CSAE Working Paper WPS/2018-02

Nepotism, Schooling Outcomes and Economic Development*

Marcello Perez-Alvarez†
Holger Strulik**

February 2018

Abstract. Schooling outcomes matter for economic development. At the same time, educational policies around the globe often fail to effectively improve them. This paper suggests perceived nepotism as an important barrier to the development of cognitive skills as schooling outcomes. We argue that students in countries that perceive labor markets to be nepotistic experience a weaker economic motive to invest in human capital. To formally motivate this relationship, we develop a dynamic general equilibrium model in which nepotism is explained as an evolving cultural norm. We test the central prediction of the model by relating the PISA scores to an indicator for perceived nepotism at the country level. The findings show that, on average, an increase in one standard deviation of the perceived nepotism indicator decreases the PISA reading scores by 0.21 standard deviations, conditioning for overall corruption perception. Several robustness checks corroborate the stability of our estimate. The analysis implies that recruitment practices in labor markets strongly shape individual's efforts to accumulate human capital. Accordingly, the consideration thereof may enhance educational policy efforts.

Keywords: nepotism; cognitive skills; human capital; economic growth; norm transmission.
JEL: E24, I21, I25, O10, O40.

* We would like to thank Andrew Foster, Thorvaldur Gylfason, Stephan Klasen, Krisztina Kis-Katos, Simon Lange and Luciane Lenz for useful comments.

† University of Göttingen, Department of Economics, Platz der Göttinger Sieben 3, 37073 Göttingen Germany; email: marcello.perez@wiwi.uni-goettingen.de.

** University of Göttingen, Department of Economics, Platz der Göttinger Sieben 3, 37073 Göttingen, Germany; email: holger.strulik@wiwi.uni-goettingen.de.

1 Introduction

Schooling outcomes are key drivers of economic development (Hanushek and Woessmann, 2008, 2010, 2012). At the same time, educational policies around the globe often fail to effectively improve them. During the last decades, large schooling expansions have not been followed by skills growth, giving rise to the so-called global learning crisis (World Bank, 2018). In the search for the determinants of these skills, factors related to student and family characteristics, school inputs, institutional features of the school system and short-run incentives have been investigated in a dynamic and exciting branch of economic research (see Hanushek and Woessmann (2010) and Kremer et al. (2013) for reviews).

This paper suggests perceived nepotism as an important barrier to the development of cognitive skills as schooling outcomes. We define nepotism as a recruitment practice in labor markets that favors social ties over human capital endowments. Assuming that investments in human capital are realized with the expectation of higher earnings in the future, we argue that individuals perceiving labor markets to be nepotistic experience a weaker economic motive to invest. Accordingly, these individuals will dedicate fewer resources to the acquisition of skills, ultimately achieving lower test scores. The cases of Singapore and Lebanon illustrate our narrative. Singapore, the top performer in PISA 2015, is well-known for its successful anti-nepotism policy implemented during the past decades (Bellows, 2009). By contrary, nepotism in Lebanon is a widespread phenomenon according to Transparency International (2012). In line with our rationale, the country performed lowest in the PISA study. This paper investigates whether these illustrations feed from a theoretically-grounded pattern with robust empirical support.

Our hypothesis complements the mechanism at play in the human capital theory first developed by Schultz (1961) and Becker (1962), as well as core assumptions of the unified growth theory by Galor (2005). The analysis also adds to recent empirical work on the impact of (perceived) returns to human capital on investments in human capital at the microeconomic level. These studies suggest that individuals respond to higher returns with higher investments, in line with the human capital theory. For example, Foster and Rosenzweig (1996) claim that the green revolution augmented returns to education, which in turn increased enrollment rates in India. Similarly, Kingdon and Theopold (2008) estimate a positive association between regional returns to years of schooling and schooling attendance in India, whereas Attanasio and Kaufmann (2014) estimate a positive effect of expected returns to schooling on college enrollment in Mexico. Experimental studies estimate a positive impact of higher perceived returns on different human capital measures, such as schooling quantity and time dedicated for homework in the Dominican Republic (Jensen, 2010) and test scores in Madagascar (Nguyen, 2008) and Uganda (Riley,

2017). Our study complements the incentives narrative of human capital investments and provides greater external validity.

A parallel literature uses cross-country regressions to explain the international differences in test scores. Such studies barely tackle drivers related to labor markets characteristics. Instead, they focus on the impact of student and family background, school inputs and institutional school characteristics such as private or public management of schools, school autonomy and the features of students' examinations (see Hanushek and Woessmann (2010) for a review). An exception is Guiso et al. (2008), who suggest that higher female labor force participation decreases the gender achievement gap in PISA. This finding evokes an incentive mechanism that is similar to the one of our paper. In their case, gender discriminatory labor markets are the factor decreasing learning outcomes, while we pose nepotistic labor markets as the disincentivizing force.

Studies on nepotism typically investigate its economic consequences at the workplace. For instance, nepotism has been linked to lower worker efforts, lower worker skills, firm investments and productivity (Bramoullé and Goyal, 2016; Parise et al., 2016), poor management (Lemos and Scur, 2017) and bureaucratic performance (Rauch and Evans, 2000). Somewhat more closely related to the rationale of this paper, Di Falco and Bulte (2015) links kinship networks and investments in human capital. However, the mechanism at play is a different one. They claim that a large kinship network represents a safety net or income source that incentivizes free rider behavior.

In order to scrutinize the proposed nepotism mechanism and its impact on economic development we develop a dynamic general equilibrium, in which nepotism is explained as an evolving cultural norm (building on Bisin and Verdier (2001) and Boyd and Richerson (1985)). Perceived nepotism affects effort at school and cognitive ability at the individual level as well as aggregate human capital at the macro-level. The theory is embedded in an endogenous growth model where human capital is an essential driver of technological progress and economic development (building on central elements from unified growth theory from Galor and Weil (2000), Galor and Moav (2000) and Galor (2005)). We show that there exist multiple cultural steady states, with and without nepotism, and that nepotism leads to inferior economic growth and perhaps even stagnation. A one-off intervention (an affirmative action policy) has the potential to set labor markets free of nepotism and initiate development towards a steady state of high economic growth.

To empirically investigate this relationship, we make use of a sample covering 73 countries to estimate random and fixed effects panel data models using the country-level PISA scores and a perceived nepotism indicator derived from the Executive Opinion Survey (EOS). The results indicate that perceived nepotism is an important determinant of cognitive skills. Controlling for economic performance, education- and other institutional quality-related variables, we find that on average, an increase in one standard deviation of the perceived nepotism indicator decreases the PISA reading scores by 0.21 standard deviations. A series of robustness checks corroborate the stability of our estimate.

This is to the best of our knowledge, the first paper linking perceived nepotism and investments in human capital as described above. It should be noted that Coco and Lagravinese (2014) provide an analysis that is similar to this paper in its conceptual foundation, but deviates both theoretically and empirically from our analysis. In this respect, we contribute to the existing literature in various ways. In terms of theoretical considerations, we develop the first dynamic general equilibrium model on the nepotism-educational outcomes relationship and conceptualize nepotism as a cultural equilibrium, presenting multiple cultural steady states and their impact on development. In addition, we show in the model how to escape from nepotistic equilibria. In terms of empirical analysis, we derive strong empirical support via established panel data techniques for the central relationship predicted by the model. Moreover, we are able to make first-use of a remarkably suitable proxy for perceived nepotism that allow us to include both OECD and non-OECD countries in our analysis. Finally, we also differentiate ourselves from past studies by presenting results from subsample and transmission channel analysis that are consistent with the storyline of this paper, as well as by controlling for other institutional quality indicators.

The remainder of the paper is structured as follows. In Section 2 we set up the model, show its implications in form of comparative statics, and derive the cultural dynamics and their consequences for economic development. In Section 3 we report the empirical analysis, including the data and descriptives, empirical specifications and results. Section 4 concludes.

2 The Model

The storyline of this paper is straightforward. Students - and their parents - perceiving labor markets to be nepotistic, that is, labor markets that reward social ties over human capital endowments, experience a decline in their instrumental motivation for education investments. As a result, fewer inputs are invested in the production of human capital, which ultimately dwarfs cognitive skills. To claim that this

relationship is stable, we rely on insights of unified growth theory (Galor, 2005; Galor and Weil, 2000). Unified growth theory suggests that technological progress augmented the demand for human capital in the second phase of the industrial revolution, stimulating investment in the human capital of and leading to a virtuos circle of prosperity between human capital-induced technological progress and technological progress-induced human capital.

Within this framework, a high level of perceived nepotism blocks the virtuos cycle by driving down expected returns to education. Our argument refines the unified growth theory rationale by suggesting that the behavioral response of education to technological progress depends on the perception of the labor market institutions. If individuals perceive the labor market to be nepotistic, conventional technological progress will not increase the expected returns to human capital and hence will lack an incentive effect. As a consequence, the reinforcing mechanism that leads to sustained economic growth decelerates. The following model formally derives this rationale.

2.1 Production

Consider a society that at any time t produces output using white collar workers performing professional, managerial, or administrative work, denoted by M_t, and blue collar workers, L_t. White collar labor input is measured in terms of human capital (i.e. cognitive skills) and blue collar labor input is measured in units of raw labor. Both types of work are fully complementary such that we could imagine firms consisting of headquarters performing M_t-tasks and of workplaces performing L_t-tasks. This notion is captured in the aggregate production function

$$Y = A_t \cdot \min\{M_t,\ \alpha L_t\} \qquad \Rightarrow \qquad M_t = \alpha L_t, \tag{1}$$

in which Y_t denotes output and A_t denotes total factor productivity (TFP). The second equation in (1) follows from requiring efficient production. The parameter α provides the constant ratio of white vs. blue collar workers in production, $0 < \alpha < 1$. Firms operate on competitive good markets such that the associated wages are $w_t^M = A_t$ per unit of white collar human capital and $w_t^L = \alpha A_t$ per unit of blue collar labor input.

2.2 Population

At any time t the economy is populated by a continuum of measure 1 of adult individuals. The adults of time (or generation) t were born and received an education at time $t-1$. The society is divided into

an elite of size λ and the rest of society, of size $1-\lambda$, $0 \geq \lambda < 1$. Adults of both social classes are either employed as white collar worker or blue collar worker such that

$$M_t = M_t^E + M_t^R, \qquad L = L_t^E + L_t^R. \tag{2}$$

A superscript E indicates a variable associated with the elite and a superscript R indicates a variable associated with the rest of society. Each individual is endowed with one unit of raw labor. Human capital, in contrast is individual-specific, depending on schooling outcomes. Individuals are heterogenous with respect to the ability to learn at school. In order to arrive at a closed-form solution we assume that ability is uniformly distributed in the unit interval for both groups, $a^j \in (0,1)$ for $j = E, R$, i.e. no group has an ability advantage.

2.3 Nepotism

A share s_t of the elite receives white collar jobs regardless of skills (i.e. merit and qualification), $0 \leq s_t \leq 1$. We say that nepotism exist when $s_t > 0$ and s_t measures the degree of nepotism in society.

2.4 Education

The adults of generation t achieved an education in period $t-1$. In order to tailor the theory for our empirical section, we focus on schooling outcomes, i.e. we ignore choices regarding the type of school or the length of the education period. Schooling outcomes, controlled in this way, depend on ability and effort at school. Schooling outcomes are measured in terms of human capital. We normalize schooling outcomes such that individuals who exert no effort obtain one unit of human capital. Individuals who exert effort obtain human capital $(1+\rho)$, in which $\rho > 0$ could be conceptualized as the return to (effort in) education. Exerting effort at school entails disutility, which declines with increasing ability of the student. Specifically, we assume that an individual of ability a^j experiences disutilty $\beta A_t / a^j$. The scaling of disutility with A_t is harmless for our results at the micro-level. At the aggregate level, the scaling with TFP prevents that the importance of disutility for the choice of effort vanishes asymptotically in a growing economy. The scaling could be motivated by the notion that the alternative to exerting effort (doing homework etc.) becomes more attractive in a technological more developed environment because technology comprises also leisure technology (TV, video-games etc).

Individuals are motivated to exert effort at school by the prospect of getting hired as a white collar worker. However, this is only true for the rest of society because members of the elite get their jobs

without regard to qualification and due to family connections etc. Thus, by design, members of the elite exert no effort at school. The rest of society considers the probability of getting a white collar job, denoted by p_t, and the associated expected income $p_t(1+\rho)w_t^M + (1-p_t)w_t^L$. Without exerting effort at school they have no chance to get a white collar job and receive income w_t^L for sure. Assuming a linear utility function such that expected utility from consumption equals expected income, we obtain that an individual i from the rest of society exerts effort at school if

$$p_t(1+\rho)w_t^M + (1-p_t)w_t^L - \beta A_t/a(i) > w_t^L.$$

Inserting wages and solving for ability the condition becomes

$$a(i) \geq \frac{\beta}{p_t(1+\rho-\alpha)} \equiv \bar{a}_t. \tag{3}$$

Higher disutility from effort β increases the ability threshold $\bar{a}_t$ that has to be crossed for exerting effort. Likewise, a higher return to education ρ or a higher probability p_t to get hired as a white collar worker reduces the ability threshold. The probability p_t, however, is endogenous and determined in general equilibrium.

