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International comparisons of rural–urban educational attainment: Data and determinants

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Abstract

We study cross-country differences in rural and urban educational attainment by using a data set comprising 56 countries. We focus on the determinants of rural–urban educational inequality, which is measured by the ratio of rural to urban average years of schooling within each country. We find that riskier human capital investment, less credit availability, a colonial heritage, a legal system of French origin and landlockedness of nations are all associated with relatively lower rural educational levels and greater rural–urban educational inequality. Conversely, larger formal labor markets, better infrastructure and a legal system of British origin are associated with relatively higher rural educational levels and lower rural–urban educational inequality. We also identify an interaction effect between economic development level and some of these factors. In particular, we find that as development level increases, the negative (positive) relationship between French (British) legal systems and rural–urban educational inequality is reversed and becomes positive (negative).

JEL classification: I20; O18; R12

Keywords: Human capital; Economic geography; Education; Rural and urban educational inequality

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1. Introduction

This paper studies cross-country differences in rural and urban educational attainment by using a data set for a diverse group of 56 countries. Using human capital, labor market and migration theories, we identify national and regional factors that are expected to influence rural and urban households and individuals in their educational decision making. We apply our theoretical arguments to a data set that we construct from data available in UNESCO Educational Yearbooks (1964–1999). In our empirical analysis, we use the ratio of rural to urban average schooling years to study rural–urban educational inequality, while we also investigate cross-country variation in the levels of rural and urban educational attainment.

The rural–urban divide has been a major area of study in development economics, focusing on rural–urban divisions within countries, particularly with respect to industrialization (Kuznets, 1955, 1973). In more recent times, studies on rural–urban issues have focused on economic geography, and its links to migration, urbanization, trade and economic growth (see Williamson, 1988; Shukla, 1996; Fujita et al., 1999; Henderson, 2005). While numerous studies have considered the rural–urban educational divide within a single country, there has been limited research on this issue across countries.[1] Thus, our paper unifies two existing literatures: (i) the survey based studies that consider rural–urban differences in educational attainment within single countries (for example Kochar, 2004, considers India; Knight and Li, 1996, consider China; and Al-Samarrai and Reilly, 2000 and Barnum and Sabot, 1977, both consider Tanzania), and (ii) the cross-country studies employing average national educational attainment (for example, de Gregorio and Lee, 2002). In doing this, we are attempting to provide a unified explanation of cross-country differences in rural–urban educational inequality (hereafter RUEI).

Barro and Lee (1993, 1996, 2001) are pioneers in providing researchers with comprehesive cross-country datasets on national educational attainment, the most recent covering the period 1960–2000 and 142 countries.[2] While the Barro and Lee data sets, which are based on UNESCO Educational Yearbooks, cannot be decomposed to create a panel of rural and urban (hereafter R&U) schooling, sufficient data exist in that source to construct an unbalanced panel data set of R&U educational attainment across countries. This is critical, as our cross-country analysis would not be possible without this data. Our data set comprises a diverse range of countries from the most developed to some of the least developed. Another feature of our data set is that we have further disaggregated R&U educational attainment into male and female attainment within R&U areas, though we do not exploit this distinction in this paper.[3]

In the empirical analysis, we focus on the determinants of RUEI, measured by the ratio of average rural years of schooling to average urban years of schooling within a country.

[1] Sahn and Stifel (2003) compare a number of living standard measures (of which educational attainment is one) across the rural–urban divide for 24 African countries.

[2] While Barro and Lee (1993, 1996, 2001) were the first to create large cross-country data sets on national average years of schooling, Nehru et al. (1995) and de la Fuente and Domenech (2001) offer alternative data sets at the national level, suggesting a growing interest in such data. We expand the diversity of datasets through disaggregation to the rural–urban level.

[3] While our focus is on cross-country differences in rural and urban educational attainment, we expect that our newly assembled data set will be useful to researchers wishing to explore cross-country issues such as growth, inequality, employment and migration. To this end, the data are presented in Table 1.

We model this ratio and the levels of R&U schooling years using economic, demographic, political, cultural, geographic, gender and infrastructural variables. We estimate reduced form equations with both General-to-Specific and Specific-to-General modelling techniques. Our results are broadly consistent regardless of the empirical technique employed, allowing us to draw robust conclusions about factors that influence RUEI across nations.

We find that countries with greater resources and those with more effective channels to allocate these resources have lower RUEI. Such distributional channels seem to be influenced by institutional framework such as the legal system within a country, colonial history, and political stability as well as geographical characteristics such as being landlocked and/or a larger country. Specifically, countries with legal systems of French origin (French legal system), on average, have higher RUEI, while the reverse is true for countries with legal systems of British origin (British legal system). Also, countries with colonial pasts in general, and the countries with post-war independence in particular have higher RUEI. This may be related to the extractive rather than settlement nature of colonies gaining independence in the post-war period; see Acemoglu et al. (2001). In addition, countries with less stable political environments, that are landlocked and those with larger surface areas have higher RUEI, suggesting that such factors negatively influence effective allocation of resources between R&U areas, other things being equal. We also find that RUEI is lower in economies with larger formal labor markets and better infrastructure, while riskier human capital investment and more limited credit availability are associated with greater RUEI.

We also find that the strength of these mechanisms depends on the level of economic development. In particular, the impact of credit availability, type of legal system, geography and religion on RUEI changes with the level of development in a country. Two important examples of such results include that a legal system of French (British) origin is negatively (positively) related to RUEI in less developed economies, while the reverse is found in more developed economies. In light of recent findings by Grier (1999) on the link between colonial history, education and economic performance and the robust impact of human capital on economic growth (Doppelhofer et al., 2004), our results suggest disparities between R&U human capital accumulation may be another mechanism through which colonial heritage and institutions affect long-run economic performance.[4]

The paper proceeds with a description of data sources and the construction of our rural–urban cross-country unbalanced panel data set in Section 2. In Section 3, we provide theoretical foundations for the analysis of rural–urban educational attainment. In Section 4 we describe our empirical methodology. We present our empirical results in Section 5 and Section 6 summarizes our findings.

2. Data construction

UNESCO Educational Yearbooks provide data on the proportion of the populations (above 25) commencing and completing different levels of education for R&U areas. The categories provided are No Schooling, Incomplete Primary Schooling, Complete Primary Schooling, Incomplete Secondary Schooling, Complete Secondary Schooling and Post-secondary Schooling. We obtain data on the schooling durations of each country at the

[4]For some other mechanisms, see Acemoglu et al. (2001), La Porta et al. (1998, 1999).

primary and secondary levels from the World Bank Education Statistics web site (http://devdata.worldbank.org/edstats/cd.asp), thereby accounting for the variation in schooling durations within countries over time. In constructing the data on the years of educational attainment, we use the following formula:

$$\begin{aligned}\text{SCHOOLING}_{it} = {} & \text{IP}_{it} \times \text{PRIMARY}_{it}/2 + \text{CP}_{it} \times \text{PRIMARY}_{it} + \text{IS}_{it} \\ & \times (\text{PRIMARY}_{it} + \text{SECONDARY}_{it}/2) \\ & + \text{CS}_{it} \times (\text{PRIMARY}_{it} + \text{SECONDARY}_{it}) + \text{PS}_{it} \\ & \times (\text{PRIMARY}_{it} + \text{SECONDARY}_{it} + 2), \qquad (1)\end{aligned}$$

where SCHOOLING is average years of schooling, IP, CP, IS, CS, PS denote the shares of population with Incomplete Primary, Complete Primary, Incomplete Secondary, Complete Secondary and Post-secondary Schooling, respectively; PRIMARY and SECONDARY denote the schooling duration at each level; and i and t denote the countries and time, respectively. In the UNESCO source, each country's data are recorded at different points in time as a result of the availability of relevant surveys. The same formula is applied for both R&U schooling.[5]

UNESCO Educational Yearbooks also provide similar information on female schooling. We can therefore also calculate female years of schooling for both R&U areas by using Eq. (1). Having this at hand, we also calculate male schooling within a country using the following formula:

$$\begin{aligned}\text{TOTAL\_SCHOOLING} = {} & \text{FEMALE\_SCHOOLING} \times \text{FEMALE\_POP} \\ & + \text{MALE\_SCHOOLING} \times \text{MALE\_POP}, \qquad (2)\end{aligned}$$

where FEMALE_POP and MALE_POP are the shares of female and male populations above 25 for each country, respectively.

The rural–urban educational attainment data for the female and total population are presented in Table 1.[6] Descriptive statistics on R&U attainment are presented in Tables 2a–d. The comparability of the data per se is limited since we have data for different countries in different years. Thus, we compare the data of developing and developed countries, classified for each decade from 1950 to 1990. These statistics are presented in Table 2e. The data set spans countries from various development levels, providing a good source of variation for empirical analysis.

To assess the reliability of our data construction and its compatibility with the existing data sets, we compare the "national" average years of schooling that we calculate from our R&U educational attainment (weighted by respective populations of age 25 years or higher) with that of Barro and Lee (2001).[7] The correlation is found to be 0.95. All statistics show strong similarities between the two measures. Statistical tests fail to reject the equality of means and medians. Minor discrepancies seem reasonable in the light of the

[5]For Incomplete Primary and Incomplete Secondary Schooling, half of the corresponding schooling years is used. We assume post-secondary schooling to comprise two years across countries as the data do not make any distinction on the type and completion of the post-graduate study. Enrollments at this level are very low for most countries, so the errors associated with this practice should be small.

[6]The male R&U schooling data are available on request, with summary statistics supplied in Table 2d.

[7]See Table 2b. This comparison is based on the countries and years with data available to us and the data of the corresponding year in the Barro and Lee data set. As their data set is in 5-year intervals, we use straight-line interpolation to approximate the data of a specific year in their data set.

