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The Effect of Intelligence on Financial Development: A Cross-Country Comparison

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The Effect of Intelligence on Financial Development: A Cross-Country Comparison

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Abstract

We assess the correlations between intelligence and financial development in 123 countries using data averages from 2000-2010. Human capital is measured in terms of IQ, cognitive ability & cognitive skills, while financial development is appreciated both from financial intermediary and stock market development perspectives. Short-term financial measures are private and domestic credits whereas long-term financial indicators include: stock market capitalization, stock market value traded and turnover ratio. The following findings are established. (1) With respect to private credit, the positive correlations of IQ and cognitive ability are broadly similar while that of cognitive skills is substantially higher in terms of magnitude. (2) The correlation between intelligence and other financial variables are broadly similar. (3) The underlying findings are broadly confirmed in terms of sign of correlation, though the magnitude of correlation is higher (lower) with the addition of social capital or ethnic fractionalization (institutions or income). (4) When continents are excluded to control for extreme effects, baseline results are confirmed and the following on order of continental importance in financial development is established in increasing magnitude: Africa, Americas, Oceania, Europe & Asia.

JEL Code: E01, G20 I20, I29

Keywords: Financial development, Intelligence, Skill, Human Capital

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1. Introduction

Financial development remains fundamental to economic growth. Despite some country-specific (Muchai, 2013) doubts, recent meta-studies have confirmed this mainstream narrative (Asongu, 2015a). The findings are consistent with perspectives of, inter alia: policy evidence (Chapili, 2013; Asongu, 2014a), financial markets (Agbloyor et al., 2015) and nexuses among saving & exports for long-run economic growth (Wang et al., 2012).

While the relationship between finance and growth has been substantially investigated, as far as we know, literature on the finance-KE (Knowledge Economy) nexus is scarce. Given the abundantly documented role of finance in economic growth, investigating the relationship between KE and finance is important since financial intermediation is indispensable for converting saving into long-term investment opportunities.

The nexus between financial development and human capital has not been the object of substantial research focus in theoretical and empirical literature. Arguments can be made to justify the relationship between the two variables. An important human capital enables access to better information, hence, a potential risk mitigating factor (Outrivelle 1999). Human capital is also positively related to savings (Kelly 1980; De Gregorio, 1992; Bernheim et al., 1997). This could be explained by the fact that developed intelligence is associated with long-term horizon planning (Potrafke, 2012). It is within this framework that Jones and Podemska (2010) have established a link between Intellectual Quotient (IQ) and savings (Podemska, 2010).

According to Ukenna et al. (2010), skills and training can better predict human capital (HC) because they affect growth rapidly. Human capital in the financial sector in forms of competent or skilled banking professionals could contribute to enhancing the stability of banks. Evidence on complementarity between HC and financial development is provided by Evans et al. (2002) who have concluded that the former is a crucial component in manpower

development (or human resources) in the growth process. From a microeconomic study viewpoint, education has been established to be an essential component of village bank success in Thailand (Paulson, 2002).

The impact of traditional measurements (such as life expectancy, average schooling years in the primary, second & tertiary levels and life expectancy) have not resulted in a consensus due to issues in data measurement (De la Fuente & Doménech, 2006; Cohen & Soto, 2007). The marginal/negligible role played by output in these indicators of human capital has been criticized by Weede & Kämpf (2002) because of too much reliance on inputs. The criticism has motivated some authors to use evaluation tests of international standard, notably: the Program of International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) (Hanushek and Kimko, 2000; Hanushek & Woessmann, 2008, 2009).

Another current of the literature involving psychologists and Vanhanen (2001, 2002, 2006) has used Intellectual Quotient (IQ) data compiled from many countries. The data which has been employed in many published studies (Lynn & Vanhanen, 2012) is increasingly being used by a growing stream of economists, notably: Weede & Kämpf (2002), Jones & Schneider (2006), Ram (2007), Potrafke (2012), Kodila-Tedika & Kanyama-Kalonda (2014), Kodila-Tedika (2014), Rindermann et al. (2014), Kodila-Tedika & Mustacu (2014) and Kodila-Tedika & Bolito-Losembe (2014). The current data from Lynn, Hanushek & Vanhanen which is increasingly being improved has recently been updated by Rindermann (2007ab) and Meisenberg & Lynn (2011). The updated data which we use in the present study has been recently employed by Kanyama-Kalonda (2014) and Meisenberg & Lynn, (2012).

