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Immigrant GPA in Danish primary school is predictable from country-level variables

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Abstract

Two datasets with grade point average by country of origin or parents' country of origin are presented (N=13 and 19). Correlation analyses show that GPA is highly predictable from country-level variables:National IQ (.40 to .64), age heaping 1900 (.32 to .53), Islam prevalence (-.72 to -.75), average years of schooling (.41 to .74) and general socioeconomic factor (S) in both Denmark (.72 to .87) and internationally (.38 to .68). Examination of the gap sizes in GPA between natives and immigrants shows that these are roughly the size one would expect based on the estimated general cognitive ability differences between the groups.

Keywords: group differences, country of origin, educational achievement, grade point average,intelligence, IQ, general cognitive ability, Islam, education, spatial transferability hypothesis

1 Introduction and data sources

A large body of research shows that the traits of immigrant groups can often be predicted from the traits of the inhabitants of their (or their ancestors') country or region of origin.[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11] While doing research for another study I came across a report from 2011, *Folkeskolens faglige kvalitet* (The Public School's Academic Quality), which on page 13 lists the grade point average (GPA) of children by their mothers' birth country/area. The GPA is from the exams taken at the end of mandatory schooling in the 9th grade and is the average of data from 2007-2009. Only countries with at least 100 students were included. The report does not state whether they examined only first, second or both generations, but from looking at the included countries, it appears they included both.

Each year, *Statistics Denmark* (*Danmarks Statistik*) publishes a report on the performance of immigrants in Denmark. Each year's report is different but always covers certain core subjects such as crime and unemployment. This year's report recently came out and contains data about the mean GPA of second generation immigrants by parents' countries of origin ([12, p. 79, Figures 3.21-22]). I contacted the authors of the report to ask if they had more data to share, but they declined stating that the samples were too small to allow useful data for more countries.

All the GPA data are shown in Table 1. The fifth column has the average of both genders in the second dataset, so as to make it more comparable with the data from the first dataset and decrease sampling error.

The correlations between the GPA variables are very strong (between datasets = .92, within dataset = .99). One can see that the GPAs of the second generation students are somewhat higher than those of the mixed generation students. It is well-known that immigrants improve in educational outcomes from the first to second generation in Denmark. Non-Western immigrants gain approximately half a point on their GPA from first to second generation (3.5 to 4.1 [12, Figure 3.13]).

2 Predictive analyses

I added the GPA data (excluding the non-country areas) to the International Megadataset[14]. I then calculated the Pearson correlations between GPA and the following variables of interest:

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Table 1: Grade point average (GPA) of children based on their mothers' country of origin. Denmark, 2008. From [13], Figure 4.

Country	Dataset 1	Dataset 2 boys	Dataset 2 girls	Dataset 2 both
Afghanistan	4.9			
Bosnia-Herzegovina		5.8	6.2	6.0
Germany	6.3			
Denmark	6.4	6.4	7.0	6.7
UK	6.5			
Iran	5.7	6.1	6.6	6.35
Iraq	4.4	5.2	5.8	5.5
Lebanon	4.2	4.2	4.6	4.4
Sri Lanka	6.4	6.2	6.8	6.5
Morocco		4.7	5.1	4.9
Norway	6.4			
Pakistan	5.3	5.0	5.5	5.25
Philippines	5.6			
Poland	6.6			
Somalia	3.7	4.5	4.9	4.7
Sweden	6.7			
Syria		4.7	5.4	5.05
Thailand	4.6			
Turkey	4.2	4.3	4.7	4.5
USA	7.2			
Vietnam	6.3	6.6	7.1	6.85
Former Yugoslavia	5.0	4.7	5.3	5.0

- Lynn and Vanhanen's 2012 national IQs with changes by Jason Malloy and the present author (see comments in datafile)[15, 16]
- Joerg Baten's age heaping scores, 1900 (crude numeracy proxy)[17, 18]
- Average years of education, 2010[19]
- International general socioeconomic factor (S factor)[20]
- S-factor in Denmark[9, 8]
- Islam prevalence by country, 2010, provided by Pew Research[21]

