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*Article*

# Intelligence of Refugees in Germany: Levels, Differences and Possible Determinants

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**Abstract:** Intelligence is the best predictor and the most important causal factor in job performance. Measuring intelligence therefore provides information about future job performance and employment. This applies to different professions and social groups, including immigrants and refugees. Two previous German studies with *N*=29 and *N*=552 refugees found average intelligence scores of IQ 92 and 86, respectively. A newer study with *N*=499 refugees and immigrants from *N*=15 countries conducted in 2017 to 2018 using the BOMAT, a German non-verbal and purely figural matrices test, found an average IQ of 90 (using the norms of the manual, 84 using a recent German comparison sample). Overall (as a result of our "mini-meta-analysis"), refugees' cognitive abilities are about (5 to) 10 IQ points higher than the average abilities of people in their home countries (measured by student assessments or intelligence tests and compiled by various research groups), but 12 (to 15) IQ points below the German average. Positive selection, people that are more intelligent being more likely to leave their countries of origin, and accessibility to testing all likely play a role. At the individual level, refugees' IQ was correlated with education: Each additional year of schooling corresponded to about 2 IQ points (*r*=.41). At the cross-national level, education was again significantly correlated with immigrants' average IQ, but so were the level of cognitive ability in the home country (five different measures), income (GDP per capita as indicator of standard of living), positively valued policies (e.g., democracy), indicators of evolutionary ancestry, and culture (religion is used as a measure here). Individuals' cognitive abilities could be better predicted with individual-level data than with country-level data (multiple *R*=.50 vs. .34). However, if individual predictors are not available, group predictors are not useless. Path analyses at different data levels showed indirect effects of country of origin cognitive ability on refugee intelligence via income and level of education.

**Keywords:** refugees; immigrants; intelligence; cognitive ability

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## 1. Introduction

Immigrants have been coming to Western Europe and the Western world in general for decades. Until the 1960s, these immigrants stemmed mostly from Eastern and Southern Europe. Since the 1960s, they have come mainly from the Middle East (North Africa, the Middle East, or West Asia, including Turkey) and, in the case of former colonial powers (Britain, France, Spain, Portugal), also from their former colonies in the Caribbean, Latin America, Africa, and Central and South Asia (India and Pakistan). In many countries, such as Germany, there were guest-worker programs. Adults, usually men, from southern Europe and Turkey were invited to work in Germany for one to two years and then had to return. Because companies did not want to bring in new workers every two years, the durations were extended; in addition, Germany allowed family reunification (spouses, children).

**Box 1:** Outline of the study and its main result.

We study the level of cognitive abilities of refugees in Germany. Cognitive ability is relevant because it is the most important factor in labor productivity and income (economically relevant); it is also important for lifestyle, health and attitudes, and for the development of a society (education, institutions, GDP, democracy, freedom, rule of law, culture). First, we describe how at the beginning of the great wave of refugees in 2015 onwards (especially from the Arab-Muslim area) great hopes were placed on the their potential by politicians and business. Field reports from the industry and education, past studies in the countries of origin, and two first studies in Germany refer to a rather low level of ability (results vary from just under IQ 80 to just over IQ 90, which roughly equates to jobs in unskilled labor up to those in craftsmanship).

We carried out our own study (before the war in Ukraine) with almost 500 people from Middle Eastern, African, Eastern European and Central Asian countries and have come to an IQ of 90 (to 84) points overall (together with two other German studies' IQ 85 to 88; see Table 7). This corresponds to a level for the profession of baker or hairdresser. The level is too low to form the basis for a second economic miracle, especially not in an increasingly complex technological, social and cultural modernity.

Since the 1970s, more and more immigrants have applied for asylum. The peak was reached in 2015/16 in the so-called "European migration crisis", when millions of refugees from the Middle East, Central and South Asia (Afghanistan and Pakistan) and Africa (mainly East Africa) arrived in Europe. Germany received the most immigrants compared to other European countries and compared to previous years (ESI (European Stability Initiative), 2017).

The political elite and large sections of the media as well as the younger and urban population welcomed this development. They saw many positive opportunities, e.g., urgently needed skilled workers (professionals, "Fachkräfte") would enter industry and the service sector. Business leaders, such as the then CEO of Daimler (Mercedes), Dieter Zetsche, also said that the immigrants are "exactly those persons we in Mercedes look for"

and that this immigration "will result in the best scenario for the next German economic miracle ('Wirtschaftswunder')" (Kröger, 2016).[1]

However, when journalists later asked Mercedes how many refugees the company had hired, they learned that only 40 asylum seekers had been given a "job" and this was in the form of a three-and-a-half-hour-per-day internship, which is usually unpaid (Kröger, 2016). Reports from teachers, trainers and journalists also indicate that a sizeable proportion of newly admitted immigrants lack the cognitive and non-cognitive skills needed for job training and career success. For example, a school project in Rosenheim, a city in Bavaria, taught young refugees from Somalia, Eritrea, the Ivory Coast and Afghanistan. The report states:

> Expectations were high. But it is an almost hopeless undertaking. ... 'Even the best won't be successful', says Johannes Fischer, the head of the youth welfare office in Rosenheim. ... He says he started the project in a 'euphoric mood'. He was so impressed by the enthusiasm of the young people. They'll make it by the end of school, he thought last year. Now he says, 'You can count those who will succeed on the fingers of one hand. Only a 'very small fraction' will graduate. ... All agencies are trying to help them, the authorities, the training institutions, the companies. If they don't make it, who will? ... 'The experiences of the last few months have opened our eyes', says Astrid Langenegger, a local leader of the help group. 'About 80% of these young people have missed nine years of schooling. Any vocational training is not a realistic goal for them.' ... Sometimes the aid workers are startled by what they say. Doesn't that sound like prejudice? (Staib, 2016)

They also reported that for most of them, an internship of two eight-hour days would be too demanding. "They do not know how work goes," said the local support group leader. And some of them do not accept women as superiors. They would not clean a kitchen. For the instructors involved, it became clear for the first time how demanding training has become in Germany in recent decades. There are no more unskilled jobs, he said. According to the Youth Welfare Office, mastering the German language at the B2 level (upper intermediate, e.g., understanding the main ideas, also with abstract themes, interacting fluently, naming the advantages and disadvantages of different options) is "intellectually unattainable" for many refugees. It would not be possible to convey to them the complex reality of the world of work in Germany. Only 1 in 100–150 unaccompanied young refugees would manage an education (Staib, 2016).

Of course, over time, many can adapt better to the new environment (Staib, 2021) and the experiences with other refugee groups are reported to be better ("Everything is different with Syrians, everyone who works in the support system agrees"; Staib, 2016).[2] Psychologists such as Heiner Rindermann (2015) or education economists such

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[1] All statements originally said or written in German have been translated by us, the authors.

[2] During the review process, our attention was drawn to the article by Staib (2021). A discussion then arose between the authors and the reviewers and editorial board (as on other points) as to how this contribution should be evaluated. On the one hand, there was the position that Staib's more recent contribution (2021) cancels out his older contribution (2016), i.e., the later one clearly contradicts the earlier one, and thus the pessimistic assessment of the difficult or non-trainability of refugees and their low usability on the labor market is incorrect. We, the authors, see this somewhat differently upon closer examination of the text. True, Staib (2021) said: "Things went better than expected." But also: "After the first article was

as Ludger Wößmann (2015) have pointed to the cognitive abilities of immigrants' in their countries of origin as evaluated in PISA or TIMSS (Programme for International Student Assessment, Trends in International Mathematics and Science Study[3]) studies and have expressed doubts. Especially regarding immigration from Syria, Wößmann (2015) wrote:

> In a nutshell: The results are devastating. In Syria, 65 percent of school children do not reach the basic level of foundational skills; in Albania, the rate is 59 percent. ... In terms of participation in a modern society, these are functional illiterates according to international educational standards. They can read and write only to a limited extent and can solve only the simplest arithmetic problems. Even if they [Syrians and Albanians immigrated to Germany] know German, they can hardly follow lessons. ... According to the Munich-Oberbayern Chamber of Skilled Crafts, 70 percent of apprentices from Afghanistan, Syria and Iraq who started their apprenticeship two years ago have already dropped out."

The ability level of students in Syria would be about 140 student assessment scale points (*SASQ*; *M*=500, *SD*=100; see fn.3) below the German level, which corresponds to a lack of four to five years of education. Therefore, only a relatively short introduction to practical work could be successful.[4]

Finally, these sceptical assessments are supported by previous student achievement studies with native and immigrant children in Germany. Immigrant pupils had significantly lower scores in the German IQB study (Stanat et al., 2019, p. 318; see fn.3), with those from Turkey scoring *SASQ*=443 and those from Arab countries scoring *SASQ*=400. German nationals had an average *SASQ*=521. Converted to an IQ of 100 for Germany,

published, the integration workers in Rosenheim were sharply criticized. In the 'poisoned atmosphere,' they said what was going on and 'took a beating for it,' says Fischer [head of the district youth welfare office]. They had not put the article on their website so as not to receive applause from the AfD [German right-wing party], reports a social worker." The only problem, as they say from today's perspective, was that too many persons were coming at the time, not problems on the part of the refugees themselves. Today's problem, it is written, is only that the fruits of their labor are threatened by Germany's strict asylum laws. But let's look at the numbers reported in the article. 11 out of 24 refugees (in 2016 adolescents from Afghanistan, Eritrea and Somalia) have completed vocational training (46%), 12 are working (50%). Generally on refugees (not just unaccompanied youth): "According to a report by the Institute for Labor Market and Vocational Research (IAB) from April 2019, about half of the people who have arrived from the most important asylum countries of origin since 2013 have found work." And: "The employment rate for people from the eight main countries of origin was 28.9 percent in May 2020 (for foreigners it is 45.4 percent overall, for Germans 62.5 percent)." Jobs are rather unskilled or temporary. Finally about the costs: The assistance costs 150 euros a day and lasts an average of 5 years, which makes 273,750 euros per unaccompanied minor refugee. Let's sum it up: More refugees than originally thought manage to get training and a start in work (mostly basic jobs or craftsmanship), but the general employment rate among refugees is far lower than among other foreigners or Germans, and the subgroup of unaccompanied minor refugees adds costs of several 100,000 euros. This is also roughly the result that systematic research (for Germany: Bettge, 2018) has shown. An economic miracle is not to be expected from this.

[3] PISA and TIMSS are international student assessment studies. PISA tests 15-year-old students in reading, mathematics and science. TIMSS tests 4th and 8th graders in mathematics and science. IQB (Institute for Educational Quality Improvement) is a regional German student assessment study that measures reading, foreign languages, mathematics, and science in 4th and 9th grades. *SASQ* stands for Student Assessment Scale Quotient or scores with *M*=500 and *SD*=100. All international student assessment studies use this scale. *SD* stands for standard deviation.

