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Financial integration and growth correlation in Sub-Saharan Africa

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Résumé

Dans ce papier, nous nous intéressons à la corrélation entre la croissance économique et l'intégration financière dans les pays d'Afrique sub-saharienne. Cette dernière est appréhendée à l'aide deux types d'indicateurs : des variables de partage de risque et des variables mesurant la convergence des marges d'intermédiation et des taux de rendement dans le secteur bancaire. Au-delà de la croissance, nous nous intéressons également aux effets sur le cycle économique en tenant compte des effets asymétriques susceptibles d'être observés selon que l'économie évolue en phase d'expansion ou de récession. Cette distinction permet, notamment, de tenir compte des coûts associés à l'absence de synchronisation entre les cycles économiques nationaux. Nos estimations conduisent à trois résultats importants. Premièrement, l'intégration financière explique peu les corrélations entre économies durant les phases de récession. Le deuxième résultat intéressant est que l'intégration financière conduit à des phénomènes de polarisation (ou de spécialisation), plutôt qu'à une convergence des Pib durant les périodes de croissance. Ce résultat vaut, quelle que soit la variable d'intégration financière retenue (partage des risques ou convergence des prix dans le secteur bancaire. Troisièmement, l'intégration mesurée par des indicateurs de prix rend mieux compte de l'intégration financière que les variables de partage de risque.

Mots clefs: Intégration financière, Corrélation des cycles, Afrique sub-Saharienne
Codes JEL Classification : F36, G21, O16

ABSTRACT

This paper studies the relationship between financial integration and the correlation of GDP growth in sub-Saharan African countries. The dynamic nature of financial integration is first emphasized in order to account for both effects of risk sharing on the one hand and intermediation margins and bank rates of return on the other hand. In addition to considering simple variables of growth correlation, we exploit the multiple dimensions of business cycle synchronization first by allowing for asymmetric dynamics during expansion and recession, and by further acknowledging the importance of de-synchronized fluctuations to allow for the costs and benefits of financial integration for an individual country. Our main results are threefold. First, it seems that the financial integration variables are not informative about the likelihood of observing co-movements between the recession phases (after controlling for different variables influencing the business cycle). Secondly, our estimates portray a situation in which both risk-sharing and the convergence of price-based indicators lead to economic specialization rather than to a convergence of the expansion phases. Thirdly, the price-based indicators provide better information than risk-sharing variables to account for business cycle synchronization.

Keywords : Financial integration, Business cycle correlation, Sub-Saharan Africa

JEL Classiffication : F36, G21, O16

Résumé non technique

Ce papier s'intéresse à la question de l'intégration financière dans les deux zones Franc d'Afrique de l'Ouest et Centrale (UEMOA et CEMAC) depuis 2000 et son impact sur la convergence des économies. La situation de ces deux zones est comparée à celle d'autres unions économiques, qui n'ont pas de monnaie en commun. Plus spécifiquement, il s'agit de savoir si, le fait que les pays de la zone Franc forment une union monétaire est un facteur qui favorise ou non l'intégration financière.

Cette question présente plusieurs intérêts.

D'un point de vue théorique, il s'agit de vérifier si l'on peut appliquer la théorie des zones monétaires optimales endogènes à ces pays. En cas de réponse positive, l'intégration des marchés financiers régionaux apparaitrait comme un moyen d'absorber les chocs asymétriques que subissent les économies.

D'un point de vue empirique, il existe une abondante littérature sur le caractère optimal ou non des pays de l'UEMOA et de la CEMAC, mais beaucoup de travaux se réfèrent, soit à l'approche originale des ZMO de Mundell et McKinnon, soit au rôle du commerce lorsque les travaux retiennent le cadre d'analyse des ZMO endogènes. Les travaux abordant la question des ZMO endogène à partir de la question de l'intégration financière sont plus rares.

Du point de vue de la politique économique, la question de l'intégration financière est fondamentale sur deux aspects. D'une part, elle conditionne le bon fonctionnement de la politique monétaire en fonction des canaux qu'elle permet d'activer en cas de chocs. D'autre part, une intégration financière incomplète peut être un reflet de l'insuffisance du dispositif réglementaire actuellement en vigueur dans la zone Franc pour favoriser cette intégration.

Au-delà de l'examen du degré d'intégration financière des pays de la zone Franc, nous cherchons à savoir dans quelle mesure l'absence d'intégration financière complète peut expliquer que les cycles économiques des pays ne sont pas synchronisés (donc que les chocs sont asymétriques). Cette question est importante pour la raison suivante. Si la littérature met en évidence le caractère asynchrones des cycles des pays de l'UEMOA et de la CEMAC, les facteurs mis en avant pour l'expliquer sont, le plus souvent, l'insuffisance du commerce intra-régional, l'hétérogénéité des structures économiques (reflétée par exemple par des sensibilités différentes aux termes de l'échange), des différences de nature géographique (certains pays sont enclavés et d'autres non). Il est rare de mettre en avant des facteurs financiers. Or, ces derniers peuvent également jouer un rôle.

