Cognitive capital, governance, and the wealth of nations

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Abstract

Good governance or "government effectiveness" (per the World Bank) is seen as a critical factor for the wealth of nations insofar as it shapes political and economic institutions and affects overall economic performance. The quality of governance, in turn, depends on the attributes of the people involved. In an analysis based on international data, government effectiveness was related to the cognitive human capital of the society as a whole, of the intellectual class, and of leading politicians. The importance of cognitive capital was reflected in the rate of innovation, the degree of economic freedom, and country competitiveness, all of which were found to have an impact on the level of productivity (GDP per capita) and wealth (per adult). Correlation, regression, and path analyses involving N=98 to 201 countries showed that government effectiveness had a very strong impact on productivity and wealth (total standardized effects of β=.56-.68). The intellectual class's cognitive competence, seen as background factor and indicated by scores for the top 5 percent of the population on PISA, TIMSS and PIRLS, also had a strong impact (β=.50-.54). Cross-lagged panel designs were used to establish causal directions, including backward effects from economic freedom and wealth on governance. The use of further controls showed no independent impacts on per capita wealth coming from geographical variables or natural resource rents. Finally, we discuss background factors and ways in which governance might be improved.

Keywords: government effectiveness, human capital, cognitive ability, intelligence, economic freedom, innovation, competitiveness

JEL code : D73, I20, O55, O41

Good governance, the benign and efficient management of society via decisions and institutions, can make a major contribution to the well-being of nations. Notorious examples of bad governance include China's "Great Leap Forward" under Mao Zedong (from 1958 to 1961) resulting in a famine with 18 to 45 million deaths, and the dictatorships of Adolf Hitler, Pol Pot, Idi Amin, and Saddam Hussein. By contrast good governance promotes not only economic prosperity, but also freedom, the rule of law, human rights, security, and peace.

How may good or bad governance affect society? Governance has an impact through the development and interpretation of law, the negotiation of agreements with other countries and international organizations, the shaping of political and economic institutions, influence on human capital development and demographic policies, the development and control of executive organs and the workforce in administration, bureaucracy, police, judiciary, military, customs, tax bodies, and technical inspection organs. Corruption and low quality in administration and economy are controlled; competence, efficiency and meritoric principles are encouraged.

Since governance under modern conditions operates through many kinds of decisions and institutions, the development of cognitive capital is critical for its success. Educational policies are important for both the spread of basic skills and the emergence of specialists working in political, economic, and scientific institutions managing processes and developing new technologies. This view of governance is actively promoted by the World Bank and its researchers (Kaufmann, 2003).

1 Human capital and cognitive ability theory

Aristotle wrote in his *Nicomachean Ethics* (VI, 8, 1141b; 2009) that "Prudence is indeed the same quality of mind as statesmanship", and that this prudence (or wisdom and intelligence) is mirrored in legislation. Modern human capital theory relates individual human capabilities to life outcomes such as job performance, marriage, and health (Becker, 1993/1964). Studies of diverse forms of human capital – diligence, conscientiousness, discipline and self-discipline, vitality, social competence, law-abidingness, agreeableness, and cognitive ability – have typically found the last of these to be the most important one. In statistical analyses of job performance, cognitive ability has the highest predictive validity of any form of human capital. Depending on the criteria used and corrections for low reliability and variance restriction, the correlations and β values for cognitive ability are typically between .25 and .80 (Salgado et al., 2003; Schmidt, 2012). Such results have been obtained in developing as well as developed countries (Meisenberg et al., 2006). In more complex jobs, the predictive validity of cognitive competence is even greater (e.g., r=.40-.58, Kuncel & Hezlett, 2010). The relationships hold regardless of whether the analysis is of a cross-sectional or longitudinal nature (Irwing & Lynn, 2006; Kramer, 2009).

One reason for these results is that cognitive ability tests are more reliable and valid than measures of other types of human capital. It is also the case that people differ in cognitive ability more so than they do with respect to fundamental traits. But differences are a prerequisite for correlational predictivity. Thus, a fundamental condition for successful job performance such as visual ability is not very predictive because blind people are rare and frequently excluded from consideration (e.g., from becoming a pilot).

More importantly, job requirements call for cognitive abilities because many tasks are better addressed through the use of knowledge and deliberation. Especially in modern and more complex jobs, learning is a prerequisite to becoming an effective worker (Schmidt & Hunter, 1998).). Job requirements themselves are cognitively demanding, e.g. understanding instructions, orders, and security risks, prioritizing tasks, coming to a decision, processing, and integrating and evaluating information for solving problems. The performance of diverse professionals such as accountants, businesspeople, physicians, engineers, managers, and scientists depends on cognitive ability to one degree or another (Gottfredson, 2003). Cognitive ability is not only helpful in navigating the educational selection and competence building process in schools, but also in coping with conditions in jobs and in every day life, e.g. driving a car, managing income and property, selecting a mate, educating children, and engaging life in a healthy and sensible way. People with greater cognitive ability learn from their mistakes and can therefore mimic what works elsewhere (Kodila-Tedika, 2012, 2013). Intelligence is also positively related to patience, which enables players in institutions to develop a better understanding of the principles and rules that govern them (Kodila-Tedika & Kanyama-Kalonda, 2012; Shamosh & Gray, 2008).

An example of *worst* practice is revealing. According to Schmidt (2009, pp. 11ff.), until the mid-1980s the Washington, DC police force was one of the best in the USA. Applicants were selected for police academy training based on a general intelligence test and a background investigation. The mayor, Marion Barry, eliminated this procedure with several consequences: the drop-out rate among the police increased (80% of the new hires were incapable of completing the required training); the content of academy training was eased; the police officers being produced were frequently incompetent (murder indictments were dismissed because the reports written by the officers on the scene were unintelligible, solution rates for murder cases declined, firearms accidents soared because officers did not know how to use weapons properly, and crime on the police force became more common).

This example highlights not only the consequences of test abandonment for hiring decisions and its cognitive outcomes, but also the effects of bad government on the *quality of institutions.* Such a view is backed by systematic studies of the impact of human capital on institutions and growth: (Glaeser, La Porta, Lopez-de-Silanes & Shleifer, 2004, p. 297f.): “Much evidence points to the primacy of human capital for both growth and democratization. ... The first order effect comes from human and social capital, which shape both institutional and productive capacities of a society.” See also Jones and Potrafke (2014).

The traditional human capital and cognitive ability approaches assume that their constructs show an impact on the achievement of *individuals*. However, in addition they have effects at higher order levels. First, there is a simple *aggregation effect*. Ability and achievement averaged across different individuals will lead to corresponding results at an aggregated level (e.g., intelligence and income: individual level across individuals: r=.35, Kramer, 2009; national level across nations, GNP/GNI per capita: r=.57 to .77, Lynn & Vanhanen, 2012a, p. 76f.). Second, there are *interaction effects* as the ability level of others in groups influences the behavior and cognitive development of individuals. Additionally, intelligence furthers cooperation within institutions (Jones, 2008). Third, there are also interaction effects insofar as the ability level of individuals and groups influences the *quality of institutions* and the institutions again have an impact on individual and group development (e.g., through the instructional quality of teachers; Chetty et al., 2011; Rindermann & Heller, 2005). This could be extended from classes and schools to administrative bodies, companies, politics, countries and cultures. E.g., economies and societies at a higher ability level are likely to develop new and complex technology and will absorb innovations from other countries more quickly (Jones, 2012). Intelligence also reduces corruption (Potrafke, 2012), and more intelligent people tend to prefer pro-market policies (Caplan & Miller, 2010), both of which have a positive impact on economic growth.

Studies at the macro-social level usually show high correlations between average cognitive ability and productivity (GDP) or income (GNI), where average cognitive ability is assessed on the basis of intelligence tests or student achievement tests. The test results are also typically related to the average number of years in primary, secondary and tertiary schools or the percentage of the population with secondary school qualifications. Correlations (r) between cognitive ability and production or income are usually between r=.50 and .80 (Lynn & Vanhanen, 2012b).

