www.devbankng.com

DBN Development Bank of Nigeria
RC 1215724
...Financing Sustainable Growth

WORKING PAPER SERIES

216, 2020

An Index of African Monetary Integration (IAMI)

Samba Diop
Faculty of Economics and Management, P.O. Box, 30,
Alioune Diop University, Bambey, Senegal
E-mail: diopapasamba@gmail.com

Simplice A. Asongu
African Governance and Development Institute,
P. O. Box 8413, Yaoundé, Cameroon
E-mails: asongus@afridev.org;
asongusimplice@yahoo.com

Abstract

This study improves the African Regional Integration Index (ARII) proposed by the African Union, the African Development Bank and the United Nations Economic Commission for Africa by providing a theoretical framework and addressing shortcomings related to weighting and aggregation of the indicator. This paper measures monetary integration in the eight African Regional Economic Communities (RECs) by constructing an Index of African Monetary Integration (IAMI). It proposes an Optimal Currency Area as theoretical framework and uses a panel approach to appreciate the dynamics of the index over different periods of time. The findings show that: (i) inflation and finance (trade and mobility) present the highest (lowest) score while ECOWAS is (EAC and IGAD are) the highest (least) performing. (ii) Surprisingly, in most RECs, the highest contributors to wealth creation are not the top performers in regional monetary integration. (iii) The RECs in Africa are characterized by a stable monetary integration which is different from the gradual process usually observed in monetary integration because with the exception of the EAC and UMA, the dynamics of IAMI show a steady trend in the overall index across time. Policy implications are discussed.

***Keywords*:** Monetary Integration; Currency Unions; Economic Communities; Africa

***JEL Codes*:** E10; E50; O10; O55; P50

1. Introduction

In recent years, the debate about African regional integration has been renewed in policy and scholarly circles (Akpan, 2014; Kayizzi-Mugerwa et al., 2014; Njifen, 2014; Charaf-Eddine & Strauss, 2014; Baricako & Ndongo, 2014; Nshimbi & Fioramonti, 2014; Ebaidalla & Yahia, 2014; Ofa & Karingi, 2014; Shuaibu, 2015; Tumwebaze & Ijjo, 2015; Asongu, 2016; Asongu et al., 2020a). Consistent with the attendant literature, the political objective of economic integration and a monetary union was formalized in the Treaty of Abuja in 1991. Indeed, after the successful launch of the euro in 1999, the association of governors of African central banks renewed their interest for monetary integration. Accordingly, the Regional Economic Communities (RECs) should play an important role in such a monetary integration[1]. In efforts to facilitate the process of monetary integration, in 2016, the African Union (AU), the African Development Bank (AfDB) and the United Nations Economic Commission for Africa (UNECA) developed and proposed an African Regional Integration Index (ARII). The objective of this index is to gauge the degree of regional integration of RECs in Africa. However, according to Gor (2017), the proposed index must be improved for many reasons. Firstly, the ARII is not founded on any theoretical framework. Secondly, there is a serious problem on weighting and aggregation of the indicator as well in the calculation of overall index from RECs. The purpose of this study is to address the shortcomings identified in Gor (2017) by constructing a quantitative monetary index for the eight existing RECs in Africa.

The construction of the new index is relevant to scholars and policy makers because it provides insights into how successful monetary policies are in promoting monetary integration in Africa. More specifically, the aim of this article is threefold: (i) to improve the ARII's relevance in order to enhance its reliability; (ii) to expand the previous literature on the feasibility of common currency in the whole Africa using a different approach; (iii) to provide a quantitative tool for both researchers and policy makers to synthesize and monitor the process of African monetary integration. In this paper, we refine the ARII's methodology to enhance its soundness to track the process of African integration. Our index differs from the ARII in three main ways. Firstly, we use the Optimum Currency Area (OCA) as a theoretical framework by anchoring the composite index on a sound theoretical footing. Secondly, panel normalization is employed to build a dynamic monitor which allows us to identify different changes over time. Finally, to avoid the problem of extreme values in the dataset, we use many other techniques of normalization to check the robustness of our results. Given the OCA theoretical underpinnings, we use macroeconomic indicators across African member states to calculate a quantitative index to assess the feasibility of a potential currency union.

[1] For more details on the RECs, see Figure 1 in appendix.

In the light of the above, the positioning of this study departs from the extant literature on the feasibility of the African Monetary Union (AMU) which has not focused on developing an index, but on using existing macroeconomic indicators to assess the feasibility of the proposed AMU (Masson & Patillo, 2004; Coulibaly & Gnimassoun, 2013; Asongu et al., 2017). The existing literature which is documented in Asongu et al. (2017) can be discussed in four main strands, notably, the: AMU, West African Monetary Zone (WAMZ), East African Monetary Union (EAMU) and Southern African Monetary Union (SAMU). Each of the strands is summarised into arguments for a currency union, arguments against a currency union and arguments for a currency union contingent on compliance with certain convergence criteria by potential member states. Each of the four strands is summarised in the following passages.

First, arguments from the proposed AMU are supported by Guillaume and Stasavage (2000) and Tsangarides et al. (2006), arguments against the proposed currency are in Bayoumi and Ostry (1997) and Karras (2007) whereas the attendant literature supporting an AMU, though with some reservations include: Yehoue (2005), Buigut (2006), Buigut and Valev (2006), Masson (2006, 2008), Debrun et al. (2011) and Tsangarides and Qureshi (2015). Second, with regard to the WAMZ, Ogunkola (2005) and Diop (2012) conclude on its feasibility, while a bulk of the attendant literature is either of the position that the currency is unfeasible (Debrun et al., 2005; Houssa, 2008; Tsangarides & Qureshi, 2006; Cham, 2009; Chuku, 2012; Alagidede et al., 2012; Asongu, 2013b, 2014bc; Dufrénot & Sugimoto, 2013; Harvey & Cushing, 2015; Asongu et al., 2019) or conditionally feasible if some criteria converge (Bénassy-Quéré & Coupet, 2005; Asongu, 2014a; Ekpoh & Udoh, 2013; Bangaké, 2008; Saka et al., 2015). Third, in the EAMU, a substantial body of literature has been sympathetic to arguments against the currency union (Rusuhuzwa & Masson, 2012; Buigut, 2011; Mafusire & Brixiova, 2013; Davoodi et al., 2013; Asongu, 2014b, 2014c; Lepetit et al., 2014), perspectives for the currency union (Mkenda, 2001; Bangaké, 2008; Asongu, 2013b) as well as views for the currency union after some conditions have been met (Buigui & Valev, 2005 ; Buigut & Valev, 2009; Falagiarda, 2010; Sheik et al., 2011; Kishor & Ssozi, 2011). Fourth, for the SAMU, Grandes (2003) and Debrun and Masson (2013) provide perspectives on its feasibility, Agdeyegbe, (2009) recommends against the union while the greater bulk of the literature in the strand advocates for a currency zone subject to improvements in compliant conditions in potential members states (Khamfula & Huizinga, 2004; Wang et al., 2007; Jefferis, 2007; Masson, 2008; Masson, 2008; Bangaké, 2008; Zehirun et al., 2015; Asongu et al., 2020b).

The rest of the study is structured as follows. Section 2 provides insights into the ARII while Section 3 discusses the proposed index in the light of theoretical underpinnings, imputation and normalization as well as weighting and aggregation. The main findings of the proposed

Index of African Monetary Integration (IAMI) are provided in Section 4 while Section 5 concludes with implications and future research directions.

2. The African Regional Integration Index

The African Regional Integration Index (ARII) is a joint product of three main institutions, namely, the: African Union Commission (AUC), African Development Bank (AfDB) and United Nations Economic Commission for Africa (UNECA). The index is comprised of five dimensions made up of sixteen indicators. The dimensions are: trade integration, regional infrastructure, productive integration, free movement of people and, financial and macroeconomic integration. Table 1 reports the average score for each REC on every dimension and the average score for all RECs in each dimension. The scores are calculated on a scale of 0 (*low*) to 1 (*high*).

Table 1: Average RECs Scores in all dimensions of regional integration

RECs	Trade integration	Regional infrastructure	Productive integration	Free movement of people	Financial and macroeconomic integration
CEN-SAD	0.353	0.251	0.247	0.479	0.524
COMESA	0.572	0.439	0.452	0.268	0.343
EAC	0.780	0.496	0.553	0.715	0.156
ECCAS	0.526	0.451	0.293	0.400	0.599
ECOWAS	0.442	0.426	0.265	0.800	0.611
IGAD	0.505	0.630	0.434	0.454	0.221
SADC	0.508	0.502	0.350	0.530	0.397
UMA	0.631	0.491	0.481	0.493	0.199
Average	0.540	0.461	0.384	0.517	0.381

Sources: ARII (2016). RECs: Regional Economic Communities. CEN-SAD: Community of Sahel-Saharan States. COMESA: Common Market for Eastern and Southern Africa. EAC: East African Community. ECCAS: Economic Community of Central African States. ECOWAS: Economic Community of West African States. IGAD: The Intergovernmental Authority on Development. SADC: Southern African Development Community. UMA: Arab Maghreb Union.