I chose two cognitive measures. The current best estimate of national mean general cognitive ability (GCA) and an estimate of numeracy ability in the year 1900 as a proxy for national GCA at that time. I chose average years of education as a purely educational measure similar to GPA. I chose the International S factor as a measure of well-being of their home country in general. I chose Islam prevalence because of frequent media attention being given to this factor and because previous research has shown that it has incremental validity over cognitive measures.[9] For instance, the conservative web-tabloid *Den Korte Avis* (The Short Newspaper) criticized researchers from a public researcher institute for not taking culture into account:[22]

> The research thus speaks only about breaking the negative social inheritance as early as possible, but does not mention the cultural inheritance and the creation of parallel societies as a substantial factor, and a focus area for combating the problems [with low performance of immigrant students in schools]. With this narrow, politically correct point of view one cannot straighten out the problems.

I used only the combined sex variable from dataset 2.

Table 2 shows the results. All correlations are in the expected direction. They are strong correlations by social science standards. There is a very strong relationship to the S factor in Denmark as expected. Both cognitive measures are strong predictors, but somewhat worse than the educational predictor. Islam again outperforms the other predictors except the local S factor.

Correlations are much weaker for dataset 2. This is likely due to sampling error with the small number of

Table 2: Correlations between predictor variables and GPA by mother's country of origin. Pearson's correlations in columns 1-2, Spearman's in 3-4. Discrepancy values in 5-6.

Predictor	GPA1	GPA2	GPA1_S	GPA2_S	DIS1	DIS2
IQ	0.64	0.4	0.66	0.35	−0.02	0.05
Heaping	0.53	0.34	0.64	0.36	−0.11	−0.02
Edu.years	0.74	0.43	0.71	0.2	0.03	0.23
Int.S	0.68	0.4	0.58	0.08	0.1	0.32
Local.S	0.87	0.74	0.85	0.76	0.02	−0.02
Islam	−0.75	−0.73	−0.75	−0.52	0	−0.21

included countries (N=13 vs. N=19) and the resulting restriction of range, see generally [23]).

2.1 *Non-normality*

A reviewer (Meng Hu) pointed out that the GPA data are not normally distributed. Figure 1 shows a histogram of the GPA dataset 1. The histogram for dataset 2 is similarly non-normal. For this reason I calculated the Spearman correlations as well. They are shown in Table 2 as well as the discrepancies to the Pearson correlations.

Generally, in dataset 1, using Spearman's did not much make difference. In dataset 2, using Spearman's reduced the effect sizes, in one case to about zero (local S).

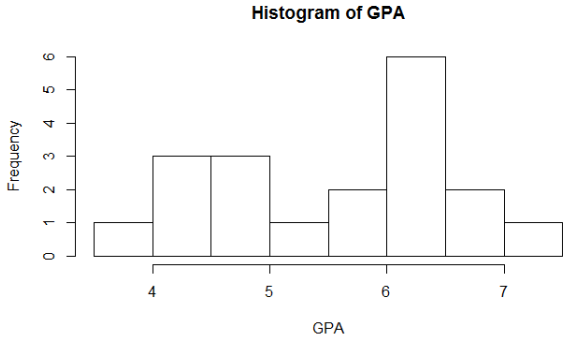

Figure 1: Histogram of GPA.

3 The size of the GPA gaps

One might wonder whether the effect size found is reasonably in line with the expected one given the estimated group differences in GCA. To investigate this requires that one has the standard deviation (SD) of the GPA, not just the means. The SD was not reported in the previous sources. However, using the UNI-C data explorer, one can download data about the distribution of grades.[1] From this, one can calculate the weighted mean and SD of the GPA. The mean GPA for all students 2013/2014 is 6.75 and the SD is 3.41.

Using this, one can calculate the GPA gap to Danish students in SDs (i.e. Cohen's d). One can do the same for IQs (using SD=15). These are shown in Table 3.

Table 3: GPA gaps to Danish students, and the corresponding national IQ gaps.