2.5 Human Capital and Employment

From the uniform distribution of ability we conclude that there is a measure $1-\bar{a}_t$ of R-group members that exert effort at school. Since the size of the R-group is $1-\lambda$, the share of high-skilled individuals in society is obtained as

$$H_t = (1-\lambda)\left[1-\bar{a}_t\right]. \tag{4}$$

By the law of large numbers, a share p_t of these individuals manages to get a white collar job such that total human capital from the rest of society that is employed in M-tasks is given by

$$M_t^R = (1+\rho)p_t H_t. \tag{5}$$

The remaining high-skilled individuals as well as all R-group members who did not exert effort at school are employed as blue collar worker such that

$$L_t^R = (1-\lambda)\bar{a}_t + (1-p_t)(1-\lambda)\left[1-\bar{a}_t\right]. \tag{6}$$

Finally, employment of the elite is determined due to nepotism and given by

$$M_t^E = s_t\lambda, \qquad L_t^E = (1 - s_t)\lambda. \tag{7}$$

2.6 Nepotism as an Evolving Social Norm

The culture of firms hiring friends and relatives may survive in the long run because it is transmitted from one generation to the next. A plausible assumption is that next period's nepotism depends positively on the level of this period's nepotism such that there exist two extreme steady states: no nepotism ($s_t = 0$) and complete nepotism ($s_t = 1$). Another plausible assumption is that the share of employed white collar workers that were hired due to qualification and merit (M_t^R) influence nepotism negatively. These considerations are captured in the modified replicator dynamics for a two-trait population model:

$$\Delta s_t \equiv s_{t+1} - s_t = (\gamma - \mu M_t^R)(1 - s_t)s_t. \tag{8}$$

For $\mu = 0$ this boils down to the standard two-trait model of logistic growth with γ determining the adjustment speed (Bisin and Verdier, 2001; Boyd and Richerson, 1985). The parameter μ measures the power of M^R workers to break the transmission of nepotism from one generation to the next.

2.7 Productivity

Human capital does not only affect current productivity, it is also conducive to long-run growth. Following considerations in standard unified growth theory (Galor and Weil, 2000) we capture this idea in reduced-from as a law of motion for TFP:

$$A_{t+1} = f(H_t)A_t, \tag{9}$$

with $f > 0$ and $f' > 0$. Technical progress is thus imagined to result from learning-by-doing of high-skilled individuals or, alternatively from the adoption of new technologies, which is facilitated by human capital (Nelson and Phelps, 1966).[1] In general equilibrium all labor markets clear and individuals form the correct expectation of getting hired according to qualification. This completes the description of the model.

[1]The alternative would be to model explicitly the impact of human capital and education on R&D and the innovation of technologies (see e.g. Strulik et al. (2013)). We abstain from this refinement because the micro-foundation of economic growth is not the main focus of our paper.

2.8 Solution

At any given time t, A_t and s_t are predetermined and thanks to the simple setup the model exhibits a closed from solution. From (1) to (7) we obtain:

Proposition 1 (Interior Equilibrium) *The unique interior general equilibrium of educational outcomes and labor allocation is given by:*

$$L_t = \frac{1+\rho(1-\lambda s_t)}{1+\rho+\alpha} \tag{10a}$$

$$M_t = \frac{\alpha[1+\rho(1-\lambda s_t)]}{1+\rho+\alpha} \tag{10b}$$

$$L_t^R = \frac{1+\rho-\lambda\left[1+\rho+\alpha-(1-\alpha)s_t\right]}{1+\rho+\alpha} \tag{10c}$$

$$M_t^R = \frac{(1+\rho)\left[\alpha-(1+\alpha)\lambda s_t\right]}{1+\rho+\alpha} \tag{10d}$$

$$H_t = \frac{(1-\lambda)(1+\rho-\alpha)\left[\alpha-(1+\alpha)\lambda s_t\right]}{\beta(1-\lambda)(1+\rho+\alpha)+(1+\rho-\alpha)\left[\alpha-(1+\alpha)\lambda s_t\right]} \tag{10e}$$

$$p_t = \frac{\beta(1-\lambda)(1+\rho+\alpha)+(1+\rho-\alpha)\left[\alpha-(1+\alpha)\lambda s_t\right]}{(1-\lambda)\left[(1+\rho)^2-\alpha^2\right]} \tag{10f}$$

The easiest way to prove the proposition is by backward induction. Take (10) and verify that (1)–(7) are fulfilled. From inspection of (10d) we obtain a condition for the interior equilibrium to prevail.

Proposition 2 (Integrated vs. Segregated Society) *An interior solution with the rest of society contributing to white collar work exists for $s_t < \bar{s} \equiv \alpha/\left[\lambda(1+\alpha)\right]$. Otherwise, the rest of society exerts no effort in education and $M_t^R = H_t = 0$. The threshold $\bar{s}$ is declining in the size of the elite λ.*

When nepotism is sufficiently strong, the probability of getting a white collar job through qualification is sufficiently low such that even the most talented individuals from the rest of society exert no effort at school and the share of high-skilled people in society is zero. The nepotism threshold is declining in the population share of the elite because a total of λs_t of white collar jobs is not available for the rest of society. Naturally, prevailing nepotism has less severe consequences if it applies only to a small share of society. Since s_t is bounded from above by one, the threshold is never crossed for sufficiently low $\lambda < \alpha/(1+\alpha)$. The threshold depends positively on α, which is also intuitive since $\alpha = M_t/L_t$ measures the relative amount of available white collar jobs. In the following, we focus on the more interesting case of an integrated society in which at least some individuals obtain a white collar job due to qualification.

Proposition 3 (Nepotism and Cognitive Skills) *At the interior equilibrium, the probability to get a white collar job by qualification p_t as well as the population share of individuals supplying high cognitive*

skills H_t and the measure of white collar workers hired by qualification M_t^R are declining in nepotism, $\partial p_t/\partial s_t < 0$, $\partial H_t/\partial s_t < 0$ and $\partial M_t^R/\partial s_t < 0$.

The result for M_t^R can be read off from (10d). For the rest of the proof we take the derivative of (10e) and (10f):

$$\frac{\partial p_t}{\partial s_t} = -\frac{(1+\alpha)\lambda}{(1-\lambda)(1+\alpha+\rho)} < 0,$$
$$\frac{\partial H_t}{\partial s_t} = -\frac{(1+\alpha)(1-\lambda)^2\beta\lambda\left[(1+\rho)^2-\alpha^2\right]}{D^2} < 0.$$

in which D is the denominator of (10e). Intuitively a higher level of nepotism, ceteris paribus, reduces the probability to obtain white collar work through qualification and reduces the motivation to exert effort at school. As a result, the population share of high-skilled individuals and therewith the average cognitive skills of students declines. This is the main hypothesis that we will scrutinize in the empirical section. The feature that $\partial M_t^R/\partial s_t < 0$ will be important for the evolution of the economy.

Proposition 4 (Size of the Elite) *An increasing size of the elite drives down the probability to obtain white collar work by qualification and reduces the population share of high-skilled individuals.*

For the proof, we take the derivative of (10f):

$$\frac{\partial p_t}{\partial \lambda} = \frac{\alpha-(1+\alpha)s}{(1-\lambda)^2(1+\alpha+\rho^2)} < 0$$

because, at the interior equilibrium, $\alpha/(1+\alpha) > \bar{s} > s_t$, which follows from Proposition 2. Next, we insert (3) in (4) and obtain from differentiating with respect to λ that

$$\frac{\partial H_t}{\partial \lambda} = -(1-\bar{a}) + (1-\lambda)\frac{\beta}{p_t^2(1+\rho-\alpha)}\frac{\partial p_t}{\partial \lambda} < 0.$$

The other comparative static results are inferred straightforwardly from inspection of (10). Notice, that declining nepotism increases white collar work M_t as well as blue collar work L_t. The reason for this seemingly implausible result is that M_t is measured in units of human capital. Declining nepotism leads to higher cognitive skills per person in white collar work, implying that less white collar workers are needed for the same tasks. In other words, the management of firms becomes more efficient. Redundant former white collar workers are employed in blue collar work.

2.9 Dynamics

We next investigate comparative dynamics. The feature that human capital hired by qualification depends negatively on nepotism ($\partial M_t^R/\partial s_t < 0$ in (10)) modifies the replicator dynamics (8) in a non-trivial way:

$$\Delta s_t = \left[\gamma - \mu M^R(s_t)\right](1 - s_t)s_t. \tag{11}$$

We illustrate the behavior of norm transmission with the help of Figure 1. The panel on the left hand side shows the case where μ is sufficiently low such that $\gamma > \mu M_R(0)$. As a result Δs_t is positive for all s_t and the society converges towards complete nepotism ($s = 1$). The right hand side of Figure 1 shows the opposite case where μ is sufficiently large such that $\gamma < \mu M_R(1)$. Now, Δs_t is always negative, and society unambiguously moves toward a steady state without nepotism ($s = 0$). The impact of white collar workers hired by qualification is strong enough to break the transmission of the social norm of nepotism at any level of s_t. Of course a necessary, non-sufficient conditions for this outcome is that white collar workers are hired $M_t^R > 0$, i.e. that society is situated at an interior equilibrium for all s_t (see Proposition 1).

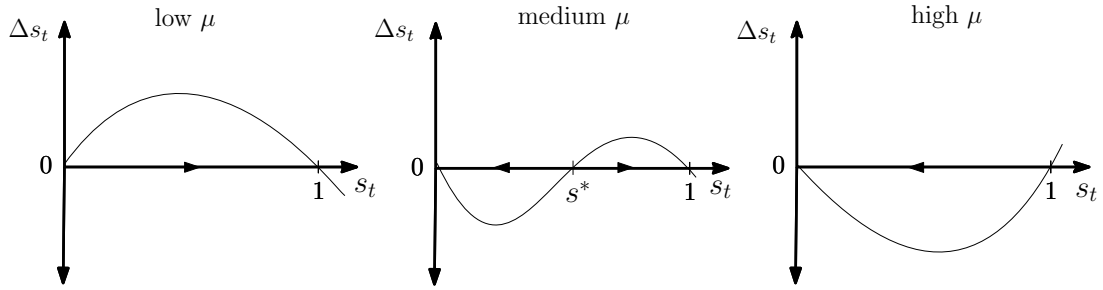

Figure 1: Social Norm Dynamics

The intermediate case, where $\mu M_R(1) < \gamma < \mu M_R(0)$, is the the most interesting one. It is shown in the center panel of Figure 1. At low values of nepotism the impact of (the relatively many) white collar workers hired by qualification is dominating and the society converges towards a steady state where nepotism is eliminated. At high values of nepotism, in contrast, white collar workers hired by family connections dominate and the cultural norm of nepotism is socially transmitted toward the steady state $s = 1$. The following proposition summarizes these observations more formally.

Proposition 5 (Multiple Cultural Steady States) *For μ in an intermediate range,*

$$\frac{(1+\alpha+\rho)\gamma}{\alpha(1+\rho)} < \mu < \frac{(+\rho)\left[\alpha(1-\lambda)-\lambda\right]\gamma}{1+\alpha+\rho}, \tag{12}$$

there exist an unstable equilibrium at

$$M^{R^*} = \frac{\gamma}{\mu} \qquad \Rightarrow \qquad s* = \frac{\alpha(1+\rho)-(\gamma/\mu)(1+\rho+\alpha)}{(1+\alpha)(1+\rho)\lambda} \tag{13}$$

with $\Delta s_t < 0$ for $s_t < s^*$ and $\Delta s_t > 0$ for $s_t > s^*$.

For the proof, M^{R^*} is obtained by setting (11) to zero for $s \neq 1$ and $s \neq 0$. Inserting M^{R^*} into (10d) and solving for s_t provides s^*, with $\partial s^*/\partial \mu > 0$. Setting $s^* = 0$ provides the lower bound for μ in (12) and setting $s^* = 1$ provides the upper bound.

The intermediate case of multiple equilibria is of particular policy relevance. It shows that a culture of nepotism can be broken by affirmative action. If a society is converging to or situated at $s = 1$, a sufficiently strong enforced increase of non-elite individuals in white collar work, brings society permanently on a path towards the steady state at $s = 0$. After a one-time movement of $M_t^R < M_R^*$, s starts declining permanently.

