EDUCATIONAL EQUITY ACCOUNT
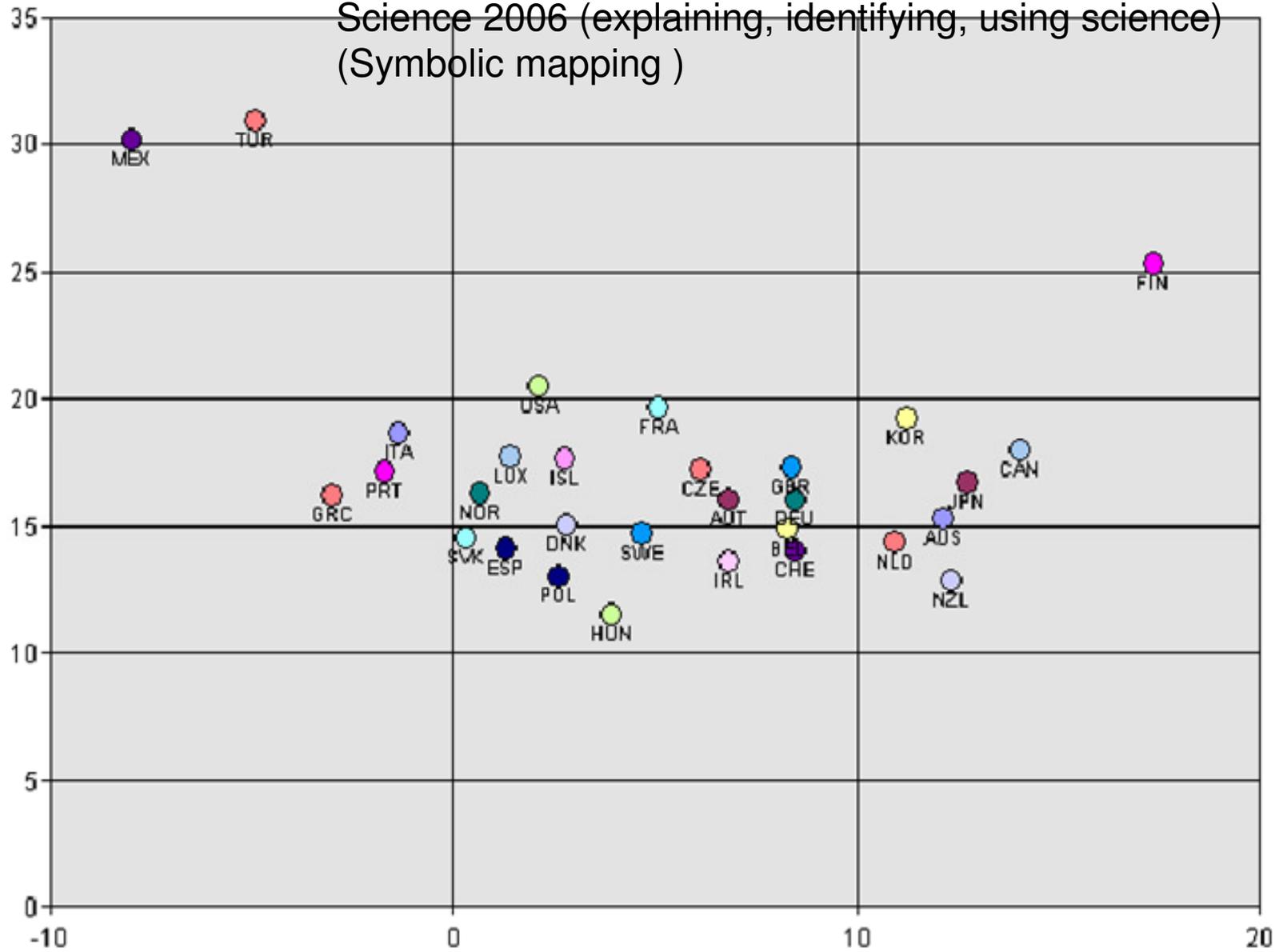# PISA 2006 in Finland
with different comparisons
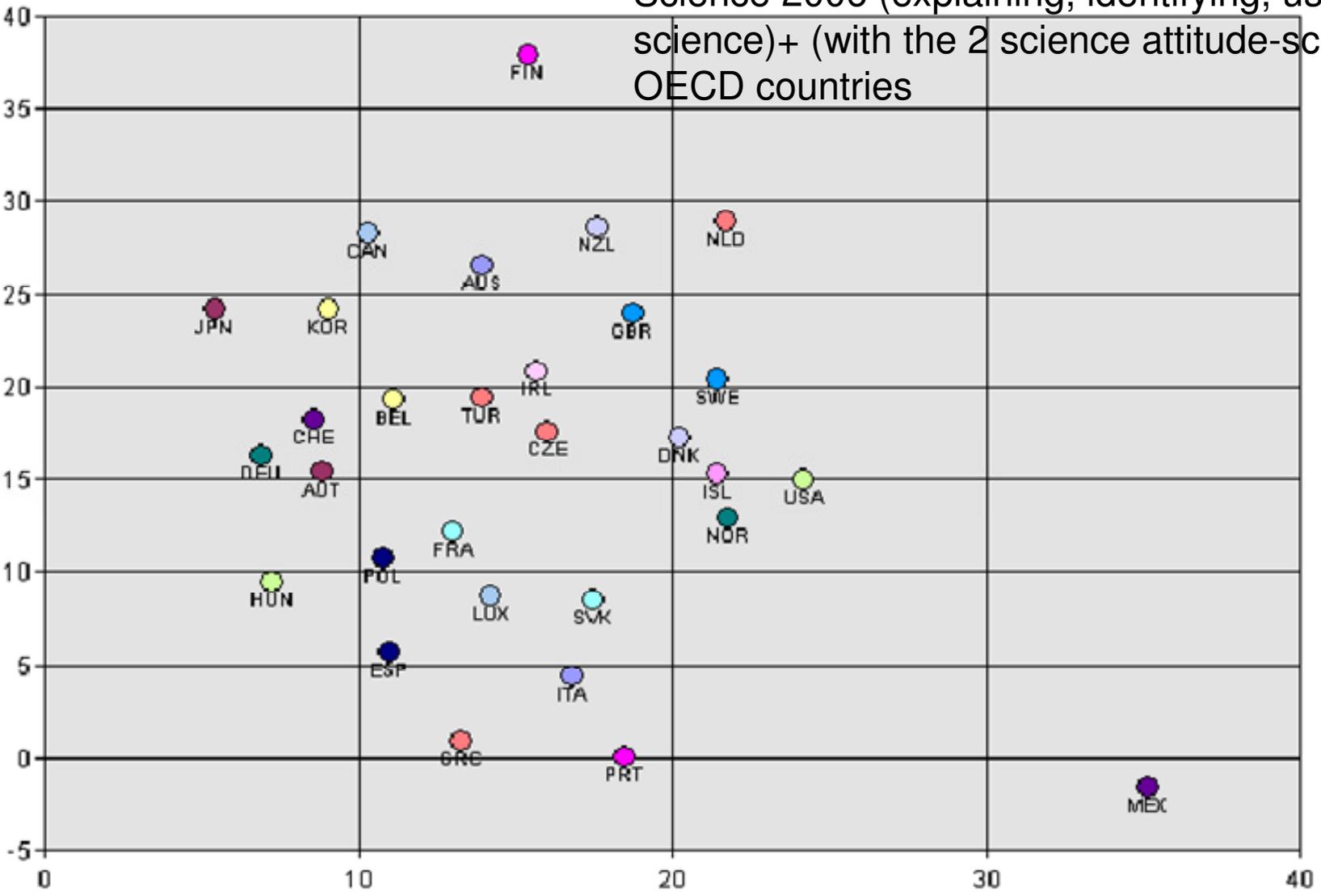
University of Helsinki, Finland

Jarkko Hautamäki

30.9.2010

To Start

Science 2006 (explaining, identifying, using science)
(Symbolic mapping)

Science 2006 (explaining, identifying, using science)+ (with the 2 science attitude-scales) OECD countries

A general problem or an issue for interpreting and using PISA type of information: so what?

