

Colonial education disparity, institutions and economic growth: A cross-country analysis

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Abstract

We hypothesize that, for a given initial incidence of lack of schooling, ‘*late*’ free nations would face greater setback than ‘*early*’ independent ones due to higher colonial education disparity (CED) between colonized and colonizer nations. Novel colonial education index is constructed capturing the disparity between uneducated population in a formerly colonized country at independence versus that in colonizer nations. Cross-country regressions demonstrate persistent detrimental effect of CED on contemporary institutions (averaged over years 1990-2017), even after controlling for regional effects and initial income. Interestingly, settler mortality rate in our models displays indirect impact on institutions via human capital CED channel. Moreover, linear interactive models and simultaneous two-stage least squares estimates indicate that negative effects of CED on long-run growth is overshadowed by the positive effects of contemporary economic institutions unlike the case of political institutions.

Keywords: Colonization; colonial education; institutional quality; economic growth

JEL: N30, O43

1. Introduction

This article revisits the links between human capital, institutions and economic development by employing colonial educational disparity between colonized and colonizer nations as innovative measure of human capital in colonies. Our findings appear to contradict the institutional school that ‘initial human capital’ does not matter for the quality of contemporary institutions (e.g., Acemoglu et al. 2014). The present research provides the following important contributions to the existing literature. First, human capital in a colonized nation is captured by a new measure, colonial education disparity (CED), that also distinguishes between early and late demise of colonial rule. In our computations, for a given incidence of lack of colonial education, late freed nations bear more severe brunt of CED and subordination than early independence gainers. Second, initial human capital is shown to use institutional quality route to affect growth and settler mortality rate exerts influence on institutions via CED. The latter result is robust to the inclusion of population density in year 1500, latitude, regional effects, and initial income as control variables. Third, empirical evidence obtained suggests that CED engenders more damaging impacts in colonies with rich accumulated pre-colonial governance heritage. Lastly, the negative effect of CED perpetuates in post-colonial political institutions whereas this effect is overwhelmingly overshadowed by the positive effects of economic institutions on growth.

The major advantage of our new CED measure is that it captures the human capital of both the colonized and colonists. In the literature, Glaeser et al. (2004) and Acemoglu et al. (2014) hold different views on whether more colonizers came to settler or extractive colonies. In our framework, the amount of colonizer human capital brought to a colony may be less important for long-run post-colonial prosperity. What matters more is educational disparity between the

colonized (including natives and imported forced labor) and colonizers and its effect on labor productivity. The mere presence of more educated human capital widens the gap between colonized and colonizer human capital. Thus, CED would reflect the dampening effect on the colonized human capital via inferiority complex and feeling of subordination, which facilitated the exploitative motivations of colonizers. Since CED is computed at time of independence, the composition of the population of a newly freed nation (i.e., consisting of previously colonized individuals and settler colonizers) would effectively determine overall incidence of educational disparity that is postulated to have lasting influence on long-run quality of institutions.

The additional innovative aspect of CED index is that it also captures the extent of challenges faced by late and early freed nations in a ‘new’ world governed by global institutions favoring former colonial rulers. Early demise of colonization when educational provision was not widespread worldwide lowers educational divergence between colonizer and colonized, implying lesser initial challenge. CED would thus seem to represent an appropriate channel of higher colonial drag for late independence gainers such as in Africa as compared to early freed ones like in Latin America. Eventually, lack of educational opportunities in former colonies reflecting dominant extractive colonialism with less focus on institutional and human capital development is posited to pose persistent drag on colonized nations’ economic performance.

Our angle of research with focus on colonial education disparity between colonized and colonizers presents a departure from the mainstream literature that has emphasized the role of colonial education on socio-economic outcomes of former colonies such as post-colonial development (Grier 1999; Glaeser et al. 2004; Bolt and Bezemer 2009; Gennaioli, et al. 2013)

and post-colonial education levels (Feldmann 2016). In this strand, some studies have attributed sources of variation in colonial education policy to colonizer identity. Grier (1999), for instance, using a sample of 63 ex-colonial states from 1960 to 1990, shows that the level of education at the time of independence can help to explain much of the development gap between the former British and French colonies in Africa. Feldmann (2016) finds substantial negative effects on contemporary schooling levels of French and Spanish ex-colonies as opposed to British ones (however, with no significant impact). Bennett et al. (2017) observe that the impact of settlement conditions is much stronger among British colonies than colonies of other European colonizers. More generally, Glaeser et al. (2004) demonstrate colonial human capital endowment (measured in 1960) as being more important for subsequent growth than institutions (captured by constraint on executive, level of autocracy and democracy in 1960). They further argued that colonizers brought more human capital in settler colonies like USA than in Latin American Countries that manifested in better performance in the former. Bolt and Bezemer (2009) additionally show that the disease environment in Africa impacted long-term growth via a human capital channel (measured as students in primary and secondary education as percent of total population between 1945 and 1950) rather than through an extractive institutions channel (proxied by European settler mortality rate). In the literature, the benefits of colonial education seem ambivalent, however. Some like Glaeser et al. (2004) support benign role of colonial education in fostering post-colonial prosperity. Others, such as Bush and Saltarelli (2000), argue that colonial education worked to undermine local populations' beliefs and promoted social fragmentation. Interestingly, mission schools pursuing intensive "evangelization" were widely prevalent in "slave coast" of Africa (Michalopoulos and Papaioannou 2020) presumably to enable understanding of Western Scriptures among the natives (Woodberry 2012).

