

# Institutions and Allocation of Talent

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## Abstract

Institutions affect investment decisions, including investments in human capital and hence the allocation of talent. Good market-supporting institutions attract talents to socially productive activities, whereas poor ones raise the appeal of rent-seeking. We propose a theoretical model which shows that more talented individuals are particularly sensitive in their career choices to the quality of institutions, and test its predictions on a sample of nearly 100 countries around the world. We find strong positive association between the quality of institutions and graduation of college and university students in science and engineering, and an even stronger negative one – with graduation in law. Our findings are robust to various specifications of empirical models, including smaller samples of former colonies and transition countries. The quality of human capital makes the distinction between educational choices under strong and weak institutions especially sharp. We show that the allocation of talent is an important link between institutions and growth.

Key words: institutions, allocation of talent, rent-seeking, economic growth

*JEL classification:* D02, I25, J24, O43

## 1. Introduction

Institutions set “rules of the game” in the economy, structure incentives, and thereby affect resource allocation and economic growth. The impact of institutions on growth depends on whether they reward productive behaviour which creates wealth, or unproductive one, also known as rent-seeking, which redistributes wealth away from its creators.<sup>1</sup> Rent-seeking is harmful for growth, since it consumes resources that could have been otherwise invested for productive purposes, and

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<sup>1</sup> The separation between rent-seeking and productive activities is not always watertight (Bhagwati 1982; Polishchuk 1994; Acemoglu, Verdier 1998), but in what follows we generally assume away such possible overlaps.

suppresses incentives to engage in productive activities by reducing effective returns to such efforts. Accordingly institutions fall into two broad categories – those protecting property rights and those facilitating rent-seeking (Acemoglu, Johnson, Robinson 2001). Massive literature provides compelling theoretical and empirical evidence of a strong association between the quality of institutions (measured inter alia by the security of property rights which is inversely related to the opportunities for rent-seeking) and economic growth and welfare.

Allocation of human resources – time, labor, effort – is also highly sensitive to the quality of institutions (Murphy, Shleifer, Vishny 1991; Acemoglu 1995). Of particular significance is the allocation of entrepreneurship and talent, as these are key drivers of economic growth. Murphy, Shleifer and Vishny (1991) argue that growth rates are higher in economies where most talented individuals are engaged in productive activities, as opposed to rent-seeking. Baumol (1990) emphasizes the allocation of entrepreneurial energy: good institutions offer generous reward to productive Schumpeterian entrepreneurs, and thus massively generate innovations, whereas poor institutions drag daring and creative individuals into rent-seeking, and hence stifle productivity growth (Mehlum, Moene, Torvik, 2003).

Institutions not only allocate the existing stock of human resources, but also affect the accumulation of human capital (Pecorino, 1992): education and skills that an individual is about to acquire are selected based on anticipated rewards and career prospects, which in their turn are shaped by the prevailing institutions.<sup>2</sup> This is a part of a more general investment-based mechanism linking institutions to economic outcomes. In the case of conventional physical and financial investments good institutions provide a credible commitment to honour investors' rights and otherwise improve investment climate, and investors' response drives economic growth (Keefer, Knack 1995). Investments in human capital are similarly influenced by institutions; thus Hall and Jones (1999) observe positive association between institutional quality and human capital per capita measured by educational attainment. What matters this time is not the security per se of such human capital investments which are not under direct threat of expropriation, but rather the prospects of earning returns to particular skills and competences.

It could be expected that good institutions strengthen the appeal of professions and careers which are pivotal for productive activities and vice versa bad institutions raise interest in occupations associated with rent-seeking. In particular, the quality of institutions should affect the choice of subject areas of post-secondary education, when young people are seeking fields where their talents could earn the highest rate of returns. While such conjecture can be deduced from the literature, to the best of our knowledge it has not been yet clearly spelled nor rigorously tested on cross-country data, and this paper is intended to fill such gap.

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<sup>2</sup> Institutions also affect investments in social networks and adoption of norms, values, identity and other elements of culture which are essential for economic performance (Akerlof, Kranton 2000; Tabellini 2008; Benabou, Tirole 2011)

In doing so, we follow Murphy, Shliefer and Vishny (1991) in using UNESCO data on graduation from post-secondary institutions across subject areas and countries around the world. However, unlike the quoted source, our main task is not to use such data to explain cross-country variations in economic performance, but rather to relate the observed variations in relative popularity of different disciplines to the quality of national institutions, measured by institutional performance indexes. Our empirical analysis shows that such relationship exists and is strong and robust. Having established this fact, we bring back economic performance to show that indeed the impact of institutions on growth is mediated by, *inter alia*, the allocation of talent.

While the link between institutions and economic performance is firmly established and rarely challenged, the direction of causality in this link remains a subject of debates. Our findings lend support to the institutional hypothesis which maintains that causality runs from institutions to growth (Rodrik, Subramanian, Trebbi 2004), since it is the institutions that motivate career choices of young talents, and such choices in their turn, in agreement with earlier literature, affect growth rates.<sup>3</sup>

Our empirical strategy is based on a theoretical model which generates testable hypotheses. In the model, an individual can choose between productive activities and rent-seeking. Individual characteristics affecting the choice are talent which is a payoff multiplier (irrespective of the chosen activity), and idiosyncratic preference for rent-seeking over productive activities, which could be positive or negative and is unrelated to talent. In other words, selection between productive activities and rent-seeking is determined by a combination of tastes and material rewards.<sup>4</sup> The model shows that as property rights protection improves, in equilibrium an increasing number of individuals indeed prefer productive activities to rent-seeking. Such response however is uneven across the range of abilities: least talented individuals are less sensitive in their career choices to changes in institutional environment than those with higher general abilities. Therefore the impact of institutions on the allocation of talent is more pronounced in the cohort with abilities in the intermediate and higher range. Those pursuing post-secondary education by and large fall in this category, which justifies our focus in the empirical part of the paper on graduates of colleges and universities. Furthermore the model predicts that when institutions are poor, the relative appeal of rent-seeking over productive activities rises with abilities, whereas for good institutions the opposite is true.

We proxy the selection of productive activities by the graduation in engineering, sciences, and medicine. Theoretical and empirical evidence indicates that better institutions create strong demand

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<sup>3</sup> Allocation of talent could be a part of the “resource curse” mechanism, whereby abundance of natural resources has adverse implications for economic growth. Excessive reliance on natural resources is shown to suppress investments in human capital (Gylfason 2001). While this effect is usually ascribed to a relative decline of the manufacturing sector due to the “Dutch disease”, another plausible explanation can be found in institutional deterioration caused by the resource manna (Brunnschweiler 2008), which in its turn affects the allocation of talent.

<sup>4</sup> This assumption is similar to voting behaviour models where an individual chooses between political parties’ platforms based on economic considerations and ideological preferences (Persson, Tabellini 2000).

for such knowledge and skills. Thus, Levchenko (2004) observes that good institutions support more complex production processes which require greater skills intensity; similarly Nunn (2007) shows that good institutions favour contract-intensive industries nearly all of which are in hi-tech and (broadly defined) science and engineering areas.

On the contrary, pursuing a degree in law is viewed in the paper, as in Murphy, Shleifer, Vishny (1991), as a possible pass into rent-seeking. This is obviously a very imprecise approximation of the actual boundary between productive activities and rent-seeking, not in the least because law is a pillar of market-supporting institutions and is vital for property rights protection which sustains productive activities. However, a lopsided talent allocation across subject areas with higher preference for law which cannot be explained by other factors could be a reflection of institutional abnormality and our econometric models show that this is indeed the case. In other words, using cross-country *variations* of the share of law students could, with appropriate controls, be a way to capture the appeal of rent-seeking to those choosing their careers. We perform various robustness checks and show that the established link is stable and highly significant over various specifications of the model, including those involving instrumental variables.

Cross-country analyses could be susceptible to the omitted variable bias, and to rule it out by robustness checks we reduce our full sample of 95 countries to smaller groups more likely to meet the *ceteris paribus* requirement. We consider two such groups which have been shaped by major “natural experiments” One is former colonies; since Acemoglu, Johnson and Robinson (2001) they have become a popular testing ground for various institutional conjectures. Another group comprises countries of Central and Eastern Europe and the former Soviet Union. Prior to the collapses of command economies in these countries their institutions and systems of higher education exhibited significant uniformity. In the course of two decades that followed a profound institutional divergence has occurred in this group and we show that talent allocation patterns in transition countries followed institutional trends. As a result, the link between institutions and allocation of talent within the group of transition countries is particularly pronounced.

The rest of the paper proceeds as follows. In Section 2 we present our theoretical model and in Section 3 describe the data. Our empirical evidence, including baseline estimations of econometric models relating allocation of talent to the quality of institutions and various robustness checks are presented in Section 4. In section 5 we discuss the link between institutions and allocation of talent for the above mentioned “natural experiment” groups of countries. In section 6 we investigate how the allocation of talent, conditional on the quality of institutions, depends on the talent level. Section 7 presents evidence that allocation of talent is an essential link between institutions and growth. Section 8 concludes.