Among School Children

I walk through the long schoolroom questioning;
A kind old nun in a white hood replies;
The children learn to cipher and to sing,
To study reading-books and history,
To cut and sew, be neat in everything
In the best modern way – the children's eyes
In momentary wonder stare upon
A sixty-year-old smiling public man
…
Are you the leaf, the blossom or the bole?
O body swayed to music, O brightening glance,
How can we know the dancer from the dance?

W.B.Yeats, Ireland

Among School Children solving PISA items

T.S.Elliot, Modern Education and the Classics, 1932, in Selected Essays, Faber and Faber, 3rd Enlarged Edition, 1969, p. 512

No one can become really educated without having pursued some study in which he took no interest-for it is a part of education to learn to interest ourselves in subjects for which we have no aptitude.

Developing national education using causal information

- How are national concerns constituted or identified?
- How one can use PISA or any international comparative study to solve national concerns?
- David Olson '*Psychological theory and educational reforms*' presents a communication dilemma between psycho-educational studies and policy-related national and local educational reforms:
- *the causal analysis of the factors relevant to the functioning of school as an institution < a break > the intentional analysis of the processes relevant to teaching and learning*
- Causal modelling produces variances and correlations, which are not easily translated into intentions and goals

Developing national education using causal information - 2

- The idea is to present how PISA information is used in Finnish educational discourse

- condensing information into *level* and *balance*

- to use these indices to prepare an *educational equity account*

- where some of relevant *educability factors* are analysed to see their effects and to identify issues of national concerns

- And to present our national concerns – and national gaps - in the light of comparative interpretation where Finland and other Nordic countries are presented in line with UK PISA outcomes

Developing national education using causal information - 3

- I am using same measures as had been done in our national book
- Hautamäki, J., Harjunen, E., Hautamäki, A., Karjalainen, T., Kupiainen, S., Laaksonen, S., Lavonen, J., Pehkonen, E., Rantanen, P. & Scheinin, P. with Halinen, I. and Jakku-SIhvonen, R. (2008). *PISA 06 Finland. Analyses, reflections and explanations*. Ministry of Education Publications 2008:44. Helsinki: Ministry of Education. (www.minedu.fi/english)
- Available also PISA06e.pdf
- www.pisa2006.helsinki.fi
- www.helsinki.fi/cea

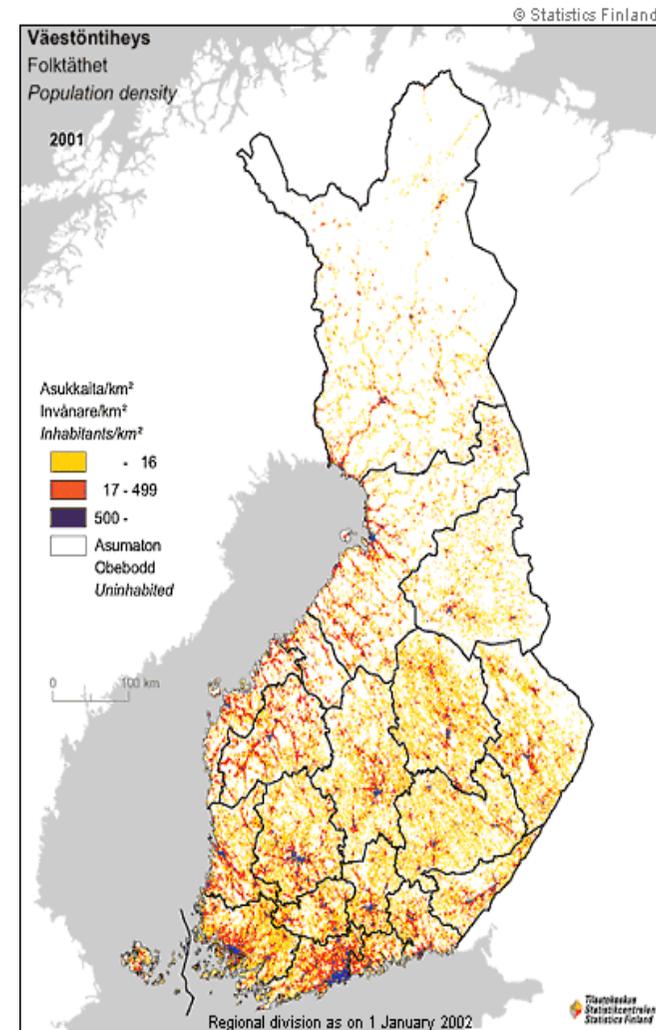# Developing national education using causal information - 4

- Social science knowledge as well as educational and psychological knowledge – is characterized by 3 rules concerning factors of causality, comparison, and multivariate complexity (see Edward Tufte *Beautiful evidence*, 2006)

- Some factors make a difference, some don't
- The differences aren't very great
- It's more complicated than that

The fundamental explanation:

the system and the people together with the common history of the role of education in the nation making – and the extent the class-based divisions can be prevented or postponed in schooling

Finland at a glance

- **Independence in 1917**
- **Member of the European Union 1995**
- **Population 5.2 million**
- **Location between latitudes 60º and 70 º**
- **Total area 338 000 m^3**
- **Two official languages: Finnish 92%, Swedish 6% (Saami 0.03%)**
- **Immigrants: 2%**
- **Two "state" religions: Lutheran 85%, Orthodox 1%**
- **Industry: Electronics, metal and engineering, forestry**
- **Compulsory education for ages 7–16**

© Statistics Finland

Väestöntiheys
Folktäthet
Population density

2001

Asukkaita/km²
Invånare/km²
Inhabitants/km²

- 16
17 - 499
500 -
Asumaton
Obebodd
Uninhabited

0   100 km

Regional division as on 1 January 2002

Tilastokeskus
Statistikcentralen
Statistics Finland

The Finnish Education System

- **Over 4000 basic education schools (grades 1-6 and/or 7-9), about 750 upper secondary schools (academic and vocational/professional), 20 universities**
  - Drop-out rate after compulsory education at age 16 about 5%
  - 60% of students continue in the general upper secondary schools and 35% in the vocational/ professional schools
  - About 60% of the students continuing in the general (academic) upper secondary school are girls
  - About 60% of the population continue their studies at tertiary education (University or Polytechnic)
- **Pre-school education oriented towards play and social development (under Ministry of Health and Social Affairs)**

The Finnish Education System, cont.

- **Basic education still mostly divided to two separate entities of grades 1–6 and grades 7-9**

- **Girls outperform boys in most subject on most levels**

- **Girls outnumber boys in general upper secondary education and in tertiary education except for technical areas**

- **Vocational/professional education strongly divided into "male" and "female" fields**

