IS THERE A RELATIONSHIP BETWEEN NATIONAL COMPETITIVENESS AND PERFORMANCE IN EDUCATION IN AFRICAN COUNTRIES?

BY

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ABSTRACT

The World Economic Forum has been producing Global Competitiveness Index for several decades. The focus of this study was on the 2019 Global Competitiveness Index (GCI) report. The indicators in the 2019 GCI report were "organized into 12 'pillars'. These pillars are regarded as drivers or determinants of competitiveness, thus implies that each of the 12 pillars is statistically significantly associated with competitiveness. Focusing on pillar 6 that has education performance indicators, this study examined the relationship between national competitiveness scores and performance in some education indicators in African countries. The data for this study consisted of the overall competitiveness scores for African countries contained in the 20129 GCI report as well as quantity and quality of education performance indicators obtained from UNESCO and the World Bank. Some issues were noted in the methodology of the 2019 GCI report. The results indicate that though the bi-variate analysis indicated that each of the education performance indicators was correlated with overall competitiveness scores in African countries in 2019, controlling for other education performance indicators, none of the education indicators was statistically significant. A major weakness in this study was the small sample size.

INTRODUCTION

This study was motivated by a discussion between a colleague and myself on the 2019 Global Competitiveness Index report. The 2019 Global Competitiveness report (GCI) defined national competitiveness as "the set of institutions, policies and factors that determine the level of productivity". The competitiveness index is "the product of an aggregation of 103 individual indicators, derived from a combination of data from international organisations as well as from the World Economic Forum's Executive Opinion Survey" (Schwab 2019). The indicators in the GCI report were "organized into 12 'pillars': Institutions; Infrastructure; ICT adoption; Macroeconomic stability; Health;

Skills; Product market; Labour market; Financial system; Market size; Business dynamism; and Innovation capability". The overall GCI ranged between 0-100. The closer to 100, the higher a country's competitiveness.

The 2019 GCI Methodology

According to Schwab (2019) the GCI is based on successive aggregations of scores from the most disaggregated level (indicator level) to the highest level (overall GCI score). Each aggregated measure is computed by taking the average of the scores of its components. The overall GCI 4.0 score is the average of the scores of the 12 pillars. For individual indicators, prior to aggregation, raw values are transformed into a progress score ranging from 0 to 100, with 100 being the ideal state. Each of the pillars is assigned a weight of 8.3%. Missing and outdated values were imputed. To allow the aggregation of indicators of different nature and magnitude, each indicator entering the GCI is converted into a unit-less score, called "progress score", ranging from 0 to 100 using a min-max transformation. Formally, each indicator is re-scaled according to the following formula:

$$Score_{i,c} = [(Value_{i,c} - Wp_i)/(Frontier_i - Wp_i)] \times 100$$

where $Value_{i,c}$ is the "raw" value of country c for indicator *i*, worst performance (Wp_i) is the lowest acceptable value for indicator *i* and $Frontier_i$ corresponds to the best possible outcome (Schwab (2019).

Some Issues Arising from the 2019 GCI Methodology

Definition of Competitiveness: The definition of competitiveness provided in the 2019 GCI report is more of an explanation rather than an operational definition of a concept. An operational definition of a key concept in research should include how the concept would be measured. The definition of competitiveness provided in the 2019 GCI report equates competitiveness with level of productivity, thus national competitiveness remains an abstract and illusive concept in the absence of specifying measuring criteria in the definition.

Assignment of equal weight of 8.3% to each of the 12 pillars: Two issues need to be noted from a statistical perspective. Firstly, is the quality of the data from which each of the 12 pillars was derived.

Assigning equal weights to each of the 12 pillars assumed that the data used to calculate each pillar were of the same quality. It is inconceivable that the quality of the data underlying each of the 12 pillars was the same across all pillars and countries. Secondly, assigning equal weight to each of the 12 pillars assumed that the 12 pillars drive competitiveness equally. It is doubtful that it is the case. In my view, the assignment of weights should have taken into consideration differential quality of the data across pillars. For example, the quality of the data on ICT adoption may not be the same as the quality of the data on innovation capability. Thus, it would have been more appropriate to design relative weights in accordance with the quality of the data on each of the 12 pillars. Furthermore, they should have designed proportional weights for each of the 12 pillars in accordance with their relative contribution as drivers of competitiveness. These two elements should then have been combined to design overall weight for each pillar which still sum up to 100 for all the pillars.