We can note that the highest scores are on trade integration, with average of the eight RECs scores of 0.540. EAC is the highest performing REC on the trade integration dimension and CEN-SAD and ECOWAS are not in particular high performers on this dimension. The lowest scores are on financial and macroeconomic integration. It is the lowest score overall among RECs with a 0.381 average. For this dimension, ECOWAS is the highest performing REC. The average REC scores are closest together on regional infrastructure and productive integration. Average REC scores are furthest apart on free movement of people and financial and macroeconomic integration. As noted earlier, this index is not based on any theoretical framework and individual indicators appear to have been selected in an arbitrary manner. Indeed, as documented in Gor (2017), the index suffers from issues of weighting,

normalization and calculation of overall index by REC. It is essentially for this shortcoming that, in this study, the proposed monetary index is based on the theoretical framework of OCA. Moreover, this study also engages sensitivity checks in order to provide an evaluation of the robustness of the composite indicator.

3. Steps for constructing the Index of African Monetary Integration (IAMI)

In this section, we present the different steps for constructing the IAMI. To avoid risks and lack of transparency in the process, especially in the methodology, we develop four steps that are extremely important for understanding the construction.

3.1Theoretical framework and data selection

The theoretical framework and the data selection are the most important steps when constructing an index. In effect, they provide the basis for the selection and combination of variables into a meaningful composite indicator. This step represents the starting point in the construction of the composite indicator. In our study, the choice of variables is guided by the OCA theory. The concept of OCA was defined by Mundell (1961). This author presented the mobility factor (especially labour mobility) as the most important criterion in the feasibility of a monetary union. In chronological relevance, the second important contributor to the OCA theory is Mckinnon (1963). For the author, the degree of openness is a crucial criterion. The third contributor is Kenen (1969) who introduces product diversity as an important criterion. It is important to note that theoretical underpinnings surrounding the OCA have evolved, building on the attendant seminal papers. Beside these traditional criteria, a large number of criteria have been introduced such as financial integration, trade openness, endogeneity of OCA, effectiveness of exchange rate adjustments, synchronization of business cycles, political and institutional factors, similarity of shocks, *inter alia* (Asongu et al., 2017, 2019, 2020b). For a more comprehensive approach, the variables used in this study in the light of the OCA theory are provided in Table 2.

Table 2: Dimensions and variables

Dimensions	Variables	Authors
Factors mobility	Proportion of intraregional remittances to total remittances	Mundell (1961) Corden (1972)
	Proportion of intraregional migrants to total migrants (inbound plus outbound)	
	Proportion of intraregional migrants to total migrants (outbound)	
	Proportion of intraregional tourists to total tourists (inbound)	

Trade integration	Intraregional trade intensity index	McKinnon (1963)
	Proportion of intraregional goods exports to total goods exports	
	Proportion of intraregional goods imports to total goods imports	
Inflation differential	Inflation rate differential	Haberler (1970) Fleming (1971) Mongelli (2002)
	Exchange rate differential	
Synchronicity	GDP growth differential	Kenen (1969), Krugman (1993) Frankel and Rose (1998)
	GDP per capita differential	
	GDP per capita growth differential	
Financial integration	Difference between number of commercial banks	Ingram (1962)
	Difference between the spread of interest rate	
	Difference of credit provided by commercial banks	

Sources: Authors' compilation

3.2 Imputation and Normalization

There are in general three methods for dealing with missing data. The methods are: case deletion, simple imputation and multiple imputations. We have a great number of missing data because of lack of observations for a set of countries. In order to minimize the missing observations, we replace some missing data by the mean of their values. Our data are annual and cover the period 2012-2016. The countries used are presented in the appendices. For the normalization, there are a large number of methods (see Table 3). In this work, we use different methods to normalize the data. They are summarized in the following table. Given x_{qc}^{t} the value of indicator *q* for country *c* at time *t*. $\bar{c}$ is the reference country.

Table 3: Normalisation methods

Methods	Equations
Ranking	$I_{qc}^{t} = rank(x_{qc}^{t})$

Standardization (or z-scores)	$I_{qc}^{t} = \frac{x_{qc}^{t} - x_{qc=\bar{c}}^{t}}{\sigma_{qc=\bar{c}}^{t}}$
Min-Max	$I_{qc}^{t} = \frac{x_{qc}^{t} - min_{c}(x_{q}^{t_0})}{max_{c}(x_{q}^{t_0}) - min_{c}(x_{q}^{t_0})}$
Softmax	$I_{qc}^{t} = \frac{1}{1 + e^{\left(-\frac{x_{qc}^{t} - x_{qc=\bar{c}}^{t}}{\sigma_{qc=\bar{c}}^{t}}\right)}}$
Distance to a reference country	$I_{qc}^{t} = \frac{x_{qc}^{t}}{x_{qc=\bar{c}}^{t_0}}$ or $I_{qc}^{t} = \frac{x_{qc}^{t} - x_{qc=\bar{c}}^{t_0}}{x_{qc=\bar{c}}^{t_0}}$
Indicator above or below the mean	$I_{qc}^{t} = \begin{cases} 1 \; if \; \omega > (1+p) \\ 0 \; if \; (1-p) \leq \omega \leq (1+p) \\ -1 \; if \; \omega < (1+p) \end{cases}$ where $\omega = \frac{x_{qc}^{t}}{x_{qc=\bar{c}}^{t}}$
Cyclical indicator	$I_{qc}^{t} = \frac{x_{qc}^{t} - E_{t}(x_{qc}^{t})}{E_{t}\left(x_{qc}^{t} - E_{t}(x_{qc}^{t})\right)}$
% of annual differences over consecutive years	$I_{qc}^{t} = \frac{x_{qc}^{t} - x_{qc}^{t-1}}{x_{qc}^{t}}$

Sources: Authors' adaptation from OECD (2008)

In this paper, we use panel normalization to take into account the time consistency in the computation of the index. Then, the minimum and the maximum values for each indicator are calculated across individuals and time periods. The transformation is :

$$I_{qc}^{t} = \frac{x_{qc}^{t} - min_{t \in T} min_{c}(x_{q}^{t})}{max_{t \in T} max_{c}(x_{q}^{t}) - min_{t \in T} min_{c}(x_{q}^{t})}$$

For indicators representing a differential such as inflation, exchange and GDP, where higher values imply lower integration, we use the following transformation:

$$I_{qc}^{t} = 1 - \frac{x_{qc}^{t} - min_{t \in T} min_{c}(x_{q}^{t})}{max_{t \in T} max_{c}(x_{q}^{t}) - min_{t \in T} min_{c}(x_{q}^{t})}$$

3.3 Weighting and aggregation

The weighting and aggregation are important in the calculation of the overall index and by extension, the rankings. There are many weighting methods. In this paper, we use a multivariate data analysis technique. More specifically, we employ a panel principal

component analysis (PPCA). This choice is justified by the fact that with this method, we can summarize a set of variables without losing the important variability in the original data (Tchamyou, 2017, 2020). Also, with the panel dimension, it is able to take into account the evolution of the index over time. The objective of PPCA is to explain the variance of the observed data through a few linear combinations of the original data.

In a panel situation, we have a multidimensional data vector[2] :

$$X_{T\times Q} = \left(x_1^t, x_2^t, \dots, x_Q^t\right), t \in T$$

where t is the number of periods and Q is the number of variables.

Let $\Sigma_{Q\times Q}$ be the correlation matrix of the variables$X_{Q\times T}$. The principal component $Z_i^t, i = 1,2, \dots, Q$ is defined as:

$$\begin{cases} Z_1^t = a_{11}x_1^t + a_{12}x_2^t + \cdots + a_{1Q}x_Q^t \\ Z_2^t = a_{21}x_1^t + a_{22}x_2^t + \cdots + a_{2Q}x_Q^t \\ \vdots \\ Z_Q^t = a_{Q1}x_1^t + a_{Q2}x_2^t + \cdots + a_{QQ}x_Q^t \end{cases}$$

Accordingly, in a matrix form, $Z = A'X_{Q\times T}$, where $A = \left(a_1, a_1, \dots, a_Q\right)$, the coefficient matrix A maximizes the variance of $Z = E(ZZ') = A'\Sigma A$ subject to the following constraints:

$a_1'a_1 = a_2'a_2 = \cdots = a_Q'a_Q = 1$ and $cov\left(a_i'x, a_j'x\right) = 0, i \neq j$

The solution to the eigenvalue-eigenvector problem resulting from of this optimization program is λ_i which is equal to the variance of Z, with $\lambda_1 > \lambda_2 > \cdots > \lambda_Q$.

Loadings obtained from the PPCA can now be used to compute the different weights.[3] In the first step, the PPCA is applied on the variables in every dimension to obtain the different weights. Once the weights are obtained, PPCA is again applied to the weighted sub-indexes to compile the overall index.

4. Main findings of the Index of African Monetary Integration (IAMI)

In the first step, we apply the PPCA to select the number of component factors. The general rule is the Kaiser criterion which drops all factors with eigenvalues below 1 (Tchamyou, 2017, 2020). As we can see in Table 4, in all cases, with the exception of factor mobility in CEN-SAD, where the first component contributes to 85% of the explanation of the overall variance, the first-two factors explain the most variance. Following this information, we conclude that the first-two principal factors explain the variability of the five dimensions. The second step deals with the construction of the weights (see Table 4).

[2]For the Panel Principal Components Analysis, we follow the criteria of Park and Claveria (2018).
[3]For more details on how to calculate the loadings and weights, see Huh and Park (2017).

