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Quality of Institutions and the Allocation of Talent: Cross-National Evidence

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I. INTRODUCTION

Primacy of institutions for economic development is a firmly established fact. Institutions affect economic outcomes via the allocation of resources, including human capital, which can be deployed for directly productive or unproductive purposes (Baumol 1990; Murphy et al., 1993). Strong institutions secure property rights and otherwise reward productive activities, whereas when institutions are weak, unproductive activities, such as rent seeking, have greater appeal and offer higher payoffs to human capital. Muprhy et al. (1991) conjectured that the impact of institutions on the allocation of talent between productive and unproductive activities could be detected in the choices of fields of study by university students around the world. So far, this conjecture has not been fully tested and confirmed empirically at the cross-country level, which is the purpose of the present paper.

Poor institutions usually suppress investment activities (Gwartney et al., 2006), but investments in human capital stand out as an exception form this rule. Over the last few decades, educational attainments, including tertiary education, were steeply rising across the developing world,[1] and this growth was not limited to countries with better institutions. Growing popularity of education is explained by its high *private* rates of return, available irrespective of institutional quality; however, in many countries the contribution of education to economic growth and welfare was close to zero or even negative (Pritchett, 2001). This "micro-macro" paradox is usually explained by the misallocation of educated labor to "individually remunerative yet socially wasteful or counterproductive activities"

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[1]See e.g. http://data.uis.unesco.org/; http://datatopics.worldbank.org/education/).

(ibid, p. 368), in response to the reward structures distorted by bad institutions. In other words, institutions matter when it comes to *public* returns to human capital.[2]

Universal appeal of higher education, irrespective of institutional quality, *and* the sensitivity to institutions[3] of the career choices by educated individuals, suggest that the selection of fields of university studies could be indeed a good opportunity to identify and estimate the impact of institutions on the allocation of human capital. Such selection, being one of the lifetime's most important investment decisions, reflects anticipated rewards (educational premiums) in different occupations, approximating to various degrees productive and unproductive activities.

We follow Murphy et al. (1991) in considering university education in sciences as an investment specific to productive activities, whereas legal education as potentially helpful in unproductive redistribution. Obviously, lawyers are the carriers of "legal human capital" (Hadfield, 2007), and the legal profession is necessary to uphold the legal capacity of a state – such capacity facilitates investments and otherwise provides foundation for productive activities (Besley and Persson, 2011). However, abnormally high popularity of legal education could be an indication of institutional pathologies which result in stronger appeal of unproductive redistribution over directly productive activities. Therefore, *variations* of such popularity between countries of the world could be expected, *ceteris paribus,* to follow the variations of institutional quality, for which the graduations in law and sciences could indeed serve as opposite "litmus tests". Murphy et al. (1991) observed a cross-country correlation between graduations in these fields and economic growth, arguing that it reflects not just contributions of particular professions to economic outcomes, but also reveals a more fundamental link between institutions and growth. However, to fully support this argument empirically, one needs to independently verify two effects – the relevance of the allocation of talent for economic growth *and* the relevance of institutional quality for the allocation of talent. Only the first of these effects was found in the above paper, and we undertake here to demonstrate the second one.

Combining various institutional indexes from the World Bank's Governance Matters database with UNESCO's data on graduation of university students in different programs from over 100 countries of the world, we observe a strong positive cross-country association between the quality of institutions and the

[2]Various cross-country studies (see e.g. Rogers, 2008; Armellini, 2012; Natkhov et al., 2018) indicate that institutions and human capital complement each other as factors of economic well-being; put differently, institutions serve as a moderator, in the sense of (Baron, Kenny, 1986), of the economic payoff to human capital. In a recent seminal contribution to the "micro-macro" debates, Marconi (2018) demonstrates that another moderating factor is age – higher educational attainments of older individuals are associated with higher growth rates.

[3]To avoid ambiguity inherent in using the term "institutions" in the context of post-secondary education, we should clarify that throughout the paper this term refers to instructions -"rules of the game" (North, 1990), and not to institutions of higher learning – universities, colleges etc.

graduation in sciences, and an even stronger negative one – between institutional quality and the graduation in law. In contrast with these clear-cut linkages, no other field of study in UNESCO's classification exhibits statistically significant correlation with institutional quality.

To address the concern that our findings could be driven by omitted variables, we control for various factors other than institutions that could conceivably affect graduation in law and sciences, such as GDP per capita, size of government, R&D spending, percent of tertiary educated, natural resources, structure and openness of national economy, emigration of university graduates, legal origins, etc. Regression results remain remarkably robust to such controls, rendering most of them statistically insignificant "in the shadow of institutions".

As another robustness check, we estimate empirical models for various sub-samples of countries, and obtain qualitatively identical results. Of particular interest is the sub-sample of transition economies. Prior to transition, institutions and educational systems in these countries exhibited significant uniformity, but subsequently, in a large-scale "natural experiment", a profound institutional divergence has occurred within the group, and talent allocation patterns closely followed and matched institutional variations. We use instrumental variables for this group of countries, as well as for former colonies, to address the concern that our estimations could be affected by endogeneity bias. We also estimate panel regressions for the sub-sample of transition nations, taking advantage of fluidity of institutions in these countries even within a relatively short observation period, and detect the same response of the allocation of talent to variations of institutional quality – this time both between and *within* individual countries.

To further demonstrate the salience of institutions for the allocation of talent, we consider several factors other than institutions *per se,* such as French legal origin, the size of informal economy, economic inequality, and trust in civil servants, which could directly affect the demand for legal services and indeed are correlated with graduation in law. However, these factors are also correlated with institutions, and the latter win a "horse race" with other predictors of the allocation of talent: once institutions are controlled for, the above alternative explanations become statistically unrelated of the popularity of legal profession.

We also consider the quality of post-secondary education as a possible allocation of talent driver, which could be in turn be affected by the institutional quality, in which case the quality of education would serve as a mediator (Baron and Keeny, 1986) in the observed link between institutions and the allocation of talent. However, such mediation turns out to be statistically insignificant, which shows that the direct impact of institutions on the allocation of talent dominates over the indirect one, via the quality of post-secondary education.

Finally, the allocation of talent sheds light on the "micro-macro paradox": we present direct confirmation of Pritchett's conjecture that the wedge between private and public returns to education could be driven by the (mis)allocation of

talent between productive and unproductive activities in response to institutional quality.

The rest of the paper proceeds as follows. In Section II we review the available body of knowledge on the impact of institutions on human capital deployment. In Section III we present our empirical evidence, including baseline estimations of econometric models relating the allocation of talent to the quality of institutions. In Section IV we perform robustness tests for various sub-samples of nations, and pay particular attention to former colonies and post-communist countries. In Section V we demonstrate primacy of institutions over other potential drivers and determinants of the graduation in law and the allocation of talent more generally. Section VI gives evidence that the allocation of talent affects the social rate of returns to "educational capital". Section VII concludes.

II. INSTITUTIONS AND HUMAN CAPITAL DEPLOYMENT: A REVIEW

While central role of institutions and human capital for development is rarely questioned, their relative significance, direction of causality, and interplay are still debated in the literature (see e.g. Glaeser et al., 2004; Acemoglu et al., 2014). One of the basic tenets of modern institutional theories is the impact of institutions on the allocation of human capital between productive and unproductive activities is a. According to North (1990), the choice between production and expropriation ("piracy") is driven by the rules of the game in society and economy. Baumol (1990) explains ebbs and flows in entrepreneurship and innovations by uneven relative payoffs in productive activities and rent-seeking, arguing that these payoffs direct entrepreneurial energy into either conventional innovations or "parasitical existence" damaging the economy. Murphy et al. (1991) stress the importance for growth of the choices made by top talents between productive entrepreneurship and rent-seeking in response to the prevailing reward structure. Talent could be misallocated when private incentives differ from social payoffs, and such a wedge is typical for bad institutions. More generally, weak protection of property rights re-deploys human resources away from production, where payoffs are vulnerable to expropriation, to rent-seeking (Tollison, 1982), which thrives on such vulnerability until rent-seekers start crowding out each other (Murphy et al., 1993). The reward structure affects the allocation of human resources between production and rent-seeking, and in turn itself depends on such allocation, so that multiple equilibria are possible (ibid; Acemoglu, 1995).

The aforementioned lack of systematic contribution of education to economic growth reflects the same phenomenon of human capital diversion from socially productive applications to unproductive ones. According to the endogenous growth views, education is expected to produce positive externalities increasing total factor productivity. In reality, under bad institutions, more educated and

hence more productive labor is deployed in rent-seeking causing *negative* externalities and driving social payoff to education down, possibly into the negative territory (Pritchett, 2001).

Mehlum et al. (2006) incorporate the impact of institutions on the allocation of human resources into a 'resource curse' theory by arguing that with poor institutions, resource wealth multiples the appeal of rent-seeking by increasing the pie available for grab, and hence draws entrepreneurs away from production and turns them into grabbers. This has an adverse effect for growth, and the magnitude of such effect could be large enough to leave an economy with a resource manna worse-off, notwithstanding the natural wealth.

There are reasons to expect that the allocation of *higher* talents between productive activities and rent-seeking is more sensitive to institutional quality.[4] Murphy et al. (1991) explain this effect by increasing returns to ability in entrepreneurial position, and by unequal economies of scale in production and rent-seeking depending on the quality of institutions. Alexeev et al. (2018) describe another mechanism, based on the conventional assumption that talent is an effort multiplier, and hence higher ability individuals are more sensitive to payoff differentials per unit of effective labor in production and rent-seeking, than those with lower ability.

Empirical confirmation of the impact of institutions on the allocation of talent, measured by the choices of fields of study by university students, so far has been limited. Natkhov and Polishchuk (2012) presented preliminary evidence of correlation between institutional quality and graduation in, resp., sciences and law, at the cross-country level. They also observed a similar phenomenon for Russian regions which exhibit significant variations in the quality of local institutions, with predictable effect for the popularity of law and public administration, on the one hand, and of engineering, on the other, among Russian students.

Ebeke et al. (2015) brought to an empirical test the impact of resource curse on the allocation of talent, and found that for a sample of developing countries graduation of university students in two groups of fields, resp. law, business, and social sciences; and engineering and technical sciences, is affected by resource wealth and the quality of national institutions in a manner predicted by Mehlum et al., (2006). Finally, Alexeev et al. (2018) used a micro data set of enrollment of over a million Russian university students in different areas of studies to show that students with higher abilities (measured by SAT-like test scores taken prior to enrollment) were indeed more responsive to the quality of regional institutions when deciding to seek education in STEM (science, technology, engineering, and mathematics) or in law and public administration.

[4]This effect amplifies the impact of institutions on growth, which is in large part driven by the ablest individuals in key managerial and entrepreneurial positions.

III. EMPIRICAL EVIDENCE

In this section, we put to a comprehensive test the hypothesis that in countries with a firmly established rule of law and adequate protection of property rights, one should observe stronger interest in education preparing students for productive activities, whereas poor institutions raise the attractiveness among younger people of subject areas that could equip for redistribution.