L'originalité du papier par rapport aux études existantes sur le sujet est double.

Nous menons une analyse comparative avec d'autres pays africains formant une union économique, mais pas une union monétaire. Cela permet de voir si la monnaie est un élément central ou non pour expliquer l'intégration financière en Afrique.

Au-delà d'une analyse simplement descriptive (examen de l'évolution des indicateurs de dispersion ou de convergence des prix et des quantités), nous nous intéressons aux déterminants de l'intégration financière. Ces déterminants sont liés aux comportements de deux types d'acteurs : les banques (pour le marché interbancaire) et les gouvernements (à travers les variables de partage de risque). Nous tenons ainsi compte des ajustements financiers contra-cycliques des pays en expansion vers les pays en récession au sein de la zone Franc et des transferts qui atténuent les

L’analyse empirique porte sur la période de la dernière décennie (2000-2012). Les deux zones CEMAC et UEMOA sont comparés aux pays appartenant aux unions économiques suivantes : SADC, COMESA, EXOWAS (hors UEMOA), ECCAS (hors CEMAC).

1.- Introduction

The empirical contribution of this paper lies in exploring whether and to what extent financial integration, both regional and international, contributes to synchronizing the growth dynamics in Sub-Saharan Africa by using two alternative indicators of financial integration, risk-sharing variables and the convergence of price indicators in the banking sector. Simultaneously, we want to know whether there are significant differences between the countries that belong to a currency union and those which do not.

The issue of a stronger regional integration in Africa is receiving a renewed interest both from academics and policy makers, given the objective of a deepening of monetary, financial and economic integration by establishing strengthening monetary and economic unions (see Table A1 in Appendix). An important question is whether a common monetary policy will be efficient in absorbing the negative economic effects of asymmetric shocks. Theoretically, this could be achieved through several channels: i) trade deepening (by reducing transportation costs and eliminating regulatory and tariff barriers to trade), ii) increasing mobility of factors of production, as well as price and wage flexibility, iii) coordinating of fiscal and macroeconomic structural policies in order to keep the macroeconomic fundamentals as close as possible (nominal convergence), iv) financial integration. The literature has discussed extensively the issue as whether these are prerequisite conditions for a currency union to be an optimum currency area (OCA) or whether sharing a single currency sets the forces that bring to a deepening of trade, market competition within the union, policy convergence and a higher integration of the financial and banking sectors. Be the above factors exogenous or endogenous to a currency union, what turns out to matter from the literature is that they are indispensable to sustain monetary unification, because in any case they yield to a higher correlation of economic growth rates and to a higher synchronization of business cycles. They are important to minimize the individual costs of relinquishing national control over the exchange rate to facilitate economic adjustment to exogenous shocks.

Our paper focuses on the role of financial integration as a stimulating factor to enhance the correlation of economic growth in sub-Saharan Africa. The measurement of financial integration itself has a multidimensional aspect. A first category of variables consists of price-based indicators that capture market integration (a convergence of financial prices, interest rates, equity and bond returns). A second set of indicators focuses on cross-border transactions in different market segments (interbank cross-border transactions and holdings of public debt, foreign direct and portfolio investment, saving and investment). Thirdly, beyond price- and

quantity-based variables, financial integration is also revealed by the degree of harmonization of legal and regulatory frameworks and coordination of macroeconomic policy and banking supervision by member states or through the creation of regional institutions.

These measures of financial integration are however not all available in the case of African countries, which score the lowest among developing countries in terms of financial development measured by overall financial deepening (M2 or Credit/GDP) and, in particular, financial market development[2]. Absent such enabling conditions for the formation of regional financial markets, priority has been so far given to financial development and integration, particularly on growth, over the study of financial integration and its consequences on economic convergence[3].

This paper explores the latter issue in order to see whether we can provide an argument in favor of, or against the regional and international integration of Sub-Saharan African financial markets and sectors (just as policymakers have provided arguments in favor of higher trade integration and of a strengthening of regional macroeconomic policies)[4]. To our knowledge, this paper is the first attempt to discuss such an issue for the Sub-Saharan African countries. Indeed, so far the literature has focused on one the following three issues : i) the degree of financial integration in Sub-Saharan African through an empirical testing of risk-sharing models, ii) an examination of the source of the low financial development and the policy challenges ahead, iii) the symmetry/asymmetry of macroeconomic shocks and business cycle synchronization. This paper goes beyond by investigating whether more financially integrated African countries would display more correlated growth dynamics. Our question is also whether a higher financial integration in different African sub-regions would be that important to make the countries' business cycle more synchronized over time.