2.10 Long-Run Economic Development

Inspection of (9) shows that an economy is capable of perpetual growth of TFP and thus (from (1)) perpetual growth of income per capita if $f(H_t) > 1$. Otherwise the economy converges towards stagnation. This observation motivates the following result.

Proposition 6 (Growth and Stagnation) *At any time t, productivity and per capita income declines in nepotism. If furthermore $f(H(1)) < 1 < f(H(0))$, then a society converging towards the steady state of nepotism ($s = 1$) experiences convergence toward economic stagnation while a society converging to the steady state free of nepotism ($s = 0$) experiences long-run economic growth.*

For the proof, we first note that the share of high-skilled individuals in society is a function of nepotism, $H_t = H(s_t)$, see (10e), and that it is declining in nepotism, see Proposition 2. Thus, $\frac{\partial f}{\partial H}\frac{\partial H}{\partial s} < 0$. The qualitative separation of steady states is then ensured by observing $\frac{A_{t+1}}{A_t} < 1$ for $f(H(1)) < 1$ as well as $\frac{A_{t+1}}{A_t} > 1$ for $f(H(0))$. Intuitively, if white collar workers are not hired according to cognitive skills, the white collar department works sufficiently inefficiently and adopts new technologies not fast enough

to sustain long-run productivity growth (see La Porta and Shleifer (2008), Bloom and Reenen (2007, 2010), Syverson (2011) and Gennaioli and Porta (2013) for evidence that firms of high productivity are on average run by better educated managers.)

We finally illustrate the potential long-run evolution of societies with a numerical example. We use a narrow notion of white collar work and associate it with professional, managerial, technical jobs. Using values for the U.S. in the year 2007 from Table 3b in Acemoglu and Autor (2011) we set $\alpha = 0.34/(1-0.34) = 0.51$. We set the return to high cognitive skills ρ to 0.4. This implies a return per year of schooling of 3.3 percent for 12 years of schooling. Notice that the return is associated with effort and not with attendance at school. It implies a skill premium for non-elite white collar workers of $(1+\rho)/\alpha = 2.7$. We assume that the elite comprises 10 percent of society ($\lambda = 0.1$). We assume that a generation takes 25 years. We use a simple linear knowledge production function $f(H_t) = \delta_t H_t$ and set $\delta = 2.5$ such that, if there is long-run growth, TFP (and income per capita) grow at about one percent annually at the steady state. We have no guidelines to determine the remaining parameter values and set them (arbitrarily) to $\beta = 0.2$ and $\gamma = 0.7$. We set $A(0) = 1$ and the initially prevailing norm $s(0)$ to 0.5, implying that half of the elite gets white-collar jobs due to kin connections. We experiment with alternative values for μ, in order to illustrate alternative long-run economic and social developments.

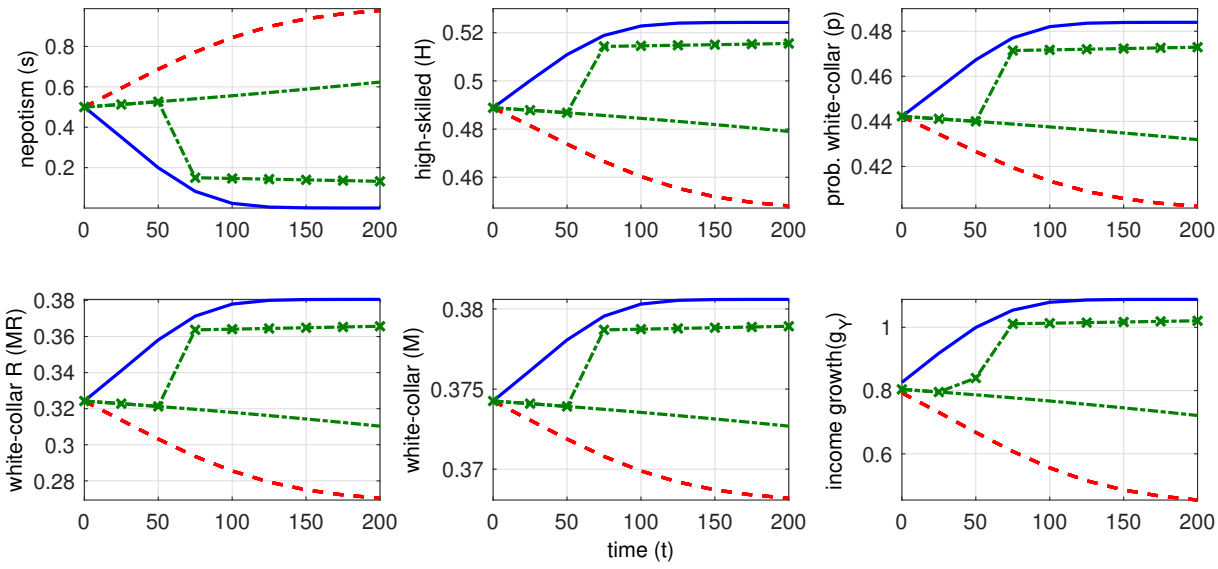

Figure 2: Nepotism and Development

Parameters: $\alpha = 0.51$, $\beta = 0.2$, $\gamma = 0.7$, $\delta = 2.5$, $\rho = 0.4$ and blue (solid) lines: $\mu = 4$, red (dashed) lines: $\mu = 1$; green (dash-dotted) lines: $\mu = 2$. x-crossed lines: policy intervention at year 50 enforces (for 1 generation) $s = 0.15$.

We first consider the case of $\mu = 4$, reflected by blue (solid) time paths in Figure 2. Here, the power of non-elite white collar workers is strong enough to break the cultural norm of nepotism. The society converges towards the nepotism-free steady state, which is approximately reached after 4 generations (at time 100). With declining nepotism the probability to get a white collar job by qualification increases (upper right panel) and the population share of high-skilled individuals H_t, i.e. the average level of cognitive skills in society increases (upper center panel). Moreover, non-elite human capital in white-collar work (lower left panel) as well as total white-collar human capital (lower center panel) and total employment of workers (not shown) increases along the adjustment path towards the steady state. As a result, TFP and income per capita growth increases (lower right panel). Summarizing, nepotism is negatively associated with cognitive skills and economic development.

The opposite case is shown by red (dashed) lines, reflecting the case of $\mu = 1$. Here, non-elite white collar workers have insufficient power to break the cultural trait of nepotism and nepotism increases further causing a decline in the probability to get a white collar job by qualification and a decline of the population share of high-skilled individuals (average cognitive skills). As result, also total human capital in white collar work and thus efficiency and the scale of production declines. At the prevailing low average skill level, there is too little knowledge adoption (or learning by doing) and long-run growth is not sustainable. The economy converges towards stagnation (lower right panel).

The case of multiple cultural equilibria is shown for $\mu = 2$ and represented by green (dash-dotted) lines in Figure 2. Here, we have two stable extreme steady states separated by an unstable intermediate steady state. Assuming that the society starts on the "wrong side" of the intermediate steady state, it converges towards full nepotism. The speed of convergence is relatively low since $(\gamma - \mu M_R)$ is smaller than for the red-lines case where $\mu = 1$. But in the end, the power of non-elite white collar workers is not high enough to break the culture of nepotism. Adjustment dynamics are slow enough that a small window of observations could suggest that nepotism is almost constant at an intermediate level.

Finally, we demonstrate the power of affirmative action. For that purpose we implement a policy that enforces $s = 0.15$ in year 50. Adjustment dynamics are shown by green crossed lines in Figure 2. Apparently, the policy was strong enough to break the nepotism culture. After termination of the affirmation action policy in year 75 and beyond, the society self-sustains a low level of nepotism and converges slowly towards the nepotism-free steady state and positive long-run growth.

3 Empirical analysis

In this section, we focus on the central proposition of our model. Proposition 3 states that cognitive skills are declining in nepotism levels. More concretely, our model predicts that the educational outcomes of the young population is negatively affected by the degree of nepotism experienced by the adult population in labor markets. To directly test for the main prediction of the model, we relate the PISA scores as an indicator for the cognitive skills of 15-year old students to a novel indicator of perceived nepotism across countries.

3.1 Data and Descriptives

Our data consists of a panel of countries participating in the Programme for International Student Assessment (PISA) implemented by the Organisation for Economic Cooperation and Development (OECD). The PISA is a multi-country study assessing the reading, mathematics and science skills of 15-year-old students every three years since 2000. We use the waves of 2009, 2012 and 2015 in our analysis.[2] Pooling the three rounds gives us a total of 73 countries and an average observation number per economy of 2.7, amounting to a total number of 191 observations.[3]

The PISA test scores have two properties that are valuable for this cross-country analysis. First, they are internationally comparable by design. PISA emphasizes its effort in designing a large-scale test that is culturally and linguistically neutral, as well as equivalent in difficulty and scale across countries. Second, the sample design, usually a two-step stratified random sampling procedure first selecting schools and then students, recovers a nationally representative sample of the target population of 15-year-old students (OECD, 2016). As a result, country averages of the test scores are a reliable proxy for the nation-wide human capital of secondary students.

The skills in reading, mathematics and science are measured via a test that takes two hours in total.[4] The test measures not only the knowledge of students but also their capacity to apply that knowledge. Moreover, information on the students and their family background, as well as information on teachers and schools as a whole, are captured through questionnaires (OECD, 2016). For example, students are

[2] We were unable to include prior rounds due to data constraints on our measure for perceived nepotism.

[3] Argentina, Kazakhstan and Malaysia 2015 values are excluded from the sample due to data collection reasons. For the case of Argentina and Malaysia, coverage was insufficient. Kazakhstan scores are not reliable due to lenient marking (OECD, 2016, pp. 303-304). Given that there is no GDP and/or perceived nepotism data for Macao(China), Miranda(Venezuela), Kosovo, and Liechtenstein, these countries are excluded from the analysis.

[4] In 2015, the assessment was mainly computer-based. To ensure comparability with previous mainly paper-based tests, PISA carefully selected test items that have been proven to be equal in their measurement in paper-based and computer-based assessments. In our analysis, we make use of year fixed effects to tackle remaining concerns.

asked to indicate the interval corresponding to the number of books they have at home.[5] We aggregate this variable at the country level to generate the share of students corresponding to each interval. We perform similar aggregations to generate additional country-level variables from these surveys such as relative teacher pay, student-teacher ratios, cumulative expenditure and percentage of private schools. Similarly, we also take information on the existence of central external examinations to generate a binary indicator.

We construct our measure of perceived nepotism at the country level from a survey item of the yearly Enterprise Opinion Survey (EOS) by the World Economic Forum (WEF). The EOS is a rotating panel dataset available since the time period 2006-2007 and captures the opinion of business leaders around the world on a broad range of topics. The sample design follows a dual stratification procedure that aims at capturing a representative sample of firm owners based on firm size and economic sector. For the time period 2013-2014, more than 13.000 business leaders in 148 economies participated in this survey. For our sample of 73 economies, the average sample size is of 114 interviews per country per wave, covering leaders of small, medium and large enterprizes operating in economic sectors such as agriculture, manufacturing industry, non-manufacturing industry and services (WEF, 2007, 2013).

Firm owners were asked to evaluate recruitment practices on a scale from 1 to 7, where 7 implies that senior management positions are held by "mostly professional managers chosen for merit and qualifications" and 1 stands for "usually relatives or friends without regard to merit" (WEF, 2013). We consider that the inverted scale of this item captures our definition of nepotism remarkably, where the emphasis on merit and qualifications is crucial for the interpretation of responses.[6] Accordingly, we use it as our proxy for perceived nepotism. According to this measure, countries such as Sweden, New Zealand, Finland and Norway had the lowest perceived nepotism in 2015, while Algeria, the Dominican Republic, Romania and Italy had the highest. Peru, Indonesia, Czech Republic and Lithuania are median countries.[7] To the best of our knowledge, this is the first paper using this indicator as a proxy for perceived nepotism.

[5]The eligible intervals are 0-10, 11-25, 26-100, 101-200, 201-500 and more than 500.

[6]While this is clearly a perception of the degree of nepotism, it could arguably stand for the degree of nepotism itself. This is not a necessary assumption for our analysis, but one we would like to entertain. The WEF argues that the perception of the interviewees is consistent with reality by cross-validating the survey data with empirical facts, whenever available. For example, they show that the correlation between their item on perceived impact of tuberculosis on business and the actual prevalence of tuberculosis is of -0.84. A similar exercise is shown for internet usage (WEF, 2007, pp. 133-134). Moreover, as agents of the private sector, respondents are in close contact with recruitment practices, enabling them to assess related questions with greater accuracy.

[7]See countries ordered by perceived nepotism scores in Table A1.

