CHAPTER 4

# The Effects of Economic Freedom on the Quality of Education

Horst Feldmann

**Abstract.** In this chapter, Dr. Horst Feldmann from the University of Bath (UK) presents statistical evidence that economic freedom improves the quality of education. He argues that economic freedom incentivizes parents to invest in the high-quality education of their children and helps them to do so. Moreover, economic freedom incentivizes and helps both governments and private providers to deliver high-quality education. Dr. Feldmann uses data from large samples of countries and two different indicators of educational quality: PISA scores (47 countries) and the World Bank's harmonized test scores (132 countries). The magnitudes of the estimated effects of economic freedom on both indicators are substantial. They are even larger once the indirect effects of economic freedom via GDP per capita are taken into account.

## 1. Introduction

Educational quality is of crucial importance for both students and the economy. For example, several studies find that the quality of the education children receive is critical for their later earnings (e.g., Hanushek et al., 2015). The quality of a college's graduates predicts the share of its students who become inventors, engage in entrepreneurship, or become top executives (Martellini et al., 2024). Moreover, there is overwhelming evidence that the cognitive skills of the population are a key driver of gross domestic product (GDP) growth (e.g., Hanushek and Woessmann, 2015). Likewise, cross-country differences in education quality are important in accounting for international differences in productivity (Schoellman, 2012).

Numerous studies have investigated the sources of international differences in student achievement (for a survey, see Hanushek and Woessmann, 2011). Most of them, however, focus on just two dimensions: the characteristics of national school systems, and the role of parents and families. While characteristics of school systems analyzed typically include issues such as governmental education expenditure, class size, and teacher qualifications, family characteristics typically cover issues such as parental education and occupation, migration status, and the availability of books and a computer at home. By contrast, there is little research on the role of country-level characteristics beyond national school systems. Here, I argue that the extent of countries' economic freedom is likely to favorably affect the quality of the education

they provide.

Why is economic freedom likely to improve educational outcomes? There are four reasons for this (Feldmann, 2025). First, the various economic freedoms jointly enhance the gains from educational investments. Secure property rights and the rule of law prevent the state from expropriating people's earnings. They also ensure that the state and the economy function in a predictable manner, helping individuals to make the best use of their human capital. A modest level of taxation implies that individuals are able to achieve comparatively high net returns to education while monetary stability ensures that individuals' returns to education are not diluted by inflation. A pro-competitive regulation of labor markets enables individuals to enter professions where their educational returns are the highest. A light regulatory burden on product markets and low barriers to international trade foster specialization and economic exchange, enhancing the gains from educational investments as well.

As economic freedom increases the returns to educational investments, it incentivizes parents to make their children more aware of the importance of learning and to induce them to put more effort into it. It also incentivizes them to invest in high-quality education for their children (e.g., by funding private tuition and choosing the best schools). Additionally, economic freedom makes parents more likely to request that head teachers raise educational standards, and it motivates them to elect politicians who promise to improve the quality of schools. To boost their electoral prospects, politicians in turn have an incentive to meet parents' demand, primarily by raising standards in government-run schools.

Second, as economic freedom facilitates the operation of credit markets, it makes it easier for parents to take out loans to fund the best possible education, thereby probably raising their children's academic achievements. The key elements of economic freedom relevant here are secure property rights (including the right to use property as collateral) and a pro-competitive regulation of credit markets.

Third, as a fundamental characteristic of economic freedom is freedom of choice, a country with more economic freedom is likely to provide parents with more choice between schools, including through a larger scope for privately operated schools. As the quality of instruction is key for many parents when choosing a school for their child, and as parental choice intensifies competition between schools, more school choice can incentivize governments as well as private providers to improve educational quality.

Fourth, as economic freedom has been shown to boost economic growth and income per capita (e.g., Feldmann, 2005), it enhances resources for educational investments, both for parents (via higher incomes) and for governments (via higher tax revenue). Parents can use these resources to fund private tuition, send their children to private schools, or move to catchment areas of better public schools. Governments can use the additional tax

revenue to increase their spending on education—e.g., by investing in school buildings or instructional material, or by hiring more teachers and improving their training.

This chapter applies regression analysis to test my hypothesis that economic freedom enhances the quality of education.[1] It uses data from 2018 because the COVID-19 pandemic severely disrupted schooling worldwide, reducing student learning outcomes (for a survey, see Betthäuser et al., 2023). I employ two different indicators of educational quality: the World Bank's harmonized test scores and the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) scores. The major advantage of the World Bank's harmonized test scores, which are based on several multi-country testing programs, is that they are available for a large number of countries. Specifically, whereas my PISA regressions cover 47 countries, my regressions using World Bank scores cover 132 countries (for a list of countries, see appendix 4.1). The downside of the World Bank scores is that these are country-level indicators and do not come with any information about students and schools. The major advantage of PISA is that it provides not only achievement data but also a rich set of background information about students and schools that I can include as controls. I employ both indicators to check whether my estimates are robust.

Standardized student test scores such as the ones I use have strengths and limitations. An important strength is that they focus on core skills—particularly, reading, mathematics, and science. These are the skills that have been shown to raise both students' later earnings and economic growth. A further strength is that by meeting stringent technical standards and providing internationally comparable results, they often induce national governments to improve their schools and educational standards (Schleicher, 2018). On the other hand, such test scores are far from perfect measures of educational quality. For example, subjects not tested are important for education as well—e.g., history, foreign languages, and the arts. Moreover, apart from the various subjects there are additional purposes of education, such as nurturing curiosity and instilling moral values (Sjøberg, 2015). Finally, it is problematic to define a universal set of valuable skills and knowledge, as done in international testing programs, because to some degree education needs to be country- and culture-specific (Zhao, 2020). Notwithstanding these limitations, standardized student test scores are widely regarded as good indicators of educational quality and particularly useful for cross-country analysis (Hanushek and Woessmann, 2011). This is why I employ them here.