PISA assessment point/position
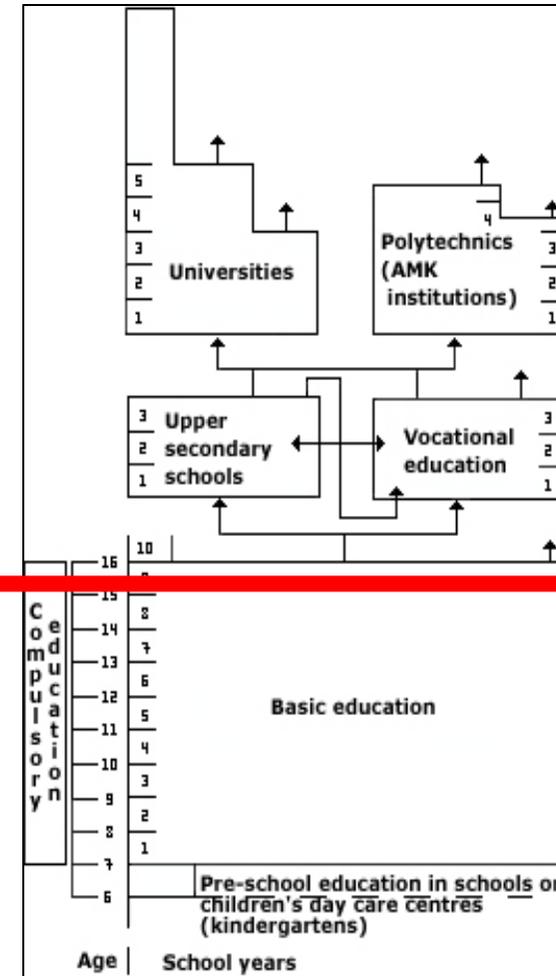
From Parallel to Comprehensive School
The Finnish School Reform

- **1964-1968 Political decisions preparing the coming of the comprehensive school – strongest opposition at the political right and among grammar school teachers**
- **1970-1972 The first national core curriculum with strictly centralised guidance**
- **1972-1977 Comprehensive school reform and the beginning of decentralisation of power from national to the municipal level**
- **Curriculum reforms**
  - 1985 Abolition of ability grouping
  - 1994 Lessening of centralised curricular planning
  - 2004 New re-strengthening of national norms as a response to fear of growing inequality (new grading guidelines, new distribution of lesson hours)

Some Features of the Finnish Comprehensive School

- **All schools create their own curricula based on the national core curriculum and lesson hour distribution**

- **No inspection of schools but mandatory self-evaluation of schools by the municipalities and the schools themselves**

- **No national examinations or testing during (or in the end of) basic education (grades 1-9)**

- **Sample-based assessment in key subjects at grade 9 by the National Board of Education with results published only at the system level (school-level results only given to the schools themselves for internal use)**

- **Pedagogy geared for the teaching of heterogeneous groups with stress on the weaker students**

Some Features of the Finnish Comprehensive School, cont.

- **No streaming or ability grouping**
  - Yet, the choice of first foreign language at grade 3 (and a possible second one at grade 5) can affect class formation in some schools
  - The same goes for a specific emphasis on music education from grade 1 on and some other "special emphasis" classes (math, science, art) in grades 7-9
- **Remedial teaching and special education**
  - Closely integrated into normal teaching; growing emphasis on inclusion
- **Free school meal as a fixed part of the school day**
- **Emphasis on student welfare: health and dental care, student welfare team, school psychologists, career counsellors (grades 7-9)**

EDUCATIONAL EQUITY ACCOUNT

as a way to look for [any] educational and schooling related results from the point-of-view of the educational policy, when repeated and abundant data are available, which makes it increasingly difficult to summarize and draw conclusions [of national gaps to be healed or bridged, or accepted]

Educational Equity Account

Educational equity refers to the impact of contextual factors on educational outcome[1]. Ideally it should be non-existent. Educational equity is seen to be in balance or to show an educationally relevant positive outcome or 'profit' when relevant contextual factors do not explain any of the variation in students' school attainment, that is, the only source of variation in scholastic attainment would stem from students' individual characteristics.

[1] The concept of (total) equity is not unproblematic. If education is expected to have a lasting impact on an individual's life it is difficult to see why these should or would not pay dividends in children's lives and future success.

Educational Equity Account

The most essential educational equity factors or factors that have been shown to impede educational equity or the equal realisation of individual educability are **gender, parents' socio-economic or educational status, immigration status, home- and schooling language and, of course, schools.**

There are also other factors that could be taken into account in estimating national educational equity account in specific areas like in Nordic countries, in Europe, in world.

National Gaps in Finland 1

- **Gender differences**
  - How to get boys more interested in reading (books!?) and girls interested in science (math!?)
- **Immigrants**
  - What to do with them in near future (now 1.6%, in ten years ?%)

- **Urban/rural differences**
  - Is Finland facing the segregation of rural-urban, and within-urban diversification
  - How schooling is provided in Northern Finland or similar places

National Gaps in Finland 2

- **What is an educational need, and why students are increasingly enrolled in part-time and full-time special education?**
  - We have a good special education system, but why are numbers increasing with a growth factor of China's economy
- **Academic / vocational 'code' is so strongly imprinted and valued that a rational life-planning is difficult**
  - dilemma between theoretical and practical knowledge
  - dilemma between abstract and theoretical knowledge

EEA using condensed information:

level and balance of PISA science, math and reading results

PISA level and PISA balance

The first principal component, indicating student's general level of attainment, was named *level*, following Hunt & Wittmann (2008; Wittmann 2004).

The second component, indicating the profile or the relative role of the three different literacies in students' attainment was named *balance*. **Positive values** in balance indicate a performance where reading is relatively stronger in relation to math and science, and **negative values** indicate a performance where math is relatively stronger in relation to reading. Balance is, accordingly, an index for student's competence profile.

The estimates for level and balance are based on the PISA data (OECD 2007) as a whole, that is the means for level and balance for the whole student population of PISA 2006 were zero [sometimes I am using only data from OECD countries]

	Level[86%]	Balance[5%]
Plausible value in math	0,92	-0,24
Plausible value in math	0,92	-0,24
Plausible value in math	0,92	-0,24
Plausible value in math	0,92	-0,24
Plausible value in math	0,92	-0,24
Plausible value in reading	0,91	0,31
Plausible value in reading	0,91	0,31
Plausible value in reading	0,91	0,31
Plausible value in reading	0,91	0,31
Plausible value in reading	0,91	0,31
Plausible value in science	0,95	-0,06
Plausible value in science	0,95	-0,06
Plausible value in science	0,95	-0,06
Plausible value in science	0,95	-0,06
Plausible value in science	0,95	-0,06

# Level and balance as indices for PISA_competence and _profile (read/math)

	level	balance	read	science	math
level	1	*0,12*	*0,95*	*0,98*	*0,96*
balance	**- 0,10**	1	*0,41*	*0,05*	*- 0,11*
meanread	0,92	0,30	1	*0,90*	*0,86*
meanscie	0,97	- 0,18	0,83	1	*0,93*
meanmath	0,94	- 0,37	0,77	0,89	1