International data bases as source of data: The use of international data bases is both inevitable and practical in this type of study. However, it should be noted that international data bases rely on participating countries to provide the necessary data. While each country may adhere to international standards in the collection of such data, the quality control in the implementation of such standards could not have been the same across all countries, thus some of the differences between countries in competitiveness scores may partly reflect differences in the quality of data underlying the computation of the indicators in the pillars.

Imputing missing and outdated values: This is a common practice among some researchers. Aside logical imputation (for example, if sex was not provided by the respondent in a questionnaire but the respondent provided information about children she has had, one may logically impute the respondent's sex as female), I view imputations (hot or cold deck) as manufacturing values that were not provided by the respondents during data collection.

The 2019 GCI report listed 12 pillars as drivers or determinants of competitiveness. Thus, implies that each of the 12 pillars is statistically significantly associated with competitiveness. But is this the case for African countries?

Objective of Study

It is not practicable to examine the relationship between national competitiveness and each of the 12 pillars and their components for African countries, the study therefore focused on one pillar – pillar

6 (education indicators) – because it is the pillar I am most familiar with though not an expert in education itself but worked in that sector for many years. The specific objective of this study therefore was to examine the relationship between national competitiveness scores and performance in some education indicators in African countries.

Definitions: The components of Pillar 6 in the 2019 GCI that were not based on opinion scores were defined in the report as follows. (1) *Mean years of schooling:* Average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades. (2) *School life expectancy:* Total number of years of schooling (primary through tertiary) that a child of school entrance age can expect to receive. (3) *Pupil-to-teacher ratio in primary education:* Average number of pupils per teacher, based on headcounts of both pupils and teachers.

DATA

The overall competitiveness scores for African countries were obtained from the 2019 GCI report. The non-opinion education indicators for African countries were obtained from external sources – UNESCO and the World Bank- for the year 2019 or closest year for which data were available. Note the weakness of using international data bases highlighted above. The analysis was confined to the 36 African countries for which overall competitiveness scores were available in the 2019 GCI report.

METHODS.

Conceptual Framework for the Analysis

If it is that national performance in education indicators is one of the drivers of national competitiveness scores, the relationship can by described quantitatively for each education indicator as

$Compscore = B_0 + B_{1Ei}$ ……(1).

Where *Compscore* is the overall competitiveness score B_0 is a constant and B_{1Ei} is the coefficient of change in an education indicator, *Ei* for a unit change in *Compscore* . For all the education indicators, the relationship may be expressed as

$Compscore = B_0 + B_{1E1} + B_{2E2} + B_{3E3} + \ldots\ldots B_{nEn}$ …….(2).

Where $_{E1\ldots\ldots En}$ are the levels of the education indicators. While equation (1) is a bi-variate regression, equation (2) is a multivariate regression. The inclusion of education indicators in equation (2) was based on the education indicators that had correlation coefficients > = 0.5 arising from fitting a regression line to the scatter plot of *Compscore* and each *Ei.*

Quantity and Quality of Education Performance

The literature is extensive in the measurement of performance in education and generally distinguish between quantity and quality. According to Hyon et al (2010), quantity indicators seek to gauge investment in the education sector and are closely related to the number of participants in education or institutions for learning. Citing Baird (1988) Hyon et al (2010) further observed that quality is an elusive concept partly because of the complexity of teaching and learning.

The indicators for quantity of education in this study comprised:

(1) Mean years of schooling,

(2) Percent of persons aged 20-29 who have completed upper secondary education. UNESCO defines upper secondary education as programmes at ISCED level 3 which are are typically designed to complete secondary education in preparation for tertiary education or provide skills relevant to employment, or both (international-standard-classification-of-education-isced-2011-en.pdf (unesco.org).

(3) Pupil-to-teacher ratio in primary education. School life expectancy was not considered in this study because the methodology of computation is not clear in the 2019 GCI report. The conventional approach in computing life expectancies is by life table methods.

The indicator of quality of education in this study comprised:

(1) Youth literacy rate as defined by UNESCO (percent of persons aged 15-24 that can read a simple sentence). The study had intended to include also international standardised test scores in education but only few African countries participate in these international standardised education tests, so this indicator was not included in the analysis.

