International Journal of Educational Development 62 (2018) 217–225

Contents lists available at ScienceDirect

International Journal of Educational Development

journal homepage: www.elsevier.com/locate/ijedudev

Corruption and education in developing countries: The role of public vs. private funding of higher education

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ARTICLE INFO

Keywords:
Public and private education
Corruption
Governance
Educational finance

ABSTRACT

Corruption reduces the incentives to invest. This is also true for investments in human capital. The paper explains how enrollment in publicly funded higher education institutions affects years of schooling at different corruption levels. Using data from 88 developing countries, we first confirm that corruption negatively correlates with expected years of schooling. Second, we identify a joint effect of corruption and the type of higher education funding in a country: in low-corruption countries, the fraction of public higher education enrollment increases expected years of schooling, while it decreases in high-corruption countries.

1. Introduction

Education is one of the most critical factors for innovation and economic growth (Barro, 2001; Hanushek and Kimko, 2000), as well as for business and society. Governments intervene in education markets in many countries and provide public funding to their educational systems (Hanushek, 1986; Trostel, 2002). The involvement of public entities or government transfers from one party to another may create the risk of misallocating resources (Acemoglu and Verdier, 2000; Shleifer, 1998). Corruption, in turn, may destroy individual incentives to invest in human capital (Heyneman et al., 2008).

India could serve as an example of the crucial role of public and private education. The Indian public education system has been criticized for low quality due to corruption and high teacher absenteeism (Kremer et al., 2005). Since parents and firms see education as a major growth factor, they demand high quality education that they expect private education institutions to provide. As a result, the number of students at private education institutions is growing rapidly compared to enrollment at public education institutions (Economist, 2015).

This paper addresses two questions in the context of developing countries: First, we examine how corruption affects years of schooling. Second, we ask how funding of higher education moderates this relation. We argue that corruption in a country affects the expected years of schooling negatively, since corruption in a society decreases the expected benefits of education without decreasing the costs. The effect, however, correlates with the importance of public institutions of higher education in a country: a higher fraction of students enrolled in public higher education goes along with higher years of schooling in low-corruption countries, but with lower years of schooling in high-corruption countries.

The empirical test of these predictions is based on 88 developing countries from 2005 to 2012. These countries have mainly been neglected in the literature (McCourt, 2008)—even if education financing and human capital formation are particularly important. The empirical results support the theoretical predictions, even after conducting several robustness checks. The optimal strategy for increasing human capital formation in a country depends on the level of corruption. In low-corruption countries, it would be beneficial to increase the number of students at public higher education institutions, while the opposite is true for high-corruption countries. This is especially interesting in terms of deriving policy implications, since increasing or reducing the enrollment in public higher education institutions seems just as feasible—if not more so—as fighting corruption.

Surprisingly, the correlation between corruption and educational outcomes has gained little attention in cross-country analyses (exceptions are Dridi, 2014; Gupta et al., 2001; Huang, 2008; Rajkumar and Swaroop, 2008). While the aforementioned studies do not distinguish between developed and developing countries, limited human capital is a severe problem particularly for developing countries. Qualifications have become more important and the number of low-skilled workplaces has diminished in many parts of the world, so it is even more surprising that years of schooling, including higher education—a reliable indicator for the human capital of a country (Barro, 2001; Woessmann, 2003)—has been largely neglected. Finally, it is even more surprising that literature on corruption has neglected the role of funding higher education, particularly the interplay between financing and corruption for educational outcomes.

This study contributes to the literature in several ways. First, it

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https://doi.org/10.1016/j.ijedudev.2018.05.002
Received 22 September 2017; Received in revised form 12 April 2018; Accepted 10 May 2018

offers a conceptual bridge between the standard human capital theory from personnel economics, which trades off the costs and benefits of an additional year of education at an individual level (Becker, 1962), and the established literature on corruption at the country level (Delavallade, 2006; Mauro, 1998). This paper develops an argument in a setting where higher education institutions are publicly and/or privately financed.

Second, the paper adds to the extensive literature on corruption. Several issues that occur in economies have been analyzed, such as the effect of corruption on foreign direct investments (Bellos and Subasat, 2012), budget consolidation (Liu and Mikesell, 2014), human development (Qizilbash, 2001), migration (Poprawe, 2015), and the shadow economy (Dreher and Schneider, 2010).[1] Although, some papers have already examined corruption in education, these either focus on single countries (Reinikka and Svensson, 2005; Theodorescu and Andrei, 2009) or rather present conceptual analyses and overviews (Heyneman, 2004; Osipian, 2007; Osipian, 2008; Rumyantseva, 2005; Sabic-El-Rayess and Mansur, 2016; Tanaka, 2001; Waite and Allen, 2003). Quantitative comparative empirical studies dealing with corruption and educational outcomes at the country level are rare (notable exceptions are Dridi, 2014; Gupta et al., 2001; Huang, 2008; Rajkumar and Swaroop, 2008) and mainly missing for developing countries.

Third, the study contributes to the discussion of the role of public and private education (e.g., Cremer et al., 2010; Welch, 2007) and investigates the interaction between corruption and the public sector (Hopkin and Rodriguez-Pose, 2007), focusing on public enrollment of students in higher education institutions compared to private. Although Rajkumar and Swaroop (2008) and Suryadarma (2012) show that the effect of public spending on educational outcomes depends on the institutional quality, neither study considers higher education nor the role of public and private institutions in a comparative framework.

Finally, the paper contributes to the discussion on fighting corruption (Mungiu-Pippidi, 2006; Rose-Ackerman, 1997; Stapenhurst and Langseth, 1997; Yang, 2009). Recently, Otáhal (2014) argued that private ownership "solves the economic problem of corruption" (Otáhal, 2014: 399). Our empirical results are consistent with this prediction: the relation between enrollment in private higher education and years of schooling is positive only in high-corruption countries.

The paper proceeds as follows: Section 2 presents the theoretical background and derives expectations on the relation between corruption, years of schooling, and public enrollment in higher education institutions. Section 3 describes the data and shows descriptive statistics. Section 4 introduces the methodological approach and shows the empirical results and robustness checks. Section 5 discusses policy implications and limitations of the study.

2. Theoretical background and hypotheses

The theoretical argument of this paper combines two approaches: On the one hand, it draws on basic considerations from the human capital theory (Becker, 1962). On the other hand, it relies on the central findings on corruption and government expenditure from public administration theory (Mauro, 1998; Montinola and Jackman, 2002).

2.1. Corruption and education

The most prominent theory explaining educational differences at an individual level is the human capital theory. Becker (1962) interprets education as an investment and the gained knowledge as the human capital of an individual. As in every investment situation, the trade-off between costs and benefits determines the optimal level of investment—or, in this framework, the optimal number of years of schooling.

We develop a human capital-based framework at the country level to analyze the influence of corruption on years of schooling based on two assumptions: First, Treisman (2000: 399) defines corruption as "the misuse of public office for private gain".[2] Since neither students nor firms are able to observe the degree of corruption objectively, the paper relies on how corrupt the public perceives the society they are living in to be (including universities[3] and the labor market). Second, we assume that students choose the optimal number of years of schooling only based on the costs and benefits of education for a given level of corruption in a country.