However, in modernity the achievements of *intellectual classes*, high ability groups, called by Pritchett and Viarengo (2009) “global performers” or the “team in the tail”, who can “compete internationally” and “perform at a globally competitive level”, seem to be especially crucial for enhancing the production of wealth. Hanushek and Woessmann (2008) referred to them as “rocket scientists”. Their impact works via technological innovation and management of complexity in companies and administration – the last as a part of government effectiveness. Contrary to other forms of “capital” there seems to be no diminishing returns from cognitive ability: the higher the ability and the more intelligent persons there are, even at highest ability levels, the better (Robertson, Smeets, Lubinski, & Benbow, 2010; Wai, 2013). The existence and extent of such *intellectual classes* can be estimated in two different ways: the size of higher ability groups (e.g., the share above SAS≥600, equivalent to IQ≥115; Hanushek & Woessmann, 2009) or the ability level of the top group (e.g., brightest 5%; Rindermann, Sailer & Thompson, 2009)[1]. Both operationalizations cover not only a small elite, but a broader spectrum of cognitive workers including teachers, engineers, entrepreneurs, physicians, lawyers, normal scientists, managers, accountants and politicians, managing and working in the areas of education, innovation, economy, administration and politics.

2 A model of governance effects

Good governance is a highly complex cognitive task. Leaders and administrators need to acquire and interpret information, frequently from multiple and even contradictory sources, process it in light of differing aims and values, and arrive at decisions. These decisions are only provisional because the evaluation of outcomes and changing conditions may call for fine-tuning or even revisions. To govern is to engage in *complex problem solving* as studied in simulations, e.g., being a company manager or the mayor of a community (Süß, 1999). We therefore assume that cognitive ability positively contributes to the quality of governance. Especially at the level of *intellectual classes*, which form the social basis for the government and *political leaders*, cognitive ability is likely to be highly important. This is backed by a study of Simonton (2006) for US presidents showing a positive relationship between intelligence and political success (r=.33).

Good governance is studied under the term "*government effectiveness.*" As used by World Bank researchers, it is defined as the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (Kaufmann, Kraay & Mastruzzi, 2010, p. 4). This government effectiveness is accompanied by further political criteria such as voice and accountability (democracy and political liberty), political stability and absence of violence (stability, low crime and peace), regulatory quality (the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development, related to economic freedom), rule of law (quality of contract enforcement, the police, and the courts), and control of corruption (low corruption).

The governance model clashes with a pure concept of *liberalism*, which generally views government interventions as a threat to the economy and the well-being of nations (Mises, 1996/1927; Hoppe, 2001). In contrast, we assume that good governance can produce conditions favorable to economic performance. First, governments can follow a more liberal or less liberal economic policy. If expressed in this way, we

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[1] More precisely, the intellectual classes' level is the ability level at the 95th percentile rank, meaning the lower cognitive ability threshold of the top 5% group.

generally support a libertarian approach. *Economic freedom* is one of the most powerful means to stimulate economic growth (de Haan, Lundstrom & Sturm, 2006), leading to increased wealth and welfare, and is even reflected in human height (Western vs. Eastern Germany, South vs. North Korea; Komlos & Kriwy, 2003; Schwekendiek & Pak, 2009) and psychological well-being (Belasen & Hafer, 2012).

However, good governance can do more than simply abstain from doing harm. Governments can stimulate the *competitiveness* of an economy, by setting rules (rule of law, low corruption), by supporting research and innovation, and by encouraging the development of human capital. As defined by the World Economic Forum, a country is said to be competitive to the extent that it has institutions, policies, and other factors that contribute to productivity (Schwab, 2013). *Innovation* is a central factor for the competitiveness. All these factors contribute through *productivity* to *wealth* – the possession of valuable assets. Governance, depending on cognitive ability of the general society, intellectual classes and political leaders, working through economic freedom, innovation and competitiveness, leading to productivity and wealth.

Of course, this model, like others, is a simplification of reality and its complexity. What is missing is that, first, produced wealth needs to be maintained; a war, political chaos, or destructive government can reduce it. However, a model with a path from governance to wealth indirectly reflect these realities. More difficult to handle are backward effects (i.e., instances of reverse causality). Longitudinal designs with cross-lagged effects can be used to detect them. Going further, there can be previously-ignored additional variables such as geography or natural resources. Next, background variables such as culture, history, or genetic factors deserve consideration. While the first ones can be easily added, the letter ones are difficult to measure. Finally, there are always outliers and single country peculiarities such as an unexpected and sudden detection of mineral resources (e.g., Equatorial Guinea: the largest oil producer in sub-Saharan Africa on a per-capita basis) or wars in neighboring countries, impairing one's own society and economy (e.g., Jordan). In the case of special local and historical conditions a general model needs to be adapted.

3 Method

[Remark for reviewers and editor: If wished, this part can be put into an appendix or online supplement and in this case we provide only some summary information.]

3.1 Data

Cognitive ability: Data from various *student assessment studies* were combined: 1. PISA (Programme for International Student Assessment – reading, mathematics and science literacy of 15 year old students), 2000, 2003, 2006, 2009; TIMSS, 1995, 1999, 2003, 2007, 2011 (mathematics and science of 4th and 8th graders); PIRLS, 2001, 2006, 2011 (Reading literacy of 4th graders). 2. If for certain countries no data could be obtained from PISA, PIRLS and TIMSS, older, regional or less representative studies were considered: IEA-Reading Literacy Study 1991 (9-year-old and 14-year-old students) and IAEP-II 1991 (International Assessment of Educational Progress, mathematics and science, 9- and 13-year-old students), LLECE 1997 and 2005-2006 (Laboratorio Latinoamericano de Evaluación de la Calidad de la Educación, in third to sixth grade reading, mathematics and science), SACMEQ 1995-1998, 1999-2004, 2007 (Southern and Eastern Africa Consortium for Monitoring Educational Quality; reading and mathematics in sixth grade), MLA 1999 (Monitoring Learning Achievement; literacy, numeracy and life skills in fourth grade), PASEC (Programme d'Analyse des Systèmes Éducatifs; French and mathematics in second and fifth grade, due to low comparability we took only mathematics), and results in the International Mathematical Olympiad (IMO). The scores from student assessments were combined with *psychometric intelligence test data* from Lynn and Vanhanen (2012a).

Before averaging, the data were, if necessary and possible, corrected for *age* (depending on the country, students may be older or younger than the international average) and *school attendance rates* (depending on the country, more or less youth than an international average attends school). Student data from countries with only regional data were corrected to be more accurate as country estimates; IQ estimates (not directly measured) were also corrected. Obviously wrong results were excluded. Student assessment scores and psychometric IQ test results are highly correlated and form a strong international *G*-factor (*r'*s around .80 to .92; Coyle & Rindermann, 2013; Lynn & Vanhanen, 2012b). At the level of individuals, knowledge (which should be measured by SAS) and thinking (which should be better measured h by IQ tests) influence each other (Maas et al., 2006; Rindermann, Flores-Mendoza & Mansur-Alves, 2010).

Many student assessment studies also provide data for the *95%-ability level* (intellectual classes, high achievement groups). All data were standardized in an IQ-metric. A detailed description of the procedure can be found in Rindermann (2014). The procedure is similar to the one used by Rindermann, Sailer and Thompson (2009). The assumption is that student-based data are good proxies for the general (adult) ability level in a society. Data are given for N=200 (cognitive ability mean) or N=98 countries (95%-ability level) and correlate at r=.97 (N=98; see Table 1). Correlations with the ability compilations of other researchers are high: r=.99 (average with average, N=200; IQ-student assessment average, Lynn & Vanhanen, 2012a), r=.88 (average with average, N=77; student assessment average, Hanushek & Woessmann, 2009) or r=.76 (95%-ability level with percentage of students with SAS=600 or higher, equivalent to IQ≥115, N=74, same source), r=.94 (average with average, N=131; student assessment average, Altinok, Diebolt & De Meulemeester, 2013) or r=.88 (95%-ability level with percentage of students with SAS=600 or higher, equivalent to IQ≥115, N=96, same source).

Competence of leading politicians: Data derived from educational levels (graduate education, at least a postgraduate qualification, 1, or not, 0) of Besley and Reynal-Querol (2011). In contrast to the original data set we coded every year (not only the inaugural year of a leader). To get a more reliable and valid measure we took a longer period, between 1960 and 2004. The correlation with a similar variable from Rindermann et al. (2009, “cognitive ability of leading politicians” based on educational degrees) is r=.44 (N=87, r=.62 not only using the graduate vs. not split). The Besley and Reynal-Querol sample covers a much larger country sample (N=182 vs. 94), thus we used their data. Data are given for N=182 countries.

Government effectiveness: Data come from the World Bank (Kaufmann, Kraay & Mastruzzi, 2010, update 2012) and stand for the quality of public services, its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government’s commitment to such policies. Data for the period 1996-2011 are given for N=200 countries.