4.1 Analysis of the indexes (average 2012-2017)

Table 5 presents the sub-indexes and the overall index for every REC. Average REC scores are closest together on financial integration and are furthest on trade integration. Moreover, highest scores are in inflation and financial integration while lowest scores are noted in trade and mobility. When we consider the overall index, among the eight RECs, the ECOWAS is the most regionally integrated with the highest score (0.672). This result confirms those of the dimension of financial and macroeconomic integration of the ARII. This is not surprising as the ECOWAS is the oldest REC in Africa. Indeed, in this community, we have the eight West Africa Economic and Monetary Union (WAEMU) economies which have been sharing the same currency for more than 70 years. The second integrated community is SADC with a score of 0.618. The EAC and IGAD are the lowest integrated regions. The EAC is the highest performing REC in terms of trade integration (0.478). The ECOWAS earns its highest scores from the mobility sub-index, while the SADC scores higher on synchronicity and finance with respectively, 0.731 and 0.793. With regards to inflation, the CEN-SAD is the top performer (0.802).

Table 6 summarizes the scores for each economy and its ranking. In the CEN-SAD, the top ten performers on all indexes are mostly ECOWAS countries. It is worthwhile to note that in this REC, we have all fifteen ECOWAS countries. This result is confirmed by the overall index where except for Chad (10^{th}), the top ten performers are in the ECOWAS. Cote d'Ivoire, which is leading in top performance, scores high across dimensions such as trade and mobility. Many ECOWAS countries in the CEN-SAD attain high scores for mobility. This result can be explained by the fact that to facilitate the free movement of people in this region, member states established in December 2000 a common passport, formally known as the ECOWAS travel certificate. Indeed, for the other sub-indexes, except for synchronicity, countries in the ECOWAS exhibit high levels of integration.

For COMESA countries, Rwanda earns the highest score for the overall index (0.804). It is followed by Congo Democratic Republic (0.710), Zambia (0.705) and Zimbabwe (0.675). Madagascar ranks last with a score value of 0.401, far below COMESA's regional average. When sub-dimensions are taken on board, it is surprisingly apparent that this country (i.e. Madagascar), even if it occupies the last position in the overall index, has a good rank in terms of synchronicity (5^{th}). Paradoxically, Rwanda and Congo Democratic Republic which are, respectively 1^{st} and 2^{nd} in overall index perform weakly in inflation (11^{th} and 13^{th}, respectively). In the EAC, Burundi, Rwanda and Uganda are at the top both for sub-indexes and the overall index. Kenya and Tanzania have the worse rankings.

In the ECCAS, high scores in the overall index are traceable to the Congo Republic, the Central African Republic, Rwanda and Tanzania. Angola and Equatorial Guinea perform weakly in the overall index scores even though the latter country is 3rd out of 11 in terms of financial integration. Within ECOWAS countries, 7 of the top performing that are deeply integrated (score higher than the average of the community) are in the WAEMU. Burkina Faso, Niger and Côte d'Ivoire are the top performers. The surprising result is the rank of Nigeria. Nigeria is the first contributor towards wealth creation in the region (i.e. more than 65% of the regional GDP). Unfortunately, it is positioned at one place to the bottom (14th) in terms of integration. This finding could call into question the appropriateness of the future common currency "Eco" in the ECOWAS. It is worth noting that during the 55th Ordinary Session of the Authority of Heads of State and Government of the ECOWAS, the members were requested to speed-up the convergence process for a single currency in 2020. Weak scores are noted for Nigeria specifically with respect to synchronicity, mobility and finance. The same remarks are observed for other WAMZ countries.

In IGAD, the top performing countries on overall index are South Sudan, Djibouti and Uganda. Ethiopia, Sudan and Kenya which are the principal contributors in term of GDP are not in the top five countries with respect to monetary integration. South Sudan and Kenya score low on all sub-dimensions especially on synchronicity and mobility (0.298 and 0.241, respectively). Best sub-indexes are in inflation and exchange. Zimbabwe is the top performing economy on the overall index while Seychelles occupies the last place in the SADC. Concerning sub-indexes, Zimbabwe has best scores especially in trade and inflation. Lesotho is first both in synchronicity and finance. Moreover, the country ranks 2nd in the overall index. Despite the economic weight of South Africa (i.e. more than 65% of regional GDP), it is ranked 10th on the overall dimension. Finally, Tunisia, with highest performing scores in some sub-dimensions (trade and mobility) has the highest overall index. Algeria, the top contributor of the regional GDP occupies the last place after Mauritania. The worse scores for Algeria are in the dimensions of mobility, synchronicity and inflation. Libya earns the best sores in finance and inflation.

4.2 Analysis of the dynamic indexes

Figure 2 presents the dynamic scores = for the overall index and sub-indexes throughout the sample period. From the graph, the evolution of every REC over time can be appreciated. Contrary to the ARII (2016) which was static, our approach is more refined by introducing the dynamic aspect. The advantage of this method is that we can interpret an increase in the index through time as an improvement of the integration and a decrease as a decline in the integration of RECs. This comparability also helps to identify the dimensions that are driving

major changes in the composite index for each region across different time periods (Park & Claveria, 2018).

Many patterns emerge from this figure. Firstly, it shows a high variability of the sub-indexes especially for synchronicity and trade. EAC and UMA exhibit the highest volatility of indexes. Secondly, trade and mobility (movement of people) have the lowest scores for the entire period of analysis while inflation and financial integration show relatively highest scores. Finally, a broadly steady trend of the overall index is apparent over time in all RECs with the exception of the EAC and UMA. In effect, the movement of the overall index is stable over the period 2012-2017. The RECs in Africa are characterized by a stable monetary integration which is different from the gradual process usually observed in monetary integration because with the exception of the EAC and UMA, the dynamics of IAMI show a steady trend in the overall index across time. Furthermore, the figure shows that the overall index is highest in the ECOWAS and EAC during the sample period.

4.3 Robustness and sensitivity checks

In Table 7, we present the results of a robustness check for our monetary index. To this end, we consider alternative methods both for normalization and aggregation. The min-max scaling used is criticized by the fact that extreme values can distort the distribution of normalized values. To avoid this issue, we consider the soft-max method. One of the advantages of this technique is its ability to reduce the influence of extreme values or outliers. To further assess the robustness, the weighting method is also changed. Contrary to the PPCA approach, the same weight is assigned for every dimension of the index. The results do not change much. Thus, we conclude that results are robust to the use of alternatives normalization and weighting methods.

5. Concluding implications and future research directions

This study improves the African Regional Integration Index (ARII) proposed by the African Union, the African Development Bank and the United Nations Economic Commission for Africa by providing a theoretical framework and addressing shortcomings related to weighting and aggregation of the indicator. This paper measures monetary integration in the eight African Regional Economic Communities (RECs) by constructing an Index of African Monetary Integration (IAMI). It proposes an Optimal Currency Area as theoretical framework and uses a panel approach to appreciate the dynamics of the index over different periods of time. The findings show that: (i) inflation and finance (trade and mobility) present the highest (lowest) score while ECOWAS is (EAC and IGAD are) the highest (least) performing. (ii) Surprisingly, in most RECs, the highest contributors to wealth creation are not the top performers in regional monetary integration. For instances, Nigeria in ECOWAS, Ethiopia,

Sudan and Kenya in IGAD, South Africa in SADC, Algeria in UMA are not among the top performers in regional monetary integration. (iii) The RECs in Africa are characterized by a stable monetary integration which is different from the gradual process usually observed in monetary integration because with the exception of the EAC and UMA, the dynamics of IAMI show a steady trend in the overall index across time.

Overall, our results highlight the importance of measuring the monetary integration process in Africa particularly within a dynamic setting. The main policy implication emerging from our findings is that deep reforms are needed in the RECs especially in trade and movement of people to reinforce the monetary integration. This policy implication builds on the fact that the monetary integration is low, stable, and not characterised by the usual gradual process over time. In what follows, some measures that facilitate integration are discussed.

Regardless of RECs, monetary integration in the assessed dimensions can be improved by keeping in check some factors that inhibit monetary convergence, *inter alia*: budget deficits, government debts and inflation. Furthermore, monetary integration should also be enhanced by curtailing setbacks to common markets creation that constraint the feasibility of common currency areas. Some recommendations in these directions are, *inter alia*: (i) taking on board adjustment devoted to aligning monetary measures in various RECs; (ii) consolidating relevant institutional frameworks for the enforcement of fiscal discipline as well as surveillance at the macroeconomic level; (iii) implementation of reforms at the structural level that are imperative in reducing policy and infrastructural gaps; (iv) complementing national currencies with a basket of common currency and (v) construction of a robust institutional framework for boosting financial, monetary and fiscal stability.

The process of convergence could be further improved by building capacities of data collection that would facilitate information sharing. Furthermore, the harmonization of statistics would boost the improvement of skills, knowledge acquisition, competences as well as the behavior of central bank officials in the various RECs. Furthermore, beyond the need to tackle these infrastructural issues, boosting awareness campaigns is important in order to share information and by extension, improve perceptions of the rewards of adopting a common currency across Africa.

Further studies can assess how to facilitate monetary integration in the light of the African Continental Free Trade Area (AfCFTA). Moreover, using this new measure of monetary integration to examine the feasibility of the proposed trade area and a unique currency for the entire African continent, are worthwhile.

References

African Union Commission, African Development Bank, and United Nations Economic Commission for Africa (2016). "Africa Regional Integration Index" 2016 Report, Addis Ababa: UNECA.

Agdeyegbe, T. D., (2009). "On the Feasibility of a Monetary Union in the Southern Africa Development Community," *International Journal of Finance and Economics*, 13(2), pp.150-157.

Akpan, U. S. (2014). "Impact of Regional Road Infrastructure Improvement on Intra-Regional Trade in ECOWAS", *African Development Review*, 26(S1), pp. 64-76.