These views by the advocates of colonial education, however, differ from the institutional stream spurred by Acemoglu et al. (2001, 2002), advocating the primacy of colonial institutions over colonial human capital in determining quality of institutions that impacted long-term growth. In their work, the authors argue that the types of colonization policies, extractive vs. settler, determined creation of institutions supporting colonizer motives. They postulate that feasibility of settlement, particularly due to disease environment, would have influenced the colonization strategy. Thus, where European settler mortality rate was higher, the odds against creation of inclusive institutions would be lower and extractive institutions would be more likely. These colonial institutions would tend to persist, and they propose settler mortality as an instrument for current institutions in the former colonies. Later, Acemoglu et al. (2014) justify this strategy contemplating that settler mortality captures the impact of human capital on long-run development as they presume that Europeans brought more human capital (the colonists themselves) to extractive colonies in Latin America as compared to settler colonies as the United States. The disparate economic performance of colonized nations therefore may not be explained by human capital differential. The authors use World Governance Indicators rule of law index in 2005 as measure of contemporary institutions and years of schooling of the population above 15 years of age in 2005 as indicator of current educational attainment (human capital). Settler mortality rate, population density in year 1500, protestant missionary activity (schools) in 1920s and primary school enrolment in 1900 are experimented as instruments for the contemporary human capital and institution in growth equations (with dependent variable, log of GDP per capita in 2005). Their findings do not however support that “differences in the human capital endowments of early European colonists would have been a major factor in the subsequent

institutional development of former colonies.” Besides this, also noteworthy are studies supporting the effects of institutions on long-term growth analyzing differences within-countries. Examples include Banerjee and Iyer (2005) for India, Dell (2000) for Peru, and Michalopoulos and Papaioannou (2020) for Africa, to name a few. The debate on what matters most: initial institutions due to disease environment or initial education however subsists due to a host of issues including sensitivity to measurement error, model specification, estimation methods, instrument relevance and samples used.

The present study contributes to this debate by undertaking a cross-country analysis of the long-term effects of an entirely new colonial dimension, that is colonial education disparity (CED) at time of independence, early and late in disparate world regions. In our view, it is CED that seems more representative of extractive intent of colonizers, that would manifest in quality of institutions and eventually affect growth. Former settler colonies like the US and Australia, at time of dissociation with the “parent” colonizer nation, enjoyed literacy level as compared to advanced nations. After independence, the ex-colonist citizens of the newly freed nations had education, wealth and administrative powers concentrated in their hands. Given their capabilities and experience, efficient running of the colonial institutions was maintained. By contrast, non-settler colonies with high CED would have suffered at independence due to paucity of administrative and technological skills. CED thus better reflects differences in colonizer motivations. Another vital dimension captured is timing of independence, which measures the opportunity cost of illiteracy in a new world shaped by former colonizers (advanced countries). The initial human capital setback would have been crucial in determining quality of early post-colonial and contemporary institutions, with the effects transmitted to economic performance.

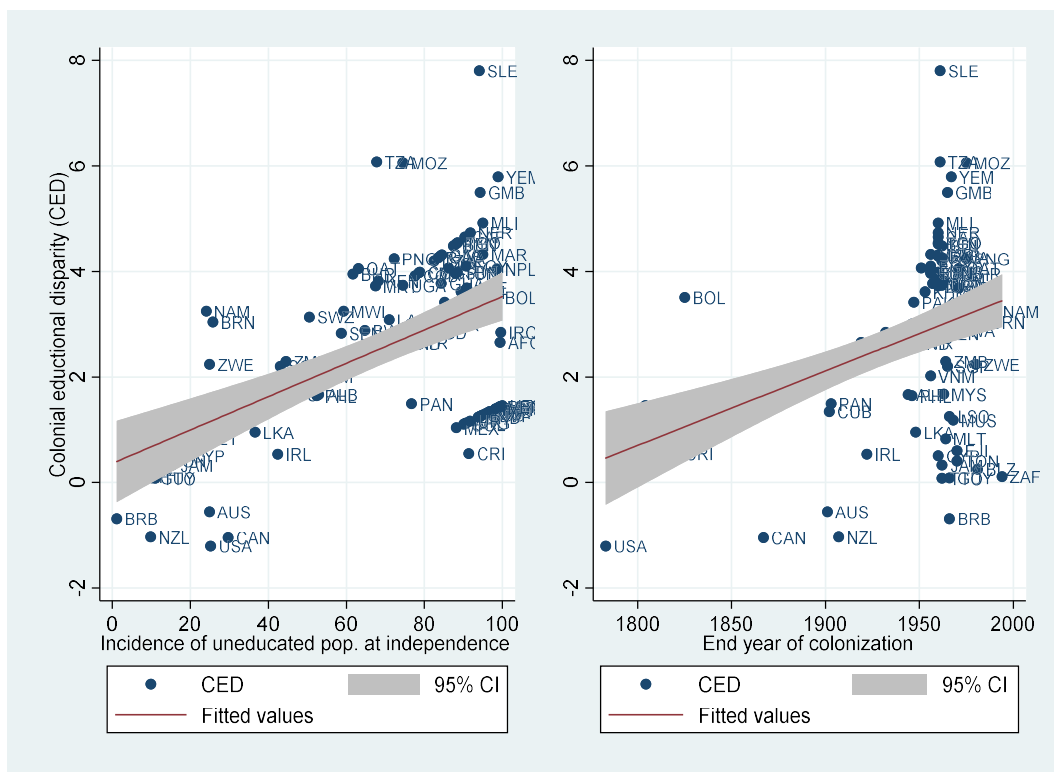
The paper is organized as follows. In Section 2, construction of our new colonial educational disparity measure is detailed. The next part empirically investigates the impact of CED on contemporary institutions while accounting for competing theories. Section 4 tests for direct and indirect impacts of CED on long-run growth using alternate modelling and estimation strategies. The final section concludes.

2. Measuring historical colonial education disparity

We construct a new measure of colonial education disparity (not attempted previously) capturing the extent of disadvantage of nations due to absence of colonial educational policy. More specifically, we conjecture that the extent of drawback (or opportunity cost) caused by not having formal education would be acute over time as education becomes widespread worldwide. Thus, countries in the Latin America and Caribbean (LAC) region that became free from colonial domination (around late 1800s) in an era when education provision was very low - including in colonizer nations - might be less disadvantaged at independence than countries that gained independence in later years. We use data on uneducated population in advanced economies grouped according to Lee and Lee (2016) as benchmark for comparison. The list includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, US, and UK. Disparity in education is captured by taking the difference between percent uneducated in a country at independence and the mean uneducated population in advanced economies in that year and weighing this difference using the standard

deviation of uneducated population in advanced countries. Greater dispersion within the high-income countries group that existed in the 1800s and early 1900s more specifically would depress the extent of disadvantage faced by an early colonized country that gained freedom during those years. In our computations, due to data constraints, percentage uneducated in 1870 is used as proxy for countries that gained independence before 1870s. Among developing regions in our sample, countries in LAC obtained independence earliest, South Asia, by mid-1940s, and those in EAP (East Asia and Pacific) and Africa, around early-1960s.