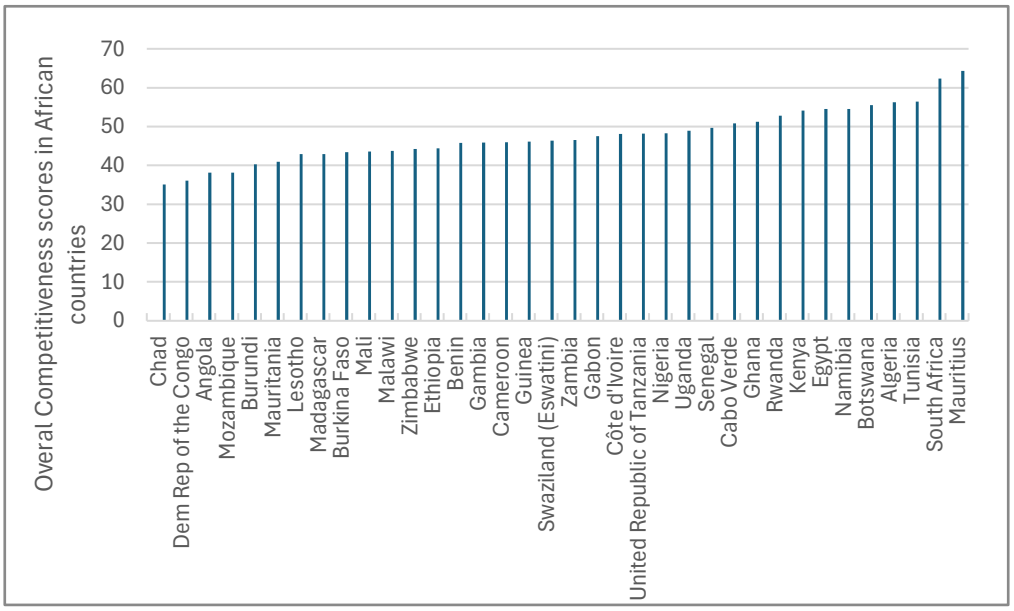
I designed an EXCEL spread sheet containing the above variables, then populated with the values of the overall competitiveness scores from the 2019 GCI report as well as values from the external sources for the other variables. The EXCEL file was then exported to SPSS for the multivariate analysis.

RESULTS

Relative Position within African Countries in Competitiveness Scores

Figure 1 shows the relative position within African countries in overall competitiveness scores in 2019. As seen in the graph, the overall competitiveness score ranged between 35.1 (Chad) and 64.3 (Mauritius). Only eleven countries (Cabo Verde, Ghana, Rwanda, Kenya, Eqypt, Namibia, Botswana, Algeria, Tunisia, South Africa and Mauritius) out of the 36 African countries for which data were available had overall competitiveness scores > = 50 in 2019.

Figure 1: Relative Position within African Countries in Overall Competitiveness Score, 2019



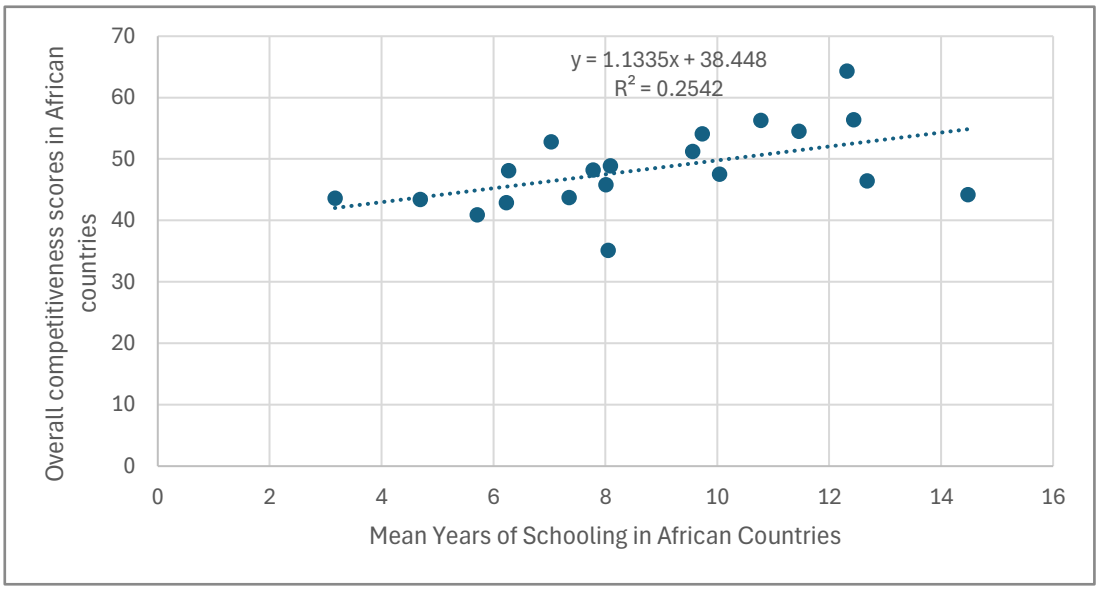
Source: Author's graph produced from values in the 2019 GCI report