Finnish correlations // *UK correlations*

# Educational Equity Account in Finland (PISA 2006 data, Hautamäki & al, 2008)

| Factor	Level	Balance	Interpretation
Regional	No difference	Small difference only in one region of 6	*Regional balance is achieved*
Urban/rural	Urban M > rural M	Urban >0, rural < 0	*Real, but so far small differences, monitoring in needed*
Parents' education	Higher means for students with better educated parents	No difference	*Debates and further analyses still needed; a complex issue!*
Finnish/Swedish	Finnish > Swedish	No difference	*Need to be analysed even if the diffs were same in PISA 00 and 03*
Immigrants	Natives > immigrants	Native = 0, immigrants > 0	*Need to be monitored reading habits?*
Gender	Girls > boys	Boys < 0, girls > 0	*Level diff is modest; balance diff is large*
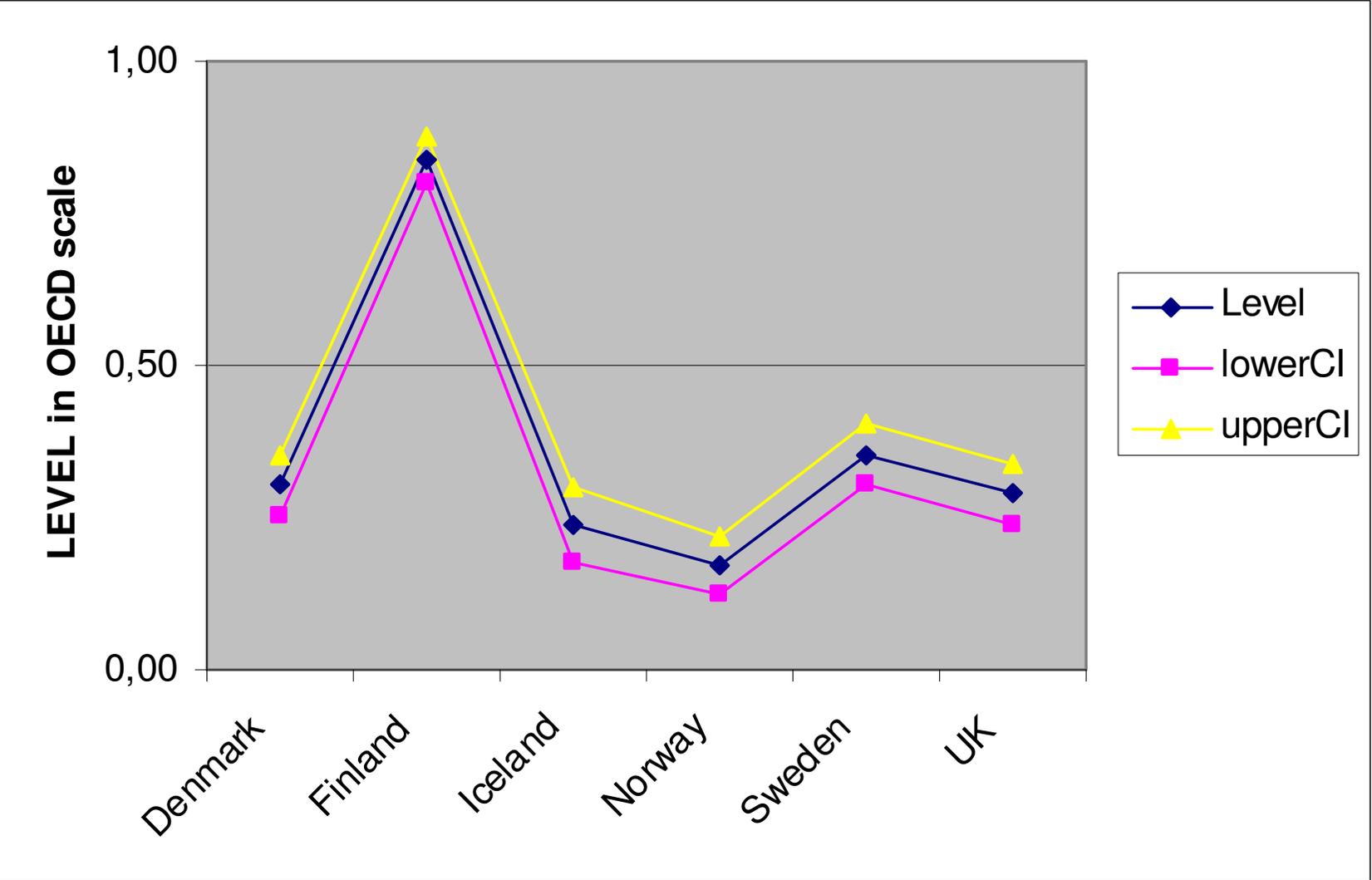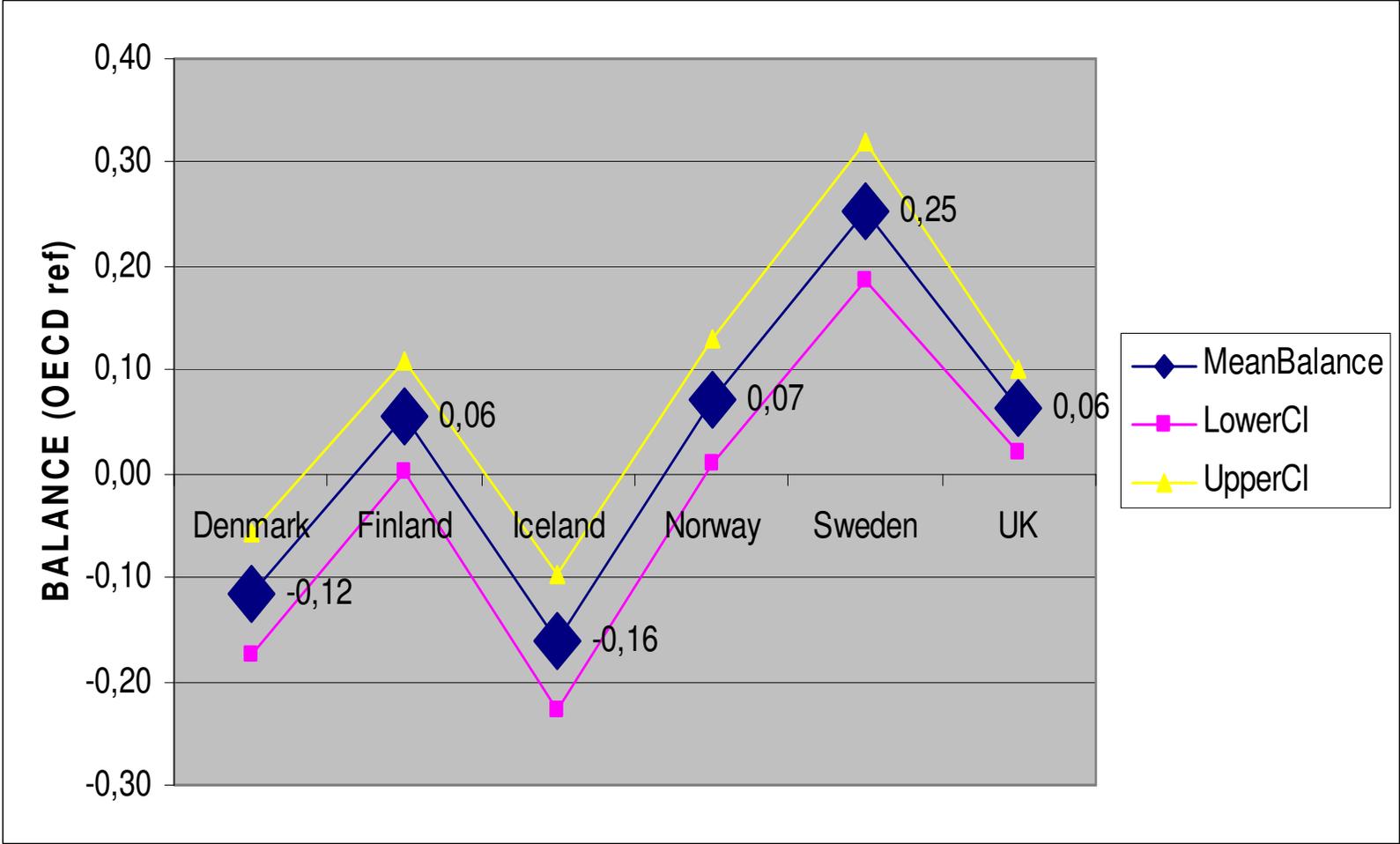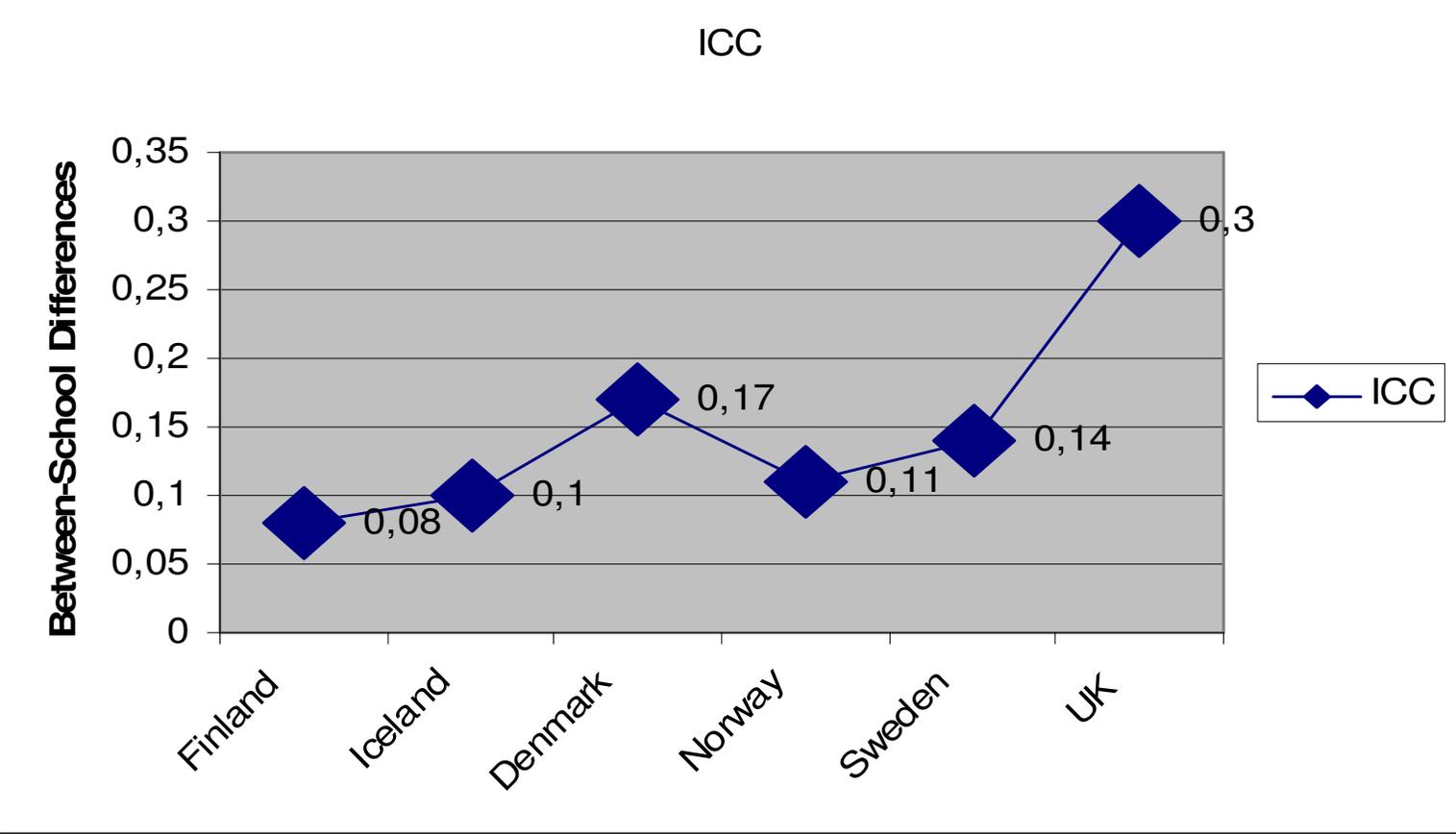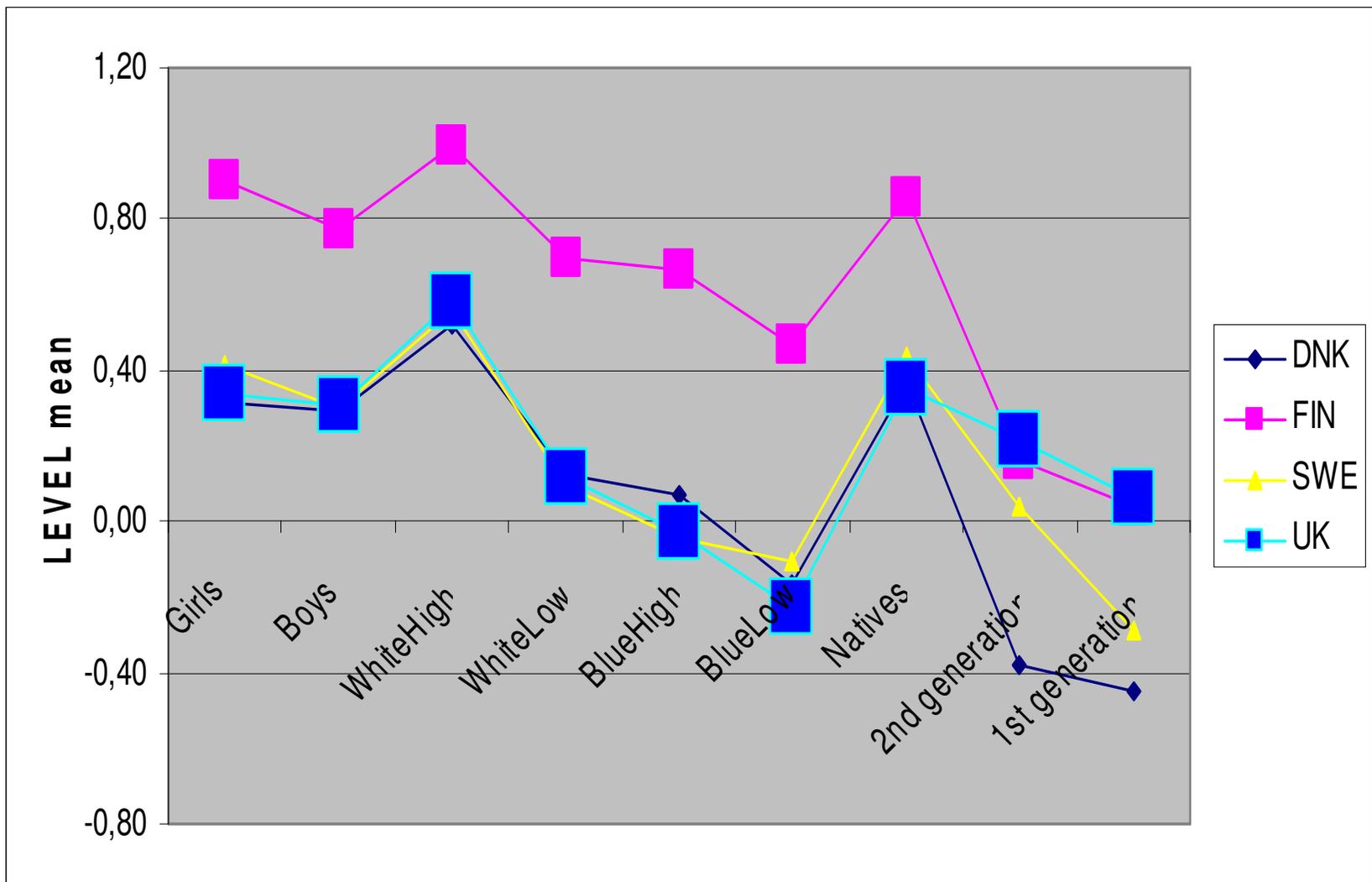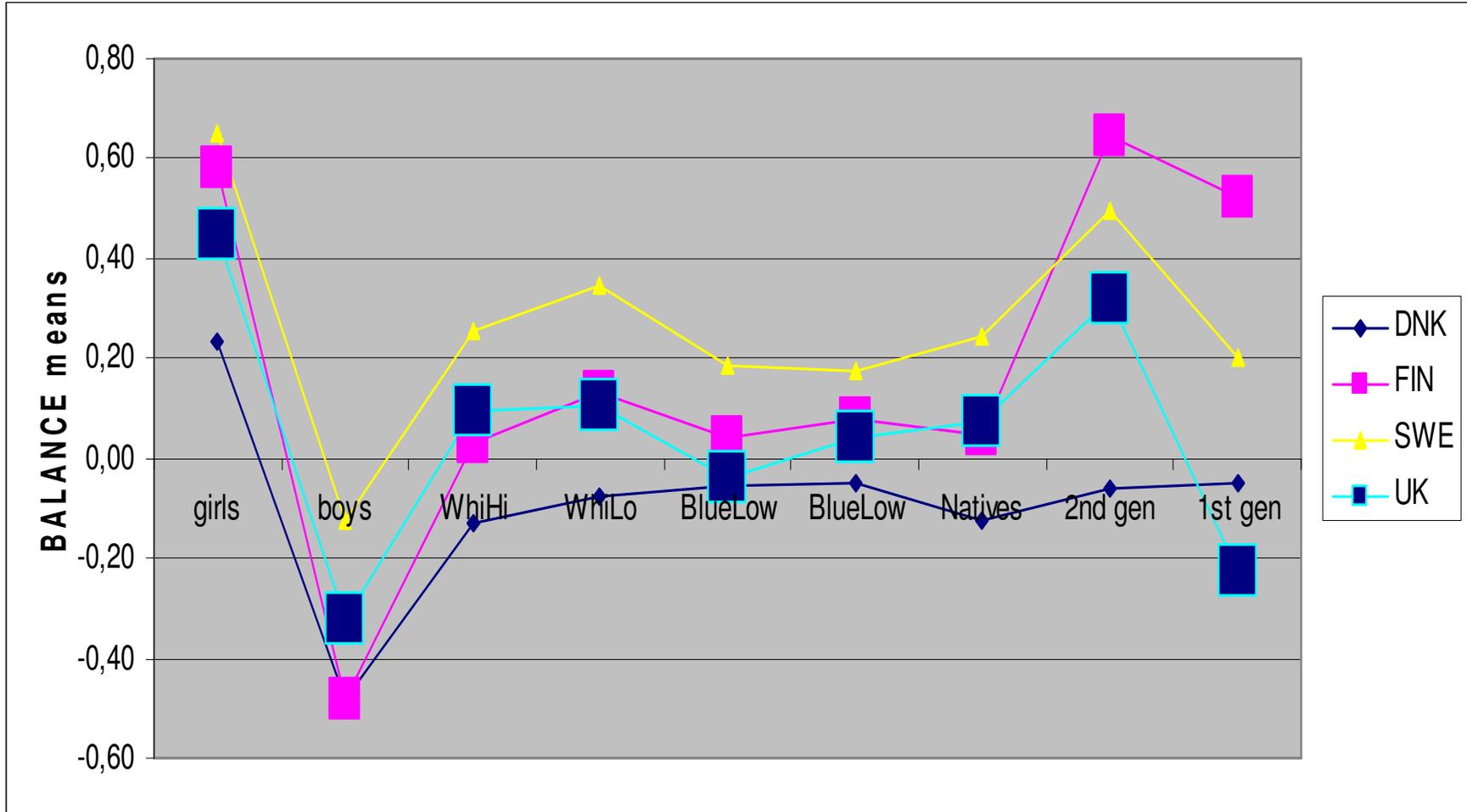
UK and Finland: Comparisons - School Gender
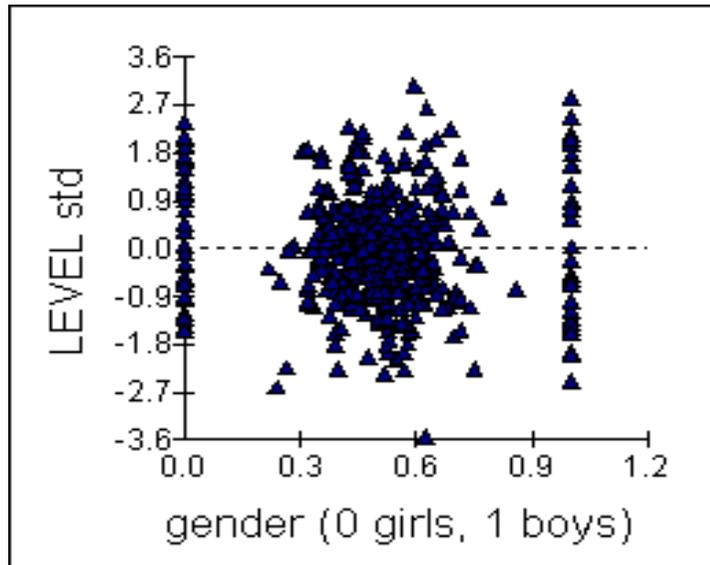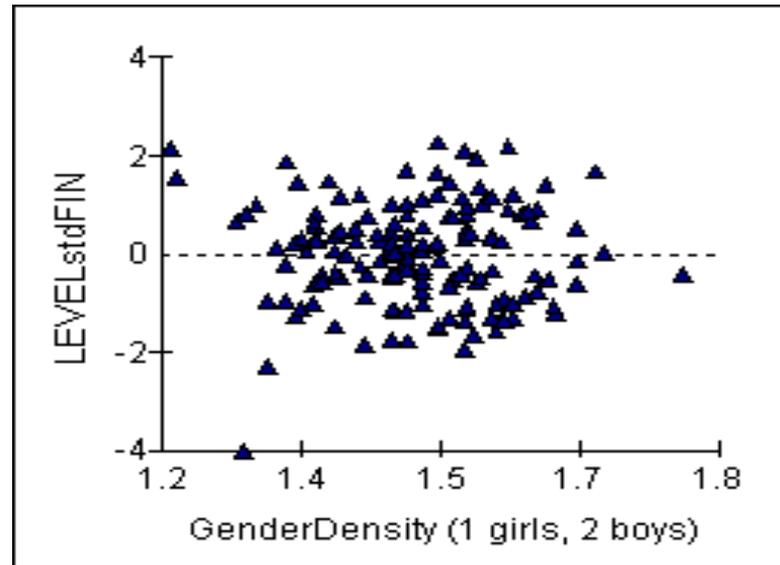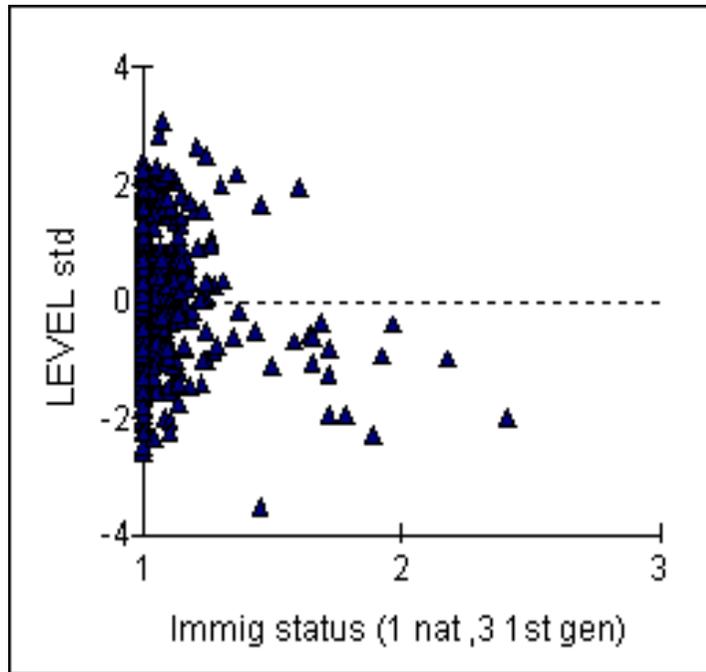