Figure 1: Scatter plot: CED, uneducated population incidence and end year of colonization



Source: Authors.

Figure 1 illustrates positive but imperfect correlation between historical CED and the general incidence of uneducated population at independence. We observe, for example, that for

comparable levels lack of education, most LAC countries record lower levels of CED than many in the African and Asian region like Ghana, The Gambia, India and Sri Lanka. Similarly, high incidence of educated population at independence is recorded in Canada, New Zealand and Australia as well as in Zimbabwe, Mauritius and Fiji but with differing CED. This is because the index is constructed to capture the relative lack of education between colonized and colonizers as well as the timing of independence. The second part of the figure displays a steeper relationship between CED and end year of colonization. More specifically, late independence gainers are generally more disadvantaged in terms of the index than early freedom gainers.

Table 1. Initial colonial education disparity according to world regions

Region	N	Mean	Std. Dev.
World	95	2.5	1.8
Africa	37	3.8	1.4
South Asia	6	2.8	1
EAP	14	1.9	1.6
LAC	25	1.1	0.8
North America	2	-1.1	0.1

Source: Computed. N: No. of countries.

From the regional analysis in Table 1, Africa clearly emerges as most disadvantaged region, followed by South Asia, EAP and LAC. Strikingly, Africa also hosts the greatest number of least developed nations characterized by state fragility. Such countries lack capacity or willingness to perform “core” government functions. Deep colonial roots would seem to underlie persistent underdevelopment despite reform attempts at in and international aid (European Report on Development 2009). In our sample, North America records lowest CED incidence with negative values indicating above-average colonial educational provision of former settler colonies.

3. Testing for persistence of CED on institutional quality

This section explores long-lasting effects of CED on selected contemporary political and economic institutions. Institutional indicators investigated comprise The Funds for Peace state fragility index (Fragility), Polity IV democracy measure (DEM), Fraser Institute economic freedom of the world index (Ec. Freedom), and various World Bank Governance indices capturing rule of law (Rule of Law), control of corruption (Control corrupt.) and government effectiveness (Govt. Effect.) (see Appendix Table A.1 for sources of information). The fragility index examines pressures on states and their vulnerability to internal conflict and societal degradation using a set of political, social, and economic indicators. Scores range from 0 (stable /least fragile) to 10 (least stable /most fragile). DEM measures extent of democracy and takes values from +10 (strongly democratic) to -10 (strongly autocratic). Fragility and DEM are considered as indicators of political institutions whereas the remaining are measures of economic institutions.

Economic freedom index captures the degree to which policies and institutions in a country are supportive of personal choice, voluntary exchange, freedom to enter markets and compete, and security of the person and privately owned property. It is a composite of five areas, namely size of government, legal structure and security of property rights, access to sound money, freedom to trade internationally and, regulation of credit, labor and business. Scores take values 0 to 10, where 0 corresponds to “less economic freedom” and 10 to “more economic freedom”. The index can therefore be thought to capture effectiveness of capitalism (Sturm and De Haan 2015). Rule of Law includes several indicators which measure the extent to which agents have

confidence in and abide by the rules of society. Control of corruption measures perceptions on checks on the exercise of public power for private gain. Government effectiveness index focuses on “inputs” (e.g., quality of the bureaucracy and competence of civil servants) required for the government to be able to produce and implement good policies and deliver public goods. These three World Governance Indicators typically lie between -2.5 and 2.5, with higher scores indicating better outcomes. The measures of economic institutions thus capture various dimensions necessary to spur investments, facilitate business transactions and trade.

Our hypothesis is that higher CED, representing both lower initial human capital endowment and greater setback with respect to the rich world institutions, would reduce the quality of a country’s institutions due to lesser capabilities and generation of productive ideas. Our specifications in Table 2 also control for initial income ($\ln Y_0$), latitude ($\ln \text{Latitude}$) and regional specificities. Due to likely simultaneity between contemporary institutions and human capital measures, we do not include the latter in our models. Nevertheless, historical CED, our variable of interest, is exogenous and would have persistent influence on post-colonial human capital performance, thereby also acting as proxy for the latter. Any effectiveness of policy attempts to improve the production of ideas in the long-term (not systematic over countries) would be captured by the error term. Despite measurement errors that abound in computations not only of historical variables but also relating to quality of current institutions, this exercise would nevertheless give useful indication on long-run drag due to initial (colonial) conditions. Appendix Table A.1 lists sources of data and description of variables.

Table 2 results obtained using the ordinary least squares (OLS) procedure confirm persistent harm of historical educational disparity on contemporary political institutions (averaged over 1990-2017), enhancing state fragility (regression 1) and lowering extent of democracy (reg. 2). Similarly, adverse impact of CED is evidenced on economic institutions measured by economic freedom index proxying capitalism (reg. 3), rule of law (reg. 4), control of corruption (reg. 5), and government effectiveness (reg. 6). These highly significant results suggest CED as potential instrument for institutional quality in growth equations. One important criticism of these findings is that our models do not consider alternate explanations that may be relevant, more specifically, the role of initial colonial institutions (Acemoglu et al. 2001, 2002).

Table 2: OLS estimates: Colonial education disparity and institutions (1990-2017)

	Political Institutions		Economic Institutions			
	State Fragility	DEM	Economic Freedom	Rule of law	Control of corruption	Govt. effectiveness
	(1)	(2)	(3)	(4)	(5)	(6)
CED	4.17*** (3.35)	-1.75*** (-4.01)	-0.17*** (-3.17)	-0.21*** (-4.26)	-0.20*** (-3.81)	-0.20*** (-4.35)
lnY ₀	-4.55*** (-3.38)	0.11 (0.23)	0.02 (0.26)	0.18*** (3.16)	0.20*** (3.02)	0.20*** (3.11)
ln Latitude	-38.9*** (-2.86)	1.36 (0.35)	0.93 (1.27)	1.25* (1.99)	1.32* (1.85)	0.96 (1.49)
Africa	2.71 (0.56)	2.38 (1.35)	-0.51** (-2.01)	0.034 (0.16)	0.042 (0.21)	-0.13 (-0.67)
South Asia	17.2*** (2.68)	4.56*** (2.68)	-0.66*** (-3.15)	-0.22 (-0.84)	-0.46* (-1.92)	-0.36 (-1.35)
LAC	3.17 (0.70)	3.57** (2.30)	-0.37 (-1.46)	-0.67*** (-3.31)	-0.50** (-2.16)	-0.57*** (-2.86)
N	87	83	85	88	88	88
Adj-R-sq	0.542	0.358	0.311	0.491	0.489	0.520

Heteroscedasticity robust t-statistics in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Intercepts not reported.