Innovation: Data come from the World Intellectual Property Organization (WIPO; Dutta & Lanvin, 2013). WIPO ranks countries according to their innovations in science, technology, economics and society based on seven pillars: Institutions including politics, human capital (education and research), infrastructure, market sophistication (credit and trade), business sophistication (knowledge workforce), knowledge and technology outputs, and creative outputs (including arts).The Global Innovation Index (GII) is used for the year 2013 (N=142 countries).

Competitiveness: The Global Competitiveness Index (GCI) from the World Economic Forum (WEF; Schwab, 2013) reflects the set of institutions, policies, and factors that determine the level of productivity of a country. This competitiveness is built upon twelve pillars: The quality of institutions including a proper management of public finances, the quality of infrastructure, the stability of the macroeconomic environment, a healthy workforce, a well educated workforce, efficient goods markets, efficiency and flexibility of the labor market, sound and well-functioning financial sector, technological readiness and innovation by the development of new technological and non-technological knowledge. There is some conceptual overlap with government effectiveness (quality of institutions), but a majority of the pillars are the result of good governance. Of course, innovation contributes to competitiveness, and these measures are highly correlated (r=.90, N=133). Data from the period 2006-2013 are given for N=148 countries.

Economic freedom: Our economic freedom measure is based on the Fraser index (Gwartney, Lawson & Hall, 2013) and the Heritage index (Miller, Holmes & Feulner, 2013). From Fraser we used the longitudinal chain-linked index; if for single countries data were not given but in the single year data set, we added them standardized on the group of countries having data in both variables (chain-linked, single year). The index takes on higher values in the presence of smaller government, an impartial legal system with secure property rights, access to sound money, freedom to trade internationally, and modest regulation of credit markets, labor markets, and business. The Heritage index covers ten aspects in four categories: rule of law (property rights, freedom from corruption), limited government (fiscal freedom, government spending), regulatory efficiency (business freedom, labor freedom, monetary freedom), and open markets (trade freedom, investment freedom, financial freedom). Fraser data are given for 1995 to 2011 (N=153), Heritage for 1995 to 2013 (N=181); the indices correlate with r=.86 (N=152). The sum exists for N=182 countries (Cronbach-α=.93).

Economic productivity: We used as an intermediate criterion per capita gross domestic product (GDP) 2010 from the Penn World Tables (Heston, Summers & Aten, 2012) in 2005 constant prices, with purchasing power parity (ppp) adapted to an international dollar (Laspeyres). 'GDP' indicates the produced per capita standard of living for one year. Because an increase at a lower level arguably has much more impact on the quality of life, we also used the natural logarithm of GDP. It transforms nonlinear, exponential increases in "currency units" to linear increases in more realistic "quality of life units". However, GDP-logs do not offer understandable units. For communication purposes unlogged numbers are more useful. Data are given for N=189 countries.

Wealth: As a final criterion we used wealth holdings of households calculated per adult according to the Credit Suisse Research Institute (2013, Tables 2-1 and 2-4, current US dollar). Wealth is the marketable value of financial assets plus non-financial assets (principally housing and land) less debts. For comparisons official exchange rates were used. We also used the natural logarithm of wealth. Data for the year 2013 come from N=174 countries.

Sub-Saharan Africa: As a control we applied a geographical variable that distinguishes sub-Saharan African countries from the rest of the world. As in most international data sets until recently, Sudan was not split into a northern and southern part.

Absolute latitude: As a further geographical control we used absolute latitude or antipodal latitude (distance from equator) derived from https://opendata.socrata.com/dataset/Country-List-ISO-3166-Codes-Latitude-Longitude/mnkm-8ram. Compared with the data used by Sala-i-Martin (1997, based on the Barro-Lee collection) the correlation is r=.99 (N=133). The used variable represents the absolute latitude average of a country, not a population-weighted absolute latitude average (e.g., for Canada and Australia these distinctions are important). The same geographical method for latitude average is used in the CIA World Factbook. Data are given for N=202 countries.

Natural resources rents: A final control used was total natural resources rents, calculated as the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents as a percent of GDP from the World Bank (2011). Data come from the years 1995-2011 (average) for N=195 countries.

3.2 Statistical analyses

We performed correlation, regression and path analyses.

Regression and path analyses are used to calculate direct, indirect, net and sum effects of variables. In these analyses the standardized path coefficients (β) between different variables must be interpreted. Correlations are always added in parentheses. Correlations help to quickly estimate the influence of other variables in a model (the larger the difference between a correlation and a path coefficient, the larger is the influence of other variables), and they make it possible to check the model ($\Sigma r\beta = R^2 = 1$-error) and to calculate the proportion of the explained variance in each factor ($R^2 = \Sigma r\beta$). "Good" values for fit indices (if models are not saturated) are SRMR≤.08 or SRMR≤.05 and CFI≥.95 or CFI≥.97, and "acceptable" fit is reached with SRMR≤.10 and CFI≥.95. For the analyses, SPSS 22 and Mplus 5.21 were used. Significance tests were not used for interpretation (for an in-depth justification, see, e.g., Armstrong, 2007; Cohen, 1994; Gigerenzer, 2004). Especially at the macro-social level they are questionable for scientific reasoning. More instructive for inductive generalization – which is not possible with significance tests – is the demonstration of the stability of relationships if control variables are included (or across different country samples, different variable operationalizations, different measurement points and various studies of different authors). We use full-information maximum likelihood (FIML). This means no listwise deletion in the case of missing data. All given information is used; behind single paths and correlations stand differing sample sizes and country compositions (see Table 1 for bivariate correlations).

We present standardized coefficients. First, they are comparable across differently scaled predictors and criteria. Second, a majority of the variables do not have natural, understandable and widely-used scales. Thus, unstandardized results would be less meaningful.

4 Results

Table 1 around here please

Figure 1 around here please

Table 1 shows the correlations among the variables. All macrosocial variables are positively correlated except for the *sub-Saharan Africa dummy* (Africa as 1, rest of world 0) and *natural resources rents* (NNR) as a percent of GDP. At a country level a relatively high level of natural resources rents seems to be an indicator of lesser economic development. Of course, high NNRs are numerically possible only if other incomes based on technology or services are low. However, longitudinally, natural resources could harm economic productivity in non-resource based sectors ("Dutch disease"; Corden & Neary, 1982).

There is only a minor correlation between the *society's cognitive ability mean* and the *educational level of its political leaders* (taken as an indicator of their competence): *r*=.15 (with ability mean, *N*=181) or *r*=.14 (with top ability level, *N*=92). It is typically the case that political leaders hail from the better-educated and higher-competence strata of society. Additionally, educational degrees are difficult to compare across different countries. However, there is considerable variation across regions with the West (North-West-Middle Europe, North America and Australia-New Zealand) having on average the best-educated politicians (on a scale between 0, not graduated, and 1, graduated, *M*=0.50, *SD*=0.27, *N*=18 countries) and the Arab-Muslim world the least-educated (*M*=0.15, *SD*=0.27, *N*=20), with sub-Saharan Africa also low (*M*=0.18, *SD*=0.29, *N*=47).[2] As expected, a reasonably high correlation is found between the political leaders' level and government effectiveness (*r*=.36, *N*=181).

Table 2 around here please

The *cognitive ability mean* and the *top ability level* have differing country sample sizes (*N*=200 vs. *N*=98). Comparing them in the same country sample across all our given variables (*N*=88) shows that the top ability level is more predictive for all positive

[2] East-Asian politicians tend to be not very highly educated -- in contrast to the high test scores of East Asian students and adults (*M*=0.16, *SD*=0.28, *N*=7).

economic variables, e.g., for government effectiveness (r=.65 vs. r=.69), but not for the non-economic variables: the sub-Saharan Africa dummy, natural resources rents and absolute latitude (see Table 2). We see this as evidence for the intellectual classes theory. I.e., the ability level of cognitive elites is crucial in modernity. Across different regions and cultures there is a close relationship (see Figure 1, scatterplot). The relationship appears to be slightly curvilinear, consistent with a view that government effectiveness has a low threshold. Lower levels may be avoided by the positive influence of advisors from international organizations, support by local but abroad educated experts (e.g., at universities in North America and Europe) and by copying the institutional features of developed countries.