These scores are collected yearly. However, the WEF publishes weighted biennial values only. We conceptualize the lagged perception on nepotism to have an impact on current learning outcomes for two reasons. First, we expect early incentive effects to reduce early skills, which in turn stunt later learning efforts and outcomes. This is in line with the rationale of skills complementarity by Cunha and Heckman (2007). Second, it might take time for investment decisions shaped by perceived nepotism to become visible in test scores. Given that we expect that the effect of interest is cumulative and dilatory, we link the average of lagged values of perceived nepotism to the PISA scores.[8] By doing so, we consider the time spacing of PISA rounds and acknowledge the data constraints of the EOS. More precisely, we link the PISA 2015 country averages to the arithmetic mean of the perceived nepotism scores from the three lagged time periods 2011-2012, 2012-2013 and 2013-2014 and the PISA 2012 values to the mean from perceived nepotism scores of 2008-2009, 2009-2010 and 2010-2011. The PISA 2009 values are in turn matched to the 2006-2007 and 2007-2008 values. Figure 3 depicts the resulting match and suggests a negative association between perceived nepotism and PISA reading scores. Additional EOS indicators such as variables for perception on governmental transparency, wastefulness of resources and infrastructure quality are included in our analysis with the same lag structure as controls.

We combine the PISA and EOS data with country-level variables from additional sources. GDP data is obtained from the World Development Indicators. Information on enrollment rates and government expenditure on secondary education are provided by the UNESCO.[9] Finally, we obtain the Corruption Perception Index (CPI) and the Property Rights Index by Transparency International (TI) and the Heritage Foundation respectively. For some of these controls, we impute values by using the average values of each wave to avoid the loss of observations.[10] For each of these controls, we include a dichotomous variable indicating imputed values in all our estimations. This inclusion takes care of the risk of imputed values driving our estimations.

[8] Moreover, averaging perceived nepotism scores help us reduce measurement error.

[9] The OECD provides data on cumulative expenditure on education using two sources: The Education at a Glance database and PISA-system level data

[10] See Table 1 for the number of observations per variable for the main variables of interest and table A2 for the same table with all variables used in this analysis.

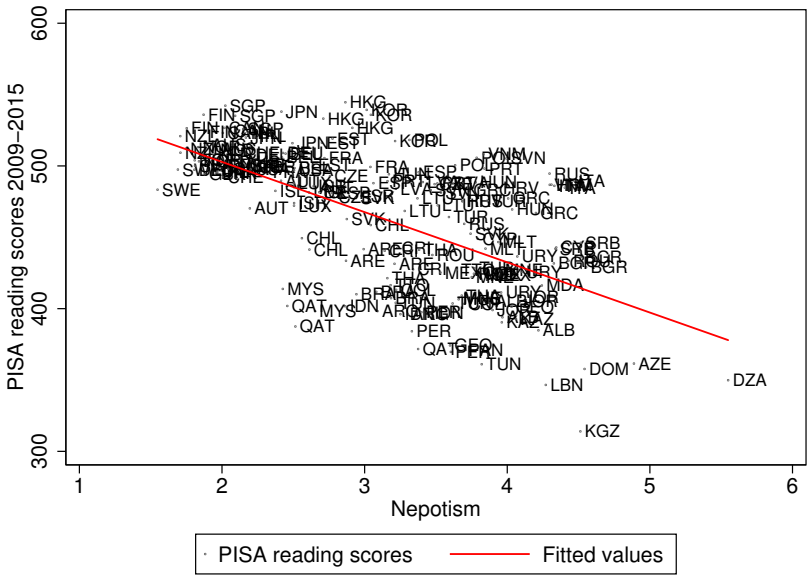

Figure 3: Perceived nepotism and cognitive skills

We now turn to the descriptive statistics of our data. Table 1 depicts the mean, overall, between and within standard deviation, as well as the number of observations of the main variables of interest by OECD membership. We focus on the PISA reading scores because we believe that reading literacy skills are more comprehensive than math or science skills.[11] However, we provide descriptive statistics and regression results using math and science skills in the Appendix, which are qualitatively equivalent. The data on PISA reading scores, GDP, enrollment, relative teacher pay and percentage of private schools stem from the three PISA wave years, namely 2009, 2012 and 2015. The data points for perceived nepotism, CPI and Property Rights Index stem from the three lagged time periods as described above.

Table 1: Descriptive statistics by sample

Variable	Mean			SD			between-SD			within-SD			Observations		
	O	N	P	O	N	P	O	N	P	O	N	P	O	N	P
PISA Reading	494	426	463	23.4	46.0	48.9	22.4	48.1	53.9	7.37	8.25	7.76	105	86	191
GDP	35.7	22.6	29.9	14.1	22.8	19.6	13.9	20.3	18.9	2.9	5.3	4.2	105	86	191
Enrollment	91.0	81.8	87	6.66	8.81	8.88	6.87	9.05	9.26	1.16	2.56	1.89	59	45	104
Relative teacher pay	1.16	1.28	1.20	0.33	0.55	0.41	0.34	0.56	0.44	0.10	0.27	0.17	87	40	127
S-T ratio	13.3	15.9	14.3	4.19	5.27	4.80	4.09	5.44	4.85	1.01	1.15	1.07	104	68	172
% Private schools	17.6	14.8	16.4	19.4	15.6	17.8	19.6	16.0	17.8	3.85	2.02	3.15	101	82	183
Perceived Nepotism	2.71	3.62	3.12	0.75	0.64	0.84	0.74	0.67	0.87	0.18	0.19	0.19	105	86	191
CPI	69.2	44.8	58.1	17.2	17.0	20.9	17.1	16.4	21.3	2.63	2.70	2.66	104	86	190

Note: O stands for OECD sample, N for Non-OECD sample and P for Pooled sample. PISA Reading refers to the test scores in the corresponding subject at the country level. GDP data is per capita/1000 and in PPP values. Enrollment is net enrollment rates. Relative Teacher pay stands for the ratio of average wages for teachers of low secondary schooling with minimum training to GDP p.c.. S-T ratio stands for student-teacher ratio. Perceived nepotism has a 1-7 scale. CPI is on a 0-100 scale, with higher values representing lower levels of perceived corruption.

[11] We base this interpretation on the PISA definition of reading literacy as the *"students' ability to understand, use, reflect on and engage with written texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society"* (OECD, 2016, p. 28).

As shown in Table 1, slightly less than half of the pooled sample corresponds to non-OECD countries. The relatively large number of Non-OECD countries contributes to the considerable variation in variables of interest for our pooled sample of countries, which can be confirmed by comparing mean values for the OECD and Non-OECD sample.[12] By comparing the different types of standard deviations, it becomes evident that most of the variation is between countries. For the case of perceived nepotism in the pooled sample, the between-SD almost reaches unity, while the within-variation is less than a fifth. This is not surprising given that such persistent factors might not change substantially within a decade.

Table 2: Correlation matrix

	Perc. nepotism	GDP	Enrollment	R. t. pay	CPI	Proprights	Infrastr.
Perceived nepotism	1						
GDP	-0.688***	1					
Enrollment	-0.118	0.229	1				
Relative teacher pay	-0.018	0.067	-0.306*	1			
CPI	-0.834***	0.768***	0.250*	0.009	1		
Proprights	-0.795***	0.763***	0.226	0.032	0.934***	1	
Infrastructure	-0.685***	0.741***	0.237	0.109	0.800***	0.815***	1

Note: Pooled sample, year 2015. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2 shows the correlation of the main variables of interest for the pooled sample in the year 2015. Our measure of perceived nepotism is highly correlated with measures of institutional quality such as the CPI and the Property Rights Index. We discuss this issue further in the next section. For the non-OECD sample (Table A4), the correlations between these variables drops to values around 0.6. On the other hand, for the sample of OECD countries (Table A3), these correlations increase. The picture is similar for the other two PISA wave years.

3.2 Empirical specification

Figure 3 illustrates the relationship of interest of our analysis. It plots our measure of perceived nepotism against the PISA reading scores of the years 2009, 2012 and 2015. There is a visually strong negative relationship which we formally explore in this section. To do that, we depart from a standard international education production function at the country level as follows:

$$Y_{ct} = \alpha_1 + \beta_1 Nepotism_{c\bar{t}} + \beta_2 GDP_{ct} + \gamma_r + \epsilon_t + e_{ct} \tag{14}$$

where the dependent variable Y_{ct} stands for PISA reading scores for country c at time t. $Nepotism_{c\bar{t}}$ is our indicator for perceived nepotism as described in the Section 3.1, GDP_{ct} is logarithmized GDP per

[12] See 2015 values per country for GDP, PISA Reading scores and Perceived Nepotism in Table A1.

capita, γ_r and ϵ_t stand for regional and PISA wave fixed effects, while e_{ct} is a classical error term. The regional fixed effects allow us to draw on variation within major geographical regions, which are more homogeneous (see Table A1 for the region categories). The PISA wave fixed effects let us control for aggregate time trends. To ease endogeneity concerns, we extend Equation (14) as follows:

$$Y_{ct} = \alpha_1 + \beta_1 Nepotism_{c\bar{t}} + \beta_2 GDP_{ct} + \boldsymbol{\delta_1} X'_{ct} + \boldsymbol{\delta_2} Z'_{c\bar{t}} + \gamma_r + \epsilon_t + e_{ct} \quad . \tag{15}$$

As shown in Equation (15), we systematically control for a vector of controls X'_{ct} related to the supply side of the education sector and for a vector of controls $Z'_{c\bar{t}}$ related to the institutional quality of countries. In so doing, we attempt to tackle the major threats to the identification of β_1 in equation (14). By doing this, we do not claim to identify a causal effect, but to provide suggestive evidence to our storyline and its robustness against alternative interpretations of the estimation results. While we cannot ensure that the identifying assumption of $Nepotism_{c\bar{t}}$ being orthogonal to e_{ct} is fulfilled in Equation (15), we are able to rule out major threats. Moreover, to the detriment of the use of between-variation, we run fixed effects regressions to tackle as a robustness check time-invariant unobserved heterogeneity.

To motivate the first type of controls, recall that our relationship of interest is demand-driven.[13] However, if countries with a high perception of nepotism perform poorly in terms of education supply factors such as government expenditure in education or relative teacher pay, and at the same time these factors turn out to be determinants of test scores, our measure for perceived nepotism would not be orthogonal to e_{ct} in equation (14). We let the literature on the country-level determinants of learning outcomes guide the selection of controls related to education supply. We control for school enrollment rates (Hanushek and Woessmann, 2011), student-teacher ratios (Hanushek and Kimko, 2000; Lee and Barro, 2001), government expenditure on secondary education as percentage of GDP, cumulative expenditure per student (Fuchs and Wößmann, 2007) and relative teacher salaries (Dolton and Marcenaro-Gutierrez, 2011).

The second type of variables we control for are factors related to the institutional quality of countries. This tackles the concern of perceived nepotism picking up the effect of poor institutional quality on educational outcomes through channels other than itself. For instance, high corruption in a country with also high perceived nepotism, might negatively affect scores by wasting education funds or having a lack of transparency in accounting. To tackle this concern, we control for two measures previously used in

[13] That is, perceived nepotism is theorized to affect the demand for education by households. Within our framework, education supply might also be affected, but only indirectly via demand effects.

economic literature, the CPI as a general corruption perception measure (Escresa and Picci, 2017; Ugur, 2014) and the Property Rights Index as an institutional quality indicator (Kerekes and Williamson, 2008; La Porta et al., 1999). Moreover, we include other corruption-related dimensions captured by the EOS, namely perceptions on governmental transparency and wastefulness of resources. We also include perceptions on infrastructure quality as an indicator for capacity and quality of public services supply.

Table 2 shows high correlations between these institutional quality variables - in particular of the CPI - and our measure of perceived nepotism. Arguably, there is a common underlying factor driving overall corruption perception and nepotism perception in similar directions. However, we argue that these indicators measure two different phenomena. First, the way they are measured is very different. On the one hand, the CPI is a composite indicator that aims at capturing the overall perception of corruption in the public sector by averaging indices of 13 different institutional quality data sources such as the Political Risk Services dataset and the World Bak Country Policy and Institutional assessment dataset. The indices are rescaled and aggregated to compute a single value per country (Transparency International, 2016). Hence, it is a combination of assessments and surveys on corruption that captures perceptions on accountability, bribery, public procurement, misuse of public funds, among others. On the other hand, our measure for perceived nepotism captures the opinion of business leaders on the specific issue of nepotism for senior management positions exclusively and is then aggregated at the country level (WEF, 2013).[14] Second, we believe that populations can distinguish in their perception overall corruption in the public sector from nepotism. As depicted in Figure A1 in the Appendix, countries with the same corruption perception score can be heterogeneous in their perception of nepotism, and the other way around. For example, while Uruguay and Kazakhstan have similarly high levels of perceived nepotism, the former has much lower corruption perception levels. In the same vein, Malaysia and Jordan score both similarly in corruption perception, but Jordan perceives nepotism substantially stronger than Malaysia.