To address this potential omission bias, as sensitivity check, we augment the models using settler mortality rate ($\ln$ Settler mortality), representing competing extractive colonial institutions channel. Pre-colonial population in year 1500 ($\ln$ Popden₁₅₀₀) taken from Putterman and Weil (2010) is included as additional covariate capturing settlement conditions. Strikingly, OLS findings from Table 3 show that the effect of colonial educational disparity persists (albeit at a lower level of significance) whereas settler mortality is insignificant in all the regressions. This may imply that the effects of settler mortality would have used a human capital channel to exert effects on present institutions. Also noteworthy is the insignificance of pre-colonial population density throughout. Moreover, as earlier, initial income and latitude generally display expected institutional quality-enhancing effect, even in the presence of regional dummies.

Table 3: CED, settler mortality and institutions: OLS regressions

	State Fragility	DEM	Economic Freedom	Rule of law	Control of corruption	Govt. effectiveness
	(1)	(2)	(3)	(4)	(5)	(6)
CED	3.49+	-1.33*	-0.22*	-0.22**	-0.19*	-0.20**
	(1.63)	(-1.97)	(-1.77)	(-2.20)	(-1.77)	(-2.08)
$\ln$ Settler mortality	0.76	0.47	-0.04	-0.02	-0.08	-0.10
	(0.27)	(0.66)	(-0.24)	(-0.14)	(-0.67)	(-0.83)
$\ln$ Popden ₁₅₀₀	0.05	0.46+	0.01	-0.01	-0.01	-0.03
	(0.05)	(1.64)	(0.13)	(-0.27)	(-0.23)	(-0.74)
$\ln Y_0$	-4.97**	1.11**	-0.06	0.15*	0.17*	0.16*
	(-2.66)	(2.25)	(-0.54)	(1.81)	(1.75)	(1.92)
$\ln$ Latitude	-44.7***	3.14	0.98	1.58*	1.32	1.08
	(-2.70)	(0.90)	(0.87)	(1.97)	(1.45)	(1.35)
Africa	5.65	1.91	-0.32	-0.01	-0.07	-0.09
	(0.84)	(0.80)	(-0.80)	(-0.02)	(-0.23)	(-0.33)
South Asia	18.3**	5.57**	-0.71**	-0.21	-0.54*	-0.30
	(2.44)	(2.26)	(-2.26)	(-0.65)	(-1.82)	(-1.17)
LAC	6.35	4.61***	-0.33	-0.72***	-0.63**	-0.60***
	(1.42)	(2.75)	(-1.14)	(-3.28)	(-2.57)	(-2.91)
N	67	64	66	67	67	67
Adj-R-sq	0.597	0.530	0.285	0.520	0.537	0.579

Heteroscedasticity robust t-statistics in parentheses. + p<0.12, * p<0.10, ** p<0.05, *** p<0.01

Table 4 explicitly tests CED as plausible channel for transmission of settler mortality effects on contemporary institutions using alternate modelling and estimation strategies. We develop the following system of regressions where the first equation shows CED to be dependent upon settler mortality rate (ln Settler mortality), pre-colonial population density in year 1500 (ln Popden₁₅₀₀), accumulated pre-colonial governance experience (standardized values) from year 1 to 1500 (State exp₁₋₁₅₀₀) indicating level of advancement of these ancient civilizations (Borcan et al. 2018), latitude (ln Latitude) and a vector of regional dummy variables (**Regions**).

System of equations:

$$\text{CED} = \psi_1 + \psi_2 \ln \text{Settler mortality} + \psi_3 \ln \text{Popden}_{1500} + \psi_4 \text{State exp}_{1-1500} + \psi_5 \ln \text{Latitude} + \mathbf{k} \text{Regions} + \iota_1$$

$$\text{INST}_j = \phi_{1j} + \phi_{2j} \text{CED} + \phi_{3j} \ln \text{Settler Mortality} + \phi_{4j} \ln \text{Latitude} + \phi_{5j} \ln Y_0 + \mathbf{z}_j \text{Regions} + \iota_{2j}$$

where j = state fragility, democracy, economic freedom, rule of law, control of corruption and government effectiveness.

Significant impact of settler mortality rate on CED would be indicative of indirect effects of the variable on current institutions using CED route. We expect CED-enhancing impact of settler mortality. The effect of pre-colonial population density on education disparity is however an empirical issue. From the literature, colonial education provision was used importantly in some extractive colonies to reduce threat of resistance from populous regions and further subjugate the natives. To the author's knowledge, the association between pre-colonial state experience

capturing the degree of advancement of the ancient civilizations and colonial education disparity has not been researched. The direction of the effect would depend on how colonizers used education policy to achieve their objectives on average. The second equation in our system represents institutional function (INST) for each of the 'j' institutional quality measures. As earlier, we postulate historical CED, settler mortality, latitude, initial income, and regional specificities as determinants of contemporary institutions. The inclusion of settler mortality in the institutional quality models thus enables to ascertain absence of direct impact (evidenced in Table 3). CED and settler mortality are considered exogenous to contemporary institutions and the error terms represented by ϵ .

The system of equations is estimated employing the seemingly unrelated estimation (SURE) technique. This strategy improves the efficiency estimates as compared to OLS in the event of contemporaneous correlation between the equations in the system and is also potentially not very sensitive to specification errors (Montalvo and Reynal-Querol 2015). Highly significant Breusch-Pagan statistic (p-value=0.000) indicates that equations are indeed interdependent, thereby validating this empirical approach. Importantly, settler mortality enters regression (1) in Table 4 very significantly, indicating CED to be potential channel of transmission of effects to contemporary institutions. In results (2)-(7), CED significantly dampens institutional quality throughout while settler mortality does not seem to exert significant direct impact, at conventional levels of significance. These findings suggest initial colonial education disparity as deep determinant of institutions, with settler mortality exerting only indirect impact using CED route. Also remarkable in result (1) is the significance of accumulated pre-colonial state experience from years 1-1500 in enhancing 'illiteracy' policy. Apparently, special care was taken

to demoralize populations endowed with advanced ancient governance structures, perhaps by destroying their accumulated heritage and knowledge, and by not substituting these with colonial education. Thus, the colonizers would have ensured that such people remain disadvantaged. Additional results include beneficial impact of latitude in reducing CED and enhancing quality of institutions generally.