## 2. The Model

Consider an economy with a unit continuum of individuals. Each individual inelastically supplies a unit of effort towards either productive activities or rent-seeking.<sup>5</sup> Individuals are characterized by talent  $\theta \geq 0$  and (relative) preference for rent-seeking over productive activities  $w$ . The above parameters are distributed independently from each other; talent's cumulative distribution function is  $G(\theta)$ , with probability density function  $g(\theta)$ , whereas the preference for rent-seeking is distributed according to respectively  $H(w)$  and  $h(w)$ . For simplicity talent measurement is normalized to unity:  $\int_0^\infty \theta g(\theta) d\theta = 1$ .

If an individual contributes her unit of labor towards a particular activity, her effective labor (Solow 1956) supplied towards this activity is  $\theta$  (abilities are untied to particular activities); the total stock of effective labor to be divided between production and rent-seeking is thus equal 1. The total  $\Theta$  of all labor supplied towards production purposes produces gross output  $Y = \mathcal{F}(\Theta)$ , where  $\mathcal{F}$  is a neoclassical production function. The quality of property rights protection is measured by the share  $\sigma$  of the output that is paid to the production input owners; in particular, assuming a competitive labor market, the rate of return to unit of effective labor in production is  $\sigma \mathcal{F}'(\Theta)$ . The balance of the output  $(1 - \sigma)\mathcal{F}(\Theta)$  is divided, as in Tullock (1980), among rent-seekers in proportion to their effective labor supplied towards rent-seeking; hence the return to unit of effective labor in rent-seeking is  $(1 - \sigma)\mathcal{F}(\Theta)/(1 - \Theta)$ .

An individual with characteristics  $(w, \theta)$  chooses production as an area of activity whenever

$$\theta \sigma \mathcal{F}'(\Theta) > \frac{\theta(1 - \sigma)\mathcal{F}(\Theta)}{1 - \Theta} + w,$$

or if

$$A \equiv \sigma \mathcal{F}'(\Theta) - (1 - \sigma)\mathcal{F}(\Theta)/(1 - \Theta) \tag{1}$$

is the difference of returns to unit of effective labor in resp. production and rent seeking, whenever  $A\theta \geq w$ . Hence the share of those in the cohort with talent  $\theta$  who are engaged in production is  $H(A\theta)$ , and therefore

$$\Theta = \int_0^\infty H(A\theta)\theta g(\theta) d\theta. \tag{2}$$

In equilibrium  $\Theta$  and  $A$  are jointly determined from equations (1) and (2). Once  $A$  is known, the number (share)  $\Pi$  of agents participating in productive activities obtains as

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<sup>5</sup> The assumption that efforts are supplied inelastically is made for simplicity. A more general model with elastic effort supply derived from utility maximization leads to nearly identical conclusions.

$$\Pi = \int_0^{\infty} H(A\theta)g(\theta)d\theta. \quad (3)$$

**Proposition.** For any level  $\sigma \in (0,1)$  of institutional quality there exists a unique equilibrium  $\Theta = \Theta(\sigma)$ ,  $A = A(\sigma)$ , where functions  $\Theta(\sigma)$  and  $A(\sigma)$  are monotonically increasing in  $\sigma$ . The share of agents participating in productive activities  $\Pi = \Pi(\sigma)$  is also an increasing function of  $\sigma$ .

Proof follows immediately from the fact that the equality (1) defines  $A$  as a *decreasing* function of  $\Theta$ , and according to (2)  $\Theta$  is an *increasing* function of  $A$ . Furthermore for the curve (1) in the  $(A, \Theta)$  axes one has  $\lim_{\Theta \rightarrow 0} A = \infty$  and  $\lim_{\Theta \rightarrow 1} A = -\infty$ , and for the curve (2)  $\lim_{A \rightarrow \infty} \Theta = 1$  and  $\lim_{A \rightarrow -\infty} \Theta = 0$ . Therefore both curves have a single intersection. To obtain the comparative statics results, notice that an increase in  $\sigma$  pushes the first curve up, while not affecting the second, and therefore shifting the intersection point upwards and to the right along the second curve. Since  $A$  is an increasing function of  $\sigma$ , so, according to (3), is  $\Pi$ .

The proposition shows that indeed an improvement of property rights protection increases the ranks of those who are engaged in productive activities and reduces the number of rent-seekers. While this effect is plausible, it is not a priori obvious since an increase of those engaged in production triggers a counter-effect by increasing the gross output and hence its share available for rent-seeking, which could make appeal of rent-seeking *ceteris paribus* stronger (Murphy, Shleifer, Vishny 1991; Polishchuk, Savvateev 2004). However the direct effect prevails, prompting the expected reaction of the equilibrium level of production efforts to improved property rights.

On the  $(w, \theta)$  plane representing the continuum of agents the ray  $w = A\theta, \theta \geq 0$  separates those engaged in production from rent-seekers, located respectively to the left and right of the separation line. As the quality of institutions rises, this line rotates around the origin clock-wise, and becomes vertical in the intermediate position when  $A = 0$  and hence production and rent-seeking offer the same returns per unit of effective labor. This simple observation leads to two interesting corollaries. First, when institutions are strong, i.e. production earns higher returns than rent-seeking and  $A > 0$ , the share of those engaged in productive activities in the cohort with the given level of talent  $\theta$  increases as  $\theta$  rises, and hence only a small percentage among exceptionally gifted individuals are still engaged in rent-seeking despite massive material losses that such unusual choice entails. This is an evidence of increasing returns to scale in allocation of talent,<sup>6</sup> which progressively drives rent-seeking out of cohorts with greater abilities. Vice versa, when institutions are weak ( $A < 0$ ), due to the same increasing returns to scale rent-seeking increasingly crowds out productive activities from more talented cohorts and only those few who have strong innate aversion to rent-

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<sup>6</sup> For other versions and interpretations of this phenomenon see Murphy, Shleifer, Vishny (1991).

seeking can resist the temptation of growing material rewards associated with unproductive activities.

Second, individuals with low level of talent are less sensitive to the quality of institutions than those with greater ability. At the limit, when  $\theta \rightarrow 0$ , institutions become irrelevant and the choice between production and rent-seeking is determined solely by non-material preferences. This means that if individuals with abilities below a modest cutoff level  $\theta_0 > 0$  are excluded from consideration, the response to institutional change of those with  $\theta \geq \theta_0$  is more elastic than such response for the full community of agents. More precisely, let

$$\Pi(\sigma, \theta_0) = \frac{\int_{\theta_0}^{\infty} H(A(\sigma)\theta)g(\theta)d\theta}{1 - G(\theta_0)} \quad (4)$$

be the share of those engaged in productive activities of all agents with  $\theta \geq \theta_0$  when the quality of institutions equals  $\sigma$ ; notice that  $\Pi(\sigma, 0) = \Pi(\sigma)$ . One can easily check that for sufficiently small  $\theta_0 > 0$

$$\Pi_{\sigma}(\sigma, \theta_0) > \Pi'(\sigma). \quad (5)$$

Notice that not only the least, but also the most talented cohorts exhibit low sensitivity in their occupational choices to changes in the quality of institutions, as long as the institutions before and after the change remain weak or strong. Indeed, due to the economy of scale effect nearly all agents among those with exceptionally high talents are engaged in productive activities (when institutions are strong) or rent-seeking (if institutions are weak). However when the institutions turn from weak to strong the elasticity of response of highly talented agents rises sharply, and at the limit, such response can be described by a step function which is equal zero for weak institutions and unity – for strong ones.

The above model allows various extensions; we will mention here one of them where institutions affect not only payoffs in production and rent-seeking, but also cultural attitudes to such activities, as e.g. in Baumol (1990). In such case stronger institutions increase aversion in the society to rent-seeking; this can be captured in the model by allowing the distribution of  $w$  to depend on  $\sigma$  as a parameter, with a cumulative distribution function  $H(w; \sigma)$  which is monotonically increasing in  $\sigma$ . In other words, the distribution of  $w$  for lower  $\sigma$  stochastically dominates such distribution for higher ones. In such case the impact of the quality of institutions on the allocation of talent becomes even sharper, as it is driven by two effects working in the same direction, first affecting relative payoffs to production and rent-seeking, and the second – social attitudes to these activities.

### 3. Data

Our theory suggests that in countries with firmly established rule of law and adequate protection of property rights we should observe stronger interest in education which prepares for productive activities, whereas poor institutions raise the attractiveness among younger people of subject areas that could equip for rent-seeking. Furthermore such institutions-related discrepancy should be more pronounced for an upper tail of the talent distribution. This justifies our empirical strategy to measure the allocation of talent in response to the quality of institutions by the enrollment (more precisely, graduation) of college and university students in different fields of study. As in Murphy, Shleifer, Vishny (1991), we use the share of law schools graduates as a proxy for the allocation of talent to unproductive activities (with the caveats made in the first section). The share of those majoring in sciences (broadly defined to include life and physical sciences, mathematics and computing) is our measure of talent allocation towards productive activities.