III.1. Data description

As in Murphy et al. (1991), we use, with appropriate caveats stated in the Introduction, the share of law school graduates as a proxy for the allocation of talent to redistribution. The share of those majoring in sciences (broadly defined to include life and physical sciences, mathematics, and computer sciences) is our proxy of talent allocation towards directly productive activities.

Our source of data of student graduation is the UNESCO Institute of Statistics,[5] which stores information on the number of graduates in tertiary education for 23 educational programs in 102 countries over the period from 1999 to 2009. We use a diverse set of countries, ranging from successful market democracies to low-income third world nations, to ensure a sufficient variation of our main independent variable – the quality of institutions – within the sample. The database has quite a few missing values; for example, data on law school graduates are available for 26 countries in 2009, 47 countries in 2008, but for only 9 countries in 2007. To maximize the number of observations, we treat the dataset as a cross section, and take the latest available graduation data for a given field in a country. This should not significantly bias our results for two reasons. First, the cross-discipline structure of post-secondary education could be "sticky" due to supply-side constraints and multi-year span of academic programs. Second, most of the data are available for more recent years close to 2009: for instance, 80% of our data on law and science graduates are from the 2005-2009 period, so the coverage of this period is fairly accurate and complete.[6]

To measure the quality of institutions, we use the well-known World Bank's Governance Matters database (Kaufmann et al., 2010) and select the following measures of institutional quality, directly relevant for the allocation of human capital between productive and non-productive activities: rule of law (including the quality of contract enforcement, property rights, and courts); government effectiveness (quality of public service, policies, and independence from political pressure); and prevention of corruption and state capture. In addition, given the

[5]We are grateful to UNESCO's Chiao-Ling Chien and Albert Motivans who kindly provided detailed data not available from UNESCO's open-access sources.

[6]We cannot extend our dataset past 2009, because for later years UNESCO was not reporting graduation in law, pooling it instead with some other disciplines.

centrality of property rights protection for our analysis, we add the Heritage Foundation's property rights index to the list (Miller and Holmes, 2010). We average these indexes over the 2000-2005 period and use the results as explanatory variables. Such choice of timing provides some initial assurance that the causality we seek to establish indeed runs from institutions to the allocation of talent (measured primarily for the 2005-2009 period); furthermore, this timing reflects a lag between the choice of a subject area and students' graduation.

Our analysis incorporates various controls which can be expected to affect the allocation of talent, such as GDP per capita, structure of the economy (share of services, manufacturing and agriculture, exports of manufacturing goods), enrollment in post-secondary education (as a percentage of the corresponding age group), public sector size, natural resources, and emigration of post-secondary degree holders to OECD countries (all from the World Development Indicators database), oil reserves (CIA World Factbook), economic inequality measured by the Gini index (United Nations Statistical Database), and ethno-linguistic heterogeneity measured by Alesina et al.'s (2003) ethnic fractionalization index. We also use data on legal origins, informal economy, trust in civil servants, and global rankings of national universities, taken respectively from La Porta et al. (1999), Schneider (2005), Aghion et al. (2010), and QS World University Ranking. Altogether the sample includes 95 countries for which all of the above dependent, independent, and control variables are available.

Table 1 contains descriptive statistics for the main variables. The table shows such statistics for all countries in the sample and also for the sub-samples with stronger and weaker institutions above and below the median value of the Rule of Law Index. In each case, we report means and standard deviations (in parenthesis), and the total number of countries for which data are available.

A comparison of enrollment levels for the above sub-samples immediately reveals stark differences in the allocation of talent between countries with strong and weak institutions. Thus, the average share of law school graduates in the countries with weaker rule of law (used as a sorting factor) is almost twice as high as in countries where rule of law is stronger. Conversely, the average share of science graduates for countries with above the median Rule of Law Index is more than 40% higher than the same share for countries below the median. These differences are statistically significant at the 1% level.

The discrepancy in enrollment between the two groups of countries is even more striking if we use differences between the shares of law and science graduates, which measure relative attractiveness of different fields of study. For countries with weaker institutions, the average of such differences is positive and equals 1.43 percentage points, whereas for countries with stronger institutions it is negative and equals 5.52 percentage points. In what follows we treat this difference as a yet another dependent variable whose distribution is closer to the normal than the distributions of enrollments in law and science taken separately.

Table 1

Descriptive statistics

	All countries (1)	Strong institution countries (2)	Weak institution countries (3)
A. Allocation of talent measures			
Share of Law graduates, %	6.22 (4.90)	4.21 (2.90)	8.27 (5.66)
Share of Science graduates, %	8.30 (4.63)	9.72 (4.92)	6.84 (3.85)
Difference between shares of law and science graduates, %	-2.08 (7.15)	-5.52 (5.90)	1.43 (6.64)
B. Institutional quality indexes			
Rule of Law, average index for 2000-2005	0.13 (1.01)	1.00 (0.63)	-0.74 (0.36)
Government Effectiveness, average index for 2000-2005	0.25 (1.02)	1.09 (0.71)	-0.59 (0.39)
Control of Corruption, average index for 2000-2005	0.19 (1.05)	1.03 (0.79)	-0.68 (0.37)
Private Property Protection, average index for 2000-2005	3.5 (1.13)	4.25 (0.81)	2.7 (0.82)
C. Controls and other variables			
GDP per capita, PPP, in 2005 dollars	15064 (13 873)	24 597 (13 378)	5 329 (4 337)
Average GDP growth rate per capita, 1990-2010, %	2.03 (1.57)	2.07 (1.00)	2.08 (1.98)
Tertiary education, gross enrollment ratio, %	40.8 (27.9)	55.3 (23.3)	26.0 (24.2)
Average Years of Tertiary Schooling (age 15 and more)	0.30 (0.24)	0.38 (0.23)	0.19 (0.21)
Change in Average Years of Tertiary Schooling 1990-2010	0.19 (0.18)	0.24 (0.17)	0.13 (0.18)
Cognitive Skills	4.60 (0.52)	4.74 (0.48)	4.12 (0.37)
Services, value added, % GDP	59.0 (14.0)	66.4 (11.3)	51.6 (12.5)
Government expenditure, % GDP	16.6 (5.7)	18.5 (4.2)	14.5 (6.5)
Proved crude oil reserves, million barrels	10 346 (38 457)	9 983 (45 281)	10 716 (30 445)
Ethnolinguistic fractionalization index	0.39 (0.25)	0.30 (0.21)	0.47 (0.25)
Gini index	0.39 (0.10)	0.33 (0.07)	0.45 (0.08)
Trade, ratio to GDP	0.90 (0.54)	1.03 (0.64)	0.76 (0.37)
Emigration rate of tertiary educated, %	14.1 (13.8)	12.7 (11.4)	15.6 (15.9)
Log Population	16.2 (1.5)	15.9 (1.5)	16.5 (1.4)
French Legal Origin	0.43	0.31	0.57
Unofficial Economy, % GDP	27.5 (14.03)	20.9 (8.9)	40.4 (13.7)
Distrust in civil servants, %	13.9 (9.2)	12.7 (7.0)	16.7 (13.3)
Number of Universities in top 500 QS rating per million of population	0.042 (0.09)	0.079 (0.10)	0.0004 (0.001)
Observations	95	48	47

Notes: Mean values of main variables with standard deviations in parentheses. Values of GDP per capita, Tertiary Schooling, Services, Oil reserves, Gini, Government Expenditures, Trade and Population are for 2009. Emigration data are for 2000. Average GDP growth data are from the last update of Penn World Tables 7.1. Tertiary education and change in tertiary education data are from the Barro-Lee (2001) dataset. Cognitive skills data are from Hanushek and Woessmann (2012).

III.2. OLS regressions

We start with estimating the following cross-country regressions relating the allocation of talent to indexes of institutional quality:

$$(Un)productive\ Activities_i = \beta_0 + \beta_1 Institutional\ Quality_i + \beta_2 X_i + \varepsilon_i, \quad (1)$$

where *(Un)productive Activities* measures reflect the allocation of talent between subject areas of post-secondary education, *Institutional Quality* is one of the indexes listed above, X_i is a vector of control variables, and ε_i is the error term. The coefficient of interest is β_1 capturing the impact of institutions on the allocation of talent.

We employ an extensive set of controls to reduce the likelihood of an omitted variable bias. Our controls are factors other than institutions that could possibly influence the allocation of talent and which are commonly used in similar cross-country analyses.[7] Thus, we control for GDP per capita since it is plausible that wealthier and poorer countries have different reward structures which are not directly related to the quality of their institutions (e.g. Murphy et al., 1991) emphasize the importance of scale economy in the allocation of talent). Furthermore, it is conceivable that more economically advanced countries are able to afford more "capital-intensive" education in sciences, and this supply-side effect could have an impact on the allocation of talent. In the same vein, we control for country-level R&D expenditures, as this affects the demand for those trained in sciences, and poor countries invest in R&D far less than rich ones not only in absolute, but also in relative terms (Goñi and Maloney, 2014). We also control for GDP structure measured by the share of services and manufacturing in GDP (and manufacturing exports), which could be correlated with the demand for respectively lawyers and scientists. There could be a link between the size and structure of the student body, and we add to the controls the aggregate enrollment in tertiary education.

Allocation of talent could be affected by natural resources in what is known as the "resource-curse syndrome" (Gylafson, 2001), when a massive resource sector suppresses investments in human capital and increases the relative attractiveness of rent-seeking over productive activities (see also Mehlum et al., 2006, and especially Ebeke et al., 2015). To account for such link, we use oil reserves as a control variable. Our controls also include population (as a proxy for market size) and general government expenditure (% of GDP) as a proxy for government size, which according to Murhy et al. (1991), and Pritchett (2001), might influence the allocation of talent. Economic and ethnic polarizations are controlled for by using the Gini and ethnic fractionalization indexes. The trade-to-GDP ratio

[7]See e.g. Barro (1991); Knack and Keefer (1995); Hall and Jones (1999); La Porta et al. (1999); Acemoglu et al. (2001); Rodrik et al. (2004).

reflects the openness of national economies, which can also be relevant for the allocation of talent (Hanushek and Woessmann, 2008).

Another potentially pertinent control variable is legal origin, which directly shapes the legal system and hence should affect the demand for law practitioners. On the one hand, litigation under common law, due to its adversarial nature, requires more trial lawyers than civil law, where trials are inquisitorial and hence less lawyer-intensive (Tullock, 1975). On the other hand, regulation under civil law is usually more complex and cumbersome (La Porta et al., 2008) and more legal professionals are needed to help individuals and businesses to clear regulatory hurdles.

Last but not least, emigration of tertiary educated could disconnect educational choices from the quality of national institutions. This is of lesser concern for education in law which is a highly country-specific trade. Education in sciences is more "portable" than in law (Mariani, 2007), and much of brain drain occurs in the STEM (science, technology, engineering, mathematics) fields (Gibson and McKenzie, 2011). Therefore, the prospect to emigrate could strengthen the relative attractiveness of sciences vs. law irrespective of domestic factors (in fact, in what is known as "beneficial brain drain," an increase in the enrollment in sciences and other "brain drain" fields, which is driven by the prospect to emigrate, could exceed the actual emigration – see e.g. Docquier and Rapoport, 2012). To account for this possibility, we control for the emigration rate of post-secondary degree holders.