Alagidede, P., Coleman, S., & Cuestas, J. C., (2012). "Inflationary shocks and common economic trends: Implications for West African Monetary Union membership", *Journal of Policy Modeling*, 34(3), pp. 460-475.

Angeloni, I., &Dedola, L., (1999). "From the ERM to the Euro: New evidence on economic and policy among EU countries", *European Central Bank Working Paper*, No. 4.

Asongu, S. A., (2013a). "Real and Monetary Policy Convergence: EMU Crisis to the CFA Zone". *Journal of Financial Economic Policy*, 5(1), pp. 20-38.

Asongu, S. A., (2013b). "A short-run Schumpeterian Trip to Embryonic African monetary zones", *Economics Bulletin*, 33(1), pp. 859-873.

Asongu, S. A., (2014a). "REER Imbalances and Macroeconomic Adjustments in the Proposed West African Monetary Union", *South African Journal of Economics*, 82(2), pp. 276-289.

Asongu, S. A., (2014b). "Are Proposed African Monetary Unions Optimal Currency Areas? Real, Monetary and Fiscal Policy Convergence Analysis". *African Journal of Economics and Management Studies*, 5(1), pp. 9-29.

Asongu, S. A., (2014c). "How Would Monetary Policy Matter In The Proposed African Monetary Unions? Evidence From Output And Prices ", *African Finance Journal*, 16(2), pp. 34-63.

Asongu, S. A., (2015). "'Growth and Institutions in African Development', Edited by Augustin K. Fosu", Reviewed by SimpliceAsongu, *African Governance and Development Institute Working Paper* No. 15/033, Yaoundé.

Asongu, S. A., (2016). "New empirics of monetary policy dynamics: evidence from the CFA franc zones", *African Journal of Economic and Management Studies*, 7(2), pp. 164-204.

Asongu, S. A., Folarin, O. E, &Biekpe, N. (2019). "The long run stability of money demand in the proposed West African monetary union", *Research in International Business and Finance*, 48(April), 483-495.

Asongu, S. A., Folarin, O. E, &Biekpe, N. (2020b). "The stability of demand for money in the proposed Southern African Monetary Union", *International Journal of Emerging Markets*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/IJOEM-08-2018-0443

Asongu, S. A., Nnanna, J., &Tchamyou, V. S., (2020a). "The comparative African regional economics of globalization in financial allocation efficiency: the pre-crisis era revisited", *Financial Innovation*, 6(1), pp. 1-41.

Asongu, S. A., Nwachukwu, J. C., &Tchamyou, V. S., (2017). "A literature survey on the proposed African Monetary Unions", *Journal of Economic Surveys*, 31(3), pp. 878–902.

Bangaké, C., (2008). "Exchange Rate Volatility and Optimum Currency Area: Evidence from Africa", *Economics Bulletin*, 6(12), pp. 1-10.

Baricako, J., &Ndongo, G. X. D., (2014). "Intégration régionale et croissance: Le cas de l'Afrique Centrale", *AfricanDevelopmentReview*, 26(S1), pp. 33-51.

Bayoumi, T., &Ostry, J., (1997). "Macroeconomic Shocks and Trade Flows within Sub-Saharan Africa: Implications for Optimum Currency Arrangements," *Journal of African Economies*, 6(3), pp. 412-444.

Bénassy-Quéré, A., & Coupet, M., (2005). "On the Adequacy of Monetary Arrangements in Sub-Saharan Africa", *The World Economy*, 28(3), pp. 349-373.

Buigut, S., (2006). "Monetary integration initiatives in Eastern and Southern Africa (ESA): sorting the overlapping membership", *International Finance,* 9(3), pp. 295-315.

Buigut, S., (2011). "A Fast-Track East African Community Monetary Union? Convergence Evidence from a Cointegration Analysis", *International Journal of Economics and Finance*, 3(1), pp. 255-261.

Buigut, S. K., &Valev, N.T., (2005). "Is the Proposed East African Monetary Union an Optimal Currency Area? A Structural Vector Autoregression Analysis", *World Development*, 33(12), pp. 260-267.

Buigut, S., &Valev, N., (2006). "Eastern and Southern Africa Monetary Integration: A Structural Vector Autoregression Approach," *Review of Development Economics*,10(4), pp. 586-603.

Buigut, S., &Valev, N. T., (2009). "Benefits from Mutual Restraint in a Multilateral Monetary Union", *World Development*, 37(3), pp. 585-594.

Carrère, C., (2004). "African regional agreements: impact on trade with or without currency unions", *Journal of African Economics*, 13(2), pp. 199-239.

Celasun, O., &Justiniano, A., (2005). "Synchronization of output fluctuations in West Africa: Implications for monetary unification", *IMF Working Paper*.

Cham, T., (2009). "Is WAMZ an Optimum Currency Area(OCA)"?, *West African Journal of Monetary and Economic Integration*, 9(2), pp. 96-120.

Charaf-Eddine, N., & Strauss, I., (2014). "The Ten Commandments of Applied Regional Integration Analysis: The African Case", *African Development Review*, 26(S1), pp. 7-20.

Chuku, A. (2012). "The proposed eco: should West Africa proceed with a common currency?", Centre for the Study of African Economies (CSAE); Conference on "Economic Development in Africa" Oxford University, Oxford 18-20 March.

Corden, W., (1972). "Monetary Integration, Essays in International Finance" International Finance Section No. 93, Princeton University, Princeton.

Coulibaly, I., &Gnimassoun, B. (2013). "Optimality of a monetary union: New evidence from exchange rate misalignments in West Africa". *Economic Modelling*, 32(May), pp. 463-482.

Davoodi, H. R., Dixit, S., & Pinter, G., (2013). "Monetary Transmission Mechanism in the East African Community: An Empirical Investigation", *IMF Working Paper* No. 13/39, Washington.

Debrun, X., Masson, P., &Pattillo, C., (2005). "Monetary union in West Africa: Who might gain, who might lose and why?" *Canadian Journal of Economics*, 38(2), pp.454-481.

Debrun, X., Masson, P., &Pattillo, C., (2010)." Should African Monetary Unions Be Expanded? An Empirical Investigation of the Scope for Monetary Integration in Sub-Saharan Africa", *Journal of African Economies*, (2011) 20 (suppl 2), ii104-ii150.

Debrun, X., & Masson, P. R., (2013). "Modelling monetary union in Southern Africa: Welfare evaluation for the CMA and SADC", *South African Journal of Economics*, 81(2), pp. 275-291.

Diop, C. (2007). "L'UEMOA et la perspective d'une zone monétaire unique de la CEDEAO: les enseignements d'un modèle de gravité", Document d'Etude et de Recherche BCEAO, N° DER/07/01 – Avril, pp. 2-38.

Dufrénot, G., & Sugimoto, K., (2013). "West African Single Currency and Competitiveness", *Review of Development Economics*, 17(4), pp. 763-777.

Ebaidalla, E. M., &Yahia, A. M., (2014). 'Performance of Intra-COMESA Trade Integration: A Comparative Study with ASEAN's Trade Integration', *African Development Review*, 26(S1), pp. 77- 95.

Ekpoh, A. H., &Udoh, E., (2013). "Policy Coordination Framework for the Proposed Monetary Union in ECOWAS", Chapter in Regional Economic Integration in West Africa, Part of the series Advances in African Economic, Social and Political Development, pp 59-77.

Falagiarda, M. (2010). "Are the East African countries ready for a common currency? Traditional indicators and cointegration analysis", School of Economics of the University of Reading, http://www.tn.auf.org/CEAFE/Papiers_CEAFE10/Monnaie/Falagiarda.pdf (Accessed: 13/09/2015).

Fleming J. M., (1971). "On Exchange Rate Unification" ,*The Economic Journal*, 81(323), pp. 467-488.

Fosu, A. K., (2012). 'The African Economic Growth Record, and the Roles of Policy Syndromes and Governance'. In A. Noman, K. Botchwey, H. Stein and J. Stiglitz (eds), *Good Growth and Governance in Africa: Rethinking Development Strategies*. Oxford: Oxford University Press.

Frankel, J.A. & Rose A. K., (1998). "The Endogeneity of the Optimum Currency Area Criteria", Economic Journal, 108(449), pp. 1009 – 1025.

Gor, S. O., (2017). "The Africa Regional Integration Index: A Selective Audit", *Trade and Development Review*, 9(1-2), pp. 86-98.

Grandes, M. (2003). "Macroeconomic convergence in Southern Africa: the rand zone experience". *OECD Development Centre Working Papers* No. 231, Paris.

Guillaume, D. M., &Stasavage, D., (2000), "Improving Policy Credibility: Is There a Case for African Monetary Unions," *World Development*, 28(8), pp. 1391-1407.

Haberler G., (1970). "The International Monetary System: Some Recent Developments and Discussions", cited in: Approaches to Greater Flexibility in Exchange Rates, edited by George Halm, Princeton University Press, pp. 115-123.

Harvey, S. K., & Cushing, M. J., (2015). "Is West African Monetary Zone (WAMZ) a common currency area?", *Review of Development Finance*, 5(1), pp. 53-63.

Houssa, R., (2008) "Monetary union in West Africa and asymmetric shocks: A dynamic structural factor model approach", *Journal of Development Economics*, 85(1-2), pp. 319- 347.

Ingram J., (1969). "Comment: The Optimum Currency Problem", in R. Mundell et A. Swoboda, Monetary Problems in International Economy, Chicago University Press.

Jefferis, K. R., (2007). "The process of monetary integration in the SADC region". *Journal of Southern African Studies,* 33(1), pp. 83-106.