Our source of data on student enrollment is UNESCO Institute of Statistics<sup>7</sup> which stores information on the numbers of graduates in tertiary education for 23 educational programs in 102 countries over the period from 1999 to 2009. Unfortunately the database has quite a few gaps; e.g. data on law schools graduates are available for 26 countries in 2009, 47 in 2008 and only 9 in 2007. In order to maximize the number of observations we treat available data as a cross section and take for a country and a given field the latest available graduation data. We believe that this should not 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 lengths of academic programs. Second, most of the data are fortunately 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, and hence our coverage of this period is fairly accurate and complete.

To measure the quality of institutions, we use the well-known World Bank Governance Matters database (Kaufmann, Kraay, Mastruzzi, 2010) and take the following measures of institutional quality: rule of law (including the quality of contract enforcement, property right, and the courts); government effectiveness (quality of public service and policies and independence from political pressures); and control of corruption (including the prevention of state capture by elites and private interests). In addition, given the centrality of property rights protection for our analysis, we add to the list the Heritage Foundation’s property rights index (Miller and Holmes, 2010). We average these indexes for the 2000-2005 period and use the results as explanatory variables. Such choice of timing is essential for two reasons: first, it gives some assurance that the causality we seek to establish indeed runs from institutions to the allocation of talent (measured primarily for the 2005-2009 period), and second, reflect the fact that the choice of subject areas is made several years prior to the graduation.

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<sup>7</sup>[www.uis.unesco.org](http://www.uis.unesco.org); we are grateful to UNESCO’s Chiao-Ling Chien and Albert Motivans who kindly supplied detailed data not available from UNESCO open-access sources.

We also add various control variables from the World Development Indicators database (WDI). Altogether our sample of the countries for which all of the above dependent, independent, and control variables are available includes 95 observations.

Table 1 contains descriptive statistics for the main variables. The table shows such statistics for all countries in the sample and also for sub-samples with stronger and weaker institutions below and above the median 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.

Simple comparisons of enrollment data for sub-samples reveal stark differences between countries with strong and weak institutions. Thus, the average share of law graduates in the countries with weaker rule of law 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 such share for the countries below the median. These differences are statistically significant at the 1% level.

**Table 1. Descriptive statistics**

	All countries	Strong institution countries	Weak institution countries
	(1)	(2)	(3)
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)
Share of Health graduates, %	8.91 (4.58)	9.76 (4.68)	8.00 (4.36)
Difference between shares of law and science graduates, %	-2.08 (7.15)	-5.52 (5.90)	1.43 (6.64)
Rule of Law, average country 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 for 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)
GDP per capita, PPP, in 2005 dollars	15064 (13 873)	24 597 (13 378)	5 329 (4 337)
Aver. Growth rate of GDP per capita, 2000-2009, %	2.62 (2.49)	2.04 (1.49)	3.20 (3.11)
School Tertiary, gross enrollment ratio, %	40.8 (27.9)	55.3 (23.3)	26.0 (24.2)
Services, value added, % GDP	59.0	66.4	51.6

	(14.0)	(11.3)	(12.5)
Oil reserves,	10 346	9 983	10 716
	(38 457)	(45 281)	(30 445)
Ethnolinguistic fractionalization index (ELF)	0.39	0.30	0.47
	(0.25)	(0.21)	(0.25)
Log Population	16.2	15.9	16.5
	(1.5)	(1.5)	(1.4)
English legal origin	0.24	0.31	0.17
French legal origin	0.44	0.31	0.57
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 and Population are for 2009.

The discrepancy in enrollment between the two groups of countries is even starker if we use the differences between shares of law and science graduates which show *relative attractiveness* of different fields of studies. 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. We treat such difference as a yet another dependent variable whose distribution is closer to normal than the distributions of separate enrollment data for law and science.

## 4. Empirical Evidence

### A. OLS estimations

We start with estimating cross-country regressions relating allocation of talent to indexes of institutional quality, which are as follows:

$$(Un)productive\ Activities_i = \beta_0 + \beta_1 Institutional\ Quality_i + \beta_2 X_i + \varepsilon_i, \quad (6)$$

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 in the previous section,  $X_i$  is the vector of additional covariates serving as control variables, and  $\varepsilon_i$  is the error term. The coefficient of interest is  $\beta_1$  capturing the impact of institutions on the allocation of talent.

The set of control variables reflects factors other than institutions that could possibly influence the allocation of talent and which are commonly used in similar cross-country analyses.<sup>8</sup>

<sup>8</sup>See e.g. Barro 1991; Knack, Keefer 1995; Hall, Jones 1999; La Porta et al. 1999; Acemoglu, Johnson, Robinson 2001; Rodrik, Subramanian, Trebbi 2004.

First, 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 institutions; furthermore it is also conceivable that more economically advanced countries are better able to afford more “capital-intensive” education in sciences, and this supply-side effect could have an impact on the allocation of talent. Second, we control for GDP structure measured by the share of services in the GDP, which could be correlated with the demand for different professions. Next, there could be a link between the size and structure of the student body, and hence we control for the aggregate enrollment in tertiary education.

There is a well-established link between the allocation of talent and natural resources: massive resource sector is shown to suppress investments in human capital (Gylfason 2001) and increase relative attractiveness of rent-seeking over productive activities, which is a part of the “resource curse syndrome”. We use data on oil reserves (from the CIA online Factbook)<sup>9</sup> as a control variable to account for such link (in some specifications this variable was replaced by the share of natural resource rents in the GDP, with similar effects). Our controls also include population (as a proxy for the market size) and ethnic fractionalization index derived by Alesina (2003). To eliminate possible impact of economic inequality, we include as a yet another control variable the Gini coefficients obtained from the United Nations Statistical Database<sup>10</sup>. Finally, the trade to GDP ratios reflects the openness of national economies.

In the first specification we estimate model (1) with 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. When we add one after the other our control variables (columns (2) to (9)), the negative association between institutional quality and graduation in law remains highly significant and grows in magnitude. Among the control variables, oil reserves have a positive and mildly significant coefficient, which is consistent with the impact of the “resource curse” on the allocation of talent. The coefficient of the openness index is also significant and negative, perhaps reflecting the well-established contribution of international trade to global competitiveness of the national economy (Frenkel, Romer, 1999) which reduces opportunities for rent-seeking.

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<sup>9</sup> [www.cia.gov/library/publications/the-world-factbook/index.html](http://www.cia.gov/library/publications/the-world-factbook/index.html)

<sup>10</sup> <http://data.un.org/>

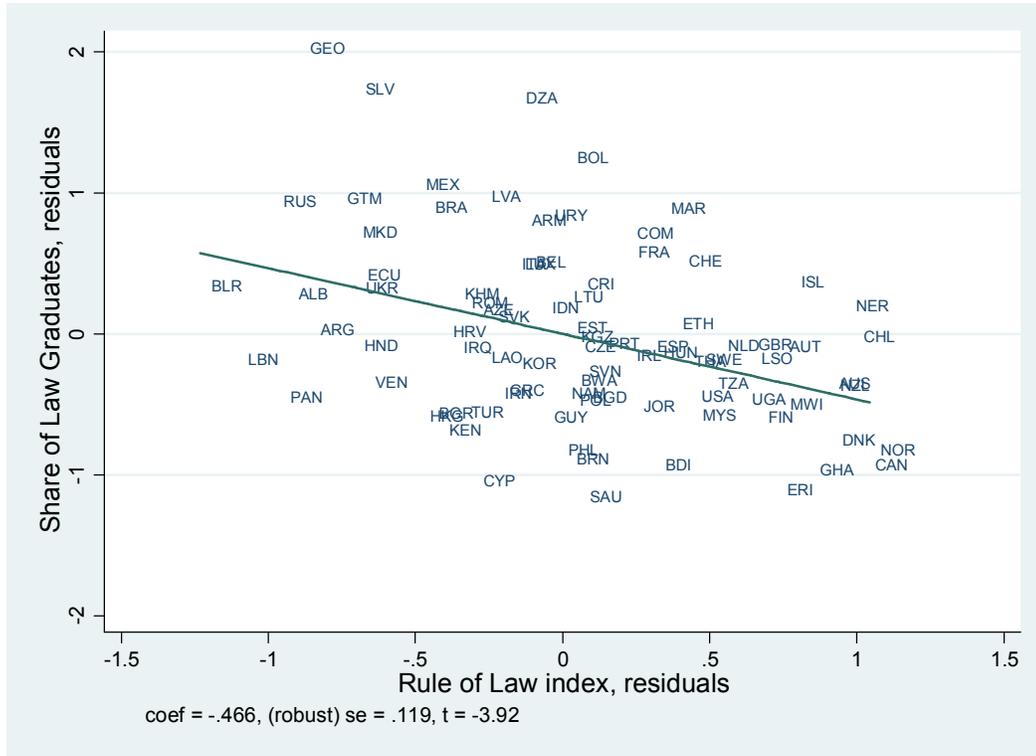
**Table 2. OLS Regressions for Share of Law Graduates**