By investigating the relationship between intelligence and financial development, the study contributes to existing literature by steering clear of the current finance-KE studies and introducing an intelligence component into the nexus. Moreover, it extends the finance-KE

literature that has been essentially focused on the African continent to a broad sample of 123 countries. In essence, a close relationship between KE and finance has been confirmed by Asongu (2014b), especially with the instrumentality of Intellectual Property Rights (IPRs) (Asongu, 2013a)². Given the apparent linkage between IPRs, KE and IQ, it would be interesting to extend the existing literature by investigating the role of IQ in financial development.

The rest of the study is organised as follows. Section 2 discusses the data and methodology. The empirical analysis and discussion of results are covered in Section 3. Robustness checks are presented in Section 4. We conclude with Section 5.

2. Empirical strategies and data

2.1 Data

The study investigates cross-sectional average data between 2000-2010 from 123 countries. The intelligence data sources from Meisenberg & Lynn (2011). This is an update of previous versions found in Lynn & Vanhanen (2002, 2006). This dataset compiles hundreds of national IQ test averages during the 20th and 21st centuries using the best methods of practice. Average IQ measures both the nation's labor quality and general-purpose human capital (Jones & Schneider, 2006; Hanushek & Kimko, 2000).

The recent dataset has the appeal of including more nations as well as a composite indicator of intelligence in human capital form.

Three indicators of intelligence are taken into account: the measurement of IQ from Lynn & Vanhanen: an indicator for which missing values are completed with school achievement and a measure of human capital that is a composite indicator for school

² The interested reader can find more literature on KE and financial sector competition in Asongu (2014c, 2015b).

achievement and IQ. However, given that the measurement of the first is a sub-set of the second, we restrict the analysis exclusively to the second and third measures.

The dependent variables consist of proxies in financial intermediary or short-run financial development and stock market development or long-term financial development. The former is measured by private sector credit and domestic credit which are proxies of financial activity (Asongu, 2013b). It is important to note that domestic credit comprises of credit from both private and public sectors. The latter or stock market variable includes: stock market capitalization, stock market value traded and stock market turnover ratio. These variables from Ang & Kumar (2014) are consistent with the underlying stock market performance/development literature (Asongu, 2012, 2013c).

The control variables include: credit rights, trade openness, financial openness, interactions between trade openness and financial openness, legal origins (British, French, German & Scandinavian), religions (Catholic, Muslim & Protestants), latitude and tropics. These variables which are from Ang & Kumar (2014) are defined in the appendix alongside information on their corresponding sources. We discuss the expected signs concurrently with the estimations in the results sections.

2.1. Empirical specification

Consistent with Ang & Kumar (2014), the specification in Eq. (1) below investigates the effect of intelligence or Human capital (HC) on financial development (FD) across 123 countries.

$$FD_i = \alpha_1 + \alpha_2 HC_i + \alpha_3 X_i + \varepsilon_i \quad (1)$$

Where: FD_i (HC_i) represents a financial development (human capital) indicator for country i α_1 is a constant, X is the vector of control variables, and ε_i the error term. FD includes:

private credit, domestic credit, stock market capitalisation, stock market value traded and stock market turnover ratio. HC are indicators of human capital discussed in the preceding section while X embodies creditor rights protection, financial openness, trade openness, legal origins, latitude and tropics.

Like in Ang & Kumar (2014), our main interest is to investigate if the HC coefficient is statistically and economically significant. While Eq. (1) is estimated using Ordinary Least Squares (OLS) using heteroscedasticity consistent standard errors, potential issues of endogeneity would be addressed with an instrumental variable (IV) estimation technique which we describe in subsequent sections. In line with Ang & Kumar (2014), we employ private sector credit in baseline regressions and use domestic credit and three stock market performance dynamics for robustness checks.