The remainder of this chapter is structured as follows. The next section presents my econometric analysis using World Bank test scores. Section 3 presents my analysis using PISA scores. The final section concludes.

1 The chapter uses material from Feldmann (2025).

## 2. Analyzing World Bank Test Scores

### 2.1 Data and methodology

To construct harmonized test scores for a large number of countries, the World Bank has used three major international testing programs: PISA, the Trends in International Mathematics and Science Study (TIMSS) program and the Progress in International Reading Literacy Study (PIRLS). It has combined them with four major regional testing programs: the Latin American Laboratory for Assessment of the Quality of Education (LLECE), the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), the Pacific Islands Learning and Numeracy Assessment (PILNA) and the Program for the Analysis of Education Systems (PASEC). Moreover, it has incorporated the Early Grade Reading Assessments (EGRAs) coordinated by the (now-defunct) US Agency for International Development (World Bank, 2023). Patrinos and Angrist (2018) have developed a harmonization methodology that can be used to place the test scores from the various programs on a common scale. The harmonized scores combine tests of student competences in reading, mathematics, and science.

I statistically control for other determinants of educational quality (for definitions and sources of all variables, see appendix 4.2; for descriptive statistics of the World Bank test scores sample, see appendix 4.3). For two reasons, I control for political freedom: first, to ensure that economic freedom does not proxy for it and second, to check whether political freedom exerts an influence of its own on the quality of education. I also control for Confucian heritage society. In these societies—i.e., countries such as China, Japan, South Korea, and Vietnam—education has been held in high regard for centuries. Nowadays people still attach great importance to it (Starr, 2012). Building on this attitude, East Asian governments made education a key element of their development strategies, investing heavily in this area (Page, 1994). Additionally, parents support their children with out-of-school tuition (Zhang and Yamato, 2018). In line with Confucian values and principles, educational practice is characterized by hard work and relentless assessment. As a consequence, Confucian heritage societies usually achieve top scores in international achievement tests.

Furthermore, I control for GDP per capita and government expenditure on education. Richer countries and countries that spend a larger share of their GDP on education are likely to achieve better learning outcomes. I control for urbanization because access to school is usually better in urban than in rural areas, which is likely to have positive knock-on effects on student achievement too. Finally, I control for the share of children in the population. Both parents and societies face a trade-off between child quantity and quality: the higher the number of children, the less they are usually able to invest into

each of them (Becker and Lewis, 1973). Thus, a higher share of children in the population could impair educational performance.

I instrument the economic freedom variable to extract its exogenous component. For three reasons, the variable is likely to be endogenous. First, educational quality may affect economic freedom (reverse causality bias). For example, Jones and Potrafke (2014) find that cognitive skill measures have a positive effect on property rights protection, a key element of economic freedom. Second, my regression analysis does not account for all determinants of student achievement (omitted variable bias). Third, my variable of interest may measure the true extent and characteristics of economic freedom with some error (measurement error). All three problems can be solved by using valid instruments for economic freedom.

I run two-stage least squares regressions of the following form:

Second stage:

$$T_c = \pi + \kappa E_c + \sum_{n=1}^{s} \boldsymbol{Z}_{n,c}\chi_n + o_c \quad (1)$$

First stage:

$$E_{c,t} = \rho + \tau E_{c,t-1} + \upsilon E_{c,t-2} + \sum_{n=1}^{s} \boldsymbol{Z}_{n,c,t}\varphi_n + \psi_{c,t} \quad (2)$$

$T_c$ is the World Bank test score of country $c$. $E$ denotes economic freedom and $\boldsymbol{Z}$ a vector of $s$ control variables. While $\pi$ and $\rho$ are the constants, $o_c$ and $\psi_{c,t}$ are the error terms. My coefficient of interest is $\kappa$, measuring the effect of economic freedom on World Bank test scores. The coefficients of the excluded instruments are $\tau$ and $\upsilon$. The coefficients of the control variables are $\chi$ and $\varphi$ in the second and first stage, respectively.

In my regressions with World Bank test scores the excluded instruments of economic freedom are lagged levels of this variable from the previous two years (equation 2). The rationale for using lagged levels of economic freedom is that they are likely to affect current educational performance only through the current level of economic freedom. That is, while a country's degree of economic freedom in the recent past clearly influences its current degree of economic freedom, it probably affects its current educational performance only through its current degree of economic freedom. Table 4.1 reports the results of standard tests of instrument validity. While the Kleibergen-Paap *rk* LM statistic (Kleibergen and Papp, 2006) indicates that each structural equation is identified, the first-stage *F* statistic (Staiger and Stock, 1997) and Hansen's (1982) *J* test suggest that my instruments are relevant and exogenous, and thus valid. Hence, my regressions are likely to identify the causal effect of economic freedom.