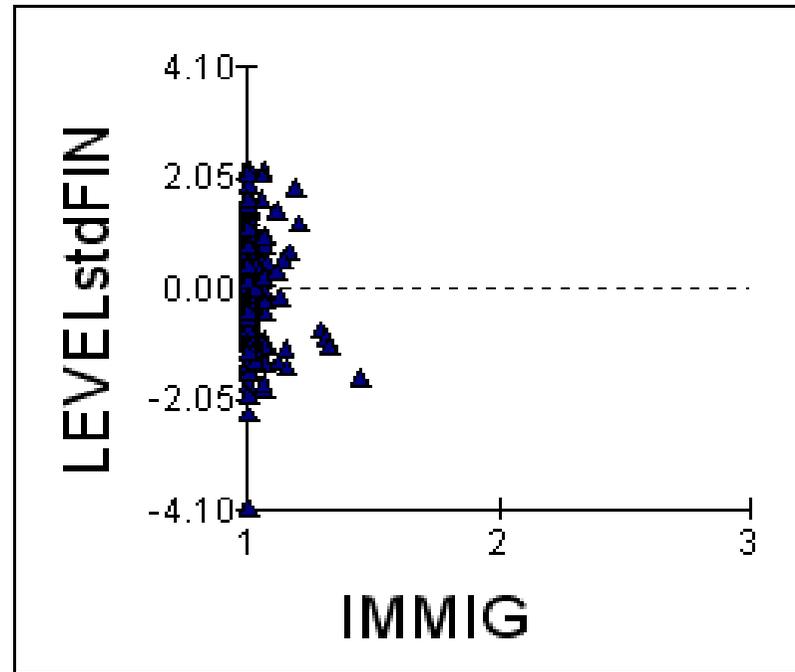R = -0.08   = -0.02

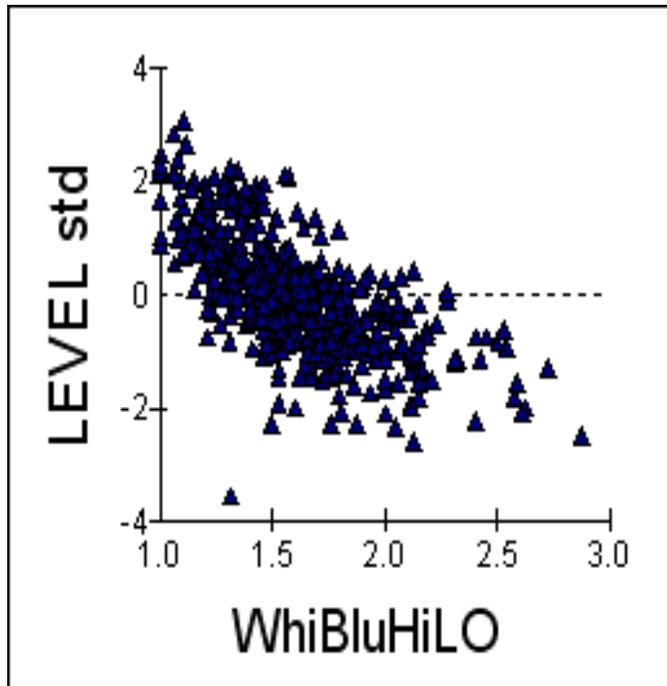# UK and Finland: Comparisons - School Immigrants (natives, 2nd generation, 1st generation)

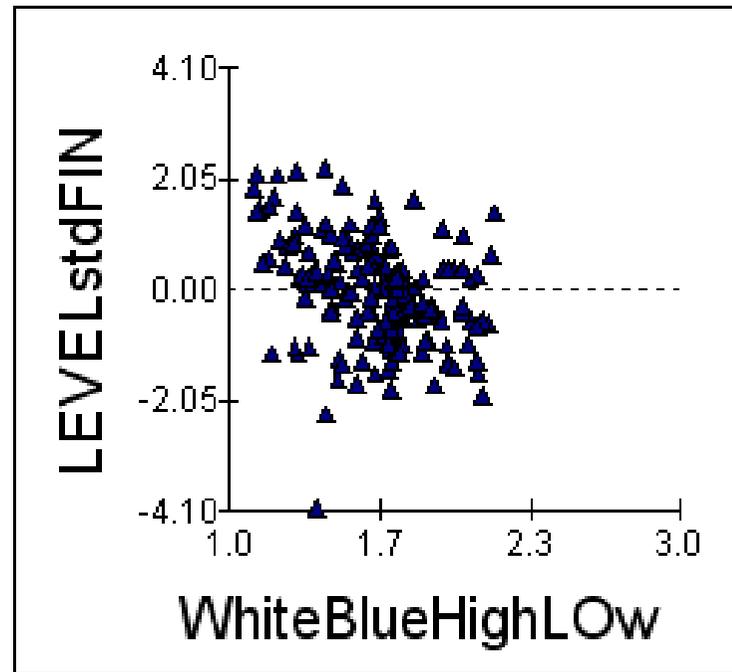R = -0.11   = -0.12

UK and Finland: Comparisons - School Socio-economic status (white/blue/high/low)

R = -0.67   = -0.35

UK, or Xountry and Finland: Comparisons

What can we learn from each other?
The scale-factor: 10 to 1, doesn't it have a role?
Local vs general goods, or
The Holiness of Minute Particulars:

Labor well the minute particulars: attend to the little Ones … He who would do good to another must do it in Minute particulars. General Good is the plea of the scoundrel, hypocrite, and flatterer; For Art and Science cannot exist but in minutely organised Particulars, and not in generalising Demonstrations of the Rational Power:

William Blake, UK

Extra material, or director's cut

Highest International Socio-economic Effect, hisei
on PISA 2006 reading scores: Nordic countries and UK
Multilevel modelling (2-level model, by countries)
Hisei is a composition index of father's and mother's socio-economic
positions

	hisei	se
Denmark	1.18	0.07
Finland	1.01	0.06
Iceland	1.07	0.09
Norway	1.71	0.08
Sweden	1.52	0.08
UK	1.33	0.05
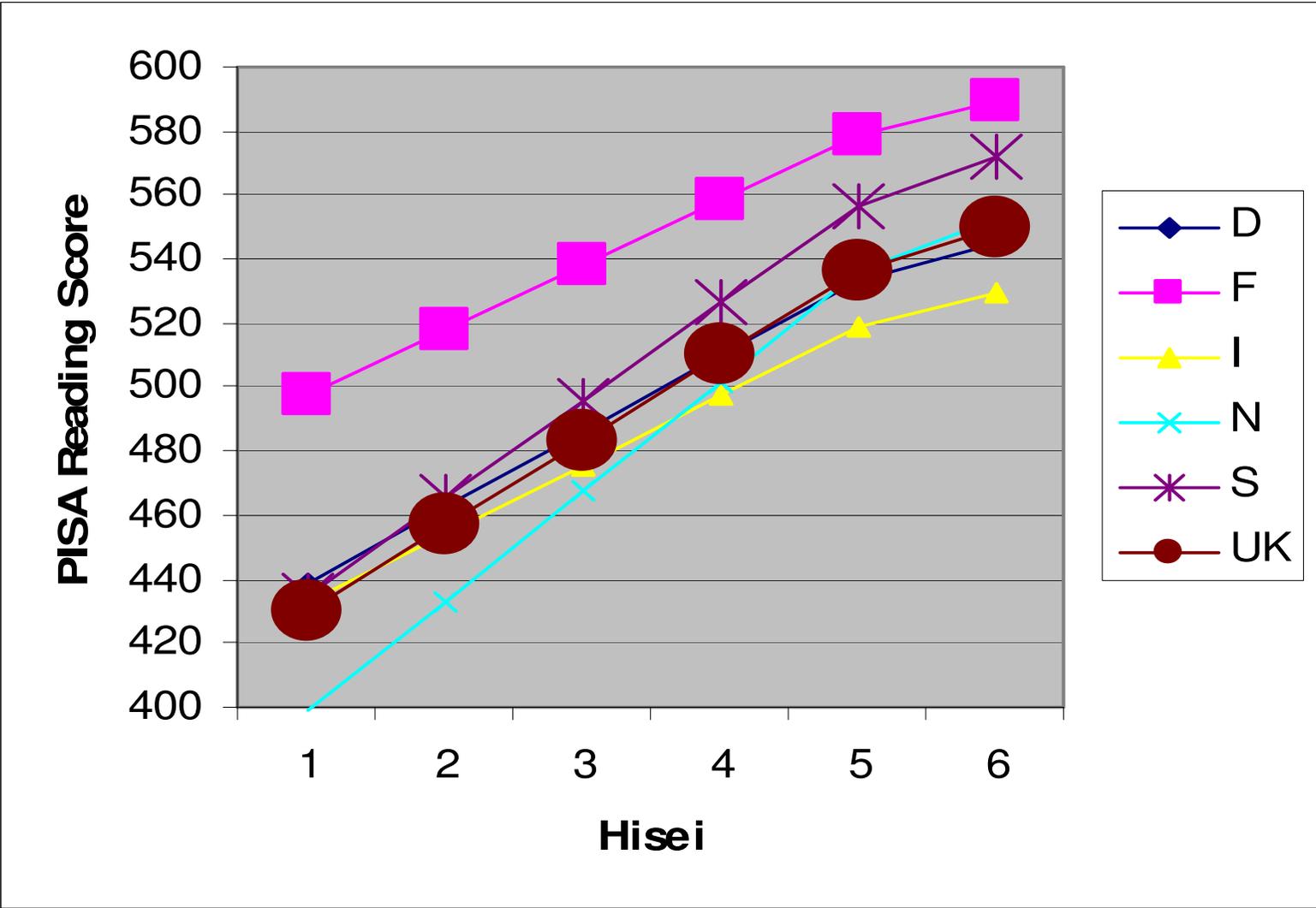
LEVEL in UK