3. Estimation results

Table 1 below shows results of baseline regressions in Eq. (1). The first Column which shows univariate regressions confirms the expected positive correlation between intelligence and financial development. Hence intelligence is positively correlated with private sector credit. Columns 2 to Column 7 assess the relationship conditional on other covariates (control variables). The order of specification is consistent with Ang & Kumar (2014). From the results, the positive correlation is broadly confirmed across specifications in significance and magnitude of estimated human capital (or intelligence) coefficient. Accordingly, the estimated coefficients vary between 0.026 and 0.029 and the degree of adjustment (or explanatory power) of estimated coefficients also varies between 42.1% and 60.4%. It is logical to expect an increasing R^2 with more control variables into the specifications. Hence, we could infer from the baseline estimations that countries with high IQ are associated with higher degrees of financial development.

Most of the significant control variables have the expected signs. (1) Creditor rights protection has been associated with higher levels of financial development (La Porta et al., 1998). (2) Financial openness is intuitively expected to be positively linked with more availability of private credit because it offers possibilities of external financial flows. However, too much trade openness may interact with financial openness to negatively affect private domestic credit. The threshold value of the modifying variable (trade openness) which is 2.96 (0.089/0.030) is within range of 0.205 to 3.729 (Ang & Kumar, 2014, p. 54). This conclusion is broadly consistent with recent literature on the need for financial initial conditions for the benefits of openness (Asongu, 2014d). (3) Countries of British legal origin have been documented to have an edge over their French civil law counterparts (La Porta et al., 2008; Asongu, 2012b). (4) The predominantly Protestant British culture also played a substantial role in London's emergence as the financial centre of the world (Rosenberg & Birdzell, 1986)

Table 1. OLS estimates of the impact of intelligence on financial development

	1	2	3	4	5	6	7
Intelligence	0.028*** (0.003)	0.027*** (0.003)	0.027*** (0.003)	0.029*** (0.003)	0.026*** (0.004)	0.027*** (0.003)	0.027*** (0.005)
Creditor Rights		0.061** (0.026)					0.031 (0.024)
Trade Openness			0.068 (0.090)				-0.001 (0.111)
Financial Openness			0.089** (0.035)				0.105** (0.043)
Trade Openness x Financial Openness			-0.030* (0.017)				-0.027 (0.023)
British Legal Origin				-0.109 (0.220)			0.271** (0.133)
French Legal Origin				-0.362* (0.215)			0.108 (0.110)
German Legal Origin				-0.400* (0.226)			(dropped)
Scandinavian Legal Origin				(dropped)			0.045

							(0.279)
Latitude				0.248			-0.168
				(0.248)			(0.279)
Tropics				0.023			-0.149
				(0.076)			(0.111)
Fraction Catholic						0.095	0.143
						(0.114)	(0.119)
Fraction Muslim						-0.004	-0.015
						(0.099)	(0.119)
Fraction Protestants						0.521***	0.454*
						(0.195)	(0.261)
_cons	-1.876***	-1.864***	-1.987***	-1.634***	-1.757***	-1.868***	-0.112***
	(0.212)	(0.212)	(0.232)	(0.362)	(0.265)	(0.223)	(0.401)
Number of observations	168	168	160	167	155	166	147
R2	0.421	0.438	0.496	0.498	0.419	0.473	0.604

note: .01 - ***, .05 - **, .1 - *;

Notes: The dependent variable is private credit to GDP, averaged over the period 2000–2010. Figures in parentheses are robust standard errors.

Dropped: Not involved in the specifications due to issues of multicollinearity and overparameterization.

4. Robustness checks

In Section 4, several robustness checks are performed on the baseline specification in Column 7 of Table 1. In the checks, alternative financial development measurements are used with different indicators of human capital. Concretely, the robustness checks entail: the use of alternative measurements of cognitive human capital (cognitive ability and cognitive skills) in Section 4.1; alternative indicators of financial development (domestic credit and three stock market performance dynamics) in Section 4.2; controlling for other effects (Section 4.3) and exclusion of continents (Section 4.4).