**Table 4.1: Estimates for World Bank Test Scores**

| | (1) Baseline model | (2) Indirect effect via 'GDP per capita' added |
|---|---|---|
| Economic freedom | 57.45*** (17.52) | 67.75*** (16.88) |
| Political freedom | −1.86 (5.45) | −2.60 (5.44) |
| Confucian heritage society | 13.83*** (4.31) | 12.51*** (4.31) |
| GDP per capita | 6.52** (2.67) | 6.55** (2.64) |
| Government expenditure on education | 1.22* (0.72) | 1.28* (0.72) |
| Urbanization rate | −12.61* (7.52) | −0.89 (6.44) |
| Child population share | −70.80*** (23.70) | −113.98*** (15.02) |
| Number of observations & countries | 132 | 132 |
| $R^2$ | 0.72 | 0.72 |
| Kleibergen-Paap *rk* LM statistic (*p* value) | 0.00 | 0.00 |
| *F* test of excluded instruments (first stage) | 706.54 | 777.96 |
| Hansen *J* statistic (*p* value) | 0.85 | 0.85 |

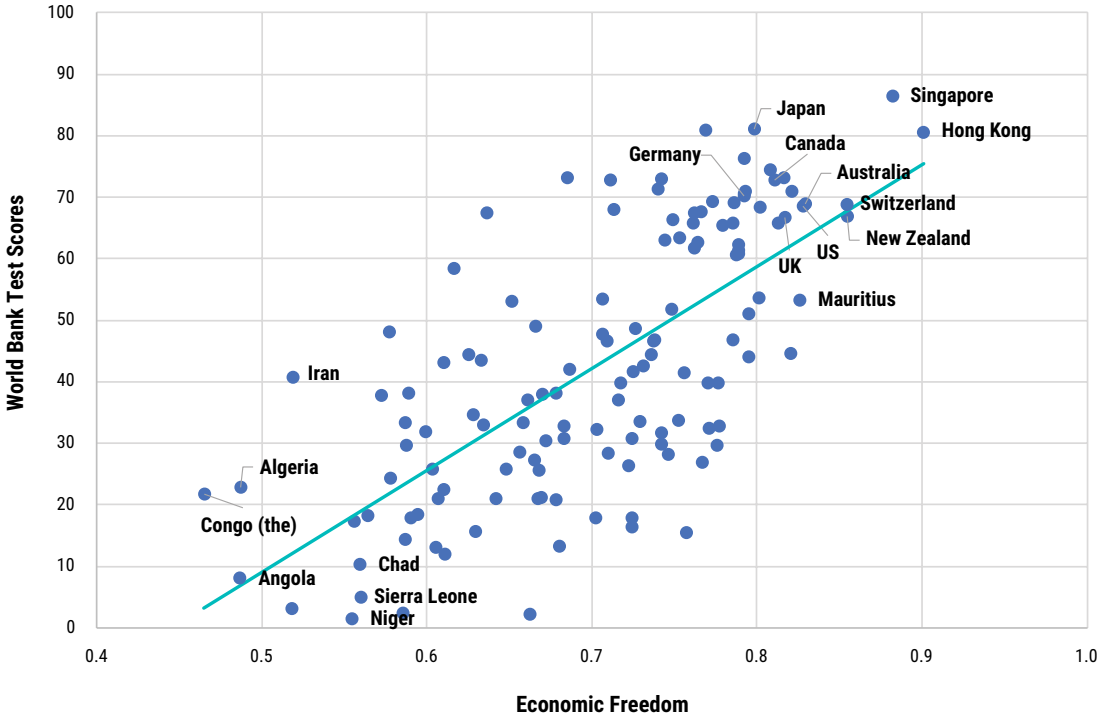
**Note:** Second-stage regression results from two-stage least squares estimation. Dependent variable: World Bank test scores. Economic freedom is instrumented with its lagged levels from $t-1$ and $t-2$. Data from 2018, except for the excluded instruments, whose data are from 2016–17. In model 2, GDP per capita is replaced by the residuals from a regression in which this variable is used as dependent variable. All regressions also include a constant term. The critical value from the Stock-Yogo weak identification test at 10% maximal IV size is 19.93. Robust standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

## 2.2 Results

Prior to delving into the outcomes derived from my multivariate regression analysis, I briefly examine the bivariate relationship between economic freedom and World Bank test scores (figure 4.1). A positive association is evident, indicating that countries characterized by more economic freedom tend to exhibit higher test scores. According to the $R^2$ of the underlying regression, economic freedom accounts for 49% of the variance in test scores observed across countries.

Table 4.1 reports my regression results. The estimates from my baseline model are in column 1. Although I use just six controls, the model explains 72% of the variance in test scores. The economic freedom variable has a positive and highly statistically significant coefficient, supporting my hypothesis that economic freedom improves educational

**Figure 4.1: Economic Freedom and World Bank Test Scores**




**Note:** 132 countries. Data from 2018. *Economic Freedom of the World* summary ratings, scaled to range from 0 (least free) to 1 (most free). Harmonized test scores constructed by the World Bank, based on several multi-country student achievement testing programs such as TIMSS, PIRLS, and PISA. The test scores are scaled to range from 0 (minimal attainment) to 100 (advanced attainment). The regression represented by the fitted line yields a coefficient of economic freedom of 165.73 (robust standard error = 13.37), $N$ = 132, $R^2$ = 0.49.

**Sources:** Gwartney et al., 2022; World Bank, 2022.

quality. In a companion paper, I additionally control for the output gap, youth unemployment, foreign direct investment, air pollution, national time and risk preferences, and find the effect of economic freedom to be robust (Feldmann, 2025).