In the first specification, we estimate model (1) with the share of law graduates as a dependent variable, and report results in Table 2. In the first column with no control variables, the coefficient of the Rule of Law Index is, as expected, negative and highly significant. Next we gradually add the above described control variables (Columns (2)-(8)). In all of these specifications the negative association between institutional quality and graduation in law remains significant at the 1% level. These estimations show that, ironically, an increase in lawlessness is associated with growing popularity of legal education.

Unlike the explanatory variable, most of controls turn out insignificant. Population is significant due to an "economy of scale" effect, which however disappears after the elimination from the sample of four small country outliers (we omit this estimation from the table). Oil reserves have a positive coefficient which is significant in some specifications; this agrees with the expected impact of the "resource curse" on the allocation of talent. The coefficient of the openness index is also mildly significant and negative, perhaps reflecting the well-established contribution of international trade to the global competitiveness of the national economy (Frenkel and Romer, 1999), which reduces opportunities for rent-seeking.[8] The

[8]Hanushek and Woessmann (2008) use openness to international trade as a yet another measure of institutional quality and show that it enhances the contribution of cognitive skills to economic growth. Our regression results reported in Table 2 indicate that the link between openness and social return to human capital involves the allocation of talent, as predicted by Pritchett (2001). More on this in section VI.

Table 2

OLS regressions for share of law school graduates

	Dependent variable: *Share of Law graduates*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rule of Law	-0.380***	-0.530***	-0.589***	-0.578***	-0.581***	-0.563***	-0.486***	-0.580***	-0.466***
	(0.100)	(0.161)	(0.172)	(0.168)	(0.171)	(0.170)	(0.168)	(0.207)	(0.119)
Log GDP per capita		0.218	0.218	0.207	0.232	0.0571	0.157	0.152	-0.0461
		(0.170)	(0.167)	(0.174)	(0.181)	(0.194)	(0.220)	(0.321)	(0.128)
School Tertiary		-0.335	-0.422	-0.433	-0.366	-0.0516	-0.581	-0.0209	0.609*
		(0.516)	(0.471)	(0.471)	(0.481)	(0.461)	(0.514)	(0.566)	(0.359)
Services, % of GDP			0.777	0.837	0.776	1.500	1.466	0.197	1.770**
			(1.014)	(1.040)	(1.053)	(1.060)	(1.046)	(1.392)	(0.832)
Log Oil reserves				0.00545	-2.57e-05	0.0626**	0.0542	0.0388	0.0575**
				(0.0259)	(0.0255)	(0.0307)	(0.0375)	(0.0450)	(0.0238)
Ethnic Fractionalization					0.285	0.327	0.286	0.352	-0.116
					(0.542)	(0.509)	(0.503)	(0.515)	(0.342)
Log Population						-0.219***	-0.357***	-0.335***	-0.178***
						(0.0779)	(0.0886)	(0.106)	(0.0596)
Gini coefficient							0.925	0.648	
							(0.0134)	(1.314)	
Trade to GDP ratio							-0.526**	-0.351	
							(0.00228)	(0.240)	
Emigration rate of tertiary educated, %								-0.00199	
								(0.0132)	
Government expenditure, % GDP								0.0285	
								(0.0254)	

(Continues)

Table 2. (Continued)

	Dependent variable: *Share of Law graduates*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
French Legal Origin =1								0.522*	
								(0.295)	
R&D spending, % GDP								0.136	
								(0.142)	
Export of manufactured products, % total export								-0.152	
								(0.537)	
Constant	0.109	-1.707	-2.123	-2.072	-2.379	1.947	3.726	3.210	1.749
	(0.105)	(1.362)	(1.319)	(1.337)	(1.470)	(2.125)	(2.658)	(3.882)	(1.571)
Observations	95	95	95	95	95	95	81	72	87
R-squared	0.145	0.165	0.171	0.171	0.175	0.230	0.322	0.400	0.278

Notes: Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0$. Columns (1) to (8) report OLS estimations of model (1) with different sets of control variables, and column (9) – with excluded outliers Angola, Cameroon, Colombia, Madagascar, Mauritania, Mozambique, Swaziland and Malta). Regression coefficients for the Rule of Law index are standardized beta.

coefficient of government expenditure is positive, as suggested by Pritchett (2001), although statistically insignificant. The share of services in GDP has a positive but statistically insignificant effect; shares of manufacturing and agriculture (not reported in the table) turn out to be insignificant either. Finally, countries with French legal origin have ceteris paribus more law graduates than common law countries (see also Section V). Overall institutional quality clearly stands out among other covariates as the only strongly and consistently significant factor across all specifications.

An inspection of post-estimation residuals reveals several outliers – Angola, Cameroon, Colombia, Madagascar, Mauritania, Mozambique, Swaziland and Malta, which represent mostly low- and lower middle-income countries with weak institutions. To ensure that our results are not driven by the outliers, we exclude them from the sample and report this estimation in Column (9). The Rule of Law Index remains statistically significant at the 1% level with a slightly lower coefficient: an increase by one standard deviation in the rule of law is associated with a decrease of 0.47 standard deviations in the share of law graduates. The scatter plot for this estimation is presented in Figure 1.

In the next regression (Table 3), the dependent variable is the share of science graduates, while the procedure otherwise remains the same. This time the coefficient of interest is positive, as expected, and in most specifications significant at the 1% or 5% levels. On average across specifications, an improvement by one standard deviation in the rule of law, holding other factors constant, is associated with an increase by 0.25 standard deviations of the share of science graduates.

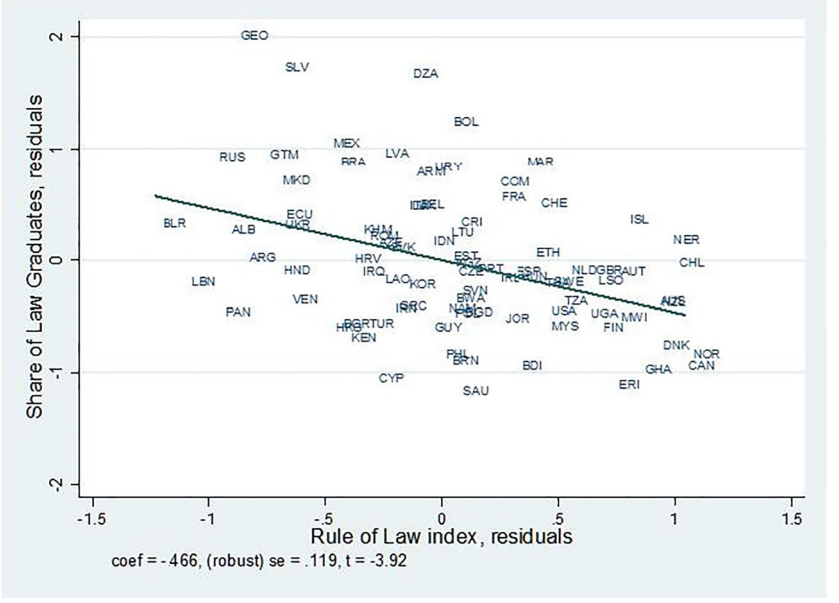
Figure 2 shows the scatter plot for Column (9) with eliminated outliers. In this case, too, controls are mostly insignificant; the only exception is the share of population with post-secondary degree, but this effect is also driven by outliers and disappears once those are removed from the sample. It is noteworthy that "brain drain" measured by emigration of tertiary educated individuals has a positive (as expected), but insignificant coefficient.[9]

Similar regressions of graduation in other fields of study from the UNESCO dataset (not reported here) serve as "placebo tests" and show in none of these

[9]We do not have country-level data on emigration of post-secondary degree holders in sciences, and use instead as a proxy the emigration rate of all tertiary educated. This could be a reasonable proxy, since scientists, teachers and academics, medical professionals, engineers and IT specialists are most numerous among university-educated migrants to the US and other OECD countries (Gibson and McKenzie, 2011), and these destinations absorb 85% of high-skill migration (Docquier and Rapoport, 2012). Besides, some stylized facts indicate that emigration is unlikely to cast doubt on our results. First, recently there has been a relative decline of brain drain as a percentage of post-secondary degree holder (Gibson and McKenzie, 2011); furthermore, those intended to emigrate have better opportunities to do so as students, rather than graduates (Docquier and Rappoport, 2012). Second, most of the "brain drain" is "south-to-north" (with some lateral movement), i.e. in the direction where institutions usually improve. It means that for graduation in sciences net of graduates' emigration, the observed association between institutions and the allocation of talent would in all likelihood be even sharper.

Figure 1

Quality of institutions and graduation in law [Colour figure can be viewed at wileyonlinelibrary.com]



Note: Conditional correlation scatterplot for OLS estimation in column (9) of Table 2.

other fields statistically significant associations with the rule of law or any other commonly used institutional indicators. This means that graduations in sciences and law are the only "litmus tests" of institutional quality, which agrees with the hypothesized impact of institutions on the allocation of talent.

Since the quality of institutions is negatively associated with the share of law students and positively – with the share of those majoring in sciences, the difference between these two shares should exhibit particularly high sensitivity to institutions. We test this for all four of our institutional performance measures, and present in Table 4 the estimation results with the main control variables included. All four indexes of institutional performance are strongly negatively linked with the dependent variable, which is consistent with our hypothesis. The strength of this connection can be seen from the fact that a one standard deviation increase in the Rule of Law Index is associated with a 0.55 standard deviations decrease in the difference between the shares of law and science graduates. The scatter plot for the estimation with the Rule of Law Index as the dependent variable (Figure 3) further illustrates this clear-cut link.