Table 4: CED, settler mortality and institutions: SURE results

	CED	State Fragility	DEM	Economic Freedom	Rule of law	Control of corruption	Govt. effect.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CED		4.62** (2.52)	-2.08*** (-4.25)	-0.31*** (-2.91)	-0.23*** (-2.88)	-0.20** (-2.46)	-0.18** (-2.40)
ln Setter Mortality	0.83*** (5.47)	0.41 (0.16)	1.08+ (1.59)	0.05 (0.34)	-0.03 (-0.24)	-0.10 (-0.90)	-0.14 (-1.30)
ln Latitude	-2.13* (-1.96)	-40.2*** (-2.61)	1.96 (0.47)	0.79 (0.88)	1.42** (2.09)	1.29* (1.85)	1.04+ (1.63)
ln Popden. 1500	-0.10+ (-1.62)						
State exp.1-1500	0.56*** (3.91)						
ln Y ₀		-4.85*** (-2.82)	0.93** (2.03)	-0.06 (-0.55)	0.15** (2.00)	0.16** (2.07)	0.16** (2.25)
Africa	1.21*** (2.91)	2.15 (0.34)	2.77+ (1.64)	-0.29 (-0.81)	0.16 (0.57)	0.07 (0.24)	0.02 (0.07)
South Asia	0.025 (0.04)	16.8** (2.03)	6.01*** (2.69)	-0.67 (-1.39)	-0.11 (-0.30)	-0.48 (-1.29)	-0.26 (-0.75)
LAC	-0.62* (-1.71)	6.40 (1.22)	3.82*** (2.70)	-0.46 (-1.52)	-0.64*** (-2.76)	-0.57** (-2.39)	-0.50** (-2.30)
N	63	63	63	63	63	63	63
R-sq	0.777	0.630	0.547	0.371	0.545	0.562	0.601

Heteroscedasticity-robust statistics in parentheses. + p<0.12, * p<0.10, ** p<0.05, *** p<0.01.

Breusch-Pagan test of independence: chi2(21) = 454.823 [P-value=0.000].

3. Colonial educational disparity in cross-country growth regressions

The present section proceeds to investigate probable direct and indirect institutional channels of influence of CED on contemporary economic growth. This exercise subscribes to the view that institutions are essentially ideas, generated by human capital (Faria et al. 2016). Thus, in our framework, any persistence of initial CED endowment would result in less productive ideas up to contemporary times and manifest as lower quality institutions. According to the institutional stream, factors like human capital, capital accumulation, and technological innovation embody the aggregate production function and would best be described as proximate growth determinants (North and Thomas 1973) that may therefore be omitted from empirical long-run growth models (Acemoglu and Johnson 2005; Acemoglu et al. 2014). Moreover, attempts to disentangle the effects of institutions and human capital on growth remain highly controversial and the results seem sensitive to underlying assumptions, specifications used and estimation strategies. Following our previous findings on significant effect of colonial CED on all our institutional measures, we proceed to estimate growth models using standard linear procedures as well as simultaneous method as robustness measure to address probable endogeneity of institutions in growth regressions.

3.1 OLS estimations without and with interaction terms

Table 5 presents results for the following simple linear growth model:

$$\text{GrY} = \theta_1 + \theta_2 \ln Y_0 + \theta_3 \text{CED} + \theta_4 \text{INST} + \theta_5 \ln \text{Latitude} + \mathbf{m} \text{Regions} + v_1 \quad (\text{eq. A})$$

where GrY, average per capita real income over the period 1990 to 2017, depends upon initial per capita income in 1990 ($\ln Y_0$), colonial education disparity (CED), and institutions (INST). Due to high collinearity between the institutional measures arising from overlap between several of the dimensions captured, the growth models are estimated with each institutional aspect separately. Latitude and a vector of regional variables (Regions) considered in our previous section are included as additional covariates while v represents the random error term. For parsimony, latitude, found insignificant in all growth models, is omitted from the specifications reported in Table 5.

Table 5: CED, institutions and growth: OLS Cross-country analysis

	<i>Dependent variable: Average growth rate (1990-2017)</i>						
	Excl. INST	State Fragility	DEM	Economic Freedom	Rule of law	Control of corruption	Govt. effect.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln Y_0$	-0.67*** (-4.12)	-1.12*** (-6.75)	-0.68*** (-3.95)	-0.68*** (-4.24)	-0.95*** (-5.60)	-0.95*** (-5.16)	-1.10*** (-6.48)
CED	-0.31** (-2.37)	-0.19+ (-1.66)	-0.36** (-2.27)	-0.25* (-1.96)	-0.15 (-1.21)	-0.19 (-1.48)	-0.13 (-1.10)
INST		-0.06*** (-5.49)	-0.02 (-0.40)	0.58** (2.57)	1.15*** (4.40)	0.89*** (3.21)	1.59*** (5.82)
Africa	-1.31*** (-2.65)	-0.93** (-2.23)	-1.47*** (-2.85)	-0.89* (-1.85)	-0.94** (-2.16)	-1.19** (-2.60)	-0.53 (-1.28)
South Asia	0.04 (0.06)	0.64 (0.93)	-0.11 (-0.13)	0.52 (0.67)	0.32 (0.44)	0.24 (0.32)	0.63 (0.93)
LAC	-0.89* (-1.96)	-0.59 (-1.51)	-1.03** (-2.08)	-0.58 (-1.29)	0.17 (0.40)	-0.33 (-0.76)	0.38 (0.94)
N	89	88	84	86	89	89	89
Adj-R-sq	0.205	0.409	0.210	0.246	0.325	0.273	0.395

Heteroscedasticity robust t-statistics in parentheses. + $p < 0.12$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Intercepts not reported.

