predictor scales and across different criterion scales are hardly **comparable** and **comprehensible**.
Frequently, it's a kind of mathematical decoration and statistical lyrics.

Therefore, usually the results of significance tests are interpreted.
Asterisks and the number of asterisks as ersatz for effect sizes.
→ However, the results of significance tests also depend on the number of observations.

Since decades, statisticians and epistemologists argue against the use of significance testing, e.g.:

- Cohen (1994): "The earth is round (p<.05)."
- Falk & Greenbaum (1995): "Significance tests die hard."
- Hunter (1997): "Needed: A ban on the significance test."
- Gigerenzer (2004): "Mindless statistics."
- Armstrong (2007): "Significance tests harm"

Tests against chance are not convincing at the country level.
Generalizations and truth do not depend on statistical significance.

→ Better: **Robustness checks** using different country samples (e.g., bootstrapping), levels, variable operationalizations and historical epochs.

Regressions vs. path analyses

Regressions treat different predictors (theoretically determinants) as if they were concurrent and theoretically equal variables.

However, that is theoretically not useful.

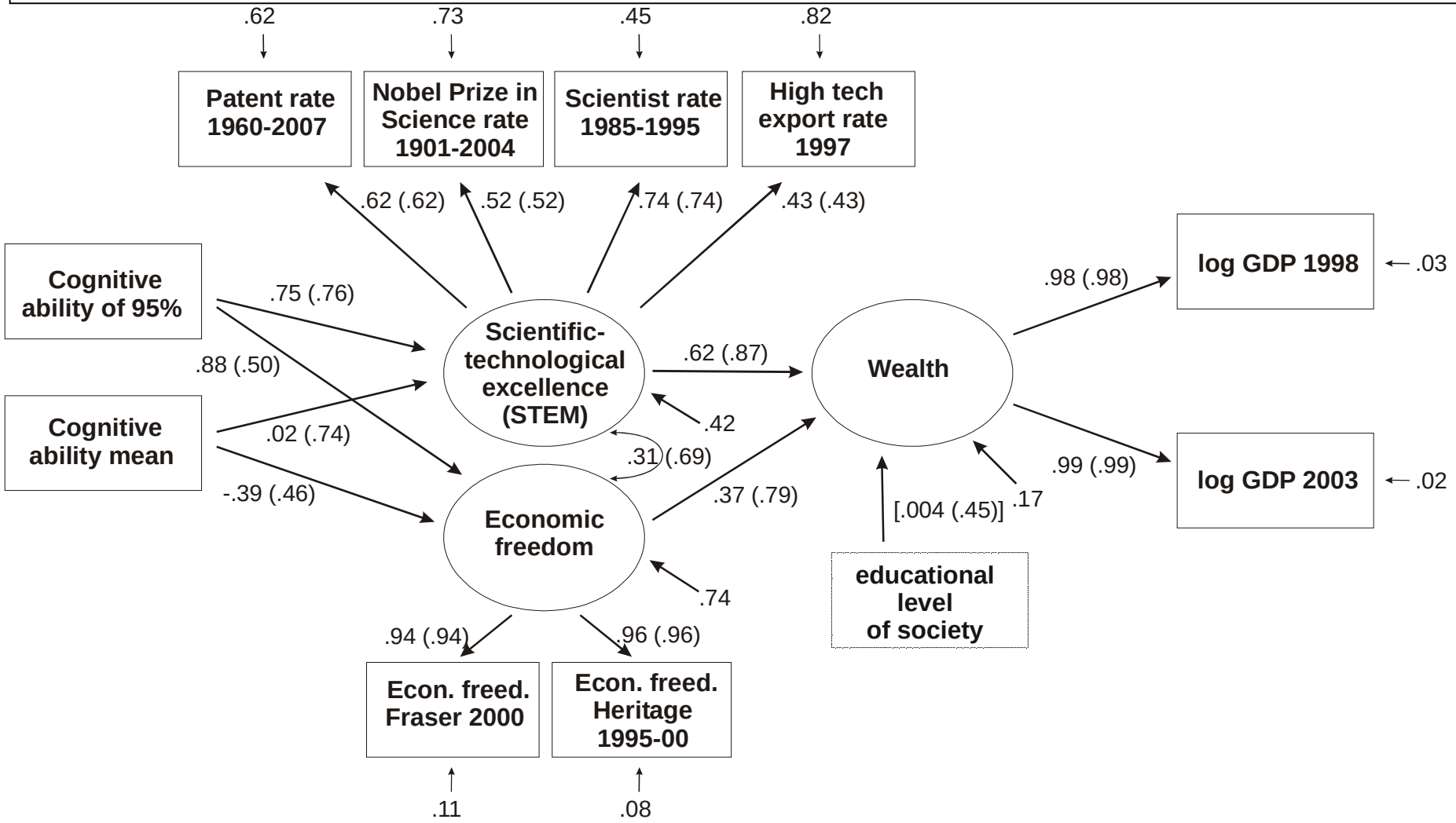
Predictors (theoretically determinants) influence each other.