Table 3

OLS regressions for share of science graduates

	Dependent variable: *Share of Science graduates*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rule of Law	0.234***	0.257***	0.205*	0.258**	0.258**	0.252**	0.262**	0.353**	0.326***
	(0.0740)	(0.0970)	(0.106)	(0.120)	(0.120)	(0.118)	(0.117)	(0.143)	(0.0919)
Log GDP per capita		0.194	0.194	0.134	0.137	0.191	0.250	0.120	-0.000884
		(0.137)	(0.132)	(0.142)	(0.148)	(0.148)	(0.179)	(0.206)	(0.110)
School Tertiary		-1.261**	-1.339**	-1.395**	-1.386**	-1.482***	-1.179**	-0.966	-0.470
		(0.565)	(0.574)	(0.574)	(0.563)	(0.558)	(0.495)	(0.607)	(0.293)
Services, % GDP			0.700	1.020	1.012	0.789	0.235	0.577	-0.0459
			(0.744)	(0.714)	(0.707)	(0.746)	(0.736)	(1.148)	(0.599)
Log Oil reserves				0.0289	0.0281	0.00887	-0.0119	-0.00170	0.00421
				(0.0211)	(0.0226)	(0.0272)	(0.0286)	(0.0369)	(0.0214)
Ethnic Fractionalization					0.0378	0.0249	0.493	0.213	0.125
					(0.356)	(0.360)	(0.380)	(0.402)	(0.291)
Log Populaion						0.0674	0.114**	0.0915	0.0773*
						(0.0530)	(0.0509)	(0.0956)	(0.0425)
Gini coefficient							-0.0210	-0.0812	
							(0.845)	(0.985)	
Trade to GDP ratio							0.289	0.413	
							(0.248)	(0.337)	
Emigration rate of tertiary educated, %								0.00423	
								(0.00873)	
Government expenditure, % GDP								-0.0265	
								(0.0205)	

(Continues)

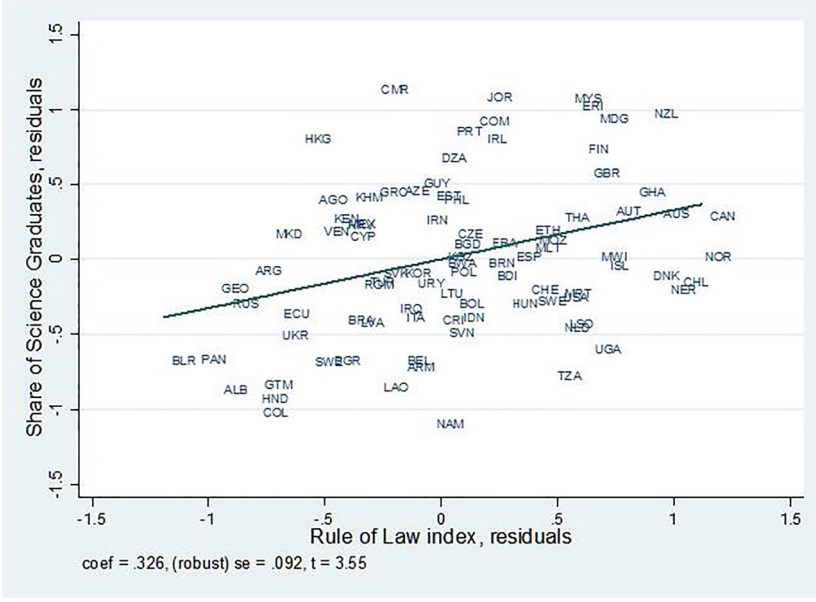
Table 3. (Continued)

	Dependent variable: *Share of Science graduates*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
French Legal Origin =1								0.0979	
								(0.198)	
R&D spending, % GDP								0.0207	
								(0.138)	
Export of manufactured products, % total export								0.112	
								(0.492)	
Constant	-0.240***	-1.487	-1.861	-1.594	-1.635	-2.964*	-4.487**	-2.963	-1.453
	(0.0718)	(1.044)	(1.141)	(1.211)	(1.307)	(1.544)	(1.935)	(2.738)	(1.349)
Observations	95	95	95	95	95	95	81	72	90
R-squared	0.102	0.199	0.208	0.223	0.223	0.233	0.339	0.410	0.211

Notes: Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0$. Columns (1) to (8) report OLS estimations of model (1) with different sets of control variables, and column (9) – with excluded outliers Angola, Cameroon, Colombia, Madagascar, Mauritania, Mozambique, Swaziland and Malta). Regression coefficients for the Rule of Law index are standardized beta.

Figure 2

Quality of institutions and graduation in science [Colour figure can be viewed at wileyonlinelibrary.com]



Note: Conditional correlation scatterplot for OLS estimation in column 9 of Table 3.

Allocation of talent theories reviewed in the previous section suggest that the allocation of greater talents could be particularly sensitive to institutional quality. This could be another rationale for seeking evidence of the impact of institutions on the allocation of talent among university students, who should be expected to have on the average higher abilities than the general population; viewed this way, the above estimations in and of themselves lend indirect support to such theories. However, tertiary education in many countries has become a mass phenomenon, with enrollment rates approaching and even exceeding 50% in younger age cohorts (OECD 2016), and there are fewer reasons to consider university enrollment or graduation as evidence of higher talent. Furthermore, enrollment standards and procedures vary from one country to another, and our dataset does not include comparable ability measures of graduating students around the world.[10]

[10]Such information is available for students pursuing post-secondary degrees in various Russian regions, and indeed allocation of stronger talents exhibits greater elasticity to the quality of institutions (Alexeev et al., 2018).

Table 4

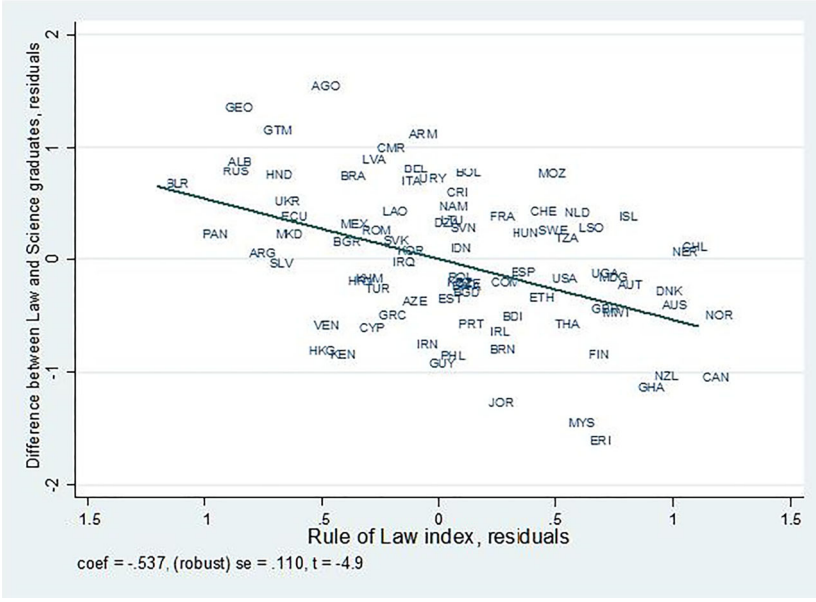
OLS regressions for difference between shares of law school and science graduates

	Dependent variable: *Difference between Shares of Law and Science graduates*			
	(1)	(2)	(3)	(4)
Rule of Law	-0.552*** (0.146)			
Government Effectiveness		-0.387** (0.152)		
Control for Corruption			-0.383*** (0.117)	
Private Property Protection				-0.294** (0.133)
Log GDP percapita	-0.116 (0.170)	-0.188 (0.188)	-0.228 (0.164)	-0.339* (0.187)
School Tertiary	1.152** (0.561)	1.153** (0.575)	1.140** (0.569)	1.013 (0.696)
Services, % GDP	0.298 (0.873)	0.0628 (0.941)	0.218 (0.890)	0.101 (0.971)
Log Oil reserves	0.0318 (0.0307)	0.0440 (0.0306)	0.0520* (0.0302)	0.0589** (0.0295)
Ethnic Fractionalization	0.182 (0.421)	0.236 (0.432)	0.144 (0.435)	0.0169 (0.518)
Log Populaion	-0.190*** (0.0671)	-0.179** (0.0682)	-0.208*** (0.0658)	-0.219*** (0.0739)
Constant	3.487* (1.994)	4.060* (2.127)	4.777** (1.848)	7.135*** (1.995)
Observations	95	95	95	83
R-squared	0.310	0.246	0.266	0.301

Notes: Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Columns (1) to (4) report OLS estimations of model (1) with different institutional quality indexes. Regression coefficients for institutional quality indexes are standardized beta.

Figure 3

Quality of institutions and difference between graduation in law and science [Colour figure can be viewed at wileyonlinelibrary.com]



Note: Conditional correlation scatterplot for OLS estimation in column 1 of Table 4.

Instead, to observe responses to the quality of institutions of higher talents, we show that more gifted individuals are reluctant to pursue careers in science and engineering in countries with inferior institutions. We find such evidence in data on locational choices of PhD holders in sciences and engineering who earned their degrees from US graduate schools. Grogger and Hanson (2013) used the National Science Foundation's Earned Doctorates Survey to conclude that foreign science and enginnering PhD holders are more likley to return to their home countries when domestic economic conditions are improving or those countries have become more democratic. We extended such analysis by including measures of home countries' instiutional quality as predictors of PhD holders' locational choices, and estimated regression equation for the percentage of science and engineering PhD holders from a given country who graduated in 2009-2011 and were intent to return to their home country upon graduation.[11] Estimation

[11]We are grateful to NORC at the University of Chicago for granting access to the NSF Earned Doctorate Survey data.

results are reported in Table 5. All four indexes of institutional quality used earlier in the paper have positive coefficients which are significant at the 0.01-0.05 levels. In these estimations, institutions dominate over economic conditions (measured by GDP per capita) and even R&D expenditures, which turned out to be statistically insignificant.

IV. SUB-SAMPLES OF NATIONS

We use various modifications of our empirical model to check robustness of the above findings, and particularly, to address the concern that our control variables do not fully eliminate an omitted variable bias that could be expected for an extremely diverse group of countries, causing an endogeneity problem. To do so, we reduce the sample to various more homogeneous sub-groups and estimate model (1) for such sub-groups with the Rule of Law Index as a measure of institutional quality and the difference between law and science graduation as the dependent variable. First, we restrict our estimation to poorer countries by excluding OECD and high-income non-OECD countries (according to the World Bank's classifications). Next, we perform the opposite exercise by retaining only the wealthier part of the sample. The two other estimations are confined to former colonies of European powers and to post-communist transition countries of Central and Eastern Europe and the former Soviet Union. Finally, in the full sample we include dummies for Asia and Africa.

The coefficient of the Rule of Law Index is negative and significant at the 1% level across all of the above specifications (Table 6). The value of this coefficient is higher for poorer countries, former colonies, and transition nations, than for the full sample.

Omitted variable bias is not the only potential cause of endogeneity – the latter could also be due to reverse causality and measurement errors.[12] Two of the above sub-samples – former colonies and transition countries – allow to address such remaining concerns by using instrumental variables.

For the sub-sample of former colonies, there is a well-known instrument for institutional quality, proposed by Acemoglu et al. (2001), i.e. the European settler mortality.[13] Albouy (2012) criticized this instrument for measurement errors and insufficient separation from other factors; for a rebuttal see Acemoglu et al. (2012). Given the dearth of valid instruments in cross-country studies, we used

[12]One could expect e.g. a reverse causality running from the cadre of lawyers to institutional quality, since legal practitioners could favor complexity of law as a source of professional rent (Hadfiled 2000)), and be self-interested in expanding the domain for litigation (Matter and Stutzer 2015). Measurement errors could be due to various imperfections of the institutional quality indexes – see e.g. Baranov et al. (2015).

[13]Nikolaev and Salahodjaev (2017) use the prevalence of infectious diseases as an instrument for cultural traits which in their turn affect institutions. In a similar vein, Ang et al. (2018) argue that exposure to ultraviolet radiation causing eye diseases is also correlated with institutional quality.