4.1 Alternatives measures of cognitive human capital

Cognitive human capital has been measured in different ways in the human capital literature. As discussed in the data section, the current measurement has experienced an evolution. While that of Rindermann (2007b) proposed a measurement of *cognitive ability*, Hanushek & Woessmann (2009) have suggested an appreciation of *cognitive skills*. We exploit these

indicators to confirm the baseline findings in Table 1. The results broadly confirm the baseline findings on a positive correlation between cognitive human capital and financial development. It is also interesting to note that the variable from Rindermann (2007b) produces findings that are more consistent with those in Table 1. On the other hand, though with a lower level of significance, that of Hanushek & Woessmann (2009) substantially deviates in terms of magnitude. Two inferences are established. (1) *Cognitive ability* is more closely related to IQ in the appreciation of the correlation between human capital and financial development. (2) *Cognitive skills* potentially drive more financial development than *cognitive ability*.

Table 2. Alternatives measures of cognitive human capital

	(1)	(2)
Cognitive Ability	0.020*** (0.003)	
Cognitive skill		0.384** (0.185)
_cons	-1.343*** (0.308)	-0.806 (0.809)
Number of observations	149	70
R2	0.601	0.511

note: .01 - ***; .05 - **; .1 - *;

A constant and all control variables (i.e., creditor rights, trade openness, financial openness, trade openness x financial openness, legal origins dummies, geographic variables and religion variables) used in Tables 1 are included in the estimations but the results are not reported to conserve space. Figures in parentheses are robust standard errors.

4.2 Alternative indicators of financial development

In Table 3 below, we employ the alternative measurements of financial development discussed in the model specification section for further robustness purposes. These include: one measurement of financial intermediary development and three indicators of stock market performance. The resulting findings confirm the direction of the underlying correlation and further reveal that irrespective of the measurement of financial development employed, the

sensitivity of intelligence is almost the same. This is essentially because magnitudes of the estimated coefficients are broadly consistent across specifications.

Table 3. Alternative measures of financial development

	Domestic credit/GDP	Stock market capitalization/GDP	Stock market value traded /GDP	Stock market turnover ratio
Intelligence	0.029*** (0.006)	0.027*** (0.007)	0.034*** (0.007)	0.029*** (0.008)
_cons	-2.148*** (0.511)	-2.007*** (0.683)	-2.904*** (0.910)	-2.485*** (0.825)
Number of observations	147	112	110	109
R2	0.518	0.417	0.539	0.431

note: .01 - ***, .05 - **, .1 *;

A constant and all control variables (i.e., creditor rights, trade openness, financial openness, trade openness x financial openness, legal origins dummies, geographic variables and religion variables) used in Tables 1 are included in the estimations but the results are not reported to conserve space. Figures in parentheses are robust standard errors.

4.3. Controlling for other effects

In Table 4 below, we control for other effects to confirm the baseline findings. Notably, we add dimensions of: social capital, institutions, ethnic fragmentation, income and continents. The definitions of these variables and their corresponding sources are provided in the Appendix. In broad terms, these additional variables can be considered as controlling for the failure to take into account the unobserved heterogeneity in baseline regressions.

We provide some justifications for the choice of additional control variables. Guiso et al. (2004) accord social capital some major role in financial development. The role of institutions has been investigated by many authors, inter alia: Girma & Shortland (2008). Ethnic diversity has been documented to substantially impair financial development (Easterly & Levine, 2003; Beck et al., 2003). The wealth of nations also fundamentally influences the level of financial development (Robinson, 1952; Ang & Kumar, 2014). Last, continent

specificities are also considered based on the intuition that some continents are less developed financially.

The underlying findings are broadly confirmed in terms of sign of correlation, though the magnitude of correlation is higher (lower) with the addition of social capital or ethnic fractionalization (institutions or income).

Most of the significant control variables have the expected signs. Accordingly, social capital, institutions and income-levels are positively correlated with private credit. This is consistent with the underpinnings from Guiso et al. (2004), Girma & Shortland (2008) and Ang & Kumar (2014) respectively.