Determinants work through other determinants (mediators, intervening variables).

More informative are standardized units
(and, if there are “natural” scales, additionally this information).

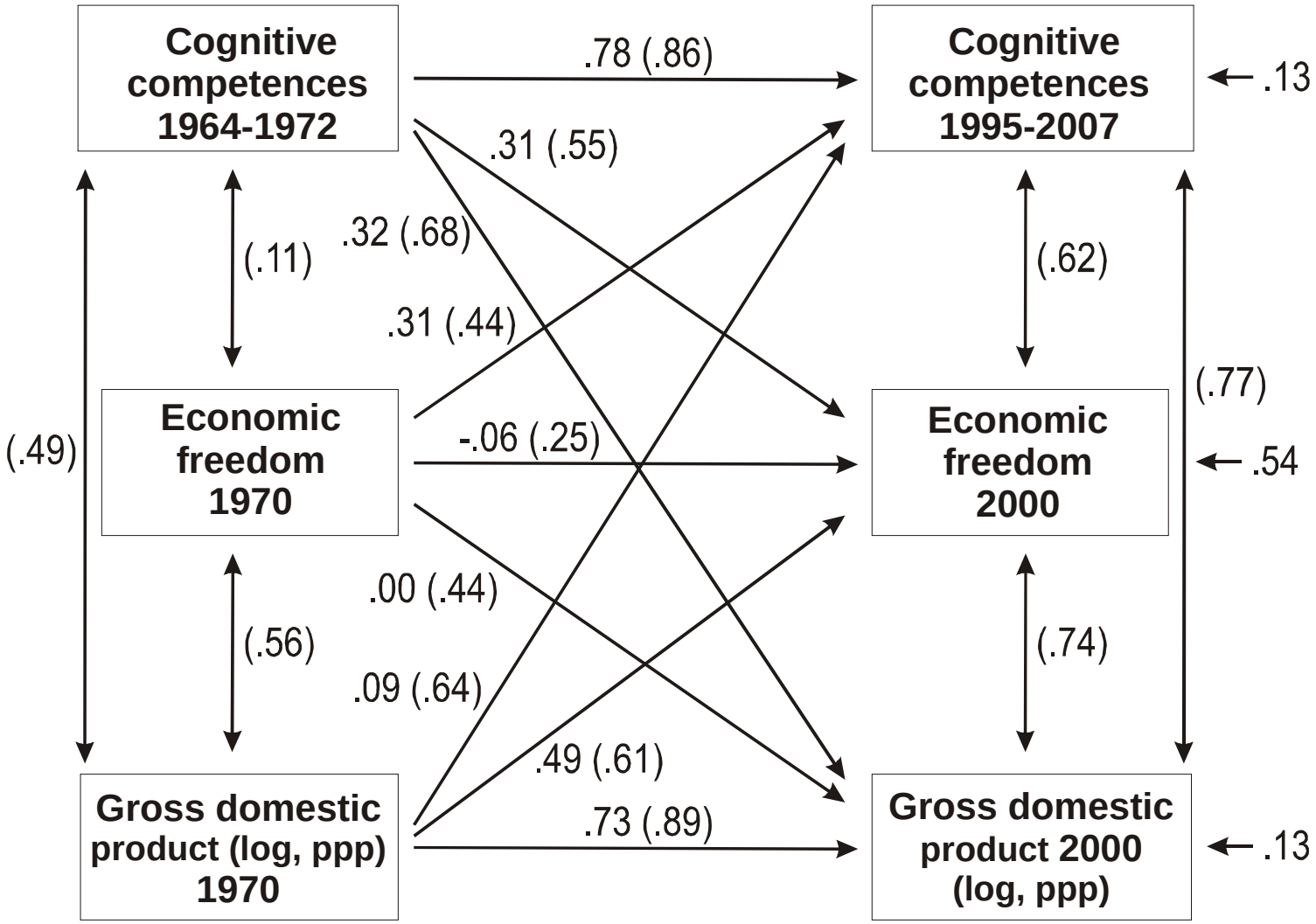
If possible, use theoretically justified causal path models.
If possible, use theoretically justified longitudinal path models.