Country	GPA1.gap.d	GPA2 gap d	IQ	IQ gap d
AFG	−0.44		75	−1.48
BIH		−0.21	93.2	−0.27
DEU	−0.03		98.8	0.11
DNK	0.00	0.00	97.2	0.00
GBR	0.03		99.1	0.13
IRN	−0.21	−0.10	85.6	−0.77
IRQ	−0.59	−0.35	87	−0.68
LBN	−0.65	−0.67	84.6	−0.84
LKA	0.00	−0.06	79	−1.21
MAR		−0.53	82.4	−0.99
NOR	0.00		97.2	0.00
PAK	−0.32	−0.43	84	−0.88
PHL	−0.23		86.1	−0.74
POL	0.06		96.1	−0.07
SOM	−0.79	−0.59	72	−1.68
SWE	0.09		98.6	0.09
SYR		−0.48	82	−1.01
THA	−0.53		93.9	−0.22
TUR	−0.65	−0.65	89.4	−0.52
USA	0.23		97.5	0.02
VNM	−0.03	0.04	91.4	−0.39
YUG	−0.41	−0.50	92.3	−0.32

The correlations between GPA gap d's and IQ gap d are .64 and .40, the same values as in Table 2. In some cases, the difference is similar e.g. Turkey (-.65 and -.65 for GPA vs. -.52 for IQ), but in other cases it is very dissimilar e.g. Sri Lanka (0 and -.06 GPA vs. -1.21 for IQ). This may indicate that the national

[1] The data for the year 2013/2014 is here.

IQ has been estimated incorrectly, that there has been immigrant selection, the presence of cultural effects, or that the particular group has increased its GCA in Denmark due to improved environment.

Since GCA is not the only factor that causes differences in GPA, one would not expect a GCA difference of 1.0 d to be associated with a 1.0 d difference in GPA. I could not find a study that reports the correlation of IQ with GPA for the final exams in Denmark, but such a correlation would likely be around .5-.7. For the UK, the correlation of GCA/IQ with the similar GSCE exams has been reported as .58 and .69.[24, 25] The GPAs from the reports are based only on test results, not yearly grades, so they are less influenced by things such as teacher-student relationship. See the peer review discussion for details.

One can examine the ratio of IQ and GPA d's in the datasets reported in the present article (IQ d divided by GPA d). The expected GPA d is IQ d x cor(IQ x GPA). I examined this for all countries in both datasets and found the median value (to avoid effects of outliers). This value was .37 for the first dataset and .50 for the second. These values are somewhat smaller than the expected .5-.7 range. However, if one uses the trimmed mean (removing the top and bottom decile of data before taking the mean), the values are .62 and .54, so the result is strongly influenced by how one chooses to deal with outliers.

3.1 *GPA gaps for the total immigrant population by generation*

GPA data are also available from UNI-C for the immigrant population as a whole by generation (here). From this, one can calculate the GPA gap in comparison with natives for each generation.

One can estimate the IQ of these immigrant groups using the model detailed in [26]. I downloaded the population data for 15 year olds in the year 2014 by generation.[2] Then I calculated a weighted mean IQ for each group estimated from population data. The estimated mean IQs for these groups were 87.6 (SD=17.7) and 86.8 (SD=16.5) for the first and second generations respectively. This corresponds to an IQ gap of -0.64 d and -0.69 d respectively (using SD=15, against a Danish mean of 97.2).

The GPA gaps were -1.7 and -1.3, -.50 and -.38 d respectively. Finally, one can again calculate the ratio which estimates the population level correlation between GCA and GPA. Table 4 summarizes the results.

[2] These are available in the FOLK2 database at the *Statistics Denmark* website.

Both ratio results are reasonably in line with the expected correlation between GCA and GPA (.5-.7). The value for the second generation is smaller because this group does better in school while the GCA gap is about the same.

There are no population data available for the third generation, but it has been reported that the non-Western third generation performs similarly to the second generation non-Westerns with regards to GPA.[12, Figure 6.7] This may indicate that the difference between the first and second generations is due to linguistic factors, but that this ceases to be an important factor for the next generation. See for instance Dunn's forgotten 1988 review of language bias with assessing Hispanic IQ, and Fuerst's 2014 meta-analysis of ethno-racial IQ by generation in the US.[27, 28]

4 To exclude Denmark or not?

There are two different but related types of questions one can ask oneself with these data: 1) Does country of origin variable X predict GPA among country of origin groups in Denmark? and 2) Does country of origin variable X predict GPA among immigrant groups by country of origin in Denmark? The slight difference is that the first would include Denmark, while the second would not. Theoretically, there could be a general effect that affects only immigrant groups, but not the native group e.g. a language barrier. For this reason it is generally preferable to exclude the natives.