Table 4. Controlling for other effects

	Private credit/GDP				
	Add Social Capital	Add Institutions	Add Ethnic Fractionalization	Add Income	Add Continents
Intelligence	0.030*** (0.005)	0.016*** (0.004)	0.026*** (0.005)	0.018*** (0.006)	0.029*** (0.006)
Social Capital	0.715** (0.312)				
Institutions		0.065*** (0.010)			
Ethnic Fractionalization			-0.194 (0.159)		
Income				0.107** (0.045)	
Europe					0.013 (0.189)
Asia					-0.040 (0.089)
Americas					-0.070 (0.129)
Oceania					-0.128 (0.197)
_cons	-2.403*** (0.452)	-1.220*** (0.382)	-1.866*** (0.486)	-2.072*** (0.413)	-2.218*** (0.583)
Number of observations	105	147	146	146	147
R2	0.649	0.681	0.608	0.627	0.607

note: .01 - ***, .05 - **, .1 - *;

A constant and all control variables (i.e., creditor rights, trade openness, financial openness, trade openness x financial openness, legal origins dummies, geographic variables and religion variables) used in Tables 1 are

included in the estimations but the results are not reported to conserve space. Figures in parentheses are robust standard errors.

4.4. Exclusion of continents

Table 5 below presents a further robustness check in which we exclude continents. The interest is to assess the behaviour of the variables of interest when a continent is excluded from the sample. This is also a means of controlling for extreme values that could influence the baseline findings. The relatively lower correlation coefficient observed when continents are excluded implies the excluded continent has a higher level of financial development. In the same line of intuition, a relatively higher correlation coefficient upon the exclusion of a continent means the excluded continent has a lower level of financial development. In addition to the baseline findings being confirmed in terms of magnitude of and significance in the correlation coefficients, the following is the order of continental importance in financial development in increasing magnitude: Africa, Americas, Oceania, Europe & Asia.

Table 5. Exclusion of continents

	Exclusion Europe	Exclusion Africa	Exclusion Oceania	Exclusion Americas	Exclusion Asia
Intelligence	0.025*** (0.005)	0.031*** (0.008)	0.028*** (0.005)	0.030*** (0.005)	0.021*** (0.006)
_cons	-1.684*** (0.511)	-2.489*** (0.783)	-2.143*** (0.418)	-1.908*** (0.398)	-1.991*** (0.475)
Number of observations	109	100	145	123	111
R2	0.511	0.631	0.594	0.630	0.668

note: .01 - ***; .05 - **; .1 - *;

A constant and all control variables (i.e., creditor rights, trade openness, financial openness, trade openness x financial openness, legal origins dummies, geographic variables and religion variables) used in Tables 1 are included in the estimations but the results are not reported to conserve space. Figures in parentheses are robust standard errors.

5. Concluding implications

The purpose of this study has been to assess the relationship between intelligence and financial development in 123 countries using cross-sectional data between 2001-2010. Our findings broadly contradict the perspective that human development can be enhanced only at the expense of financial development. Accordingly, the view of a trade-off substantially misstates the fundamental purpose of human development and at the same time underestimates the return to education, especially if it is construed as resulting in more risk-taking.

Human capital is measured in terms of IQ, cognitive ability & cognitive skills, while financial development is appreciated both from financial intermediary and stock market development perspectives. Short-term financial measures are private and domestic credits whereas long-term financial indicators include: stock market capitalization, stock market value traded and turnover ratio. The following findings have been established. (1) With respect to private credit, the positive correlations of IQ and cognitive ability are broadly similar while that of cognitive skills is substantially higher in terms of magnitude. (2) The correlation between intelligence and other financial variables are broadly similar. (3) The underlying findings are broadly confirmed in terms of sign of correlation, though the magnitude of correlation is higher (lower) with the addition of social capital or ethnic fractionalization (institutions or income). (4) When continents are excluded to control for extreme effects, baseline results are confirmed and the following on order of continental importance in financial development is established in increasing magnitude: Africa, Americas, Oceania, Europe & Asia.