Table 1
Data on rural and urban schooling and RATIO

Country	Year	Total population above 25				Female population above 25			
		Urban years	Rural years	Ratio	Nat'l years	Urban years	Rural years	Ratio	Nat'l. years
Afghanistan	1975	2.35	0.51	0.22	0.78	0.88	0.10	0.11	0.20
Afghanistan	1979	2.58	0.54	0.21	0.84	1.00	0.03	0.03	0.18
Algeria	1971	2.03	0.65	0.32	1.11	0.79	0.07	0.09	0.30
Bangladesh	1981	4.10	1.77	0.43	2.15	2.31	0.79	0.34	0.99
Bolivia	1976	7.82	3.05	0.39	4.91	6.56	1.64	0.25	3.61
Bolivia	1992	7.84	3.83	0.49	6.13	7.05	2.56	0.36	5.19
Brazil	1980	4.60	1.83	0.40	3.82	4.37	1.72	0.39	3.65
Bulgaria	1992	10.60	7.27	0.69	9.44	10.48	6.74	0.64	9.17
Cameroon	1976	3.57	1.42	0.40	2.06	2.39	0.68	0.29	1.06
Canada	1976	10.27	9.08	0.88	10.01	10.14	9.41	0.93	9.98
Canada	1981	10.83	9.92	0.92	10.65	10.70	10.15	0.95	10.60
Canada	1986	10.05	9.20	0.92	9.85	9.86	9.30	0.94	9.75
Canada	1991	10.40	9.62	0.93	10.23	10.24	9.74	0.95	10.13
Chile	1970	7.36	3.70	0.50	6.52	—	—	—	—
China	1988	9.59	5.45	0.57	7.09	—	—	—	—
Colombia	1973	6.25	3.31	0.53	5.25	5.91	3.18	0.54	5.07
Costa Rica	1973	5.90	3.08	0.52	4.37	5.67	3.02	0.53	4.31
Croatia	1991	10.07	7.98	0.79	9.12	9.56	7.26	0.76	8.38
Dom. Rep.	1970	4.55	1.75	0.38	2.94	—	—	—	—
Ecuador	1974	6.82	3.41	0.50	4.84	6.37	2.96	0.46	4.46
Egypt	1986	5.13	1.90	0.37	3.41	3.61	0.62	0.17	1.99
El Salvador	1971	5.03	1.81	0.36	3.18	—	—	—	—
Estonia	1989	8.51	7.05	0.83	8.10	8.44	7.01	0.83	8.04
Ethiopia	1994	4.29	0.46	0.11	1.02	2.78	0.13	0.05	0.52
Finland	1950	5.91	3.89	0.66	4.61	—	—	—	—
France	1954	3.18	2.10	0.66	3.25	—	—	—	—
Greece	1971	6.51	4.52	0.69	5.80	—	—	—	—
Greece	1991	8.53	5.32	0.62	7.49	—	—	—	—
Guatemala	1973	1.11	0.09	0.08	0.46	—	—	—	—
Haiti	1971	3.31	0.34	0.10	0.90	2.49	0.16	0.06	0.65
Haiti	1986	6.03	2.07	0.34	3.04	—	—	—	—
Honduras	1974	3.80	1.25	0.33	2.07	3.41	1.12	0.33	1.91
Hungary	1970	9.91	8.86	0.89	9.35	9.64	8.74	0.91	9.16
India	1971	3.90	1.22	0.31	1.76	2.33	0.44	0.19	0.78
India	1991	5.92	2.34	0.40	3.29	—	—	—	—
Indonesia	1980	5.35	2.49	0.46	3.08	4.16	1.77	0.43	2.29
Japan	1970	10.49	9.73	0.93	10.27	10.27	9.56	0.93	10.07
Japan	1980	11.07	10.26	0.93	10.88	10.90	10.11	0.93	10.68
Kenya	1969	4.73	1.54	0.33	1.84	—	—	—	—
Korea, Rep.	1970	8.04	4.05	0.50	4.18	6.50	2.87	0.44	4.01
Lebanon	1970	3.49	1.67	0.48	2.76	2.78	1.04	0.37	2.08
Liberia	1974	3.21	0.45	0.14	1.15	1.88	0.13	0.07	0.52
Malaysia	1970	4.66	2.76	0.59	3.26	—	—	—	—
Malaysia	1996	8.74	6.23	0.71	7.58	7.99	5.43	0.68	6.80
Mali	1976	1.09	0.12	0.11	0.27	0.51	0.03	0.07	0.11
Morocco	1971	1.74	0.18	0.10	0.72	0.95	0.04	0.04	0.35
Nepal	1981	2.76	0.62	0.22	0.74	1.53	0.21	0.13	0.29
N. Zealand	1981	12.03	11.89	0.99	11.99	11.89	12.07	1.02	11.92

Table 1 (*continued*)

Country	Year	Total population above 25				Female population above 25			
		Urban years	Rural years	Ratio	Nat'l years	Urban years	Rural years	Ratio	Nat'l. years
Norway	1950	8.16	6.60	0.81	7.63	—	—	—	—
Norway	1970	11.21	10.49	0.94	10.97	10.94	10.36	0.95	10.75
Norway	1990	11.16	10.72	0.96	11.04	11.02	10.67	0.97	10.92
Pakistan	1981	4.05	1.12	0.28	1.96	2.44	0.25	0.10	0.84
Pakistan	1990	3.88	1.58	0.41	2.31	2.30	0.38	0.16	1.03
Panama	1980	7.79	3.45	0.44	5.80	7.62	3.31	0.43	5.78
Paraguay	1972	5.20	2.65	0.51	3.71	4.63	2.33	0.50	3.36
Philippines	1970	6.72	3.71	0.55	4.69	6.30	3.49	0.55	4.45
Philippines	1995	8.61	6.70	0.78	7.67	8.71	6.76	0.78	7.76
Poland	1970	7.23	4.74	0.66	6.08	6.75	4.38	0.65	5.68
Poland	1978	8.05	5.87	0.73	7.15	7.65	5.49	0.72	6.78
Poland	1988	8.81	7.01	0.80	8.13	8.52	6.66	0.78	7.83
Puerto Rico	1970	7.77	4.76	0.61	6.63	7.44	4.48	0.60	6.36
Puerto Rico	1980	10.01	8.38	0.84	9.50	—	—	—	—
Romania	1992	11.00	7.92	0.72	9.53	10.58	7.03	0.66	8.89
S. Africa	1970	6.28	2.14	0.34	4.41	6.63	2.01	0.30	4.26
Spain	1970	4.74	4.14	0.87	4.58	4.29	3.84	0.89	4.17
Spain	1981	4.56	3.13	0.69	4.25	4.03	2.86	0.71	3.79
Sri Lanka	1971	6.58	4.55	0.69	5.05	5.87	3.69	0.63	4.19
Sri Lanka	1981	9.13	7.06	0.77	7.53	8.59	6.42	0.75	6.91
Sudan	1983	3.49	1.09	0.31	1.64	2.11	0.42	0.20	0.78
Tunisia	1975	2.31	0.46	0.20	1.59	1.49	0.11	0.07	0.82
Tunisia	1984	4.49	1.43	0.32	3.11	2.95	0.54	0.18	1.85
Turkey	1993	4.80	3.30	0.69	4.30	—	—	—	—
Utd. States	1970	11.19	10.54	0.94	11.02	11.14	10.73	0.96	11.03
Uruguay	1996	8.57	7.01	0.82	8.43	8.66	6.98	0.81	8.55
Venezuela	1990	8.26	5.08	0.61	7.80	8.02	4.80	0.60	7.64
Zambia	1980	5.84	3.09	0.53	4.18	4.57	1.95	0.43	2.82

Table 2a
Descriptive statistics (total population)

	Rural years	Urban years	RATIO
Mean	4.23	6.53	0.55
Median	3.36	6.27	0.53
Std. dev	3.23	2.89	0.25
Min.	0.10	1.09	0.09
Max.	11.89	12.03	0.99

fact that Barro and Lee, (i) have time series observations available on national schooling enrollments, (ii) take into account population growth (by looking at national birth and mortality rates) to approximate the enrollment of each age group, and (iii) use gross enrollment rates, adjusted for repeaters, while such features are not available for our data.

Table 2b
Descriptive statistics (total population—matched years of national schooling)

	National years (this study)	National years (Barro and Lee, 2001)
Mean	5.25	4.82
Median	4.59	4.27
Std. dev	3.29	3.12
Min	0.27	0.26
Max.	11.99	11.43

Table 2c
Descriptive statistics (female population)

	Rural years	Urban years	RATIO	National years (this study)
Mean	4.01	5.99	0.51	4.94
Median	2.99	6.33	0.52	4.28
Std. dev	3.65	3.42	0.32	3.70
Min.	0.03	0.51	0.03	0.11
Max.	12.07	11.89	1.02	11.92

Table 2d
Descriptive statistics (male population)

	Rural years	Urban years	RATIO	National years (this study)
Mean	4.86	7.31	0.59	5.89
Median	4.19	7.18	0.57	5.24
Std. dev	3.30	2.74	0.25	3.31
Min.	0.22	1.70	0.12	0.44
Max.	11.74	12.19	0.96	12.07

Table 2e
Developing vs. developed countries, decadal means

	Developing countries					Developed countries				
	No. of obs.	Rural years	Urban years	RATIO	Nat'l (this study)	No. of obs.	Rural years	Urban years	RATIO	Nat'l (this study)
1950s	—	—	—	—	—	3	4.20	5.75	0.71	5.16
1960s	—	—	—	—	—	—	—	—	—	—
1970s	31	2.41	4.95	0.41	3.38	6	8.08	9.07	0.88	8.78
1980s	16	3.49	6.23	0.49	4.58	5	8.88	9.71	0.89	9.52
1990s	12	4.98	7.72	0.60	6.39	3	8.56	10.03	0.84	9.59

3. Rural and urban schooling: A theoretical framework

Haveman and Wolfe (1995) provide a broad framework for the analysis of children's educational attainment. The key components of this framework involve objectives, opportunities and constraints relating to education, reflecting the roles of economic and institutional factors in determining household and student educational choices. We focus on human capital and labor market theories and the labor market returns to human capital investment through formal education. We take a cost-benefit approach, where households face the choice of their children supplying labor in the household or family farm and subsisting, during school years and beyond. The alternative is foregoing some household or farm labor during school years and supplying labor in formal labor markets in the long run.[8] The key point is that education levels are determined by the trade-off between resource use in the household and formal markets. This is affected not only by economic development within a country but by differences in development and opportunities between R&U areas and the way that nation-wide factors influence both R&U households.[9] The following theoretical arguments underpin our empirical analysis of cross-country differences in the ratio and the levels of R&U schooling years.[10]

3.1. *Riskiness of the investment*

Like any investment, acquisition of human capital through formal schooling entails uncertainty. For households, this might be the risk of child mortality, while for students, it might be related to demand for skilled labor in local areas. We expect that differences in demographic characteristics such as health and death rates as well as political environments and institutions that enforce contracts and protect property rights will influence the probability of children completing a schooling program and entering formal labor markets. The data we have in this category include: (i) demographic and infrastructural variables such as national life expectancy, R&U death rates and doctor availability; and (ii) political and institutional variables such as standard of political rights and civil liberties, the average number of revolutions, coups and assassinations, and the type of legal system (British, French, German, Scandinavian and Socialist). Motivations for the use of such political and institutional variables are discussed in La Porta et al. (1998, 1999).