An important aspect of our narrative is the mechanism at work in the relationship of analysis. Our storyline suggests that underinvestment in human capital induced by perceived nepotism leads to lower test scores. The transmission channels that bring to life such a relationship can take different forms such

[14]Conceptually, corruption in the public sector and nepotism are well-defined distinct concepts. For instance, the latter is necessarily specific to labor and within-group dynamics, while the former refers to a more general phenomenon. While nepotism can be a dimension of corruption, the latter encompasses many other dimensions that can conceptually be neutral, complementary or substitutes to nepotism. For example, Olken (2007) provides evidence from a field experiment in Indonesia for a substitution effect between corruption dimensions. He suggests that villagers randomly assigned to imminent audit on village road projects substitute a funds diversion type of corruption with nepotism.

as learning effort, parental involvement and investments in education-related assets. To investigate this, we expand equation (15) by $\theta_1 T'_{ct}$ to get Equation (16).

$$Y_{ct} = \alpha_1 + \beta_1 Nepotism_{c\bar{t}} + \beta_2 GDP_{ct} + \boldsymbol{\delta_1} X'_{ct} + \boldsymbol{\delta_2} Z'_{c\bar{t}} + \theta_1 T_{ct} + \gamma_r + \epsilon_t + e_{ct} \quad . \tag{16}$$

Plausible transmission channels for this analysis should be microfounded in nature, identifiable at the macro level and internationally comparable. We propose the number of books at student's homes as an intermediating factor that proxies for investments in human capital and meets these criteria. We interpret changes of β_1 by comparing estimations of equations (15) and (16).

Most equations are estimated using panel data random effects models. Country fixed effects are arguably not the best fit for two reasons. First, they eliminate between-country variation, which is larger than within-country variation for the relatively short time period of analysis both conceptually and empirically (see Table 1). Second, fixed effects estimations are advised against when the independent variable of interest is measured with error, as taking differences from the mean increases the noise-to-signal ratio and the attenuation bias significantly. This is particularly the case when the independent variable is persistent over time and its measurement error is of classical nature (Griliches and Hausman, 1986). As a robustness check, we nevertheless run fixed effects regressions acknowledging the above.

3.3 Results

3.3.1 Main results

The results of our main regressions are reported in Table 3. All regressions control for GDP, regional and PISA-wave fixed effects. Specification (1) corresponds to Equation (14) and specification (6) to Equation (15). All the columns in between include each additional control piecewise.[15] Our analysis suggests that countries with high levels of perceived nepotism perform worse in PISA reading scores. More concretely, an increase of one standard deviation in the perceived nepotism indicator decreases the reading scores by 0.21 standard deviations (specification 6).[16] This statistically significant estimate remains

[15] For the selection of controls, we first perform a similar exercise with education-related variables (see Appendix). The variables that obtain statistically significant coefficients in any of these estimations are included in our analysis. Given the high correlation of CPI with the other institutional quality variables, and taking into account that they all aim at capturing the same type of factor, we only control for CPI in our analysis. However, we also run regressions controlling for all institutional quality and all education variables simultaneously. The results remain robust and are available upon request.

[16] Similar effects have been found in experimental studies that estimate the impact of significantly raising the aspirations of students in Madagascar (Nguyen, 2008) and Uganda (Riley, 2017) via role models interventions. Our estimates are complementary to this evidence in the sense that they link perceptions on education-related prospects to investments in human capital and learning outcomes.

stable throughout all estimations. While our analysis does not allow us to claim a causal relationship, entertaining the thought reveals potential severe implications. If, for example, the population of Algeria had perceived the role of nepotism to be as weak as the Swedish did for the years 2011-2014, they would have obtained 47 additional points in their 2015 PISA reading scores. The implications for economic development of such a nation-wide cognitive jump are substantial (see Hanushek and Woessmann (2012)).

This model is able to explain 72% of the international variation in PISA reading scores. The coefficient for the logarithm of GDP p.c. remains positive and statistically significant at conventional levels in most of the specifications. However, in specification 5, the coefficient for GDP is only marginally significant. This is not unexpected since this regression includes two other measures that are highly correlated with GDP. Given that this is also true for our indicator for perceived nepotism (see Table 2), it is remarkable that its coefficient remains significant.

Table 3: Main results. Effect of Perceived Nepotism on PISA Reading Scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se
Perceived nepotism	-12.61***	-14.01***	-13.40***	-12.25***	-9.91***	-12.28***
	(3.76)	(3.77)	(3.68)	(3.64)	(3.41)	(3.24)
Enrollment		0.14				0.04
		(0.23)				(0.21)
Relative teacher pay			0.72			-0.81
			(3.64)			(3.86)
Cumulative expenditure p.c.				-0.05		-0.28
				(0.58)		(0.59)
CPI					0.81***	0.75***
					(0.19)	(0.18)
GDP	31.60***	30.75***	33.50***	30.52***	19.11*	20.95**
	(10.28)	(10.49)	(9.99)	(10.60)	(10.29)	(10.44)
Observations	191	191	191	191	190	190
R^2	0.644	0.656	0.643	0.656	0.706	0.720

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA reading scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

3.3.2 Robustness Checks

In this section, we perform four robustness checks and report them in Table 4. First, we look at the high correlation between perceived nepotism and CPI (see Table 2). On the one hand, it is remarkable that the coefficient for perceived nepotism remains significant throughout Table 3 under the presence of

multicollinearity.[17] On the other hand however, high correlations among covariates speak against ceteris paribus interpretations.

We exploit subsample analysis to tackle this concern. For that purpose, we divide the sample into OECD and non-OECD countries. The correlation between perceived nepotism and the institutional quality variables is significantly lower among non-OECD countries. For example, the correlation between CPI and our measure for perceived nepotism drops 25 percentage points to 61%, while the OECD sample shows even higher correlations than in the pooled sample (see tables A3 and A4). Hence, our attempt of separating the effect of perceived nepotism on reading scores from the effects of these covariates is more plausible for the non-OECD subsample, whereas multicollinearity and interpretation concerns would amplify in the OECD sample.

Table 4: Robustness Checks

	(1) RE-P b/se	(2) RE-N b/se	(3) RE-O b/se	(4) FE-N b/se	(5) FE-O b/se	(6) RE-P b/se	(7) RE-P b/se	(8) RE-P b/se
Perceived nepotism	-12.28***	-15.11***	-7.68	-11.73**	0.19			-12.07***
	(3.24)	(3.71)	(5.09)	(5.64)	(7.26)			(4.37)
Perceived nepotism alt.						-11.22***		
						(3.65)		
Perceived nepotism alt.							-15.48***	
							(4.63)	
GDP	20.95**	6.94	21.48	9.29	25.71*	21.61**	17.93	21.96*
	(10.44)	(11.02)	(17.96)	(24.96)	(14.95)	(10.55)	(11.56)	(11.92)
Observations	190	86	104	86	104	190	124	160
R^2	0.720	0.642	0.616	0.332	0.0744	0.714	0.726	0.700

Note: Random effects (RE) and fixed effects (FE) regressions at the country level. P stands for Pooled sample, N for Non-OECD sample and O for OECD sample. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA reading scores. All regressions control for region and year fixed effects, enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values. Random effects regressions control in addition for region fixed effects. Column (8) controls additionally for the share of private schools and existence of central examinations at the secondary level.

The results are reassuring. For the low-correlation sample of non-OECD countries (specification 2), the coefficient is statistically significant and even higher in magnitude than in the pooled sample (specification 1) and the OECD sample (specification 3). This reinforces the implication that perceived nepotism is associated with poor performance on its own and tentatively hints at interpreting specification 1 as a lower-bound estimate. For the case of the OECD sample, the effect remains negative but is not distinguishable from zero anymore. Arguably, this is a consequence of the sample consisting of a more homogenous group of countries in terms of PISA scores. The variation in PISA scores more than halves compared to the other two samples (see Table 2). Moreover, the standard error is higher than in the

[17] The coefficient remains significant also under the stronger presence of multicollinearity in estimations that simultaneously include the CPI, Property Rights Index and perceptions on governmental transparency and wastefulness of resources, while most of the instutional quality controls themselves turn insignificant.

non-OECD sample, even though the sample size is bigger. This might be a statistical consequence of multicollinearity being higher in the OECD sample.

We further explore the subsample analysis by running fixed effects regressions for the Non-OECD and OECD subsamples (specifications 4 and 5 respectively). This represents a conservative robustness check as most of the variation in the variables of interest stems from differences between countries. Remarkably, the Non-OECD subsample, which has a larger within-variation in the variables of interest than the OECD subsample, shows a negative, economically and statistically significant effect of perceived nepotism on the PISA scores. As this specification takes care of all time-invariant determinants of learning outcomes, we interpret these results as strong empirical support of the model prediction.

As a third robustness check, we investigate alternative time periods covered by our measure of perceived nepotism (see section 3.1 for detailed description). In specification 6, we lead the time period covered by one unit of time. In specification 7, we double the time period covered. For example, instead of linking the 2015 PISA scores to the time period 2011-2014 as in specification 1, we link them to the time period 2012-2015 in specification 6 and to 2008-2014 in specification 7. The estimations reveal an interesting pattern. By comparing the estimates for three different time periods, it seems that averages from values lagged further in the past have a slightly stronger effect on performance. This is consistent with the idea of skills complementarity posed by Cunha and Heckman (2007) and with our conceptualization of a cumulative and dilatory effect of perceived nepotism.

A fourth robustness check addresses the institutional features of education systems, which are suggested by the literature to partly explain international differences in learning outcomes. To tackle this concern, we control for the share of private schools (West and Woessmann, 2010) and the existence of central exams at the secondary level (Bishop, 2006) in specification 8. In line with the expectation that the omission of these type of variables are not driving our results, our estimations are barely altered.

Lastly, we run regressions with alternative values for our control variables.[18] First, we run our main regression (Table 3 specification 6) without imputing values for education variables. The coefficient increases in magnitude and remains significant. Second, we also run regressions by lagging the institutional quality variables as described by one time period. Here again, results remain qualitatively unaltered.

[18]These estimations are available upon request.

3.3.3 Transmission channels

We now show evidence on transmission channels that are consistent with a causal effect of perceived nepotism on test scores. Plausible transmission channels should be microfounded in nature, identifiable at the macro level and internationally comparable. We identified the number of books at home as a factor meeting these three criteria. As a response to the lack of income and wealth data, this variable has been interpreted as a proxy for socioeconomic background in microstudies (Schütz et al., 2008, pp-283-286). A large number of books at home has also been interpreted as an indicator for a home environment that esteems education, values knowledge acquisition and promotes the learning efforts of children (Beaton et al., 1996; Mullis and Martin, 2000; Schütz et al., 2008). We argue that at the macro level and conditioning for GDP p.c., this indicator stands for the latter interpretation. We make use of the share of students corresponding to various intervals of the number of books at home as described in section 3.1. Plotting perceived nepotism against these categories shows that in countries with high perceived nepotism, the valuation of education in terms of the number of books at home is low. The share of students falling into the category of low stocks of books at home (i.e. the category for relatively low valuation of education) increases with nepotism levels. On the contrary, for the categories representing large numbers of books at home and hence high valuation of education, the share of students decreases with nepotism levels (see Figures A2, A3, A4 in the Appendix).

The results in Table 5 hint that the number of books at students' homes represents an intermediating factor in the investigated relationship. Part of the effect associated with the nepotism indicator migrates to the share of students with 26-100 books at home and the share of students with 201-500 number of books in specification 2. A switch of one percentage point of students having 11-25 books at home to having 26-100 books at home is associated with an increase of 3.04 points in the PISA reading scores. The effect is larger if these students switch to a category corresponding to more books, namely 201-500.[19] This is consistent with our narrative. The results in Table 5 suggest that part of the effect of perceived nepotism on reading scores works through the cumulative valuation of education by students or parents, which is manifested in the purchase of books kept at home. The fact that the coefficient for perceived nepotism remains large and statistically significant suggests that there are additional transmission channels driving our results.

[19] As these categories shares are proportions that sum up to 1, the category of 11-25 books is left out as baseline. Given that all the other categories are held constant, an increase in any of the categories included must imply a decrease in the baseline category.

Table 5: Transmission channels

	(1) b/se	(2) b/se
Perceived nepotism	-12.28***	-9.38**
	(3.24)	(3.65)
% Students with 26-100 books		3.04**
		(1.42)
% Students with 201-500 books		4.66***
		(1.52)
Observations	190	189
r2_o	0.720	0.785

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA reading scores. All regressions control for region and year fixed effects, GDP p.c., enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values.

4 Conclusion

In this paper we proposed a dynamic general equilibrium model that explains nepotism as a (locally) stable cultural steady state. In this context we have shown that perceived nepotism reduces effort at school and cognitive ability of the workforce. Through this channel, nepotism reduces aggregate productivity and technological advances and can explain low economic growth and, at the extreme, stagnation in a culturally determined poverty trap.