	Dependent variable: <i>Share of Law graduates</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rule of Law	-0.380*** (0.100)	-0.530*** (0.161)	-0.589*** (0.172)	-0.578*** (0.168)	-0.581*** (0.171)	-0.563*** (0.170)	-0.486*** (0.168)	-0.466*** (0.119)
Log GDP percapita		0.218 (0.170)	0.218 (0.167)	0.207 (0.174)	0.232 (0.181)	0.0571 (0.194)	0.157 (0.220)	-0.0461 (0.128)
School Tertiary		-0.335 (0.516)	-0.422 (0.471)	-0.433 (0.471)	-0.366 (0.481)	-0.0516 (0.461)	-0.581 (0.514)	0.609* (0.359)
Services, % GDP			0.777 (1.014)	0.837 (1.040)	0.776 (1.053)	1.500 (1.060)	1.466 (1.046)	1.770** (0.832)
Log Oil reserves				0.00545 (0.0259)	-2.57e-05 (0.0255)	0.0626** (0.0307)	0.0542 (0.0375)	0.0575** (0.0238)
Ethnic Fractionalization					0.285 (0.542)	0.327 (0.509)	0.286 (0.503)	-0.116 (0.342)
Log Populaion						-0.219*** (0.0779)	-0.357*** (0.0886)	-0.178*** (0.0596)
Gini coefficient							0.925 (0.0134)	
Trade to GDP ratio							-0.526** (0.00228)	
Constant	0.109 (0.105)	-1.707 (1.362)	-2.123 (1.319)	-2.072 (1.337)	-2.379 (1.470)	1.947 (2.125)	3.726 (2.658)	1.749 (1.571)
Observations	95	95	95	95	95	95	81	87
R-squared	0.145	0.165	0.171	0.171	0.175	0.230	0.322	0.278

Robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

An inspection of post-estimation residuals reveals several outliers which are mostly low and lower middle income countries with weak institutions – Angola, Cameroon, Colombia, Madagascar, Mauritania, Mozambique, Swaziland and Malta. To ensure that our results are not driven by outliers, we exclude them from the sample, and report such estimation in column (8). The Rule of Law index remains statistically significant at 1% level with a slightly lower coefficient: a one standard deviation increase in the rule of law is associated with 0.47 standard deviations decrease in the share of law graduates. The scatter plot for this estimation is shown in Figure 1.

In the next regression (Table 3) the dependent variable is the share of science graduates; otherwise the procedure remains the same. This time the coefficient of interest is positive, as expected, and in most specifications significant at 1% or 5% levels. On the average across specifications a one standard deviation improvement of the rule of law, holding other factors constant, is associated with 0.25 standard deviations increase of the share of science graduates. Figure 2 shows the scatter plot for column (8) with eliminated outliers.

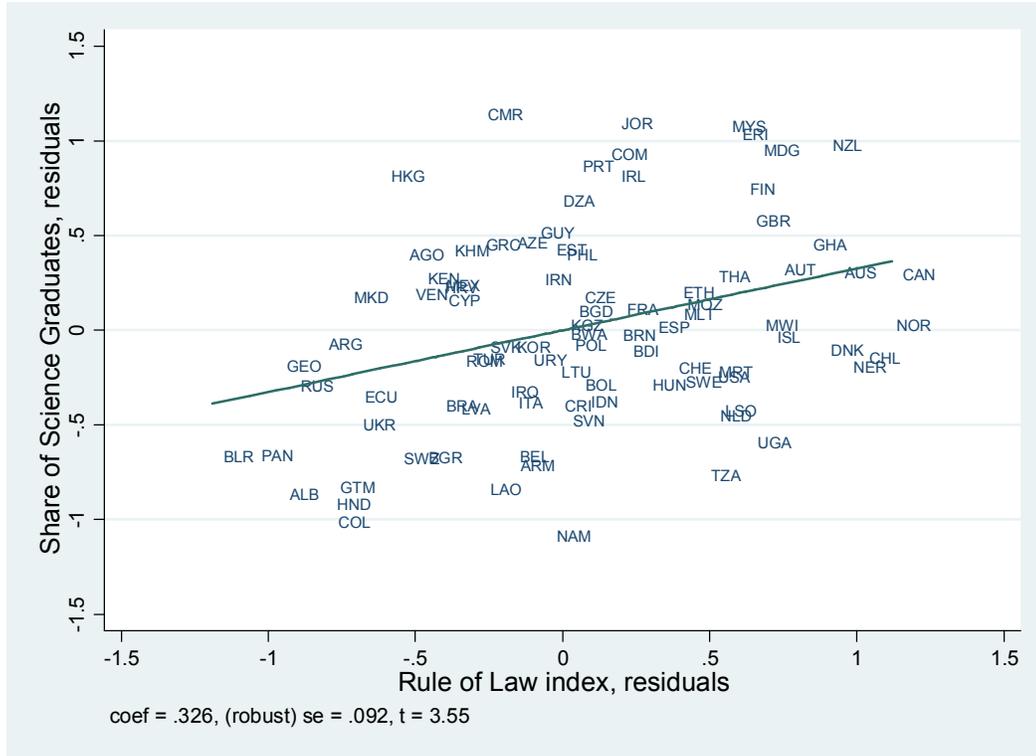


**Figure 1. Quality of Institutions and Graduation in Law**

**Table 3. OLS Regressions for Share of Science Graduates**

	Dependent variable: <i>Share of Science graduates</i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rule of Law	0.234*** (0.0740)	0.257*** (0.0970)	0.205* (0.106)	0.258** (0.120)	0.258** (0.120)	0.252** (0.118)	0.262** (0.117)	0.326*** (0.0919)
Log GDP percapita		0.194 (0.137)	0.194 (0.132)	0.134 (0.142)	0.137 (0.148)	0.191 (0.148)	0.250 (0.179)	-0.000884 (0.110)
School Tertiary		-1.261** (0.565)	-1.339** (0.574)	-1.395** (0.574)	-1.386** (0.563)	-1.482*** (0.558)	-1.179** (0.495)	-0.470 (0.293)
Services, % GDP			0.700 (0.744)	1.020 (0.714)	1.012 (0.707)	0.789 (0.746)	0.235 (0.736)	-0.0459 (0.599)
Log Oil reserves				0.0289 (0.0211)	0.0281 (0.0226)	0.00887 (0.0272)	-0.0119 (0.0286)	0.00421 (0.0214)
Ethnic Fractionalization					0.0378 (0.356)	0.0249 (0.360)	0.493 (0.380)	0.125 (0.291)
Log Populaion						0.0674 (0.0530)	0.114** (0.0509)	0.0773* (0.0425)
Gini coefficient							-0.0210 (0.845)	
Trade to GDP ratio							0.289 (0.248)	
Constant	-0.240*** (0.0718)	-1.487 (1.044)	-1.861 (1.141)	-1.594 (1.211)	-1.635 (1.307)	-2.964* (1.544)	-4.487** (1.935)	-1.453 (1.349)
Observations	95	95	95	95	95	95	81	90
R-squared	0.102	0.199	0.208	0.223	0.223	0.233	0.339	0.211

Robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Figure 2. Quality of Institutions and Science Graduates**

Since the quality of institutions is negatively associated with the share of law students and positively – with the share of those majoring in sciences, we should expect that the difference between these two shares should be particularly sensitive to the institutional quality. We test this for all four measures of institutional performance listed in the previous section and present in Table 4 estimation results with all control variables included.

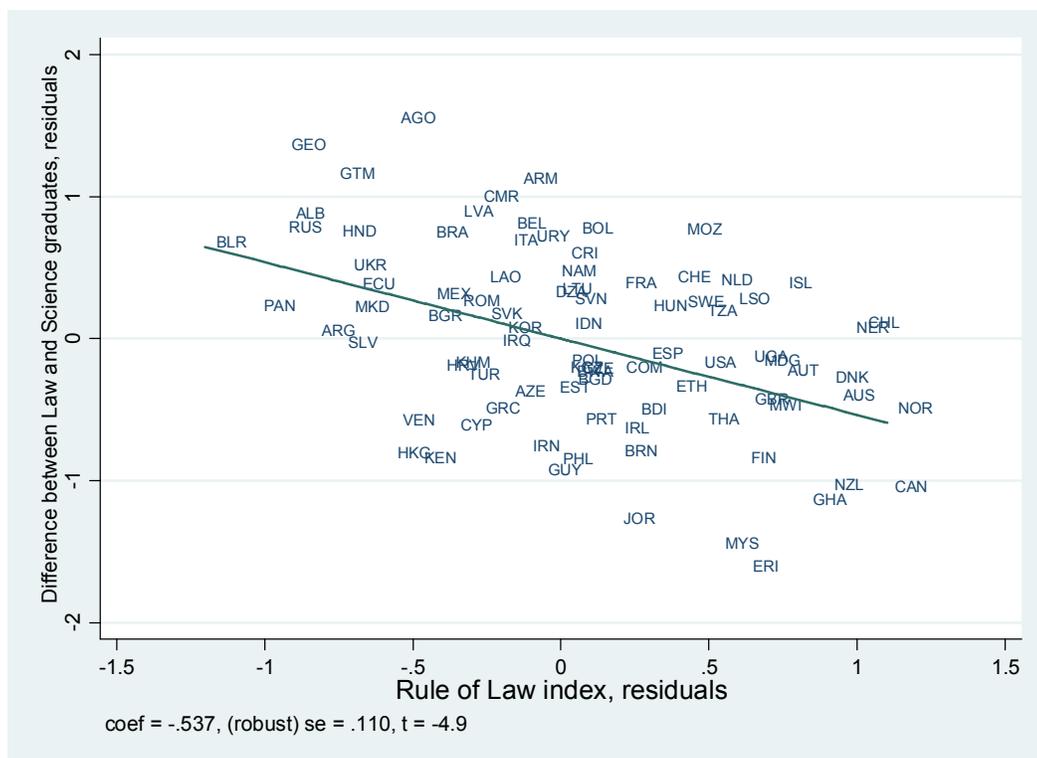
**Table 4. OLS Regressions for Difference between Shares of Law and Science Graduates**