Table 5

Quality of institutions and return of science and engineering PhD holders to their home countries

	Dependent variable: *Share of foreign science & engineering PhD holders from US universities returning to their countries of citizenship*				
	(1)	(2)	(3)	(4)	(5)
Rule of Law	7.765** (3.151)				
Government Effectiveness		8.317** (3.721)			
Control for Corruption			7.826*** (2.652)		
Private Property Protection				6.456** (2.729)	
Log GDP per capita	-4.541 (3.162)	-5.487 (3.444)	-5.290* (3.047)	-4.146 (3.150)	-0.105 (2.376)
School Tertiary	-7.016 (9.214)	-6.302 (9.340)	-6.786 (8.835)	-8.216 (9.040)	-8.798 (10.76)
R&D spending, % GDP	0.562 (2.199)	0.591 (2.120)	0.455 (1.911)	2.214 (2.353)	2.816 (2.391)
Constant	69.72** (27.68)	76.70** (29.76)	76.52*** (26.49)	43.48* (21.83)	29.44 (19.97)
Observations	51	51	51	50	51
R-squared	0.130	0.118	0.145	0.167	0.034

Notes: Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Columns (1) to (5) report OLS estimations of the regression of the share of science & engineering PhD holders from US universities returning to their countries of citizenship on various institutional quality indexes.

Table 6

OLS Regressions for Sub-Samples of Nations

	Dependent variable: *Difference between Shares of Law and Science graduates*					
	Without OECD and High-Income Countries (1)	Without Low-Income Countries (2)	Post-Communist Countries (3)	Former European Colonies (4)	Full Sample with dummy for Asia (5)	Full Sample with dummy for Africa (6)
Rule of Law	-0.697*** (0.258)	-0.488*** (0.181)	-0.912*** (0.148)	-0.737*** (0.232)	-0.636*** (0.140)	-0.631*** (0.165)
Log GDP per capita	0.0930 (0.188)	-0.368 (0.239)	-0.432** (0.158)	0.0665 (0.203)	0.00175 (0.163)	-0.0149 (0.184)
School Tertiary	0.307 (0.575)	1.210** (0.557)	1.421*** (0.398)	0.0892 (0.989)	0.995* (0.545)	1.354** (0.567)
Services, % GDP	0.680 (1.055)	0.804 (0.792)	3.946*** (0.973)	1.095 (1.213)	-0.613 (0.961)	0.397 (0.878)
Log Oil reserves	0.0577 (0.0427)	0.0360 (0.0330)	-0.0205 (0.0486)	0.0654 (0.0440)	0.0153 (0.0312)	0.0301 (0.0310)
Ethnic Fractionalization	0.435 (0.460)	0.00826 (0.556)	-2.127*** (0.607)	0.264 (0.529)	-0.0105 (0.369)	0.115 (0.417)
Log Populaion	-0.288*** (0.0925)	-0.198** (0.0787)	-0.271* (0.130)	-0.210** (0.0999)	-0.133* (0.0733)	-0.187*** (0.0671)
Asia					-0.777*** (0.223)	
Africa						0.421 (0.320)
Constant	3.129 (2.554)	5.729** (2.655)	6.363** (2.404)	1.945 (2.583)	2.408 (1.988)	2.330 (2.201)
Observations	61	81	20	49	95	95
R-squared	0.29	0.36	0.833	0.33	0.41	0.32

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Columns (1) to (6) report OLS estimations of model (1) for different subsamples of countries. Regression coefficients for the Rule of Law index are standardized beta.

the settler mortality in a 2SLS estimation for former colonies, and present the results in Table 7 for various measures of institutional quality as predictors of the allocation of talent (to save space, we skip the first stage, but report its F-statistics). The instrument is weak for the Rule of Law and Control of Corruption indexes, but it is somewhat stronger for Government Effectiveness and especially for the Protection of Property Rights index (which closely resembles the institutional performance measure used by Acemoglu et al. (2001)). In the latter case, the coefficient of the fitted explanatory variable has the expected sign and is significant at the 5% level, and the F-statistics is safely above the conventional threshold of 10, ruling out a weak instrument.

We now turn to the group of transition countries, where the allocation of talent is especially sensitive to the quality of institutions: the regression coefficient of the Rule of Law index in Table 6, Column (3) is more than 60% higher than such coefficient for the full sample (Table 4, Column (1)).[14] This sub-sample is of particular interest for our analysis due to its quasi "natural experiment" features. Moscow's domination ensured high uniformity both of economic and political institutions, and of post-secondary educational systems across the former Eastern Bloc.[15] Higher education in engineering and sciences were strong priorities, whereas law schools were rare and far less prestigious and appealing to younger talents.[16] Similarity of former command economies at the outset of their transition to free market, and the availability of strong educational potential in sciences and engineering alleviate the concern that the allocation of students across fields of studies at the end of past decade was at least in part a "supply-side" phenomenon reflecting the pre-existing capacities of national university systems. The divergence in allocation of talent that ensued could then be with greater confidence ascribed to "demand-side" forces, which in their turn reflected the quality of post-communist institutions. The scatter plot (Figure 4) shows a tight relation between the quality of institutions and allocation of talent in the former Soviet Union and Central and Eastern Europe.

To further illustrate diverse outcomes of the "natural experiment" within the group, we compare Poland and Ukraine – these two nations are of about equal size, share common border and history, and have significant linguistic and

[14]Regressions for the graduations in sciences and law taken separately for this sub-sample (not reported here) produce similarly higher coefficients of institutional quality than for the whole sample.

[15]"… basic principles and methods [of higher education], as well as the academic curricula … are applied strictly on patterns devised in Moscow" (Wrenn, 1963, p. 179); "… the patterns and aims of higher education in all the European states dominated by the Soviet ideology are alike" (ibid, p. 197).

[16]This appears to be at odds with our general hypothesis, since the institutions of the command economy were obviously quite poor from the market economy's perspective. However, the logic of our hypothesis assumes a market economy, no matter how distorted, with a degree of economic freedoms and at least a modicum of private property rights. Rigid command economies did not meet such assumptions and are thus exceptions from the rule we seek to establish. However, after the collapse of central planning they confirm this rule with exceptional clarity.

Table 7

Settler mortality as instrumental variable (former European colonies)

	Dependent variable: *Difference between Shares of Law and Science graduates*			
	(1)	(2)	(3)	(4)
Rule of Law	-1.533 (0.921)			
Government Effectiveness		-1.526** (0.702)		
Control for Corruption			-1.413 (0.918)	
Private Property Protection				-0.931** (0.447)
Log of GDP per capita	0.471 (0.452)	0.627 (0.428)	0.495 (0.499)	0.828* (0.483)
School Tertiary	0.336 (2.159)	-0.0628 (1.791)	0.771 (2.302)	0.279 (1.463)
Services, % of GDP	1.778 (2.034)	1.616 (1.849)	1.587 (2.202)	-0.604 (1.487)
Log of Oil reserves	0.0395 (0.101)	0.0543 (0.0873)	0.0361 (0.108)	0.0655 (0.0766)
Ethnic fractionalization	0.0448 (0.833)	0.284 (0.698)	0.358 (0.971)	0.967 (0.932)
Log of Population	-0.263 (0.186)	-0.183 (0.163)	-0.223 (0.157)	0.0285 (0.212)
Constant	-0.964 (6.398)	-3.409 (5.792)	-1.929 (6.446)	-1.709 (4.921)
Second Stage R-squared	0.615	0.707	0.675	0.775
First Stage F-statistics	6.15	9.30	8.02	13.26

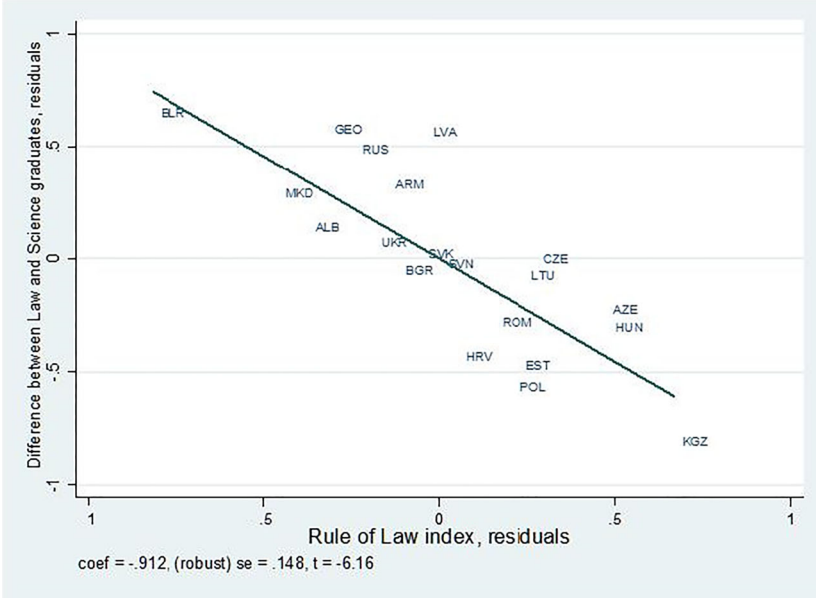
Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Columns (1) to (4) present second stage 2SLS estimations of model (1) with fitted institutional quality indexes instrumented by settler mortality at the first stage. Source of settler mortality data: Acemoglu et al. (2001). The regression coefficients reported for Rule of Law index are standardized beta.

cultural affinity. These proximities notwithstanding, Polish and Ukrainian university students have markedly different preferences over fields of study. In Poland, the share of students pursuing degrees in science was recently close to 8%, while in Ukraine it was less than 4%. At the same time, more than 8% of all Ukrainian students are studying law, whereas in Poland this share is a mere 2.5%. Pre-existing educational capacities of the two countries would suggest the opposite: prior to the breakup of the Soviet Union, Ukraine had cutting-edge research and educational facilities in science and engineering, including aviation and space technologies, whereas in Poland the tradition and culture of legal studies was stronger than in its eastern neighbor.

Demand-side forces clearly prevailed in Poland and Ukraine over those on the supply side. In the early 1990s both countries experienced an explosive growth of interest in the legal profession to fill the voids left by their pre-transition educational systems, and at that time education in science and engineering suffered a precipitous decline. However, over time the enrollment in law schools in Poland subsided and enrolment in science and engineering recovered, whereas no such adjustment has occurred in Ukraine, where the formidable capacity for post-secondary education in sciences and engineering gradually vanished (Figure 5). This discrepancy reflects uneven quality of institutions in the two countries: at the end of the past decade Poland's percentile rank on the Rule of Law global scale was around 70, whereas for Ukraine, despite the abundance of law degree holders, it was just 23.