Our empirical analysis has shown that higher perceived nepotism levels are systematically related to lower cognitive skills as proxied by PISA scores, as predicted by our theoretical model. While our analysis does not allow us to claim a definite causal relationship, we provide a novel theory and strong empirical evidence supporting this association. Controlling for economic performance, education inputs and institutional quality does not alter our conclusions. Several robustness checks support our claim empirically. Moreover, our conclusions are robust to controlling for all time-invariant determinants of nation-wide educational outcomes for the subsample presenting larger variation over time in the perceived nepotism and educational outcomes.

This finding is consistent with experimental microeconomic evidence that causally links higher perceived returns to higher test scores in Madagascar (Nguyen, 2008) and Uganda (Riley, 2017) and higher schooling in the Dominican Republic (Jensen, 2010). Our estimations complement the incentives narrative of human capital investments and provides greater external validity. Distinct from the above-mentioned studies that underscore information failures and aspirations, we draw attention to nepotism as an institutional feature

of labor markets that drives human capital investment decisions. The analysis on transmission channels reinforces our nepotism-incentives storyline by suggesting that increased perceived nepotism is associated with a lower stock of books at home, which in turn affects negatively the students' performance in the PISA scores.

A natural question that derives from this analysis is why do countries vary in their levels of (perceived) nepotism in the first place. While there is an established literature on the determinants of corruption levels across countries (i.e. Alesina et al. (2003); La Porta et al. (1999)), studies on the causes of international differences in nepotism are to our knowledge not available. This literature gap can be closed in future work by exploiting the multinational coverage of our measure for perceived nepotism.

The analysis in this paper implies that the consequences of perceived nepotism are far-reaching as they transcend the working place and infiltrate into the classroom, ultimately harming economic performance. Policies targeting cognitive skills should closely examine the perception that students and their parents have on the *relative* reward of human capital in labor markets, and how these might affect education commitment and support. Importantly, theoretical considerations showed that one-off interventions have the potential to free labor markets from nepotism and drive countries into sustained economic growth. Hence, the consideration of our conclusions may potentiate educational policy efforts, drive individuals into effectively seizing their schooling opportunities and contribute to the economic development of nations.

5 Appendix

Table A1: Country values. Year 2015

Country	Code	Region	GDP	PISA Reading	Perceived Nepotism
OECD					
New Zealand	NZL	Commonwealth	10.5	509	1.71
Finland	FIN	Western Europe	10.6	526	1.75
Sweden	SWE	Western Europe	10.7	500	1.81
Norway	NOR	Western Europe	11.1	513	1.83
Netherlands	NLD	Western Europe	10.7	503	1.93
Switzerland	CHE	Western Europe	10.9	492	2.01
Denmark	DNK	Western Europe	10.7	500	2.01
Canada	CAN	Commonwealth	10.7	527	2.02
United Kingdom	GBR	Western Europe	10.6	498	2.04
Australia	AUS	Commonwealth	10.7	503	2.13
Ireland	IRL	Western Europe	11.0	521	2.23
Germany	DEU	Western Europe	10.7	509	2.43
Japan	JPN	Asia	10.5	516	2.49
United States	USA	Commonwealth	10.9	497	2.51
Belgium	BEL	Western Europe	10.6	499	2.51
Luxembourg	LUX	Western Europe	11.4	481	2.61
Austria	AUT	Western Europe	10.7	485	2.65
Iceland	ISL	Western Europe	10.7	482	2.68
Estonia	EST	Eastern Europe	10.2	519	2.77
Israel	ISR	MENA	10.4	479	2.98
France	FRA	Western Europe	10.5	499	3.04
Chile	CHL	Latin America	10.0	459	3.04
South Korea	KOR	Asia	10.4	517	3.21
Spain	ESP	Southern Europe	10.4	496	3.38
Czech Rep.	CZE	Eastern Europe	10.3	487	3.49
Latvia	LVA	Eastern Europe	10.0	488	3.62
Slovak Rep.	SVK	Eastern Europe	10.2	453	3.74
Turkey	TUR	Asia	9.88	428	3.77
Poland	POL	Eastern Europe	10.1	506	3.79
Mexico	MEX	Latin America	9.71	423	3.81
Portugal	PRT	Southern Europe	10.2	498	3.84
Slovenia	SVN	Eastern Europe	10.3	505	3.99
Hungary	HUN	Eastern Europe	10.1	470	4.03
Greece	GRC	Southern Europe	10.1	467	4.20
Italy	ITA	Southern Europe	10.4	485	4.40
Non-OECD					
Singapore	SGP	Asia	11.3	535	2.09
Qatar	QAT	MENA	11.8	402	2.46
Malaysia	MYS	Asia	10.1	431	2.60
United Arab Emirates	ARE	MENA	11.1	434	2.87
Hong Kong	HKG	Asia	10.9	527	2.91
Brazil	BRA	Latin America	9.58	407	3.19
Costa Rica	CRI	Latin America	9.59	427	3.34

Table A1: Country values. Year 2015

Country	Code	Region	GDP	PISA Reading	Perceived Nepotism
China	CHN	Asia	9.52	494	3.39
Peru	PER	Latin America	9.37	398	3.40
Indonesia	IDN	Asia	9.25	397	3.46
Lithuania	LTU	Eastern Europe	10.2	472	3.51
Mauritius	MUS	Asia	9.85	.	3.57
Argentina	ARG	Latin America	9.86	425	3.63
Trinidad and Tobago	TTO	Latin America	10.4	427	3.65
Thailand	THA	Asia	9.64	409	3.68
Colombia	COL	Latin America	9.47	425	3.80
Tunisia	TUN	MENA	9.28	361	3.82
Albania	ALB	Southern Europe	9.31	405	3.88
Malta	MLT	Southern Europe	10.4	447	3.94
Montenegro	MNE	Southern Europe	9.63	427	3.95
Georgia	GEO	Asia	9.11	401	4.03
Kazakhstan	KAZ	Asia	10.1	427	4.06
Uruguay	URY	Latin America	9.90	437	4.07
Jordan	JOR	MENA	9.23	408	4.09
Azerbaijan	AZE	Asia	9.72	.	4.21
Moldova	MDA	Eastern Europe	8.46	416	4.24
Lebanon	LBN	MENA	9.48	347	4.27
Russia	RUS	Eastern Europe	10.1	495	4.30
Viet Nam	VNM	Asia	8.64	487	4.30
Croatia	HRV	Southern Europe	9.94	487	4.31
Bulgaria	BGR	Eastern Europe	9.74	432	4.33
Cyprus	CYP	Southern Europe	10.3	443	4.34
Panama	PAN	Latin America	9.95	.	4.36
Romania	ROU	Eastern Europe	9.93	434	4.43
Dominican Republic	DOM	Latin America	9.50	358	4.54
Kyrgyzstan	KGZ	Asia	8.08	.	4.55
Serbia	SRB	Southern Europe	9.49	.	4.77
Algeria	DZA	MENA	9.53	350	5.55

Note: List of all countries included in the analysis. Countries grouped by OECD membership and ordered after ascending order in perceived nepotism scores.

Table A3: Correlation matrix. OECD sample

	Perc. nepotism	GDP	Enrollment	R. t. pay	CPI	Proprights	Infrastr.
Perceived nepotism	1						
GDP	-0.700***	1					
Enrollment	-0.101	-0.0255	1				
Relative teacher pay	-0.0785	-0.123	-0.105	1			
CPI	-0.921***	0.722***	0.112	0.0483	1		
Proprights	-0.900***	0.715***	0.133	0.0662	0.923***	1	
Infrastructure	-0.567***	0.534***	0.0692	0.289	0.650***	0.674***	1

Note: OECD sample, year 2015. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A2: Descriptive statistics by sample

Variable	Mean			SD			between-SD			within-SD			Observations		
	O	N	P	O	N	P	O	N	P	O	N	P	O	N	P
PISA Reading	494	426	463	23.4	46.0	48.9	22.4	48.1	53.9	7.37	8.25	7.76	105	86	191
PISA Math	493	424	463	28.7	53.7	54.0	28.2	52.2	56.4	6.58	7.38	6.92	105	83	188
PISA Science	498	431	468	28.0	48.6	51.1	27.4	49.6	55.0	6.73	8.21	7.41	105	86	191
GDP	35.7	22.6	29.8	14.1	22.8	19.6	13.9	20.3	18.9	2.9	5.3	4.2	105	86	191
Enrollment	91.0	81.8	87	6.66	8.81	8.88	6.87	9.05	9.26	1.16	2.56	1.89	59	45	104
Relative teacher pay	1.16	1.28	1.20	0.33	0.55	0.41	0.34	0.56	0.44	0.10	0.27	0.17	87	40	127
S-T ratio	13.3	15.9	14.3	4.19	5.27	4.80	4.09	5.44	4.85	1.01	1.15	1.07	104	68	172
Govern. expen.	24.6	17.9	22.0	5.45	6.07	6.54	5.55	6.79	6.86	1.30	1.91	1.55	56	34	90
Cumulative expen.	8.15	3.85	7	3.34	3.22	3.81	3.18	3.33	3.82	1.07	0.76	1	98	36	134
% Private schools	17.6	14.8	16.4	19.4	15.6	17.8	19.6	16.0	17.8	3.85	2.02	3.15	101	82	183
%26-100 books	29.9	27.1	28.6	3.29	5.48	4.61	3.10	5.90	5.01	1.19	0.94	1.08	105	85	190
%201-500 books	13.9	6.49	10.6	4.33	3.87	5.54	4.29	3.83	5.59	0.85	0.64	0.76	105	85	190
Perceived Nepotism	2.71	3.62	3.12	0.75	0.64	0.84	0.74	0.67	0.87	0.18	0.19	0.19	105	86	191
CPI	69.2	44.8	58.1	17.2	17.0	20.9	17.1	16.4	21.3	2.63	2.70	2.66	104	86	190
Infrastructure	5.32	4.04	4.74	0.92	1.22	1.24	0.89	1.12	1.22	0.25	0.35	0.30	105	86	191
Property Rights	76.5	47.0	63.4	15.8	19.1	22.7	15.8	18.7	23.4	1.93	3.80	2.90	105	84	189
Wastefulness	3.66	3.51	3.59	0.79	1.04	0.91	0.74	0.99	0.88	0.29	0.27	0.28	105	86	191
Transparency	4.75	4.22	4.51	0.73	0.82	0.81	0.71	0.75	0.79	0.20	0.29	0.25	105	86	191

Note: O stands for OECD sample, N for Non-OECD sample and P for Pooled sample. PISA Reading, Math and Science refer to the test scores in the corresponding subject at the country level. GDP data is per capita/1000 and in PPP values. Enrollment is net enrollment rates. Relative Teacher pay stands for the ratio of average wages for teachers of low secondary schooling with minimum training to GDP p.c.. S-T ratio stands for student-teacher ratio. Government expenditure is the expenditure per secondary student as a % of GDP p.c.. Cumulative expenditure is the expenditure per student accumulated over the theoretical schooling duration of a pupil from age 6 to 15. in PPP values. The share of 26-100 (201-500) books stand for the share of students having a number of books at home within that range. Perceived nepotism, Infrastructure, Wastefulness and Transparency have a 1-7 scale. CPI and the Property Rights Index are on a 0-100 scale.