At a country level, institutional and economic conditions vary and influence the costs and benefits of an individual's investment in human capital. Both affect the number of years of schooling. If the direct costs of education for individuals are low—for example, through higher public expenditure on education (Heinesen and Graversen, 2005), financial support provided by the state (Dynarski, 2003; Schultz, 2004), or good infrastructure in urban regions (Ulubaşoğlu and Cardak, 2007)—then, years of schooling are greater. If the direct costs of education for individuals increase—for example, through higher tuitions and fees (Riphahn, 2012; Coelli, 2009)—then, years of schooling decrease. Opportunity costs reduce years of schooling in the same way. For example, if child labor is a genuine problem in a country (Psacharopoulos, 1997) or the unemployment rate is low (Clark, 2011), then opportunity costs are high, and an additional year of schooling becomes less attractive.

Assuming that the costs of education in a country are given and do not depend on the perceived corruption in a society, the benefits of education drive the years of schooling. The benefits of education probably decrease with higher corruption, since perceived corruption increases the uncertainty of success in the labor market after graduating. Getting a job, high wages, or both may not depend only on qualifications (e.g., years of schooling) but also on personal relations (Heyneman, 2004: 638; Stapenhurst and Langseth, 1997: 315). Hence, in the labor market of a country with high corruption levels, the success of graduates can be easily manipulated. If a greater number of years of schooling does not increase the probability of success in the labor market reliably, the expected returns on education decrease along with the incentive to invest in human capital. Higher levels of corruption decrease students' effort and years of schooling in a country. Briefly, corruption negatively affects the benefits of education and proposes the expectation that higher levels of corruption in countries go along with fewer years of schooling.

2.2. The role of public enrollment in higher education

Education—and, mostly, higher education—is funded differently across countries (Liefner, 2003). In some countries, the majority of students study at private higher education institutions; in other countries, all students study at publicly funded institutions. While primary and secondary schooling are usually compulsory, higher education is voluntary in all countries. The effect of attending higher education institutions on years of schooling can be expected to be remarkable.

The theoretical discussion draws on the effect of the percentage of students enrolled in public institutions on years of schooling. This effect is hypothesized to vary across high- and low-corruption countries, which requires inspecting the costs and benefits of higher education at private and public institutions for low- and high-corruption countries separately. Two assumptions are crucial: First, tuition and fees at public institutions are lower than they are at private institutions. For example,

[1] For excellent surveys of the consequences of corruption, see Lambsdorff (2006), Mauro (1998), or Rose-Ackerman (1997).

[2] For an extensive discussion on the definition of corruption, see Shleifer and Vishny (1993), Svensson (2005), or Treisman (2000).

[3] Teixeira and Rocha (2010: 693) state that students from countries with higher perceived corruption show higher average incidence rates for academic dishonesty.

in the Slovak Republic, there is no cost of tuition and fees to obtain a bachelor's degree in public institutions, and private institutions reach 2300 USD; in Colombia, the corresponding costs are 574 USD and 3082 USD, respectively (OECD, 2016: 243). Dumauli (2015: 15) reports for Indonesian universities tuition and fees as below 4,498,031 Rupiah (about 297 USD 2015) at public universities and 39,370,079 Rupiah (about 2603 USD in 2015) at private universities. Second, the labor market firms' expectations about the quality of university degrees affect the wages of university graduates. These expectations may differ with the degree of corruption in a country (Heyneman et al., 2008: 11).

Students at private institutions pay higher tuitions and fees than those at public institutions; thus, the costs for an additional year of schooling in low-corruption countries are higher at private than at public education institutions. The benefits of graduating from public and private institutions lack variance in low-corruption countries, since the labor market expects grades from private and public institutions to reflect the productivity of graduates equally.[4] For acquiring a job, students expect academic performance to be the relevant factor, so that students at both types of institutions work similarly hard and are similarly successful in the labor market.

These cost-benefit comparisons let us conclude that, in low-corruption countries, the differences in costs between public and private education institutions are great (with private education being much more expensive), while the differences in benefits, if existent, are small. Applying the human capital theory predicts a greater number of years of schooling in public education systems if corruption is low, which proposes the expectation that in low-corruption countries, a higher fraction of students enrolled in public higher education institutions increases the number of years of schooling.

In high-corruption countries, the costs for an additional year of schooling are higher at private than at public education institutions—as it is the case in low-corruption countries. However, the expected benefits of a university degree from a public or private institution differ greatly in high-corruption countries, with the benefits of graduating from a public institution being smaller. The reasons are twofold: First, in high-corruption countries, firms in the labor market expect public institutions (including higher education institutions) to be more prone to corruption than private ones (Heyneman et al., 2008). Government officials may impose direct or indirect regulations on public organizations and, therefore, restrict the markets (Montinola and Jackman, 2002: 149) and political control mechanisms drive public managers' decision-making (Rutherford and Meier, 2015). Regulations may for example include imposing boundaries on salaries for academic staff, introducing admission standards, or regulating tuition and fees. Presuming that corruption at the societal level also applies specifically to education, in high corruption countries, students (or their parents) and public higher education officials try to circumvent regulations and rules. Thus, the labor market expects private higher education institutions to provide graduates with more reliable signals on a graduate's quality. Consequently, expected wages are higher after graduating from private (as opposed to public) higher education institutions in high-corruption countries. Calónico and Ñopo (2007), for example, find significant wage advantages for graduates from private higher education institutions compared to public higher education institutions in Peru (as an above-average corruption country). Bedi and Garg (2000) show that graduates of private secondary schools in Indonesia (above-average corruption) have higher earnings than those from public schools. Second, since students in high-corruption countries expect that getting a job does not only depend on academic performance, they have a lower incentive to work hard or to enter a higher education institution. As a result, graduates from public institutions on average work less hard during higher education and are indeed less productive than those from private institutions. This supports the belief of the firms in the labor market.

In high-corruption countries, the differences in costs between public and private education institutions do not differ from low-corruption countries, while the expected differences in benefits are great (with lower expected returns after graduating from public compared to private institutions in high-corruption countries). Therefore, we expect that in high-corruption countries, a higher fraction of students enrolled in public higher education institutions decreases the number of years of schooling.

3. Data and variables

The empirical analysis focuses on developing countries, so the sample consists of countries which the World Bank classifies as having low, lower-middle, and upper-middle income. These countries had gross national incomes below 12,615 USD per capita in 2012 (Atlas method, World Bank, 2018g). After eliminating missing values and cases with obvious data errors, the sample consists of 350 observations from 88 developing countries[5] over a period of eight years (2005 to 2012). We collected data from various sources. Information on education and economic factors comes from the UNESCO Institute for Statistics Database and the World Bank. Both institutions apply international procedures leading to consistent and reliable data (World Bank, 2018a; UNESCO, 2018). Information on corruption comes from a well-established organization, Transparency International.

Expected years of schooling, compiled by UNESCO as 'school-life expectancy', serves as the dependent variable throughout this paper (UNESCO Institute for Statistics, 2018a). It sums up the age-specific enrollment rates for all levels of education—or, less technically, it measures the number of years of schooling (including tertiary education) that a five-year-old child will receive throughout their entire life if current enrollment rates persist (Malik, 2013: 147). On average, over the course of the observation period, the number of expected years of schooling is slightly above 12 years and shows considerable variation across countries: while the expected years of schooling in Lithuania (in 2009) was 17.0, in Eritrea (in 2010), it was only 4.1.