3.2. *Labor markets*

The education choices of households and students are influenced by the role of formal labor markets in an economy which in turn depend on the roles of agriculture and non-farm production. If agriculture is primarily for subsistence, the required human capital can be acquired without formal schooling.[11] Alternatively, with significant non-farm employment prospects, the expected benefits of formal schooling would be greater as would

[8]These choices are limited by mandatory schooling requirements and how strictly they are enforced.

[9]Barro (1991) emphasizes the importance of national characteristics by implying that the individual return to ability (or education) is higher if the population is generally more able (or educated).

[10]For an expanded discussion, see Ulubasoglu and Cardak (2006).

[11]There is empirical evidence that farmers with more education are more productive and earlier to adopt new farming techniques and technologies, see Schultz (1988, p. 597).

educational attainment. Of the data we have, economic variables include agricultural vs. non-agricultural value added per worker, arable land per capita and the proportion of female teachers to total teachers. We expect higher levels of female teachers to lead to higher rural educational attainment because of greater labor market opportunities for both men and women. Demographic data include R&U birth rates and rural population density, while geographical data include countries' surface area and latitude (weather conditions and rainfall). Latitude can affect agricultural land productivity, thereby affecting the size of formal labor markets and making education more or less attractive.

3.3. Labor mobility and intersectoral migration

As discussed above, labor demand will influence levels of education. However, non-farm employers might be located far from rural centers, implying transport infrastructure and migration patterns may play a role in explaining RUEI.[12] The more urbanized and rurally inaccessible are labor markets, the greater we expect RUEI to be. Schultz (1988) points out that migration is one way for rural students to increase returns on their education. We use the following data to measure labor mobility: economic data such as intersectoral migration; geographical variables such as surface area, latitude, and landlocked and island dummies; demographic variable, ethnic fractionalization; infrastructural variable, telephone line availability; political variables such as number of assassinations, coups and revolutions. Ethnically fractionalized countries, those with lower political freedom and stability and a larger geographical area are less likely to experience migration (see Larson and Mundlak, 1997), thereby lowering returns and discouraging rural education. Easterly and Levine (1997) show that ethnic diversity reduces the provision of public goods like physical infrastructure and national education, thereby reducing labor mobility and discouraging rural education. However, political instability leads governments to discourage rural–urban migration in order to reduce political and social unrest in the seat of power, see Davis and Henderson (2003) and Ades and Glaeser (1995).

3.4. Credit constraints

A classic explanation for differences in education and human capital accumulation involves credit constraints. In our cross-country setting, rural–urban differences in credit availabilities and the distribution of assets used to credibly borrow could explain RUEI across countries. Variables like land Gini and M2/GDP can proxy such effects (see Deininger and Olinto, 2000; Benhabib and Spiegel, 2000, respectively). While the land Gini is typically used to proxy cross-country differences in asset distribution, we use it as a proxy for income distribution in rural areas. We expect greater rural income inequality and limited credit availabilities to increase RUEI. We also use a German legal system dummy, as financial systems of German origin are known to be strict but efficient in allocating credit (see Aoki et al., 1995 Chapter 4).[13]

[12]See Kochar (2000, 2004) on the interaction between R&U labor markets and their implications for education in India.

[13]Countries in our sample with a German legal system are Japan and South Korea.

3.5. Infrastructure

Infrastructure and its availability is a general development issue and educational infrastructure is expected to help explain RUEI. Behrman and Birdsall (1983) argue that returns to schooling in rural areas may be lower due to lower quality of schools. We have data on primary school pupil–teacher ratios and the share of education expenditures in GDP, while we also use the ratio of rural–urban birth rates to proxy for R&U differences in congestion in schools.[14] More general infrastructure measures we use are phone line availability, fertilizer consumption, tractor availability, and a colonization dummy which controls for infrastructural and institutional inheritances from colonial powers as in Acemoglu et al. (2001) and La Porta et al. (1999).[15]

3.6. Other factors

We also consider cultural controls such as religion variables and the ratio of female-to-male pupils in primary and secondary schools (girl–boy ratio). We use Catholic, Protestant and Confucian[16] religion variables to control for differences in national attitudes to education based on religious practices. The girl–boy ratio can control for differences in cultural attitudes to the education of girls and boys, possibly reflecting differences in attitudes towards education between R&U areas; see Sahn and Stifel (2003), who find that girl–boy ratio is lower in rural areas.

4. Rural and urban schooling: An econometric framework

As discussed above, we use a range of data at the rural, urban and national levels to find the determinants of the levels of R&U schooling and the ratio of average rural years of schooling to average urban years of schooling within a country (henceforth, RATIO). Detailed data definitions and sources are provided in Appendix A, with summary statistics presented in Table 3. Data on explanatory variables are averaged at five-year intervals (i.e., 1970–1974, 1975–1979, etc.). For instance, R&U educational attainment data for Chile are recorded for 1970, and for that observation we use the independent variables from the 1970–1974 period.[17]

4.1. Econometric specification and methodology

As per the Haveman–Wolfe structure, the econometric specification should include the objectives, opportunities and constraints-related variables. These variables are linked to

[14]We would prefer to use the ratio of rural to urban pupil/teacher ratio but such data are unavailable.

[15]We do not use data on time held as a colony. However, Grier (1999) finds that colonies held for longer periods tend to perform better on average.

[16]Countries in the Confucian category in our sample are Japan, South Korea and China. The name Confucian refers to general East Asian teachings and approach to education.

[17]We assume that three data points of the 1950s (Finland, France and Norway) on schooling belong to 1960–1964. Two observations of Afghanistan (1975 and 1979) are averaged to use explanatory variables from the 1975–1979 period.

Table 3
Summary statistics for explanatory variables

Variable	Mean	Median	Max	Min	St. dev.	Obs.	Category
Agr. ValueAdded/worker ($)	5449.00	1917.00	32,470.00	137.00	7432.00	59	(1)
NonAgr. VA/worker ($)	13,641.00	6600.00	64,257.00	628.00	15,182.00	58	(1)
Relative income	0.38	0.29	2.80	0.03	0.38	58	(1)
Real income/capita ($)	5273.00	1616.00	30,493.00	95.00	7175.00	70	—
Education expend. (% of GDP)	3.62	3.39	7.54	1.14	1.65	66	(1)
M2/GDP (%)	34.75	30.35	89.05	8.13	18.56	60	(1)
Industry VA/total VA (%)	31.12	30.89	52.30	10.43	9.60	63	(1)
Services VA/total VA (%)	49.07	49.34	73.45	26.50	10.17	63	(1)
Agr. VA/total VA (%)	19.80	18.62	61.07	2.26	14.17	63	(1)
Land Gini index	64.03	62.72	93.31	33.85	15.90	54	(1)
Hectares of arable land/person	0.37	0.27	1.87	0.02	0.39	74	(1)
Migration (%)	12.55	12.34	36.98	0.00	8.37	72	(1)
Agr. deflator/nonagr. def.	1.18	1.07	2.94	0.59	0.40	59	(1)
Life expectancy (years)	63.27	65.67	77.65	39.60	10.11	75	(2)
Nat. pop. density (people)	97.57	52.64	785.28	2.58	125.16	74	(2)
Rural pop. density (people)	332.46	176.56	1558.77	13.00	345.72	74	(2)
Rural births (per 1000 people)	28.75	30.80	64.00	2.50	11.95	59	(2)
Rural deaths (per 1000 people)	10.86	9.70	50.40	1.20	6.89	56	(2)
Rural pop./tot. pop. (%)	51.72	49.48	92.99	8.91	20.80	75	(2)
Urban births (per 1000 people)	25.06	21.30	59.30	7.80	12.99	59	(2)
Urban deaths (per 1000 people)	9.35	8.50	42.80	3.00	5.53	55	(2)
Urban pop./tot. pop. (%)	48.28	50.52	91.09	7.01	20.80	75	(2)
Relative birth rate	1.28	1.20	3.04	0.21	0.55	59	(2)
Relative death rate	1.23	1.24	2.43	0.27	0.46	44	(2)
Relative population	1.79	0.98	13.24	0.10	2.15	75	(2)
Ethnic frac. index	0.40	0.42	0.91	0.00	0.27	73	(2)
Doctors (per 1000 people)	0.95	0.50	4.78	0.02	1.05	64	(3)
Fertilizer cons. (kg/hectare)	113.18	76.94	695.53	1.97	123.44	72	(3)
Pupil/teacher in pri. educ.	30.60	30.98	56.87	12.53	10.05	61	(3)
Phone lines (per 1000 people)	108.30	32.03	578.70	0.60	152.36	68	(3)
Tractors (per 100 ha)	2.25	0.86	31.51	0.01	4.51	72	(3)
British legal sys. dummy	0.28	0.00	1.00	0.00	0.45	75	(4)
French legal sys. dummy	0.51	1.00	1.00	0.00	0.50	75	(4)
German legal sys. dummy	0.04	0.00	1.00	0.00	0.20	75	(4)
Scandin. legal sys. dummy	0.05	0.00	1.00	0.00	0.23	75	(4)
Socialist legal sys. dummy	0.12	0.00	1.00	0.00	0.33	75	(4)
Political rights index	3.79	4.27	7.00	1.00	2.00	68	(4)
Civil liberties index	3.78	4.00	6.80	1.00	1.68	68	(4)
Colony dummy	0.67	1.00	1.00	0.00	0.47	75	(4)
No. of revolutions (5-year avg.)	0.17	0.00	1.25	0.00	0.27	66	(4)
Post-war indep. dummy	0.39	0.00	1.00	0.00	0.49	75	(4)
No. of assassin. (5-year avg.)	0.28	0.00	3.25	0.00	0.65	66	(4)
Island dummy	0.17	0.00	1.00	0.00	0.38	75	(5)
Landlocked dummy	0.11	0.00	1.00	0.00	0.31	75	(5)
Tropical dummy	0.40	0.00	1.00	0.00	0.49	75	(5)
Latitude (absolute value)	28.36	30.00	60.21	0.51	16.28	75	(5)
Catholic (% of total population)	39.12	26.20	96.90	0.00	40.42	75	(6)
Confucian (% of total pop.)	4.57	0.00	98.50	0.00	20.03	75	(6)
Protestant (% of total pop.)	12.35	1.90	97.80	0.00	23.81	75	(6)
Girl–boy ratio (%)	82.20	91.22	103.29	16.80	20.18	57	(6)

Variable categories: (1) economic, (2) demographic, (3) infrastructural, (4) political, (5) geographic, (6) cultural variable.

the labor market, human capital and migration theories discussed above. Thus, our regression takes the following form:

$$\begin{aligned}\text{REG\_SCHOOLING}_{it} = \alpha_0 + \alpha_1\text{ECONOMIC}_{it} + \alpha_2\text{DEMOGRAPHIC}_{it} + \alpha_3\text{INFRASTRUCTURAL}_{it} \\ + \alpha_4\text{POLITICAL}_{it} + \alpha_5\text{GEOGRAPHIC}_{it} + \alpha_6\text{CULTURAL}_{it} + \varepsilon_{it}\end{aligned} \quad (3)$$

where the variables on the right-hand side derive from the relevant categories, and REG_SCHOOLING is one of the three dependent variables: RATIO, rural or urban schooling levels.