[4] The uncorrected means in international student assessment studies as PISA and TIMSS are in *SASQ*: Afghanistan –, 315; Albania 411, 412; Syria 388, 404; Turkey 445, 463 (first number from Rindermann, 2018, second number from Angrist et al. , 2021).

these correspond to 88.30 and 81.85 IQ points, respectively.[5] However, these results also show that the performance level of immigrants might be somewhat *better* than the average performance level in their countries of origin. While Wößmann mentions an international gap of 140 SASQ (in TIMSS 2011) (in the IQ-metric 21 IQ points), we now have a gap for Arabic-speaking pupils in Germany of 121 SASQ (in the IQ-metric 18 IQ points). Nevertheless, pupils with a Turkish immigrant background do not perform better than pupils in Turkey (in TIMSS 2011 a cross-national gap of 57 SASQ, 9 IQ points; within Germany in IQB a gap of 78 student assessment scale points; with both parents born in Turkey, 12 IQ points).

Intelligence and developmental tests administered to children ages 5 and 6 before they enter school or to children already in school also reveal differences in achievement and development: A study of children ages 5 and 6 from 2000 to 2005 found that Turkish children in Germany had IQs of 90 (German reference sample set at IQ 100; Becker and Biedinger , 2006). Tiedemann and Billmann-Mahecha (2004) found an ability difference of *d*=0.80 in Turkish-speaking elementary school children, which corresponds to an IQ of 88, similar to the Becker and Biedinger study .[6] In an older study by Taschinski (1985) using the Raven matrices, the average IQ of secondary school students with a Turkish background was 76 IQ points. If both the older and more recent results are valid, this would indicate a catching-up process, possibly due to improved integration. Finally, in Berlin, a psychological study of children who started school in 2017 found that, on average, about 30% of German and Eastern European children had deficits in

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[5] Student achievement (or assessment) studies use as a standard a mean of 500 and a standard deviation of 100. Psychometric intelligence tests use the IQ-scale (*M*=100, *SD*=15). A simple conversion is possible, as, for example, from Fahrenheit to Celsius or from feet to meters: $IQ = \frac{X-500}{100} \times 15 + 100$.

However, there are two problems:

1. In student achievement studies, it is unclear what exactly the reference sample is for the mean 500 and standard deviation 100. Roughly speaking, it is a sample of well-developed countries (USA or OECD countries) around the year 1990 to 2000. However, this information is not explicitly stated (at least we could not find). For psychometric intelligence test results, the IQ value 100 represents the average in official standardization samples of the tests in UK. The reported mean of IQ 99.12 differs slightly because additional samples were used by Lynn and Becker (2019, pp. 158–159). The value represents England, Wales and Scotland). For the values of Rindermann (2018; appendix, Tables A1 and A2), IQ 100 represents the results of natives in United Kingdom in intelligence and student achievement studies. The country mean of IQ 99.60 slightly differs because students with immigrant background are included here. These differences in scales affect the means and *SD*s, but not the patterns of differences between countries. The standard deviation is based primarily on student achievement studies, i.e., on the *SD*s in developed countries (converted from 100 to 15).

2. As a kind of statistical game, it is always possible to convert everything into everything, for example height in meters into height in Celsius. But that makes no sense in terms of content, because the same scale is supposed to mean that the measured values are the same, which is not the case when converting height (meters) into Celsius, which stands for temperature. It is necessary to check the content validity. There is extensive research, dating back almost 100 years, on the similarity or even identity of the constructs and tests of student achievement and intelligence (e.g., Kaufman et al., 2012; Kelley, 1927; Pokropek et al., 2022; Rindermann and Baumeister, 2015). From the perspective of student achievement researchers, however, the constructs are different; IQ is not mentioned. This could also be motivated by research strategic reasons.

[6] *d*=0.80 means a difference of 80% of one standard deviation (*d*=1.00).

hand-eye coordination. However, 37.4% of children with a Turkish background and 51.5% of Arabic-speaking children in Germany showed such deficits (Bettge, 2018, p. 77).[7]

**Box 2:** Terms: Refugee, asylum seeker, foreigner, immigrant, migrant, migration background.

The broadest and best term is "people with a migration background". This term includes everyone from newly arrived refugees to the children and grandchildren of immigrants. "Refugee" is a political, media and legal term; it stands in the proper sense for people who come from war or other life-threatening emergency countries (e.g., political oppression). "Asylum seeker" is a legal term, it stands for people who have applied for asylum. "Foreigner" is also a legal term; it stands for people who have another citizenship. "Immigrants" or "migrants" are people who have come from abroad and are staying for a longer period of time (the term "migrant" also includes "emigrants", but this aspect is not relevant here).

In practice, terms are used very variably and they change over time. A negative aura is attributed and then they are exchanged ("euphemism treadmill"; Pinker, 1994). In German, for example, it is no longer appropriate to use "Asylant" (asylee) but "Asylbewerber" (asylum seeker); similarly it is said that "Flüchtling" (refugee, fugitive) should no longer be used, but rather "Geflüchtete" (a person who fled).

In our study we deal with people with a migration background who all immigrated; about 90% are seen as refugees. In the pre-study A, all were asylum seekers, about 95% refugees; in pre-study B, about 90% were refugees; and in the principal study C about 80% were refugees. The legal or political status is secondary to the scientific study; the country of origin (native or person with a migration background) is important.

While there is convincing evidence of noticeable differences in cognitive abilities, either observed by practitioners or measured by various tests at different ages and in different decades, the evidence for positive or negative selection effects is weak and contradictory. According to Kapur and McHale (2005), poorer countries in particular suffer from a brain drain. However, there are few statistical data on the ability levels of emigrants. A study by Borjas (2016, pp. 78ff.) indicates that it is the lower-achieving strata of Latin Americans that emigrate. In student assessment studies, students' abilities are generally similar to those of their countries of origin (Carabaña, 2011). Based on PISA data (Levels et al., 2008), Rindermann found only a +1 IQ point positive selection or modification effect, i.e., immigrants' achievement levels are only slightly better than those of their countries of origin (and whether this is due to selection or modification we do not know; Rindermann, 2018, p. 289).

Why is all this important? Cognitive ability – intelligence, having true and relevant knowledge and using it intelligently – is crucial for success in school, vocational training, and the labor market (e.g., Kramer, 2009; Schmidt, 2009). The more complex the work requirements are, the higher the intelligence must be in order to successfully meet these requirements (Gottfredson, 2003). Societies with higher average levels of ability produce and have more wealth, are more democratic and free, respect human rights more, have better universities, fewer plane crashes, more patents, more innovations; in short, living conditions in these societies are better from the perspective of most people (e.g.,

[7] In our view, hand-eye coordination is not a characteristic of intelligence (the ability to think), but is one of the broader cognitive abilities. As a rather basic skill, it is not a subject of higher education, but is a prerequisite for writing. It is a topic in kindergarten and in "normal" children's activities (drawing, playing with building blocks, dolls, construction toys as Lego, etc.).

Hanushek and Woessmann, 2015; Jones, 2016; Lynn and Becker, 2019; Rindermann and Carl, 2018, 2020). The positive effect of intelligence also applies to immigrants, e.g., the brighter ones achieve a higher income (Jones and Schneider, 2010; Richwine, 2009). At the same time, however, this also means that successful integration (which includes even more, e.g., attitudes) is less likely if cognitive human capital is poorly developed, and at the same time high costs arise for the host society. Although there is a need for immigration of young people in Western societies due to aging, only well-qualified people support the social systems and society (Manthei and Raffelhüschen, 2018). The authors estimated that public liabilities in Germany would increase by around 9% as a result of the immigration wave of 2015 onwards.[8] For the Netherlands, Van de Beek et al. (2021, 2023) calculated average costs for non-Western immigrants of "almost €275,000" (over a lifetime). These skeptical assessments are generally confirmed by an older international comparative review of immigration in the West by Nannestad (2007, p. 530) which weighted gains and losses across various fiscal and welfare measures: "Immigration into Western welfare states of the last 15 to 20 years tend not to be to the advantage for the natives."

To the best of our knowledge, there is no previous study published in English that focuses on the cognitive ability levels of immigrants who arrived in Europe during the European migrant crisis in 2015 onwards. Our study has three goals:

1. What is the average cognitive ability level of refugees and immigrants? We present results from three independently conducted intelligence test studies by three different researchers or research groups in Germany.
2. How can ability differences within the group of refugees be (statistically) explained? What role does education play, for example?
3. Can we explain ability differences among refugees taking into account variables from their country of origin? Here we perform analyses on different data levels.

## 2. Results of Two Previous Studies

We have results from two previous studies on refugees, one preliminary with a small and local sample, another with a large sample and from different regions in Germany. We present their results to compare with our third study. Are there major differences or are the results stable across studies, tests, samples and researchers?

### 2.1. Previous study A: Refugees in Chemnitz

In a bachelor thesis by two psychology students (Albrecht and Buchhardt , 2015), supervised by Heiner Rindermann, the intelligence of 29 (originally 31, see end of paragraph) asylum seekers in Chemnitz was measured. They were from Syria (*N*=15), Tunisia (*N*=6), Libya (*N*=3), and Russia (*N*=5). All were men (in 2015, 74% of asylum

[8] "Both refugee and welfare migration are ongoing challenges for host countries, and especially those with a well-developed welfare system. ... The results reveal that immigrants' below-average productivity and remaining lifetime net payments jeopardize the positive effects of their favorable age structure. ... Migration not only costs the current population but also broadens the intergenerational imbalance. ... Only highly qualified immigrants might help ease the burden on Europe's weakened fiscal sustainability resulting from an intense double aging process." (Manthei and Raffelhüschen, 2018, pp. 459f.)

seekers in Germany were men [Rich, 2016]; among Syrians about 75% [Damir-Geilsdorf and Sabra, 2018]). 27 of the Chemnitz sample were Muslim, 2 were Christian. They were on average 32 years old (19 to 59 years). 66% were unmarried, 34% were married. On average, they had an education of 10.31 years (*SD*=1.97). Their fathers had an educational attainment of 7.55 years (*SD*=4.76) and mothers had an educational attainment of 5.41 years (*SD*=5.14), consistent with a secular increase in education (the younger generation had more education; Meyer et al., 1992) and a traditional gender pattern in Muslim countries (UNDP, 2003). 35% stated that they had an academic education or were students, 65% had none. 3% were not employed in their country of origin, 59% were employed, 21% worked as skilled workers, 17% were students. Two individuals who did not understand the test instructions were excluded from the original sample (31 individuals, among the two excluded was the only woman).

A numerical scale and a figural scale from the German I-S-T 2000R (Liepmann et al., 2012) were used. The numerical tasks included arithmetic (plus, minus, multiplication, division, fraction, root extraction, exponentiation) and number series. Figural tasks included assembling shapes (e.g., a circle) from individual parts (as in a tangram), determining the identity of cubes, and tasks similar to Raven's Progressive Matrices but with only four elements.