The results from my baseline model suggest that the magnitude of the effect is considerable. For example, compare New Zealand and Brazil. Whereas New Zealand had one of the highest degrees of economic freedom and one of the best World Bank test scores, Brazil's values were well below the sample mean in both areas (figure 4.1). According to my estimates, if economic freedom in Brazil had been as high as in New Zealand, its World Bank score might have been 33% higher, *ceteris paribus*. While any cross-country comparison warrants caution, the figure illustrates that economic freedom could exert a substantial influence on the quality of education.

As explained in section 1, economic freedom has also been found to increase income per capita, which in turn may contribute to improving educational quality. Thus, the positive effect of GDP per capita on World Bank scores in my baseline model is probably partly due to economic freedom's positive effect on GDP per capita. In other words, in this model the coefficient of economic freedom may underestimate the overall effect of

economic freedom because some of the effect may be captured by the coefficient of GDP per capita. In order to add the indirect effect of economic freedom on educational quality via GDP per capita to the coefficient of economic freedom, I use a method proposed by Gwartney and his colleagues (2006). I first estimate an equation with GDP per capita as the dependent variable and economic freedom and the baseline controls as right-hand side variables. Subsequently, I substitute the residuals from this regression for GDP per capita in my baseline model. The logic of doing this is that the residuals from the GDP per capita regression represent the variation that is uncorrelated with economic freedom. By using these residuals, the variation in GDP per capita that is associated with differences in economic freedom is captured in the coefficient of economic freedom. Thus, this coefficient reflects both the direct effect of economic freedom as well as its indirect effect via GDP per capita. The estimates are reported in column 2 of table 4.1. As expected, the coefficient of economic freedom is substantially larger than in the baseline model. With the indirect path through GDP per capita additionally taken into account, Brazil's World Bank test score might have been 39% higher, had its economic freedom rating been as high as New Zealand's, *ceteris paribus*.

## 3. Analyzing PISA Scores

### 3.1 Data and methodology

As my second measure of educational performance, I use PISA mathematics scores (OECD, 2019). PISA tests random samples of 15-year-old students, independent of the educational track attended or the school year they are in. The OECD's high sampling and data-quality standards ensure that each country's results are representative. The PISA math test asks students to apply their mathematical knowledge to solve real-world problems. Math scores are generally considered to be most readily comparable across countries, in contrast to other subjects such as reading, which is to some extent language-specific.

The PISA dataset allows me to control for all major determinants of educational performance that have been considered in the literature (for definitions and sources of all variables, see appendix 4.2; for descriptive statistics, see appendix 4.4). Specifically, the country-level controls include the share of government funding for schools, the share of private schools, the share of students subject to central exit exams, and an index of school autonomy. The school-level controls are the share of certified teachers, a dummy for a shortage of educational material, two school location dummies, and a school's number of students. The individual-level controls cover sex, age, migration status, parental education and occupation, books and computer at home, and language spoken at home. In addition, I employ the same country-level controls that I also use in my regressions with World Bank test scores, and for the same reasons.[2]

2 The only control from my World Bank regressions that I do not use in my PISA regressions is government

As with the World Bank test scores data, I run two-stage least squares regressions, instrumenting economic freedom to extract its exogenous component. Here, the specification is as follows:

Second stage:

$$P_{i,s,c} = \alpha + \beta E_c + \sum_{j=1}^{p} \boldsymbol{V}_{j,c}\gamma_j + \sum_{k=1}^{q} \boldsymbol{W}_{k,s,c}\delta_k + \sum_{l=1}^{r} \boldsymbol{X}_{l,i,s,c}\zeta_l + \varepsilon_{i,s,c} \quad (3)$$

First stage:

$$E_{c,t} = \eta + \sum_{m=1}^{5} \theta(E_{c,t-m} - E_{c,t-m-1}) + \sum_{j=1}^{p} \boldsymbol{V}_{j,c}\lambda_j + \sum_{k=1}^{q} \boldsymbol{W}_{k,s,c}\mu_k + \sum_{l=1}^{r} \boldsymbol{X}_{l,i,s,c}\upsilon_l + \omega_{i,s,c} \quad (4)$$

$P_{i,s,c}$ measures the PISA score of individual $i$ in school $s$ and country $c$. $E$ represents economic freedom and $\boldsymbol{V}$ a vector of $p$ country-level control variables. $\boldsymbol{W}$ denotes a vector of $q$ school-level control variables and $\boldsymbol{X}$ a vector of $r$ individual-level control variables. While $\alpha$ and $\eta$ are the constants, $\varepsilon_{i,s,c}$ and $\omega_{i,s,c}$ are the error terms. My coefficient of interest is $\beta$, which measures the effect of economic freedom on PISA scores. The coefficients of the excluded instruments are symbolized by $\theta$. The coefficients of the control variables are $\gamma$, $\delta$ and $\zeta$ in the second stage and $\lambda$, $\mu$ and $\nu$ in the first stage. As 'economic freedom' is a country-level variable, I cluster standard errors at this level.

In my PISA regressions, my instruments are lagged differences of the instrumented variable covering the years $t$–1 to $t$–6 (equation 4). Obviously, changes in economic freedom over the previous six years affect its current level. Moreover, it is plausible to assume that those changes affect current educational performance not directly but only through the current extent of economic freedom. The test results suggest that my instruments are valid (table 4.2). Whilst the Kleibergen-Paap *rk* LM statistic indicates that each structural equation is identified, the Kleibergen-Paap *rk* Wald *F* statistic suggests that my instruments are relevant, and the results from Hansen's *J* test indicate that they are exogenous (Kleibergen and Paap, 2006; Hansen, 1982). Thus, my statistical model probably establishes causality.