Government effectiveness, *innovation* and *competitiveness* are highly correlated (r=.90 to .92). There is some conceptual overlap. However, competent government supports innovation and competitiveness by the fostering of research and economic freedom. Similarly, economic freedom is highly (but somewhat less) correlated with these three variables (r=.76 to .81).

The *sub-Saharan Africa* dummy correlates negatively with cognitive, technological and economic modernity indicators. In the total sample, the cognitive ability mean and GDP-log show the highest negative correlations (r=-.67 and -.64). In a same country sample of N=88 the highest correlations could be found with the cognitive ability mean and top ability level (r=-.44 and -.37). However, there are only data for four African countries in all variables (Botswana, Ghana, Mauritius and South Africa), and one of these countries (Mauritius) is, for the most part, not populated by sub-Saharan African people.

Absolute latitude, the distance from the equator, is positively correlated with all developmental indicators. The highest correlation is found for the cognitive ability mean (r=.69). In the same country sample the highest correlations are with cognitive ability (r=.62), top ability level (r=.60) and innovation (r=.51).

As mentioned before, *natural resources rents* are negatively correlated with developmental and modernity indicators. The highest negative correlations are found for economic freedom and government effectiveness (r=-.39 and -.34).

Generally, the logarithmic *productivity* and *wealth* measures are more highly correlated with developmental indicators than the same measures in usual money units (differences in correlation of about .10 or .20). The logarithm converts nonlinear, exponential increases to linear ones appropriate for conventional statistical analyses such as correlation, regression and path analyses. Also the correlation between one year's productivity, GDP, and the result of long term productivity, wealth, increases by using the logarithmic transformation, from r=.73 to r=.92 (N=172). Both indicators correlate most highly with competitiveness (r=.72 to r=.87), innovation (r=.68 to r=.86) and government effectiveness (r=.70 to r=.84). Assuming no backward effects (which is rather simplistic), these three factors are the most important variables for a country's wealth. However, even without backward effects from wealth these factors are not exogenous variables. They depend, e.g., on the competence of political leaders and the country's cognitive ability level. These relationships were examined by using path analyses.

Table 3 around here please
Figure 2 around here please

Before showing results from path analyses we want to mention the limits of conventional regression studies (see Table 3). Regression analysis cannot typically capture both direct and indirect effects. Thus, the relevance of background factors such as cognitive ability will be underestimated insofar as it operates (indirectly) through an impact on governance and institutions. Additionally, the traditional use of unstandardized coefficients in regression analysis may lead to confusion with respect to predictors using differing scales. Organizations have developed their own scales (from 1 to 10 or 1 to 100 or –3 to +3) and use different segments within scales. Unstandardized effects are not strictly comparable in such a context. The only message we can take from our regression analysis is that government effectiveness is more important than other factors for wealth.

These problems are resolved by using path analyses and presenting the results in terms of standardized effects. Figure 2 shows a path analysis using productivity and wealth criteria in usual money units. The fit is very good CFI=.98 and $SRMR$=.03, and the chosen model is consistent with the empirical covariations between the variables. The *cognitive ability mean* and the *top cognitive ability level* are highly correlated

(r=.98). The correlation slightly deviates from the one calculated by SPSS (r=.97). First, Mplus estimates correlations in a slightly different way (Muthen, 2009), and second, there could be some minor rounding errors. In the first model we do not consider any effects of the average cognitive ability of a society. However, intellectual classes come from the general society. In any case, the *top cognitive ability level* has a positive impact on the competence of leading politicians ($\beta_{95\%\rightarrow \mathrm{CClP}}$=.17), on government effectiveness ($\beta_{95\%\rightarrow \mathrm{GovE}}$=.62), innovation ($\beta_{95\%\rightarrow \mathrm{Inno}}$=.36) and competitiveness ($\beta_{95\%\rightarrow \mathrm{Com}}$=.16). These are all theoretically highly convincing paths insofar as people working in these fields must have high cognitive ability to satisfy work requirements.

The *competence of leading politicians* also has a positive impact on government effectiveness ($\beta_{\mathrm{CClP}\rightarrow \mathrm{GovE}}$=.26). Leading politicians manage government and affect government effectiveness. They set the general conditions, and they select the staff for administration. As a prime example, consider in Singapore longtime Prime Minister *Lee Kuan Yew* (university degree with double First Class Honours from Cambridge): “I realized that the more talented people I had as ministers, administrators, and professionals, the more effective my policies were, and the better the results” (Yew, 2000, p. 135). According to the World Bank, Singapore’s government effectiveness has been the second highest of the 200 countries evaluated.

Government effectiveness is crucial for economic freedom ($\beta_{\mathrm{GovE}\rightarrow \mathrm{EF}}$=.81). The two concepts are theoretically distinguishable. A competent government pays attention to economic liberty because it is a means to achieve higher competitiveness, economic growth and wealth. However, some backward effects (economic freedom fosters not only economic productivity, but also has a positive impact on government effectiveness) cannot be excluded. Testing this, a longitudinal analysis using cross-lagged effects for 135 countries between the middle of the 1990s and 2010 (see Figure 3) shows that government effectiveness has had in the past a stronger effect on economic freedom ($\beta_{\mathrm{GovE96}\rightarrow \mathrm{EF10}}$=.29) than economic freedom on government effectiveness ($\beta_{\mathrm{EF95}\rightarrow \mathrm{GovE10}}$=.06). Thus the direction of our chosen path is empirically backed.

Figure 3 around here please

Similarly, *government effectiveness* has a positive impact on competitiveness (Figure 2, directly and indirectly via economic freedom, direct: $\beta_{\text{GovE}\rightarrow\text{Com}}$=.38; indirect: $\beta_{\text{GovE(ind)}\rightarrow\text{Com}}$=.81×.08=.06; total: $\beta_{\text{GovE(tot)}\rightarrow\text{Com}}$=.38+.06=.44), on innovation ($\beta_{\text{GovE}\rightarrow\text{Inno}}$=.67) and on productivity (direct: $\beta_{\text{GovE}\rightarrow\text{GDP}}$=.26; indirect via economic freedom, competitiveness and innovation, indirect sum: $\beta_{\text{GovE(ind)}\rightarrow\text{GDP}}$=.34; total: $\beta_{\text{GovE(tot)}\rightarrow\text{GDP}}$=.60).[3]

Productivity (GDP per capita) directly depends on competitiveness ($\beta_{\text{Com}\rightarrow\text{GDP}}$=.49) and government effectiveness ($\beta_{\text{GovE}\rightarrow\text{GDP}}$=.26; total effect: $\beta_{\text{GovE(tot)}\rightarrow\text{GDP}}$=.60).

Figure 4 around here please

Wealth (per adult) directly depends on yearly productivity ($\beta_{\text{GDP}\rightarrow\text{Wealth}}$=.37) and government effectiveness ($\beta_{\text{GovE}\rightarrow\text{Wealth}}$=.51; indirect: $\beta_{\text{GovE(ind)}\rightarrow\text{Wealth}}$=.22; total effect: $\beta_{\text{GovE(tot)}\rightarrow\text{Wealth}}$=.73). The analysis of longitudinal data (for only a ten year interval) for reciprocal effects between government effectiveness and wealth did not yield a clear result (see Figure 4). Depending on how the wealth data were used (in monetary units or logarithmic form) government effectiveness or wealth had a stronger effect (monetary units: $\beta_{\text{GovE00}\rightarrow\text{Wealth10}}$=.20 vs. $\beta_{\text{Wealth00}\rightarrow\text{GovE10}}$=-.02; logarithm: $\beta_{\text{GovE00}\rightarrow\text{Wealth10}}$=.09 vs. $\beta_{\text{Wealth00}\rightarrow\text{GovE10}}$=.12). There seem to be reciprocal effects. A cross-sectional model is in this respect not sufficiently complex.

Figure 5 around here please

In a final path analysis (Figure 5) we have used logarithmic versions of GDP and wealth. This model has as a feature that wealth increases in the lower tail receive more emphasis. Lower tail increases are arguably more important for the improvement of quality of life than wealth increases in the upper tail. Additionally, using the logarithm converts nonlinear, exponential increases to linear ones. We also added three controls for wealth, a sub-Saharan African dummy, absolute latitude and natural resources rents. Finally, we added a direct path from the *cognitive ability mean* to productivity

[3] Indirect effects of government effectiveness on GDP: (.67×.37×.49)+(.38×.49)+(.81×.08×.49)=.34.