Karras, G., (2007), "Is Africa an Optimum Currency Area? A Comparison of Macroeconomic Costs and Benefits," *Journal of African Economies*, 16(2), pp. 234-258.

Kayizzi-Mugerwa, S., Anyanwu, J. C., &Conceição, P., (2014). "Regional Integration in Africa: An Introduction", *African Development Review*, 26(S1), pp. 1-6.

Kenen, P. B., (1969). "The Theory of Optimum Currency Areas: An Eclectic View", In R.A. Mundell and A.K. Swoboda (eds), Monetary Problems of the International Economy, Chicago: University of Chicago Press.

Khamfula, Y., & Huizinga, H., (2004). "The Southern African Development Community: Suitable for a monetary union?" *Journal of Development Economics*, 73(2), pp. 699-714.

Khamfula, Y., &Mensteab T., (2004). "South Africa and Southern African Monetary Union: A Critical Review of Sources of Costs and Benefits," *South African Journal of Economics*, 72(1), pp. 37-49.

Kishor, N. K., &Ssozi, J., (2011). "Business Cycle Synchronization in the Proposed East African Monetary Union: An Unobserved Component Approach", *Review of Development Economics*, 15(4), pp. 664-675.

Krugman, P., (1993). "Lessons of Massachusetts for EMU". In F. Giavazzi and F. Torres (eds), The Transition to Economic and Monetary Union in Europe, Cambridge, UK: Cambridge University Press, pp. 241–61.

Kuteesa, A., (2012). "East African Regional Integration: Challenges in Meeting the Convergence Criteria for Monetary Union: A Survey", *International Journal of Economics and Finance*, 4(10), pp. 147-160.

Lepetit, L., Rugemintwari, C., &Strobel, F., (2014). "Monetary, Financial and Fiscal Stability in the East African Community: Ready for a Monetary Union?", *The World Economy*, 38(8), pp. 1179-1204.

Mafusire, A., &Brixiova, Z., (2013). "Macroeconomic Shock Synchronization in the East African Community", *Global Economic Journal*, 13(2), pp. 261-280.

Masson, P. (2008) "Currency Unions in Africa: Is the Trade Effect Substantial Enough to Justify their Formation?", *The World Economy*, 31(4), pp. 533-547.

Masson, P., (2006). "New Monetary Unions in Africa: a Major Change in the Monetary Landscape?", *International Economics*, CEPII research Center, Issue 3Q, pp. 87-105.

Masson, P., &Pattillo, C., (2004). "The monetary geography of Africa", Washington, DC: Brookings Institution.

McKinnon, R.I., (1963). "Optimum Currency Areas", *American Economic Review*, 53(4), pp. 717–725.

Mkenda, B. K., (2001). "Is East Africa an optimum currency area?", Working Papers in Economics, No. 41. School of Economics and Commercial Law, Goteborg University.

Mongelli, F., (2002). "'New' Views on the Optimum Currency Area Theory : What is EMU Telling Us", European Central Bank, Working Paper, No. 138, Frankfurt.

Mundell, R.A., (1961). "A Theory of Optimum Currency Areas", American Economic Review, Vol. 51(4), pp. 657–665.

Njifen, I., (2014). "L'informalité: un nouveau paradigme de développement et d'intégration « par le bas » en Afrique", *African Development Review*, 26(S1), pp. 21-32.

Nshimbi, C. C., &Fioramonti, L., (2014). "The Will to Integrate: South Africa's Responses to Regional Migration from the SADC Region", *African Development Review*, 26(S1), pp. 52-63.
OECD & Joint Research Centre (2008). Handbook on constructing composite indicators: methodology and user guide. Paris: OECD.

Ofa, S. V., &Karingi, S., (2014). "Trade in Intermediate Inputs and Trade Facilitation in Africa's Regional Integration", *African Development Review*, 26(S1), pp. 96-110.

Ogunkola, O., (2005) "An evaluation of the viability of a single monetary zone in ECOWAS", *AERC Research Paper* No. 147, African Economic Research Consortium, Kenya.

Park C.Y., Claveria R., (2018). "Constructing the Asia-Pacific Regional Cooperation and Integration Index : A Panel Aproach", Asia Development Bank (ADB) Economics Working Paper Series N°544, Mandaluyong,.

Qureshi, M. S., &Tsangarides, C., (2012). "Hard or Soft Pegs? Choice of Exchange Rate Regime and Trade in Africa", *World Development*, 40(4), pp. 667-680.

Qureshi, M. S., &Tsangarides, C. G., (2015). "Exchange-rate regimes and trade: is Africa different?", in *Growth and Institutions in African Development*, First edited by Augustin K. Fosu, 2015, Chapter 4, pp. 59-83, Routledge Studies in Development Economics: New York.

Rusuhuzwa, T. K., & Masson, P. R., (2012). "Design and Implementation of a Common Currency Area in the East African Community", University of Toronto, Department of Economics *Working Paper* No. 451.

Saka, J. O., Onafowokan, I. A., & Adebayo, A. A.,(2015). "Analysis of Convergence Criteria in a Proposed Monetary Union: A Study of the Economic Community of West African States", *International Journal of Economic and Financial Issues*, 5(1), pp. 230-239.

Sheikh, K. A., Azam, M. N., Rabby, T. G., Alam, G. M., & Khan, I. (2011). "Monetary union for the development process in the East African community: Business cycle synchronization approach", *African Journal of Business Management*, 5(17), pp. 7632-7641.

Shuaibu, M. (2015). "Trade Liberalization and Intra-Regional Trade: A Case of Selected ECOWAS Countries", *African Development Review*, 27(1), pp. 27-40.

Talvas, G. S., (2008). "The benefits and costs of monetary union in Southern Africa: a critical survey of the literature", *Bank of Greece Working Paper* No. 70, Athens.

Tchamyou, V. S., (2017). "The Role of Knowledge Economy in African Business". Journal *of the Knowledge Economy*, 8(4), pp. 1189-1228.

Tchamyou, V. S., (2020). "Education, Lifelong learning, Inequality and Financial access: Evidence from African countries". *Contemporary Social Science*. DOI: 10.1080/21582041.2018.1433314.

Tumwebaze, H. K., &Ijjo A. I., (2015). "Regional Economic Integration and Economic Growth in the COMESA Region, 1980–2010", *African Development Review*, 27(1), pp. 67-77.

Tsangarides, C. G., Ewenczyk, P., &Hulej, M., (2006). "Stylized facts on bilateral trade and currency unions: Implications for Africa", *IMF Working Paper* No. WP/06/31, Washington.

Tsangarides, C.G., & Qureshi, M.S., (2008). "Monetary Union Membership in West Africa: A Cluster Analysis", *World Development*, 36(7), pp.1261-1279.

Wang, J.-Y., Masha, I., Shirono, K., & Harris, L. (2007). "The common monetary area in Southern Africa: shocks, adjustment, and policy challenges". *IMF Working Paper* No. 07/158.

World Bank (2015). "World Development Indicators', World Bank Publications http://www.gopa.de/fr/news/world-bank-release-world-development-indicators-2015 (Accessed: 21/08/2015).

Yehoue, E., (2005), "On the Pattern of Currency Blocs in Africa," *IMF Working Paper* No. 05/45, Washington.

Zehirun, M. F., Breitenbach, M. C., &Kemegue, F., (2015). "Assessment of Monetary Union in SADC: Evidence from Cointegration and Panel Unit Root Tests", *EconomicResearch Southern Africa (ERSA) Paper* No. 945.