## 3.2 Results

Let me start again by looking at the bivariate association between economic freedom and test scores, in this case country averages of PISA scores (figure 4.2). The association is moderately positive. The $R^2$ of the underlying regression suggests that economic freedom alone accounts for 31% of the cross-country variation in achievement.

expenditure on education. This is because my PISA dataset includes the equivalent variable government funding for schools (appendix 4.2).

## Table 4.2: Estimates for PISA Scores

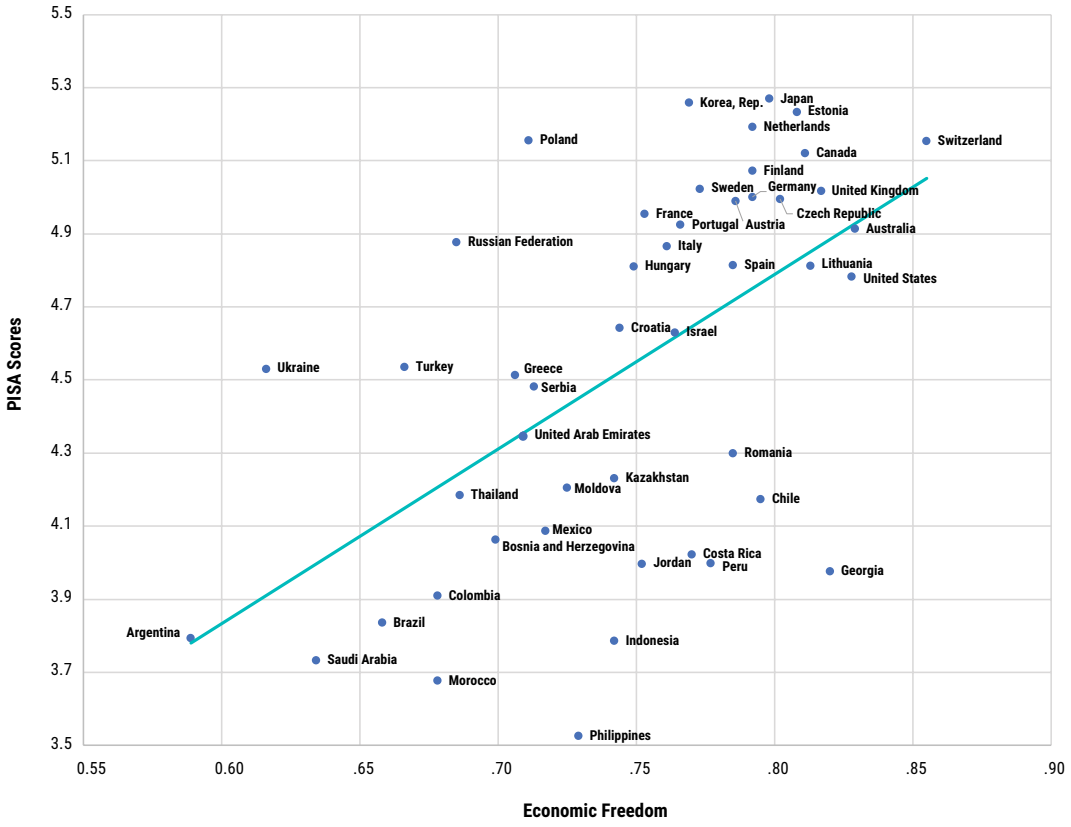
| | (1) Baseline model | (2) Indirect effect via 'GDP per capita' added |
|---|---|---|
| Economic freedom | 1.663** (0.799) | 2.163*** (0.775) |
| Political freedom | 0.181 (0.126) | 0.168 (0.129) |
| Confucian heritage society | 0.473*** (0.076) | 0.504*** (0.075) |
| GDP per capita | 0.222*** (0.071) | 0.236*** (0.072) |
| Government funding for schools | 0.308 (0.203) | 0.292 (0.204) |
| Private schools | −0.390** (0.159) | −0.338** (0.163) |
| Central exit exams | 0.030 (0.058) | 0.024 (0.058) |
| School autonomy | 0.039 (0.120) | 0.179 (0.109) |
| Certified teachers | 0.071 (0.049) | 0.099* (0.053) |
| Shortage of educational material | −0.101*** (0.021) | −0.127*** (0.019) |
| School location: town | 0.137*** (0.024) | 0.154*** (0.027) |
| School location: city | 0.224*** (0.031) | 0.233*** (0.032) |
| School size | 0.052* (0.028) | 0.039 (0.029) |
| Individual-level controls | Yes | Yes |
| Number of observations | 408,589 | 408,589 |
| Number of countries | 47 | 47 |
| $R^2$ | 0.31 | 0.31 |
| Kleibergen-Paap *rk* LM statistic (*p* value) | 0.03 | 0.07 |
| Kleibergen-Paap *rk* Wald *F* statistic | 21.19 | 25.90 |
| Hansen *J* statistic (*p* value) | 0.62 | 0.61 |

**Note:** Second-stage regression results from two-stage least squares estimation, weighted by students' sampling probability. Dependent variable: PISA scores (mathematics). Economic freedom is instrumented with its lagged annual differences over *t*−1 to *t*−6. Data from 2018, except for the excluded instruments, whose sample period stretches back to 2012. In model 2, GDP per capita is replaced by the residuals from a regression in which this variable is used as dependent variable. Individual-level controls: sex, age, migration status, parental education, parental occupation, books at home, computer for school work at home, and other language than test language spoken at home. All regressions also include a constant term. The critical value from the Stock-Yogo weak identification test at 10% maximal IV relative bias is 10.83. Robust standard errors, adjusted for clustering at the country level, are reported in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

Table 4.2 reports the estimates from my multivariate regressions. The estimates from the baseline model are in column 1. The coefficient of economic freedom is positive and statistically significant. This suggests that economic freedom has a positive effect on students' PISA scores, providing further support for my hypothesis. As documented in my companion paper, the result is robust to additionally controlling for the output gap, youth unemployment, foreign direct investment, air pollution, and national time and risk preferences (Feldmann, 2025). According to my baseline model, the magnitude of the estimated direct effect is large: a one standard deviation increase in economic freedom is associated with learning gains of 50% of a school year.