($\beta_{\text{CAM}\rightarrow\text{GDPl}}$=.24). If we set such a path for a linear measure of GDP – i.e., GDP in a nonlogarithmic form – the result is zero ($\beta_{\text{CAM}\rightarrow\text{GDP}}$=.00). Why is there such a remarkable difference? Taking the logarithm means stressing differences at the lower to average levels of the GDP distribution across countries. Compared to the influence of intellectual classes (measured by the cognitive level of the 95$^{\text{th}}$ percentile), the influence of the average ability range (as indicated by the cognitive ability of the general society) is larger at the average levels of the GDP distribution. The impact of competitiveness and government effectiveness is only slightly changed ($\beta_{\text{Com}\rightarrow\text{GDPl}}$=.45, minus .04; $\beta_{\text{GovE}\rightarrow\text{GDPl}}$=.24, minus .02). The impact of GDP on wealth is increased dramatically, from $\beta_{\text{GDP}\rightarrow\text{Wealth}}$=.37 to $\beta_{\text{GDPl}\rightarrow\text{Wealthl}}$=.70, and the direct effect of government effectiveness decreases, from $\beta_{\text{GovE}\rightarrow\text{Wealth}}$=.51 to $\beta_{\text{GovE}\rightarrow\text{Wealthl}}$=.29.

The total impact of government effectiveness on wealth is now $\beta_{\text{GovE(tot)}\rightarrow\text{Wealthl}}$=.68, and somewhat smaller than for wealth in monetary units (the total impact of government effectiveness for not-log was: .73).[4]

The additional control variables in a model with cognitive ability mean, top cognitive ability, competence of politicians, government effectiveness, innovation, competitiveness, economic freedom and depending on them: GDP, cannot explain further variance in wealth (expressed in logarithmic form): The *sub-Saharan African* dummy has nearly no effect ($\beta_{\text{sSA}\rightarrow\text{Wealthl}}$=-.04), and *absolute latitude* ($\beta_{\text{ALat}\rightarrow\text{Wealthl}}$=.04) and *natural resources rents* ($\beta_{\text{NRR}\rightarrow\text{Wealthl}}$=.03) likewise have only trivial impacts. Together they explain only 4% of the variance in national wealth, whereas government effectiveness by itself directly explains 24%.[5] However, the substantial correlations between the sub-Saharan African dummy and wealth (in parentheses: r=-.58) and between absolute latitude (distance to the equator) and wealth (r=.52) show a closer relationship. But in our model the other human capital, political and economic attributes of societies can explain the given wealth differences that are associated with geography. Geography is not relevant – unless it is assumed that it influences the predictor variables in our model, e.g., via culture.

[4] Calculation of total effect of government effectiveness on log-wealth:
.29+((.24+(.68×.37×.45)+(.40×.45)+(.81×.08×.45))×.70)=.68 (.683666).
[5] Calculation of the variance explained in log-wealth by the three controls:
(-.04×-.58)+(.04×.52)+(.03×-.09)=.04.
Calculation of the variance explained in log-wealth by government effectiveness: .29×.83=.24.

The total effect of *government effectiveness* on wealth is $\beta_{\text{GovE(tot)}\rightarrow\text{Wealthl}}$=.68. The total effect of *competence of leading politicians* on wealth is $\beta_{\text{CClP(tot)}\rightarrow\text{Wealthl}}$=.18.[6] The total effect of *cognitive ability mean* on wealth is $\beta_{\text{CAM(tot)}\rightarrow\text{Wealthl}}$=.17.[7] Here we have not considered that the intellectual classes come from the general society. Finally, the total effect of the *top cognitive ability level* on wealth is $\beta_{95\%\ \text{(tot)}\rightarrow\text{Wealthl}}$=.54.[8]

Looking at productivity gives us the same pattern of results: $\beta_{\text{GovE(tot)}\rightarrow\text{GDPl}}$=.56[9], $\beta_{\text{CClP(tot)}\rightarrow\text{GDPl}}$=.15[10], $\beta_{\text{CAM(tot)}\rightarrow\text{GDPl}}$=.24[11], and $\beta_{95\%\ \text{(tot)}\rightarrow\text{GDPl}}$=.50[12].

Thus, *government effectiveness* is seen to be the crucial political-institutional variable in understanding productivity and wealth differences between countries. Since government effectiveness depends on the cognitive competence of politicians and the intellectual class, it is not easy to change administrative and bureaucratic structures in a sustainable way.

5 Discussion

Our aim has been to empirically analyze the impact of *good governance* on economic productivity and wealth. We took as our measure of good governance the *government effectiveness* concept of the World Bank (quality of policy formulation and its implementation through public services). Government effectiveness depends positively on the intellectual class's ability level (the level of the top ability group at the 95th percentile, total effect: $\beta_{95\%\text{(tot)}\rightarrow\text{GovE}}$=.66) and on the cognitive competence of leading

[6] Calculation of competence of leading politicians on log-wealth: Taking the above .68 and multiplying with .26 = .18 (.17775316).
[7] Calculation of cognitive ability mean on log-wealth: .24×.70=.17 (.168).
[8] Calculation of total effect of top cognitive ability level on log-wealth: We took the government effectiveness effect (.68 written for .683666):
(.17×.26×.68)+(.62×.68)+(.36×.37×.45×.70)+(.14×.45×.70)=.54 (.540148957).
[9] Calculation of total effect of government effectiveness on log-GDP:
.24+(.68×.37×.45)+(.40×.45)+(.81×.08×.45)=.56 (.56238).
[10] Calculation of competence of leading politicians on log-GDP: Taking the above .56 and multiplying with .26 = .15 (.1462188).
[11] Calculation of cognitive ability mean on log-GDP: Simply taking the direct effect of .24.
[12] Calculation of total effect of top cognitive ability level on log-GDP: We took the government effectiveness effect (.56 written for .56238): (.17×.26×.56)+(.62×.56)+(.36×.37×.45)+(.14×.45)=.50 (.496472796).

politicians ($\beta_{\text{CClP(tot)}\rightarrow\text{GovE}}$=.26[13]). Using these two variables, we can explain 51-52 percent of the cross-national variation in government effectiveness.[14]

Of course, government policy and its implementation are also subject to ideological currents, and even intelligent people can be influenced by bad ideas. We can shake our heads about Mao Zedong and Adolf Hitler, but they and the people they governed in their times were not lacking in general intelligence. From 1995 to 2010, however – the period for which we have assembled quantitative evidence – there developed a fair degree of consensus among intellectual people in support of free and open markets and more generally of political freedom and rule of law.

Government effectiveness has a positive impact by supporting economic freedom, innovation and competitiveness, which in turn affect economic productivity (GDP per capita, total impact: $\beta_{\text{GovE(tot)}\rightarrow\text{GDPl}}$=.56) and wealth (per adult, total: $\beta_{\text{GovE(tot)}\rightarrow\text{Wealthl}}$=.68). Our final model (Figure 5) using GDP and wealth in logarithmic form explains a whopping 73 percent (GDP) and 88 percent (wealth) of the cross-national variation in these variables. Compared to economic freedom (total on GDP: $\beta_{\text{EF(tot)}\rightarrow\text{GDPl}}$=.04, total wealth: $\beta_{\text{EF(tot)}\rightarrow\text{Wealthl}}$=.03[15]) the impact of government effectiveness is much larger. This result can also be inferred from the higher correlations between government effectiveness and GDP/wealth than between economic freedom and GDP/wealth (Table 1, mean across the four indicators: r_{GovE}=.78 vs. r_{EF}=.64). Additional geographic and natural resources controls have only a minor impact (β<|.05|).

In the context of technological and social modernity, featuring increases in the complexity of economies, politics and daily life (e.g., the coordination of supplies and production, the management of financial assets, the competent operation of technology as in telephones, TVs and cars), good governance is the crucial factor for producing and maintaining national wealth.

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[13] For the effect of competence of leading politicians on government effectiveness direct and total effects are identical (only one effect).

[14] Taken from the Mplus output. It can be also calculated by this, using Figure 2 or Figure 5: (.62×.67)+(.26×.36)=.51; (.62×.69)+(.26×.37)=.52. There are minor differences in correlations between SPSS and Mplus and in the correlations between the two models calculated by Mplus.

[15] For the effect of economic freedom on GDP and wealth indirect and total effects are identical; taken from the final model in Figure 5.

As in previous studies (Rindermann et al., 2009) the level of the top ability group (“intellectual classes”, “smart fractions”, “rocket scientists”, “the team in the tail”) had the strongest impact on economic performance. Cognitive capitalism is built upon intellectual classes.