	Dependent variable: <i>Difference between Shares of Law and Science graduates</i>			
	(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

Robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

All four indexes of institutional performance are strongly negatively associated with the dependent variable, which is consistent with our hypotheses. 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 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 further illustrates this clearly expressed link.



**Figure 3. Quality of Institutions and Difference between Law and Science Graduates**

## B. Robustness checks

We use various modifications of our empirical model to check robustness of the above findings, and in particular to address the concern that our control variables do not fully eliminate an omitted variable bias which is likely for the extremely diverse group of countries in our sample. To do so we reduce the sample to various more homogeneous sub-groups and estimate model (6) for such sub-groups with the Rule of Law index as a measure of institutional quality and the difference between law and science graduates as the dependent variable. First we restrict our estimation to poorer countries by excluding OECD and high-income non-OECD countries (according to World Bank's classification). Next we perform the opposite exercise by retaining only the wealthier part of the sample. The two following 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 (we will return to these subgroups in Section 5).

**Table 5. Robustness Checks**

	Dependent variable: <i>Difference between Shares of Law and Science graduates</i>					
	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 percapita	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)
LogPopulaion	-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

### C. Instrumental variables analysis

Multi-country cross-sectional regressions are often suspected of an endogeneity bias which could be caused, apart from omitted variables, by measurement errors (which are likely to affect institutional performance indexes) and especially by simultaneity. It could be argued that the allocation of talent is not only driven by institutions but also affects those, perhaps due to political pressure from organized interests demanding more enabling conditions for certain trades, or due to entrenched cultural attitudes, such as in Baumol (1990), which could impact institutions (Tabellini 2008). Endogeneity bias could render OLS estimations inconsistent, and such problem is usually remedied by using appropriate instrumental variables and 2SLS estimations.

Since La Porta et al. (1997, 1998) legal origins (legal traditions, law families) were commonly used as instruments in cross-country institutional analyses (see the literature review in La Porta et al., 2008). The main dichotomy in legal origins is between common and civil law systems; it is shown that the former has clear advantages over the latter in protecting investors' rights, quality of economic regulation, administration of justice and overall property rights protection (La Porta et al., 2008), which makes legal origins a relevant instrument for institutions. Moreover, legal origins affect a number of important economic outcomes (financial sector conditions; capital and labor markets; media freedoms; incidences of corruption; size of the informal sector; etc.) and it is shown that such impact is mediated by institutions (ibid).

To see if the allocation of talent can be added to the list, we estimate the 2SLS model (6) and

$$\text{Institutional Quality}_i = \gamma_0 + \gamma_1 \text{Legal Origins}_i + \gamma_2 X_i + \delta_i, \quad (7)$$

where *Legal origins* is the dummy for the common law system from La Porta et al. (1999). We still use the difference between the enrollment in law and sciences as the dependent variable and estimate the model (6), (7) for the same quality of institutions indexes as in Table 4. The estimation results are presented in the Table 6.

**Table 6: Legal Origins as Instrumental Variables**

Panel A. Second Stage				
<i>Difference between Shares of Law and Science graduates</i>				
	(1)	(2)	(3)	(4)
Rule of Law	-1.544*** (0.581)			
Government Effectiveness		-1.781** (0.729)		
Control for Corruption			-1.750**	

			(0.788)	
Private Property Protection				-0.740*** (0.267)
Log GDP per capita	0.454 (0.383)	0.696 (0.503)	0.506 (0.475)	-0.0708 (0.253)
School Tertiary	1.099 (0.666)	1.048 (0.743)	0.992 (0.782)	0.885 (0.723)
Services, % GDP	1.858 (1.401)	2.341 (1.773)	3.027 (2.148)	0.540 (1.198)
Log Oil reserves	-0.0317 (0.0566)	-0.0394 (0.0710)	-0.00210 (0.0627)	0.0336 (0.0343)
Ethnic Fractionalization	0.253 (0.491)	0.576 (0.619)	0.148 (0.596)	-0.0546 (0.586)
LogPopulaion	-0.168* (0.0873)	-0.0974 (0.104)	-0.230** (0.111)	-0.179** (0.0864)
Constant	-2.569 (4.139)	-6.022 (5.820)	-2.646 (5.022)	5.516** (2.543)
Observations	95	95	95	83

PanelB. FirstStage				
	<i>Rule of Law</i>	<i>Government Effectiveness</i>	<i>Control for Corruption</i>	<i>Private Property Protection</i>
EnglishLegalOrigin	0.430*** (0.122)	0.373*** (0.108)	0.379*** (0.133)	1.024*** (0.172)
Log GDP per capita	0.525*** (0.0804)	0.591*** (0.0714)	0.493*** (0.102)	0.570*** (0.158)
School Tertiary	0.246 (0.321)	0.184 (0.298)	0.156 (0.355)	0.273 (0.447)
Services, % GDP	1.519** (0.605)	1.588*** (0.580)	2.008*** (0.738)	0.560 (0.962)
Log Oil reserves	-0.0633** (0.0242)	-0.0592** (0.0241)	-0.0389 (0.0298)	-0.0589* (0.0341)
Ethnic Fractionalization	0.0254 (0.250)	0.203 (0.226)	-0.0375 (0.299)	-0.174 (0.451)
LogPopulaion	0.0136 (0.0481)	0.0515 (0.0465)	-0.0232 (0.0608)	0.0616 (0.0751)
Constant	-5.703*** (1.108)	-6.882*** (1.049)	-5.076*** (1.344)	-3.080* (1.767)
Observations	95	95	95	83
R-squared	0.732	0.773	0.679	0.610
FirstStageF-statistics	33.97	42.23	26.34	16.77

Legal origins prove to be relevant instruments for all four measures of institutional quality with sufficiently high first stage  $F$ -statistics. Second-stage coefficients of the fitted explanatory variables are of the expected sign, significant at the 1% level, and of substantially higher magnitude than in the initial OLS estimations. Therefore 2SLS model shows an even stronger impact of institutions on the allocation of talent.

La Porta et al. (2008) express reservations about using legal origins as instruments because they affect the economy in a variety of ways, some of which might not be captured by institutional

variables entering 2SLS models. This is a valid concern in our case, since the type of legal system obviously has a direct effect on the administration of justice, courts, law-making etc, and hence on the size of legal profession. While this direct influence could compromise the exogeneity of legal origins as an instrument in our analysis, it actually reinforces our main argument that the quality of institutions matter for the allocation of talent. Indeed, since the adversarial legal proceedings in the common law system involve much more jurists than inquisitorial ones under the civil law (Tullock, 1975), the direct impact of legal origins on the allocation of talent is opposite to the indirect one, working through the institutions, and the latter strongly dominates over the former. The average percentage of law graduates in our sample in civil law countries is 7.24, whereas in common law countries (where trials are *more* “lawyers-intensive”) is 2.99. The difference of 4.25 p.p. is significant at the 1% level.

To further test the established link between institutions and the allocation of talent we now turn to two “natural experiments” – a) colonial conquest and b) establishment and collapse of command economies, followed by transition to free market.

## **5. Natural experiments**

Acemoglu, Johnson and Robinson (2001) observed that European powers had established in their former colonies vastly different institutional regimes some of which protected private property rights whereas others secured extraction and appropriation of rents. Moreover such discrepancy proved to be remarkably resilient and sustained itself over centuries well into the present time. A likely root cause of the divergence of institutional regimes was the mortality of European settlers – in some colonies extreme climate and tropical diseases caused very high mortality among the settlers making them to view such colonies as external reservoir of resources and crafting institutions accordingly. Conditions in other colonies (most notably, the “New Europe” – North America, Australia, and New Zealand) with lower mortality rates proved to be more amenable for Europeans, and hence settlers established there good institutions to serve their own needs. Sustainability of such institutional regimes has been ensured by a combination of political and cultural mechanisms, making settlers mortality a good candidate for instruments that would explain today’s institutions while hopefully eliminating an endogeneity bias.