The average intelligence level of the refugees in this sample was 92 IQ points according to German norms. The result for the numerical, more scholastic scale was 91 IQ points, for the figural scale 92 IQ points. The correlation with years of education was $r$=.50 ($N$=29), and with parental education $r$=.27 ($N$=29), both of which support the validity of the data (Rindermann and Baumeister, 2015; Rindermann and Ceci, 2018). One year more of schooling for refugees corresponds to 1.99 IQ points more. The average IQ of those with or in academic education was IQ 95, and without such education was IQ 91. In this rather small sample, older refugees had a higher IQ ($r$=.42), even when controlling for education (partial $r_p$=.51) or when Russians were excluded ($r_p$=.48), contradicting an age decline and a FLynn effect.[9]

Refugee graduates had an IQ (95) comparable to that of German Realschule students, e.g., for the occupation of auto mechanic or nursing assistant. The non-graduates had an IQ (91) comparable to that of German Hauptschule (lower secondary education, level 2) students, e.g., for the occupation of baker or hairdresser. The comparison with students from German schools is based on the German CogAT (Cognitive Abilities Test; Heller and Perleth, 2000).

Mean scores for countries are quite speculative (data are available from only 29 individuals); refugees from the three Arab countries had IQs of 89 ($N$=24), those from Russia had IQs of 100 ($N$=5). The same shaky basis is given for religion: IQ 91 for Muslims ($N$=27), IQ 94 for Christians ($N$=2).

It is a small sample, but the results are plausible and seem to be valid: a slightly higher IQ at a figural scale with no school-related content; substantial correlations with the subjects' own and parental education; higher correlation with their own than with parents' education; higher IQ among graduates; higher IQ among the few refugees from Russia compared to those from Arab countries; higher educational level in the younger generation.

[9] Two researchers, Flynn and Lynn, or Lynn and Flynn, have rediscovered the secular IQ rise, which is why we call it the "FLynn effect".

The only contradiction is the "Woodley effect" of higher intelligence in the older generation, i.e., no FLynn effect.[10]

The measured intelligence level in this small sample does not support the previously reported assumption that skilled workers arrived during the European migrant crisis; rather, it supports the later experiences of teachers and aides working with refugees. Keep in mind that refugees from Afghanistan and sub-Saharan African countries were missing from this sample. Presumably, the averages could be even lower (see study C, Table 2). Compared to studies done in the regions of origin (in various ability studies, Arab countries had IQs of about 79 IQ points, Russia about 98 IQ points; Table 3), the results in this refugee sample are somewhat elevated. Perhaps the cognitively more competent ones emigrated or the smarter refugees were willing to participate in the study.

## 2.2. Previous study B: Refugees in Germany

A private company (HR [Human Resources] Diagnostics) based in Stuttgart (southwest Germany) has developed a test battery called Caidance-R (psychological competence analysis for refugees) to measure the human resources of refugees in Germany (Frintrup and Spengler, 2016a, 2016b). The approach originates from occupational aptitude diagnostics. The web-based test takes two hours to complete and can be administered on a PC, notebook, or tablet. The test is conducted in German, English, French, Arabic, Farsi, and Turkish. It measures cognitive abilities and personality, including job-relevant attitudes and interests (e.g., conscientiousness and task orientation). Cognitive abilities include several scales: verbal, numerical, and figural intelligence (content scales language, mathematics, culture-reduced graphic-abstract), problem-solving (matrices), mental speed (measured with verbal, numerical and figural tasks), concentration (number series), working memory (*n*-back, "cognitive flexibility"), and mental arithmetic. The average reliability (internal, Cronbach-$\alpha$) is $r$=.82, and the average validity is $r$=.27 (criterion validity, e.g., success in commercial, simpler activities) (not corrected for unreliability and restricted variance, corrected $\rho$=.56; Frintrup, 2018a, pp. 64f.). The comparison of two samples of $N$=220 refugees yielded stable results; the differences between the samples were $d$<0.10 (Frintrup and Spengler, 2016b). The norm sample is a labor market sample, it is not clear whether it includes university students and graduates (i.e., the norm sample might be slightly below average). This means that the test results can be compared well with those of German job seekers.

In a sample of $N$=552 refugees seeking work in Germany who are supported by the employment agency and participate in qualification measures, the average age was 24.3 years (Frintrup, 2018a). The average education was 11.24 years. 32% had no work experience, 17% had 1–2 years, 43% had 2 or more years (8% did not specify). 22% had been in Germany between 0 and 6 months, 54% up to one year, 14% up to 3 years, and 10% more than 3 years. In the sample measured between 2015 and 2017, average "problem-solving" IQ (matrices) was 89.50 IQ points, mental speed 77.50, concentration 86.50, working memory 85.00, and mental arithmetic 77.50 (all in IQ with $SD$=15).

[10] "Woodley effect": Decline of intelligence across generations (Rindermann and Thompson, 2017).

In another paper (Frintrup, 2018b), the result is given as $d=-1.20$ below the German average, which is equivalent to an IQ of 82 points. The average of 89.50 and 82.00 corresponds to an IQ of 86 (compared to the first study in Chemnitz; there: 92 IQ points).[11]

In the words of test author Andreas Frintrup (2018b, p. 16, translation by us):

> Compared with the norm values of German labor market participants, the current refugee cohorts show considerable deficits, especially in cognitive abilities. ... A detailed examination shows that the greatest deficits are in ability areas requiring basic arithmetic skills (1.5 standard deviations below the average for German participants) and number handling (such as sorting by size). ...
>
> There are many possible explanations for why the average cognitive performance is so much lower in migration samples, including ugly epigenetic theories, above all different learning cultures, the duration and accessibility of schooling, cultural dependence of diagnostics and the tests used, and the influence of escape trauma.[12]

Similar to the first study, the results for arithmetic were lower than for figural (school-distant, culture-reduced) intelligence. Frintrup mentioned "ugly" (epi)genetic theories, culture, schooling, cultural bias in testing, and trauma as possible causes. Of course, whether a theory is "ugly" or not is epistemically irrelevant (what matters is whether a theory is true or not). Ugliness is an aesthetic criterion in the strict sense, but most likely it was meant as a political criterion (from the point of view of the left). Political criteria are also irrelevant to scientific or epistemic goals (Rindermann, 2018, pp. 211ff.). Finally, genes are often cited as a possible cause in the scientific community (Rindermann et al., 2016). There is extensive indirect evidence for their effect on intelligence differences (e.g., Connor and Fuerst, 2024; Piffer, 2015; Piffer and Kirkegaard, 2024; Rindermann, 2018, chs. 3.4.3 and 10.7). Trauma, such as that caused by having experienced war, by personal persecution and mistreatment, or by stresses during flight, could reduce intelligence. These assumptions are generally supported by a study by Mani et al. (2013), who observed declines in intelligence when psychosocial stress was high.

In our study, we address the possible educational, genetic, and cultural causes mentioned above. The effects of cultural bias in testing can be compared by comparing different tests. However, all tests are still tests. In addition, an analysis of performance and thinking in everyday life is necessary (see above; for example, behavior in vocational training). A possible impact of trauma and selection effects can be measured by comparing refugees' test scores with older, pre-war test scores in their countries of origin.

## 3. Method

The second author (Bruno Klauk) designed the study (study C) and collected the data including that of the 2022 comparison group (Klauk, 2019).

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[11] In a later newspaper article (Frintrup, 2018a, p. 16), the average IQ of refugees in Germany, as measured by the Caidance-R, was IQ 82.30, so our estimate for this approach of IQ 86 is rather optimistic. (Frintrup's results vary somewhat, differences in the samples, e.g., country of origin, could explain them.)

[12] One reviewer of our paper said that instead of "epigenetic", "genetic" was probably meant here. We agree with this assessment. "Epigenetic" might be a milder (but not appropriate) term for "genetic". Perhaps it was changed by a journalist (they usually edit newspaper articles before they go to press) for political reasons.

### 3.1. Sample

The sample consists of 507 immigrants tested in language courses (around 57% at a more advanced level B2 and above; see Table 1) from eleven educational institutions (e.g., Adult Education Centers, in German "Volkshochschule") in two German states (North Rhine-Westphalia and Saxony-Anhalt) between May 2017 and December 2018. Participants provided written informed consent in their native language. The percentage of test refusers was less than 5%, and overall there was a high interest in knowing how well one would do on the test. The participants did not received any compensation; however, they did receive the results (including a written document for their free disposal) in a personal consultation with a psychologist (Bruno Klauk) on the same day. IRB (Institutional Review Board) approval for psychological testing studies with adults and voluntary participation is not required in Germany (freedom of research is guaranteed by the constitution).

Attendance at a language course and participation in the test may lead to a slight positive selection. The average age was 32.91 years. 63% were men, 37% were women, slightly more women than in the 2015 immigration wave (Rich, 2016). Presumably, not all participants were legally recognized refugees (asylum seekers, recognized asylum seekers). 18% indicated that they came to Germany due to economic reasons (see Table 2). About 71% were from Arab and Muslim countries (see Tables 3 and 4). 42% were unmarried, 45% married, 7.9% widowed, and 4.5% divorced. The average duration of schooling was 10.53 years, 7.95 years for fathers and 6.43 years for mothers. The same pattern was found in study A: fathers had higher schooling than mothers did; similarly, the younger generation had more education. This underscores the validity of the results.

We compared the distribution of the nations (see Table 3) with information from the official central register of foreigners from 2019 (Ausländerzentralregister , 2019). This comparison shows that the sample of almost 500 test persons is largely representative of the migration processes up to the end of 2017 in terms of the countries of origin and their distribution (see also Klauk, 2019, p. 57). As in Germany in general, refugees from Syria form the largest group in the sample. Then come refugees from other Arab and Central Asian countries (Afghanistan, Iraq, Iran) and Eritrea. Most importantly, the respective regions of origin (Middle East, Central Asia, Africa) are adequately represented.

On average, participants had 4.68 siblings. They had been in Germany for 40 months (*SD*=48) – three years and four months. About 63% were Muslims. 26% were Christians, the rest other religions such as Yazidis or no religion (see Table 1). The average income in their country of origin was 707 euros per month (about 765 US dollars), *SD*=746 euros. Originally, the data set consisted of 508 individuals. However, no information on the country of origin was available for 8 persons, and one person was a teacher. Thus, nine observations were excluded, 499 remained. Sample sizes vary somewhat between analyses as not all questions were answered by all participants.[13]

[13] Depending on the error correction of the data, sample characteristics also vary minimally (first digit after the decimal point), e.g., here the average age is 32.91 years, whereas in Klauk (2019, p. 62) it was 33.1 years.

### 3.2. Variables and instruments

The tests were conducted in groups in the classrooms of the language courses. A demographic questionnaire was used to collect information on age, gender, country of origin, marital status, reason for entering Germany, education, number of books in their household in the country of origin, etc. These variables help explain individual differences in ability outcomes.