Column 2 of table 4.2 reports the results from a model where the coefficient of economic freedom captures both the direct effect of economic freedom and its indirect effect via GDP per capita. Once again, I use the method developed by Gwartney and his colleagues (2006) and find that the overall effect is much larger than the direct effect only. Specifically, a one standard deviation rise in economic freedom is associated with learning gains of no less than 65% of a school year. Taken together, the results with PISA scores

**Figure 4.2: Economic Freedom and PISA Scores**




**Note:** 47 countries. Data from 2018. Economic freedom values scaled to range from 0 to 1. PISA scores are for mathematics; original values divided by 100. Higher values indicate more economic freedom and higher test scores, respectively. The regression represented by the fitted line yields a coefficient of economic freedom of 4.78 (robust standard error = 0.94), $N = 47$, $R^2 = 0.31$.

**Sources:** Gwartney, Lawson, Hall, and Murphy, 2022; OECD, 2019.

indicate that economic freedom substantially improves educational quality, even after controlling for all major factors that have been considered in the literature.

## 4. Conclusion

There is a vast literature on the effects of economic freedom, in most cases finding normatively good outcomes (for a survey, see Lawson, 2022). Equally, there is a large but so far completely separate body of literature on the sources of international differences in student achievement (Hanushek and Woessmann, 2011). I bridge the gap between the two by analyzing the effects of economic freedom on the quality of education. In line with my companion paper (Feldmann, 2025), I find that economic freedom has substantial positive effects. This is probably mainly because it incentivizes parents to invest in the high-quality education of their children and helps them to do so. Economic freedom also incentivizes and helps both governments and private providers to deliver high-quality education.

The estimated direct effect of economic freedom on educational quality is substantial. Additionally, it is important to account for its indirect effect via GDP per capita since previous research has shown economic freedom to raise income per capita (Feldmann, 2005). Once the direct and indirect effects are jointly taken into account, my regression results suggest that the overall effect of economic freedom on educational quality is large. This is evident when using either PISA scores or the World Bank's harmonized test scores. Therefore, in their quest to raise the quality of education, policy makers should not narrowly focus on education policy and school systems, they should also take the institutional environment into account. Specifically, my research suggests that they should consider increasing the level of economic freedom.

## Appendix 4.1: List of Countries

Albania, Algeria, Angola, *Argentina*, Armenia, *Australia*, *Austria*, Azerbaijan, Bahrain, Bangladesh, Belgium, Benin, Bosnia and Herzegovina, Botswana, *Brazil*, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, *Canada*, Chad, *Chile*, China, *Colombia*, *Costa Rica*, Côte d'Ivoire, *Croatia*, Cyprus, *Czech Republic*, Democratic Republic of the Congo, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, *Estonia*, Eswatini, Ethiopia, *Finland*, *France*, Gabon, Gambia, *Georgia*, *Germany*, Ghana, *Greece*, Guatemala, Guinea, Guyana, Honduras, Hong Kong, *Hungary*, Iceland, India, *Indonesia*, Iran, Ireland, *Israel*, *Italy*, Jamaica, *Japan*, *Jordan*, *Kazakhstan*, Kenya, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, *Lithuania*, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, *Mexico*, *Moldova*, Mongolia, *Morocco*, Mozambique, Namibia, Nepal, *Netherlands*, New Zealand, Nicaragua, Niger, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, *Peru*, *Philippines*, *Poland*, *Portugal*, Republic of the Congo, *Romania*, *Russia*, Rwanda, *Saudi Arabia*, Senegal, *Serbia*, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, *South Korea*, *Spain*, Sri Lanka, *Sweden*, *Switzerland*, Tajikistan, Tanzania, *Thailand*, Togo, Trinidad and Tobago, *Turkey*, Uganda, *Ukraine*, *United Arab Emirates*, *United Kingdom*, *United States*, Uruguay, Vietnam, Zambia, Zimbabwe.

**Note:** Countries included in both PISA sample and sample using World Bank scores are in *italic*. Bosnia and Herzegovina is included in PISA sample only. All other countries are included in sample using World Bank scores only.

## Appendix 4.2: Definitions and Sources of Variables

**Central exit exams**

Share of students subject to central exit exams (decimal fraction, country mean). Variable used in PISA regressions only. Source: Hanushek et al., 2022.

**Certified teachers**

Share of fully certified teachers (decimal fraction, school level). Variable used in PISA regressions only. Source: OECD, 2019.

**Child population share**

Population between the ages 0 to 14 years as a decimal fraction of the total population. Variable used in regressions with World Bank test scores only. Source: World Bank, 2022.

**Confucian heritage society**

Dummy variable that takes the value 1 if a country's culture has historically been shaped by Confucianism. Source: To, 1993; Yao, 2000; Rainey, 2010; author's calculations.