We first estimate the growth equation by excluding INST, our postulated transmission channel for CED on growth. This strategy enables us to obtain an estimate of the total growth impact of

CED, where total impact is the sum of the variable's direct and indirect impacts. From Column (1), when controlling for initial income and regional specificities, significant adverse effect of historical educational disparity on long-run growth is witnessed, indicating persistence. One standard deviation increase in CED is estimated to reduce growth rate by about 0.56 percent, *ceteris paribus*. The subsequent regressions (2)-(7) control for the various measures of institutions as possible channels for CED. In these results, the coefficient on CED captures the variable's direct effect on contemporary economic prosperity. In the presence of fragility (result 2), CED's effect on growth is rendered insignificant at conventional levels while fragility is highly significant. This may imply that the effects of initial illiteracy are transmitted via poor governance channel, resulting in lower growth outcomes. Interestingly, in the presence of DEM, adverse direct impact of CED on growth appears significantly enhanced (with magnitude -0.36 in regression 3 vs. -0.31 in regression 1) while the coefficient on democracy is statistically insignificant, with a negative sign. Thus, CED may be overshadowing the potential benefits of democracy. Coming to our measures of economic institutions, a rise in the economic freedom produces significant growth benefits and mitigates harm due to CED. This is indicated by the lower magnitude of CED's coefficient in column (4) as compared to regression (1). Nevertheless, CED still impacts growth directly but at a lower level of significance (10 percent). Reassuringly, remaining results indicate that harmful effects of initial education disparity are totally overpowered (rendered insignificant) by good quality institutions captured by rule of law (reg. 5), control of corruption (reg. 6) and government effectiveness (reg. 7). Moreover, all these INST measures are highly significant implying sizeable growth benefits as quality improves, provided causality is unidirectional. We also note negative impact of initial income on growth, in

concordance with the convergence literature and growth-retarding characteristics of the African region.

In the next stage, we augment model (A) using the interaction between INST and CED to further disentangle CED's direct and indirect effects. Here again, we assume no simultaneity between INST and growth.

$$\text{GrY} = \sigma_1 + \sigma_2 \ln Y_0 + \sigma_3 \text{CED} + \sigma_4 \text{INST} + \sigma_5 (\text{CED} \times \text{INST}) + \sigma_6 \ln \text{Latitude} + \mathbf{n \text{ Regions}} + v_2$$

(eq. B)

In equation (B), the coefficient σ_5 on the interaction term ($\text{CED} \times \text{INST}$) captures the indirect effect of CED on growth using INST as transmission channel whereas σ_3 measures CED's direct effect. Despite collinearity between CED, INST and the interaction term, the new set of results would shed additional light on the dependency between CED and institutions. Heteroscedasticity-robust estimators are reported in Table 6. Latitude is dropped from the growth specifications as it insignificant throughout. Result 1 indicates no significant direct impact of CED on economic growth when controlling for state fragility, as evidenced in Table 5. Nevertheless, the interaction variable enters significantly in the model confirming that CED would be using weak governance channel to transmit its effects. Historical education disparity and fragility appear to reinforce each other's impact to depress long-run growth outcomes. In result (2), as previously, the adverse direct impact of CED on growth persists when controlling for democracy. The coefficients on the interaction term and DEM are however both insignificant. Thus, we do not obtain robust support that DEM acts as channel for CED if causality runs one-

way. Result (3) indicates the ability of economic freedom to dampen CED's damage to long-run growth, but without overpowering its effects. This is implied by the significance of the coefficient on interaction term bearing a positive sign while CED still displays direct harm to growth. Unlike in Table 5, economic freedom is now not significant. The next measures of economic institutions, rule of law (reg. 4), control of corruption (reg. 5) and government effectiveness (reg. 6) all retain strong positive impact on growth. In their presence, CED is overwhelmingly overpowered; its direct impact is nullified while the interaction term is positive and significant. To synthesize our findings, economic institutions appear generally successful in alleviating adverse impacts of historical CED on contemporary growth. Such evidence on political institutions however does not emerge clearly.

Table 6: OLS results from Interactive Growth Models

<i>Dependent variable: Average growth rate (1990-2017)</i>						
	State Fragility	DEM	Economic Freedom	Rule of law	Control of corruption	Govt. effect.
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln Y_0$	-1.13*** (-7.84)	-0.62*** (-3.28)	-0.58*** (-3.71)	-0.90*** (-5.67)	-0.89*** (-5.17)	-1.06*** (-6.63)
CED	-0.66 (-1.60)	-0.45** (-2.39)	-1.53** (-2.23)	-0.07 (-0.60)	-0.12 (-0.98)	-0.09 (-0.80)
INST	-0.04*** (-3.96)	-0.07 (-0.86)	0.37 (1.20)	0.76** (2.58)	0.52* (1.80)	1.14*** (3.79)
CED $\times$ INST	-0.02*** (-4.47)	0.02 (0.75)	0.20* (1.95)	0.30*** (3.19)	0.33*** (3.35)	0.25*** (2.93)
Africa	-0.83** (-2.29)	-1.39*** (-2.66)	-0.31 (-0.66)	-0.87** (-2.10)	-0.94** (-2.21)	-0.49 (-1.26)
South Asia	0.77 (1.29)	-0.11 (-0.13)	1.02 (1.35)	0.32 (0.47)	0.48 (0.69)	0.56 (0.88)
LAC	-0.83** (-2.39)	-1.10** (-2.16)	-0.38 (-0.85)	-0.01 (-0.02)	-0.48 (-1.11)	0.12 (0.30)
N	88	84	86	89	89	89
Adj-R-sq	0.457	0.201	0.285	0.402	0.336	0.451

Heteroscedasticity robust t-statistics in parentheses. + p<0.12, * p<0.10, ** p<0.05, *** p<0.01
Intercepts not reported.