$$\text{level}_{ij} \sim \text{N}(XB, \ \Omega)$$

$$\text{level}_{ij} = \beta_{0ij}\text{cons}$$

$$\beta_{0ij} = 0.297(0.023) + u_{0j} + e_{0ij}$$

$$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \ \Omega_u) \ : \ \Omega_u = \begin{bmatrix} 0.252(0.017) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \ \Omega_e) \ : \ \Omega_e = \begin{bmatrix} 0.594(0.007) \end{bmatrix}$$

$-2*loglikelihood(IGLS\ Deviance) = 31723.549(13152\ of\ 13152\ cases\ in\ use)$

ICC, or between-school differences, = 0.297, about 30%

LEVEL in Finland

$$\text{level}_{ij} \sim \text{N}(XB, \; \Omega)$$

$$\text{level}_{ij} = \beta_{0ij}\text{cons}$$

$$\beta_{0ij} = 0.654(0.022) + u_{0j} + e_{0ij}$$

$$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \; \Omega_u) \; : \; \Omega_u = \begin{bmatrix} 0.051(0.008) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \; \Omega_e) \; : \; \Omega_e = \begin{bmatrix} 0.607(0.013) \end{bmatrix}$$

$$-2*loglikelihood(IGLS \; Deviance) = 11222.368(4714 \; of \; 4714 \; cases \; in \; use)$$

Note: here level estimated using only OECD countries, UK with world data, where Finland would be

LEVEL in UK

$$\text{level}_{ij} \sim N(XB, \ \Omega)$$

$$\text{level}_{ij} = \beta_{0ij}\text{cons} + \text{-0.009(0.015)boys}_{ij}$$

$$\beta_{0ij} = 0.301(0.025) + u_{0j} + e_{0ij}$$

$$\left[u_{0j} \right] \sim N(0, \ \Omega_u) \ : \ \Omega_u = \left[0.252(0.017) \right]$$

$$\left[e_{0ij} \right] \sim N(0, \ \Omega_e) \ : \ \Omega_e = \left[0.594(0.007) \right]$$

-2*loglikelihood(IGLS Deviance) = 31723.133(13152 of 13152 cases in use)

No gender difference, at all!

LEVEL in UK

$\text{level}_{ij} \sim \text{N}(XB, \Omega)$

$\text{level}_{ij} = \beta_{0ij}\text{cons} + \text{-0.305(0.016)WhiLow}_{ij} + \text{-0.410(0.028)BlueHi}_{ij} + \text{-0.552(0.030)BlueLow}_{ij}$

$\beta_{0ij} = 0.472(0.022) + u_{0j} + e_{0ij}$

SES explains

$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.192(0.014) \end{bmatrix}$

24% of school-level variance

$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.554(0.007) \end{bmatrix}$

7% of student-level variance

$\text{-2*loglikelihood(IGLS Deviance)} = 28986.453(12399 \text{ of } 13152 \text{ cases in use})$

The reference is white collar high status, and all the other groups do worse

LEVEL in UK

$level_{ij} \sim \mathrm{N}(\mathcal{XB}, \Omega)$

$level_{ij} = \beta_{0ij}cons + \text{-0.095(0.046)}2ndGen_{ij} + \text{-0.185(0.050)}1stGen_{ij}$

$\beta_{0ij} = 0.317(0.023) + u_{0j} + e_{0ij}$

Immigrant status explains

$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \mathrm{N}(0, \ \Omega_u) \ : \ \Omega_u = \begin{bmatrix} 0.243(0.017) \end{bmatrix}$

4% of school-level variance

$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \mathrm{N}(0, \ \Omega_e) \ : \ \Omega_e = \begin{bmatrix} 0.588(0.008) \end{bmatrix}$

1% of student-level variance

$-2*loglikelihood(IGLS \ Deviance) = 30630.619(12751 \ of \ 13152 \ cases \ in \ use)$

The reference is native, and all the other groups do worse, and the 1st generation students worse than 2nd generation students

$$\text{MeanRead}_{ij} \sim \text{N}(XB, \Omega)$$

$$\text{MeanRead}_{ij} = \beta_{0ij}\text{cons} + 1.328(0.046)\text{HISEI}_{ij}$$

$$\beta_{0ij} = 430.264(3.138) + u_{0j} + e_{0ij}$$

$$\left[u_{0j} \right] \sim \text{N}(0,\ \Omega_u) : \Omega_u = \left[2050.790(145.997) \right]$$

$$\left[e_{0ij} \right] \sim \text{N}(0,\ \Omega_e) : \Omega_e = \left[5871.159(76.107) \right]$$

$$-2*loglikelihood(IGLS\ Deviance) = 143908.594(12399\ \text{of}\ 13152\ \text{cases in use})$$

BALANCE in UK

$$\text{balance}_{ij} \sim N(XB, \ \Omega)$$

$$\text{balance}_{ij} = \beta_{0ij}\text{cons}$$

$$\beta_{0ij} = 0.064(0.020) + u_{0j} + e_{0ij}$$

$$\begin{bmatrix} u_{0j} \end{bmatrix} \sim N(0, \ \Omega_u) \ : \ \Omega_u = \begin{bmatrix} 0.177(0.012) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim N(0, \ \Omega_e) \ : \ \Omega_e = \begin{bmatrix} 0.490(0.006) \end{bmatrix}$$

$-2*loglikelihood(IGLS \ Deviance) = 29112.750(13152 \ of \ 13152 \ cases \ in \ use)$

ICC, or between-school differences, is 0.27, or 27%

BALANCE in UK

$$\text{balance}_{ij} \sim N(XB, \Omega)$$

$$\text{balance}_{ij} = \beta_{0ij}\text{cons} + -0.785(0.011)\text{boys}_{ij}$$

$$\beta_{0ij} = 0.455(0.020) + u_{0j} + e_{0ij}$$

Gender explains

$$\begin{bmatrix} u_{0j} \end{bmatrix} \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.166(0.011) \end{bmatrix}$$

6% of between-school

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.356(0.004) \end{bmatrix}$$

27% of between-student variance

$$-2*loglikelihood(IGLS\ Deviance) = 25027.869(13152\ of\ 13152\ cases\ in\ use)$$

The profile of boys is math dominated and of girls, strongly reading dominated