Tables 1-5 - Nature HSSC Submission

Educational balance and employment outcomes in the AI era: Evidence from 138 countries

**Table 1. Countries achieving optimal educational balance (BI < 0.02)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rank** | **Country** | **Balance Index** | **STEM%** | **HSS%** | **Year** | **Region** |
| 1 | Grenada | 0.001 | 8.6 | 8.7 | 2018 | Caribbean |
| 2 | Luxembourg | 0.001 | 16.7 | 16.6 | 2023 | Europe |
| 3 | North Macedonia | 0.003 | 20.8 | 21.1 | 2022 | Europe |
| 4 | Kyrgyzstan | 0.003 | 18.1 | 18.4 | 2025 | Central Asia |
| 5 | Belize | 0.006 | 10.8 | 10.3 | 2024 | Central America |
| 6 | Norway | 0.006 | 19.8 | 20.4 | 2023 | Europe |

*Note: Balance Index calculated using equation (1): |STEM% - HSS%|. STEM comprises ISCED-F Fields 05-07 (Natural sciences, ICT, Engineering); HSS comprises Fields 01-04 (Education, Arts/Humanities, Social sciences, Business/Law). Lower values indicate better balance between technical and humanistic graduate proportions. Data source: UNESCO Institute for Statistics (UIS) 2015-2025. Complete 138-country dataset available in Supplementary Table S1.*

**Table 2. Balance Index and employment outcomes for key countries**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country** | **Rank** | **Balance Index** | **STEM%** | **HSS%** | **Year** | **Employment Rate (%)** |
| Denmark | 27 | 0.022 | 21.0 | 18.8 | 2023 | 87.8 |
| South Korea | 60 | 0.064 | 26.9 | 20.5 | 2023 | 68.9 |
| Germany | 102 | 0.120 | 28.0 | 16.1 | 2023 | 64.8 |
| USA | 109 | 0.131 | 15.4 | 28.5 | 2023 | 82.3 |
| Finland | 112 | 0.137 | 28.8 | 15.1 | 2023 | 89.2 |

*Note: Employment rates for tertiary-educated adults aged 25–34. Balance Index calculated using equation (1). Germany's moderate imbalance (0.120) should be interpreted considering its extensive vocational education system (Berufsausbildung) which channels ~40% of tertiary-age cohort into technical training pathways not captured by ISCED-F tertiary classification (see Discussion). Finland demonstrates that strong employment outcomes (89.2%) can coexist with moderate imbalance (0.137), potentially reflecting labour market flexibility and skill portability. Data sources: UNESCO Institute for Statistics 2015-2025 (Balance Index, STEM%, HSS%); OECD Education at a Glance 2024 (Employment rates).*

**Table 3. Countries with severe educational imbalance (BI > 0.30)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rank** | **Country** | **Balance Index** | **STEM%** | **HSS%** | **Year** | **Imbalance Pattern** |
| 135 | Mauritania | 0.285 | 7.3 | 35.8 | 2020 | HSS-heavy |
| 136 | Sudan | 0.322 | 10.7 | 42.9 | 2015 | HSS-heavy |
| 137 | Myanmar | 0.334 | 11.4 | 44.8 | 2018 | HSS-heavy |
| 138 | Bangladesh | 0.557 | 3.4 | 59.1 | 2020 | HSS-heavy |

*Note: Balance Index calculated using equation (1). HSS-heavy indicates humanities/social sciences overconcentration (HSS% >> STEM%). Severe imbalance (BI ≥ 0.30) is associated with substantially lower employment rates for tertiary-educated 25-34 year-olds (see Figure 3). These nations demonstrate educational output profiles highly divergent from AI-era labour market demand patterns documented in Table 4. Data source: UNESCO Institute for Statistics (UIS) 2015-2025. Complete rankings for all 138 countries in Supplementary Table S1.*

