NOTE

The Africa Regional Integration Index: A Selective Audit

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This study reviews the first edition of the African Regional Integration Index in terms of its mechanics and outcomes. The findings show that the index has no theoretical basis and that the process of data normalization used is inappropriate given the gap between the richest and the poorest countries in Africa. The review unveils irregularities in computation of the overall index, which alters the Regional Economic Community (REC) rankings in positions two, three and four. In conclusion, this is a good starting point, but the index can be made more relevant and objective by anchoring it on sound theoretical footing.

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1. Introduction

The growing interest in composite indicators in both academic and policy arenas is fuelled largely by the difficulty of interpreting the myriads of existing individual indicators in light of the continuously emerging developmental concerns. A natural offshoot of this interest is the persistent debate on the bases, appropriateness, meaningfulness, relevance and robustness especially of the new composite indices like the Africa Regional Integration Index (ARII).

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Tracking the process of regional integration is however not new. The European Union (EU) index (EU-Index), is a composite measure of the extent to which individual member states are integrated in EU. The index has five indicators namely; the single market, EU importance, EU homogeneity, EU symmetry and institutional conformity. Each indicator has a raft of sub-indices. The indicators and sub-indices are statistically calculated using the Principal Component Analysis (PCA). The indicators are assigned unequal weights in constructing this measure with the “single market’ and “EU-importance” receiving a weighting of 40% and 44% respectively.

The European Central Bank uses two categories of individual indicators- price based and quantity based to measure the extent of financial integration in the Eurozone. The measure uses a number of computed and model-based indicators including; standard deviation, beta coefficients, variance ratio, distance of intercept, variance, coefficients of country dummies and dispersion of country parameters.

Regional Integration Index for the Arab World developed by the United Nations Economic and Social Commission for Western Asia is used to monitor regional integration among sixteen countries. These are; Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen. The index is based on four arbitrarily chosen variables – openness to trade, investment, workers’ remittances and tourism. Principal Component Analysis is used to combine the four variables into a single measure that is used to rank the countries. The variables are weighted statistically with the greatest weight assigned to variables that vary most widely among the sixteen countries.

The Asian Development Bank (ADB) tracks progress on regional cooperation and integration for the 48 members of the ADB using 12 individual indicators. These are; export growth, export intensity index, export share, import growth, import share, intra-regional trade intensity index, intra-regional trade share, total trade growth, total trade, trade intensity index and trade share. The ADB also measures the extent of integration between the Pacific Developing Member Countries and Asia. The measure is based on two dimension (the sum of Pacific intra-sub regional shares and inter-sub regional shares) and five indicators namely; trade in goods, remittance inflow, Overseas Development Assistance inflow, migrant outflow and tourist arrivals.
A common thread across all these attempts is the absence of a clear underpinning theoretical framework for the respective measures be they individual indicators or composite measures. However, unlike the ARII whose weights are chosen ex ante, some of these indices attempt an endogenous selection of weights through the PCA which to some extent, provides amethodological basis for selection of weights. Overall, this makes it difficult to find an appropriate justification for selection of variables or sub-indices. It also makes the linkage between the variables and the dimensions they are intended to measure weak.

The first edition of the ARII released in 2016, marks a milestone in the measurement of progress achieved over the years in priority pillars of the African integration agenda. Developed through the collaboration of African Union Commission, African Development Bank and the United Nations’ Economic Commission for Africa, the index is designed to be an independent source of good quality data on regional integration intended to help assess the level of integration for every REC and their respective member states.

The ARII comes at an extremely critical phase of the continental integration agenda; the individual RECs are expanding and engaging more with themselves and also with the rest of the world, and the Continental Free Trade Area (CFTA) is at a formative stage, having been launched in 2015. Measuring the relative distance covered to deep integration is therefore useful not only in terms of tracking integration in the continent, but also in terms of identifying the appropriate political response and policy prescriptions to take the process forward.