6. Appendices

Figure 1: Regional Economic Communities in Africa

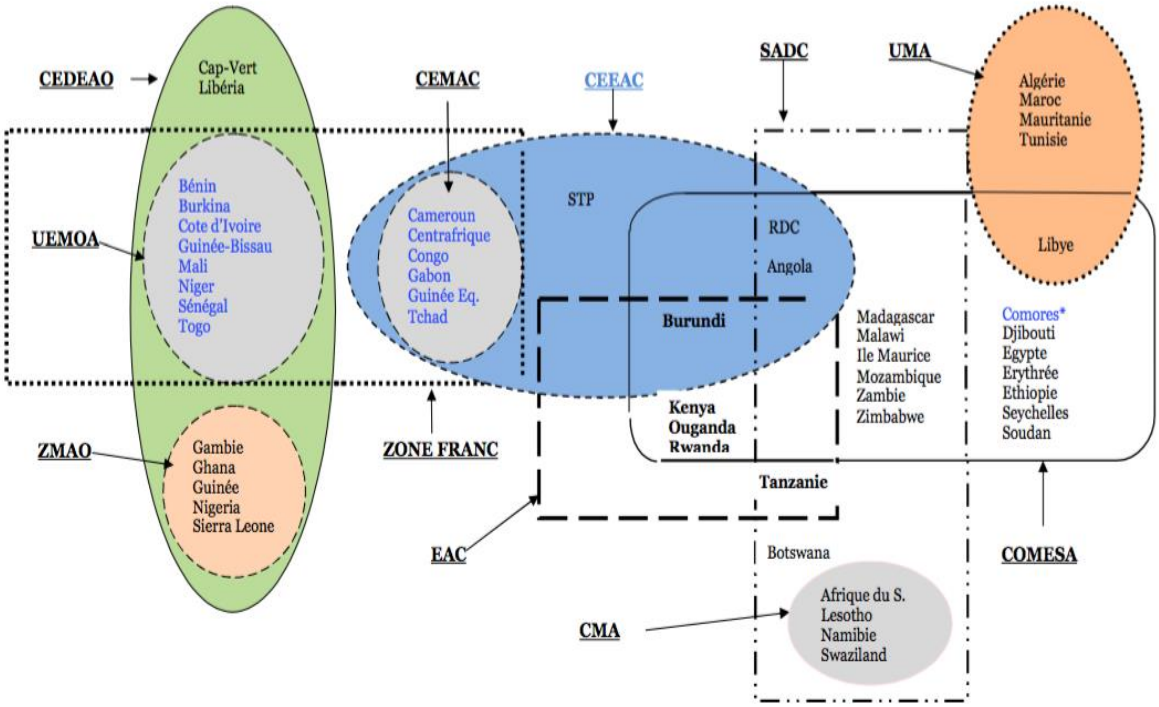


Table 4: Number of principal components

ECOWAS																				
	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	**2**	3	**1**	**2**	3	4	**1**	**2**	3	**1**	**2**	3	**1**	**2**	1	2	3	4	5
Eig. val.	**1.288**	**1.058**	0.654	**3.150**	**0.599**	0.196	0.054	**1.549**	**0.971**	0.480	**2.168**	**0.776**	0.056	**1.327**	**0.673**	2.237	1.172	0.801	0.636	0.154
Prop.	**0.429**	**0.352**	0.218	**0.787**	**0.150**	0.049	0.140	**0.516**	**0.324**	0.160	**0.723**	**0.259**	0.019	**0.663**	**0.337**	0.447	0.244	0.160	0.127	0.031
Cum	**0.429**	**0.782**	1.000	**0.787**	**0.937**	0.986	1.000	**0.516**	**0.840**	1.000	**0.723**	**0.981**	1.000	**0.663**	**1.000**	0.447	0.682	0.842	0.969	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.053	0.412	0.536	0.270	0.301	0.183	0.245	0.050	0.473	0.476	0.429	0.406	0.165	0.500	0.500	0.187	0.251	0.186	0.364	0.011
F2	0.774	0.210	0.016	0.025	0.000	0.685	0.289	0.949	0.029	0.022	0.051	0.120	0.828	0.500	0.500	0.021	0.202	0.001	0.009	0.766
Weights																				
Weights	0.378	0.321	0.301	0.231	0.253	0.264	0.252	0.396	0.302	0.301	0.330	0.330	0.340	0.500	0.500	0.130	0.234	0.122	0.242	0.270

CEN-SAD																				
	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	**2**	3	**1**	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	**1.490**	**0.953**	0.557	**3.413**	0.382	0.155	0.048	1.399	1.014	0.587	1.558	0.896	0.545	1.131	0.869	2.179	1.557	0.533	0.478	0.253
Prop.	**0.497**	**0.318**	0.186	**0.853**	0.096	0.039	0.012	0.466	0.338	0.195	0.519	0.299	0.182	0.566	0.434	0.436	0.311	0.106	0.096	0.051
Cum	**0.497**	**0.814**	1.000	**0.853**	0.949	0.988	1.000	0.466	0.804	1.000	0.519	0.818	1.000	0.566	1.000	0.436	0.747	0.854	0.949	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.111	0.416	0.469	0.250	0.274	0.221	0.252	0.056	0.508	0.436	0.443	0.187	0.368	0.500	0.500	0.267	0.355	0.088	0.267	0.022
F2	0.852	0.138	0.011	-	-	-	-	0.861	0.001	0.138	0.016	0.753	0.230	0.500	0.500	0.083	0.001	0.402	0.054	0.460
Weights																				
Weights	0.400	0.307	0.290	0.250	0.274	0.221	0.252	0.394	0.295	0.310	0.287	0.394	0.318	0.500	0.500	0.190	0.208	0.219	0.178	0.204

COMESA																				
	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	1.650	0.709	0.632	3.243	0.516	0.210	0.040	1.025	0.997	0.978	1.421	0.821	0.757	1.014	0.986	2.596	1.009	0.938	0.348	0.108
Prop.	0.553	0.236	0.211	0.809	0.129	0.052	0.010	0.342	0.332	0.326	0.474	0.274	0.252	0.507	0.493	0.519	0.202	0.188	0.007	0.022
Cum	0.553	0.789	1.000	0.809	0.938	0.990	1.000	0.342	0.674	1.000	0.474	0.748	1.000	0.507	1.000	0.519	0.721	0.909	0.978	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.336	0.309	0.354	0.244	0.290	0.198	0.267	0.142	0.392	0.466	0.309	0.365	0.326	0.500	0.500	0.271	0.271	0.153	0.229	0.074
F2	0.296	0.653	0.051	0.178	0.005	0.672	0.144	0.801	0.191	0.009	0.577	0.009	0.413	0.500	0.500	0.004	0.003	0.000	0.229	0.074
Weights																				
Weights	0.324	0.412	0.263	0.235	0.251	0.263	0.250	0.467	0.293	0.241	0.407	0.234	0.358	0.500	0.500	0.196	0.196	0.110	0.235	0.261

EAC																				
	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	1.581	1.329	0.090	2.686	0.926	0.321	0.065	2.094	0.834	0.072	1.492	1.016	0.492	1.034	0.966	3.512	1.488	0.000	0.000	0.000
Prop.	0.527	0.443	0.03à	0.672	0.232	0.080	0.016	0.698	0.278	0.024	0.497	0.339	0.164	0.517	0.483	0.702	0.293	0.000	0.000	0.000
Cum	0.527	0.970	1.000	0.672	0.903	0.984	1.000	0.698	0.976	1.000	0.497	0.836	1.000	0.517	1.000	0.702	0.293	1.000	1.000	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.518	0.000	0.486	0.281	0.339	0.113	0.267	0.140	0.446	0.413	0.240	0.508	0.252	0.500	0.500	0.170	0.278	0.000	0.284	0.267
F2	0.116	0.733	0.150	0.025	0.005	0.740	0.221	0.846	0.032	0.121	0.511	0.000	0.489	0.500	0.500	0.270	0.017	0.671	0.001	0.041
Weights																				
Weights	0.335	0.335	0.332	0.215	0.253	0.274	0.255	0.341	0.328	0.330	0.350	0.302	0.348	0.500	0.500	0.200	0.200	0.200	0.200	0.200

ECCAS																				
	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				

	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	1.397	1.104	0.500	1.731	1.400	0.792	0.076	1.36	1.075	0.565	2.250	0.476	0.274	1.118	0.881	2.835	1.888	0.276	0.000	0.000
Prop.	0.466	0.368	0.166	0.433	0.350	0.198	0.019	0.453	0.358	0.188	0.750	0.157	0.091	0.559	0.441	0.567	0.378	0.055	0.000	0.000
Cum	0.466	0.834	1.000	0.433	0.783	0.981	1.000	0.453	0.812	1.000	0.750	0.909	1.000	0.559	1.000	0.567	0.945	1.000	1.000	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.533	0.021	0.446	0.172	0.424	0.349	0.054	0.389	0.539	0.072	0.361	0.298	0.341	0.500	0.500	0.305	0.310	0.159	0.210	0.017
F2	0.038	0.797	0.166	0.109	0.114	0.193	0.616	0.246	0.012	0.741	0.064	0.677	0.259	0.500	0.500	0.003	0.010	0.284	0.211	0.491
Weights																				
Weights	0.314	0.364	0.322	0.144	0.285	0.279	0.291	0.326	0.306	0.367	0.309	0.364	0.328	0.500	0.500	0.184	0.190	0.209	0.210	0.206

IGAD

	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	1.432	0.943	0.625	1.957	1.230	0.696	0.117	1.599	0.983	0.418	2.593	0.317	0.09	1.032	0.968	5.000	0.000	0.000	0.000	0.000
Prop.	0.477	0.314	0.209	0.489	0.307	0.174	0.029	0.553	0.328	0.139	0.864	0.106	0.03	0.516	0.484	1.000	0.000	0.000	0.000	0.000
Cum	0.477	0.791	1.000	0.489	0.797	0.971	1.000	0.553	0.861	1.000	0.864	0.97	1.000	0.516	1.000	1.000	1.000	1.000	1.000	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.244	0.464	0.292	0.280	0.202	0.472	0.046	0.037	0.472	0.491	0.336	0.304	0.359	0.500	0.500	0.200	0.200	0.200	0.200	0.200
F2	0.559	0.000	0.439	0.038	0.377	0.000	0.584	0.952	0.043	0.004	0.298	0.654	0.047	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Weights																				
Weights	0.370	0.280	0.350	0.187	0.270	0.290	0.253	0.386	0.309	0.306	0.332	0.342	0.325	0.500	0.500	0.200	0.200	0.200	0.200	0.200

SADC

	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5

Eig. val.	1.836	0.883	0.280	3.356	0.452	0.163	0.028	1.314	0.905	0.781	1.597	0.799	0.604	1.108	0.892	2.607	1.590	0.440	0.252	0.110
Prop.	0.612	0.294	0.093	0.839	0.113	0.041	0.007	0.438	0.302	0.260	0.532	0.266	0.201	0.554	0.446	0.521	0.318	0.088	0.005	0.022
Cum	0.612	0.907	1.000	0.839	0.952	0.993	1.000	0.438	0.740	1.000	0.532	0.799	1.000	0.554	1.000	0.521	0.839	0.927	0.978	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.132	0.451	0.416	0.196	0.282	0.242	0.276	0.383	0.232	0.384	0.305	0.399	0.300	0.500	0.500	0.321	0.347	0.013	0.234	0.085