This empirical analysis builds on two central independent variables: corruption and enrollment percentage in public higher education. The corruption variable is derived from the well-established corruption perception index (Lambsdorff, 2006; Mensah, 2014). Transparency International annually collects data on more than 180 countries from various independent sources on how corrupt the country's public sector is perceived to be (Lambsdorff, 2008: 2; Transparency International, 2018).[6] The original index uses a 10-point scale, with higher values indicating less corruption. Reversing the scale by subtracting the original value from 10 (Treisman, 2000) results in a corruption measure in which higher values of the corruption variable denote higher levels of perceived corruption in a country. In the underlying sample, this corruption variable fluctuates around a mean of 6.6; Chile showed the

[4] In the United States, a low-corruption country, private university graduates do not seem to receive a consistently positive wage premium compared to public university graduates. If there is a wage premium, it is rather small (Behrman et al., 1996; Black et al., 2005; Brewer et al., 1999; Monks, 2000).

[5] Afghanistan, Algeria, Angola, Argentina, Belarus, Benin, Bhutan, Bolivia, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Chile, Colombia, Democratic Republic of the Congo, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Georgia, Ghana, Guatemala, Guinea, Guyana, Honduras, Hungary, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Latvia, Lebanon, Lesotho, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Sao Tome and Principe, Senegal, Serbia, Seychelles, Slovak Republic, South Africa, Sri Lanka, St. Lucia, Swaziland, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Turkey, Ukraine, Uruguay, Uzbekistan, Venezuela, Yemen.

[6] Although, the comparison of countries based on the ranks of corruption in panel analysis might be problematic, using the corruption scores should not suffer from the problem as indicated by Transparency International.

lowest corruption value of 2.7 in 2006, and Myanmar presented the highest value of 8.6 in 2007.

The percentage of students enrolled in public higher education (Public HE enrollment) is calculated as the total number of students enrolled in public higher education institutions (ISCED 5 + 6) as a percentage of the total number of students enrolled in higher education (UNESCO, 2012: 70; UNESCO Institute for Statistics, 2018b). Higher percentages indicate a greater importance of publicly financed higher education institutions in a country. Focusing on higher education enrollment is particularly appropriate for this analysis, since the previously developed theory draws on the duration of education to reflect the potential of human capital. On average, the percentage of enrollment in public higher education is about 71.5 percent in developing countries. In some countries (e.g., Algeria, Guyana, Uzbekistan), all students are enrolled in public higher education institutions, whereas in others (e.g., Latvia, Estonia), almost all students are enrolled at private institutions.

The literature suggests several other factors that affect educational outcome. All empirical models control for family background (Biblarz and Raftery, 1999) and environmental factors (Ulubaşoğlu and Cardak, 2007). Since family background is difficult to pinpoint at country level, the fertility rate (World Bank, 2018b)—measured as the expected number of births per woman if current age-specific fertility rates persist until the end of the woman's childbearing years—gives the number of children in a family (Klepinger et al., 1999; Waite and Moore, 1978). The age-dependency ratio measures the proportion of dependents (above 64 years old) in comparison to working-age population (aged 15 to 64 years old) (World Bank, 2018c) and captures the age structure of a country (Gupta et al., 2001). Urbanization, defined as the share of the population living in urban areas (World Bank, 2018d), presents the impact of infrastructure on expected years of schooling (Gupta et al., 2001). Finally, a dummy variable for countries from the Asia Pacific area is included, as several countries from this area performed quite well in international student assessment tests (Huang, 2008).

Since the dependent variable—expected years of schooling—includes higher education as well, further education-specific factors probably correlate with the outcome variable. We also control for the enrollment ratio in secondary education (World Bank, 2018h) and for the enrollment in tertiary education per 1000 inhabitants of a country (World Bank, 2016). Wealth of a country might play an important role for the expected years of schooling, thus the gross national income per capita (per 1000 inhabitants) computed with the Atlas method controls for a country's financial resources (World Bank, 2018i). Table 1 reports the descriptive statistics for all variables, based on pooled data.

Table 1
Summary descriptive statistics (averaged data over the observation period).

	Observations	Mean	Std. Dev.	Min	Max
Expected years of schooling	350	12.257	2.424	4.100	17.000
Corruption	350	6.586	1.221	2.700	8.600
Public HE enrollment	350	71.532	22.994	0	100.000
Fertility rate	350	2.776	1.420	1.213	6.699
Age-dependency ratio	350	11.683	6.475	4.581	27.912
Urban population	350	54.843	20.695	10.376	94.414
Asia Pacific	350	0.129	–	0	1
Enrollment ratio - secondary education	350	74.581	25.097	13.096	110.764[a]
Enrollment in tertiary education	350	29.508	19.130	0.471	75.011
Gross national income per capita (per 1000)	350	4.484	3.596	0.190	13.420
For robustness section only					
Pupil-teacher ratio	244	18.941	9.662	7.463	80.052
Female-male enrollment ratio	343	1.148	0.469	0.174	3.295
Free country	350	4.561	1.598	1.154	7.000
Gross national income per capita in 2000 (per 1000)	346	2.147	1.956	0.130	7.440

[a] The World Bank states that values can exceed 100 percent due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.

4. Empirical analysis

4.1. Results

This section empirically studies the relationship between corruption and expected years of schooling, considering the role of public higher education enrollment. The theoretical argument draws on the cross-section variance and the base models rely on random effects specifications. Clustered standard errors at country level correct for potential correlation within countries over time. Alternatively, the Prais-Winsten estimator (assuming an AR1 process) explicitly models the correlation over time. The robustness section provides alternative models treating the time dimension differently and addressing potential endogeneity problems.

To test the first expectation that states a negative relationship between corruption and years of schooling, Table 2 presents the results of the baseline model (M1) explaining expected years of schooling using corruption and a set of control variables. The coefficient of corruption is negative and statistically different from zero: in countries with higher perceived corruption, the number of expected years of schooling is smaller, which lends support to the first expectation. If corruption in a country is one point higher (approximately 0.8 standard deviation), expected years of schooling are 0.137 years (roughly 1.6 months) smaller. At first glance, this effect seems small. Instrumental variable

Table 2
Results of the regression analyses.