Table A4: Correlation matrix. Non-OECD sample

	Perc. nepotism	GDP	Enrollment	R. t. pay	CPI	Proprights	Infrastr.
Perceived nepotism	1						
GDP	-0.577***	1					
Enrollment	0.108	0.155	1				
Relative teacher pay	-0.131	0.258	-0.350*	1			
CPI	-0.567***	0.703***	0.136	0.161	1		
Proprights	-0.528**	0.656***	0.0441	0.221	0.885***	1	
Infrastructure	-0.590***	0.689***	0.134	0.191	0.768***	0.751***	1

Note: Non-OECD sample, year 2015. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

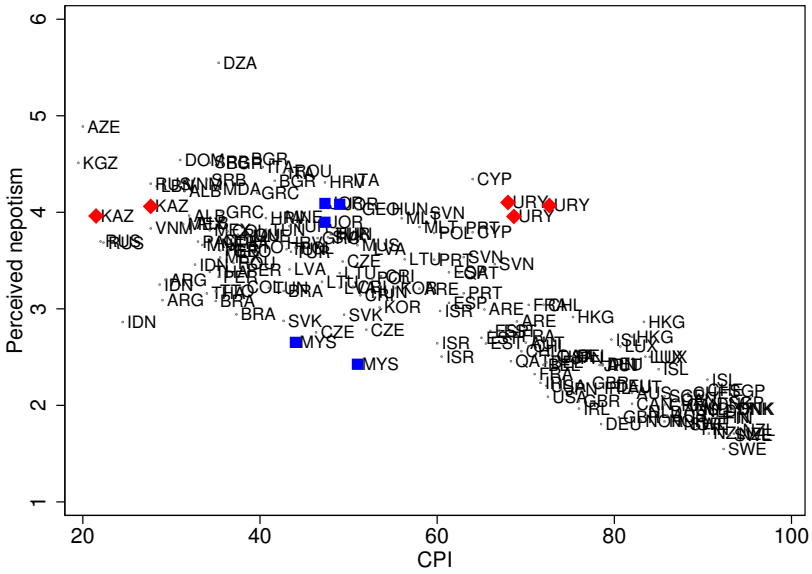

Figure A1: Perceived Nepotism and Corruption Perception Index

Table A5: Selection regression with education variables. Reading scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-12.61***	-14.01***	-12.38***	-12.25***	-12.18***	-13.40***	-14.24***
	(3.76)	(3.77)	(3.76)	(3.64)	(3.94)	(3.68)	(3.60)
Enrollment		0.14					0.25
		(0.23)					(0.22)
S-T ratio			0.56				0.54
			(0.64)				(0.59)
Cumulative expenditure p.c.				-0.05			-0.32
				(0.58)			(0.65)
Government expenditure p.c.					-0.25		-0.31
					(0.23)		(0.26)
Relative teacher pay						0.72	-0.52
						(3.64)	(4.09)
GDP	31.60***	30.75***	32.27***	30.52***	31.96***	33.50***	33.21***
	(10.28)	(10.49)	(10.18)	(10.60)	(10.60)	(9.99)	(10.34)
Observations	191	191	191	191	191	191	191
R^2	0.644	0.656	0.648	0.656	0.643	0.643	0.674

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA reading scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

Table A6: Selection regression with education variables. Math scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-9.20**	-10.54***	-9.42**	-8.92**	-9.01**	-8.30**	-10.12***
	(3.90)	(4.05)	(3.92)	(3.81)	(3.92)	(3.59)	(3.74)
Enrollment		0.04					0.01
		(0.23)					(0.25)
S-T ratio			-0.28				-0.47
			(0.59)				(0.53)
Cumulative expenditure p.c.				-0.80*			-1.02**
				(0.48)			(0.51)
Government expenditure p.c.					0.11		-0.02
					(0.26)		(0.29)
Relative teacher pay						6.40**	5.01
						(3.26)	(3.49)
GDP	38.70***	37.87***	37.18***	38.45***	38.47***	40.24***	38.97***
	(10.77)	(11.10)	(10.96)	(10.92)	(10.89)	(10.48)	(11.21)
Observations	188	188	188	188	188	188	188
R^2	0.709	0.710	0.711	0.710	0.712	0.711	0.719

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA math scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

Table A7: Selection regression with education variables. Science scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-12.33***	-13.44***	-12.36***	-12.20***	-11.91***	-12.36***	-13.86***
	(3.81)	(3.85)	(3.90)	(3.80)	(3.78)	(3.69)	(3.63)
Enrollment		0.50**					0.54**
		(0.23)					(0.24)
S-T ratio			-0.34				-0.17
			(0.61)				(0.54)
Cumulative expenditure p.c.				-0.42			-0.54
				(0.61)			(0.62)
Government expenditure p.c.					0.13		-0.10
					(0.29)		(0.29)
Relative teacher pay						2.91	1.47
						(3.82)	(3.97)
GDP	31.89***	29.93***	30.61***	31.67***	31.89***	33.40***	31.49***
	(11.13)	(10.95)	(11.13)	(11.32)	(11.13)	(10.83)	(10.77)
Observations	191	191	191	191	191	191	191
R^2	0.654	0.677	0.660	0.658	0.658	0.656	0.692

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

Table A8: Selection regression with institutional quality variables variables. Reading scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-12.61***	-9.74**	-11.47**	-11.65***	-9.91***	-8.61**	-9.25**
	(3.76)	(3.89)	(4.67)	(3.60)	(3.41)	(3.78)	(4.38)
Transparency		6.97**					1.59
		(3.39)					(3.85)
Wastefulness			1.70				-2.29
			(4.11)				(3.81)
Infrastructure				6.85*			2.47
				(3.51)			(3.74)
CPI					0.81***		0.50**
					(0.19)		(0.24)
Proprights						0.68***	0.44*
						(0.22)	(0.27)
GDP	31.60***	28.37***	31.08***	23.88**	19.11*	22.24**	15.07
	(10.28)	(10.15)	(10.32)	(10.82)	(10.29)	(10.07)	(10.66)
Observations	191	191	191	191	190	189	188
R^2	0.644	0.650	0.639	0.674	0.706	0.696	0.726

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects.

Table A9: Selection regression with institutional quality variables variables. Math scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-9.20**	-6.99*	-9.71**	-7.93**	-7.58**	-6.84*	-8.53**
	(3.90)	(3.77)	(4.16)	(3.36)	(3.60)	(3.71)	(3.62)
Transparency		5.72*					0.10
		(3.01)					(3.81)
Wastefulness			-0.67				-3.88
			(2.71)				(2.62)
Infrastructure				8.18**			5.68
				(3.24)			(3.61)
CPI					0.72***		0.48**
					(0.16)		(0.19)
Proprights						0.54**	0.28
						(0.22)	(0.23)
GDP	38.70***	35.83***	38.90***	29.11***	26.58***	30.97***	21.33**
	(10.77)	(10.44)	(10.75)	(10.96)	(10.19)	(10.74)	(10.52)
Observations	188	188	188	188	187	186	185
R^2	0.709	0.717	0.710	0.741	0.762	0.751	0.787

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA math scores. All regressions control for region and year fixed effects.

Table A11: Main results. Effect of Perceived Nepotism on PISA Math Scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se
Perceived nepotism	-9.20**	-10.54***	-8.30**	-8.92**	-7.58**	-8.58**
	(3.90)	(4.05)	(3.59)	(3.81)	(3.60)	(3.69)
Enrollment		0.04				-0.08
		(0.23)				(0.21)
Relative teacher pay			6.40**			4.62
			(3.26)			(3.49)
Cumulative expenditure p.c.				-0.80*		-0.82
				(0.48)		(0.53)
CPI					0.72***	0.62***
					(0.16)	(0.16)
GDP	38.70***	37.87***	40.24***	38.45***	26.58***	29.75***
	(10.77)	(11.10)	(10.48)	(10.92)	(10.19)	(10.44)
Observations	188	188	188	188	187	187
R^2	0.709	0.710	0.711	0.710	0.762	0.758

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA math scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

Table A10: Selection regression with institutional quality variables variables. Science scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se
Perceived nepotism	-12.33***	-9.59***	-13.54***	-11.26***	-9.97***	-9.89***	-12.52***
	(3.81)	(3.65)	(4.37)	(3.48)	(3.65)	(3.80)	(3.78)
Transparency		7.12**					3.12
		(2.81)					(3.38)
Wastefulness			-1.44				-6.26**
			(2.89)				(2.85)
Infrastructure				7.72**			4.01
				(3.65)			(4.06)
CPI					0.84***		0.67**
					(0.22)		(0.26)
Proprights						0.47**	0.16
						(0.22)	(0.25)
GDP	31.89***	28.33***	32.25***	22.83**	18.39*	25.36**	14.68
	(11.13)	(10.55)	(11.07)	(11.27)	(10.39)	(10.96)	(10.94)
Observations	191	191	191	191	190	189	188
R^2	0.654	0.664	0.658	0.690	0.720	0.695	0.751

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects.

Table A12: Main results. Effect of Perceived Nepotism on PISA Science Scores

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se
Perceived nepotism	-12.33***	-13.44***	-12.36***	-12.20***	-9.97***	-12.19***
	(3.81)	(3.85)	(3.69)	(3.80)	(3.65)	(3.69)
Enrollment		0.50**				0.42*
		(0.23)				(0.22)
Relative teacher pay			2.91			1.21
			(3.82)			(3.84)
Cumulative expenditure p.c.				-0.42		-0.33
				(0.61)		(0.61)
CPI					0.84***	0.69***
					(0.22)	(0.23)
GDP	31.89***	29.93***	33.40***	31.67***	18.39*	20.82**
	(11.13)	(10.95)	(10.83)	(11.32)	(10.39)	(10.43)
Observations	191	191	191	191	190	190
R^2	0.654	0.677	0.656	0.658	0.720	0.735

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects, as well as imputation dummies for education variables with missing values.

Table A13: Robustness Checks. Math scores

	(1) RE-P b/se	(2) RE-N b/se	(3) RE-O b/se	(4) FE-N b/se	(5) FE-O b/se	(6) RE-P b/se	(7) RE-P b/se	(8) RE-P b/se
Perceived nepotism	-8.58**	-10.02**	-5.11	-10.88**	-0.90			-10.57**
	(3.69)	(5.04)	(4.98)	(5.11)	(6.99)			(4.15)
Perceived nepotism alt.						-4.20		
						(3.74)		
Perceived nepotism alt.							-13.20***	
							(4.11)	
GDP	29.75***	18.19*	25.07	19.47	15.84	31.14***	24.43**	29.69**
	(10.44)	(10.76)	(15.96)	(24.76)	(12.54)	(10.52)	(12.40)	(11.79)
Observations	187	83	104	83	104	187	122	157
R^2	0.758	0.676	0.684	0.288	0.103	0.756	0.751	0.768

Note: Random effects (RE) and fixed effects (FE) regressions at the country level. P stands for Pooled sample, N for Non-OECD sample and O for OECD sample. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA math scores. All regressions control for region and year fixed effects, enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values. Random effects regressions control in addition for region fixed effects. Column (8) controls additionally for the share of private schools and existence of central examinations at the secondary level.

Table A14: Robustness Checks. Science scores

	(1) RE-P b/se	(2) RE-N b/se	(3) RE-O b/se	(4) FE-N b/se	(5) FE-O b/se	(6) RE-P b/se	(7) RE-P b/se	(8) RE-P b/se
Perceived nepotism	-12.19***	-15.33***	-9.40**	-13.83**	-2.80			-13.42***
	(3.69)	(4.76)	(4.78)	(5.48)	(6.30)			(4.45)
Perceived nepotism alt.						-8.16**		
						(3.61)		
Perceived nepotism alt.							-15.84***	
							(5.07)	
GDP	20.82**	9.27	6.90	41.36*	-8.41	22.18**	10.83	19.21
	(10.43)	(11.54)	(16.09)	(22.30)	(14.95)	(10.50)	(12.38)	(11.68)
Observations	190	86	104	86	104	190	124	160
R^2	0.735	0.620	0.672	0.275	0.00915	0.729	0.726	0.742

Note: Random effects (RE) and fixed effects (FE) regressions at the country level. P stands for Pooled sample, N for Non-OECD sample and O for OECD sample. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects, enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values. Random effects regressions control in addition for region fixed effects. Column (8) controls additionally for the share of private schools and existence of central examinations at the secondary level.

Table A15: Transmission channels. Math scores

	(1) b/se	(2) b/se
Perceived nepotism	-8.58**	-4.84
	(3.69)	(3.68)
% Students with 26-100 books		2.34*
		(1.27)
% Students with 201-500 books		4.15***
		(1.28)
Observations	187	186
r2_o	0.758	0.822

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA math scores. All regressions control for region and year fixed effects, GDP p.c., enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values.

Table A16: Transmission channels. Science scores

	(1) b/se	(2) b/se
Perceived nepotism	-12.19***	-8.65**
	(3.69)	(3.48)
% Students with 26-100 books		2.78**
		(1.36)
% Students with 201-500 books		4.44***
		(1.28)
Observations	190	189
r2_o	0.735	0.804

Note: Random effects regressions at the country level. *, **, *** denote significance at the 0.1, 0.5 and 0.01 level. Robust standard errors in parenthesis and clustered at the country level. Dependent variable is PISA science scores. All regressions control for region and year fixed effects, GDP p.c., enrollment, relative teacher pay, cumulative expenditure p.c., CPI, as well as imputation dummies for education variables with missing values.