To test such instruments in our case, we restrict the full sample to former colonies and perform 2SLS estimations for all four measures of institutional quality, using settlers mortality data (from Acemoglu, Johnson and Robinson 2001) as an instrumental variable. Estimation results are reported in Table 7.

**Table 7. Settler Mortality as Instrumental Variable (the case of former colonies)**

Panel A. Second Stage				
Dependent variable: <i>Difference between Shares of Law and Science graduates</i>				
	(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 GDP per capita	0.471 (0.452)	0.627 (0.428)	0.495 (0.499)	0.828* (0.483)
SchoolTertiary	0.336 (2.159)	-0.0628 (1.791)	0.771 (2.302)	0.279 (1.463)
Services, % GDP	1.778 (2.034)	1.616 (1.849)	1.587 (2.202)	-0.604 (1.487)
Log 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 Populaion	-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)
Observations	35	35	35	35
Panel B. First Stage				
	<i>RuleofLaw</i>	<i>GovernmentEffect iveness</i>	<i>ControlforCorrupt ion</i>	<i>PrivatePropertyPr otection</i>
Log Settler Mortality	-0.245 (0.156)	-0.246* (0.140)	-0.266 (0.162)	-0.403* (0.207)
Log GDP percapita	0.285 (0.234)	0.389* (0.222)	0.326 (0.244)	0.852** (0.313)
SchoolTertiary	0.639 (0.915)	0.381 (0.785)	1.002 (0.907)	0.992 (0.967)
Services, % GDP	1.144 (1.222)	1.043 (1.309)	1.107 (1.294)	-0.674 (1.270)
Log Oil reserves	-0.0553 (0.0534)	-0.0458 (0.0532)	-0.0624 (0.0563)	-0.0631 (0.0656)
Ethnic fractionalization	0.297 (0.553)	0.455 (0.445)	0.545 (0.599)	1.480** (0.630)
Log Populaion	0.00684 (0.0955)	0.0595 (0.0865)	0.0363 (0.0887)	0.325*** (0.116)
Constant	-2.411 (3.001)	-4.025 (2.613)	-3.301 (3.008)	-4.772 (3.765)
Observations	35	35	35	35
R-squared	0.615	0.707	0.675	0.775
FirstStage F-statistics	6.15	9.30	8.02	13.26

The settler mortality instrument is weak for the Rule of Law and Control of Corruption indexes; it is somewhat stronger for government effectiveness and especially for property rights protection (which is similar to the institutional performance measures used in Acemoglu, Robison and Johnson 2001). In that latter case the coefficient of the fitted explanatory variable is still of the expected sign and significant at 5% level.

Next we turn to the case of post-communist countries of the former Soviet Union and Central and Eastern Europe. This sub-sample is of particular interest for our analysis due to its near ideal “natural experiment” features. Moscow’s domination ensured high uniformity of both institutions and post-secondary educational systems across the region. Reflecting the nature of economic and political system, higher education under socialism was focused on engineering and sciences, whereas law schools were few and far between and somewhat marginal in terms of their attractiveness for younger talents; the prevailing attitudes and social customs viewed education in sciences as more prestigious and holding better promise of a successful career.<sup>11</sup> This similarity alleviates the concern that allocation of students across fields of studies is at least in part a “supply-side” phenomenon reflecting the capacities of national university systems to offer education in particular disciplines. Such capacities were similar throughout the region at the outset of transition, and the divergence that ensued could be with greater confidence linked to the “demand-side” forces which in their turn reflected the quality of post-communist institutions.

We report the results of OLS estimations of models (6) for the sub-sample of transition countries and the Rule of Law Index as a measure of institutional quality; the graduations in sciences, law, and the difference thereof are used as dependent variables.

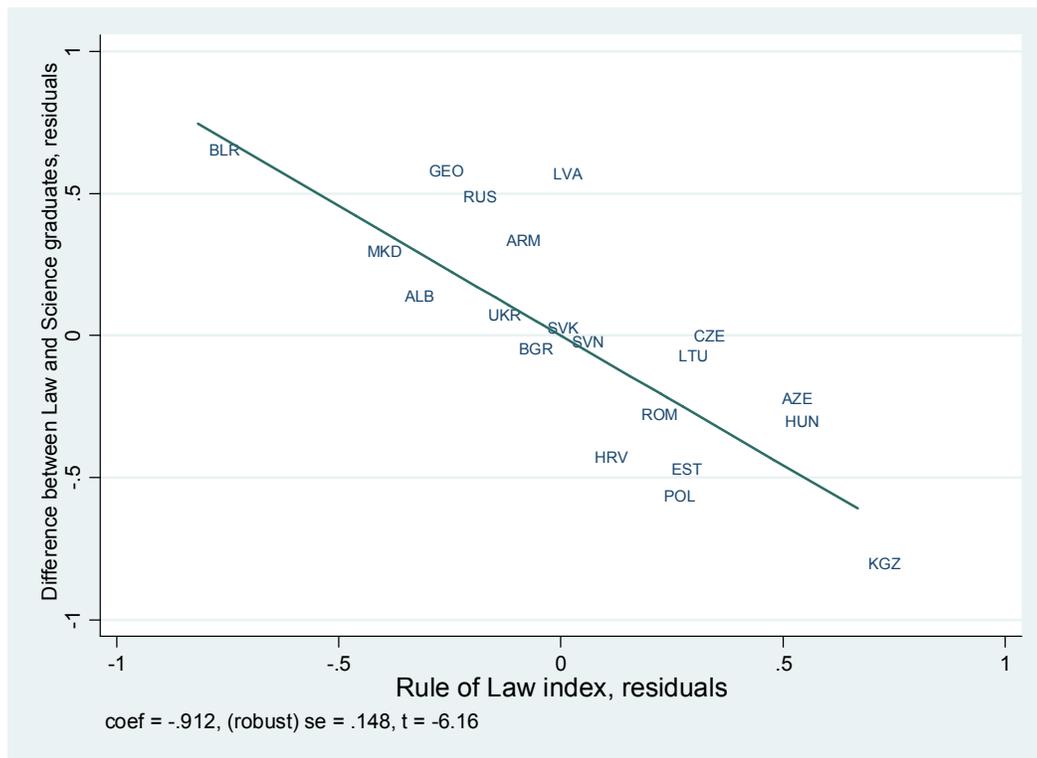
**Table 8. OLS Regressions for Post-Socialist Countries**

	<i>Share of Law Graduates</i> (1)	<i>Share of Science Graduates</i> (2)	<i>Difference between Shares of Law and Science graduates</i> (3)
Rule of Law	-0.735** (0.307)	0.571*** (0.129)	-0.912*** (0.148)
Log GDP percapita	-0.286 (0.313)	0.320** (0.146)	-0.432** (0.158)
School Tertiary	0.399 (0.892)	-1.477*** (0.427)	1.421*** (0.398)
Services, % GDP	3.992* (2.099)	-1.845** (0.819)	3.946*** (0.973)
Log Oil reserves	0.0303 (0.0895)	0.0490 (0.0504)	-0.0205 (0.0486)
Ethnic fractionalization	-0.554 (1.160)	2.224*** (0.549)	-2.127*** (0.607)

<sup>11</sup>This perhaps could be construed as a contradiction to our theory, since the institutions of command economy were obviously quite poor on the counts of property rights protection, rule of law etc. Our logic implies that even with bad institutions there is a private sector on which rent-seekers prey; command economies with totalitarian states do not meet such assumption and are thus exceptions from our rule. As we argue below, these “exceptions” confirmed the rule with particular clarity once central planning was dismantled.

Log Populaion	-0.246 (0.227)	0.148 (0.130)	-0.271* (0.130)
Constant	4.181 (5.001)	-4.827* (2.596)	6.363** (2.404)
Observations	20	20	20
R-squared	0.601	0.735	0.833