	Random effects		Prais Winsten	
	(M1)	(M2)	(M3)	(M4)
Corruption	−0.137**	0.148	−0.075*	0.229*
	(0.067)	(0.151)	(0.041)	(0.125)
Public HE enrollment		0.023**		0.021**
		(0.010)		(0.010)
Corruption X Public HE enrollment		−0.004**		−0.004**
		(0.002)		(0.002)
Gross national income per capita (per 1000)	0.005	0.002	0.027	0.025
	(0.022)	(0.023)	(0.017)	(0.016)
Fertility rate	−0.020	0.004	−0.039	−0.025
	(0.179)	(0.172)	(0.124)	(0.120)
Age dependency ratio	0.010	0.015	0.042***	0.046***
	(0.029)	(0.028)	(0.016)	(0.015)
Urban population	0.008	0.007	0.005	0.003
	(0.010)	(0.010)	(0.007)	(0.007)
Asia-Pacific country	0.058	−0.014	−0.145	−0.297
	(0.338)	(0.329)	(0.423)	(0.409)
Enrollment ratio - secondary education	0.049***	0.049***	0.045***	0.046***
	(0.007)	(0.007)	(0.006)	(0.006)
Enrollment in tertiary education	0.052***	0.052***	0.042***	0.041***
	(0.010)	(0.010)	(0.006)	(0.006)
Constant	7.551***	5.869***	7.452***	6.004***
	(1.139)	(1.277)	(0.904)	(1.204)
Observations	350	350	350	350
No. of countries	88	88	88	88
R^2	0.865	0.874	0.967	0.969

Dependent variable: expected years of schooling. Clustered standard errors at country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Overall R^2 in models M1 and M2. Adjusted R^2 in models M3 and M4.

estimations (results in the robustness section), however, indicate that the effect is about three times greater.

Out of the control variables in model M1, only the education-specific coefficients (secondary enrollment and tertiary enrollment) are statistically different from zero. Both variables correlate positively with expected years of schooling. All other control variables—gross national income per capita, fertility rate, age-dependency ratio, urban population, and the Asia Pacific dummy—do not show significant correlations with expected years of schooling.

The results of models M1 and M3 confirm the negative relationship between corruption and expected years of schooling in developing countries. They do not differ from existing empirical evidence based on developed and developing countries: Dridi (2014) finds a negative relation between corruption and secondary school enrollment rates. Huang (2008) shows a negative correlation between corruption and standardized mathematical test results as well as between corruption and expected years of schooling, while Gupta et al. (2001) finds a positive effect of corruption on dropout rates in primary schooling.

The second part of the empirical investigation draws on the role of financing higher education. Models M2 and M4 in Table 2 add the percentage of students enrolled in public higher education institutions and examine the relationship of main interest: the joint effect of corruption and enrollment in public higher education on years of schooling. To test our theoretical expectations, which predict different effects of public higher education enrollment on expected years of schooling for low- and high-corruption countries, we focus on the interaction term.

In the special case of zero corruption (where also the interaction term is zero), the coefficient of public higher education enrollment indicates that an increase of one percentage point in public higher education enrollment increases expected years of schooling by 0.023 years in the random effects model (M2) and 0.021 in the Prais Winsten model (M4). This is about 2.5 months for a ten-percentage point increase in public education enrollment. Taking the interaction term explicitly into account (in models M2 and M4) reveals the effect of public higher education enrollment on expected years of schooling in the general case (Brambor et al., 2006). To illustrate the effect for various levels of corruption, Table 3 displays the marginal effects for model M4. All control variables are fixed to their means.

Table 3 shows a clear downward trend. The effect of public higher education enrollment is positive in low-corruption countries and becomes negative in high-corruption countries. The effect is statistically significant at the 90 percent, for values of corruption below 2.6 and above 6.1.

To illustrate the quantitative investigation, we take a detailed look at the expected years of schooling in four countries from our sample in 2009: public enrollment and low corruption, private enrollment and low corruption, public enrollment and high corruption, as well as private enrollment and high corruption. Uruguay and Cape Verde serve as exemplary countries with low levels of corruption of 3.3 and 4.9, respectively, but they differ regarding the fraction of students enrolled in public higher education institutions. In Uruguay, 87 percent of students are enrolled in public higher education institutions while in Cape Verde this figure reaches only 39 percent. Previous reasoning suggests greater expected years of schooling in the country with higher enrollment in public higher education institutions. In this example, Uruguay shows 15.5 expected years of schooling compared to Cape Verde with 12.6 years. Central African Republic and Lebanon are examples for countries with high corruption levels of 8 and 7.5, respectively. While the Central African Republic has a high fraction of students enrolled in public higher education institutions (92 percent), only 44 percent of all students in Lebanon are enrolled in public higher education institutions. As predicted for high-corruption countries, the Central African Republic (6.7 years) shows substantially lower expected years of schooling than does Lebanon (13.1 years).

Table 3
Marginal effects of public higher education enrollment (based on model M4).

	Low corruption				Medium corruption		
Corruption	0	1	2	3	4	5	6
Marginal effect	.0208**	.0166**	.0123*	.0081	.0039	−.0004	−.0046
Standard error	(.010)	(.008)	(.007)	(.005)	(.004)	(.003)	(.003)

	High corruption			
Corruption	7	8	9	10
Marginal effect	−.0089**	−.0131***	−.0173***	−.0216***
Standard error	(.004)	(.005)	(.006)	(.008)

*p < 0.10, ** p < 0.05, *** p < 0.01.

Overall, these results are consistent with the expectations. Briefly, the relation of enrollment in public and private higher education institutions and expected years of schooling differs with levels of corruption: in low-corruption countries, public higher education increases expected years of schooling, while in high-corruption countries, public higher education decreases expected years of schooling.

These results are not only fully consistent with results in the literature, but they complement the discussion on the role of public spending, corruption, and educational outcome. In this respect, studies similar to ours show different effects of public spending on educational outcomes for low- and high-corruption regimes: Rajkumar and Swaroop (2008) for primary education in 19 countries and Suryadarma (2012) for junior and senior schooling in Indonesian regions. Both reveal a positive effect of public spending under low corruption, but no effect under high-corruption regimes. Focusing on higher education and explicitly considering public and private higher education enrollment, our results are compatible with the literature for low-corruption regimes: a higher fraction of students enrolled in public higher education institutions (i.e., a low fraction enrolled in private higher education) increases years of schooling. For high-corruption regimes, however, we do not support the nil effect but reveal that the fraction of public higher education enrollment decreases the number of years of schooling. This new finding suggests that not only total public spending but also the role of public enrollment in higher education matters for educational outcome at the country level.

4.2. Robustness of the results

Four sets of additional regressions prove the robustness of the results. These address the time dimension, additional control variables, regional differences, and endogeneity.

First, the results in Table 4 consider the time structure explicitly in several ways. Since the argument mainly draws on the cross-section variance, we run a simple pooled OLS model with errors clustered at country level (models R1 and R2). Additionally, we average all values, run a simple OLS model with robust standard errors (models R3 and R4), and confirm the robustness of the models M3 to M4.

Second, Table 5 considers additional control variables in models M3 and M4: the pupil-to-teacher ratio (Gupta et al., 2001; Hanushek, 1997, World Bank, 2018e) and the female-to-male tertiary enrollment ratio to measure the extent of gender inequality in a country (similar to Gupta et al., 2001; World Bank, 2018f). The results regarding our expectations are consistent with the results of the main models M3 and M4. The relevant coefficients remain significant (except for the coefficient of corruption in model R7, which remains similar in size only) and do not change signs (models R5 to R8). In model R5, we confirm the significantly negative relation between perceived corruption and expected years of schooling. The coefficient of the interaction term in models R6 and R8 remains significant and negative.

Third, we examine whether certain countries drive the results. Two different subsamples (European and OECD countries) are excluded from the main models. Independent of the subsample of countries, the results of models M3 and M4 are robust as the models R9 to R12 in Table 6

Table 4
Regression results, considering time structure differently.