However, we should not forget the limitations of our model: First, there are *backward, reciprocal effects*: wealth may also have an impact on government effectiveness (here Figure 4), GDP has also an effect on economic freedom (Rindermann, 2012, Figures 1 and 2 therein) and economic freedom a small one on government effectiveness (here Figure 3). But there is no hint that wealth/GDP longitudinally has a stronger impact on government effectiveness than on economic freedom. Rather, the opposite is true: there is longitudinally a stronger effect of wealth/GDP on economic freedom. Thus, the stronger cross-sectional statistical impact of government effectiveness on GDP/wealth than of economic freedom on GDP/wealth is not due to a stronger reciprocal effect of GDP/wealth on government effectiveness.

What we have not analyzed here are backward effects of wealth on cognitive ability. Previous longitudinal analyses at the international level (Rindermann, 2012) have shown that the cognitive human capital effect on GDP/wealth is larger than the backward effect of GDP/wealth on cognitive human capital (see also Christainsen, 2013). Research has shown that there are poor regions with low cognitive ability levels (Africa or Bali; Rindermann, 2013; Rindermann & te Nijenhuis, 2012), but also poor regions with average to high ability levels (Vietnam; Rindermann, Hoang & Baumeister, 2013) and rich regions with rather low ability levels (Emirates; Rindermann, Baumeister & Gröper, 2013). However, developing countries often experience a “brain drain” from their intellectual classes (Kapur & McHale, 2005) because developed countries provide better political, economic and institutional working and living conditions for them (political stability, security, contract safety, prospects for promotion, interaction with highly competent others). Africa in particular suffers from this talent loss.

Second, further effects of government effectiveness on the control of corruption, rule of law and human capital policies (leading to productivity and wealth) are not covered by our model. Further studies can try to integrate them.

Third, we have not considered general *background variables* such as culture and history including evolutionary history. *Genes* and *evolutionary history* appear to have effects at the cross-country level (Ashraf & Galor, 2013; Meisenberg & Woodley, 2013; Putterman & Weil, 2010; Rindermann, Woodley & Stratford, 2012; Spolaore & Wacziarg, 2013), but no concrete gene-ability-relationships applicable to cross-country analyses have yet been found.[16] Thus, their explanatory value (as compared to their statistical one) is small. *Culture* is a somewhat fuzzy concept. However, developing a theory going out from world views and values influencing behavior in education, learning, thinking, work and dealing with others (Weber, 2008/1904; Harrison, 2006) may explain, after properly operationalizing such a theory, differences in our factors from cognitive ability to governance.

Fourth, our model is a general one. Historical analyses of single countries and regions may shed light on special regional and historical paths to wealth.

Fifth, there are concerns about the rating approach. Experts evaluating indicators for different political and economic criteria (government effectiveness, economic freedom, innovation and competitiveness) may be influenced by halo effects. For example, they may perceive a competitive economy and therefore infer that there is a high level of innovation. However, all global indicators are based on more specific ones. For some of the specific ones there are objective measures. For others, guidelines exist as to how to score them. Nevertheless, it would be better if the research organizations would alternatively provide only measured indicators for their concepts.

Finally, productivity and wealth may be important for the well-being of nations, but well-being itself is a broader concept encompassing psychological health and political values – liberty, democracy, autonomy, civil society ("bürgerliche Gesellschaft"), rule of law, peace, and a low crime rate (e.g., Ura, Alkire, Zangmo & Wangdi, 2012). However, previous research (Rindermann et al., 2009; Vanhanen, 2011) as well as the present paper offers evidence that cognitive ability contributes to all of the above. Good governance would be aimed at improving these outcomes via health, demographic, education and cultural change policies (Heckman, 2000; Hunt, 2012).

[16] Possibly the first exception is the study of Piffer (2013). However, further research will be needed to establish the causal path from genes via proteins and neurological processes to intelligence and cross-country differences in gene frequencies.

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Table 1: Correlation matrix, all used variables

		Ability mean	Top (95%) ability level	Competence leaders	Gov. effectiveness	Innovation	Competitiveness	Economic freedom	Sub-Sahara Africa	Absolute latitude	Resource rents	GDP Penn	GDP Penn log	Wealth Credit Suisse	Wealth CS log
Cognitive ability mean	r	1	.97	.15	.66	.82	.79	.43	-.67	.69	-.17	.55	.73	.60	.75
	p	.	.00	.04	.00	.00	.00	.00	.00	.00	.02	.00	.00	.00	.00
	N	200	98	181	195	142	148	182	200	199	191	188	188	174	174
Top (95%) ability level	r	.97	1	.14	.70	.81	.69	.49	-.33	.58	-.33	.47	.70	.60	.69
	p	.00	.	.18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	N	98	98	92	98	94	93	96	98	98	97	96	96	95	95
Competence of leaders	r	.15	.14	1	.36	.23	.19	.30	-.20	.19	-.28	.14	.23	.21	.24
	p	.04	.18	.	.00	.01	.03	.00	.01	.01	.00	.07	.00	.01	.00
	N	181	92	181	181	139	144	176	181	181	177	179	179	169	169
Government effectiveness	r	.66	.70	.36	1	.92	.90	.81	-.42	.50	-.34	.70	.79	.77	.84
	p	.00	.00	.00	.	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	N	195	98	181	196	142	148	182	196	196	190	189	189	174	174
Innovation	r	.82	.81	.23	.92	1	.90	.78	-.49	.61	-.30	.68	.81	.81	.86
	p	.00	.00	.01	.00	.	.00	.00	.00	.00	.00	.00	.00	.00	.00
	N	142	94	139	142	142	133	142	142	142	142	142	142	138	138
Competitiveness	r	.79	.69	.19	.90	.90	1	.76	-.52	.52	-.16	.72	.84	.77	.87
	p	.00	.00	.03	.00	.00	.	.00	.00	.00	.06	.00	.00	.00	.00
	N	148	93	144	148	133	148	147	148	148	146	147	147	142	142
Economic freedom	r	.43	.49	.30	.81	.78	.76	1	-.32	.32	-.39	.57	.65	.63	.71
	p	.00	.00	.00	.00	.00	.00	.	.00	.00	.00	.00	.00	.00	.00
	N	182	96	176	182	142	147	182	182	182	179	180	180	170	170
Sub-Sahara Africa	r	-.67	-.33	-.20	-.42	-.49	-.52	-.32	1	-.46	.10	-.36	-.64	-.31	-.61
	p	.00	.00	.01	.00	.00	.00	.00	.	.00	.16	.00	.00	.00	.00
	N	200	98	181	196	142	148	182	201	200	192	189	189	174	174
Absolute latitude	r	.69	.58	.19	.50	.61	.52	.32	-.46	1	-.14	.38	.52	.48	.56
	p	.00	.00	.01	.00	.00	.00	.00	.00	.	.05	.00	.00	.00	.00
	N	199	98	181	196	142	148	182	200	200	192	189	189	174	174

Natural resources rents	r	-.17	-.33	-.28	-.34	-.30	-.16	-.39	.10	-.14	1	.03	.00	-.14	-.05
	p	.02	.00	.00	.00	.00	.06	.00	.16	.05	.	.70	.99	.07	.49
	N	191	97	177	190	142	146	179	192	192	192	187	187	172	172
GDP/capita Penn	r	.55	.47	.14	.70	.68	.72	.57	-.36	.38	.03	1	.79	.73	.75
	p	.00	.00	.07	.00	.00	.00	.00	.00	.00	.70	.	.00	.00	.00
	N	188	96	179	189	142	147	180	189	189	187	189	189	172	172
GDP/cap Penn log	r	.73	.70	.23	.79	.81	.84	.65	-.64	.52	.00	.79	1	.64	.92
	p	.00	.00	.00	.00	.00	.00	.00	.00	.00	.99	.00	.	.00	.00
	N	188	96	179	189	142	147	180	189	189	187	189	189	172	172
Wealth/adult Credit Suisse	r	.60	.60	.21	.77	.81	.77	.63	-.31	.48	-.14	.73	.64	1	.77
	p	.00	.00	.01	.00	.00	.00	.00	.00	.00	.07	.00	.00	.	.00
	N	174	95	169	174	138	142	170	174	174	172	172	172	174	174
Wealth/adult CS log	r	.75	.69	.24	.84	.86	.87	.71	-.61	.56	-.05	.75	.92	.77	1
	p	.00	.00	.00	.00	.00	.00	.00	.00	.00	.49	.00	.00	.00	.
	N	174	95	169	174	138	142	170	174	174	172	172	172	174	174

Table 2: Correlations between cognitive ability measures and the other variables in a same country sample

		Competence leaders	Gov. effectiveness	Innovation	Competitiveness	Economic freedom	Sub-Sahara Africa	Absolute latitude	Resource rents	GDP Penn	GDP Penn log	Wealth Credit Suisse	Wealth CS log
Cognitive ability mean	r	.13	.65	.79	.65	.41	-.44	.62	-.37	.38	.63	.58	.66
	p	.23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Top (95%) ability level	r	.15	.69	.81	.67	.47	-.37	.60	-.36	.44	.69	.60	.68
	p	.17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Notes: *N*=88.