As described in Box 3, the intelligence test used was the BOMAT (Bochumer Matrizentest; Hossiep and Hasella, 2010), a Raven-like pure figural intelligence test.[14]

**Table 1:** Sample characteristics.

| Variable | Values |
|---|---|
| **Course level, language courses** | |
| Prep/school | 4% |
| A1 | 9% |
| A2 | 12% |
| B1 | 19% |
| B2 | 31% |
| C1 | 16% |
| Studying | 10% |
| **German state** | |
| North Rhine-Westphalia | 81% |
| Saxony-Anhalt | 19% |
| **Sex/gender** | |
| Male | 63% |
| Female | 37% |
| **Age** | |
| Mean 32.91 years | Standard deviation 9.94 years |
| **Civil status** | |
| Unmarried | 42% |
| Married | 45% |
| Widowed | 8% |
| Divorced | 5% |
| **Years of schooling** | |
| Migrant | *M*=10.53 years, *SD*=2.93 |
| Father of migrant | *M*=7.95 years, *SD*=4.72 |
| Mother of migrant | *M*=6.43 years, *SD*=5.01 |

[14] For a first look about the Raven see link to the article

**Table 1:** *Cont.*

| Variable | Values |
|---|---|
| **Number of siblings** | |
| Mean 4.68 | Standard deviation 2.98 |
| **Religion** | |
| Muslims | 63% |
| Christian-Orthodox | 11% |
| Christian-Catholic | 7% |
| Christian-Other | 8% |
| Yazidi | 2% |
| Other religion | 2% |
| Not religious | 7% |
| **Income in country of origin** | |
| Mean 707 euros | Standard deviation 746 euros |

*Note*: Where the total is not exactly 100%, this is due to rounding inaccuracy.

**Box 3:** Terms: Intelligence, IQ, cognitive ability, cognitive competence, student achievement, human capital, cognitive human capital.

"Intelligence" is defined as the ability to think, a rather knowledge-reduced mental capacity, ideally free of specific knowledge. "IQ", the intelligence quotient, is the result of an intelligence test. The scale is age-neutral with a mean of 100 and standard deviation of 15. In a narrower sense, IQ is just a scale like meters. "Cognitive ability" (or interchangeably "cognitive competence") is understood as the ability to think (intelligence), knowledge (the store of true and relevant knowledge) and the intelligent use of this knowledge. The term cognitive abilities can also be broadened to include everything from basic cognitive abilities (mental speed, concentration, working memory) to solving complex problems. "Student achievement" is pupils' achievement in school and measured by grades or by student achievement tests. The type of measurement and the results overlap strongly with "broad" intelligence tests, i.e., those tests that also contain knowledge components. "Human capital" is defined as everything within a person that helps to be productive in economic action including personality (e.g., conscientiousness), health and physical abilities. Cognitive ability is crucial here. "Cognitive human capital" covers the application of cognitive ability in (economic) prediction and explanation studies.

The BOMAT (Bochumer Matrizentest; Hossiep and Hasella, 2010), used in our study is a (narrow) figural intelligence test that measures intelligence well in a culture-reduced way (no arithmetic, no language, no knowledge questions). A similar figural test is in the I-S-T (or IST, pre-study A), but it also contains more school-near arithmetic tasks. A broader cognitive ability test was used in pre-study B including verbal and maths tasks. This test was translated into different languages.

The BOMAT was developed in several studies with secondary school students and adults between 1997 and 2007. The aim was to measure general intelligence with figural-abstract material that was relatively independent of specific school experiences. There are 15 fields, one field is empty, and the only correct solution to the question of what should complete this field must be chosen from six possible options (see Figure 1).

The test consists of 30 figural tasks to be completed in 30 minutes. Reliability is $r$=.82 (Cronbach-$\alpha$) and $r$=.79 (retest). Correlations with Raven Matrices are about $r$=.41, with CFT 20-R $r$=.57, with grades in mathematics $r$=|.34| (validity; Hossiep and Hasella, 2010, pp. 51–56). Norms are given for a younger population (mean age 16 years, range 14 to 20 years; Hossiep and Hasella, 2010, p. 37; norms, p. 85, "all"). A histogram in the supplementary material shows the distribution of IQs for the refugee sample tested (Figure S1).

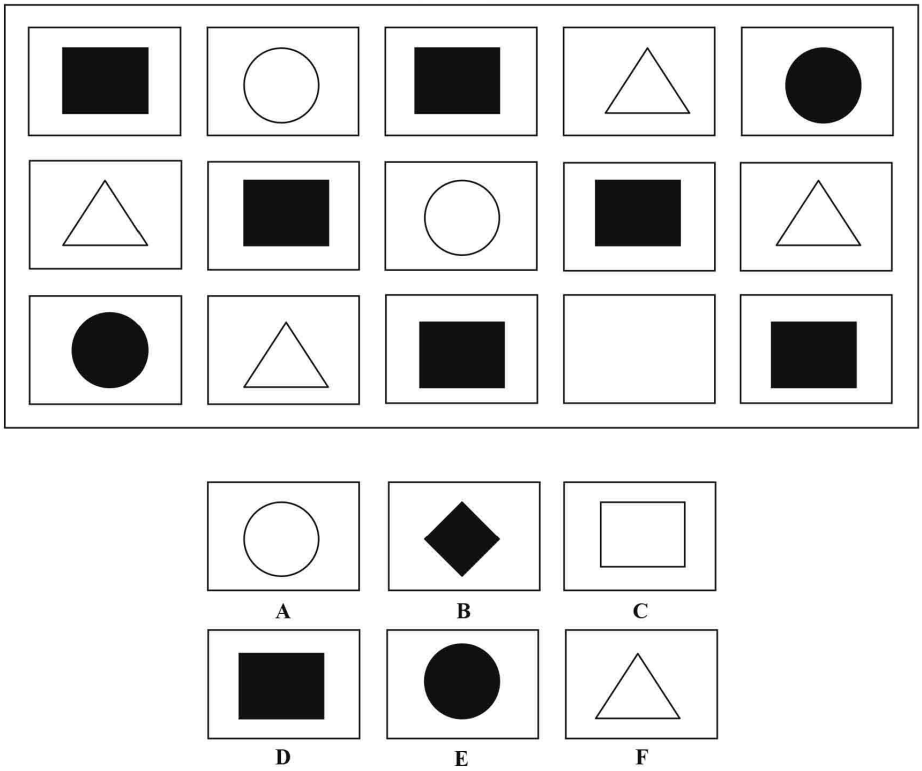


**Figure 1:** Exercise task 2 of the BOMAT (with an easy level of difficulty). The correct answer is A (Hossiep and Hasella, 2010).[15]

## 3.3. Additional new adult German BOMAT sample

The standard sample presented in the test manual was composed of young people (school pupils in North Rhine-Westphalia under the age of 21 years; Hossiep and Hasella, 2010). This sample is not representative of Germany or adults in Germany. This can have two consequences:

1. The norms are too hard because the type of intelligence that is measured by the BOMAT reaches its plateau in youth and then drops again. This would mean that the ability level of migrants would be underestimated relative to adults in Germany.

[15] Copyright Hogrefe Publishing Corp. Unauthorized reprint and reproduction prohibited. Reprinted with permission from Hogrefe. The Bochumer Matrizentest Standard (BOMAT – standard) can be ordered at the Testzentrale, Herbert-Quandt-Str. 4, D-37081 Göttingen, Germany.

2. The norms are too lenient because the norm sample also included young people (around the ages of 14 to 16) who have not yet reached their maximum developmental level of intelligence in their later adulthood. This would mean that the ability level of migrants would be overestimated relative to adults in Germany.

Therefore, data with the BOMAT were collected from adult samples in 2022. There were four samples: university students (*N*=201), predominantly working people (*N*=140), working people (*N*=43) and retired persons (*N*=23), mainly from North Rhine-Westphalia and Saxony-Anhalt. Both university students and retirees are not appropriate samples for comparisons with our immigrant sample (mean age around 33 years). We used this new survey as an additional check of IQ scores (which are always based on comparative samples).

## 3.4. Country-level data

The description of the data at country level can be found in the supplementary material.

## 3.5. Statistical analyses

**Box 4:** Standard deviations, correlations, regressions and path analyses.

In statistical analyses we calculate *mean values* and *standard deviations*. The latter reflect whether a group is homogeneous or heterogeneous.

*Correlations* indicate the closeness (or strength) and the direction of a relationship. Correlation coefficients (*r*) vary between −1, 0 and +1; 0 means no association (such as between hair length and height within women or men), +1 exact positive association (as between height expressed in meters or feet), −1 exact negative association (such as between grades in a scale from 1 (good) to 6 (bad), and credit points in the scale from 1 (low-bad) to 15 (high-good)). At *r*=±.10 one speaks of a weak connection, at *r*=±.30 of a medium and from *r*=±.50 to *r*=1 of a strong correlation.

Like correlations, *regressions* calculate relationships. If there are only two variables, the (standardized) results are the same. However, if there are three variables, i.e., two variables, with which one target criterion is predicted, the regression coefficients are usually smaller, since they indicate the relative relationship between a variable A and C compared to the relationship between B and C. One example: intelligence and student achievement at school correlate at *r*=.50 and diligence and student achievement at *r*=.30. However, the regression coefficient of intelligence on achievement is only beta $\beta$=.41 and that of diligence on achievement only $\beta$=.23. Why? Because intelligence and diligence correlate with each other with *r*=.35. What explains intelligence in terms of achievement at school also partly explains diligence in terms of achievement. Regression coefficients thus reflect the "pure" relationship. *R* (in capital letters) is the multiple correlation of two or more variables with a target criterion (range 0 to 1).

*Path coefficients* are the same as regression coefficients: they reflect a relative relationship to other variables. However, in *path analyses* one can distinguish between direct and indirect relationships. To come back to the example: diligence has a direct positive effect on achievement, but also on intelligence and thus, via intelligence, again indirect on achievement. Standardized regression and path coefficients vary between −1, 0 and +1, with rare exceptions.

What is the *meaning* of these relationships, whether they are between two or more variables, whether they are relative, direct or indirect? For correlations, regressions and path analyses, only statistical relationships are given, nothing more. Their interpretation is important. High correlations could stand for the similarity or identity of characteristics and measurements, such as body weight measured in the morning with one scale and in the evening with another scale. Or intelligence measured with two different tests. Or correlations could stand for causal influences. Two examples: height and weight correlate with $r$=.60 (fictitious). Sure, taller people are heavier (height→weight). However, better nutrition in childhood leads to greater height (weight→height). Hair length and height are negatively correlated: Taller persons have shorter hair. But height has no effect on hair length, and hair length has no effect on height. It is gender, men have shorter hair and are taller, women have longer hair and are shorter. Genes are certainly relevant for the sex-related height difference, but for the difference in hair length it is gender-related concepts of attractiveness. There are cultural factors behind gender-related concepts of attractiveness, perhaps also social, economic and genetic ones. Causal interpretations require theoretical assumptions about causal processes; they can be corroborated particularly well by experimental studies. Since characteristics often cannot be varied (e.g., height and gender), quasi-experimental studies are often used for this purpose.