1.1 Composition of the Index

The ARII is composed of five dimensions made up of sixteen indicators based on the Abuja Treaty and its operational framework. The dimensions are; trade integration, productive integration, free movement of people, financial and macroeconomic integration and regional infrastructure.

Trade integration dimension is made up of four indicators; the level of customs duties on imports, the share of intra-regional goods exports in Gross Domestic Product (GDP), the share of intra-regional goods imports in GDP and the share of total intra-regional goods trade in total intra-REC trade. Productive Integration
dimension consists of three indicators namely; the share of intra-regional intermediate goods exports, the share of intra-regional intermediate goods imports and Merchandise Trade Complementarity Index (MTCI).

The Free Movement of People dimension has three indicators; the proportion of REC member countries whose nationals do not require a visa for entry, ratification (or not) of REC protocol on free movement of persons, and the proportion of REC member countries whose nationals are issued with a visa on arrival. Financial and Macroeconomic Integration dimension is made up of two indicators. These are; the regional convertibility of national currencies and the Harmonised Consumer Price Index (HCPI) based inflation rate differential.

The dimension on Regional Infrastructure is composed of four indicators namely; the average cost of roaming, total regional electricity trade per capita and the proportion of intra-regional flights. The fourth indicator in this dimension; the Africa Infrastructure Development Index (AIDI) is by itself a composite indicator made up of four components namely; transport, electricity, Information Communication and Technology (ICT) and water and sanitation. These dimensions are further disaggregated into nine indicators.

The indicators for transport are two; total paved roads per every 10,000 inhabitants and total road network in kilometres. The indicator for electricity is the generation in Kilowatt-hour (KWh) produced per inhabitant. The dimension on Water and Sanitation has two indicators; the percentage of population with access to improved water source and the percentage of population with access to improved sanitation facilities.

The dimension on ICT has five indicators. These are; the total telephone subscriptions per 100 inhabitants, fixed line telephone subscriptions as a percent of the population and mobile-cellular subscriptions as a percentage of the population. The others are; the number of internet users per100 inhabitants, fixed (wired) broadband internet subscribers per 100 inhabitants and finally the international internet bandwidth.
1.2 Mechanics of the Index

The indicator for each dimension is calculated from data for 2010-2014. Included in the list of indicators are African Development Bank’s (AfDB) the Africa Infrastructure Development Index (AIDI) and United Nations Conference on Trade and Development’s (UNCTAD) Merchandise Complementarity Index (MCI). It is not clear whether these were computed or adopted and whether data for the same period was used.

Computations of the index are based on the sum of the average of all dimensions. The indicators are weighted equally in the calculation of the scores for each dimension using the sum of the average of the indicators. The only exception is the Free Movement of People.

The Min-Max approach to scaling is used to standardize the results to render them comparable for purposes of measurement and aggregation of data. All necessary steps have been taken to select unrelated indicators so as to avoid double counting in the calculations.

Five stages have been observed in the construction of the index in the following sequence; selection of indicators, standardization process, calculation of index by dimension, calculation of overall index for countries and finally the calculation of overall index by REC.

The ARII values as computed and published in the Africa Regional Integration Index Report 2016 (Page 16) are reported in Table 1. Individual country scores on each dimension of integration are ranked on a scale of 0 (low) to 1 (high). A simple average of the country scores for each dimension is taken to get the REC scores. For every dimension, a score tending towards 1 denotes a high level of integration in that particular dimension.

Table 1, on a scale of 0 to 1, reports the average score for each REC on every dimension of integration and the average score for all RECs in each dimension. The overall regional integration score is highest for “Trade Integration” dimension (0.540) and lowest for “Financial and Macroeconomic Integration” dimension (0.381). These results mean that “Trade Integration” is a high and “Financial and
Macroeconomic Integration”, a low priority area across all the RECs. This may be attributed to the view that trade integration is a necessary condition for financial and monetary integration. This is well documented in the history of evolution of major trading blocs such as the European Union and in the Association of South East Asian Nations (ASEAN) – China monetary integration process.