However, in small datasets excluding datapoints can drastically change the results. To see why, consider Figures 2 and 3 with national IQs and GPA in Denmark.

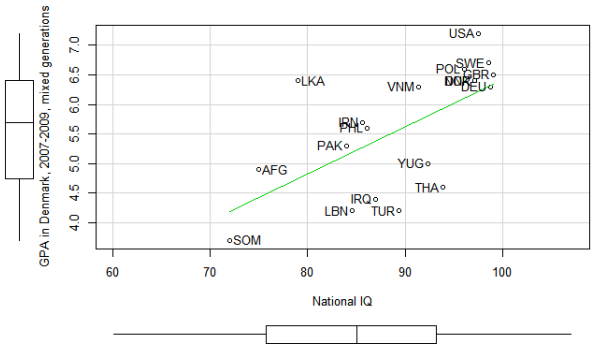

Figure 2: Scatterplot of National IQs and 9th grade exam PGA for mixed generation immigrants in Denmark, 2007-2009.

Table 4: IQ and GPA gaps at the generational level.

Generation	IQ gap	IQ gap d	GPA gap	GPA gap d	Ratio IQ/GPA d gap
First	87.6	−0.64	−1.7	−0.50	0.78
Second	86.8	−0.69	−1.3	−0.38	0.55

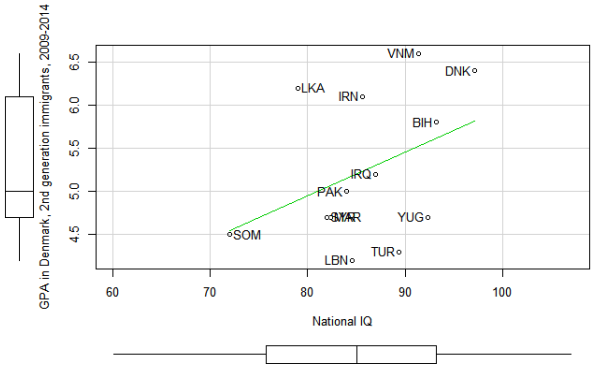

Figure 3: Scatterplot of National IQs and 9th grade exam PGA for second generation immigrants in Denmark, 2009-2014.

In Figure 3, it can be seen that excluding Denmark would change the regression line quite a lot. To see the effect, I calculated all the correlations without Denmark, and calculated the discrepancies between the ones with and the ones without. Table 5 shows the results.

Table 5: Predictor correlations with GPA among immigrant groups by mother's country of birth. Column 3-4 shows the discrepancy values compared with correlation in Table 2.

Predictor	GPA1	GPA2	DIS1	DIS2
IQ	0.62	0.24	0.02	0.16
Heaping	0.53	0.34	0	0
Edu.years	0.73	0.21	0.01	0.39
Int.S	0.67	0.01	0	0
Local.S	0.87	0.74	0.01	0.22
Islam	−0.74	−0.66	−0.01	−0.07

For the small dataset, the predictors fared worse without Denmark. However, excluding Denmark in the larger sample had almost no effect on the results which indicates that the effect of excluding Denmark in the smaller sample is perhaps a sampling error.

5 Combining the GPA variables

A further option is to combine the GPA variables which will increase sample size if the smaller sample is not a proper subset of the larger, and even if they overlap completely, one may still reduce sampling error by averaging results from multiple years.

The smaller sample (N=13) does not not overlap completely with the larger sample (N=19). There are, however, two ways to combine them. Either take the mean of the raw GPAs, or take the mean of the standardized GPAs. I used both methods. Then I redid the predictive analyses from Section 2. The results are shown in Table 6.

Table 6: Correlations of country of origin predictors and combined GPA among country of origin groups in Denmark (Denmark included).

Predictor	GPA mean	GPA z mean
IQ	0.62	0.63
Heaping	0.58	0.59
Edu.years	0.7	0.71
Int.S	0.67	0.68
Local.S	0.79	0.81
Islam	−0.73	−0.73

Results using raw and standardized GPA means were nearly the same, with using raw GPAs a bit higher. The results are also nearly the same as using only the larger dataset. This indicates that sampling error was responsible for the weaker correlations when using dataset 2 only.

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