RECs	Trade	Mobility	Synchronicity	Finance	Inflation	Overall	Rank

F2	0.852	0.028	0.119	0.724	0.028	0.240	0.008	0.120	0.767	0.111	0.480	0.000	0.518	0.500	0.500	0.001	0.006	0.476	0.117	0.401
Weights																				
Weights	0.366	0.314	0.319	0.259	0.255	0.242	0.244	0.276	0.450	0.273	0.363	0.266	0.373	0.500	0.500	0.200	0.218	0.188	0.190	0.204

UMA

	Trade integration			Factor mobility				Synchronicity			Financial integration			Inflation diff		Overall				
	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	4	5
Eig. val.	1.966	1.002	0.033	2.165	1.028	0.672	0.135	1.288	1.002	0.710	1.288	1.921	0.848	1.407	0.592	3.469	1.530	0.000	0.000	0.000
Prop.	0.655	0.334	0.011	0.541	0.257	0.168	0.034	0.429	0.334	0.237	0.640	0.283	0.077	0.704	0.296	0.694	0.306	0.000	0.000	0.000
Cum	0.655	0.989	1.000	0.541	0.798	0.966	1.000	0.429	0.763	1.000	0.640	0.923	1.000	0.704	1.000	0.694	1.000	1.000	1.000	1.000
Squared loadings																				
Variables	TI	PE	PI	PMIG	PMIT	MIGD	MIGS	GDPg	GDPp	GDP	CB	CRED	SPRE	DI	DER	TR	MOB	SYN	FIN	INF
F1	0.434	0.500	0.065	0.279	0.140	0.301	0.280	0.091	0.407	0.503	0.410	0.442	0.148	0.500	0.500	0.229	0.260	0.274	0.001	0.234
F2	0.132	0.000	0.867	0.088	0.581	0.253	0.078	0.812	0.188	0.000	0.125	0.036	0.839	0.500	0.500	0.133	0.063	0.031	0.650	0.121
Weights																				
Weights	0.332	0.331	0.336	0.217	0.282	0.286	0.215	0.406	0.311	0.283	0.322	0.318	0.360	0.500	0.500	0.200	0.200	0.200	0.200	0.200

Table 5: sub-indexes and overall index 2012-2017 (average)

CEN-SAD	0.212	0.510	0.698	0.686	0.802	0.589	4
COMESA	0.336	0.321	0.683	0.777	0.774	0.588	5
EAC	0.478	0.486	0.519	0.569	0.513	0.513	8
ECCAS	0.257	0.427	0.676	0.532	0.658	0.617	3
ECOWAS	0.294	0.688	0.706	0.781	0.769	0.672	1
IGAD	0.341	0.431	0.497	0.516	0.761	0.508	7
SADC	0.316	0.522	0.731	0.793	0.785	0.618	2
UMA	0.421	0.405	0.521	0.743	0.644	0.547	6
Average	0.332	0.474	0.629	0.675	0.713	0.581	-

Table 6: Economy rankings

CEN-SAD												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Benin	0.270	9	0.871	4	0.736	14	0.863	3	0.902	3	0.735	5
Burkina Faso	0.346	7	0.980	1	0.735	15	0.850	4	0.900	4	0.767	2
Cabo Verde	0.017	27	0.195	23	0.665	22	0.263	29	0.759	20	0.404	28
Central Afr	0.046	25	0.357	20	0.816	3	0.686	12	0.741	24	0.537	18
Chad	0.071	24	0.730	10	0.791	5	0.686	12	0.826	16	0.644	10
Comoros	0.012	28	0.064	27	0.772	9	0.726	10	0.894	6	0.497	22
Cote d'Ivoire	0.655	1	0.917	3	0.648	23	0.824	6	0.887	10	0.787	1
Djibouti	0.139	19	0.479	16	0.678	20	0.686	12	0.855	14	0.577	16
Egypt	0.217	12	0.052	28	0.453	28	0.513	26	0.716	26	0.392	29
Eritrea	0.073	23	0.248	21	0.833	1	0.686	12	0.887	8	0.578	17
Gambia	0.473	3	0.647	13	0.782	6	0.473	27	0.755	22	0.641	9
Ghana	0.238	11	0.666	12	0.685	19	0.686	12	0.723	25	0.604	14
Guinea	0.143	18	0.739	9	0.701	18	0.686	12	0.413	29	0.531	19
Guinea-Biss	0.187	14	0.643	14	0.758	10	0.875	2	0.870	13	0.668	7
Kenya	0.114	21	0.216	22	0.667	21	0.648	23	0.795	19	0.488	23
Liberia	0.027	26	0.758	8	0.798	4	0.575	24	0.758	21	0.601	15
Libya	0.161	16	0.188	24	0.474	27	0.817	8	0.907	2	0.507	21
Mali	0.551	2	0.729	11	0.727	16	0.836	5	0.898	5	0.750	4
Mauritania	0.087	22	0.771	7	0.740	13	0.521	25	0.807	17	0.606	13
Morocco	0.190	13	0.021	29	0.602	26	0.686	12	0.871	12	0.478	26
Niger	0.266	10	0.933	2	0.745	11	0.900	1	0.916	1	0.755	3
Nigeria	0.359	6	0.418	18	0.390	29	0.698	11	0.752	23	0.514	20
Sao Tome	0.006	29	0.140	25	0.780	7	0.360	28	0.794	18	0.437	27
Senegal	0.399	4	0.451	17	0.708	17	0.818	7	0.894	7	0.655	8
Sierra Leone	0.272	8	0.824	5	0.777	8	0.686	12	0.569	28	0.627	11
Somalia	0.123	20	0.510	15	0.831	2	0.686	12	0.887	8	0.621	12
Sudan	0.167	15	0.369	19	0.624	24	0.686	12	0.585	27	0.483	24
Togo	0.384	5	0.797	6	0.742	12	0.784	9	0.874	11	0.722	6
Tunisia	0.158	17	0.083	26	0.617	25	0.686	12	0.833	15	0.479	25

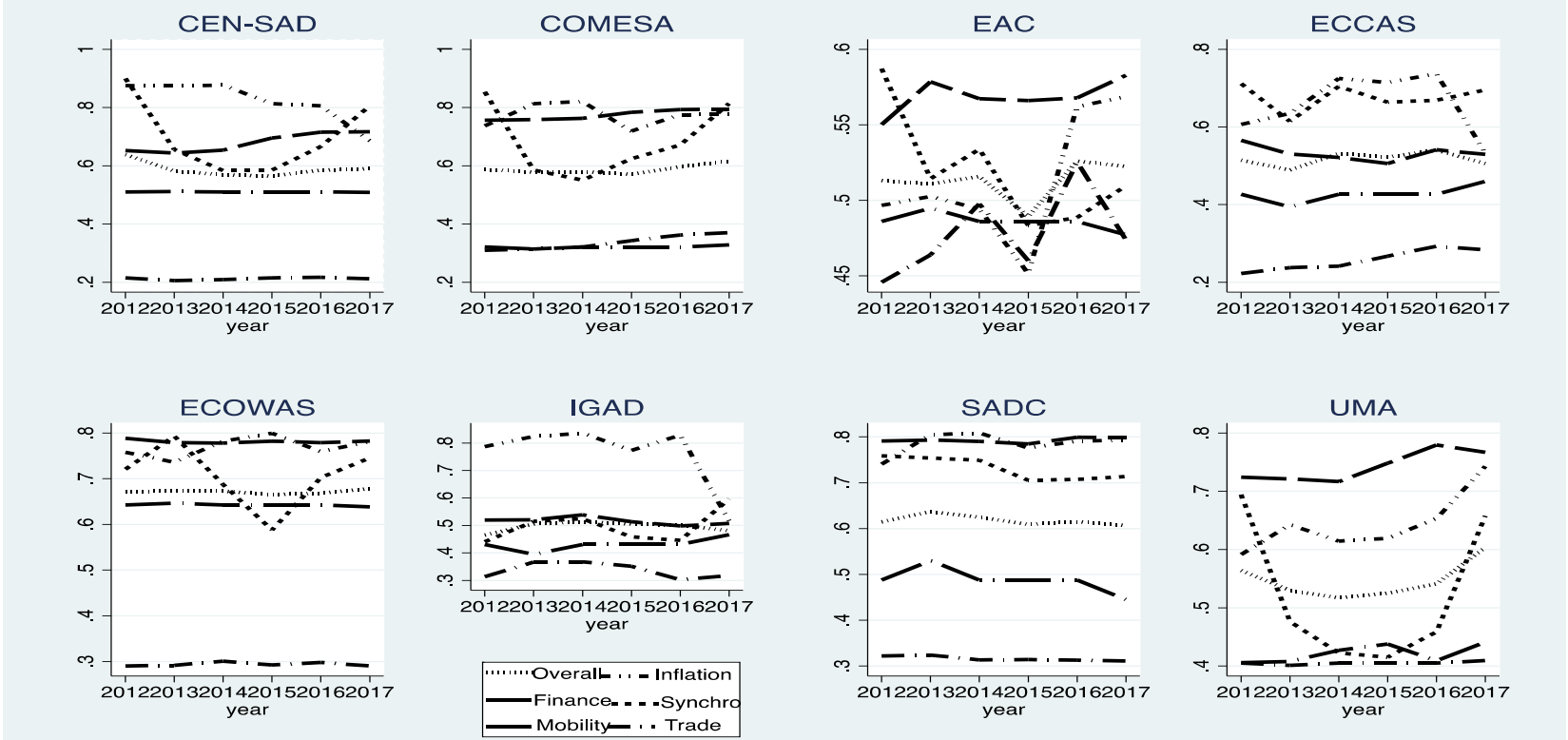
COMESA												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Burundi	0.499	6	0.659	2	0.832	1	0.777	9	0.595	16	0.649	6
Comoros	0.178	13	0.422	7	0.786	2	0.884	4	0.927	2	0.654	5
Congo Dem.	0.654	4	0.580	4	0.707	9	0.816	8	0.769	13	0.710	2
Djibouti	0.095	17	0.317	9	0.688	12	0.777	9	0.861	6	0.567	12
Egypt	0.197	12	0.017	17	0.473	18	0.757	16	0.760	14	0.470	16
Eritrea	0.083	18	0.581	3	0.683	13	0.777	9	0.911	4	0.632	7
Ethiopia	0.312	10	0.143	13	0.595	16	0.777	9	0.748	15	0.531	15
Kenya	0.516	5	0.193	12	0.663	14	0.830	7	0.815	8	0.617	10
Libya	0.154	14	0.085	16	0.640	15	0.895	3	0.919	3	0.568	11
Madagascar	0.095	16	0.132	14	0.764	5	0.573	18	0.532	17	0.401	19
Malawi	0.287	11	0.435	6	0.769	3	0.777	9	0.529	18	0.536	14
Mauritius	0.152	15	0.014	18	0.573	17	0.604	17	0.821	7	0.460	17
Rwanda	0.686	1	0.977	1	0.700	10	0.850	6	0.786	11	0.804	1
Seychelles	0.053	19	0.101	15	0.469	19	0.445	19	0.771	12	0.401	18
Sudan	0.319	9	0.272	10	0.693	11	0.777	9	0.911	4	0.618	9
Swaziland	0.337	8	0.000	19	0.725	7	0.777	9	0.814	9	0.541	13
Uganda	0.667	3	0.538	5	0.728	6	0.868	5	0.489	19	0.630	8
Zambia	0.682	2	0.387	8	0.721	8	0.904	1	0.806	10	0.705	3
Zimbabwe	0.427	7	0.245	11	0.768	4	0.896	2	0.940	1	0.675	4
EAC												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Burundi	0.315	4	0.874	1	0.968	1	0.569	3	0.407	4	0.627	1
Kenya	0.449	3	0.057	5	0.142	5	0.293	5	0.577	2	0.304	5
Rwanda	0.758	1	0.567	3	0.548	3	0.414	4	0.771	1	0.612	2
Tanzania	0.208	5	0.623	2	0.304	4	0.960	1	0.453	3	0.510	4
Uganda	0.659	2	0.309	4	0.636	2	0.608	2	0.355	5	0.513	3
ECCAS												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Angola	0.002	11	0.287	8	0.335	11	0.430	10	0.613	8	0.341	11
Burundi	0.305	3	0.427	6	0.826	1	0.532	3	0.306	11	0.485	8
Cameroon	0.229	6	0.314	7	0.627	8	0.532	3	0.731	4	0.495	6