Figure 4

Quality of institutions and difference between law and science graduation in post-Communist countries
[Colour figure can be viewed at wileyonlinelibrary.com]



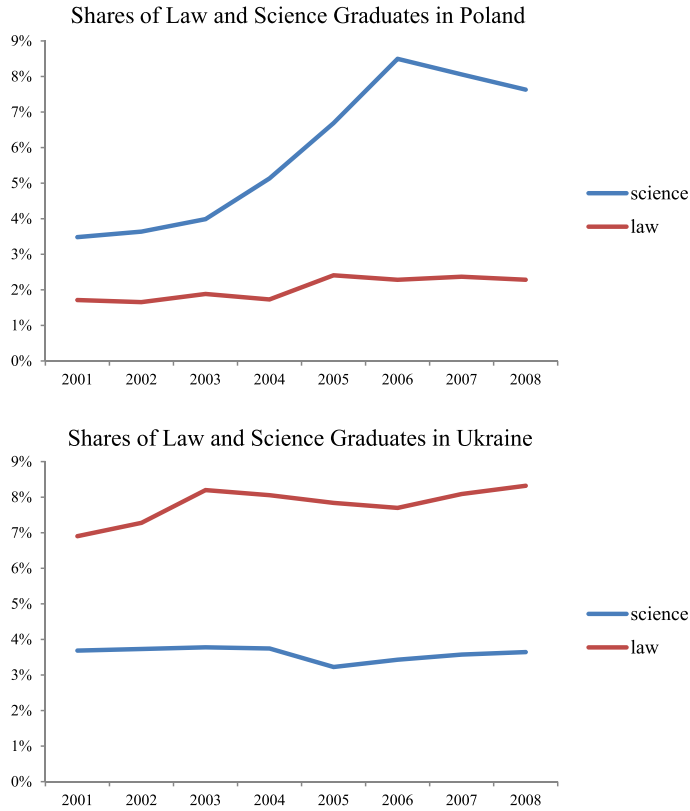
Note: Conditional correlation scatterplot for OLS estimation in column 3 of Table 6.

Our instrument for institutions in transition economies is the number of veto players (political actors with the ability to block policy change; see Tsebelis (2002)) in the early 1990s, which were the years of key post-communist reforms. The intuition behind this instrument is as follows: the number of veto players at a "critical juncture" of a fundamental institutional transformation proxies checks and balances which protected fledgling post-communist institutions from a persistent capture by narrow ("oligarchic") interests by ensuring a degree of inclusion and "plurality" (Acemoglu and Robinson, 2012). Polishchuk and Sokolov (2017) show that the number of veto players in the early 1990s is indeed a good predictor of institutional quality throughout the subsequent quarter of century period.

2SLS estimation results for the allocation of talent measured by the difference in the graduations in law and sciences, and the rule of law as the independent variable instrumented by the number of veto players, are presented in Table 8. As in the previous case, we keep only the F-statistics from the first stage. Given the small size of the sub-sample of transition nations for which we have all the

Figure 5

Law and science graduation trends in Poland and Ukraine [Colour figure can be viewed at wileyonlinelibrary.com]



Note: UNESCO Educational Statistics.

necessary data, we use a more parsimonious set of control typical for the studies of institutions in transition (see e.g. Gehlbach and Malesky 2010; Sachs 2018), i.e. GDP per capita, proximity to Europe (measured by the distance from the national capital to Dusseldorf), and resource (oil) rent as a share in GDP. We add these controls one after another (columns (1)-(4)) at both the first and second stages. All coefficients for the fitted rule of law variable have the expected sign and are statistically significant at the 10% level. In three out of four reported 2SLS specifications, including the one with full set of controls, F-statistics are above the rule-of-thumb threshold of 10, indicating that the instrument is not weak.

Table 8

Number of veto players as instrumental variable (transition countries)

	Dependent variable: *Difference between Shares of Law and Science graduates*			
	(1)	(2)	(3)	(4)
Rule of Law	-0.704*** (0.238)	-0.738* (0.408)	-0.911* (0.472)	-1.346* (0.670)
Log GDP per capita		0.0539 (0.355)	-0.0896 (0.640)	1.399 (1.272)
Distance to Dusseldorf			-0.000210 (0.000265)	0.000530 (0.000507)
Oil rents, % GDP				-0.0634* (0.0355)
Constant	0.450*** (0.114)	-0.0507 (3.310)	1.679 (6.309)	-13.31 (12.61)
Observations	22	22	20	20
Second stage R-squared	0.284	0.266	0.189	0.189
First stage F-statistics	16.51	13.23	9.63	10.84

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Columns (1) to (4) present second stage 2SLS estimations of model (1) with fitted rule of law index and expanding sets of controls. The rule of law index is instrumented by the number of veto players at the first stage. Source of veto players data: Database of Political Institutions (Beck et al., 2001). The regression coefficients reported for Rule of Law index are standardized beta.

Table 9

Panel estimations for transition countries

	(1)	(2)	(3)
	Dependent variable – graduation in law	Dependent variable – graduation in science	Dependent variable – difference between graduations in law and science
Rule of Law	-0.185** (0.0769)	0.156** (0.0769)	-0.342*** (0.112)
Controls for GDP per capita	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Constant	0.0746*** (0.0128)	0.0526*** (0.0128)	0.0245** (0.0106)
Observations	132	132	134
R-squared	0.133	0.085	0.142
Number of countries	14	14	14

Note: Unbalanced panel for 14 transition countries: Armenia, Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Poland, Romania, Serbia, Slovakia, Slovenia, Ukraine. Years: 1999-2009. Robust standard errors in parentheses; ***$p<0.01$, **$p<0.05$, *$p<0.1$

The sub-sample of transition countries allows a yet another robustness check of our results – this time to an estimation strategy, by using a panel estimation. As explained in Section III.1, we opted for cross-sectional models instead of panel regressions due to multiple missing values in our allocation of talent dataset for single years; furthermore institutions more often than not change rather slowly, and their minor variations within an eleven years-long observation period are unlikely to produce statistically significant results in a panel regression with country fixed effects. Fortunately, for the transition countries the allocation of talent dataset has much fewer omissions, and in addition those countries exhibited greater institutional fluidity echoing the dramatic transformations of the 1990s. This bodes well for a panel estimation reduced to such sub-sample;[17] the results reflecting both the between and within effects of the impact of institutions (measured by the Rule of Law index) on the allocation of talent are presented in Table 9. The impact of institutions on the allocation of talent is clearly visible in such panel, with both year *and* country fixed effects included: coefficients of interest are statistically significant at the 1% to 5% level and have the signs agreeing with our hypotheses.

V. PRIMACY OF INSTITUTIONS

Allocation of talent is affected by multiple factors other than institutions, some of which were included as control variables in previous estimations. By and large,

[17]We are grateful to the anonymous reviewer of the Journal for suggesting a panel estimation for a sub-sample of countries with more pronounced institutional variations over a more extended period of time.

these factors were insignificant "in the shadow" of institutions. Still, there are confounding variables which are linked both with institutions and the allocation of talent. We present several examples of such variables and show that without institutions they are significant in regression models for the graduation in law, but lose significance once institutions are factored in. This illustrates the primacy of institutions as root causes of the allocation of talent.

The first example is given by the share of the informal sector in the national GDP. By definition, informal economy is outside of the realm of law, which makes one to expect negative correlation between its size and the graduation in law. In fact, when graduation in law is regressed on the size of informal economy (with standard controls, but *excluding* institutional quality), the informal sector's coefficient is positive and statistically significant (Table 10, Column (1)). This counterintuitive result reflects the role of institutions affecting both variables – informal economy is inversely related to institutional quality (De Soto 1989; Djankov et al., 2002), and the latter, as demonstrated above, is in its turn negatively correlated with the graduation in law. The pivotal role of institutions becomes evident once the rule of law index is brought back into the regression – it has the expected negative sign and renders the size of informal sector statistically insignificant (Table 10, Column (2)).

In the second example the confounding variable is legal origin. We mentioned earlier in the paper that French legal origin reduces the need in trial lawyers, but is more "lawyer-intensive" in dealing with regulatory matters. The coefficient of French legal origin in a regression explaining the graduation in law is positive and significant (Table 10, Column (3)). Here too the observed effect is due to the omitted institutions, which are shown to be adversely affected by civil law in comparison to common law systems (La Porta et al., 2008). The inclusion of institutions into regression reduces the coefficient of legal origin in magnitude by almost three times and makes it statistically insignificant (Table 10, Column (4)). Put differently, institutions fully mediate (Baron and Kenny, 1986) the impact of legal origins on the appeal of education in law.

The same pattern is observed for economic inequality. Direct impact of inequality on the demand for legal services is unclear. One could argue e.g. that in less equal societies the poor cannot afford such services, which should lead to demand contraction, and yet in Latin American countries with deep inequality and massive poverty there are surprisingly many lawyers – both in absolute and relative (per capita) terms (Anderson and Grossman, 1988). Indeed, in a regression of the graduation in law on economic inequality the latter gets a statistically significant positive coefficient (Table 10, Column (5)). This, too, is a reflection of institutional forces at work – more often than not economic inequality is inversely related to the quality of institutions (see e.g. Easterly (2007) and especially Acemoglu and Robinson (2012), who argue that strong institutions are inclusive and benefit large strata in the society, whereas weak institutions are

Table 10

Primacy of institutions

	Dependent variable: *Share of Law graduates*							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unofficial economy	0.0251*	0.0142						
	(0.0133)	(0.0144)						
Gini coefficient			1.570*	0.571				
			(0.905)	(0.870)				
French Legal Origin					0.325*	0.229		
					(0.169)	(0.172)		
Distrust in civil servants							2.887***	0.963
							(0.902)	(1.388)
Rule of Law		-0.486**		-0.551***		-0.450***		-0.567*
		(0.185)		(0.126)		(0.146)		(0.290)
Log GDP per capita	-0.276	0.159	-0.224*	0.205	-0.374***	-0.0316	-0.124	0.360
	(0.205)	(0.252)	(0.132)	(0.126)	(0.118)	(0.153)	(0.196)	(0.275)
School Tertiary	-0.264	-0.738	0.189	-0.184	0.765*	0.533	-0.305	-0.886
	(0.528)	(0.514)	(0.421)	(0.388)	(0.388)	(0.427)	(0.610)	(0.639)
Services, % of GDP	2.792***	2.185**	1.415*	1.528*	1.567	1.807*	0.219	0.911
	(0.987)	(0.918)	(0.831)	(0.771)	(0.994)	(0.967)	(2.049)	(1.878)
Log Oil reserves	0.0742**	0.0414	0.0656**	0.0260	0.0829***	0.0454**	0.0627**	0.0407*
	(0.0299)	(0.0274)	(0.0270)	(0.0221)	(0.0252)	(0.0213)	(0.0291)	(0.0235)
Ethnic Fractionalization	-0.0964	-0.0727	-0.0101	0.139	-0.106	-0.0531	0.132	0.0940
	(0.568)	(0.482)	(0.361)	(0.309)	(0.324)	(0.320)	(0.465)	(0.386)
Log Populaion	-0.250***	-0.265***	-0.313***	-0.271***	-0.290***	-0.239***	-0.0540	-0.143
	(0.0799)	(0.0666)	(0.0740)	(0.0645)	(0.0617)	(0.0586)	(0.123)	(0.126)
Trade to GDP ratio	-0.220*	-0.278**	-0.233	-0.353**	-0.0888	-0.144	0.329	0.0301
	(0.126)	(0.120)	(0.174)	(0.157)	(0.124)	(0.125)	(0.207)	(0.244)
Emigration rate of tertiary educated, %	-0.0181	-0.0183	-0.0160***	-0.0146***	-0.0124**	-0.0117**	-0.00714	-0.00602
	(0.0117)	(0.0120)	(0.00561)	(0.00504)	(0.00547)	(0.00507)	(0.00954)	(0.00900)