Bi-Variate Regression

Figures 2-4 show the results of fitting regression line to the scatter plot of overall competitiveness scores and each of the education indicators. The results suggest that each of the education indicators - mean years of schooling, pupil to teacher ratio, percent aged 20-29 that completed upper secondary, percent aged 15-24 that can read a simple sentence – in African countries was correlated with overall competitiveness scores in African countries in 2019. The correlation coefficients, r, arising from the fitted line to each of the scatter plots ranged between 0.504 (overall competitiveness scores and mean years of schooling) and 0.657 (overall competitiveness scores and percent aged 20-29 completed

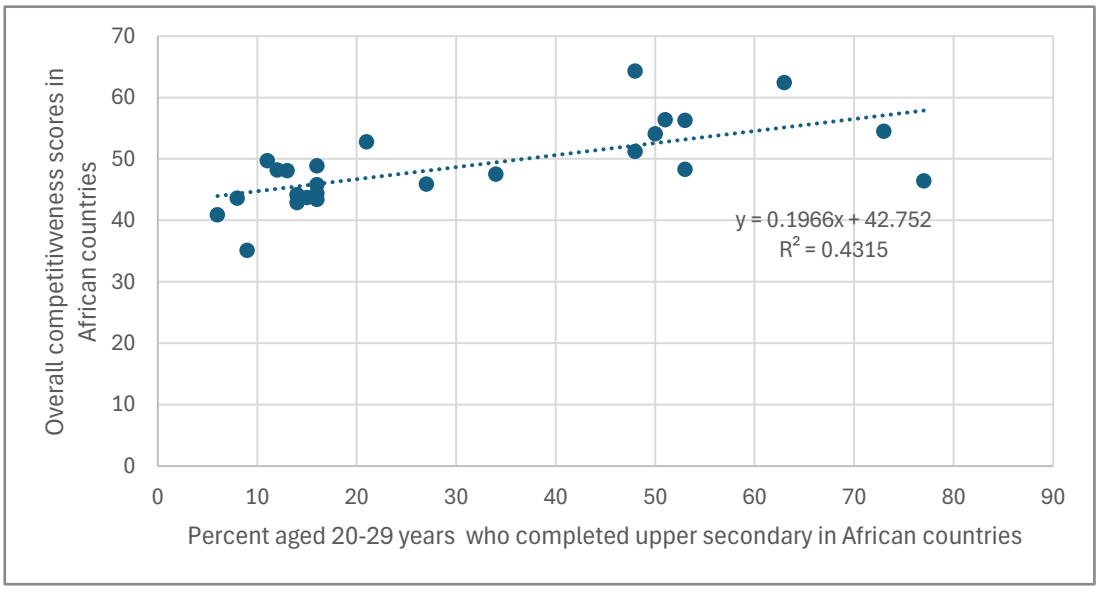
upper secondary education). But are these correlations statistically significant combining all the education indicators together?

Figure 2: Scatter Plot of Overall Competitiveness Scores in 2019 and Mean Years of Schooling in African Countries in 2019 or nearest date