**Economic freedom**

*Economic Freedom of the World* summary index, scaled to range from 0 (least free) to 1 (most free). The index measures the degree of economic freedom in the following five areas: size of government, legal system and property rights, sound money, freedom to trade internationally, regulation. Source: Gwartney et al., 2022.

**GDP per capita**

Natural logarithm of real GDP per capita at purchasing power parity rates, 2017 international dollars. Source: World Bank, 2022; author's calculations.

**Government expenditure on education**

General government expenditure on education (current, capital, and transfers) as a percentage of GDP. Variable used in regressions with World Bank test scores only. Source: World Bank, 2022.

**Government funding for schools**

Share of government funding for schools (decimal fraction, country mean). Variable used in PISA regressions only. Source: Hanushek et al., 2022.

**PISA scores**

PISA mathematics test scores. Original scores divided by 100. Individual-level variable. Variable used in PISA regressions only. Source: OECD, 2019.

**Political freedom**

Average of political rights and civil liberties ratings, scaled to range from 0 to 1, with higher values representing more such rights and liberties. Political rights include the right to form political parties, to compete for public office and to elect representatives who have a decisive vote on public policies. Civil liberties include religious, ethnic, economic, linguistic, gender and family rights, personal freedoms and freedom of the press, belief and association. Source: Freedom House, 2022; author's calculations.

**Private schools**

Share of privately managed (or operated) schools (decimal fraction, country mean). Variable used in PISA regressions only. Source: Hanushek et al., 2022.

**School autonomy**

School-autonomy index (0–1, country level). Variable used in PISA regressions only. Source: Hanushek et al., 2022.

**School location: city**

School is located in a city (>100,000 inhabitants) (dummy variable). Variable used in PISA regressions only. Source: OECD, 2019.

**School location: town**

School is located in a town (3,000–100,000 inhabitants) (dummy variable). Variable used in PISA regressions only. Source: OECD, 2019.

**School size**

A school's number of students, divided by 1,000. Variable used in PISA regressions only. Source: OECD, 2019.

**Shortage of educational material**

Shortage (or lack) of educational material (dummy variable, school level). Variable used in PISA regressions only. *Source*: OECD, 2019.

**Urbanization rate**

People living in urban areas as a decimal fraction of the total population. Variable used in regressions with World Bank test scores only. *Source*: World Bank, 2022.

**World Bank test scores**

Harmonized test scores from several multi-country student achievement testing programs such as TIMMS (Trends in International Mathematics and Science Study), PIRLS (Progress in International Reading Literacy Study) and PISA (Programme for International Student Assessment). The test scores are scaled to range from 0 (minimal attainment) to 100 (advanced attainment). Variable used in regressions with World Bank test scores only. Source: World Bank, 2022.

**Note:** PISA regressions additionally include individual-level control variables covering sex, age, migration status, parental education, parental occupation, books at home, computer for school work at home, and other language than test language spoken at home. Source: OECD, 2019.

## Appendix 4.3: Descriptive Statistics of World Bank Test Scores Sample

| | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|
| | | Dependent variable | | |
| World Bank test scores | 42.93 | 21.31 | 1.51 | 86.42 |
| | | Variable of interest | | |
| Economic freedom | 0.70 | 0.09 | 0.47 | 0.90 |
| | | Control variables | | |
| Political freedom | 0.61 | 0.32 | 0.00 | 1.00 |
| Confucian heritage society | 0.05 | 0.22 | 0.00 | 1.00 |
| GDP per capita | 9.49 | 1.19 | 6.61 | 11.65 |
| Government expenditure on education | 4.34 | 1.53 | 1.51 | 9.86 |
| Urbanization rate | 0.61 | 0.23 | 0.13 | 1.00 |
| Child population share | 0.27 | 0.11 | 0.12 | 0.49 |

**Note**: Data from 2018.

## Appendix 4.4: Descriptive Statistics of PISA Sample

| | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|
| | | Dependent variable | | |
| PISA scores | 4.58 | 1.01 | 0.25 | 8.88 |
| | | Variable of interest | | |
| Economic freedom | 0.75 | 0.06 | 0.59 | 0.85 |
| | | Control variables | | |
| Political freedom | 0.74 | 0.32 | 0.00 | 1.00 |
| Confucian heritage society | 0.03 | 0.17 | 0.00 | 1.00 |
| GDP per capita | 10.30 | 0.58 | 9.00 | 11.18 |
| Government funding for schools | 0.81 | 0.15 | 0.45 | 1.00 |
| Private schools | 0.21 | 0.20 | 0.00 | 0.66 |
| Central exit exams | 0.62 | 0.43 | 0.00 | 1.00 |
| School autonomy | 0.77 | 0.28 | 0.07 | 1.00 |
| Certified teachers | 0.80 | 0.32 | 0.00 | 1.00 |
| Shortage of educational material | 0.36 | 0.47 | 0.00 | 1.00 |
| School location: town | 0.47 | 0.49 | 0.00 | 1.00 |
| School location: city | 0.43 | 0.49 | 0.00 | 1.00 |
| School size | 0.88 | 0.75 | 0.00 | 11.99 |

**Note:** Data from 2018. PISA regressions additionally include individual-level control variables covering sex, age, migration status, parental education, parental occupation, books at home, computer for school work at home and other language than test language spoken at home.

## References

Becker, Gary S., and H. Gregg Lewis (1973). On the Interaction between the Quantity and Quality of Children. *Journal of Political Economy* 81, 2, Part 2 (March-April): S279–S288.