We performed descriptive analyses (means, standard deviations, frequencies) and correlation, regression, and path analyses. Path analyses are used to calculate the direct, indirect, net, and sum statistical effects of variables. In these analyses, the standardized path coefficients ($\beta$) between different variables are most important. Correlations are always added in parentheses. The differences between correlations and path coefficients help to quickly estimate the influence of other variables in a model (the larger the difference, the larger the statistical influence of other variables), and they enable model checking ($\Sigma r\beta$=$R^2$ = 1 – residual; the sum of the products of the correlations and beta coefficients gives the variance explained; residual/error is the unexplained variance) and calculation of the proportion of variance explained by each single predictor ($R^2$=$r\beta$). Missing paths correspond to small effects around zero. “Good” values for fit indices (when models are not saturated) are SRMR≤.08 or SRMR≤.05 and CFI≥.95 or CFI≥.97, and “acceptable” fit is achieved with SRMR≤.10 and CFI≥.95.

SPSS and Mplus were used for the analyses. Significance tests were not used for interpretation (for a detailed rationale, see, e.g., Cohen, 1994; Gigerenzer, 2004; Wasserstein et al., 2019). The Full Information Maximum Likelihood (FIML) method was used for all analyses. This means that there is no listwise deletion in case of missing data. All given information is used; sample sizes and country compositions may differ from one path (and correlation and error term) to another.

We conducted three types of analyses: An individual-level data analysis that also uses country-level data (Figure 2); a multilevel analysis combining individual-level and country-level data (Figure 3); and for the Appendix (because of the small country sample), a country-level data analysis using BOMAT survey results averaged for countries of origin (Figure S2).

We present standardized coefficients. First, they are comparable for differently scaled predictors and criteria. Second, the majority of variables do not have natural, understandable, and widely used scales. Therefore, nonstandardized results would be less meaningful.

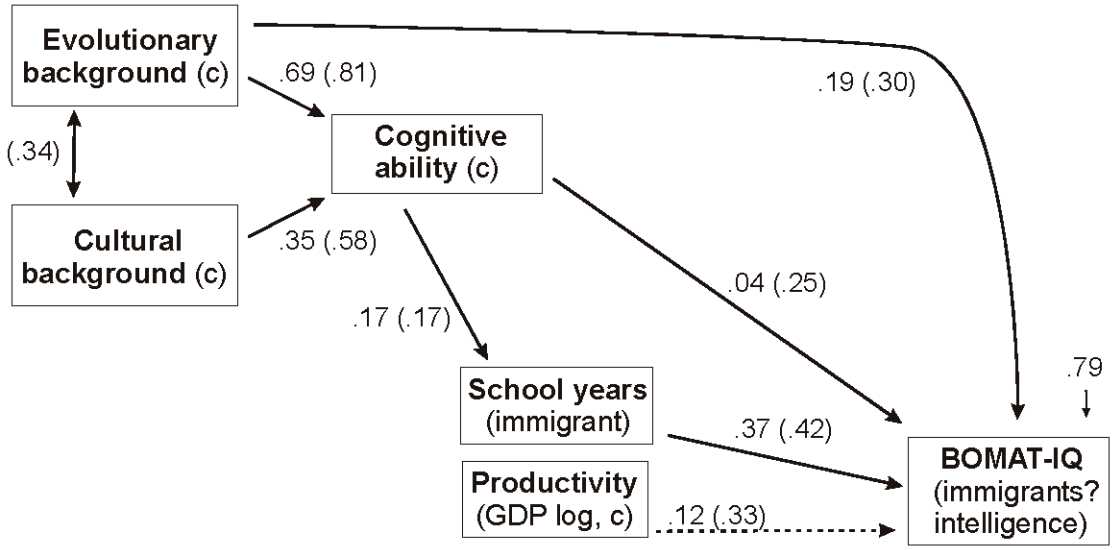


**Figure 2:** Path analysis at the individual level with country of origin (evolution, culture, cognitive ability, "c") and individual (school years, BOMAT-IQ) variables, criterion immigrants' intelligence (BOMAT-IQ), GDP per capita of a country (c) as control added in a second variant (standardized path coefficients, correlations in parentheses, FIML (no listwise deletion), error term (.79) as unexplained variance, *CFI*=.98, *SRMR*=.03), standard errors in Table S2, *N*=425 persons.

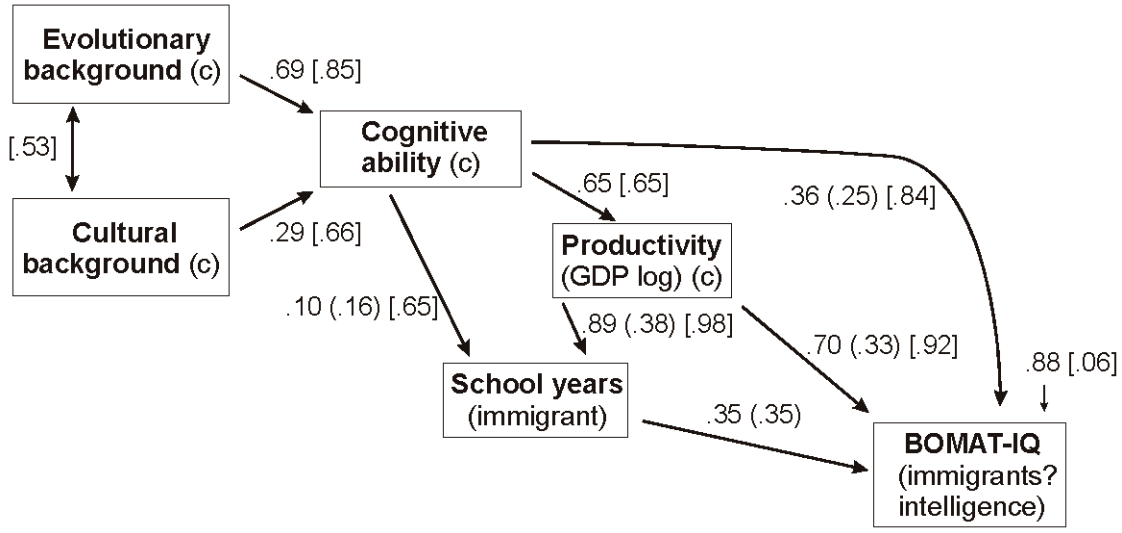


**Figure 3:** Multilevel path analysis at the individual and country level (c) with country of origin (evolution, culture, cognitive ability, productivity-income) and individual (school years, BOMAT-IQ) variables, criterion immigrants' intelligence (BOMAT-IQ) (standardized path coefficients, individual-level correlations in parentheses, country-level correlations in brackets, FIML, error term as unexplained variance (individual .88, country .06), *CFI*=.99, *SRMR*=.01 within [.05 between]), standard errors in Table S3, *N*=425 persons and 15 countries.

# 4. Results

## 4.1. Means

The overall mean score on the BOMAT intelligence test for the immigrants was IQ 90 (see Table 2). The mean score for refugees in the narrower sense (humanitarian reasons) was IQ 89 (for comparison: 92 IQ points in study A, 86 IQ points in study B). It was identical to that of those who came to Germany for economic reasons (IQ 89; Table 2). Those who came for both political and economic reasons or for private reasons had a slightly higher IQ of 92 points. The differences are not large. Self-assignment may also not correspond to their official legal status.

**Table 2:** Means and standard deviations in the BOMAT, grouped by reasons for coming to Germany.

| Group | N | Percentage of sample | Mean | Standard Deviation | Standard Error |
|---|---|---|---|---|---|
| Political, humanitarian reasons | 226 | 49.13% | 88.84 | 14.39 | 0.96 |
| Economic reasons | 82 | 17.83% | 89.31 | 16.77 | 1.85 |
| Both political and economic | 65 | 14.13% | 92.17 | 16.65 | 2.07 |
| Private | 87 | 18.91% | 92.21 | 13.77 | 1.48 |
| All together | 460 | (100%) | 90.03 | 15.09 | 0.70 |

*Notes*: Self-report of reasons for staying in Germany. All countries included (even those with fewer than five observations). Norms of the BOMAT manual.

Of the Syrians (the largest group), 67% reported that they came for humanitarian reasons, 6% for economic reasons, 23% for both reasons, and 4% for private reasons.

*Comparison with the additional new German BOMAT sample of adults*: In raw values, the average result of the immigrant sample was 12.04 solved BOMAT tasks (Klauk, 2019, p. 68). The two adult samples chosen for comparison, those predominantly working people and those entirely working people, solved on average 17.03 tasks (using a weighted average would result in a harder norm). The average standard deviation is 4.82. Using these two samples and their standard deviation would result in 84.47 IQ points (instead of IQ 90.03 in Table 2).[16] The applied BOMAT norms from young persons therefore do not lead to an underestimation of migrant IQ, but rather to an overestimation. We then varied the group composition (working people, age) and also looked at newly collected data again later (October/November 2023). Everything indicates that such variations would tend to lead to even slightly harder norms (lower migrant IQ). Over and beyond, it should be borne in mind that the norms obtained from samples from North Rhine-Westphalia (BOMAT manual, majority in the comparison sample) can be somewhat lenient relative to Germany (North Rhine-Westphalia always performs somewhat weaker in ability studies within Germany). In any case, there is *no* evidence of an underestimation of migrants' IQs. Finally, it should be pointed out that questions of standardization have no consequences for the later correlative analyses (correlations are independent of the mean).

[16] IQ conversion: $(\frac{(12.04-17.03)}{4.82} \times 15) + 100 = 84.47$ IQ points.