Table 3: Prediction of wealth (logarithm, regression analysis)

Predictor	**Standardized regression coefficient (β)**	**Predictor scale**	**Unstandardized effect for wealth in monetary units** (only direct effects, not indirect; in current US dollar)
Top (95%) ability level	.07	IQ, from (empirically) around 77 to 126, *M*=108.42, *SD*=10.31	+ 1 IQ point → + $ 777
Government effectiveness	.48	World Bank scale, from (empirically) around –2.50 to +2.50, *M*=0.54, *SD*=0.88	+ 1 WB scale point → + $ 60.836
Innovation	.10	WIPO scale, from (empirically) around 19 to 67, *M*=42.60, *SD*=10.38	+ 1 WIPO scale point → + $ 1.012
Competitiveness	.24	WEF scale, from (empirically) around 2.60 to 5.80, *M*=4.47, *SD*=0.57	+ 1 WEF scale point → + $ 45.734
Economic freedom	.08	Fraser scale, from (empirically) around 1.50 to 9.20, *M*=7.06, *SD*=0.77	+ 1 Fraser scale point → + $ 11.507

Notes: The five most relevant predictors used, *N*=91 (listwise deletion); means (*M*) and standard deviations (*SD*) of our 91 country sample, minima and maxima from data samples of the variables covering more countries; economic freedom is based on Fraser and Heritage, the Heritage data were adapted to the Fraser scale.

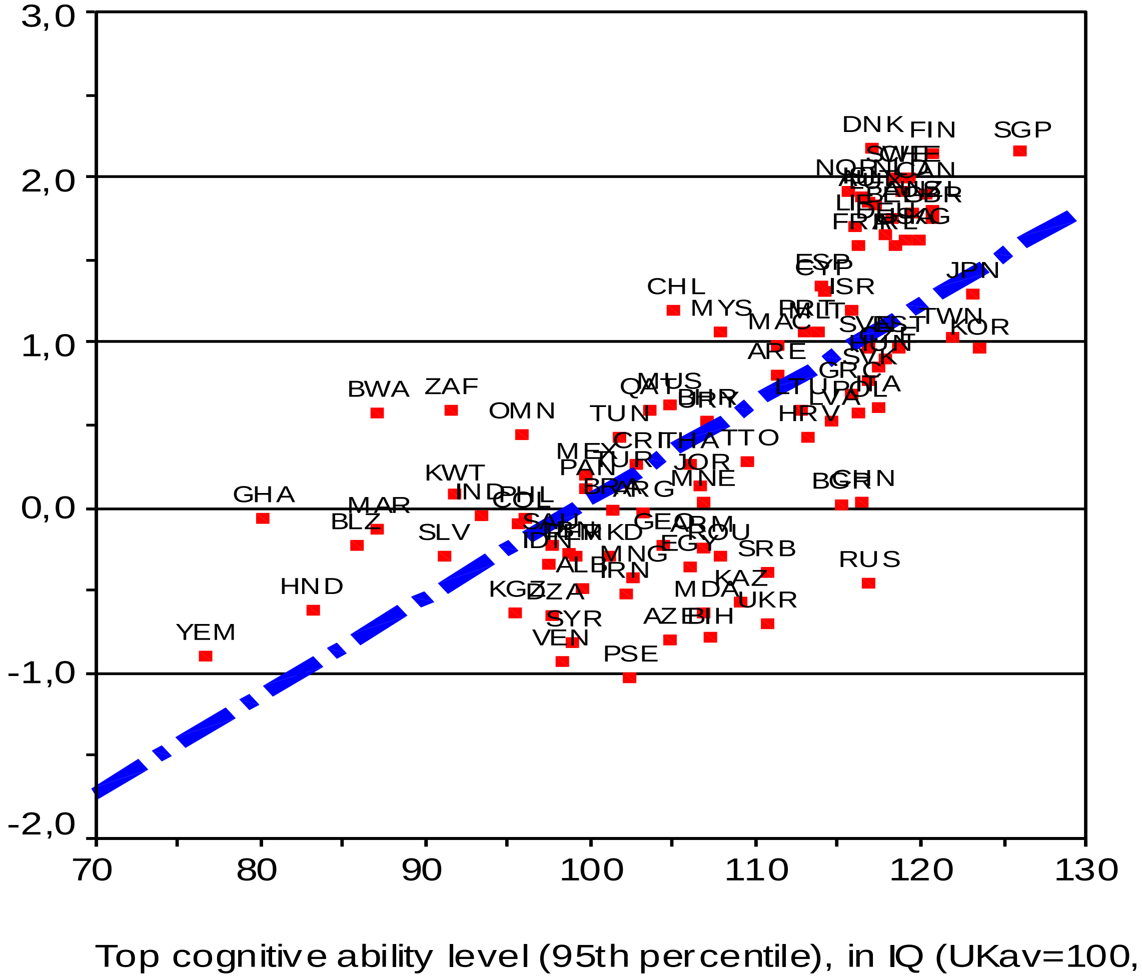

Figure 1: Scatterplot between top cognitive ability level (intellectual classes) and government effectiveness, United Kingdom average (UKav/mean, not 95th percentile) is set at IQ 100, countries indicated by country code (ISO 3166-1 alpha-3 code), *N*=98 nations

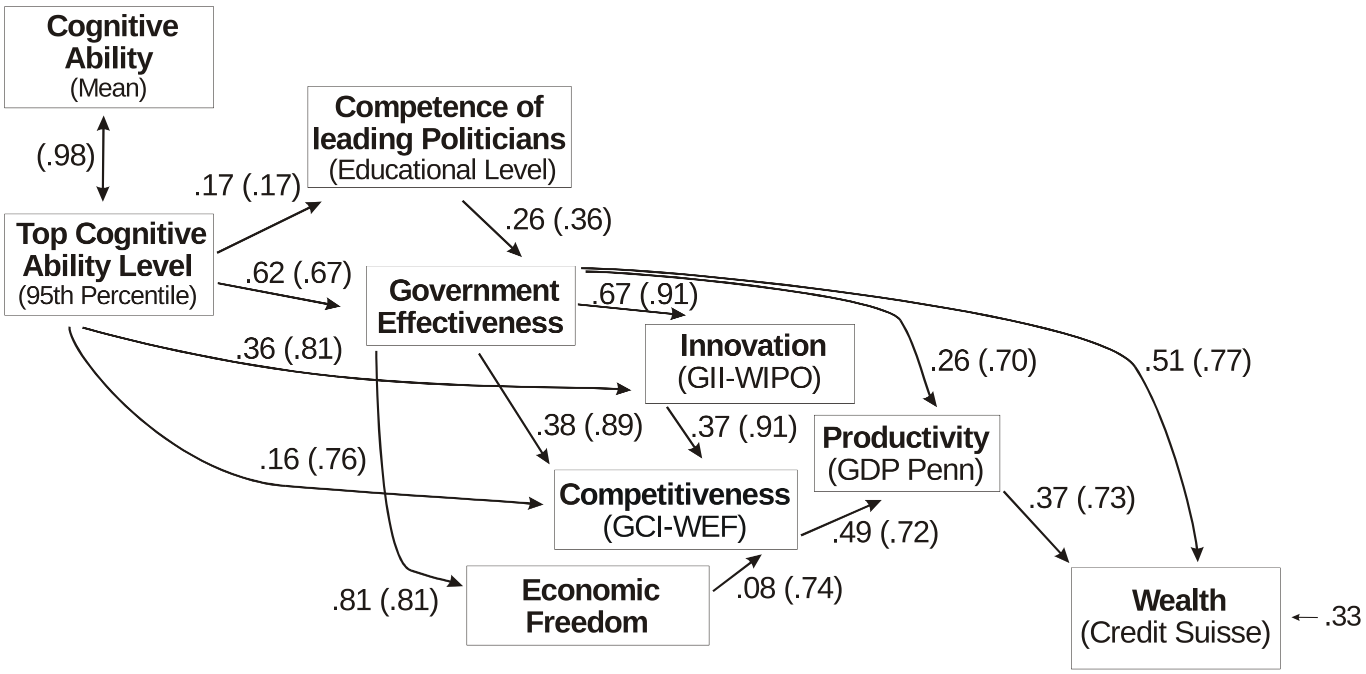

Figure 2: Path analysis for cognitive ability, institutional and economic variables and wealth in monetary units, standardized path coefficients (and correlations in parentheses, FIML, error term as unexplained variance, CFI=.98, SRMR=.03), *N*=201 nations