Table 1: Average REC Scores in all Dimensions of Regional Integration

<table>
<thead>
<tr>
<th>REC</th>
<th>Trade Integration</th>
<th>Regional Infrastructure</th>
<th>Productive Integration</th>
<th>Free Movement of People</th>
<th>Financial and Macroeconomic Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEN-SAD</td>
<td>0.353</td>
<td>0.251</td>
<td>0.247</td>
<td>0.479</td>
<td>0.524</td>
</tr>
<tr>
<td>COMESA</td>
<td>0.572</td>
<td>0.439</td>
<td>0.452</td>
<td>0.268</td>
<td>0.343</td>
</tr>
<tr>
<td>EAC</td>
<td>0.780</td>
<td>0.496</td>
<td>0.553</td>
<td>0.715</td>
<td>0.156</td>
</tr>
<tr>
<td>ECCAS</td>
<td>0.526</td>
<td>0.451</td>
<td>0.293</td>
<td>0.400</td>
<td>0.599</td>
</tr>
<tr>
<td>ECOWAS</td>
<td>0.442</td>
<td>0.426</td>
<td>0.265</td>
<td>0.800</td>
<td>0.611</td>
</tr>
<tr>
<td>IGAD</td>
<td>0.505</td>
<td>0.630</td>
<td>0.434</td>
<td>0.454</td>
<td>0.221</td>
</tr>
<tr>
<td>SADC</td>
<td>0.508</td>
<td>0.502</td>
<td>0.350</td>
<td>0.530</td>
<td>0.397</td>
</tr>
<tr>
<td>UMA</td>
<td>0.631</td>
<td>0.491</td>
<td>0.481</td>
<td>0.493</td>
<td>0.199</td>
</tr>
<tr>
<td>Average of Eight RECs</td>
<td>0.540</td>
<td>0.461</td>
<td>0.384</td>
<td>0.517</td>
<td>0.381</td>
</tr>
</tbody>
</table>

Source: Africa Regional Integration Index Report 2016.

The individual dimension scores across RECs on the other hand show that East African Community (EAC) is the most integrated (0.780) and Community of Sahel-Sahara States (CEN-SAD) the least integrated (0.353) in the “Trade Integration” dimension. EAC is also the most integrated (0.553) and CEN-SAD the least integrated (0.247) in terms of “Productive Integration” dimension. In “Free
Movement of People”, Economic Community of West African States (ECOWAS) is the most integrated (0.800) and Common Market for Eastern and Southern Africa (COMESA), the least integrated (0.268). These results showcase the pace, differences in prioritization, constraints and challenges of regional integration across Africa. In most REC Agreements, negotiations commence with trade in goods. This explains the apparently high priority this dimension commands across the eight RECs.

2. A Selective Audit

Our audit of the index is selective because it focuses on two of the five stages observed in the construction of the index namely; selection of the indicators and the calculation of overall index by REC. In the latter case, our concern is more on the outcome than the process.

2.1 Selection of Indicators for ARII

Adopted in 1991, the Treaty establishing the African Economic Community (Abuja Treaty) entered into force in 1994. The centre piece of this Treaty, was the integration of Africa. Abuja Treaty and its operational framework is the basis for the choice of dimensions for which the indicators for ARII have been selected. This approach was necessary in view of the fact that the process was aimed at solving an existing practical problem but it certainly has serious shortcomings.

A composite indicator is the sum of its parts. This means that the strength or weakness of a composite indicator is determined by the quality of the underlying variables used to construct it. This quality is founded on the theoretical soundness of the link between the dimensions of the index and the underlying indicators. Conventionally, this is best operationalised by use of a theoretical framework.