(Continues)

Table 10. (Continued)

	Dependent variable: *Share of Law graduates*							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Government expenditure, % GDP	0.0170	0.0295	-0.0118	0.0120	-0.0287*	-0.00941	0.0190	0.0257
	(0.0218)	(0.0210)	(0.0174)	(0.0155)	(0.0144)	(0.0152)	(0.0259)	(0.0253)
Constant	4.162*	1.432	5.872***	1.645	7.035***	2.994*	0.650	-1.774
	(2.263)	(2.268)	(1.861)	(1.688)	(1.399)	(1.678)	(2.621)	(2.127)
Observations	52	52	74	74	85	85	45	45
R-squared	0.512	0.591	0.318	0.480	0.268	0.364	0.330	0.431

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Columns (1) and (2) report OLS estimations including the informal sector's share in GDP, without and with the Rule of Law index; columns (3) and (4) report OLS estimations including the Gini coefficient, without and with the Rule of Law index; columns (5) and (6) report OLS estimations including the French Legal Origin dummy, without and with the Rule of Law index; columns (7) and (8) report OLS estimations including a Distrust in Civil Servants measure, without and with the Rule of Law index. The regression coefficients reported for Rule of Law index are standardized beta.

extractive and benefit privileged elites at the expense of the rest of society). Once institutions are included, the coefficient of inequality drops to 1/3 of its initial magnitude and becomes insignificant, while institutions are significant at the 0.01 level (Table 10, Column (6)).

Further, more lawyers are required to represent their clients vis-à-vis the state when government agencies and civil servants are mistrusted by the public. This is confirmed by a regression of the graduation in law on distrust in civil servants, where the latter obtains a positive and highly significant coefficient (Table 10, Column (7)). On the other hand, mistrust in civil servants could be correlated with poor institutions (e.g. when both are caused by a lack of social capital – see Aghion et al. (2010)), and the inclusion of institutions in the regression leaves distrust in civil servants insignificant, while reducing its coefficient by two thirds (Table 10, Column (8)).

The above examples demonstrate a consistent pattern: various factors affect the allocation of talent prima facie as long as institutions are taken out of the equation. Once institutions are reinstated, they trump such factors, and stand out among other variables as a salient root cause driver of career choices by younger talents. Inclusion of institutions also markedly improves the predictive power of regression models – R-squared goes up by 15-30%.

Finally, the observed association between institutional quality and the allocation of talent could be explained by uneven quality of higher education across the globe. It is conceivable that the quality of institutions of higher learning is positively correlated with the quality of institutions – rules of the game (e.g. because rights and freedoms and the rule of law are conducive for free thinking, innovations and the protection of intellectual property rights; and/or because stronger institutions generate wealth that could be invested in research and education). One could further expect that the demand for education in sciences is more elastic to quality of the national university system than the demand for legal education, because the latter is much less "portable" and hence better protected from foreign competition at home, and cannot be used abroad where its weakness would have been exposed. In such case institutions would still matter for the allocation of talent, but the mechanism of this link would involve institutions of higher learning, in addition to, if not instead of, the reward differentials between productive and non-productive activities, as conjectured in this paper.[18]

To assess the role of higher education quality as a possible mediator in the established link between institutions and the allocation of talent, we need to perform mediation analysis (Baron and Kenny, 1986), which consists of three steps: (a) demonstrate that the independent variable (institutional quality) explains

[18]We thank the anonymous reviewer for pointing out to such possibility (see also Section VI). Notice that Pritchett (2001), and especially Hanushek and Woessmann (2012) stress the role of the quality of education in the contribution of education (or lack thereof) to macroeconomic outcomes.

variations in the mediator (quality of higher education); (b) show that mediator, in its turn, explains variations in the dependent variable (the allocation of talent), and (c) simultaneously enter the mediator and the independent variable in a regression equation explaining the dependent variable, and see what, if any, impact the independent variable still carries alongside the mediator. In the event of full mediation, the independent variable becomes statistically insignificant in such joint estimation, whereas in the case of partial mediation the mediator remains statistically significant, whereas the independent variable's contribution declines in significance and/or magnitude.

To perform such analysis, we calculate an index of relative quality of a national system of post-secondary education as the number of national universities in the top 500 universities globally, according to the QS World University Ranking[19] per 1 million of the country's population. With this index, the first two steps point to possible mediation: (a) quality of post-secondary education is indeed strongly correlated with the institutional quality, measured by the Rule of Law index (even if the GDP per capita is controlled for; Columns (1)-(4), Table 11); and (b) quality of national universities is indeed positively correlated with the graduation in sciences, and negatively – with the graduation in law and the difference thereof (Columns (5)-(7), Table 11). However, at step (c), once the quality of institutions – rules of the game (still measured by the Rule of Law index) is controlled for, the results are opposite to those expected in the case of mediation: correlation of the difference in enrollments in the above disciplines and the quality of university system changes sign, drops in magnitude, and becomes statistically insignificant, whereas, as in the previous examples, the quality of institutions per se remains highly significant, and R-squared more than doubles (Column (8), Table 11). Institutions remain significant at the 1% level even with the full set of other controls, whereas the magnitude and p-value of the quality of national university system drops further (Column (9), Table 11).

Estimations reported in Columns (8) and (9) allow us to differentiate our main hypothesis that institutions directly affect the allocation of talent, from the above described alternative, whereby the impact of institutions on the allocation of talent is mediated by the quality of post-secondary education. These estimations show that such mediation is not statistically significant, and the direct effect of institutions clearly dominates over the indirect one, via the quality of national university system.[20]

[19]www.topuniversities.com

[20]Other university ratings – Times Higher Education World University Ranking and Shanghai Academic Ranking of World Universities – deliver similar results. The same conclusion holds, when the quality of higher education is proxied by the Program of International Student Assessment (PISA) test results – the latter gauge would-be university students' abilities. Such abilities contribute to the quality of post-secondary education via the peer effect (see e.g. Epple and Romano, 2011).

Table 11

Impact of institutions and quality of university system

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Whole sample (178 countries)		Allocation of Talent sample (97 countries)						
	Number of Universities in Top 500 per capita				*Share of Law graduates*	*Share of Science graduates*	*Difference between Shares of Law and Science graduates*		
Top 500 universities per capita					-4.651***	2.298**	-4.732***	1.572	0.828
					(0.973)	(0.899)	(0.975)	(2.202)	(2.199)
Rule of Law	0.297***	0.332***	0.477***	0.474***				-0.525***	-0.616***
	(0.0433)	(0.0535)	(0.0538)	(0.0671)				(0.156)	(0.218)
Log GDP per capita		0.0599		0.0379					-0.0883
		(0.225)		(0.346)					(0.175)
School Tertiary									1.039*
									(0.546)
Services, % of GDP									0.374
									(0.866)
Log Oil reserves									0.0284
									(0.0322)
Ethnic Fractionalization									0.199
									(0.426)
Log Populaion									-0.175**
									(0.0701)
Constant	0.0198***	0.0173	0.0291***	0.0257	0.205	-0.283***	0.270**	0.119	2.966
	(0.00291)	(0.0203)	(0.00374)	(0.0309)	(0.127)	(0.0921)	(0.111)	(0.117)	(2.160)
Observations	178	178	97	97	97	97	97	96	94
R-squared	0.362	0.422	0.574	0.574	0.086	0.038	0.107	0.248	0.316

Notes: Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Columns (1) and (2) report OLS regressions of the number of national universities in the top 500 per million population on the Rule of Law Index for the full sample of 178 countries in the world; columns (3) and (4) report the same for the sample of countries for which allocation of talent data exist. Columns (5), (6) and (7) report OLS regressions of, resp., graduations in law, sciences, and the difference thereof, on the number of national universities in the top 500 per million of population. Column (8) reports OLS regression of the difference between graduations in law and sciences on the number of national universities in the top 500 per million of population and on the Rule of Law Index; in column (9) the same regression includes a set of control variables. The regression coefficients reported for Rule of Law index are standardized beta.

VI. ALLOCATION OF TALENT AND SOCIAL RETURN TO EDUCATION

Institutions and human capital are sometimes considered as alternative explanations of economic growth (Glaeser et al., 2004; Acemoglu et al.,2014), but they do not act independently from each other. The observed influence of institutions on program selection by university students connects human capital allocation to institutions. Pritchett (2001) invoked the famous metaphor of North (1990) that piracy and chemical manufacturing alike could benefit from education, to argue that public returns to education could be negligible or even negative, despite of tangible private returns, if the acquired knowledge and skills are applied for socially unproductive purposes. In other words, institutions, by directing investments in human capital, could complement education as growth factors. This conjecture has been tested and confirmed by several authors by including various measures of institutional quality (corruption, black market premium, and brain drain (Rogers, 2008); trade openness and the protection against expropriation (Hanushek and Woessmann, 2008); democratic performance (Armellini, 2012); corruption prevention and the rule of law (Natkhov et al., 2018)) into empirical models relating economic growth to stock and/or flow of education-enhanced human capital.[21]

In this section, we put Pritchett's hypothesis to a direct test by estimating regression models measuring social returns to an increase in education conditional not on institutions per se, but instead on the allocation of talent driven by institutions. Such test is expected to confirm that the complementarity between institutions and education indeed runs through students' preferences over skills required in productive activities or redistribution.

Education as a factor contributing to economic outcomes can be measured by stock and flow (see e.g. Bosworth and Collins, 2003; Hanushek and Woessmann, 2008), when it is either considered as a proxy to human capital accumulation and as such affects growth rates, or is measured at the beginning of the observation period and expected, in the spirit of the endogenous growth theory (Aghion and Howitt, 2009), to increase the total factor productivity. Since Barro and Sala-i-Martin (1995), initial level of education has been consistently shown to have a robust positive impact on subsequent economic growth.[22] However, an association between *increments* in education and economic growth appeared to be elusive (Pritchett, 2001), and misallocation of talent was suggested as a probable cause.

To verify if this is indeed the case, we begin with the following baseline model:

[21]Similarly Gwartney et al. (2006) show that institutional quality moderates the payoff to investments in physical capital.

[22]This impact becomes weaker once business environment measures are factored in (Gillanders and Whelan, 2014).

$$Growth\ GDP\ per\ Capita_i = \beta_0 + \beta_1 Change\ in\ Schooling_i + \beta_2 X_i + \varepsilon_i, \quad (2)$$

where *Growth GDP pc*$_i$ is the average annual growth rate of GDP per capita in country i over the 1990-2010 period; *Change in Schooling*$_i$ is the increase over the same period of the average years of tertiary education;[23] X_i is the vector of control variables, and ε_i is the error term. The coefficient of interest is β_1. Estimation results are presented in Table 12, Column (1). The coefficient of post-secondary education is positive, but statistically insignificant, which agrees with the earlier literature.