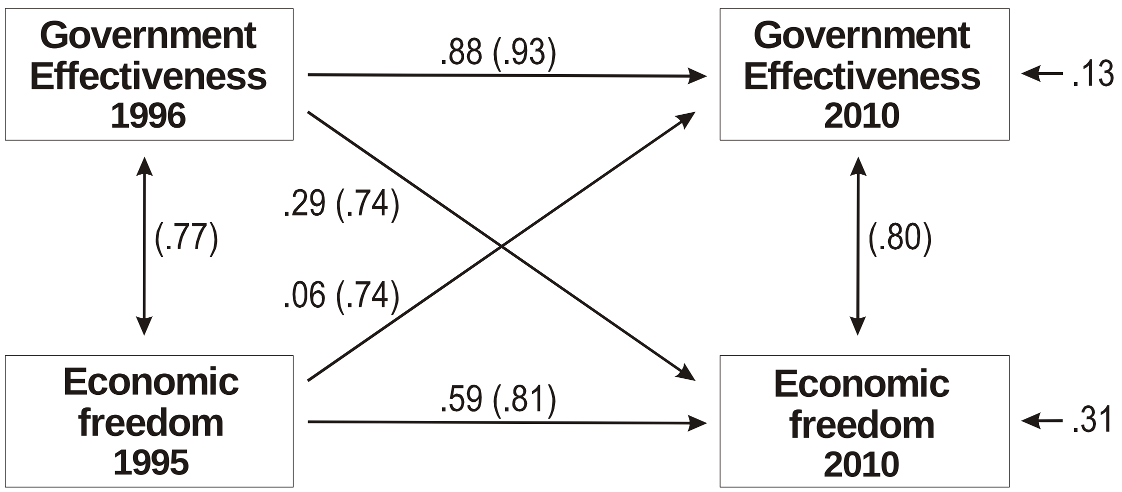

Figure 3: Analysis of cross-lagged effects between government effectiveness and economic freedom in a 15 year interval (standardized path coefficients, correlations in parentheses, CFI=1.00, SRMR=.00), *N*=135 nations

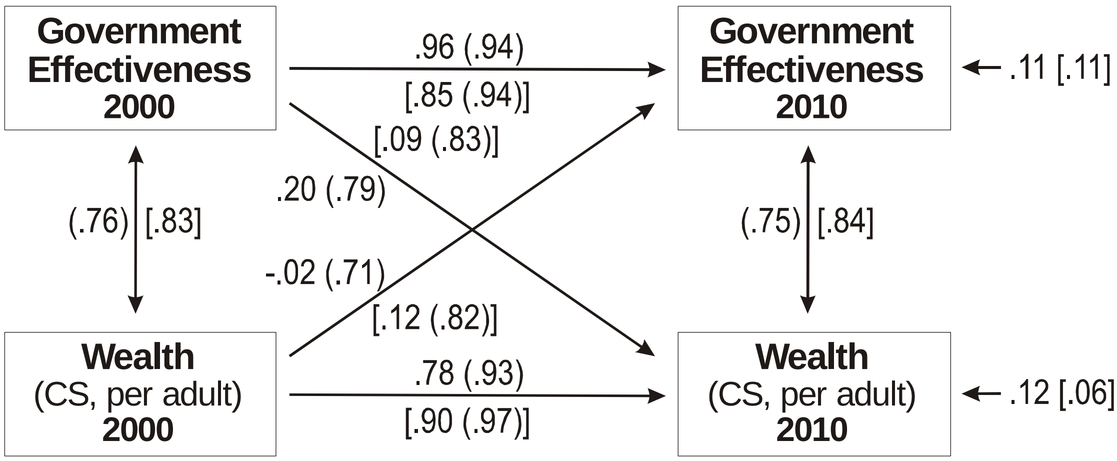

Figure 4: Analysis of cross-lagged effects between government effectiveness and wealth in a 10 year interval (standardized path coefficients, correlations in parentheses, CFI=1.00, SRMR=.00, in brackets [ ] results for wealth logarithm), *N*=173 nations

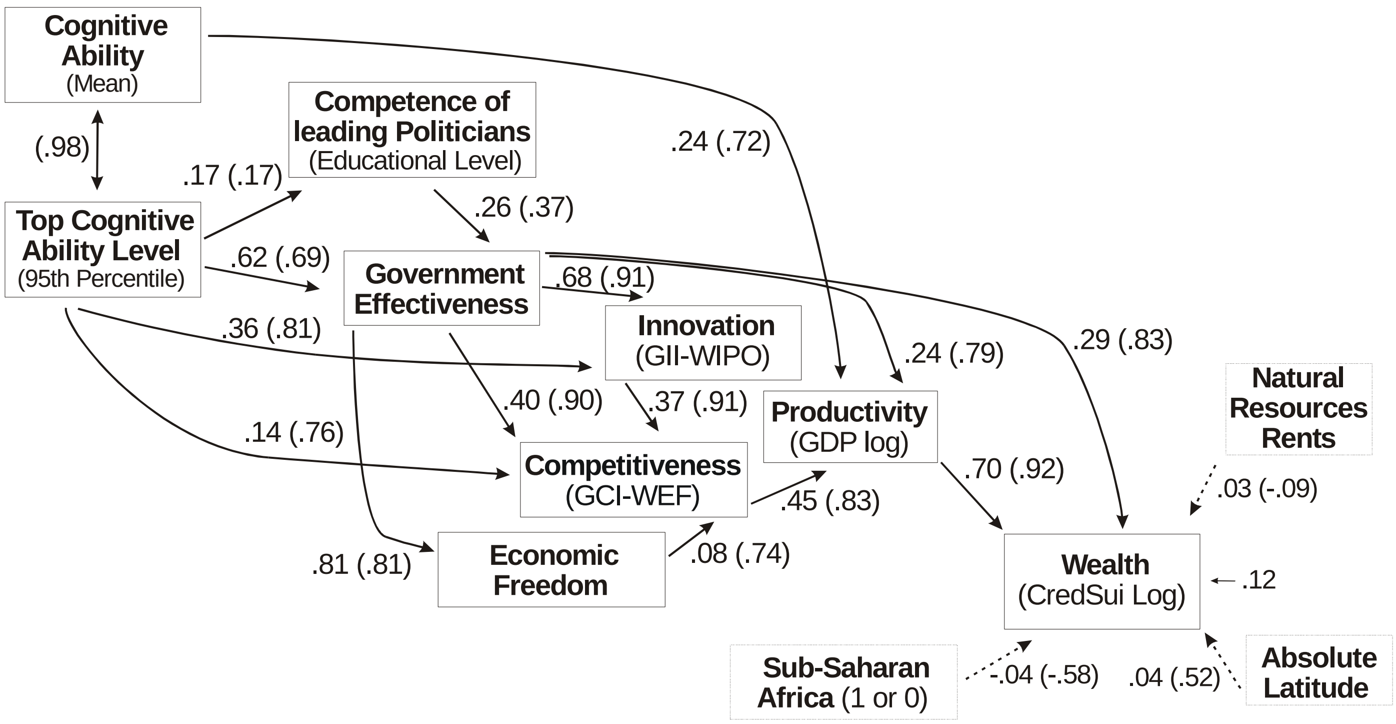

Figure 5: Path analysis for cognitive ability, institutional and economic variables and wealth (logarithm), with direct path of average cognitive ability on log GDP (standardized path coefficients, correlations in parentheses, FIML, error term as unexplained variance, CFI=.98, SRMR=.03), *N*=201 nations