The ARII is not founded on any theoretical framework. Consequently, individual indicators (which in some cases are compound), appear to have been selected in an arbitrary manner with little attention paid to the interrelationship between them. For instance, in the Trade dimension, share of intra-regional goods exports and share of intra-regional goods imports are measures of one and the same thing in an intra-REC context. They measure the value or volume of trade.
In the Regional Infrastructure dimension, the AIDI is selected as an indicator. The AIDI, by its choice of components does not provide a measure of integration. Instead, it provides an up-to-date picture of the existing state of African Infrastructure development. The fixed line telephone subscriptions, as a percentage of the population for instance, is one of the indicators of the ICT dimension. It is not clear how this variable can be used to measure regional integration.

Transport dimension is measured by two indicators; the total paved roads per 10,000 inhabitants and total road network in kilometres. These are evidently neither direct nor proxy measures of regional integration. The AIDI, by determining which countries are performing more strongly across the five infrastructure indicators, therefore simply provides an indication of those countries’ future economic and not necessarily, integration prospects.

In any case, AIDI is a compound index with an entirely different basis for selection and aggregation of its component parts. The other three indicators of the Regional Infrastructure dimension are already well represented in AIDI. Transport is represented by two indicators; electricity by one indicator and ICT by six indicators. The indicator for electricity in AIDI- the generation in KWh produced per hour per inhabitant is clearly related to the total regional electricity trade per capita, which is the fourth indicator of the Regional infrastructure dimension. Selecting both to measure the same dimension is therefore imprudent.

In the productive integration dimension, two indicators- the share of intra-regional intermediate goods exports and the share of intra-regional intermediate goods imports are a measure of one and the same thing in intra-trade context. Selecting both to measure the same dimension is to therefore measure the volume/value of intra-REC trade twice. This can have the effect of introducing statistical imbalances in the overall index.

The choice of UNCTAD’s Merchandise Trade Complementarity Index (MTCI) to measure this dimension is also debatable. The MTCI measures the correspondence between one country’s export structure and its trading partner country’s import structure. The MTCI is therefore useful in assessing the suitability of a Preferential Trade Agreement between two economies given the structure of one potential
partner’s export match the imports of the other potential partner. In this sense, it is not a measure of productive integration.

Measures of Vertical Integration would be more appropriate. Such measures are based on two strategies. On one hand are those that utilize ratios like value added over sales, which change consistently with the number of processes performed by the industry. On the other are those that use percentage of total product which is part of a firm’s vertical chain. In either case, the measures show the participation of a firm in successive production stages across different countries which is a reflection of value-chain integration. Value-chain integration is a good proxy for deep integration.

The selection of indicators for the Free Movement of People dimension is also arbitrary. First the aggregation of binary measure for ratification of REC protocol on free movement of people to the other indicators is not explained, neither is the choice justified. Besides, ratification is a process. At any point in time, countries are therefore bound to be at different phases of this process. A binary measure applied in this manner does not take this into account. Second, the three indicators are related. In practical terms, there appears to be a long lag for some countries between ratification and implementation of REC protocols. This suggests the possibility of a spill-over of countries that have ratified the protocol onto the other two indicators thereby leading to double counting.

2.2 Weighting and Aggregation of Indicators in the ARII

The ARII does not have an underlying theoretical framework. It is therefore not possible to evaluate the weighting and aggregation procedures as well as the data properties of the composite index. It is also not possible to determine whether correlation issues among the selected indicators should be accounted for.

The ARII gives equal weights to all the indicators in the calculation of the dimensions’ scores. The indicators are first grouped into dimensions and the dimensions then aggregated into the composite index. This is intended to ensure that “the index does not prioritize any particular topic on regional integration”.

In a structural sense, applying equal weights to the indicators imply an unequal weighting of the dimensions. The various dimensions in the ARII have different
number of indicators. Trade Integration and Regional Infrastructure dimensions each
group four indicators. The dimensions on Productive Integration and Free Movement
of People each have three indicators while the dimension on Financial and
Macroeconomic integration groups two indicators.