Betthäuser, Bastian A., Anders M. Bach-Mortensen, and Per Engzell (2023). A Systematic Review and Meta-Analysis of the Evidence on Learning during the COVID-19 Pandemic. *Nature Human Behaviour* 7 (January): 375–385.

Feldmann, Horst (2005). Hayek's Theory of Cultural Evolution: A Critique of the Critiques. In Jürgen G. Backhaus (ed.), *Entrepreneurship, Money and Coordination: Hayek's Theory of Cultural Evolution* (Edward Elgar): 1–46.

Feldmann, Horst (2025). Economic Freedom and the Quality of Education. *Kyklos* 78, 1 (February): 86–110.

Freedom House (2022). *Freedom in the World 2022*. Freedom House. <https://freedomhouse.org/sites/default/files/2022-02/FIW_2022_PDF_Booklet_Digital_Final_Web.pdf>, as of April 27, 2022.

Gwartney, James, Randall Holcombe, and Robert Lawson (2006). Institutions and the Impact of Investment on Growth. *Kyklos* 59, 2 (May): 255–273.

Gwartney, James, Robert Lawson, Joshua Hall, and Ryan Murphy (2022). *Economic Freedom of the World: 2022 Annual Report*. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/economic-freedom-of-the-world-2022.pdf>, as of October 25, 2022.

Hansen, Lars Peter (1982). Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica* 50, 4 (July): 1029–1054.

Hanushek, Eric A., Lavinia Kinne, Philipp Lergetporer, and Ludger Woessmann (2022). Patience, Risk-Taking, and Human Capital Investment across Countries. *Economic Journal* 132, 646 (August): 2290–2307.

Hanushek, Eric A., Guido Schwerdt, Simon Wiederhold, and Ludger Woessmann (2015). Returns to Skills around the World: Evidence from PIAAC. *European Economic Review* 73 (January): 103–130.

Hanushek, Eric A., and Ludger Woessmann (2011). The Economics of International Differences in Educational Achievement. In Eric A. Hanushek, Stephen Machin, and Ludger Woessmann (eds.), *Handbook of the Economics of Education* 3 (North-Holland): 89–200.

Hanushek, Eric A., and Ludger Woessmann (2015). *The Knowledge Capital of Nations*. MIT Press.

Jones, Garett, and Niklas Potrafke (2014). Human Capital and National Institutional Quality: Are TIMSS, PISA, and National Average IQ Robust Predictors? *Intelligence* 46 (September-October): 148–155.

Kleibergen, Frank, and Richard Paap (2006). Generalized Reduced Rank Tests Using the Singular Value Decomposition. *Journal of Econometrics* 133, 1 (July): 97–126.

Lawson, Robert (2022). Economic Freedom in the Literature: What Is It Good (Bad) For? In James Gwartney, Robert Lawson, Joshua Hall and Ryan Murphy (eds.), *Economic Freedom of the World: 2022 Annual Report* (Fraser Institute): 187–199. <https://www.fraserinstitute.org/sites/default/files/economic-freedom-of-the-world-2022.pdf>, as of October 25, 2022.

Martellini, Paolo, Todd Schoellman, and Jason Sockin (2024). The Global Distribution of College Graduate Quality. *Journal of Political Economy* 132, 2 (February): 434–483.

Organisation for Economic Co-operation and Development [OECD] (2019). *PISA 2018 Results (Volume I)*. Organisation for Economic Co-operation and Development.

Page, John (1994). The East Asian Miracle: Four Lessons for Development Policy. *NBER Macroeconomics Annual* 9 (January): 219–282.

Patrinos, Harry Anthony, and Noam Angrist (2018). *Global Dataset on Education Quality: A Review and Update (2000–2017)*. Policy Research Working Paper 8592. World Bank.

Rainey, Lee Dian (2010). *Confucius and Confucianism: The Essentials*. Wiley-Blackwell.

Schleicher, Andreas (2018). *World Class: How to Build a 21st-Century School System*. OECD Publishing.

Schoellman, Todd (2012). Education Quality and Development Accounting. *Review of Economic Studies* 79, 1 (January): 388–417.

Sjøberg, Svein (2015). PISA and Global Educational Governance: A Critique of the Project, its Uses and Implications. *Eurasia Journal of Mathematics, Science and Technology Education* 11, 1 (December): 111–127.

Staiger, Douglas, and James H. Stock (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica* 65, 3 (May): 557–586.

Starr, Don (2012). China and the Confucian Education Model. *Universitas* 21: 1–27.

To, Cho-Yee (1993). Confucianism in East Asia. In Witold Tulasiewicz and Cho-Yee To (eds.), *World Religions and Educational Practice* (Cassell): 72–83.

World Bank (2022). *World Development Indicators*. World Bank. <https://databank.worldbank.org>, as of January 3 and July 25, 2023.

World Bank (2023). *Human Capital Project*. World Bank. <https://databank.worldbank.org/source/human-capital-index>, as of August 7, 2023.

Yao, Xinzhong (2000). *An Introduction to Confucianism*. Cambridge University Press.

Zhang, Wei, and Yoko Yamato (2018). Shadow Education in East Asia: Entrenched but Evolving Private Supplementary Tutoring. In Kerry J. Kennedy and John Chi-Kin Lee (eds.), *Routledge International Handbook of Schools and Schooling in Asia* (Routledge): 323–32.

Zhao, Yong (2020). Two Decades of Havoc: A Synthesis of Criticism against PISA. *Journal of Educational Change* 21, 2 (January): 245–266.