The findings have strong implications for countries in Sub-Saharan Africa where low literacy rate influences people to hold wealth in physical assets as opposed to financial assets, hence, marring financial development. Moreover, as sustained by Hakeem & Oluitan (2012),

high literacy may push citizens to engage in financial transactions among themselves without the intermediary of the formal financial system. Therefore, high education is needed for stock market development. In the same vein, education also increases banking patronage.

It is also important to note that the type of education matter and financial development project also matters. For instance, many analysts think the Douala Stock Exchange of Cameroon has not picked-up well since its launch because the business community was not properly informed/educated of the benefits of financial markets before it was launched. Hence the stock market has failed to affect economic growth (Ake & Ognaligui, 2010).

The above evidence is not definitive, fundamentally because it points to the associations between indicators of human capital and financial development, which are not causalities but correlations. Hence, assessing the causal nexuses with data endowed with more degrees of freedom is an interesting future research direction.

Appendix

Appendix A. Data sources and summary statistics of variables

Table A1
Definitions and Sources of variables.

Variables	Definition	Source
Privatecredit	“Value of financial intermediaries credits to the private sector as a share of GDP (excludes credit to the public sector and credit issued by central and development banks), average over 2000–2010”	World Bank WDI online database; Beck et al. (2010)
Domesticcredit	“Comprised of private credit as well as credit to the public sector (central and local governments and public enterprise) as a share of GDP, average over 2000–2010”	World Bank WDI online database; Beck et al. (2010)
Stock marketcapitalization	“Value of listed companies shares on domestic exchanges as a share of GDP, average over 2000–2010”	World Bank WDI online database; Beck et al. (2010)
Total value of stock market Trade	“Total value of domestic shares traded (on domestic exchanges) during the period as a share of GDP, average over 2000–2010 »	World Bank WDI online database; Beck et al. (2010)
Stock market turnover ratio	“Ratio of trades in domestic shares divided by market capitalization, average over 2000–2010”	World Bank WDI online database; Beck et al. (2010)
Creditorrights	“An index of the protection of creditor rights in 2000. It reflects the ease with which creditors can secure assets in the event of bankruptcy. It takes on discrete values of 0 (weak creditor rights) to 4 (strong creditor rights)”	Djankov et al. (2007)
Trade openness	“Sum of exports and imports of goods and services as a share of GDP in 2000”	World Bank WDI online Database
Financial openness	“Sum of gross stock of foreign assets and liabilities as a share of GDP in 2000”	Lane et al. (2007)
LegalOrigins	“Dummy variable that takes a value of one if a country’s legal system is of French, German or Scandinavian Civil Law origin and zero otherwise”	La Porta et al. (2008)
Latitude	“Absolute value of the latitude of a country, scaled between zero and one, where zero is for the location of the equator and one is for the poles”	La Porta et al. (1999)
Tropics	“The percentage of land area classified as tropical and subtropical based on the Koeppen-Geiger system”	Gallup et al. (1999)
Religion variables	“A set of three variables that identifies the percentage of a country’s population in the 1980s that follows Catholic, Muslim and Other religion”	La Porta et al. (1999)
EthnicFractionalization	“An index of ethnic fractionalization, constructed as one minus the Herfindahl index of the share of the largest ethnic groups. It reflects the probability that two individuals, selected at random from a country’s population, will belong to different ethnic groups. The index ranges from 0 to 1 where the higher the value the greater the fractionalization in a country”	Alesina et al. (2003)
InstitutionalQuality	“An overall indicator of institutional quality measured as the sum of the six sub-indices for 2000 from World Bank Governance Indicators (WBGI): voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Countries with higher values on this index have institutions of greater quality”	Kaufmann et al. (2010)
Social Capital	“Data on trust between individuals in a given country. Measured by taking the percentage of a population that	Bjørnskov (2008)

answers 'Yes' to the World Value Survey (WVS) question 'In general, do you think that most people can be trusted?', supplemented by data from the Danish Social Capital Project, the Latinobarometro and the Afrobarometer"

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