Central Afr	0.258	5	0.824	1	0.829	2	0.532	3	0.571	10	0.607	2
Chad	0.206	7	0.228	11	0.744	6	0.532	3	0.698	6	0.492	7
Congo Dem.	0.195	8	0.673	2	0.600	9	0.532	3	0.609	9	0.526	4
Congo Rep.	0.758	1	0.424	5	0.757	4	0.929	1	0.748	2	0.728	1
Equa Gui	0.151	9	0.287	9	0.548	10	0.532	3	0.711	5	0.455	10
Gabon	0.093	10	0.228	10	0.746	5	0.532	3	0.741	3	0.481	9
Rwanda	0.295	4	0.525	3	0.646	7	0.632	2	0.659	7	0.558	3
Sao Tome	0.338	2	0.477	4	0.782	3	0.137	11	0.856	1	0.521	5
ECOWAS												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Benin	0.231	10	0.827	5	0.743	9	0.947	3	0.908	6	0.789	4
Burkina Faso	0.349	6	0.978	1	0.757	7	0.926	4	0.914	4	0.838	1
Cabo Verde	0.005	15	-		0.576	13	0.153	15	0.820	9	0.329	15
Cote d'Ivoire	0.625	1	0.894	3	0.570	14	0.892	6	0.900	7	0.819	3
Gambia	0.495	3	0.634	9	0.859	2	0.494	14	0.742	10	0.637	10
Ghana	0.208	11	0.631	10	0.642	12	0.782	9	0.583	13	0.600	12
Guinea	0.126	13	0.833	4	0.699	11	0.782	9	0.243	15	0.551	13
Guinea-Biss	0.186	12	0.581	11	0.824	3	0.962	2	0.921	3	0.742	7
Liberia	0.020	14	0.753	7	0.862	1	0.691	13	0.714	11	0.644	8
Mali	0.560	2	0.558	12	0.762	5	0.913	5	0.909	5	0.763	5
Niger	0.272	9	0.897	2	0.757	6	0.998	1	0.935	1	0.832	2
Nigeria	0.293	7	0.329	13	0.322	15	0.718	12	0.650	12	0.504	14
Senegal	0.370	5	0.187	14	0.705	10	0.884	7	0.923	2	0.641	9
Sierra Leone	0.287	8	0.818	6	0.748	8	0.749	11	0.493	14	0.634	11
Togo	0.381	4	0.717	8	0.767	4	0.832	8	0.886	8	0.751	6
IGAD												
Countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Djibouti	0.394	3	0.686	2	0.504	3	0.516	3	0.862	4	0.592	2
Eritrea	0.092	7	0.344	6	0.497	4	0.516	3	0.915	2	0.473	5
Ethiopia	0.351	5	0.399	3	0.342	7	0.516	3	0.741	6	0.470	6
Kenya	0.343	6	0.241	8	0.389	6	0.331	8	0.758	5	0.412	7
Somalia	0.379	4	0.380	4	0.497	4	0.516	3	0.915	2	0.538	4
South Sudan	0.424	2	0.726	1	0.876	1	0.586	2	0.927	1	0.697	1

Sudan	0.088	8	0.298	7	0.224	8	0.516	3	0.502	7	0.326	8
Uganda	0.658	1	0.373	5	0.645	2	0.632	1	0.466	8	0.555	3
SADC												
countries	Trade	Rank	Mobility	Rank	Sync	Rank	Finance	Rank	Inflation	Rank	Overall	Rank
Angola	0.081	12	0.421	9	0.709	11	0.810	8	0.730	12	0.544	11
Botswana	0.513	3	0.800	3	0.642	12	0.894	4	0.886	4	0.748	4
Congo Dem.	0.299	8	0.170	11	0.774	8	0.866	6	0.768	11	0.563	9
Lesotho	0.496	4	0.800	2	0.897	1	0.925	1	0.890	3	0.800	2
Madagascar	0.052	13	-	-	0.881	2	0.586	13	0.502	15	0.390	14
Malawi	0.272	10	0.775	5	0.873	3	0.793	9	0.508	14	0.642	8
Mauritius	0.034	14	0.054	14	0.573	13	0.585	14	0.869	5	0.415	13
Mozambique	0.281	9	0.738	6	0.800	7	0.860	7	0.898	2	0.714	7
Namibia	0.599	2	0.779	4	0.709	10	0.792	11	0.862	6	0.749	3
Seychelles	0.007	15	0.104	13	0.409	15	0.502	15	0.845	8	0.369	15
South Africa	0.460	5	0.251	10	0.478	14	0.756	12	0.854	7	0.554	10
Swaziland	0.316	7	0.859	1	0.807	5	0.793	9	0.844	9	0.725	6
Tanzania	0.138	11	0.151	12	0.749	9	0.915	3	0.543	13	0.486	12
Zambia	0.442	6	0.680	8	0.805	6	0.925	2	0.824	10	0.732	5
Zimbabwe	0.752	1	0.730	7	0.864	4	0.893	5	0.962	1	0.838	1
UMA												
countries	Trade	Rank	Mobility	Rank	Synchro	Rank	Finance	Rank	Inflation	rank	Overall	Rank
Algeria	0.380	2	0.281	4	0.281	5	0.840	2	0.230	5	0.402	5
Libya	0.195	5	0.585	2	0.485	4	0.881	1	0.913	1	0.612	2
Mauritania	0.225	4	0.338	3	0.754	1	0.507	5	0.598	4	0.484	4
Morocco	0.347	3	0.220	5	0.506	3	0.743	3	0.865	2	0.536	3
Tunisia	0.960	1	0.603	1	0.577	2	0.743	3	0.614	3	0.699	1

Sources: authors

Figure 2: Indexes evolution over time



Sources: authors

Table 7: sub-indexes and overall index 2012-2017 (average) with softmax normalization

Sources: authors

RECs	Trade	Mobility	Synchronicity	Finance	Inflation	Overall	Rank
CEN-SAD	0.483	0.506	0.514	0.529	0.525	0.588	3
COMESA	0.489	0.488	0.511	0.522	0.519	0.587	4
EAC	0.498	0.503	0.501	0.519	0.503	0.513	7
ECCAS	0.483	0.494	0.512	0.494	0.511	0.517	6
ECOWAS	0.487	0.513	0.515	0.514	0.517	0.672	1
IGAD	0.491	0.483	0.457	0.501	0.522	0.508	8
SADC	0.500	0.497	0.519	0.518	0.523	0.623	2
UMA	0.495	0.494	0.502	0.618	0.526	0.547	5
Average	0.491	0.497	0.504	0.527	0.518	0.570	-