3.2 Capturing bidirectional effects

These above results assume unidirectional causality between INST and growth. Their robustness in case of plausible endogeneity of the institutional measures is now investigated using the simultaneous two-stage least squares (2SLS) strategy. Moreover, the growth model in the system is augmented with additional covariates to reduce possibility of omitted variables bias. We formalize the 2SLS framework as follows:

First stage

$$\text{INST} = \alpha_1 + \alpha_2 \text{CED} + \alpha_3 \ln Y_0 + \alpha_4 \ln \text{Latitude} + \mathbf{v} \text{Regions} + \boldsymbol{\theta} \boldsymbol{\psi} + \varepsilon_1 \quad (\text{eq. C})$$

Second stage

$$\text{GrY} = \beta_1 + \beta_2 \ln Y_0 + \beta_3 \text{INST} + \beta_4 \text{CED} + \mathbf{w} \text{Regions} + \boldsymbol{\sigma} \mathbf{X} + \varepsilon_2 \quad (\text{eq. D})$$

where INST, our measure of institutional quality, in equation C depends on colonial education disparity, latitude, initial income, regional characteristics and a vector $\boldsymbol{\psi}$ of additional potential instruments used in the literature, e.g., population density. Equation D presents the typical growth model augmented with CED. Usual growth determinants included are initial income, INST, regional dummies and a vector $\mathbf{X}$ of additional controls (ln price of investment and growth rate of population, grPop, proxying human capital) as deep determinants. These variables are treated as exogenous as they are measured at the start of the period in year 1990. The excluded instruments for institutions in equation C are thus latitude and population density. Heteroscedasticity-robust estimates with standard errors corrected for small sample size using STATA 15.1 software are presented in Table 6 (see Appendix Table A.1 for data description).

Table 6: 2SLS estimates of growth regressions (1990-2017)

<i>Panel A: Second stage – Dependent variable: Average growth rate (1990-2017)</i>						
	State Fragility	DEM	Economic Freedom	Rule of law	Control corruption	Govt. effect.
	(1)	(2)	(3)	(4)	(5)	(6)
INST	-0.08*** (-2.77)	-0.37** (-2.01)	1.53*** (3.24)	2.07*** (2.84)	1.78*** (2.88)	1.98*** (3.70)
CED	-0.00 (-0.04)	-0.76** (-2.01)	0.09 (0.67)	0.13 (0.89)	0.06 (0.49)	0.09 (0.79)
lnY ₀	-1.23*** (-3.82)	-0.47** (-2.30)	-0.75** (-2.48)	-1.22*** (-3.24)	-1.19*** (-3.44)	-1.25*** (-3.69)
ln Price of Investment ₉₀	-0.61* (-1.88)	0.25 (0.51)	-0.70* (-1.94)	-0.72* (-1.94)	-0.66* (-1.82)	-0.65* (-1.90)
grPop ₉₀	-0.26 (-1.49)	-0.89*** (-3.55)	-0.61*** (-4.16)	-0.37** (-2.16)	-0.37** (-2.27)	-0.41*** (-2.97)
Africa	-1.22** (-2.14)	-0.68 (-0.88)	-0.58 (-0.74)	-1.39** (-2.06)	-1.38** (-2.14)	-1.06+ (-1.65)
South Asia	0.30 (0.44)	1.75 (1.50)	0.45 (0.51)	-0.52 (-0.64)	-0.08 (-0.10)	-0.23 (-0.30)
LAC	-0.75* (-1.68)	0.18 (0.18)	-0.50 (-0.76)	0.39 (0.54)	-0.01 (-0.02)	0.15 (0.25)
N	85	81	85	85	85	85
R-sq	0.419	-0.122	0.227	0.298	0.294	0.387
Over-id J-test [p-val]	[0.58]	[0.32]	[0.53]	[0.89]	[0.73]	[0.38]
<i>Panel B: First stage – Dependent variable: Institutional quality (1990-2017)</i>						
CED	1.46 (1.42)	-1.67*** (-3.77)	-0.15** (-2.38)	-0.13** (-2.57)	-0.11** (-2.34)	-0.11*** (-2.82)
Weak instrument						
F-stat	17.08	4.13	26.08	17.19	15.17	21.85
[p-val.]	[0.00]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]

Heteroscedasticity robust t-statistics in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Note: Results on additional regressors used in institutional functions in Panel B are not reported.

From the first-stage results in Panel B, CED is significant in all institutional models, excepting regression 1, where the variable bears the posited sign on its coefficient indicating fragility-enhancing tendency. Highly significant effect of CED in reducing democracy (reg. 2), economic freedom (reg. 3), effectiveness of rule of law (reg. 4), control of corruption (reg. 5) and

government effectiveness (reg. 6) highlight persistent constraint posed by initial educational disparity setback, even after controlling for excluded and included instruments. In the second-stage growth regressions (Panel A), various diagnostic tests are run. More specifically, the null hypothesis of over-identification (OID J-test) is not rejected for all institutional measures (results 1-6). So, the excluded instruments of INST (latitude and population density) appear exogenous and uncorrelated with the error terms of the respective first-stage specifications, thereby satisfying the exclusion principle. Moreover, these instruments also satisfy the weak instruments test with F-value generally exceeding ten (except in reg. 2) and significant at the 1 per cent level. Our political institution variables, state fragility representing quality of governance and democracy, enter significantly in the models with the expected and unexpected negative signs, respectively. Furthermore, we find that CED exerts significant negative impact on growth (reg. 2) via democracy and state fragility (the latter however not statistically significant). We conjecture that the positive returns of democracy would be overpowered by effects of initial educational disadvantage. As regards economic institutions (models 3-6), results emerge consistently and straightforwardly: significant beneficial growth returns are evidenced. The effects of CED on growth after controlling for these institutions are however highly insignificant (second-stage regressions). In other words, the positive effects of contemporary economic institutions on growth overpower the adverse effects of CED. Strikingly, any direct effect of CED on growth (Tables 5 and 6) seems to vanish in the 2SLS estimations, excepting in the presence of democracy.

The results on the negative direct effect of DEM on growth may need some elaboration. Greater level of democracy implies more competition between electoral players, which would increase constraints on executives, yielding improvements in growth outcomes. However, it is also

acknowledged that the benefits of democracy may not be felt in the early stages of democracy when institutional checks may not be in place or working effectively, for example, to detect defect on the part of chief executives. Moreover, the literature also suggests possible deepening of cleavages in society due to higher political competition, which may dampen the rule of law and public goods provision (e.g., Eifert et al. 2010). In our sample of formerly colonized nations, the mean level of contemporary democracy is low (around 3). Overall, therefore, the countries seem characterized by insufficiently high levels of democracy such that increments in DEM produce negative (Table 7, 2SLS results) or insignificant (OLS results) growth benefits.