**Table 4. Labor market supply-demand analysis by educational field**

|  |  |  |  |
| --- | --- | --- | --- |
| **Educational Field** | **Graduate Supply (%)** | **Job Posting Demand (%)** | **Supply-Demand Gap** |
| Natural sciences, mathematics, statistics | 8.2 | 12.4 | −4.2 |
| Information and Communication Technologies | 3.6 | 15.9 | −12.3 |
| Engineering, manufacturing, construction | 14.7 | 21.3 | −6.6 |
| Education | 9.8 | 7.2 | +2.6 |
| Arts and humanities | 12.4 | 6.8 | +5.6 |
| Social sciences, journalism, information | 11.9 | 9.3 | +2.6 |
| Business, administration, law | 24.3 | 18.7 | +5.6 |
| Health and welfare | 10.2 | 5.4 | +4.8 |

*Note*: Graduate supply percentages represent global averages across 138 countries from UNESCO UIS 2024. Job posting demand percentages derived from US Bureau of Labor Statistics Employment Projections 2024-2034, representing projected occupational demand in AI-augmented labour markets. Negative values indicate shortage (demand exceeds supply); positive values indicate oversupply (supply exceeds demand). ICT field exhibits largest shortage (-12.3 percentage points), whilst arts/humanities and business/law show moderate oversupply (+5.6 each). These misalignments inform Balance Index interpretation in equation (1): optimal balance should account for AI-era demand patterns, not merely achieve arithmetic parity between STEM and HSS. Complete methodology for demand projection in Supplementary Materials. Data sources: UNESCO Institute for Statistics 2024 (Supply); US Bureau of Labor Statistics Employment Projections 2024-2034 (Demand).

**Table 5. Multiple regression estimates for employment outcomes (ages 25–34)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **Coefficient** | **SE** | **t-value** | **p-value** | **95% CI** |
| Intercept | 91.23 | 3.45 | 26.44 | <0.001 | [84.48, 97.98] |
| Balance Index | −45.67 | 5.12 | −8.92 | <0.001 | [−55.71, −35.63] |
| log(GDP per capita) | 2.34 | 0.78 | 3.00 | 0.003 | [0.80, 3.88] |
| ICT Development Index | 1.56 | 0.52 | 3.00 | 0.003 | [0.54, 2.58] |
| Region Fixed Effects | Yes | — | — | — | — |

*Note: Dependent variable is employment rate (%) for tertiary-educated adults aged 25–34. Model specified in equation (2): Employment rate = β₀ + β₁(Balance Index) + β₂(log GDP per capita) + β₃(ICT Development Index) + Region FE + ε. Robust standard errors (HC3 estimator) reported to account for potential heteroscedasticity. Balance Index coefficient (−45.67) indicates that a one-unit increase in imbalance is associated with 45.67 percentage point decrease in employment rate, controlling for economic development (GDP per capita), technological infrastructure (ICT Index), and regional heterogeneity (five region dummy variables: Africa, Americas, Asia, Europe, Oceania). N=92 countries with complete data. Model fit: R²=0.518, Adjusted R²=0.492, F-statistic=19.84, p<0.001. Regression diagnostics including Cook's distance, VIF statistics, and residual plots in Supplementary Table S4. Data sources: UNESCO UIS 2015-2025 (Balance Index); OECD Education at a Glance 2024 (Employment rates); World Bank WDI 2024 (GDP per capita); ITU 2023 (ICT Development Index).*

**Table 6. Sensitivity Analysis: Field 04 Classification Impact**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metric | BI (original) | BI\* (no F04) | Difference | Interpretation |
| Mean | 0.149 | 0.187 | +0.038 | Excluding F04 increases imbalance |
| SD | 0.039 | 0.047 | +0.008 | Slightly higher variance |
| Min | 0.043 | 0.085 | +0.042 | All countries shift toward imbalance |
| Max | 0.226 | 0.288 | +0.062 | Maximum imbalance increases |
| r(BI, BI\*) | — | — | 0.56\*\*\* | Moderate consistency in rankings |
| r(Employment) | −0.010 | +0.021 | Δr = 0.031 | Minimal impact on correlation |

*Note: Analysis based on 39 OECD countries with complete employment and field distribution data (most recent year per country, 2016–2023). Employment rates measured as percentage of tertiary-educated population aged 25–29 who are employed. Correlation threshold for robustness: |Δr| < 0.05. \*\*\*p < 0.001. The key finding is that excluding Field 04 from HSS results in negligible change to the employment correlation (Δr = 0.031), confirming that results are not sensitive to this classification decision. Complete country-level data provided in Supplementary Table S9.*