**Table 3:** Mean scores of immigrants by country and compared to scores in country of origin based on student assessment studies and psychometric intelligence tests.

| | | Current immigrant study | | Previous country-level studies | | | | |
|---|---|---|---|---|---|---|---|---|
| **Group** | **N** | **Percentage of Sample** | **BOMAT Mean (SD, SE)** | **Cognitive ability** (Rindermann) | **SAS-IQ** (Rindermann) | **Intelligence** (Lynn & Becker) | **Learning** (Lim et al.) | **Human Capital** (Angrist et al.) |
| Afghanistan | 21 | 4.94% | 83.52 (15.26, 3.33) | 81.90 | – | – | 78.95 (388) | 69.19 (315) |
| Eritrea | 39 | 9.18% | 75.32 (10.42, 1.67) | 66.85 | – | 68.77 | 78.60 (385) | – |
| Greece | 8 | 1.88% | 97.64 (11.10, 3.92) | 93.14 | 94.46 | 86.45 | 95.75 (500) | 94.27 (483) |
| Iran | 21 | 4.94% | 95.80 (16.85, 3.68) | 82.22 | 83.75 | 78.88 | 86.98 (441) | 86.42 (430) |
| Iraq | 18 | 4.24% | 85.08 (11.89, 2.80) | 89.17 | – | 89.28 | 81.07 (402) | 71.55 (331) |
| Jordan | 6 | 1.41% | 101.29 (14.24, 5.81) | 83.97 | 85.70 | 77.97 | 86.35 (430) | 84.55 (418) |
| Kazakhstan | 10 | 2.35% | 90.00 (11.84, 3.75) | 90.17 | 92.85 | 84.27 | 95.91 (501) | 95.16 (489) |
| Morocco | 11 | 2.59% | 86.29 (12.32, 3.72) | 69.51 | 71.36 | 68.73 | 77.52 (378) | 74.13 (348) |
| Palestine | 5 | 1.18% | 90.19 (6.97, 3.12) | 81.11 | 81.03 | 79.66 | 82.62 (412) | 82.41 (404) |
| Poland | 24 | 5.65% | 91.48 (15.43, 3.15) | 97.48 | 98.35 | 94.62 | 99.63 (526) | 99.30 (516) |
| Russia | 7 | 1.65% | 100.57 (8.28, 3.13) | 96.94 | 98.59 | 92.95 | 101.28 (537) | 99.52 (518) |
| Somalia | 6 | 1.41% | 77.77 (9.86, 4.03) | 66.23 | – | 67.67 | 76.87 (374) | – |
| Syria | 223 | 52.47% | 91.08 (14.19, 0.95) | 77.56 | 80.02 | 72.99 | 83.48 (418) | 82.41 (404) |
| Turkey | 16 | 3.76% | 92.46 (18.48, 4.62) | 86.86 | 88.78 | 86.66 | 92.28 (477) | 91.25 (463) |
| Ukraine | 10 | 2.35% | 102.03 (14.59, 4.61) | 91.90 | 93.48 | 88.61 | 94.91 (494) | 93.63 (478) |
| **All together** | **425** | **(100%)** | **89.65 (14.98, 0.73)** | **80.00** | **83.28** | **76.68** | **84.98 (428)** | **83.81 (413)** |

**Table 3:** *Cont.*

| | Current immigrant study | | | Previous country-level studies | | | | |
|---|---|---|---|---|---|---|---|---|
| **Group** | **N** | **Percentage of Sample** | **BOMAT Mean (SD, SE)** | **Cognitive ability** (Rindermann) | **SAS-IQ** (Rindermann) | **Intelligence** (Lynn & Becker) | **Learning** (Lim et al.) | **Human Capital** (Angrist et al.) |
| For comparison, German and British (Greenwich) means | | | | | | | | |
| Germany | – | – | – | 99.74 | 99.11 | 102.33 | 100.26 (530) | 100.18 (522) |
| United Kingdom | – | – | – | 99.78 | 99.78 | 98.35 | 99.78 (527) | 99.78 (519) |

*Notes*: As minimum *N*=5 persons per country; *N*, means and standard deviations are based on the BOMAT (norms of the manual); Cognitive ability (HR): Cognitive ability values (Rindermann) are based on the corrected mean of student assessment and psychometric intelligence tests, Greenwich-scale (i.e., UK natives set at IQ 100) (Rindermann, 2018, updated); SAS-IQ: mean in student assessment tests, averaged across scales and studies and adapted to a common IQ-scale (Greenwich natives), not corrected; intelligence test results from Lynn and Becker (2019); Learning (Lim et al., 2018): mean of student assessment and psychometric intelligence tests, Greenwich-scale, UK natives set at IQ 100 (converted by HR), in parentheses original values on a student assessment scale with 500 as mean and 100 as standard deviation (reference points unclear); Human capital (Angrist et al. , 2021): mean of student assessment tests, Greenwich-scale, UK natives set at IQ 100 (converted by HR), in parentheses original values on a student assessment scale with 500 as mean and 100 as standard deviation. The four previous country-level studies do not report standard deviations; however, the standard deviation of the scale could be applied (15 or 100; e.g., for calculating *d*s). Standard errors (SE) are only given for the BOMAT.

There are clear mean differences between the countries (Table 3). However, due to the small samples for individual countries (e.g., Jordan with six individuals), the differences cannot be reliably interpreted. Table 3 also shows the country averages from larger and mostly representative studies (e.g., TIMSS) for the respective countries of origin.

Comparing the average immigrant IQ scores (BOMAT, norms of the manual) with the five country-of-origin measures (90 vs. 80, 83, 77, 85, and 84 IQ points) in Table 3 (row in bold), we find a difference of 5 to 13 IQ points, with an average difference of +8 IQ points. If the adult sample (see Section 3.3) were used, the difference would be 2 to 3 IQ points. Most likely, this is a positive selection effect. Smarter citizens emigrate. At the very least, it does not support the theory that the gap between German and refugee averages is due to trauma, because in their home countries the averages are considerably lower. In the supplementary material, in Table S1 (lower half) we also compare the results of our sample in the BOMAT with country values in cognitive ability studies of different origins, with adult education and the number of books to test the validity of the country differences. In these variables, the mean correlation is $r$=.68 ($N$ between 11 and 15 countries). The correlations, which are acceptably high and stable (across various variables) despite the small country sample, underline the validity of the data.

Table 4 contains information for regions (categorized by geographic and cultural criteria). For all variables, the lowest results are found for sub-Saharan countries (IQs 77, 67, 72, 69, 78, and 71; similarly in Rindermann, 2013). The result in BOMAT is significantly different from that in other regions. Again, we observe substantially higher IQ scores for refugees in Germany (IQ 77) than for those in their countries of origin (across the five indices IQ 71).

## 4.2. Correlation, regression and path analyses at the individual level

Table 5 shows the correlations between the BOMAT IQ and the individual and country of origin variables at the individual data level. The three individual education indicators show the highest correlations: own years of schooling ($r$=.41), parental education ($r$=.39), and number of books at home (in the former housing in the country of origin; $r$=.33). One more year of own schooling corresponds to 2.11 more IQ points in the BOMAT. Previous income does not matter ($r$=.09), and the duration of residence in Germany is even negatively correlated ($r$=−.10), which probably represents delayed language course attendance. Number of siblings and age are negatively correlated with intelligence, the latter representing a FLynn effect. We did not find this in the small sample of study A. There is no sex difference ($r$=−.03).

The individual education variables are positively correlated with each other: parents' education with immigrants' education $r$=.45, parents' education with books $r$=.38, and immigrants' education with books $r$=.34.

**Table 4:** Mean values of immigrants by region and in comparison with the level in the region of origin.

| | Current immigrant study | | | Previous country-level studies | | | | |
|---|---|---|---|---|---|---|---|---|
| **Group** | **N** | **Percentage of Sample** | **BOMAT Mean (SD, SE)** | **Cognitive ability (Rindermann, 2018)** | **SAS-IQ (Rindermann, 2018)** | **Intelligence (Lynn and Becker, 2019)** | **Learning (Lim et al., 2018)** | **Human Capital (Angrist et al. , 2021)** |
| Eastnorth Europe (e.g., Poland, Russia) | 44 | 9.09 | 96.88 (15.15, 2.29) | 96.40 | 97.24 | 93.41 | 98.68 (519) | 97.99 (507) |
| Southeast Europe (e.g., Bosnia, Greece) | 24 | 4.96 | 98.28 (14.44, 2.95) | 90.05 | 91.26 | 87.53 | 93.23 (483) | 91.60 (465) |
| Asia (Central-South) (e.g., Kazakhstan, Thail.) | 18 | 3.72 | 88.16 (11.81, 2.78) | 88.92 | 91.10 | 85.85 | 92.73 (480) | 91.56 (465) |
| North Africa/Middle East (e.g., Iraq, Syria) | 342 | 70.66 | 90.45 (14.55, 0.79) | 79.27 | 80.62 | 75.47 | 83.65 (419) | 81.33 (397) |
| Africa (sub-Sahara) (e.g., Eritrea, Nigeria) | 56 | 11.57 | 77.39 (11.93, 1.59) | 67.06 | 71.94 | 69.34 | 78.03 (382) | 71.32 (330) |
| All together | 484 | (100%) | 89.82 (15.08, 0.69) | 80.31 | 83.44 | 77.41 | 85.18 (429) | 83.68 (412) |
| For comparison, means for the Western world | | | | | | | | |
| Western world | – | – | – | 98.91 | 99.28 | 97.39 | 99.70 (526) | 99.86 (520) |

*Notes*: (Cognitive ability, Rindermann, 2018; SAS-IQ, Rindermann, 2018; Intelligence, Lynn and Becker, 2019; Learning Lim et al., 2018; Human capital, Angrist et al. , 2021). As minimum *N*=10 persons per region; also see Table 3 (norms for the BOMAT from the manual); regional sample sizes do not correspond to the sums of matching individual countries from Table 3, because not all countries were listed in Table 3 (where at least 5 persons per country were required); Western world: North, West, Central and Southwest Europe, USA and Canada, Australia and New Zealand. In post hoc tests for differences in BOMAT, the results depend somewhat on the test chosen: According to Scheffé, sub-Saharan Africa's BOMAT IQ differs significantly from all other regions. According to Tukey, sub-Saharan Africa differs from all others; and Central-South Asia differs from Southeast Europe. According to Duncan, sub-Saharan Africa differs from all other regions; Central-South Asia differs from Southeast Europe and Eastnorth Europe; and North Africa/Middle East differs from Eastnorth Europe. Standard errors (SE) are only given for the BOMAT.

**Table 5:** Correlations at the individual level with individual and country of origin variables.

| **Individual-level variables** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Age | Sex | Marriage | Siblings | School Years | Parents' School | Number of Books | Months in Germany | Past Income |
| BOMAT-IQ | −.24 (−.32, −.16) | −.03 (−.12, +.06) | −.16 (−.25, −.08) | −.21 (−.32, −.09) | .41 (.33, .48) | .39 (.31, .46) | .33 (.25, .40) | −.10 (−.18, −.01) | .09 (−.10, +.27) |

| **Country-level variables** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CA-totc | SAS-IQ | IQ | Learning | Human Capital | Adult Education | Books | SQM | Evolution | Culture | Politics G | GDP/c log |
| BOMAT-IQ | .25 | .13 | .18 | .24 | .19 | .33 | .15 | .10 | .29 | .08 | .18 | .32 |

*Notes*: Sex (gender): 1 male, 2 female; Marriage: 1 unmarried or divorced, 2 married or widowed; Siblings: number of siblings; own and parents school education in years; past income in Euro; *N* about 499 to 400, except for siblings (297) and income (106); in parentheses confidence intervals (largest for income due to smaller *N*); country-level variables: CA-totc: Cognitive ability values (Rindermann, 2018, updated, same for following variables), see Table 3; SAS-IQ: student assessment tests; IQ: intelligence test results (Lynn and Becker, 2019); Learning: cognitive ability values from Lim et al. (2018); Human capital student assessment survey results from Angrist et al. (2021); Adult Education: Adult education mean (e.g., years at school; see Rindermann, 2018, updated, same for all following variables); Books: Number of books at home; SQM: School quality mean; Evolution: G factor evolution; Culture: Weighted religions (for education, rationality etc.); Politics G: Positively valued politics (mean of democracy, rule of law, freedom); GDP/c log: logarithm of GDP per capita Maddison for the year 2010, productivity and income; all given countries and data included.