5. Conclusion

The present paper introduces a new dimension to the development literature that focuses on colonizers' motivation in creating non-functional institutions by diminishing the significance of human capital. This angle of research portrays an alternative narrative from the mainstream literature that has emphasized the role of colonial education on socio-economic outcomes of former colonies such as post-colonial development (Grier 1999; Glaeser et al. 2004; Bolt and Bezemer 2009; Gennaioli, et al. 2013) and post-colonial education levels (Feldmann 2016). Our work also differs from Acemoglu et al. (2001, 2002) and Acemoglu et al. (2014) which attempts to establish the primacy of colonial institutions over colonial human capital in determining quality of institutions that impacted long-term growth. In their work, the authors argue that the types of colonization policies, extractive vs. settler, determined creation of institutions supporting colonizer motives. They postulate that feasibility of settlement, particularly due to disease environment, would have influenced the colonization strategy. Thus, where European

settler mortality rate was higher, the odds against creation of inclusive institutions would be lower and extractive institutions would be more likely. These colonial institutions would tend to persist, and they propose settler mortality rate as major instrument for current institutions in the former colonies.

We hypothesize, on the contrary that, for a given initial incidence of lack of schooling, ‘late’ free nations would face greater setback than ‘early’ independent ones due to higher colonial education disparity (CED) between colonized and colonizer nations. In our view, it is CED that seems more representative of extractive intent of colonizers, that would manifest in quality of institutions and eventually affect growth. In our analysis, the amount of human capital brought by colonizers to colonies is not important, what is important is the presence of colonizer human capital in colonies resulting in educational disparity between natives and colonizers and its effect on labor productivity. Former settler colonies like the US and Australia, at time of dissociation with the “parent” colonizer nation, enjoyed literacy level as compared to advanced nations. After independence, the ex-colonist citizens of the newly freed nations had education, wealth and administrative powers concentrated in their hands. Given their capabilities and experience, efficient running of the colonial institutions was maintained. By contrast, non-settler colonies with high CED would have suffered at independence due to paucity of administrative and technological skills. CED thus better reflects differences in colonizer motivations reflected in initial institutions. Thus, the vital dimension captured is timing of independence, which measures the opportunity cost of illiteracy in a new world shaped by former colonizers (advanced countries). The extent of initial human capital setback would have been crucial in determining

quality of early post-colonial and contemporary institutions, with the effects transmitted to economic performance.

Our newly constructed CED measure is shown to have robust long-run effects, manifesting as lower contemporary institutional quality. This result is not sensitive to the inclusion of settler mortality rate that appears to exert damage to institutions using CED route. Findings using SURE method further strengthen this contention. *Thus, results emanating from our study appear to contribute to the contention that 'initial human capital' does matter for the quality of contemporary institutions.* Nevertheless, lack of initial human capital entails different implications for political and economic institutions. Interestingly, the direct negative influence of CED seems overpowered by contemporary economic institutions. But this negative influence tends to perpetuate in post-colonial political institutions, that is, state fragility is enhanced, and the potential of democracy is dwarfed by CED. Also remarkable in our result is the significance of accumulated pre-colonial state experience in enhancing education policy. Apparently, special care was taken during colonization to demoralize populations endowed with advanced ancient governance structures, perhaps by destroying their accumulated heritage and knowledge, and by not substituting these with colonial education.

As future research agenda, the differential efficacy of CED with respect to post-colonial economic and political institutions would necessitate further empirical enquiry. It can be conjectured that colonial mentality of colonized originating in educational disparity would exert greater incidence on governance capability of political institutions however with a potential of spillovers to economic performance. Moreover, it would be worthwhile to examine the damages

inflicted on pre-colonial governance capability and cumulative state experience in regimes witnessing early and late demise of colonial rule.

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Appendix Table A.1: Description of Variables and Sources of Data

Variable	Definition & construction	Source(s)	N	Mean	SD
Accumulated state exp. ₁₋₁₅₀₀	Standardized values of State history index from year 1 to 1500.	Borcan et al. (2018).	105	0.23	0.26
ln Popden ₁₅₀₀	Density of pre-colonial population measured in year 1500 (persons per km ²).	Putterman and Weil (2010).	128	0.96	1.76
Percent uneducated at indep.	Percent uneducated at indep. For countries that gained independence before 1870s, we use percentage of uneducated in 1870 as proxy.	Compiled / constructed using data from Barro and Lee (2013); Lee and Lee (2016).	95	68.31	29.84
CED	Colonial education disparity index. (See text for details on construction).		95	2.52	1.79
ln Setter mortality	ln European settler mortality rate	Acemoglu et al. (2001). Reported in Teorell et al. (2020).	86	4.61	1.29
ln Latitude	Log Latitude (absolute value).	La Porta et al. (1999).	95	0.21	0.13
GrY ₉₀₋₁₇	Average growth rate of per capita GDP at constant 2010 dollars (1990-2017).	Computed from World Bank (2020).	95	1.97	1.68
lnY ₀	Log Initial per capita GDP in 1990 (constant 2010 dollars).		89	7.72	1.37
GrPop ₉₀	Population growth rate (1990).		90	2.26	1.15
Popden ₉₀₋₁₇	Population density (averaged 1990-2017).		94	197.22	682.33
Rule of law ₉₅₋₁₇	World Bank Governance Indicators (WGI) rule of law index (1995-2017). Ranges from -2.5 (worst outcome) to 2.5 (best outcome).		95	-0.32	0.86
Control of corruption ₉₅₋₁₇	WGI control of corruption index (1995-2017).		95	-0.29	0.87
Govt. effect. ₉₅₋₁₇	WGI government effectiveness index (1995-2017).		95	-0.25	0.86

State Fragility ₉₀₋₁₇	Funds for Peace Failed States Index (1990-2017. Ranges from 0 (lowest intensity/most stable) to 10 (highest intensity/least stable).		94	75.73	20.84
DEM ₉₀₋₁₇	Polity IV democracy index (1990-2017). Ranges from +10 (strongly democratic) to -10 (strongly autocratic).	Computed using data compiled at Teorell et al. (2020).	90	2.49	5.74
Economic Freedom ₉₀₋₁₇	Fraser Institute economic freedom of the world index (1990-2017). Ranges from 0 (less “economic freedom”) to 10 (“more economic freedom”).		91	6.45	0.9
ln Price of investment ₉₀	Log Real price level of investment (1990).	Feenstra et al. (2015).	90	-0.83	0.56