One way to estimate Eq. (3) is to form a general unrestricted model with several explanatory variables from each category on the right-hand side, and testing it down to arrive at a final model in which all variables are significant (i.e., general-to-specific modelling). However, in this case, (i) multicollinearity may arise in the general models as most explanatory variables are development-related and likely to be correlated with each other. Thus, in some cases relevant variables may initially appear as insignificant and be incorrectly omitted; (ii) there is no unique reduction path for these models; (iii) there might be several economic mechanisms driving rural–urban educational attainments (Hendry 1995, p. 501).

To address these issues simultaneously, Eq. (3) is estimated with each category having only one representative variable, and by constructing five different models for each dependent variable. Each of these models is intended to capture a mechanism suggested by the theoretical arguments in Sections 3.1–3.5. We refer to these models as: *Ratio1*, *Ratio2*, …, *Ratio5*. In terms of a starting point, we conjecture that some variables are more important than others and can drive a mechanism. We therefore start the search by including what we call a "seeded" variable in each model. We then add one control variable from each category (economic, demographic, infrastructural, political, geographic and cultural—note that a second variable from the category of the seeded variable is not used) in order to identify which variables need to be held constant, in the context of Eq. (3), to find a more precise relationship between the seeded variables and the dependent variable (i.e., specific-to-general modelling). This process whereby the final set of control variables for each model is determined is an iterative one. We search the variables in our pool (see Table 3) in such a way that the final model specification includes the most significant combinations of seeded and control variables. That is, no other variables or no other combination of them have been found to be more significant than those presented.[18] When adding each variable, we conduct Lagrange multiplier (LM) tests in order to ensure that the procedure is statistically justifiable.[19]

Nevertheless, restricting ourselves to one variable in each category may result in the omitted variables problem. After identifying such models with Ramsey's RESET test, we

[18] As will be seen in our results, there is a very limited overlap of variables across different RATIO models. This is almost a natural outcome of our search process, because we start the search with different seeded variables whose domains are different. In a small number of cases where a choice needed to be made between two alternative control variables in the same category with similar significance levels, we chose the most economically intuitive one, given the seeded variable and other controls included in the model.

[19] For the LM test, the chi-squared statistic is obtained from a Gauss–Newtonian regression of the residuals of restricted models on the variables of the unrestricted models. We also use an *F*-test to see whether the added variables are jointly significant in the respective unrestricted models, because the power of the LM-based test decreases in small samples (see Davidson and McKinnon, 2004, p. 249).

augment them with more variables, allowing them to be from any category, as long as they are estimated significantly and the previous variables remain significant.

Throughout the estimation we use OLS. To identify possible endogeneity of the right-hand side variables, we carry out a series of Durbin–Wu–Hausman (DWH) tests (see Davidson and McKinnon, 2004, p. 338 for details).[20] We also appraise the power of each individual model/mechanism by looking at their adjusted *R*-squareds, and Akaike and Schwarz criteria.

Note that both the general-to-specific and specific-to-general methodologies tell broadly the same story about the determinants of the ratio and the levels of R&U schooling. Most of the same variables turn out to be significant in explaining the relevant dependent variable, regardless of the methodology. This is encouraging for the robustness of our findings.

4.2. Time effects and other issues

Owing to the structure of the data set at hand, there is no provision to test for panel effects.[21] However, it is important to control for possible parametric shifts across time because the data for every country are available for different years. Most of our data span the 1970s, 1980s and 1990s. Therefore, time dummies for 1980s and 1990s are consistently used, with 1970s (including a small number of observations belonging to the 1960s) being the base period.[22] Most of these dummies are estimated to be insignificant, implying that the modelled variations can account for any cross-country temporal differences in schooling years. We also employed quadratic and interaction terms of seeded and control variables at each stage of modelling. This did not yield any extra information.

4.3. Some issues on explanatory variables in modelling

We have two types of explanatory variables. The first type are region-specific variables, where R&U decompositions are available, such as agricultural and non-agricultural value added per worker and R&U birth rates. In the RATIO models, we employ the ratios of such variables, while their levels are employed in the corresponding models of the levels of R&U schooling. The second type are national variables. We make a further distinction within this class of variables: (i) 'truly' national variables (e.g., landlocked, political rights), which are not likely to differ across R&U areas, and (ii) those that could be decomposed into R&U values (e.g., pupil–teacher ratio), but whose decompositions are not available. National variables are employed in the models of both the ratio and the levels of R&U schooling.

[20]We use two sets of instruments in the DWH tests: the lagged values of the suspected endogenous variables (where available), and more theory-oriented exogenous variables. For, the rationale behind theory-oriented variables, see Ulubasoglu and Cardak (2006).

[21]Pooling developing and developed countries for empirical analysis rests on a parameter stability assumption, which is pointed out by Grier and Tullock (1988). In our context pooling developing and developed countries provides a source of variation that is needed to explain the cross-country differences in R&U schooling. Nevertheless, we address the parameter stability issue in Section 5.2 by interacting some important variables with log per capita income.

[22]We treat the observation for Kenya in 1969 as belonging to 1970s.

While truly national variables do not differ across regions, *their influence on R&U areas may be quite different*. In particular, their impact on R&U schooling may vary with development level, a hypothesis that we test in Section 5.2. Potentially decomposible national variables may have different effects across R&U areas but a R&U decomposition is simply unavailable for them.[23] Thus, some of these variables are used as proxies for national resources in the RATIO models, (e.g., credit availability), while others are used as proxies for their R&U counterparts in the levels models (e.g., pupil–teacher ratio).

5. Estimation results

As a preliminary analysis, we test the hypothesis that *the correlation between the ratio of R&U educational attainment and long-run development (as measured by per capita income) is positive, be it linear or non-linear*. The same hypothesis can also be tested for the levels of R&U schooling. We also test *how both the ratio and the levels of R&U years of schooling are related to national years of schooling, and whether these relationships are linear or non-linear*. This shows how uniformly education is "distributed" across R&U regions given the overall level of education within a country. The estimation results are presented in Table 4. They show that per capita income can explain around 50–55% of the variation in RATIO and rural schooling, and 35% of the variation in urban schooling. We also find that RATIO and per capita income are positively and non-linearly related. Educational inequality falls with development, though at a decreasing rate. The level of income where the estimated relationship becomes negative (i.e. the turning point) is $51,000, which is well out of our sample. Also, both R&U schooling are positively related to development, while the relationship is non-linear in the case of rural schooling and linear in the case of urban schooling.[24,25]

Table 4 also shows that the relationship between RATIO and national educational attainment is positive and non-linear. Higher national educational attainment is associated with lower RUEI. The correlation between urban schooling and national educational attainment is positive and non-linear, while the relationship between national and rural educational attainment is positive and linear. There is a very high correlation between national years of schooling and RATIO and the levels of R&U schooling, as shown by R-squareds around 80%.[26]

5.1. Results for rural–urban educational inequality (RATIO)

The GTS results for RATIO are presented in Table 5.[27] Recalling that RATIO is the ratio of average rural years of schooling to average urban years of schooling, the results

[23]Unfortunately a wide variety of national data disaggregated at the rural and urban levels (such as unemployment) are not readily available for a large number of countries.

[24]We are careful here to describe the relationship as "correlation", as there is possibly an endogeneity between the levels of schooling and income. This does not preclude, however, numerical evaluations related to joint plot of the variables.

[25]The estimated relationship between per capita income and rural schooling becomes negative at an income of $64,500, again out of our sample.

[26]The national years of schooling at which the relationships with RATIO and urban schooling become negative are 25 and 29 years, respectively, which are clearly out of sample.

[27]Sample sizes vary throughout the regressions because data on explanatory variables used in different regressions are not available for all countries.

Table 4
The relationship between RATIO, rural and urban schooling, and per capita income and national schooling

	Dep. var.: RATIO				Dep. var.: rural schooling years				Dep. var.: urban schooling years			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	0.423***	0.374***	0.198***	0.104***	2.509***	2.174***	−0.487***	−0.401	5.344***	5.104***	2.564***	1.558***
	(0.029)	(0.031)	(0.023)	(0.036)	(0.317)	(0.345)	(0.144)	(0.307)	(0.351)	(0.042)	(0.227)	(0.357)
Per capita income	0.025***	0.051***			0.340***	0.516***			0.242***	0.369***		
	(0.003)	(0.006)			(0.034)	(0.105)			(0.030)	(0.105)		
Per capita income sq'd.		−0.001***				−0.008**				−0.006		
		(0.000)				(0.004)				(0.004)		
National Sch. (Barro–Lee)			0.073***	0.123***			0.984***	0.939***			0.841***	1.374***
			(0.004)	(0.017)			(0.141)	(0.181)			(0.040)	(0.177)
National Sch. squared				−0.005***				0.004				−0.048***
				(0.001)				(0.015)				(0.015)
Adj. R^2	0.50	0.57	0.80	0.82	0.55	0.56	0.87	0.87	0.35	0.36	0.83	0.85
Obs.	70	70	68	68	70	70	68	68	70	70	68	68

Notes: Standard errors in parentheses. *** Denotes 1% significance, ** denotes 5% significance, * denotes 10% significance. Per capita income is scaled by 1000.