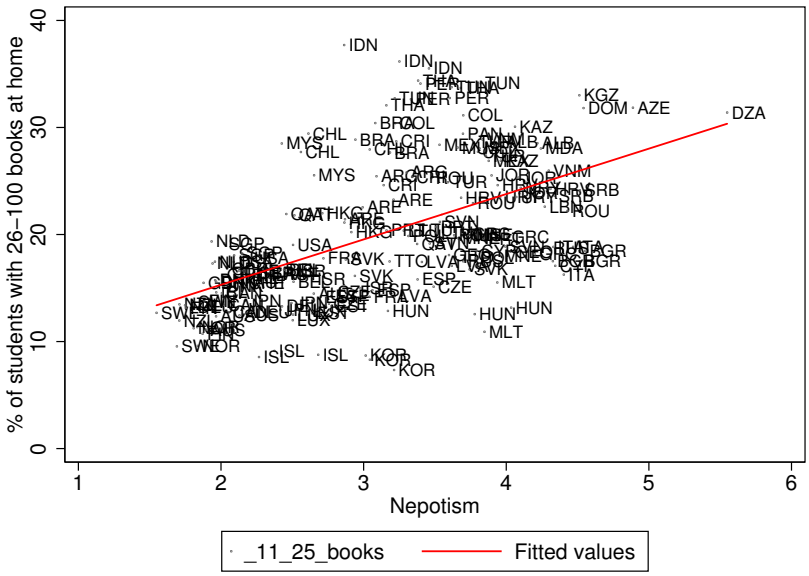

Figure A2: Perceived Nepotism and % students with 11-25 books at home

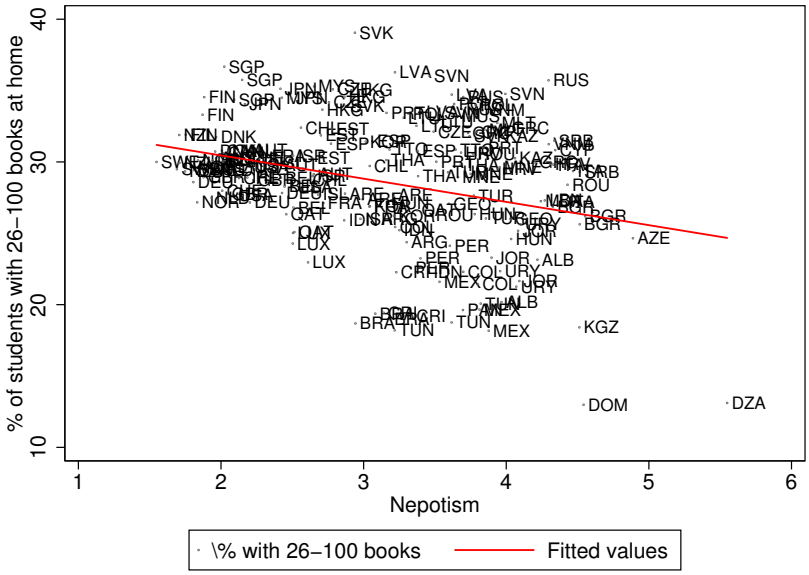

Figure A3: Perceived Nepotism and % students with 26-100 books at home

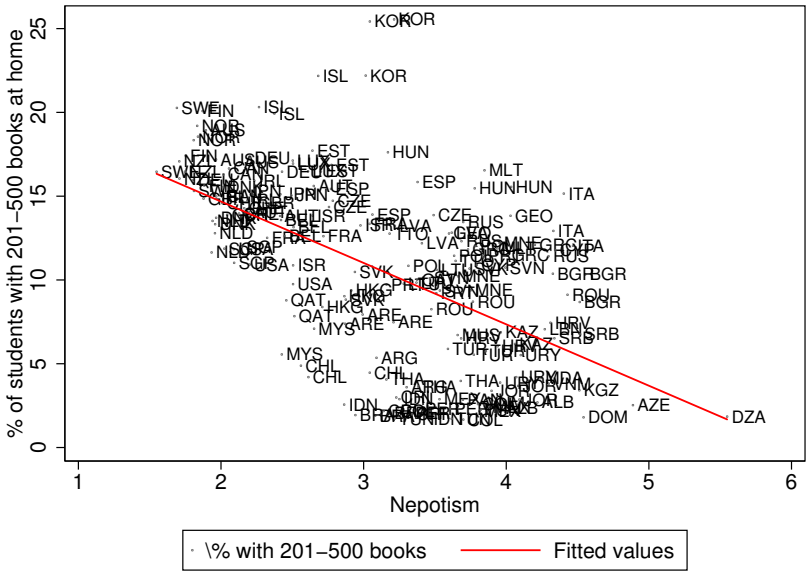

Figure A4: Perceived Nepotism and % students with 201-500 books at home

References

Acemoglu, D. and D. Autor (2011). Skills, tasks and technologies: Implications for Employment and Earnings. In D. Card and O. Ashenfelter (Eds.), *Handbook of Labor Economics*, Volume 4, pp. 1043–1171. North Holland.

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003). Fractionalization. *Journal of Economic Growth 8*(2), 155–194.

Attanasio, O. P. and K. M. Kaufmann (2014). Education choices and returns to schooling: Mothers' and youths' subjective expectations and their role by gender. *Journal of Development Economics 109*, 203–216.

Beaton, A. E., M. O. Martin, I. V. S. Mullis, E. J. Gonzalez, T. A. Smith, D. L. Kelly, and C. Hall (1996). *Mathematic achievement in the middle years: IEA's third international mathematics and science study (TIMSS)*. Boston: Center for the Study of Testing, Evaluation and Educational Policy Boston College.

Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy 70*(5, Part 2), 9–49.

Bellows, T. J. (2009). Meritocracy and the Singapore Political System. *Asian Journal of Political Science 17*(1), 24–44.

Bishop, J. (2006). Drinking from the Fountain of Knowledge: Student Incentive to Study and Learn - Externalities, Information Problems and Peer Pressure. In E. A. Hanushek and F. Welch (Eds.), *Handbook of the Economics of Education*, Volume 2, pp. 909–944. North Holland.

Bisin, A. and T. Verdier (2001). The Economics of Cultural Transmission and the Dynamics of Preferences. *Journal of Economic Theory 97*(2), 298–319.

Bloom, N. and J. V. Reenen (2007). Measuring and Explaining Management Practices Across Firms and Countries. *Quarterly Journal of Economics 122*(4), 1351–1408.

Bloom, N. and J. V. Reenen (2010). Why Do Management Practices Differ across Firms and Countries? *Journal of Economic Perspectives 24*(1), 203–224.

Boyd, R. and P. J. Richerson (1985). *Culture and the Evolutionary Process*. Chicago, IL: University of Chicago Press.

Bramoullé, Y. and S. Goyal (2016). Favoritism. *Journal of Development Economics 122*, 16–27.

Coco, G. and R. Lagravinese (2014). Cronyism and education performance. *Economic Modelling 38*, 443–450.

Cunha, F. and J. Heckman (2007). The Technology of Skill Formation. In *American Economic Review*, Volume 97, pp. 31–47.

Di Falco, S. and E. Bulte (2015). Does social capital affect investment in human capital? Family ties and schooling decisions. *Applied Economics 47*(2), 195–205.

Dolton, P. and O. D. Marcenaro-Gutierrez (2011). If You Pay Peanuts Do You Get Monkeys? A Cross-Country Analysis of Teacher Pay and Pupil Performance. *Economic Policy 26*(65), 5–55.

Escresa, L. and L. Picci (2017). A new cross-national measure of corruption. *World Bank Economic Review 31*(1), 196–219.

Foster, A. D. and M. R. Rosenzweig (1996). Technical Change and Human-Capital Returns and Investments: Evidence from the Green Revolution. *American Economic Review 86*(4), 931–953.

Fuchs, T. and L. Wößmann (2007). What Accounts for International Differences in Student Performance? A Re-examination using PISA Data. *Empirical Economics 32*(2-3), 433–464.

Galor, O. (2005). From Stagnation to Growth: Unified Growth Theory. In P. Aghion and S. Durlauf (Eds.), *Handbook of Economic Growth*, Volume 1, pp. 171–293. North Holland.

Galor, O. and O. Moav (2000). Ability-Biased Technological Transition , Wage Inequality , and Economic Growth. *Quarterly Journal of Economics 115*(2), 469–497.

Galor, O. and D. N. Weil (2000). Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond. *American Economic Review 90*(4), 806–828.

Gennaioli, N. and R. L. Porta (2013). Human Capital and Regional Development. *Quarterly Journal of Economics 128*(1), 105–164.

Griliches, Z. and J. A. Hausman (1986). Errors in Variables in Panel Data. *Journal of Econometrics 31*(1), 93–118.

Guiso, L., F. Monte, P. Sapienza, and L. Zingales (2008). Culture, Gender, and Math. *Science 320*(5880), 1164–1165.

Hanushek, E. A. and D. D. Kimko (2000). Schooling, labor-force quality, and the growth of nations. *American Economic Review 90*(5), 1184–1208.

Hanushek, E. A. and L. Woessmann (2008). The Role of Cognitive Skills in Economic Development. *Journal of Economic Literature 46*, 607–668.

Hanushek, E. A. and L. Woessmann (2010). The Economics of International Differences in Educational Achievement. In E. Hanushek, S. Machin, and L. Woessmann (Eds.), *Handbook of the Economics of Education*, Volume 3, pp. 89–200. North Holland.

Hanushek, E. A. and L. Woessmann (2011). Sample selectivity and the validity of international student achievement tests in economic research. *Economics Letters 110*(2), 79–82.

Hanushek, E. A. and L. Woessmann (2012). Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. *Journal of Economic Growth 17*(4), 267–321.

Jensen, R. (2010). The (Perceived) Returns to Education and the Demand for Schooling. *Quarterly Journal of Economics 125*(2), 515–548.

Kerekes, C. B. and C. R. Williamson (2008). Unveiling de Soto's Mystery: Property Rights, Capital Formation, and Development. *Journal of Institutional Economics 4*(3), 299–325.

Kingdon, G. G. and N. Theopold (2008). Do Returns to Education Matter to Schooling Participation? Evidence from India. *Education Economics 16*(4), 329–350.

Kremer, M., C. Brannen, and R. Glennerster (2013). The Challenge of Education and Learning in the Developing World. *Science 340*(6130), 297–300.

La Porta, R. and A. Shleifer (2008). The Unofficial Economy and Economic Development. *Brookings Papers on Economic Activity 2*, 275–352.

La Porta, R. R., F. Lopez-de Silanes, A. Shleifer, R. W. Vishny, and R. Vishney (1999). The Quality of Government. *Journal of Law, Economics, and Organization 15*(1), 222–279.

Lee, J.-W. and R. Barro (2001). Schooling Quality in a Cross-Section of Countries. *Economica 68*(272), 465–488.

Lemos, R. and D. Scur (2017). All in the Family ? CEO Choice and Firm Organization. *Unpublished manuscript*.

Mullis, I. V. and M. O. Martin (2000). TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eight Grade (TIMSS). Technical report, Center for the Study of Testing, Evaluation and Educational Policy Boston College, Boston.

Nelson, R. R. and E. S. Phelps (1966). Investment in Humans, Technological Diffusion, and Economic Growth.

Nguyen, T. (2008). Information, Role Models and Perceived Returns to Education: Experimental Evidence from Madagascar. *Unpublished manuscript*.

OECD (2016). *PISA 2015 Results (Volume I): Excellence and Equity in Education*. Paris: OECD Publishing.

Olken, B. (2007). Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy 115*(2), 200–249.

Parise, G., F. Leone, and C. Sommavilla (2016). Family First? Nepotism in Hiring Decisions and Corporate Investment.

Rauch, J. E. and P. B. Evans (2000). Bureaucratic structure and bureaucratic performance in less developed countries. *Journal of Public Economics 75*(1), 49–71.

Riley, E. (2017). Increasing Students' Aspirations: The Impact of Queen of Katwe on Students' Educational Attainment. *CSAE Working Paper WPS 13 44*.

Schultz, T. W. (1961). Investment in Human Capital. *American Economic Review 51*(1), 1–17.

Schütz, G., H. W. Ursprung, and L. Wößmann (2008). Education Policy and Equality of Opportunity. *Kyklos 61*(2), 279–308.

Strulik, H., K. Prettner, and A. Prskawetz (2013). The Past and Future of Knowledge-based Growth. *Journal of Economic Growth 18*(4), 411–437.

Syverson, C. (2011). What Determines Productivity? *Journal of Economic Literature 49*(2), 326–365.

Transparency International (2012). Overview of Corruption and Anti-Corruption in Lebanon. Technical Report October, U4 Anti-Corruption Resource Center.

Transparency International (2016). Corruption Perceptions Index 2016. Full Source Description.

Ugur, M. (2014). Corruption's direct Effects on per-capita Income Growth: A Meta-Analysis. *Journal of Economic Surveys 28*(3), 472–490.

WEF (2007). *World Economic Forum: The Global Competitiveness Report 2006-2007*. Geneva: Palgrave Macmillan.

WEF (2013). *World Economic Forum: The Global Competitiveness Report 2013-2014*. Geneva: Palgrave Macmillan.

West, M. R. and L. Woessmann (2010). 'Every Catholic Child in a Catholic School': Historical Resistance to State Schooling, Contemporary Private Competition and Student Achievement across Countries. *Economic Journal 120*(546), 229–255.

World Bank (2018). World Development Report 2018: Learning to Realize Education's Promise.