Moreover, country-level variables correlate significantly with individual refugee and immigrant IQ: highest are adult education level, GDP/c, evolution, and home country cognitive ability (CA-totc): *r*=.33, .32, .29, .25. This means that immigrants from nations with better education, more wealth, on average larger brains and better test results have higher intelligence levels. One IQ point more of a country's cognitive ability level corresponds to 0.44 more IQ points on the BOMAT (adult education level has no meaningful scale). These correlations mean that it is possible to some extent to infer probable estimates of individual characteristics from a group level (see also Sesardic, 2005, pp. 223, 217ff.). It should be borne in mind that this is a highly variance-reduced sample that excludes, for example, East Asia and the West as countries of origin. Therefore, even higher correlations would be expected if a global sample of immigrants could be used (e.g., Australians immigrating to the US and Canadians immigrating to Switzerland, etc.).

Table 6 shows the results of three types of regressions: individual-level predictors only, country-level predictors only, and combined individual- and country-level predictors, all on individual-level data with about 450 observations in the BOMAT test. Predictors were selected based on effect size, theoretical considerations (i.e., education was considered more fundamental than the number of books), and the absence of (not meaningfully interpretable) suppressor effects. Of the five cognitive ability indicators, the one for which data were available for the most individuals and countries (the first based on student assessment studies and psychometric IQs) was selected. In addition, errors and biases in this indicator were corrected before averaging. Finally, the scores are based on a defined benchmark (UK natives, "Greenwich").

**Table 6:** Regressions at the individual level with individual and country of origin predictors, criterion immigrants' intelligence (BOMAT-IQ).

| **Individual-level variables only** | | | | | |
|---|---|---|---|---|---|
| | School Years | Parents' School Years | Number of Books | N | R |
| BOMAT-IQ | .27 | .21 | .17 | 448 | .50 |
| **Country-level variables only** | | | | | |
| | Cognitive Ability (CA-totc, HR) | Adult Educational Level | Income-Wealth (GDP/c log) | N | R |
| BOMAT-IQ | .07 | .14 | .17 | 492 | .34 |
| **Individual-level and country-level variables together** | | | | | |
| | School Years (ind.) | Parents' School Years (ind.) | Number of Books (ind.) | Adult Education (country) | N | R |
| BOMAT-IQ | .24 | .18 | .15 | .14 | 443 | .51 |

*Notes*: Criterion always BOMAT-IQ (refugees cognitive ability measure), predictors from school years to adult education at different data levels. For variable names see Table 5. Standardized beta ($\beta$) effects for predictors; listwise deletion in case of missing data.

The multiple correlation for individual-level variables is considerably higher ($R$=.50) than the multiple correlation for country-level variables ($R$=.34). That is, when individual-level data are available, they allow a much better prediction of an individual's intelligence. However, if country-level data are not available, they also allow prediction, but are less informative. Finally, individual and country-level data together provide the best prediction ($R$=.51). The gain from adding country-level variables to individual-level variables is not high ($R$=+.01).

In an individual-level path analysis, country-level data were included as individual data (Figure 2). As variables, we selected theoretically and empirically important background factors and the theoretically most important individual-level causal variable for intelligence, the level of education (Ritchie and Tucker-Drob, 2018). As a further control, we added an indicator of wealth, GDP per capita.

The most important variable was the educational level of the individual immigrant himself/herself (years of schooling, $\beta$=.37). One more year of schooling corresponds to 1.83 more IQ points in the BOMAT. The second most important predictor variable was evolutionary background (direct effect: $\beta$=.19). This means that, taking into account individual education, markers of evolutionary background can serve as informative predictors of intelligence. Productivity (or income) also has a positive effect when added ($\beta$=.12; no informative raw value scales of evolution and GDP log). When individual education is taken into account, the cognitive ability of the country of origin has almost no additional effect ($\beta$=.04). Culture has no direct effect on immigrant IQ.

However, there are also indirect effects, e.g., of home country cognitive ability through individual education ($\beta_{ind}$=.17$\times$.37=.06). Direct and indirect effects added together: $\beta_{tot}=\beta_{dir}+\beta_{ind}$=.04+.06=.10. The total statistical effect of evolution (over cognitive ability and years of schooling) is $\beta_{tot}$=.29. The total statistical effect of culture is $\beta_{tot}$=.05. The ranking of the factors is that first is the education of the individual immigrant ($\beta$=.37), followed by evolution $\beta_{tot}$=.29, and third is culture $\beta_{tot}$=.05. When GDP is added, GDP is the third most important variable. Again, individual predictors were shown to be more informative than group predictors, but the latter are not useless.

It is an open question to what extent the relationships mentioned represent causal effects. This applies to all variables, including the evolution factor. Other possible influencing factors that may be associated with a variable (e.g., quality of living conditions, as done for migrants' IQ) must be taken into account.

### 4.3. Multilevel analysis

In a multilevel path analysis (Figure 3), two variables were used at the "within" level (individual years of schooling and, as a criterion, immigrants' intelligence BOMAT). At the individual level, $N$=425 observations were used. At the "between" country-level ($N$=15 countries of origin), the variables chosen were evolution, culture, cognitive ability, and the logarithm of GDP per capita.[17] At the individual level, the statistical effect of years of

[17] A reviewer asked why there was a path from cognitive ability to GDP in the model of Figure 3, but not in the model of Figure 2. While in the individual data model of Figure 2, GDP was only an additional control variable for immigrants' BOMAT IQ (added in a separate analysis), in the model of Figure 3, GDP is a variable that is part of the model itself. GDP is therefore not a regular variable in the model, but only a control variable for BOMAT-IQ (how large could the effect of wealth on individual intelligence be?).

schooling was $\beta$=.35; one year of schooling is equivalent to 1.77 IQ points in the BOMAT. At the country level, GDP/c and IQ had substantial effects ($\beta_{GDP}$=.70, $\beta_{CA}$=.36). Note that the sample includes only 15 emigration (or "refugee") countries. In a broader sample including Western and East Asian countries, the pattern of effects might be reversed ($\beta_{CA}$>$\beta_{GDP}$). However, it must be taken into account that behind wealth (GDP per capita) there is also societal cognitive ability. Behind cognitive ability are evolution ($\beta_{Evo}$=.69) and culture ($\beta_{Cul}$=.29). Compared to the level of individual data, the path coefficients remain stable but not (all) identical: $\beta_{Evo}$=.69 vs. $\beta_{Evo}$=.69, $\beta_{Cul}$=.35 vs. $\beta_{Cul}$=.29, as does the statistical effect of country cognitive ability on years of schooling: $\beta_{CA}$=.17 vs. $\beta_{CA}$=.10. However, it must always be considered that the models are always simplifying – for example, education in families is missing.

## 5. Discussion

We begin by comparing the main findings of three independent studies conducted by three different research groups in three different regions of Germany (see Table 7; a kind of "mini-meta-analysis").

**Table 7:** Results of three German studies on refugees and immigrants compared.

| | **Study A (1)** | **Study B (2)** | **Study C (3)** | **Weighted mean/span/sum** |
|---|---|---|---|---|
| Author | Albrecht & Buchhardt (Rindermann) | Frintrup & Spengler | Klauk | Three independent researchers (research groups) |
| Year | 2015 | 2015– 2017 | 2017–2018 | 2015–2018 |
| Sample size | 29 | 552 | 499 | sum 1080 |
| Age mean | 31.86 years | 24.30 years | 32.91 years | 28.48 years |
| % female | 0% | – | 37% | 35% |
| Test | I-S-T numerical and figural | Caidance-R (matrices, speed, WM, calculation) | BOMAT (figural matrices) | Figural and other intelligence tests |
| IQ | 92 IQ points | 86 IQ points | 90 IQ points (84 IQ points) | 88 IQ points (85 IQ points) |
| Education mean | 10.31 years | 11.24 years | 10.53 years | 10.89 years |
| Education-IQ *r* | .50 | – | .41 | .41 |
| IQ per school year | 1.99 IQ points | – | 1.77 to 2.11 | 2 IQ points |

*Notes*: WM: working memory; Weighted: weighted for sample size. With IQ 86, Study B gives a rather optimistic average for this sample (alternatively about IQ 82 points). For study C, the norms of the BOMAT manual were applied (IQ 90); if the later German adult sample would be used as comparison (in parentheses) the estimates of migrants' IQ would be lower (IQ 84).

The average intelligence of refugees in Germany is 88 IQ points (or 85 IQ points, depending on the German samples used for standardization). This shows some variability,

as always occurs between samples, but is not indicative of a large bias that could jeopardize the interpretation of the results. The range of results is robust and always indicates a below-average intelligence level compared to Central European norms. It is also consistent with the results of student assessment and intelligence test studies with students from Turkey and Arab countries tested in Germany over the last three decades before enrollment or in primary and secondary schools (average at around 87 IQ points; see Introduction). Higher intelligence is associated with more success in German courses ($r$=.35). The duration of schooling is about 11 years (Table 7). Education is positively correlated with intelligence ($r$=.41; Table 7). Differences exist in age and general conditions: In study B, refugees were younger. In study A, the data were collected in asylum seekers' homes. In study C data were collected in language courses, in study B in job centers and their qualification measures. This may have an influence on the age structure. The robustness of the findings despite these differences attests to the validity of the general result.

An average intelligence quotient of 88 or 85 IQ points (compared to a German average of around 100 and a standard deviation of 15) means an intelligence level similar to that of German pupils in Hauptschule, e.g., for the profession of baker or hairdresser (Heller and Perleth, 2000). The level is certainly too low to form the basis for a second German economic miracle, as expected by the former CEO of Daimler, Dieter Zetsche. Cognitive ability (intelligence, disposal of knowledge and the intelligent use of it) is the best predictor of job performance, innovation and breakthrough ideas. Especially in the modern age with increasing complexity, such as digitalization, abstract process flows, and lower error tolerances, cognitive ability is becoming more and more important for success. There is no evidence that the new immigrant groups – at least the majority of them – will contribute to such a development. However, in the less complex service sector, such as logistics or manual work, they could have good chances – depending on labor market demand and personality traits.