	Pooled OLS		Averaged over all years	
	(R1)	(R2)	(R3)	(R4)
Corruption	−0.183**	0.233	−0.167**	0.195
	(0.076)	(0.142)	(0.083)	(0.163)
Public HE enrollment		0.032***		0.030***
		(0.009)		(0.011)
Corruption X Public HE enrollment		−0.006***		−0.005***
		(0.002)		(0.002)
Gross national income per capita (per 1000)	0.056**	0.048**	0.088***	0.082***
	(0.021)	(0.019)	(0.023)	(0.023)
Fertility rate	0.175	0.199	0.137	0.149
	(0.129)	(0.131)	(0.119)	(0.116)
Age dependency ratio	0.057***	0.058***	0.040***	0.043***
	(0.012)	(0.011)	(0.014)	(0.014)
Urban population	0.006	0.004	0.005	0.003
	(0.007)	(0.006)	(0.008)	(0.008)
Asia Pacific country	0.437	0.263	0.259	0.147
	(0.318)	(0.307)	(0.327)	(0.303)
Enrollment ratio - secondary education	0.051***	0.054***	0.060***	0.061***
	(0.007)	(0.008)	(0.009)	(0.009)
Enrollment in tertiary education	0.040***	0.040***	0.028***	0.028***
	(0.007)	(0.007)	(0.008)	(0.008)
Constant	6.662***	4.437***	6.510***	4.490**
	(1.178)	(1.484)	(1.493)	(1.816)
Observations	350	350	88	88
No. of countries	88	88	88	88
Adjusted R^2	0.878	0.886	0.881	0.883

Dependent variable: expected years of schooling. All models are estimated with clustered (models R1, R2) or robust (R3, R4) standard errors. Standard errors in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

indicate.

Finally, an instrumental variable approach addresses a potential endogeneity bias, since reversed causality might be a problem (i.e., a low level of education in a country could lead to higher levels of corruption; Truex, 2011). Suitable instruments must fulfill two conditions: First, the instruments should correlate with the potentially endogenous variable. Second, they should not correlate with the error term in the second-stage regression or have a direct effect on the dependent variable. To identify instruments, the literature suggests two candidates. First, Treisman (2000) proposes that democracy correlates with corruption. To ascertain the level of democracy and political freedom, Freedom House's data on the level of political rights and the index for civil liberties are combined (Freedom House, 2018); the variable "Free country" is simply the mean of the two indices. After reversing the index order, larger numbers represent freer countries. Second, we use the gross national income per capita (per 1000) from 2000 ("GNI in 2000") as an instrument (Gupta et al., 2001; World Bank, 2018i). These two variables are not only theoretically plausible instruments, they also pass the formal requirements using the tests for instruments in random effects models (Schaffer and Stillman, 2010).

The first-stage random effects model (R13b) in Table 6 shows that the two instrumental variables correlate with the potentially endogenous variable corruption. Furthermore, the test for overidentification is not rejected—as required (Sargan-Hansen statistic = 0.034, p = 0.8539). Finally, the instruments pass the test for weak instruments (Kleibergen-Paap Wald F statistic = 16.89). Consequently, "Free country" and "GNI in 2000" are suitable instruments for corruption. The random effects model R13a shows a statistically significant relationship between corruption and expected years of schooling as the theoretical expectation proposed. In fact, the coefficient is almost three times larger than in the base model (M1), which hints at an underestimation of the corruption effect on expected years of schooling in the base model.

Table 5
Prais-Winsten results, including additional control variables.

	(R5)	(R6)	(R7)	(R8)
Corruption	−0.087**	0.230*	−0.054	0.299*
	(0.043)	(0.124)	(0.047)	(0.159)
Public HE enrollment		0.022**		0.023*
		(0.010)		(0.012)
Corruption X Public HE enrollment		−0.004***		−0.005**
		(0.002)		(0.002)
Gross national income per capita (in 1000)	0.029*	0.027	0.029	0.027
	(0.017)	(0.017)	(0.020)	(0.020)
Fertility rate	−0.029	−0.025	−0.148	−0.137
	(0.128)	(0.123)	(0.156)	(0.154)
Age-dependency ratio	0.045***	0.048***	0.040**	0.043**
	(0.016)	(0.015)	(0.019)	(0.017)
Urban population	0.005	0.003	0.007	0.004
	(0.007)	(0.007)	(0.008)	(0.008)
Asia Pacific country	−0.160	−0.304	−0.035	−0.188
	(0.437)	(0.425)	(0.333)	(0.326)
Enrollment ratio - secondary education	0.044***	0.044***	0.037***	0.038***
	(0.007)	(0.006)	(0.008)	(0.008)
Enrollment in tertiary education	0.042***	0.041***	0.034***	0.032***
	(0.006)	(0.006)	(0.007)	(0.007)
Female-male enrollment ratio	0.043	0.033		
	(0.164)	(0.156)		
Pupil to teacher ratio			−0.019**	−0.019**
			(0.009)	(0.009)
Constant	7.465***	6.003***	8.723***	7.244***
	(0.974)	(1.245)	(1.139)	(1.553)
Observations	343	343	244	244
No countries	86	86	66	66
Adjusted R^2	0.968	0.969	0.967	0.970

Dependent variable: expected years of schooling. Clustered standard errors at country level in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

5. Conclusion and discussion

Based on a human capital-theoretic argument this paper has investigated the role of public higher education enrollment to explain years of schooling under various levels of corruption. Empirical evidence for developing countries confirms a negative, significant, and robust relationship between corruption and expected years of schooling. The effect of public higher education enrollment on expected years of schooling depends on corruption levels: at low levels of corruption, public higher education increases the expected years of schooling, while at high levels of corruption, public higher education enrollment decreases the expected years of schooling.

The first result extends the understanding of a partly researched relationship and supports the finding that corruption is harmful to education, particularly for years of schooling and the stock of human capital in a country. The second finding reinforces the importance of how higher education is funded. These results suggest that corruption does not have merely a separated effect. Instead, the relationship between corruption and the percentage of students enrolled at public and private higher education institutions is crucial. As a side result, we also provide explicit empirical evidence—both in general and specifically for the education sector—of Otáhal's (2014) theoretical reasoning, which argues that private ownership reduces the economic problem of corruption.

The results of the paper suggest that the effect of public enrollment differs with corruption levels. A "one-size-fits-all"-policy toward higher education across developing countries does not seem to be the optimal strategy to increase years of schooling. Instead, government, firms and international organizations should take institutional quality, such as

Table 6
Prais-Winsten results for subsamples and instrumental variable estimation.