Table 5
General-to-specific modelling

RATIO			Rural schooling			Urban schooling		
	General	Specific		General	Specific		General	Specific
Constant	0.365	−0.051	Constant	−5.906	−2.566**	Constant	−7.301	−0.209
	(0.314)	(−0.168)		(−0.702)	(−2.269)		(−0.697)	(−0.082)
AgVA_W/	0.524	0.768**	Agr.VA/	0.061		NonagVA/	−0.030	
NoAV_W	(0.564)	(2.082)	worker§	(0.109)		Worker§	(−0.055)	
Migration	0.001		Arabland/	0.807	2.412***	Migration	−0.069	
	(0.184)		capita	(0.350)	(7.160)		(−1.173)	
M2/GDP	0.000		Land Gini	−0.029		M2/GDP	0.035*	
	(0.064)			(−0.554)			(1.889)	
AgrDef/	0.001		Educ./GDP	0.361				
NoAgDef	(0.004)			(1.179)				
			Life expec.	0.060		Life expec.	0.019	0.113***
				(0.903)			(0.268)	(2.745)
RurBirth/	0.033		Rural birth	−0.036	−0.046***	Urban birth	−0.139*	−0.121***
UrbBirth	(0.264)			(−0.911)	(−2.874)		(−2.025)	(−3.094)
RurDeath/	−0.002							
UrbDeath	(−0.023)							
Nat. pop.	−0.002		Rur pop	−0.193		Ethnic frac.	1.669	
density§	(−0.038)		density§	(−0.255)			(0.696)	
Phone avail.	0.001	0.001***	Tractor avail.	0.052		Phone avail.	−0.001	
	(1.380)	(4.065)		(0.735)			(−0.144)	
			Fertilizer	0.442	0.474***	Pupil/teacher	0.103	
			cons.§	(0.962)	(3.295)		(0.808)	
			Pupil/teacher	0.026		Doctor avail.	0.861	
				(0.344)			(1.235)	
Colony	−0.221*	−0.120**	Colony	−2.386*	−1.236***			
	(−1.797)	(−2.227)		(−1.779)	(−2.650)			
French legis.	−0.189	−0.167***	French legis.	−2.272*	−1.768***	French legis.	−0.816	
	(−1.324)	(−3.279)		(−2.120)	(−4.637)		(−0.775)	
Civil liberties	−0.032					Civil liberties	0.081	
	(−0.990)						(0.352)	
Land-locked	0.093		Land-locked	1.745*	1.881***	Land-locked	1.050	1.126*
	(0.617)			(1.824)	(3.921)		(1.146)	(1.981)
Latitude§§	−0.001		Latit.§§	−0.005		Latitude§§	0.064	
	(0.138)			(−0.120)			(1.403)	
Surface area§	0.005		Surface area§	0.282		Surface area§	0.042	
	(0.138)			(1.351)			(0.219)	
Catholic	0.001	0.002***	Catholic	0.022		Catholic	0.004	
	(0.433)	(2.700)		(1.055)			(0.276)	
Prot.	0.001		Prot.	0.011	0.046***	Prot.	−0.003	
	(0.399)			(0.387)	(5.133)		(−0.184)	
			Girl–boy	0.032	0.061***	Girl–boy	0.116*	0.031*
			ratio	(1.148)	(5.447)	ratio	(1.892)	(1.854)
Time dummy	Yes	Yes	Time dummy	Yes	Yes	Time dummy	Yes	Yes
# Obs.	36	56	# Obs.	32	46	# Obs.	30	47
F-GTS		0.83	*F*-GTS		1.44	*F*-GTS		1.44
Adj. R^2	0.62	0.62	Adj. R^2	0.89	0.88	Adj. R^2	0.87	0.80

Notes: *t*-statistics in parentheses. *** Denotes 1% significance, ** denotes 5% significance, * denotes 10% significance. §Means in logs. §§ Means in absolute value. *F*-GTS is the statistic of the *F*-test on whether the removed variables are jointly equal to zero.

show that countries with higher relative productivity, greater availability of telephone mainlines, and a higher share of Catholic population, and those without colonial pasts and a legal system of French origin have higher RATIO, implying that they have lower RUEI. These variables point to the importance of access to formal labor markets, physical infrastructure, and the political and cultural structure within countries for the efficient allocation of resources across R&U areas.

The STG results are presented in Table 6. Test results at the bottom of the table suggest that all of the regressions have strong explanatory power and are robust to the modelling routines described in Section 4.1. The seeded variables are the ratio of M2/GDP (credit constraints), the ratio of agricultural to non-agricultural value added per worker (labor markets), migration (labor mobility), the ratio of rural to urban death rate (riskiness of investment), and telephone line availability (infrastructure).

The column in Table 6 headed *Ratio1* focuses on the credit constraints mechanism. We find that higher M2/GDP leads to higher RATIO, i.e., lower RUEI. This is consistent with our expectations: improved credit markets will enable investment in human capital in rural as well as urban areas. The coefficient estimate 0.004 implies that, ceteris paribus, Japan, which has the highest value of M2/GDP in our sample, has 0.21 higher RATIO values than Panama for 1980–1984, the latter having the mean value. Higher national population density is found to be associated with lower RATIO, implying that, given other factors in the model, more crowded countries have higher RUEI on average. This is possibly due to a failure to allocate resources evenly between populations in R&U areas. We also find that countries having colonial pasts, which form 67% of our sample, have on average 0.14 lower RATIO values than those with no colonial past, implying a higher RUEI. It is possible that "having a colonial past" is too broad a class of nations, as some of today's wealthy nations such as the US, Australia and New Zealand were once colonies, along with some of the world's poorest nations. This issue is handled with the interaction effect of development and national variables in Section 5.2. We also find that landlocked countries, 11% of our sample, on average have 0.19 lower RATIO points than non-landlocked countries, ceteris paribus. This suggests that rough geographical conditions (most landlocked countries in our sample are mountainous, such as Afghanistan, Nepal and Bolivia) and a reliance on infrastructure investment for transportation are associated with higher RUEI. Lastly, this model finds that nations with high proportions of Catholic, Protestant and Confucian populations are found to exhibit less RUEI. Countries exclusively with these religions, either jointly or separately, have, ceteris paribus, 0.20 higher RATIO points than an average country that has none of these.[28] This may be associated with the involvement of these religions in the provision of education.

The column labelled *Ratio2* in Table 6 focuses on the labor market mechanism. The results show that higher relative income is associated with higher RATIO. This is in line with our expectations: the higher is relative income, the greater the role of formal agricultural labor markets and the greater the incentive for rural educational attainment. The estimated coefficient 1.28 predicts the whole 0.67 point difference between Nepal and Canada, countries with the lowest and highest relative income in our sample for the 1980–1984 period, respectively. Relative birth rate is also estimated to be negatively related

[28] Grouping religions together aims to maximize the information from these variables, because the involvement of these religions in education is likely to be positive and similar, i.e., mutually inclusive.

Table 6
Cross-country determinants of RATIO, specific-to-general modelling

	Ratio1 (credit cons.)		*Ratio2* (labor market)		*Ratio3* (migration)		*Ratio4* (inv. riskiness)		*Ratio5* (infrast. avail.)	
Constant		0.514***		−0.746**		0.588***		−0.095		1.228***
		(3.706)		(−2.572)		(4.820)		(−0.292)		(5.332)
Economic variable	*M2/GDP*	0.004***	*AgVA_Work/*	1.278***	*Migrat.*	0.007**	Educ.Exp./GDP	0.035*		
		(2.681)	*NoAgVA_W*	(3.847)		(2.214)		(1.701)		
Demograph. variable	NatPop	−0.043**	RurBirth/	0.124***			*Rurdeath/*	−0.129*	RurPop/UrbPop	−0.037***
	density§	(−2.158)	UrbBirth	(2.991)			*UrbDeath*	(−1.802)		(−3.603)
Infrastruc. variable					Pupil/	−0.006**	Doctor Avail.	0.089*	*Phone Avail.*	0.001***
					Teach.	(−2.564)		(1.815)		(3.559)
Political variable	Colony	−0.136**	French Legisl.	−0.131**	Pol. Rights	−0.021	British Leg.	0.321***	No. of Revol.	−0.121**
		(−2.080)		(−2.371)		(−1.552)		(4.861)		(−2.208)
Geograph. variable	Land-	−0.188***	Island	0.289***	Latit.§§	0.003*			Surface Area§	−0.032**
	locked	(−3.144)		(5.422)		(1.965)				(−2.246)
Cultural variable	C+C+P	0.002***	C+C+P	0.001**	Conf.	0.002***			Conf.	0.002***
		(2.984)		(2.032)		(4.005)				(4.367)
Added var.			Sub-sah. Africa	−0.077			AgVA_W/	0.619*	Pupil/Teacher	−0.009***
				(−0.675)			NAVA_W	(1.659)		(−2.979)
Added var.							Confucian	0.001*	British Legis.	0.114**
								(1.752)		(2.367)
Added Var.							Postwar	−0.204**		
							Independ.	(−2.617)		
Adj. R^2		0.37		0.70		0.50		0.68		0.61
Akaike/Sch.		−0.22/−0.06		−0.87/−0.54		−0.61/−0.32		−0.61/−0.17		−0.68/−0.40
LM–χ^2		17.99***		24.97***		25.75***		11.56***		9.76***
LM–F. stat		7.93***		16.30***		20.61***		9.99***		5.26***
Reset F.stat		2.30		0.26		0.78		1.79		0.57
Obs.		60		45		58		36		48

Notes: Dependent variable is RATIO which is the ratio of rural to urban years of schooling; higher values imply more educational equality. Italic variables are the seeded variables used in the specific-to-general empirical specification search. C+C+P is the sum of the shares of Confucian, Catholic and Protestant populations in total population. Added Var. denotes that the relevant model is augmented over the form in Eq. (3) to treat the omitted variables problem. Time dummies included but not reported to save space; many are insignificant and all are jointly insignificant in the respective models.
t-statistics in parentheses. *** Denotes 1% significance, ** 5% significance, * 10% significance. § Means in logs. §§ Means in absolute value. White heteroskedasticity-consistent standard errors. Adj. R^2 and Akaike/Schwarz criteria include added variables. LM–χ^2 is the chi-squared test statistic of the LM test, and LM–F. Stat. is the F statistic of the same test. Reset F-stat. is F-statistic of the omitted variables test.

to inequality, while we find that French legal system is associated with higher RUEI. Other things being equal, countries with a French legal system have 0.13 lower RATIO points than countries with non-French legal systems. This result is robust to the inclusion of a Sub-saharan Africa dummy in the model.[29] This model also finds that island countries on average have lower RUEI by around 0.30 RATIO points. Finally, we find that the joint positive impact of Catholic, Protestant and Confucian populations on RATIO also holds in this model.