Next, we divide the sample at the median level of the allocation of talent index calculated as the difference between the shares of graduates in law and sciences, and estimate model (2) for the upper and lower halves. When increase in human capital is (mis)allocated towards redistribution, the public rate of returns to tertiary education turns negative and remains statistically insignificant (Column (2)). However, for the other half with stronger preferences towards education in sciences, this rate becomes positive, sharply rises in magnitude, and is significant at the 10% level (Column (3)). This suggests complementarity between the allocation of talent and post-secondary education as factors of economic growth.

To better visualize the role of allocation of talent in the social payoff to education, we estimate rolling sample regressions (2) for a series of contiguous sub-samples comprising 50% of observations each, sliding those down step by step on our allocation of talent scale all the way from the upper to the lower half.[24] Figure 6 demonstrates a gradual increase in the payoff to higher education in this rolling regression, with a concurrent narrowing of the confidence intervals indicating growing precision of estimation.

Rogers (2008) conducted similar analyses for a number of institutional quality indexes and total and secondary schooling as measures of educational attainment. However, he was unable to confirm the complementarity between institutions and increase in tertiary education – regression coefficients in such case turned out to be insignificant. Our approach which uses direct measures of the allocation of talent, instead of measures of underlying institutional quality, has higher accuracy and reveals the expected complementarity.

As a robustness check, we repeat the above analysis when human capital is measured by cognitive skills instead of the duration of tertiary schooling. Hanushek and Woessmann (2008, 2012) stress the role of cognitive skills as an educational outcome which is highly relevant for economic growth, and argue that such indexes are more suitable for measuring public returns to human capital than the duration of schooling per se. We use cognitive skills measures from

[23]We choose years of tertiary education, as opposed to total years of schooling, as in Pritchett, 2001 and Rogers, 2008, to ensure consistency of our education measures with those of the allocation of talent.; see also Aghion and Howitt, 2009).

[24]The idea is borrowed from Rogers (2008).

Table 12

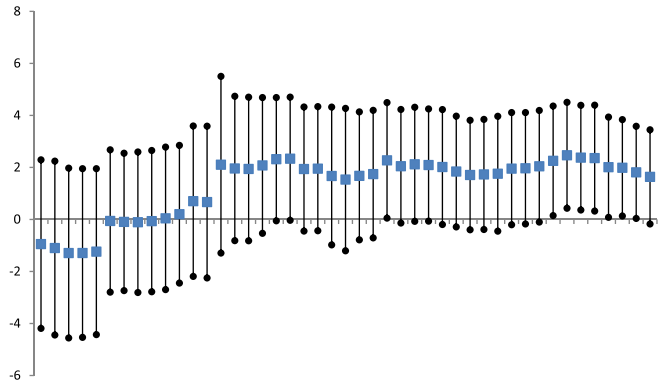
Allocation of talent and public returns to education in law and science

	Dependent Variable: *Average growth Rates of GDP per Capita in 1990-2010*					
	Full Sample (1)	Difference Above Median (2)	Difference Below Median (3)	Full Sample (4)	Difference Above Median (5)	Difference Below Median (6)
Change in Tertiary Schooling	0.569 (0.886)	-0.948 (1.602)	1.637* (0.896)			
Cognitive Skills				1.069*** (0.371)	0.745 (0.584)	1.158*** (0.346)
Log Initial GDP per Capita	-0.427** (0.171)	-0.641* (0.320)	-0.382* (0.199)	-1.085*** (0.317)	-1.599*** (0.470)	-0.629** (0.247)
Log Initial Tertiary Schooling	1.110 (0.833)	3.670* (1.871)	-0.234 (0.524)	0.522 (0.618)	2.258 (1.775)	-0.496 (0.426)
Average Investment, % GDP	0.0432* (0.0222)	0.0600 (0.0403)	0.0255 (0.0284)	0.0191 (0.0255)	0.0181 (0.103)	0.0192 (0.0219)
Constant	4.294** (1.646)	5.165* (2.717)	4.698** (2.127)	6.610*** (1.969)	12.09*** (2.094)	2.470* (1.315)
Observations	88	44	44	58	29	29
R-squared	0.105	0.150	0.221	0.321	0.502	0.422

Notes: Robust standard errors in parentheses; *** p<0.01, ** $p<0.05$, * $p<0.1$. Columns (1) to (3) represent OLS regressions of economic growth rates on the increase of average tertiary schooling for respectively the full sample and sub-samples with the differences between law and science graduation above and below the sample median. Columns (4) to (6) represent similar regressions, where increase in tertiary schooling is replaced by a cognitive skills measure from Hanushek and Woessmann (2012).

Figure 6

Rolling sample regression of economic growth on tertiary education [Colour figure can be viewed at wileyonlinelibrary.com]



Note: Model (2) rolling regression results with 95% confidence intervals for contiguous sub-samples comprising 50% of observations.

Hanushek and Woessmann (2012), which are based on the results of tests administered primarily at the high school level. The purpose of such estimation is to see how successfully the economy utilizes human capital accumulated at lower levels of the education chain.

As before, the answer depends on the allocation of talent. Estimations of model (2) for the full sample of countries for which the necessary data exist, and the sub-samples above and below the median level of the allocation of talent are reported in columns (4)-(6) of Table 12. Notice that in contrast with the above used measure of human capital accumulation, now the significance of human capital for economic growth can be already seen for the full sample of countries (Column (4); as also demonstrated in Hanushek and Woesmann (2012)). When the estimation is reduced to the below the median sub-sample, the coefficient remains significant at 1% and rises in magnitude (Column (6)). For the above the median subsample (Column (5)), where the allocation of talent is skewed in favor of redistribution, the coefficient drops in magnitude by a quarter and becomes statistically insignificant. [25]

Apart from providing a robustness check, estimations in Columns (4)-(6) serve another purpose – to explore an alternative explanation of the differentiated public

[25]Hanushek and Woessmann (2008) controlled the impact of cognitive skills on institutional performance by introducing the interaction between institutions and cognitive skills in their regression model, and concluded that there is still "a significant positive growth effect of cognitive skills even in countries with a poor institutional environment" (p. 648). Our analysis which uses a direct measure of the allocation of talent leads to a more qualified conclusion.

returns to education, contingent on the allocation of talent. One could argue, similarly to the previous section, that here, too, the observed link involves uneven quality of education, which is, according to Columns (1)-(6) of Table 11, a confounding variable for institutions and the allocation of talent. In such case, positive growth effect of education in the sub-sample of Column (3), Table 12, could be due to higher educational quality in this sub-sample (comprising countries with stronger institutions), rather than to greater propensity of students to acquire training in sciences in such countries. Vice versa, the sub-sample of Column (2), Table 12 includes countries with inferior educational quality, in which case a lack of contribution of education to economic growth should come as no surprise.

Estimations using cognitive skills partly alleviate such concerns, because the human capital measure used in those estimations already reflects educational quality, and countries where talents are more massively allocated to directly productive purposes exhibit higher social payoff to resultant cognitive skills, not just years of schooling. In a more direct test differentiating between the explanations invoking allocation of talent vs. educational quality, we divide the full sample of nations into two sub-samples, first comprising countries which have universities in the top 500 group according to the QS World University Ranking, and the second comprising countries which are not represented in the top 500 group. Estimations of model (2) for these sub-samples (not reported here and available upon request), show that in neither of sub-samples defined by educational quality, increase in schooling makes a statistically significant contribution to growth (which essentially reproduces the full sample estimation). This is in contrast with using the allocation of talent as a differentiating factor explaining public returns (or lack thereof) to post-secondary education, as can be seen from Columns (1)-(3), Table 12.

The allocation of talent is not the only moderating factor in the link between education and growth. According to Marconi (2018), age is another such moderator: increase of educational level in the 25-44 years old age group makes no tangible contribution to growth, whereas higher educational attainment in 45-64 years old group significantly contributes to growth. It is unclear whether the allocation of talent and age operate independently or in relation with each other as moderating factors. Marconi suggests learning-by-doing as a possible explanation of the age's moderating role: education enhances the ability to learn (op. cit., p. 137) and hence pays off only after a period of time necessary for learning. It is plausible that it takes more time to learn and hone rent-seeking skills, which are deployed in a non-transparent, uncertain and convoluted institutional environment, and to establish personalized connections necessary to succeed in such environment, than it would be to deploy directly productive skills in a streamlined, enabling and inclusive institutional environment. If so, age and allocation of talent are interconnected as moderating factors, but more work is required to test such conjecture empirically.

VII. CONCLUDING REMARKS

Institutions affect investment decisions, and we show that this is also true about investments in human capital and hence the allocation of talent. Market-supporting institutions attract talents to productive activities, and this is reflected in the choices of fields of study by university students, many of whom select engineering, sciences, and other similar disciplines. Poor institutions, on the other hand, make redistribution more attractive than socially productive activities, and this causes excessive enrollment in law, public administration, and similar educational programs.

We confirm these patterns by using data on the allocation of talent and institutional quality for approximately 100 countries of the world, and demonstrate robustness of our findings. For smaller groups of countries, such as transition economies, which share a number of common features and have been exposed to a "natural experiment" that set them on different institutional trajectories, the link between institutions and the allocation of talent is particularly sharp. We also show that the quality of institutions stands out among other factors that could influence the allocation of talent and in fact could be behind such influence. Finally, we demonstrate that the allocation of talent is a mediating factor in the impact of institutions on the public returns to education.

Our findings confirm the general dictum that enabling institutions and policies are essential for making proper use of factors of production, including investments in human capital. Human capital *accumulation* is driven by private returns and as such is less sensitive to the institutional quality than its *allocation* between productive and unproductive activities, which is essential for economic growth and social welfare. Education is usually expected to generate positive externalities ranging from increased productivity and adoption of new technologies to improved democratic participation. However, inadequate institutions cause *negative* educational externalities with rent-seeking as the medium. The paper contributes to the debates in the literature over relative significance of human capital and institutions by providing direct evidence of an allocation-of-talent-based complementarity between institutions and education.

A discrepancy between private and public returns to education usually calls for public intervention. In the case of positive externalities such intervention could involve e.g. educational subsidies. If externalities are negative, they need to be corrected by public policies and reforms that repair faulty institutions and thus re-direct talents towards socially productive activities.

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SUMMARY

Strong institutions attract talent to productive activities, whereas weak ones raise the appeal of redistribution. We find a strong positive cross-country association between the quality of institutions and graduation of university students in science, and an even stronger negative correlation with graduation in law. These findings are robust to various specifications of empirical models. We also demonstrate that institutions dominate other factors affecting the allocation of talent. Finally, we present direct evidence that (mis)allocation of talent between productive and unproductive activities driven by institutional quality explains the discrepancy between private and public returns to education.