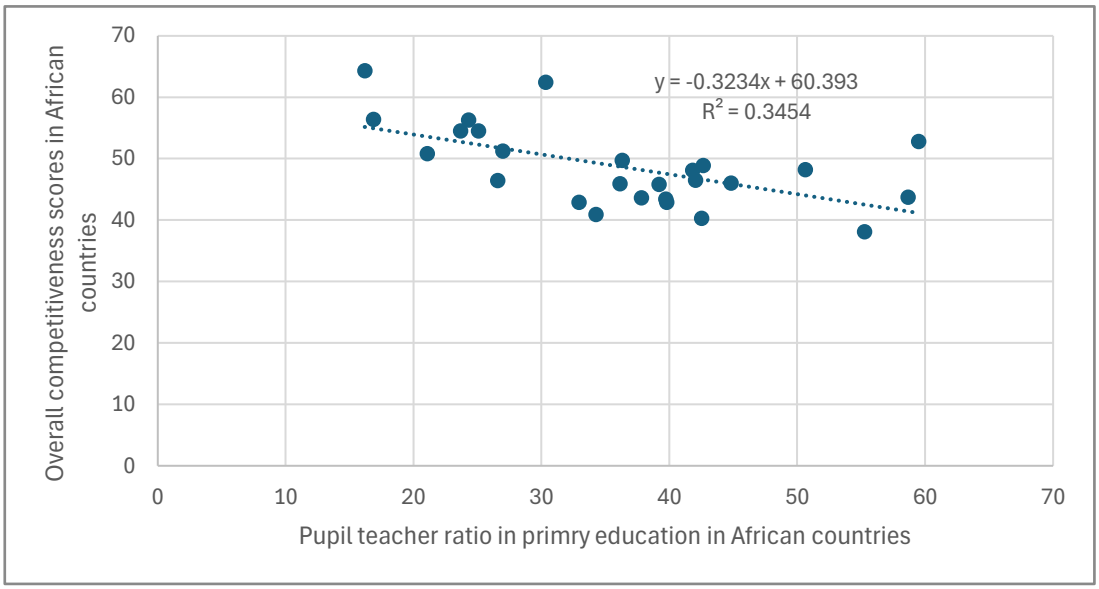
Source: Author's analysis from values in the 2019 GCI report and UNESCO data.

Figure 3: Scatter Plot of Overall Competitiveness Scores in 2019 and Percent aged 20-29 that completed Upper Secondary in African Countries in 2019 or nearest date



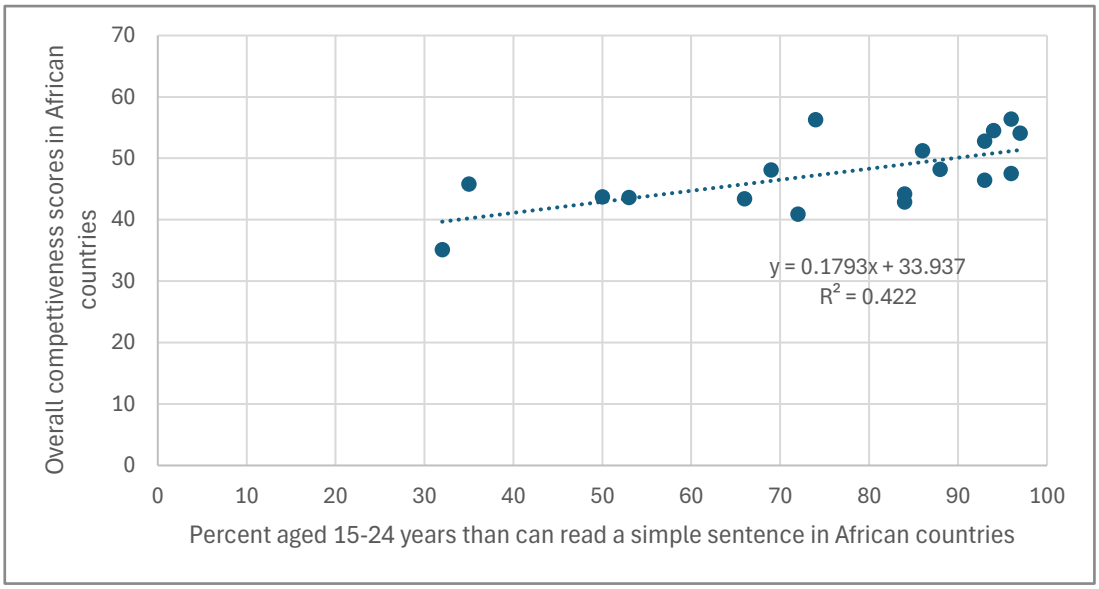
Source: Author's analysis from values in the 2019 GCI report and UNESCO data.

Figure 4: Scatter Plot of Overall Competitiveness Scores in 2019 and Pupil Teacher Ratio in Primary Education in African Countries in 2019 or nearest date



Source: Author's analysis from values in the 2019 GCI report and UNESCO data.