The above finding on French legal systems is new and important, with implications for the long-run performance of economies. Essentially, French legal systems appear to encourage bureaucracy, which creates an urban bias. Thus, a French colonial heritage appears to hurt rural educational opportunitites. Evidence on the mechanisms at work can be found in La Porta et al. (1999), who find more bureaucracy and weaker infrastructure in countries with French legal systems, relative to countries with British legal systems. Together with the general urban biases regarding investment, trade protection and capital markets highlighted by Henderson (2005), this provides an explanation for higher RUEI in countries with a French legal system.

The column labelled *Ratio3* in Table 6 focuses on the migration mechanism. We find that intersectoral migration is positively related to RATIO, which provides some support for the idea that labor mobility through migration raises rural educational attainment. Higher pupil–teacher ratio, on the other hand, is related to lower RATIO, suggesting the fewer resources devoted to education, the more unevenly they are distributed between R&U areas. The estimated coefficient of −0.006 implies that one standard deviation increase from the mean, which roughly takes us from Greece to Algeria for the 1970–1974 period, predicts a 0.06 lower RATIO. The model also finds that higher political rights are associated with higher RATIO, although the coefficient is weakly significant.[30] The point estimate of −0.021 implies 0.13 higher RATIO points for the most democratic countries than the least democratic ones, other things being equal. The model's prediction on the relationship between the distance from equator and RATIO is a positive one. The estimated coefficient of 0.003 implies 0.19 higher RATIO points for Finland than Kenya, the latter being on equator. Given other control variables, it is likely that latitude is also proxying the income level in this model. Finally, Confucian religion is associated with lower RUEI.

The column labelled *Ratio4* in Table 6 focuses on the investment riskiness mechanism. We find that the higher the share of education in GDP, the lower is RUEI. The estimated coefficient of 0.035 can, ceteris paribus, explain 0.22 points of difference between the RATIO values of the US and Haiti, possessing the highest and lowest values in 1970–1974 in our sample. Holding a rich array of variables constant (i.e. on labor markets, institutions and investment riskiness), this variable should be capturing the effect of educational resources availability. The model also finds that a higher relative death rate is associated with higher RUEI. Higher doctor availability is also an important factor. The positive coefficient 0.089 predicts a 0.42 point difference between Estonia and Ethiopia,

[29] Our approach is not to include regional dummies in the final models, because we aim to capture the variations in models through categorical variables. However, it is of policy interest to check the robustness of the French law variable, and accordingly *Ratio2* includes a Sub-saharan Africa dummy.

[30] Note that political rights, civil liberties and land Gini are measured in descending order.

which, respectively, possess the highest and lowest doctor availabilities in our sample for around 1990. These results confirm the riskiness of investment factor: higher doctor availability and lower death rates are correlated with less educational inequality between R&U areas, both capturing different risks faced by parents and children. We also find that countries with British (common law) legal systems on average have 0.32 higher RATIO values, i.e., lower RUEI, than countries with non-British legal systems. This may be due to better protection afforded to investors by common law legal systems. The model also provides further support for a result in the *Ratio2* model: relative income and RATIO are positively related. The estimated coefficient, 0.619, is about the half that in *Ratio2*, however. Our further investigation shows that it is the presence of British legal system variable in the regression that halves the coefficient of relative income.[31] This implies that about half of the impact of relative income on RATIO is related to the British legal system variable, i.e., relative income and British law are strongly and positively correlated, holding other factors constant. We also find further support for the earlier result that a higher proportion of Confucian population implies higher RATIO. Finally, we find another important result: Countries that gained their independence in the post-war period, about 40% our sample, on average have 0.20 lower RATIO values than countries that gained independence before WW II. The majority of the post-war-independent countries in our sample are ex-colonies. This result may be related to the extractive rather than settlement nature of colonies gaining independence in the post-war period; see Acemoglu et al. (2001). In addition, Fieldhouse (1983, p. 49), discusses the limited institutional structures built by colonizers, which did not help national cohesion and economic self-sufficiency in the post-colonial period. Thus a lower RATIO may result from a lack of institutions that allocate educational resources between R&U regions.

The column labelled *Ratio5* focuses on the infrastructure availability mechanism. We find that a higher rural to urban population is associated with higher RUEI. This can be rationalized as countries with relatively higher rural populations are more agriculturally based. However, this may point out a demand effect, bigger rural populations exert pressure to obtain better education. It seems that the agriculture argument dominates. Infrastructural availability, as proxied by telephone mainlines availability per 1,000 people, is positively related to RATIO. We also find that higher political instability (proxied by number of revolutions), higher pupil–teacher ratio, and greater surface area are positively related to RUEI. The latter implies that larger countries have difficulties in allocating resources evenly across R&U regions. Confucian religion is also a significant cultural explanatory variable. Finally, this model finds that a country with a British legal system has, on average, 0.11 points higher RATIO values than an average country with a non-British legal system. The magnitude of the coefficient on the British variable in this model is lower as compared to *Ratio4*. Further analysis shows this is due to different variables held constant in the models. In particular, removing any of the variables from *Ratio4* one at a time (other than the education share of GDP) decreases the coefficient of the British dummy by about 0.10–0.15, while the same exercise does not change the coefficient in *Ratio5*. Thus, the bottomline effect of the British legal system in our models can be said to

[31] Dropping the British law dummy from the regression brings the coefficient of relative income to 1.4, while dropping any of the other variables does not change the coefficient significantly.

be around a 0.10 higher RATIO points than the other systems, while different factors can also augment this impact.[32]

Overall, our results reveal important implications regarding the impact of national resources on RUEI. There are two important points to consider regarding this link: (i) volume (availability) of resources, and (ii) distribution of available resources. Our models contain important variables that capture both the volume and the distribution of resources. The former category can include credit, teacher, doctor and phone availability and funds available for education, while the distribution effect can be captured by institutional, geographic, demographic and religion variables (such as colonization, legal system, surface area, being a landlocked or an island country, population density, relative population, etc.). In terms of the latter, institutions (including religious ones) establish the channels to distribute resources, geographic variables explain the natural constraints on distribution, and demographic variables capture the demand for resources. Although one might argue that both development and distributional variables are correlated, the importance of distribution arises once the resource availability grows. That is, holding resource availability constant, how does distribution affect education? Likewise, holding distributional channels constant, how does resource availability affect education? We find that development does seem to account for lower RUEI within a country, holding distributional channels constant. That is, the more resources available, the closer RATIO is to unity. Similarly we find that the distribution of resources is important, holding their availability constant. Our results also provide support for urban bias arguments: when resources are limited, they seem to be concentrated in urban areas.

We next proceed to an endogeneity check. Although the majority of the explanatory variables are exogenous by construction (e.g., geographical variables), some economic and demographic variables might be affected by reverse causation. In particular, relative income and relative birth rate in *Ratio2*, migration in *Ratio3* and relative income in *Ratio4* may be endogenous. The DWH tests that we carry out show that, using two sets of instruments for each suspected variable (i.e., lagged values where available and theoretical instruments), these variables are exogenous in the models.[33] We do not report the steps of the DWH tests to save space; see Ulubasoglu and Cardak (2006) for details.

The results in Table 6 suggest the best-fitting models in terms of adjusted R-squared and Akaike and Schwarz criteria are labor markets (*Ratio2*) and relative riskiness (*Ratio4*). Migration (*Ratio3*) and infrastructural availability (*Ratio5*) are also important but less so. The credit availability mechanism (*Ratio1*) has relatively low power in explaining RATIO. Care should be taken with these comparisons owing to the different sample sizes used in estimating each model.

[32]The lower coefficient magnitude in *Ratio5* may imply that other variables in this model may be the ones through which the British law dummy has an indirect effect on RATIO, so that when these variables are held constant in the model, the direct effect of this legal system on RATIO is revealed. This may also imply that the British legal system has a positive impact on such variables, i.e., it is associated with lower pupil–teacher ratio, lower political instability and higher telephone availability.

[33]The lagged value of relative birth rate is not available. Theory oriented instruments are; for relative productivity: tractor availability, arable land per capita, M2/GDP, German legislation dummy, share of government tax revenue in GDP and postwar independence dummy (0.31); for relative birth rate: tractor availability, religion variables, tropical dummy and M2/GDP(0.14); and for migration: arable land per capita, log of surface area and ethnic fractionalization (0.22). Adjusted R-squareds of the first-step regressions in parentheses and all models are significant as shown by F-tests.

5.2. The interaction effect of development and national variables on RATIO

We further explore the behavior of the RATIO variable, focusing on the following hypothesis: *The influence that 'truly national' variables exert on R&U educational attainment varies with the level of development.* To illustrate, consider M2/GDP, which proxies national credit availability. The allocation and impact of national credit availability in Germany is expected to operate more evenly on R&U schooling than it would in Bangladesh. That is, financial markets would be relatively equally accessible in both R&U regions of Germany, while financial markets in the rural areas of Bangladesh might be relatively restricted compared to its urban areas.

We focus on national variables that are constant across regions and could not be decomposed into R&U variables for this analysis.[34] Along with M2/GDP, all political and geographic variables are relevant. We introduce an interaction term between the relevant variables and log of real per capita income (RPCY) in our regressions. There is a potential feedback from RUEI to RPCY, thus the endogeneity problem needs to be addressed. In addition to interacting all the 'truly' national variables with RPCY, we also interact them with the residuals of RPCY, that are obtained from a first-step regression.[35] The second step DWH tests-incorporated results are presented in Table 7 and show that a majority of the interaction variables are endogenous. The coefficients of the endogenous variables presented in the table are unbiased estimates, and one can correct the standard errors to obtain the relevant instrumental variables (IV) standard errors (see Davidson and McKinnon, 2004, p. 331).[36]

The variables M2/GDP (*Ratio1*) and education share of GDP (*Ratio4*) support our hypothesis, as seen through the positive signs on the interaction terms. Our conclusion is that credit markets seem to operate more evenly between R&U areas in more developed economies, facilitating lower RUEI. The signs of the coefficients on the interaction terms are all opposite to the sign on the variable of interest on its own, implying that the sign of the effect of the variable of interest will switch at some level of RPCY. To illustrate, in the case of M2/GDP if RPCY is above (below) 8.25, the effect of M2/GDP is positive (negative), while in the case of education share of GDP if RPCY is above (below) 7.83, the effect of increased education share of GDP is also positive (negative). Table 8 presents the RPCY for our sample countries in ascending order. As per this table, we find Brazil's RPCY just above 8.25 and South Korea's RPCY just above 7.83. That is, for countries above Brazil in the list, improved credit availability acts to reduce RUEI, while for countries above South Korea in the list, increased education share of GDP is allocated more evenly across R&U regions than for those countries below South Korea.