If business leaders like Zetsche, journalists, politicians (e.g., Katrin Göring-Eckardt from the Green Party) or activists (including in academia) seriously believed that this kind of immigration would be good for the host country, they would behave differently. They would happily measure the cognitive abilities of all incoming immigrants and track their educational, employment and economic success. They would allocate millions of euros in research funding to cognitive testing of immigrants. But they don't do that.[18] Why? Probably because they don't really believe what they say, and because they would prefer the public not to know about these IQ differences. Instead, it is claimed, as SPD politician Petra Berg did, that such a demand for intelligence tests massively stirs up prejudices and reveals a misanthropic and discriminatory view of human beings.[19]

Another important finding is that the average intelligence level of immigrants in Germany is about 5 to 10 IQ points *higher* than the averages in their countries of origin (Table 3). This means, first of all, that an explanation of trauma or negative selection for the gap between natives and immigrants is not convincing. Refugees are significantly more intelligent than the average student and young adult in their home countries. It is rather implausible to assume that there are geniuses who immigrate to Germany and later suffer

[18] We would like to thank Geoffrey Miller of the University of New Mexico for pointing out this inconsistency.
[19] link to this article, April 17, 2016,

traumas that cause an IQ of 88. It is more plausible to assume that refugees are positively selected to some degree. They are also younger; but the student assessment results also refer to young people, and the results were low (Tables 3 and 4). To some extent, the samples in all three studies may be positively skewed: results are only available from those who agreed to be tested and/or attended courses. The true value of the total population of all refugees in Germany (at this time) is possibly lower.

Probably the somewhat better educated come to Europe. But this harms the home country, because the better educated and smarter ones no longer contribute to the country. At the same time, it also hurts the host country because they will lower the average ability level of the host country. So it is not a win-win situation, but a lose-lose situation. Rindermann (2018, fig. 23.3) called it the *migration–ability paradox*: if the above-average cognitive strata in the emigration country emigrate, this lowers the ability level of the home society. If the average ability differences between the two countries are large, the above-average cognitive strata in the emigration countries would correspond to the below-average cognitive strata in the receiving countries. This is the case for sub-Saharan African countries with an average cognitive ability level of about 70 IQ points, while Western Europe is about 99 IQ points (Table 4). The situation is similar in the Middle Eastern countries, with an average cognitive ability level of around 80 IQ points. Compared to international benchmarks, the intellectual classes or "smart fractions" in these emigration-prone countries are too small to raise the intellectual level of the receiving country.[20]

Individual IQ scores can also be predicted by using aggregated data from countries of origin, but the predictive quality is lower (multiple $R$=.50 vs. .34, Table 6). Aggregated data added to individual data increase the multiple correlation by only $R$=+.01. If individual data are available, they should be used. If they are not available, aggregated data can be used. This is consistent with the philosophical-epistemic literature on thinking and science (Sesardic, 2005, pp. 223, 217ff.). The same is true for the use of (aggregated) stereotypes to predict the behavior of individuals (Jussim, 2012, pp. 362ff.). Unless one has (reliable and valid) information on an individual, one can resort to group-based data, which Jussim calls the *Stereotype Rationality Hypothesis*:

> It is rational and reasonable to use stereotypes in the complete absence of individuating information, when the individuating information is perceived to be useless, and when individuating information is either scarce or ambiguous.
>
> (Jussim, 2012, pp. 380f.)

For example, if we want to say something about the temperature in New York and Anchorage on May 12, 2022, we can just measure it there. However, if we can't, it would be foolish not to use geographic information, the opinions of a larger sample of raters (not experts), or past temperatures. Since information about individuals is never perfect, and our formulas for integrating different variables are not perfect either, it would often be better to use additional group-based data. If we are wrong, it is more likely that the true result will be toward a group mean than away from a group mean. Rational Bayesian inference

[20] Exceptions are possible, as these are always distributions with extreme values at the top and bottom. For example, the heads of Biontech, who developed a vaccine against COVID-19 together with Pfizer, are a couple of Turkish origin (Uğur Şahin and Özlem Türeci).

(in humans or sophisticated machine learning algorithms) would likewise consider group membership for predictions given the known unreliability of individual-level measurements. An epistemically rational person uses such information.

An interesting side finding is the negative correlation between number of siblings and intelligence (individuals: $r=-.21$, at the country level $r=-.81$; Table 5, Table S1 in the supplementary material). This would mean, regardless of whether one assumes rather an environmental or a genetic transmission of abilities over generations, that environmental improvements must be present in order to maintain intelligence over the generations.

How can the *individual differences* within immigrant groups be explained (based on the results of study C)? Education is crucial – the longer the schooling, the more intelligent the immigrants ($r=.41$; Table 5 and Figures 2 and 3). There is also a transgenerational effect that passes from parents to children and their current IQ scores as adults (parents' education $r=.39$, books $r=.33$). The positive correlation between education and the scores in intelligence tests confirms the validity of the results. Moreover, it can be explained by a causal theory of education on IQ (Ceci, 1991). In a meta-analysis of natural experiments on school effects on intelligence by Ritchie and Tucker-Drob (2018), the average gain from attending one year of school was 3.39 IQ points. In our study, it was about 2 IQ points. This is lower, and in no study or individual data analysis here was it higher than 2.11 IQ points. This may indicate that schools in refugees' countries of origin have a lower cognitive effect, likely due to the lower quality of schools. Of course, intelligence also boosts education – the smarter ones go to school longer. Finally, a third variable such as genes may further strengthen the correlation between education and intelligence (Plomin, 2018). Our approach to the study cannot differentiate the directions of effect. Other determinants that we did not collect, such as nutrition and health care, could play a role. Such should be taken into account in future studies.

And how can we explain the *differences in immigrants' intelligence by country of origin*? Again, it is education, and either the individual immigrants' scores averaged for the country (books, parents' education, and own education) or the mean of adult education in the home country. Average cognitive ability in a society correlates somewhat less strongly with immigrant IQ, but in this 15-country sample with small sample sizes of 5 to 10 individuals, such differences in correlations cannot be interpreted. Behind a country's average cognitive ability level are education, evolutionary heritage and culture (see also Rindermann, 2018).

## 6. Caveats, Limitations and Outlook

Several caveats should be noted: First, as always, there are individual differences. Among immigrants, or any other chosen group, there will be doctors, engineers, and geniuses (see also histogram in Figure S1, appendix). Nevertheless, for every one of these individuals with an IQ above 130, it would take 5.25 individuals with an IQ of 80 to arrive at the observed average of 88 IQ points. Thus, for every one person of high cognitive ability, there would be more low-level individuals. Second, acculturation within a generation and intermarriage generally reduce differences between immigrants and natives (e.g., Rindermann and Thompson, 2016; Robie et al., 2017; te Nijenhuis et al., 2004). However, in an international study (Rindermann and Thompson, 2016) the convergence with 1 to 2 IQ points per generation was not that large, and it is likely that the

trend toward narrowing the gaps will diminish over time (smaller gains from second to third generations) and with increasing proportions of immigrants (who create their own milieus).

A common objection is that tests are negatively biased against migrants. This is countered by the fact that the tests in studies A and C are language-free and in study C (BOMAT) purely figural, and by the fact that results in student achievement studies in their native language, conducted in the countries of origin, tended to produce rather lower results. In study B, the tests were administered in the participants' native language. Everyday tasks (e.g., using a smartphone, planning an appointment at the immigration office, driving license test, price control when shopping, problem-solving, etc.) and an analysis of thinking and rationality in everyday life should supplement the usual test approach. In studies B and C we have the phenomenon that the exact IQ values fluctuate, in study B depending on the mentioned source, in study C depending on the standardization sample used. It is therefore perhaps better to speak of a range of values (IQ around 84 to 92) instead of just one IQ value (88 or 85). Anyway, all results point to a below-average IQ.

One problem with study C (the data analyzed here) is the fairly limited number of countries (*N*=15) and, for some countries, the small immigrant samples. The sample is dominated by Syrians (*N*=223). The path analyses were carried out at the lower end of the just possible sample size and require replication on an independent sample. Further studies should attempt to measure for more refugee countries and larger samples. It may be possible to cross-validate with country data from study B in the future. In study B, the different tests and their different knowledge-heaviness (e.g., calculation vs. mental speed) could help distinguish between general intelligence and school and cultural effects.

The results were obtained in Germany. Complementary studies in Austria, Switzerland or Benelux and Scandinavian countries, or in France, Italy and Spain could demonstrate the generalizability or the specificity of the results (possibly due to different immigration policies). Another sample in Germany ("IAB-BAMF-SOEP-Befragung von Geflüchteten"; Brücker et al., 2018), which also collected cognitive ability data, however in a very short form (a 90-second mental speed test), could be analyzed in the future.

## 7. Post Scriptum

After completing our studies and manuscript, a reader of our research from Iran alerted us to an unpublished study that included a larger Iranian refugee study in Germany (Pinto and Kühnel, 2020). There are three important findings in this study:

1. The average IQ level (using figural intelligence tests with German norms) is IQ 100 (Pinto and Kühnel, 2020, p. 17). This is initially in clear contradiction to our results (mean of three studies around IQ 85 to 88; Table 7). However, Pinto and Kühnel's 115-person sample appears to be positively selected: 65% had attended university (p. 15), which is a significantly higher proportion than the native population in Germany; participants could speak and understand German at least at the B1 level (p. 12). In addition, it is unclear how the refugee sample was obtained (not described); it does not appear to be representative. Finally, university graduates in the Pinto and Kühnel refugee sample had an average IQ of 102 (p. 18), which almost corresponds to that of German Realschule (middle school) graduates (p. 20, IQ 103). At school level, this is exactly the same result as the Chemnitz study with

refugees (described in a newspaper headline as: "Engineers at the level of middle school students").

2. The individual length of school attendance is a good predictor of the results of intelligence tests (r=.32, .36; Pinto and Kühnel, 2020, p. 17). Our correlation is slightly higher, probably because we have a more ability-diverse refugee sample (*r*=.41; Table 7).
3. A country's average educational level correlates with the refugees' IQ (r=.17, N=115; Pinto and Kühnel, 2020, p. 18). Our result, based on country level data correlated with individual refugee data, is with *r*=.33 (Table 5) again slightly higher. We used fine-grained numerical data for country education levels, Pinto and Kühnel used a three-group categorization. This could explain our slightly higher correlations.

Even though Pinto and Kühnel have a different theoretical background and interpret their results differently (people are equally intelligent: "It is unreasonable to assume that the refugee sample is less intelligent than the German school sample"; Pinto and Kühnel, 2020, p. 20), their results support rather than contradict the results of the three studies presented here.

**Supplementary Material:** In the supplementary material, we document the distribution of IQs (study C, BOMAT) and the results of country-level regression and path analyses for 14 to 15 countries.

**Author Contribution Statement:** Bruno Klauk designed study C and collected the data (including that of the 2022 comparison group). Heiner Rindermann supervised study A and performed the statistical analysis (including path analyses) on study C for this paper. All international data (education, school, wealth, evolutionary and cultural indicators, etc.) were compiled by him. He also drafted a first preliminary version of the paper and its revision. All three authors, Bruno Klauk, Heiner Rindermann and James Thompson, wrote and revised the paper.

**Data Availability Statement:** Data from study B were taken from publications. Data from studies A and C will be published with the publication of this paper.

**Conflict of Interest:** The authors declare that there is no conflict of interest.

**Ethical Statement:** Data from study B were taken from publications (reanalysis). Study A and C were collected by students and a researcher, respectively, from two different German universities. No approval by an ethics committee is required for psychological studies with adults at German universities (freedom of research and teaching is protected by the constitution).

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