Path model using latent variables (in circles). Standardized path coefficients and in parentheses correlations (both between –1, 0 and +1). The ability level of intellectual classes increases STEM (β=.75) and economic freedom (β=.88) both increasing GDP. Backward effects and effects of further variables are possible!



("Cognitive capitalism"; Rindermann & Thompson, 2011, p. 760

Longitudinal causal path models testing reciprocal effects



Standardized path coefficients and in parentheses correlations (both ±1). Competence stimulates economic freedom (β=.31) and GDP (β=.32). The effect of competence on GDP is larger than the effect of freedom (β=.00). Competence itself is stimulated by freedom (β=.31), but nearly not by wealth (β=.09).

(Rindermann, 2012, p. 110)

7 Causes of national ability differences

- Wealth
- Health
- Politics
- Modernity
- Education
- Geography and climate
- Evolutionary-genetic dispositions
- Culture

And their interplay!

2013 expert survey on intelligence and cognitive ability

Mean rating by experts of the causes of international differences in cognitive ability (Becker, Rindermann & Coyle, 2013):

GENES
M: 15.3 %
N: 60

WEALTH
M: 8.8 %
N 59

CULTURE
M: 7.2 %
N: 58

POLITICS
M: 5.2 %
N: 51

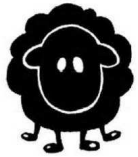
MIGRATION
M: 3.9 %
N: 45

TEST BIAS
M: 3.2 %
N: 49

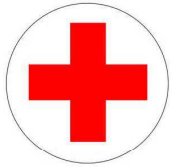
EDUCATION

M (sum): 20.6 %; N: 57-59
M (qt.): 9.8 %; N: 57
M (ql.): 11.0 %; N: 59

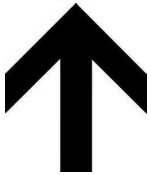
DISCRIMINATION



M: 2.5 %
N: 48



HEALTH
M: 10.0 %
N: 59



MODERNIZATION
M: 7.6 %
N 54

TEST KNOWLEDGE
M: 5.7 %
N: 54

SAMPLING ERROR
M: 4.0 %
N: 49

GEOGRAPHY
M: 3.4 %
N: 53

CURRENT CLIMAT
M: 2.5 %
N: 52

45 to 60 experts gave answers to this question. The experts think that 20.6% of the international differences in cognitive ability depend on education (sum 100%).

8 Development and improvement of national ability

FLynn-effect: secular rise of intelligence test results in 20th century (Flynn, 1984, 2012; Lynn, 1982, 2013), similar to the increases of height (Komlos & Snowdon, 2005).

→ At least partly a real increase in cognitive ability (not only IQ test result inflation).

Health policies.

Nutrition, health care, avoidance of contaminants
(e.g., Hunt, 2012).

Education policies.

Pre-school education
(Heckman, 2000; Baumeister, Rindermann & Barnett, 2013).

Extension and improvement of education at home, in school and of educational systems (e.g., central exams, discipline; Bishop, 1997; Rindermann & Ceci, 2009).
Education for girls and women (and push boys and men!).

Modernization (Technological).

Technological progress. Internet. Mobiles. Complexity stimulates cognitive development (Schooler et al., 1999).

Cultural change.

Push education, achievement, reading, thinking, meritoric principles and rationality (e.g., Harrison, 2006; Weber, 2008/1904).[1]
Ban marriages among relatives (Woodley, 2009).

[1] "Meritoric", not "meritocratic": a) allocation of education and jobs according to the fit of ability and complexity, of human capital and job demand;
b) remuneration and acknowledgement according to complexity, accountability and usefulness of occupation.

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