[34]The variables that can be decomposed into regional variables would address a separate issue, the relative effectiveness of regional factors on RATIO due to development.

[35]The following variables, suggested by Alesina et al. (2000), are expected to be exogenous to schooling and are used as instruments in the first step DWH regressions: Ethnic fractionalization, surface area, latitude, colonization, post-war independence and regional dummies, and the shares of Hindu, Catholic, Protestant, Muslim and Confucian religions in total population. The adjusted R-squared of this regression is 0.64 and the regression is significant as shown by the F-test.

[36]We also test for the endogeneity of the other variables present in the respective models (i.e., relative income, birth rates, and migration). They are all exogenous in this framework, with residuals excluded from regressions reported in Table 7 to save degrees of freedom. The correction coefficients in the covariance matrices due to the endogeneity of per capita income are: 1.20 for *Ratio1*, 1.13 for *Ratio2*, 1.17 for *Ratio3*, 1.25 for *Ratio4*, and 1.13 for *Ratio5*.

Table 7
The interaction effect of development and national variables on RATIO (DWH tests incorporated)

	Ratio1		*Ratio2*		*Ratio3*		*Ratio4*		*Ratio5*	
Constant		0.327**		−0.532**		0.477***		−0.162		0.431
		(2.606)		(−2.579)		(3.852)		(−0.442)		(1.462)
Econ. var.	*M2/GDP*	−0.033***	*AgVA_Work/NoAgVA_W*	0.936***	*Migrat.*	−0.001	Educ.Exp./GDP	−0.227*		
		(−4.528)		(4.151)		(−0.080)		(−1.707)		
Dem. var.	NatPop density.§	0.038**	RurBirth/UrbBirth	0.150***			*Rurdeath/UrbDeath*	0.053	RurPop/UrbPop	−0.005
		(2.127)		(3.224)				(0.604)		(−0.472)
Inf. var.					Pupil/Teach.	0.000	Doctor Avail.	−0.006	*Phone Avail.*	0.000
						(0.063)		(−0.105)		(0.425)
Pol. var	Colony	0.220	French Legis.	−0.830***	Pol. rights	−0.125**	British Legis.	1.005**	No. of Revol.	0.193
		(0.733)		(−2.607)		(−2.539)		(2.580)		(0.414)
Geo. var.	Land-locked	−1.206***	Island	0.560***	Latit.§§	−0.030***			Area§	−0.101***
		(−2.804)		(4.212)		(−4.545)				(−3.281)
Cult. var.	C+C+P	−0.007*	C+C+P	−0.007**	Conf.	0.439			Conf.	0.138
		(−1.743)		(−2.049)		(0.960)				(0.285)
Added var.							AgVA_W/NoAgVAW	0.723*	Pupil/Teacher	−0.000
								(1.845)		(−0.074)
Added var.							Conf.	0.043	British Legis.	0.926***
								(1.003)		(3.254)
Added var.							Postwar Indep.	0.200		
								(0.496)		
Interact. var.	M2/GDP × RPCY	0.004***	FrenchLeg × RPCY	0.107**	PolRig × RPCY	0.017**	EdExp/GDP × RPCY	0.029**	No.of Rev × RPCY	−0.034
		(4.314)		(2.401)		(2.588)		(2.117)		(−0.501)
Interact. var.	Colony × RPCY	−0.022	Island × RPCY	−0.040**	Latit§§ × RPCY	0.004***	Brit Leg. × RPCY	−0.108**	Area × RPCP	0.014***
		(−0.615)		(−2.642)		(5.119)		(−2.125)		(3.276)
Interact. var.	Landlock × RPCY	0.189***	C+C+P × RPCY	0.001**	Conf. × RPCY	−0.051	Conf × RPCY	−0.004	Conf. × RPCP	−0.016
		(2.728)		(2.576)		(−0.956)		(−0.918)		(−0.284)
Interact. var.	C+C+P × RPCY	0.001					Postwar Ind. × RPCY	−0.072	Brit. Leg. × RPCP	−0.120***
		(1.631)						(−1.143)		(−2.867)
InterVar × res PRCY	M2/GDP × ResRPCY	−0.003***	FrenchLeg × ResRPCY	0.025	PolRig × ResRPCY	0.001	Sav.s on Ed × ResRPCY	−0.002	No. of Rev × ResRPCY	0.144
		(−2.804)		(0.350)		(0.065)		(−0.084)		(1.065)
InterVar × res PRCY	Colony × ResRPCY	0.169**	Island × ResRPCY	0.177**	Latit§§ × ResRPCY	−0.004**	Brit. Leg. × ResRPCY	−0.021	Area × ResRPCY	−0.013**
		(2.589)		(2.316)		(−2.185)		(−0.210)		(−2.628)
InterVar × res PRCY	Landlock × ResRPCY	−0.134	C+C+P × ResRPCY	−0.002***	Conf. × ResRPCY	0.055	Postwar Ind. × ResRPCY	0.273*	Conf. × ResRPCY	0.018
		(−1.235)		(−2.900)		(0.959)		(1.833)		(0.293)
InterVar × res PRCY	C+C+P × ResRPCY	−0.001**							Brit. Leg. × ResRPCY	0.205***
		(−2.074)								(3.161)
Adj. R^2		0.66		0.80		0.70		0.75		0.68
Obs.		59		45		53		36		44

Notes: Dependent variable is RATIO which is the ratio of rural to urban schooling levels; higher values imply more educational equality. RPCY is the log of real per capita income. Res RPCY is the residuals from the first step DWH regression of RPCY as described in the text. Output suppressed: time dummies are in the regressions but not reported to save space. Added var. denotes that the relevant model is augmented over the form in Eq. (3) to treat the omitted variables problem. *t*-statistics in parentheses. *** Denotes 1% significance, ** 5% significance, * 10% significance. § Means in logs. §§ Means in absolute value. White heteroskedasticity-consistent standard errors. Adj. R^2 includes added variables.

Table 8
Log of real per capita income (RPCY) of the sample countries

Ethiopia	90–94	4.55	Bolivia	90–94	6.76	Chile	70–74	7.78	France	60–64	9.36
Nepal	80–84	5.05	Morocco	70–74	6.78	Korea	70–74	7.85	Greece	95–99	9.38
India	70–74	5.34	Egypt	85–89	6.81	C. Rica	70–74	7.86	Norway	60–64	9.41
Kenya	65–69	5.42	Philippines	70–74	6.83	Turkey	90–94	7.88	N. Zeal.	80–84	9.59
Sudan	80–84	5.46	Liberia	70–74	6.84	Panama	80–84	7.95	Canada	75–79	9.66
Bangladesh	85–89	5.58	Dom. Rep.	70–74	6.93	Hungary	70–74	8.04	Canada	80–84	9.72
Mali	75–79	5.72	Bolivia	75–79	6.96	Venezuela	90–94	8.18	Norway	70–74	9.74
China	85–89	5.72	Ecuador	70–74	6.97	Brazil	80–84	8.28	US	70–74	9.80
India	90–94	5.82	Philippines	95–99	7.02	Croatia	90–94	8.33	Canada	85–89	9.84
Pakistan	80–84	5.85	Paraguay	70–74	7.05	S. Africa	70–74	8.36	Canada	90–94	9.85
Sri Lanka	70–74	5.87	Guatemala	70–74	7.16	Malaysia	95–99	8.42	Japan	70–74	10.02
Pakistan	90–94	6.15	Algeria	70–74	7.18	Estonia	85–89	8.44	Japan	80–84	10.29
Sri Lanka	80–84	6.19	Romania	90–94	7.20	Uruguay	95–99	8.72	Norway	90–94	10.33
Haiti	70–74	6.21	Bulgaria	95–99	7.27	P. Rico	70–74	8.77	Afghan.	75–79	—
Haiti	85–89	6.23	Tunisia	75–79	7.30	P. Rico	80–84	8.93	Lebanon	70–74	—
Indonesia	80–84	6.30	Malaysia	70–74	7.34	Greece	70–74	9.05	Poland	70–74	—
Zambia	80–84	6.33	El Salv.	70–74	7.43	Spain	70–74	9.15	Poland	75–79	—
Honduras	70–74	6.43	Colombia	75–79	7.45	Finland	60–64	9.27	Poland	85–89	—
Cameroon	75–79	6.50	Tunisia	85–89	7.46	Spain	80–84	9.30			

In addition, the French legal system variable (*Ratio2*) has a positive and the British legal system variable (*Ratio4*, *Ratio5*) has a negative impact on RATIO in development level. This result implies that at low levels of development, economies with British (common law) legal systems are more effective at evenly distributing resources, while at high levels of development, countries with French legal systems seem to do better. The level of RPCY where the effect of the French legal system dummy switches sign in *Ratio2* is 7.76, implying that countries from Chile onwards experience a positive relationship between the French legal system and RATIO while those below Chile experience a negative effect. The RPCY level where the effect of the British legal system switches sign in *Ratio4* is 9.31 and in *Ratio5* is 7.72. *Ratio4* suggests that only New Zealand, the US and Canada are affected by the non-linearity. *Ratio5* implies that, in addition to these three countries, South Africa and Malaysia also experience a negative impact of British legal system on RATIO.

Assuming higher levels of development are associated with higher levels of industrialization, a British legal system, through the greater investor protection it provides (La Porta et al., 1998), might have encouraged education in urban areas where industries are based, relative to education in rural areas. Conversely, the weaker investor protection afforded by legal systems of French origin does not encourage education in urban areas in the same way, leading to lower RUEI in more industrialized French legal system economies.

Part of the explanation may also lie in different colonial educational practices. As pointed out by Grier (1999), French colonies were centrally governed from Paris, with local education prohibited in favor of French instruction by imported French teachers. The less developed an economy, the less relevant such education would be, particularly in rural areas, consistent with our result. Conversely, as development increases, the importance of labor markets increases and returns to this French education rise, leading to lower educational inequality. British educational practices were more decentralized with instruction in vernacular languages and by native teachers. This would have been less likely to alienate rural households from education and may have led to lower RUEI at lower development levels. However, this effect may not change with development.