	Excluding European countries		Excluding OECD countries		G2SLS	First stage G2SLS
	(R9)	(R10)	(R11)	(R12)	(R13a)	(R13b)
Corruption	−0.084*	0.347**	−0.083*	0.229*	−0.375**	
	(0.050)	(0.141)	(0.042)	(0.136)	(0.187)	
Public HE enrollment		0.035***		0.021*		
		(0.013)		(0.011)		
Corruption X Public		−0.006***		−0.004**		
HE enrollment		(0.002)		(0.002)		
GNI per capita	0.018	0.018	0.023	0.019	−0.009	−0.057***
(per 1000)	(0.024)	(0.021)	(0.018)	(0.018)	(0.023)	(0.018)
Fertility rate	−0.104	−0.068	−0.041	−0.024	−0.014	0.029
	(0.151)	(0.142)	(0.129)	(0.124)	(0.119)	(0.110)
Age-dependency ratio	0.006	0.009	0.036**	0.041**	0.014	0.031
	(0.030)	(0.026)	(0.017)	(0.016)	(0.023)	(0.022)
Urban population	0.006	0.004	0.006	0.003	0.004	0.003
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Asia Pacific country	−0.213	−0.370	−0.148	−0.305	0.016	−0.123
	(0.431)	(0.409)	(0.425)	(0.410)	(0.373)	(0.345)
Enrollment ratio – secondary education	0.046***	0.047***	0.045***	0.046***	0.046***	−0.010
	(0.007)	(0.007)	(0.007)	(0.006)	(0.005)	(0.004)
Enrollment in tertiary education	0.040***	0.039***	0.041***	0.040***	0.055***	0.007
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)
Free country						−0.335***
						(0.075)
GNI per capita in 2000 (per 1000)						−0.159*
						(0.079)
Constant	8.041***	5.599***	7.523***	6.055***	9.503***	8.634***
	(1.065)	(1.375)	(0.940)	(1.273)	(1.559)	(0.784)
Observations	278	278	322	322	346	346
No. of countries	74	74	82	82	84	84
R^2	0.958	0.962	0.964	0.966	0.868	

Dependent variable: expected years of schooling in models R9 to R13a; corruption in model R13b. Clustered standard errors at country level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Instruments in model R13a: free country, gross national income per capita (per 1000) in 2000. Adjusted R^2 in models R9 to R12. Overall R^2 in model R13a.

corruption, in a country into account. While the fraction of students enrolled in public higher education institutions decreases the years of schooling in high-corruption countries, it has a positive effect in low-corruption countries. If we believe in this relation, then policy implications on regulating the higher education sector should differ across corruption levels, and probably also with other institutional factors. If corruption in a country is low, then higher percentages of enrollment in public education institutions might have a positive effect on years of schooling. In other words, if corruption in a country is low, the government should intervene and foster public higher education to increase the incentive to attend these institutions and to invest in human capital. On the contrary, in high-corruption countries, higher percentages of students in private higher education may enhance years of schooling and the stock of human capital in a country.

As any study, this one has limitations. First, the study's focus on years of schooling could be considered a limitation. Future studies might focus on alternative educational outcomes—in terms of quality and quantity but also in terms of different levels of education (e.g., primary or secondary schooling). Second, as a quantitative study, the paper does not shed light on the channels of corruption; more specific data (which may be difficult to collect) or carefully selected case studies could enhance the understanding the underlying mechanisms. Case studies can also consider other factors, which potentially influence higher education enrollment. Finally, the interplay of corruption and public higher education enrollment identified in the paper may be a starting point for studying mechanisms in other areas, where public and private institutions coexist, such as the health or the public transportation sector.

Declaration of interest

None.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

The authors are very grateful to two anonymous reviewers of this journal for helpful comments and suggestions. The authors are also grateful to the participants of the Annual Conference of the *Verein für Socialpolitik* (German Economic Association) for valuable comments on an earlier version of the paper.

References

Acemoglu, D., Verdier, T., 2000. The choice between market failures and corruption. Am. Econ. Rev. 90 (1), 194–211. http://dx.doi.org/10.1257/aer.90.1.194.
Barro, R.J., 2001. Human capital and growth. Am. Econ. Rev. 91 (2), 12–17. http://dx.doi.org/10.1257/aer.91.2.12.
Becker, G.S., 1962. Investment in human capital: a theoretical analysis. J. Polit. Econ. 70 (5), 9–49. http://dx.doi.org/10.1086/258724.
Bedi, A.S., Garg, A., 2000. The effectiveness of private versus public schools: the case of Indonesia. J. Dev. Econ. 61 (2), 463–494. http://dx.doi.org/10.1016/S0304-3878(00)00065-1.
Behrman, J.R., Rosenzweig, M.R., Taubman, P., 1996. College choices and wages: estimates using data on female twins. Rev. Econ. Stat. 78 (4), 672–685. http://dx.doi.org/10.2307/2109954.
Bellos, S., Subasat, T., 2012. Corruption and foreign direct investment: a panel gravity model approach. Bull. Econ. Res. 64 (4), 565–574. http://dx.doi.org/10.1111/j.1467-8586.2010.00370.x.
Biblarz, T.J., Raftery, A.E., 1999. Family structure, educational attainment, and socioeconomic success: rethinking the "Pathology of Matriarchy. Am. J. Sociol. 105 (2), 321–365. http://dx.doi.org/10.1086/210314.
Black, D., Smith, J., Daniel, K., 2005. College quality and wages in the United States. Ger. Econ. Rev. 6 (3), 415–443. http://dx.doi.org/10.1111/j.1468-0475.2005.00140.x.
Brambor, T., Clark, W.R., Golder, M., 2006. Understanding interaction models: improving empirical analyses. Polit. Anal. 14 (1), 63–82. http://dx.doi.org/10.1093/pan/