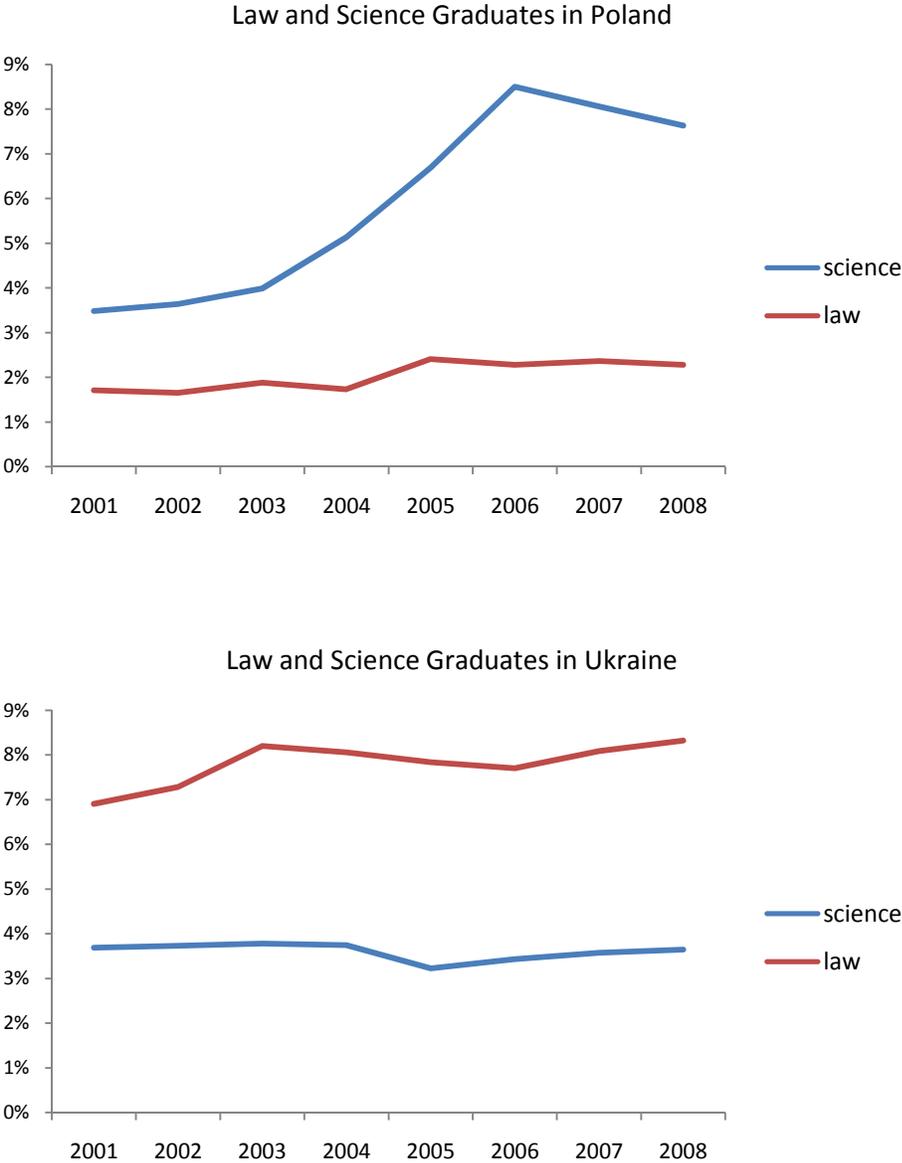
All coefficients of institutional quality in the above estimations are of the expected sign and significant at the 1% level. An inspection of Table 5 (where column (3) is the same as in the above table) shows that of all groups of countries considered in the paper, the coefficient of the Rule of Law index is the highest for the group of post-communist countries and exceeds such coefficient for the whole sample by more than 60%. The following scatter plot (Figure 4) further illustrates the strong association between the quality of institutions and allocation of talent in the former Soviet Union and Central Eastern Europe.



**Figure 4. Quality of Institutions and Difference between Law and Science Graduates in Post-Communist Countries**

Comparisons of different, often neighboring and otherwise comparable, countries, further illustrates the “natural experiment” within the group. A case in point is the divergence between Ukraine and Poland. Both countries experienced an explosive growth of interests in legal profession in the early 1990s to fill the voids left by pre-transition educational systems, and at that

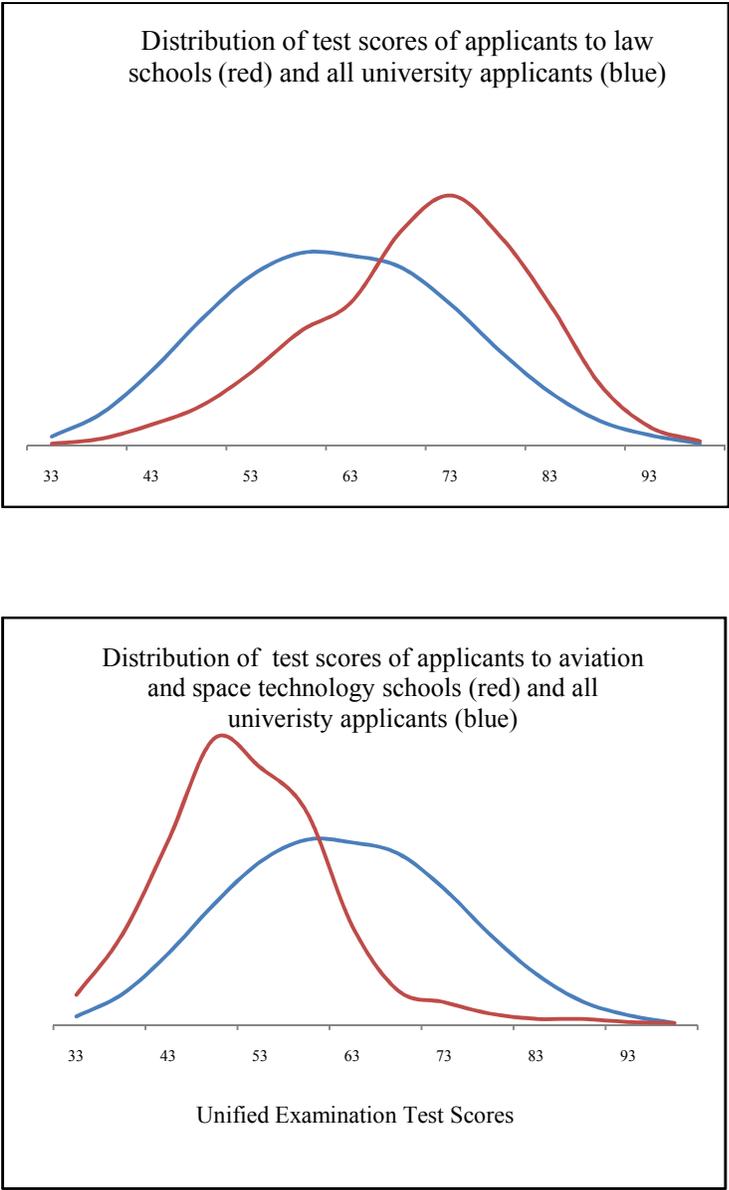
time education in science and engineering suffered a perceptible neglect. However over time the enrollment in law schools in Poland subsided and enrolment in science and engineering recovered numerically and grew steadily over most of 2000s. In Ukraine however no such adjustment has occurred (Figure 5). Stark difference between the two countries can be seen in the numbers of law schools – in Poland degrees in law are conferred by 16 universities whereas in Ukraine the number of such institutions runs in hundreds.



**Figure 5. Law and Science Graduation trends in Poland and Ukraine**

The case in Russia which is notorious for the low quality of its institutions (Polishchuk 2012) further illuminates the link between institutions and the allocation of talent. The following

distributions of the results of the 2010 Russian SAT-like Unified State Examinations of applicants seeking education in various fields reveals clear preference of more talented youth to law over even the most cutting-edge engineering disciplines (Figure 6).



**Figure 6. Distribution of Test Scores in Different Fields in Russia**

**6. Institutions and Allocation of Stronger Talent**

Murphy, Shleifer and Vishny (1991) stress the importance of occupational choices of the most talented individuals who become leading entrepreneurs in either productive activities or rent-seeking

and thus predicate growth rates of their countries (see also Aghion, Howitt, 2009). Recall that the model set forth in Section 2 predicts that when institutions are poor, rent-seeking attracts a higher proportion of more talented individuals than for whole pool, and at the limit absorbs nearly all of the best and brightest. On the contrary, when institutions are strong, more talented individuals show stronger preference to socially productive activities than the whole pool, and at the limit nearly all of the best and brightest are engaged in those activities. Such difference in allocation of stronger talent depending on the institutional quality is of particular importance for economic growth, and we now turn to testing this effect empirically.

We do not have individual data on talent and occupational choice and keep treating countries as our sample's units, using human capital quality measures as proxies for talent of university students of a given country. Our source of data is an international database assembled by Altinok and Murseli (2007) who administered tests in mathematics, sciences and reading among junior high school students in resp. 104, 79, and 88 countries and aggregated the test results in an overall national human capital quality index which we use as a proxy for talent and which is available for 61 countries in our sample.<sup>12</sup>

We divide the sample of countries in two parts at the median of the Rule of Law index (as we did in Table 1), and next divide both halves at their respective average levels of the national human capital quality measures. Next, we calculate average levels of the shares of law graduates for each of the four groups with stronger or weaker institutions and higher and lower human capital levels. The results are presented in Table 9.