We also find geographical characteristics such as landlocked (*Ratio1*), latitude (*Ratio3*) and surface area (*Ratio5*) have positive impacts on the RATIO as development increases. Less developed economies with these characteristics are at a disadvantage, possibly due to a lack of infrastructure to distribute resources between R&U regions. We also find the joint impact of Catholic, Protestant and Confucian populations on RATIO increases in development (*Ratio1* and *Ratio2*). In other words, these religions contribute to an increase in RUEI at low levels of development, but lead to the reverse at high levels of development. On the other hand, we find that being an island country (*Ratio2*) and greater political rights (*Ratio3*) have negative effects on RATIO in development. On islands, urbanization and resource usage might be centered on the coasts, marginalizing rural areas as development increases. In countries with improved political rights, people in urban areas may be better politically organized, demanding biased resource allocation at the expense of rural areas. The impact of political rights switches sign at the RPCY level 7.35.

Lastly, we find that the impact of a colonial past on RATIO does not vary with the level of development. Recalling the negative and significant sign of the colonization dummy in Section 5.1, we conclude that the colonization effect identified may be related to common practices adopted by all colonizing powers and the influences such practices had on colonial and current institutions.[37] An explanation might be that parent countries encouraged urban-biased infrastructure investment in the colonies. Investment in railways, harbors, roads and communication infrastructure were likely to have been tilted against rural areas where people were already pre-occupied with agricultural production and high taxes. Such urban bias may even have been observed in today's wealthy countries (such as Canada, New Zealand and the US) when they had close links with Britain until WW II, as Britain was the main supplier of capital and labor to these countries at the time.[38] We also find that in countries with colonial pasts, the feedback from RATIO to long-term income (RPCY) has been more significant and dominant than the reverse (the interaction of colony dummy and the residual RPCY is significant).[39] Note that the interaction term of post-war independence is also insignificant. This is possibly because countries with post-war independence are still poor today.

[37]Acemoglu et al. (2001) argue that colonial institutions persist after independence.

[38]Cain and Hopkins (1993) cite Habakkuk (1940): "…(colonies) found they had neither the means nor the administrative capacity to redeem and carry on with ease the public works which they desired. England had to supply not merely the original capital but the permanent direction. The companies formed to build railways, found banks and cultivate tea had their headquarters in London and worked their properties from England". Cain and Hopkins go on to note that in both Australasia and Canada, economic power rested in urban rather than rural bases after 1850 (p. 242).

[39]In an attempt to explore this effect further, we regress RPCY on RATIO, RATIO interacted with the colony dummy, and the other variables of *Ratio1* (including time dummies). We find that while RATIO has a positive and significant coefficient, RATIO interacted with colony has a negative and significant coefficient. The magnitude of the latter is about the half of the former, indicating that the impact of regional educational equality on development is smaller in the countries with colonial pasts.

5.3. Results for levels of rural schooling

The GTS results for rural schooling are presented in Table 5. The significant variables are found to be arable land per capita (+), rural birth rate (−), fertilizer consumption (+), colonization (−), landlock (+) and French legislation (−) dummies, share of Protestants in the population (+) and the girl–boy ratio (+). In parentheses are the signs of the estimated coefficients, which are all consistent with economic intuition.

Our conclusions are not changed by the STG analysis, which also finds signs consistent with intuition.[40] Examples of some positive effects are, arable land per capita, tractors availability, British legal system, agricultural value added per worker, fertilizer consumption, education share of GDP and the joint effect of Confucian, Catholic and Protestant populations. Negative effects include, pupil–teacher ratio, French legal system, land Gini, rural population density, rural birth and death rates, colonization and number of assassinations.

Adjusted R-squareds and Akaike and Schwarz criteria suggest that the best-fitting models are of labor market mechanisms. The infrastructural availability and credit constraint models also exhibit some explanatory power, while the investment riskiness model is statistically weak.[41] As per the endogeneity problem, we subject agricultural value added per worker, rural birth rate, life expectancy and the share of female teachers in primary schooling to DWH tests. Only life expectancy seems to be endogenous to rural schooling.[42]

5.4. Results for levels of urban schooling

The GTS analysis for urban schooling leads to fewer significant variables (see Table 5). They include, life expectancy (+), urban birth rate (−), landlock dummy (+) and girl–boy ratio (+). While these signs are consistent with intuition, we expected more variables to explain urban educational attainment.

The STG modelling provides a similar but richer set of results. Variables with positive effects include; M2/GDP, phone availability, girl–boy ratio, non-agricultural value added per worker, doctor availability, migration, education share of GDP, German and British legal systems, tropical dummy and the industry and services share in GDP. Variables with negative effects include urban birth and death rates, French legal system, latitude, ethnic fractionalization and pupil–teacher ratio.

The best-fitting model is of the credit constraints mechanism.[43] The labor markets, investment riskiness and infrastructural availability mechanisms also have strong explanatory power, while that of the migration mechanism is relatively weak. The urban birth rate, girl–boy ratio, non-agricultural value added per worker and migration variables are all suspected of endogeneity. The DWH results show that only non-agricultural value added per worker is endogenous to urban schooling.

[40]We do not present the results on the levels of R&U schooling to save space. For results and a more detailed discussion, see Ulubasoglu and Cardak (2006).

[41]The same caveat on comparing results of regressions with different sample sizes applies.

[42]The exogeneity of agricultural value added per worker may be due to the fact that the relevant model includes tractor availability and land Gini. Thus, the agricultural value added per worker is most likely measuring how the labor market works in rewarding labor *for a given level of productivity*.

[43]Note again, we are comparing regressions with different sample sizes.

6. Conclusions

In this paper, we have studied differences between rural and urban educational attainment across a diverse group of 56 countries. Using the ratio of rural to urban average years of schooling as our measure of rural–urban educational inequality, we find that countries with greater resources and those with more effective channels to allocate these resources have lower RUEI. Such distributional channels seem to be influenced by institutional characteristics, such as the type of legal system, colonial history, degree of political stability as well as geographical characteristics, such as landlockedness and a country's surface area.

Some of the most significant results we find are about the impact of colonial histories on RUEI. We find that countries with colonial pasts in general, and those that gained their independence in the post-war period in particular, have greater RUEI. We also find that in countries with legal systems of French origin, the educational inequality between rural and urban citizens is much wider than in other countries, implying greater RUEI. This may be associated with the bureacracy of French legal systems and urban bias identified in the literature; see La Porta et al. (1999) for the former and Henderson (2005) for the latter. Conversely, countries with legal systems of British origin exhibit lower RUEI, which may be due to the types of colonies settled by the British. British colonies were less likely to be extractive and more likely to involve a high degree of settlement, with colonists demanding the rights and priviliges afforded to citizens in the colonizing country (see Acemoglu et al., 2001). We also identified an interaction effect between the level of economic development and some of the factors already mentioned. Most important were the interactions with legal systems and colonial histories. We found the French (British) legal system variable to have a positive (negative) interaction with economic development. That is, developing economies exhibit more (less) rural–urban educational inequality if they have a legal system of French (British) origin, while the reverse is true of developed economies. On the other hand, countries with colonial pasts and those with post-war independence have higher RUEI, regardless of development.

In addition, we find that riskier human capital investment, less credit availability and landlockedness of nations are all associated with relatively lower rural educational levels and greater RUEI. Conversely, larger formal labor markets and better infrastructure are associated with lower RUEI.

In light of the impact of human capital on economic growth (see for example, Doppelhofer et al., 2004), our results suggest that colonial history and the types of legal systems in place (British versus French) have long run implications for countries. Overall, rural–urban differences in human capital accumulation seem to have been considerably influenced by the historical, and in many cases, colonially-imposed institutional structure within a country.

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Appendix A. Data definitions and sources

We obtain most of our data on explanatory variables from World Development Indicators (2003). Education share of GDP is defined as the share of current operating expenditures on education in Gross Domestic Product. Pupil–teacher ratio is the number of pupils enrolled in primary schools divided by the number of primary school teachers. Girl–boy ratio is the percentage ratio of female pupils to male pupils in primary and secondary public and private schools. Rural population density is rural population divided by the arable land area. Agricultural per worker is agricultural value added divided by agricultural labor force. Non-agricultural value added is found in the same way. Agricultural GDP deflator is defined as the ratio of nominal agricultural value added to real agricultural value added (base year 1995). Non-agricultural GDP deflator is defined in a similar vein. Other data obtained from WDI (2003) are M2/GDP; life expectancy at birth; share of arable land in total land; fertilizer consumption (in terms of 100 g/ha of arable land); arable land per person (in hectares); tractor/100 ha of arable land; doctors per 1000 people; and telephone mainlines per 1000 people (whose original source is International Telecommunication Union, World Telecommunication Development Report and database). Female teachers is percentage of female teachers in all teachers.

Colonization is a dummy variable that takes 1 if a country was colonized since 1774, and 0 otherwise, and is based on Acemoglu et al. (2001). British, French, German, Scandinavian and Socialist legal system dummies and the shares of Catholic, Protestant, Confucian, Muslim, Hindu religion populations in total populations are also obtained from La Porta et al. (1999). Post-war independence is also a dummy and takes 1 if the country gained its independence after 1945. Rural and urban birth rate are the number of live births in rural and urban areas per 1000 people. Rural and urban death rate is defined as the number of deaths in rural and urban areas per 1000 people. These are obtained from UN Demographic Yearbooks (various issues). The figures for total and female populations above 25 years are obtained from Barro-Lee (2001). Data on surface area, latitude and dummy variables on landlock, island, tropical, obtained from Social and Fixed factors data set of World Bank. Land Gini is obtained from Deininger and Olinto (2000), real GDP per capita data are from Summers et al. (2000), and political rights and civil liberties data are from Freedom House data set. Ethnic fractionalization data are obtained from Alesina et al. (2003).

In the absence of concrete figures on intersectoral migration, we approximate migration (the number of people migrating) according to Larson and Mundlak (1997) by using the formula $\text{MIGRATION}_{it} = \text{ALF}_{i,t-1} \times (1 + n_{it}) - \text{ALF}_{it}$,where ALF is the agricultural labor force, and n is the growth of agricultural labor force. MIGRATION is attributed to the difference between the current level of the agricultural labor force and that with expected innovation. Then, the migration rate is simply $m_{it} = \text{MIGRATION}_{it}/\text{ALF}_{i,t-1}$. Generally, the literature assumes that the growth of agricultural labor is equal to the national labor force growth.

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