mpi014.
Brewer, D.J., Eide, E.R., Ehrenberg, R.G., 1999. Does it pay to attend an elite private college? Cross-cohort evidence on the effects of college type on earnings. J. Hum. Resour. 34 (1), 104–123. http://dx.doi.org/10.2307/146304.
Calónico, S., Ñopo, H., 2007. Where did you go to school? Private-public differences in schooling trajectories and their role on earnings. Well-Being Soc. Policy 3 (1), 25–46.
Clark, D., 2011. Do recessions keep students in school? The impact of youth unemployment on enrolment in post-compulsory education in England. Economica 78 (311), 523–545. http://dx.doi.org/10.1111/j.1468-0335.2009.00824.x.
Coelli, M.B., 2009. Tuition fees and equality of university enrolment. Can. J. Econ. 42 (3), 1072–1099. http://dx.doi.org/10.1111/j.1540-5982.2009.01539.x.
Cremer, H., De Donder, P., Pestieau, P., 2010. Education and social mobility. Int. Tax Public Finance 17 (4), 357–377. http://dx.doi.org/10.1007/s10797-010-9133-0.
Delavallade, C., 2006. Corruption and distribution of public spending in developing countries. J. Econ. Finance 30 (2), 222–239. http://dx.doi.org/10.1007/BF02761488.
Dreher, A., Schneider, F., 2010. Corruption and the shadow economy: an empirical analysis. Public Choice 144 (1–2), 215–238. http://dx.doi.org/10.1007/s11127-009-9513-0.
Dridi, M., 2014. Corruption and education: empirical evidence. Int. J. Econ. Financ. Issues 4 (3), 476–493.
Dumauli, M.T., 2015. Estimate of the private return on education in Indonesia: evidence from sibling data. Int. J. Educ. Dev. 42, 14–24. http://dx.doi.org/10.1016/j.ijedudev.2015.02.012.
Dynarski, S.M., 2003. Does aid matter? Measuring the effect of student aid on college attendance and completion. Am. Econ. Rev. 93 (1), 279–288. http://dx.doi.org/10.1257/000282803321455287.
Economist, 2015. For-profit education. The $1-a-week school. The Economist. (August 1st 2015). https://www.economist.com/news/leaders/21660113-private-schools-are-booming-poor-countries-governments-should-either-help-them-or-get-out Accessed 27 March 2018.
[dataset] Freedom House, 2018. Freedom in the World. In: https://freedomhouse.org/report-types/freedom-world, last access 28 March 2018.
Gupta, S., Davoodi, H., Tiongson, E., 2001. Corruption and the provison of health care and education services. In: In: Jain, A.K. (Ed.), The Political Economy of Corruption, vol. 1. Routledge, London and New York, pp. 111–141.
Hanushek, E.A., 1986. The economics of schooling: production and efficiency in public schools. J. Econ. Lit. 24 (3), 1141–1177.
Hanushek, E.A., 1997. Assessing the effects of school resources on student performance: an update. Educ. Eval. Policy Anal. 19 (2), 141–164. http://dx.doi.org/10.3102/01623737019002141.
Hanushek, E.A., Kimko, D.D., 2000. Schooling, labor-force quality, and the growth of nations. Am. Econ. Rev. 90 (5), 1184–1208. http://dx.doi.org/10.1257/aer.90.5.1184.
Heinesen, E., Graversen, B.K., 2005. The effect of school resources on educational attainment: evidence from Denmark. Bull. Econ. Res. 57 (2), 109–143. http://dx.doi.org/10.1111/j.0307-3378.2005.00217.x.
Heyneman, S.P., 2004. Education and corruption. Int. J. Educ. Dev. 24 (6), 637–648. http://dx.doi.org/10.1016/j.ijedudev.2004.02.005.
Heyneman, S.P., Anderson, K.H., Nuraliyeva, N., 2008. The cost of corruption in higher education. Comp. Educ. Rev. 52 (1), 1–25. http://dx.doi.org/10.1086/524367.
Hopkin, J., Rodriguez-Pose, A., 2007. Grabbing Hand" or "Helping Hand"?: Corruption and the economic role of the state. Governance Int. J. Policy Admin. Institutions 20 (2), 187–208. http://dx.doi.org/10.1111/j.1468-0491.2007.00353.x.
Huang, F.L., 2008. Corruption and educational outcomes: Two steps forward, one step back. Int. J. Educ. Policy Leadersh. 3 (9), 1–10. http://dx.doi.org/10.22230/ijepl.2008v3n9a142.
Klepinger, D., Lundberg, S., Plotnick, R., 1999. How does adolescent fertility affect the human capital and wages of young women? J. Hum. Resour. 34 (3), 421–448. http://dx.doi.org/10.2307/146375.
Kremer, M., Chaudhury, N., Rogers, F.H., Muralidharan, K., Hammer, J., 2005. Teacher absence in India. A snapshot. J. the Eur. Econ. Assoc. 3 (2–3), 658–667. http://dx.doi.org/10.1162/jeea.2005.3.2-3.658.
Lambsdorff, J.G., 2006. Causes and consequences of corruption: what do we know from a cross-section of countries? In: Rose-Ackerman, S. (Ed.), International Handbook on the Economics of Corruption. Edward Elgar, Massachusetts, pp. 3–51.
Lambsdorff, J.G., 2008. The Methodology of the Corruption Perceptions Index 2008. Transparency International and University of Passau. Accessed 28 March 2018. http://www.icgg.org/downloads/Methodology_2008.pdf.
Liefner, I., 2003. Funding, resource allocation, and performance in higher education systems. High. Educ. 46 (4), 469–489. http://dx.doi.org/10.1023/A:1027381906977.
Liu, C., Mikesell, J.L., 2014. The impact of public officials' corruption on the size and allocation of US state spending. Public Adm. Rev. 74 (3), 346–359. http://dx.doi.org/10.1111/puar.12212.
Malik, K., 2013. Human Development Report 2013. The Rise of the South: Human Progress in a Diverse World. United Nations Development Programme (UNDP), New York.
Mauro, P., 1998. Corruption and the composition of government expenditure. J. Public Econ. 69 (2), 263–279. http://dx.doi.org/10.1016/S0047-2727(98)00025-5.
McCourt, W., 2008. Public management in developing countries. From downsizing to governance. Public Manage. Rev. 10 (4), 467–479. http://dx.doi.org/10.1080/14719030802263897.
Mensah, Y.M., 2014. An analysis of the effect of culture and religion on perceived corruption in a global context. J. Bus. Ethics 121 (2), 255–282. http://dx.doi.org/10.1007/s10551-013-1696-0.
Monks, J., 2000. The returns to individual and college characteristics: evidence from the national longitudinal survey of youth. Econ. Educ. Rev. 19 (3), 279–289. http://dx.doi.org/10.1016/S0272-7757(99)00023-0.
Mungiu-Pippidi, A., 2006. Corruption: diagnosis and treatment. J. Democr. 17 (3), 86–99. http://dx.doi.org/10.1353/jod.2006.0050.
Montinola, G.R., Jackman, R.W., 2002. Sources of corruption: a cross-country study. Br. J. Polit. Sci. 32 (1), 147–170. http://dx.doi.org/10.1017/S0007123402000066.
OECD, 2016. Education at a Glance 2016: OECD Indicators. OECD Publishing, New York. http://dx.doi.org/10.1787/eag-2016-en.
Osipian, A.L., 2007. Corruption in higher education: conceptual approaches and measurement techniques. Res. Comp. Int. Educ. 2 (4), 313–332. http://dx.doi.org/10.2304/rcie.2007.2.4.313.
Osipian, A.L., 2008. Corruption in higher education: does it differ across the nations and why? Res. Comp. Int. Educ. 3 (4), 345–365. http://dx.doi.org/10.2304/rcie.2008.3.4.345.
Otáhal, T., 2014. Mises, Hayek and corruption. J. Bus. Ethics 119 (3), 399–404. http://dx.doi.org/10.1007/s10551-013-1646-x.
Poprawe, M., 2015. On the relationship between corruption and migration: empirical evidence from a gravity model of migration. Public Choice 163 (3-4), 337–354. http://dx.doi.org/10.1007/s11127-015-0255-x.
Psacharopoulos, G., 1997. Child labor versus educational attainment: some evidence from Latin America. J. Popul. Econ. 10 (4), 377–386. http://dx.doi.org/10.1007/s001480050049.
Qizilbash, M., 2001. Corruption and human development: a conceptual discussion. Oxf. Dev. Stud. 29 (3), 265–278. http://dx.doi.org/10.1080/13600810120088868.
Rajkumar, A.S., Swaroop, V., 2008. Public spending and outcomes: does governance matter? J. Dev. Econ. 86 (1), 96–111. http://dx.doi.org/10.1016/j.jdeveco.2007.08.003.
Reinikka, R., Svensson, J., 2005. Fighting corruption to improve schooling: evidence from a newspaper campaign in Uganda. J. the Eur. Econ. Assoc. 3 (2–3), 259–267. http://dx.doi.org/10.1162/jeea.2005.3.2-3.259.
Riphahn, R.T., 2012. Effect of secondary school fees on educational attainment. Scand. J. Econ. 114 (1), 148–176. http://dx.doi.org/10.1111/j.1467-9442.2011.01661.x.
Rose-Ackerman, S., 1997. The political economy of corruption. In: Elliott, K.A. (Ed.), Corruption and the Global Economy. Peterson Institute for International Economics, Washington, pp. 31–60.
Rumyantseva, N.L., 2005. Taxonomy of corruption in higher education. Peabody J. Educ. 80 (1), 81–92. http://dx.doi.org/10.1207/S15327930pje8001_5.
Rutherford, A., Meier, K.J., 2015. Managerial goals in a performance-driven system: theory and empirical test in higher education. Public Adm. 93 (1), 17–33. http://dx.doi.org/10.1111/padm.12124.
Sabic-El-Rayess, A., Mansur, N.N., 2016. Favor reciprocation theory in education: New corruption typology. Int. J. Educ. Dev. 50, 20–32. http://dx.doi.org/10.1016/j.ijedudev.2016.04.005.
Schaffer, M.E., Stillman, S., 2010. xtoverid: Stata Module to Calculate Tests of Overidentifying Restrictions after xtreg, xtivreg, xtivreg2 and xthtaylor. Accessed 28 March 2018. http://ideas.repec.org/c/boc/bocode/s456779.html.
Schultz, T.P., 2004. School subsidies for the poor: evaluating the mexican progresa poverty program. J. Dev. Econ. 74 (1), 199–250. http://dx.doi.org/10.1016/j.jdeveco.2003.12.009.
Shleifer, A., 1998. State versus private ownership. J. Econ. Perspect. 12 (4), 133–150. http://dx.doi.org/10.1257/jep.12.4.133.
Shleifer, A., Vishny, R.W., 1993. Corruption. Q. J. Econ. 108 (3), 599–617. http://dx.doi.org/10.2307/2118402.
Stapenhurst, F., Langseth, P., 1997. The role of the public administration in fighting corruption. Int. J. Public Sect. Manage. 10 (5), 311–330. http://dx.doi.org/10.1108/09513559710172131.
Suryadarma, D., 2012. How corruption diminishes the effectiveness of public spending on education in Indonesia. Bull. Indonesian Econ. Stud. 48 (1), 85–100. http://dx.doi.org/10.1080/00074918.2012.654485.
Svensson, J., 2005. Eight questions about corruption. J. Econ. Perspect. 19 (3), 19–42. http://dx.doi.org/10.1257/089533005774357860.
Tanaka, S., 2001. Corruption in education sector development: a suggestion for anticipatory strategy. Int. J. Educ. Manage. 15 (4), 158–166. http://dx.doi.org/10.1108/09513540110394384.
Teixeira, A.A.C., Rocha, M.F., 2010. Cheating by economics and business undergraduate students: an exploratory international assessment. High. Educ. 59 (6), 663–701. http://dx.doi.org/10.1007/s10734-009-9274-1.
Theodorescu, D., Andrei, T., 2009. Faculty and peer influences on academic integrity: College cheating in Romania. High. Educ. 57 (3), 267–282. http://dx.doi.org/10.1007/s10734-008-9143-3.
[dataset] Transparency International, 2018. Corruption Perception Index. In: https://www.transparency.org/research/cpi/overview, last access 28 March 2018.
Treisman, D., 2000. The causes of corruption: a cross-national study. J. Public Econ. 76 (3), 399–457. http://dx.doi.org/10.1016/S0047-2727(99)00092-4.
Trostel, P.A., 2002. Should education be publicly provided? Bull. Econ. Res. 54 (4), 373–391. http://dx.doi.org/10.1111/1467-8586.00157.
Truex, R., 2011. Corruption, attitudes, and education: survey evidence from Nepal. World Dev. 39 (7), 1133–1142. http://dx.doi.org/10.1016/j.worlddev.2010.11.003.
Ulubaşoğlu, M.A., Cardak, B.A., 2007. International comparisons of rural–urban educational attainment: data and determinants. Eur. Econ. Rev. 51 (7), 1828–1857. http://dx.doi.org/10.1016/j.euroecorev.2006.11.003.
UNESCO, 2012. Global Education Digest. UNESCO Institute for Statistics, Quebec.
UNESCO, 2018. About UNESCO. Institute for Statistics last access 27 March 2018. http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-all/resources/statistics/.