Figure 5: Scatter Plot of Overall Competitiveness Scores in 2019 and Youth Literacy in African Countries in 2019 or nearest date



Source: Author's analysis from values in the 2019 GCI report and UNESCO data.

Multivariate Regression Results

Since the correlation coefficient arising from each of the education indicators performance plotted against overall competitiveness exceeded the threshold of 0.5, they were all included in the multivariate analysis based on equation 2 above. The results are summarised in Table 1.

Table 1: Multivariate Regression of Overall Competitiveness Scores in 2019 and Education Indicators Performance in African Countries in 2019 or nearest date

Overall Competitiveness Scores in African Countries in 2019 Regressed on:	
Education Indicators	**Coefficient**
Mean years of schooling, persons aged 20-24	1.067 *(0.928)*
Percent aged 20-29 that completed upper secondary education	-0.004 *(0.124)*
Pupil teacher ratio in primary education	-0.004 *(0.130)*
Percent aged 15-24 that can read a simple sentence	0.062 *(0.444)*
R^2	0.529
Constant	35.12

Source: Author's computation from values in the 2019 GCI report and UNESCO data.
Standard errors in italic parentheses.

The coefficients in the Table indicate that controlling for other education performance indicators shown in the table, the percentage of persons aged 20-29 who completed upper secondary education as of 2019 or nearest date was negatively associated with overall competitiveness scores in African countries in 2019. This seems counter-intuitive. One sometimes encounters what seems counter-intuitive results in research based on what has generally been found previously and accepted as a normative pattern. Pupil teacher ratio in primary education in African countries or nearest date to 2019 showed similar negative association with overall competitiveness scores. Controlling for other education performance indicators, none of the education indicators was statistically significant ($p > 0.05$). The R^2 value indicate that the education performance indicators all together accounted for about 53% of the variation in overall competitiveness scores in the 36 African countries in 2019.

DISCUSSION AND CONCLUSION

Some weaknesses were identified in the methodology of the 2019 GCI report. Of note is the assignment of equal weight of 8.3% to each of the 12 pillars in the computation of the overall competitiveness scores. Though practical may not be realistic. It is doubtful whether the 12 pillars contribute equally to overall competitiveness. If the relative contribution of each pillar to overall competitiveness were assessed empirically, one may have different values and pattern of overall

competitiveness scores for countries. Imputations for missing or outdate in the 2019 GCI methodology in the view of this author amounts to manufacturing values that were not provided by the respondents during data collection. From my experience, the distribution of imputed values for a variable can be different from the distribution of the original values of the same variable. This is evident, from the analysis of some Demographic and Health Survey data I have examined/analysed. An example is the distributions of the number of deaths of children aged 0-15 years unimputed (what was collected during fieldwork) and imputed (what was not collected during fieldwork) in the 1988 Botswana Family Health Survey II from the raw data. In view of this, imputations (aside logical imputations) in my view should be avoided.

Although, the bi-variate analysis indicated that each of the education performance indicators analysed in this study was correlated with overall competitiveness scores in African countries in 2019, controlling for other education performance indicators, none of the education indicators was statistically significant.

The overall, outcome of the 2019 GCI seems to be another exercise that placed world economies into more developed and developed economies with African countries generally at the bottom. Though of theoretical interest, but from a policy perspective, it may not be a simple tool for policy makers to use. The number of indicators used to derive national competitiveness is unwieldy, thus raises doubt about the utility of the index for policy makers. The definition of competitiveness employed in the report remains abstract. One may ask for example and especially for policy makers, what is the threshold that defines competitiveness, is it overall competitiveness score of 50 or higher?

A major weakness in this study was the small sample size. Of all the African countries, only 36 had overall competitiveness index values in 2019. Furthermore, for each of the education performance indicators, the UNESCO or World Bank data base did not have values for some of the 36 countries that had overall competitiveness values. This resulted in some empty cells in both the bi-variate and multivariate analyses and hence the large standard errors in Table 2. It should be noted however that, the small sample size is not unique to this study. By default, any research focusing on African countries would have a small sample size if the unit of analysis is “country” because there are 54 countries in Africa. To compound this further, each of the 54 countries may not have all the data for the variables that one would want to analyse so there would be missing units for some variables making the sample size even smaller as was the case in this study. It is however comforting that the scatter plots in Figures

2-5 had many points. It would have been more concerning if there were only 2-3 points in the scatter plots.

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