**Table 9. Quality of Institutions and Strength of Talent**

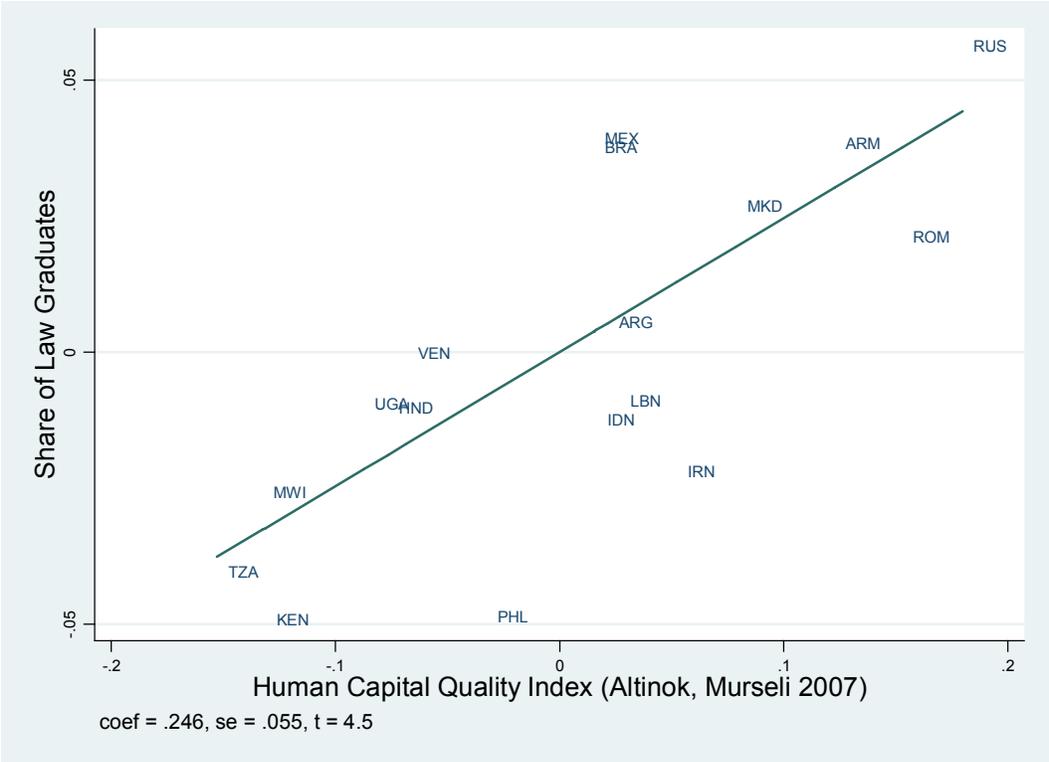
	Weak Institutions	Strong Institutions
High Human Capital Index	7.33%	4.24%
Low Human Capital Index	2.88%	3.20%
Significance of the difference	4.44% ***	1.04%
t-statistics	3.76	1.2
Observations	17	44

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<sup>12</sup> Other sources of similar indexes, e.g. Lee and Barro (2001) and Hanushek and Kimko (2000) cover much fewer countries.

The table confirms that indeed for countries with weaker institutions the share of law graduates for the sub-sample with higher human capital quality is 2.5 times as high as for countries with the same quality of institutions but lower human capital quality. This difference which is consistent with our theory is strongly pronounced and significant at the 1% level. When we compare this to countries with stronger institutions, we observe that for higher levels of human capital quality the impact of the quality of institutions is strong (the share of law graduates drops by more than 40%), and this difference is also significant at 5% level. For lower human capital quality countries improvement of institutions leaves no statistically significant impact on talent allocation, which is also what the theory predicts. Finally, when we restrict our attention to the subgroup with stronger institutions, we do not observe a statistically significant difference between enrollment in law schools in countries with higher and lower human capital quality, which is in contrast with the poorer institutions group of countries.

The predicted impact of the human capital quality on the allocation of talent is particularly clear for the subsample of countries with weak institutions and below average human capital levels (Figure 7). It clearly shows an increase of enrollment in law schools when human capital quality rises, with Kenya and Tanzania at the lower, and Armenia and Russia – at the higher end of the spectrum.



**Figure 7. Quality of Human Capital and Allocation of Talent in Countries with Weak Institutions**

## 7. Allocation of Talent as a Link between Institutions and Growth

Institutions are known for being key factors and drivers of economic growth, and this link is mediated by investments in physical capital. This is usually established as follows (Knack, Keefer 1995; 1997): first, regression models are estimated with resp. growth and investments as dependent variables, and institutions – as explanatory ones, to show that institutions matter for both. Next, a regression model with growth as the dependent variable and institutions *and* investments as explanatory ones are estimated to demonstrate that investments reduce the (residual) impact of institutions or make the latter insignificant altogether. We perform the same exercise with the allocation of talent to show it is also an important link, largely neglected in the prior literature, between institutions and growth. The results are presented in Table 10.

**Table 10. Growth, Institutions, and the Allocation of Talent**

	Dependent variable: <i>Average Growth rate of GDP per capita in 2000-2009</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Rule of Law in 1996	0.759*** (0.244)	0.681** (0.280)	0.673** (0.279)	1.672** (0.633)	0.601 (0.532)	0.601 (0.532)
Share of Law grads		-0.139 (0.195)	-0.136 (0.197)		-1.418*** (0.312)	-1.418*** (0.312)
Share of Science grads			0.124 (0.228)		0.0190 (0.962)	0.0190 (0.962)
School Tertiary	0.288 (0.798)	0.284 (0.793)	0.473 (0.782)	-2.280 (2.437)	-1.580 (3.067)	-1.580 (3.067)
Services, % GDP	0.480 (1.520)	0.678 (1.543)	0.569 (1.553)	3.885 (2.439)	8.391*** (2.073)	8.391*** (2.073)
Log Oil reserves	-0.0295 (0.0602)	-0.0201 (0.0608)	-0.0182 (0.0616)	0.124 (0.214)	0.130 (0.162)	0.130 (0.162)
Ethnic fractionalization	-0.175 (0.842)	-0.147 (0.836)	-0.165 (0.839)	-1.997 (1.615)	-2.151* (1.088)	-2.151* (1.088)
Log Populaion	0.130 (0.122)	0.0989 (0.123)	0.0878 (0.125)	-0.133 (0.608)	-0.271 (0.540)	-0.271 (0.540)
Log initial GDP per capita	-0.403 (0.305)	-0.397 (0.312)	-0.449 (0.320)	0.322 (0.612)	-0.374 (0.810)	-0.374 (0.810)
Constant	2.860 (3.708)	3.184 (3.661)	3.833 (3.878)	-0.274 (10.38)	5.418 (12.41)	5.418 (12.41)
Observations	94	94	94	20	20	20
R-squared	0.174	0.180	0.183	0.616	0.783	0.783

First we run standard regression of growth rates (averaged for the 2000-2009 period) on the quality of institutions, represented by the Rule of Law index, and find the coefficient of the latter positive and significant at the 1% level (column (1)). Next (column (2)) we include an allocation of talent measure – the percentage of law graduates – and observe that the coefficient of the Rule of

Law index drops by 10% of its initial magnitude, and its significance gets weaker. Finally in column (3) we add another allocation of talent measure – the percentage of science graduates – and this leads to further decline of the impact of institutions. Allocation of talent measures in the above regressions have the expected signs, but none of them is significant at 10% level and less. Still, this analysis proves that some part of the impact of institutions on economic growth is mediated by the allocation of talent.

To get a sharper version of the same result, we once again restrict our sample to transition countries and estimate the same regression models (columns (4) to (6)). The full impact of institutions on growth more than doubles in magnitude in comparison with the full sample and is significant at the 5% level. However, once allocation of talent measures are added into equation, institutions become insignificant, and their impact is carried out by the allocation of talent measures which are significant at the 1% level. Therefore the allocation of talent is a highly important transmission link from institutions to growth among the transition economies.

## **8. Concluding Comments**

Institutions affect economic behavior, and long-term investment decisions are particularly sensitive to their quality. Insecure property rights, absence of the rule of law and excessive red tape elevate investment risks and suppress physical capital accumulation. We show that institutions also strongly affect investments in human capital and hence the allocation of talent. Market-supporting institutions attracts talents to productive activities and this is reflected by the choices of fields of study by university students many of whom elect engineering, sciences, medicine and other similar disciplines. Poor institutions on the other hand make rent-seeking more attractive than socially productive activities, and this leads to hypertrophied enrollment in law, public administration, and other similar educational programs.

We confirm these patterns by using data on the allocation of talent and institutional quality for nearly 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 through “natural experiments” which set them on different institutional courses, the link between institutions and allocation of talent is particularly pronounced.

We also find that socially unproductive distortions of the allocation of talent caused by poor institutions are greater for more talented individuals and this exacerbates the damage to economic growth and social welfare, since top talents are not generating innovations and otherwise advance growth, but are engaged in re-distributive activities which could be very harmful for economic development. Indeed, we show that the link between institutions and development is to a significant extent mediated by the allocation of talent.

It is well-known that private and social returns to education could be apart from each other (see e.g. Moretti 2004) and in such case individual incentives that drive educational choices are not properly aligned with social needs. Much of the literature that deals with such discrepancies emphasizes various externalities as their root cause, and implicitly assumes that all educational investments in human capital serve socially productive needs. We point out to another important cause of the gap between private and social returns to education, i.e. when education prepares an individual for rent-seeking.

It is often argued that a discrepancy between social and private returns to education calls for public intervention. This general dictum clearly holds in our case: public policies and reforms that repair faulty institutions would direct talents towards socially productive activities and hence reduce the gap between private incentives and social needs in human capital accumulation.

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