When the weights are equal, then the dimensions grouping larger number of
indicators will tend to have higher weights. In this sense, Trade Integration and
Regional Infrastructure therefore have higher weights than Productive Integration
and Free Movement of People. These four in turn have higher weights than Financial
and Macroeconomic Integration. The effect of this is to create an unbalanced
structure in the composite index.

The other problem with equal weighting relates to the choice and combination of
variables in the ARII. In the Regional Infrastructure dimension, the two electricity
indicators- generation in KWh produced per hour per inhabitant (in the AIDI) and
the total regional electricity trade per capita are related. The same applies to
indicators in the free movement of people dimension. Ratification by the country of
REC protocol and the proportion of REC member countries whose nationals either
do not require visa for entry or may obtain visa on arrival are related.

Such obvious relationships between variables can introduce an element of double
counting into the composite index. This happens in the following way. In the Trade
Integration dimension for instance, the share of intra-regional goods export in GDP
and the share of intra-regional goods imports in GDP are closely related. They both
measure the volume/value of intra-regional trade. If both are weighted equally so that
intra-imports are denoted by \( W_1 \) and intra-exports by \( W_2 \) then the volume/value of
intra-regional trade will have a higher weight equivalent to \( W_1 + W_2 \) in the
composite index.

2.3 Normalization of Data

The ARII uses the Min-Max method to normalize the data used. This is necessary
prior to any aggregation since the indicators selected for this index have different
measurement units. The basic problem with the Min-Max approach is that it is
affected by extreme values in the data set. Regional integration in Africa pulls
together countries at disparate levels of the integration continuum; from the very
poor, (Democratic Republic of Congo) to the very rich (South Africa) both in Southern Africa Development Community (SADC); the smallest (Gambia) to the largest economy in Africa (Nigeria) both in ECOWAS. These extremes have the effect of distorting an indicator whose underlying data is normalized using the Min-Max method.

2.4 Calculation of Overall Index by REC

In the calculation of the average overall scores on regional integration, the REC scores for SADC and Intergovernmental Authority on Development (IGAD) are incorrectly computed. Whereas the correct score for SADC is 0.4574 and that for IGAD 0.4488, in the report, they are presented as 0.531 and 0.457 respectively (Page 15). This can be confirmed by simply adding up the average of the eight REC’s scores for each dimension on one hand, and the average for each REC’s scores for each dimension on the other. The two (the sum of columns plus rows in the unlabelled table on page 16) should add up to the same value. This error has serious implications for the overall ranking of RECs. Whereas EAC retains its first position, it pushes ECOWAS and Arab Maghreb Union (UMA) to positions two and three respectively and SADC to position four overall.

There are several other incorrect computations in the report. The comparison of average scores by REC on regional infrastructure (Continuum on Page 31) should ideally match up to the column for regional infrastructure on page 16 (Unlabelled table), yet it does not. Similarly, the comparison of average scores by REC on Trade Integration dimension for UMA reads two different values; 0.681 on the continuum on page 29 and 0.631 in the unlabelled table on page 16. This disparity is also noted for the computations on comparison of average scores by REC on Productive Integration dimension for COMESA. In the continuum in page 33, this is computed as 0.572 but in the unlabelled table on page 16, it reads 0.452.

3. Conclusion

The ARII is a welcome addition to the existing family of welfare measures. To improve its relevance especially to researchers on international trade, it is imperative that it develops into a more objective measure. This can only be achieved by anchoring the composite index on a sound theoretical footing.
A theoretically consistent ARII will provide a scientific criterion for selection and aggregation of individual indicators into a more meaningful and objective composite index. This will permit selection of indicators on the basis of their analytical soundness, measurability, country coverage, relationship to each other and their relevance to integration agenda in Africa.

In addition, a theoretically consistent ARII will make it possible to determine whether the various dimensions espoused in the Abuja treaty and its operational framework are statistically well balanced to make the resultant composite index sufficiently robust.

References