[dataset] UNESCO Institute for Statistics, 2018a. Human Development Report. Expected years of schooling. In: http://hdr.undp.org/en/content/expected-years-schooling-children-years, last access 28 March 2018.
[dataset] UNESCO Institute for Statistics, 2018b. Percentage of enrolment in tertiary education in private institutions. In: http://data.un.org/Data.aspx?d=UNESCO&f=series%3aPRP_56, last access 28 March 2018.
Waite, D., Allen, D., 2003. Corruption and abuse of power in educational administration. Urban Rev. 35 (4), 281–296. http://dx.doi.org/10.1023/B:URRE.0000017531.73129.4f.
Waite, L.J., Moore, K.A., 1978. The impact of an early first birth on young women's educational attainment. Soc. Forces 56 (3), 845–865. http://dx.doi.org/10.1093/sf/56.3.845.
Welch, A.R., 2007. Blurred vision?: Public and private higher education in Indonesia. High. Educ. 54 (5), 665–687. http://dx.doi.org/10.1007/s10734-006-9017-5.
Woessmann, L., 2003. Specifying human capital. J. Econ. Surveys 17 (3), 239–270. http://dx.doi.org/10.1111/1467-6419.00195.
[dataset] World Bank, 2016. Enrolment in tertiary education per 100,000 inhabitants, both sexes. In: https://data.worldbank.org/indicator/UIS.TE_100000.56, last access 8 February 2016.
World Bank, 2018a. About World Bank. https://data.worldbank.org/about, last access 28 March 2018.
[dataset] World Bank, 2018b. Fertility rate, total (births per woman). In: https://data.worldbank.org/indicator/SP.DYN.TFRT.IN, last access 28 March 2018.
[dataset] World Bank, 2018c. Age dependency ratio, old (% of working-age population). In: https://data.worldbank.org/indicator/SP.POP.DPND.OL, last access 28 March 2018.
[dataset] World Bank, 2018d. Urban population (% of total). In: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS, last access 28 March 2018.
[dataset] World Bank, 2018e. Pupil-teacher ratio in secondary education. In: http://data.worldbank.org/indicator/SE.SEC.ENRL.TC.ZS, last access 28 March 2018.
[dataset] World Bank, 2018f. Ratio of female to male tertiary enrollment (%). In: http://data.worldbank.org/indicator/SE.ENR.TERT.FM.ZS, last access 28 March 2018.
[dataset] World Bank, 2018g. Country Classification. In: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519, last access 28 March 2018.
[dataset] World Bank, 2018h. Gross enrolment ratio, secondary, both sexes (%). In: https://data.worldbank.org/indicator/SE.SEC.ENRR, last access 28 March 2018.
[dataset] World Bank, 2018i. GNI per capita, Atlas method (current US$). In: https://data.worldbank.org/indicator/NY.GNP.PCAP.CD, last access 28 March 2018.
Yang, K., 2009. Institutional congruence, ideas, and anticorruption policy: the case of China and the United States. Public Adm. Rev. 69 (s1), 142–150. http://dx.doi.org/10.1111/j.1540-6210.2009.02102.x.