To do this, one first needs to define financial integration. Given the low level of development of the African financial markets, we have very few price- and quantity-based indicators available. Data availability leads us to refer to three types of indicators throughout the rest of

[2] See Beck et al. (2011), Montford et al. (2013),

[3] An abundant literature addresses the issue of financial integration and the developments of financial markets and/or the economic development of the sub-Saharan African countries, but not on economic convergence. See, amongst others, Frey and Volz (2011), Sy (2007), Wakeman-Linn and Wagh (2008).

[4] This has yielded the formation of economic and trade unions (WAEMU, ECOWAS, EAC, SADC, etc).

this paper: i) bank-based indicators, ii) a set of indicators capturing the absorption of shocks through consumption smoothing and iii) a variable of reserve pooling.

Our motivations for choosing a bank-sector based indicator of financial integration are threefold. First, the financial sector in Africa is dominated by banks and empirical evidence has been provided showing that banking efficiency promotes financial development in Sub-Saharan Africa[5]. Moreover, the issuance of equity and bonds is irregular, thereby raising the issue of availability of data[6]. Secondly, progress has been made towards reducing the costs associated with interbank cross-border payments. For instance, the WAEMU and CAEMC have adopted, respectively in 2004 and in 2007, Real Time Gross Settlement systems which allows interbank transfers, an interbank clearing system (SICA, SYSTAC and SYGMA) and an interbank payment system for bank cards (GIM ,SMI)[7]. The WAMZ is currently finalizing a project of upgrading the existing RTGS system between Ghana and Nigeria to other three member countries (the Gambia, Guinea and Sierra-Leone) to facilitate the use of banking services across countries. The medium-term outcome is a deeper integration of the financial system. In Eastern Africa, South Africa and the EAC (East African Community) have harmonized their accounting standards to facilitate reporting principles when investing cross-border.

A third motivation for adopting bank-based indicators is the rapid expansion of pan-African bank groups and, in parallel, the volume of cross-border transactions between African banks[8]. As an illustration, four African banks (Bank of Africa, Ecobank, Stanbic, United Bank of Africa) account for one-third of total deposits in at least 13 countries. The implication should be narrowed interest rate spreads in the credit markets. In this paper, we propose indicators of the convergence of commercial banks' intermediation margins (Net intermediation margin) and financial performance (ROE, ROA), based on time-varying sigma convergence.

The second type of indicator relevant for our study is derived from risk-sharing models of consumption smoothing originally applied to the developed countries and widely used in the

[5] See Beck (2015), Beck and Gull (2014), Kablan (2010), Rousseau and D'Onofrio (2013)

[6] See, Diouf and Boutin-Dufresne (2012) for an illustration.

[7] SICA : Système Interbancaire de Compensation Automatisé (WAEMU), SYSTAC: Système de Télécompensation en Afrique Centrale (CAEMU), SYGMA : Système de gros montant automatisé (CAEMU), GIM : Groupement Interbancaire Monétique (WAEMU), SMI :Système de Monétique Interbancaire (CAEMU).

[8] See Montfort et al. (2012).

literature. A major difference with the traditional literature is our assumption that the contributions of the different factors in smoothing shocks to GDP are time-varying. Indeed, depending upon the changing cross-border linkages across time, the smoothing can operate through different factors of unequal importance (factor income, capital depreciation, saving, etc). Moreover, shock smoothing is not a continuous phenomenon and can alternate with periods of substantial volatility.

Our analysis is based on a panel of 31 sub-Saharan African countries over the period from 2000 to 2012 (see Table 1 for a list of countries).

INSERT TABLE 1 ABOUT HERE

The remainder of the paper proceeds as follows. Section 2 presents our variables of financial integration. Sections 3 and 4 respectively presents the empirical framework and the data. Our main comments of the results are contained in Section 5. Section 6 concludes.

2. Financial integration in Sub-Saharan Africa

2.1. Risk-sharing variables

It has become common wisdom in the literature to examine financial integration by investigating cross-country risk-sharing within a group of countries. Such a methodology, originally proposed for the industrialized countries[9], has been applied to Sub-Saharan African countries. The idea is the following. Idiosyncratic shock smoothing can be achieved by risk-sharing among countries through several channels of international income insurance: a repatriation of income earned on capital assets owned abroad or a reduction of capital held abroad, remittances from residents living abroad (both accounts for net factor income from abroad), international transfers, interregional credits.

Formally, the risk-sharing assumption implies a de-correlation between consumption and production, which amounts to estimating the following equation where $(1-\rho^{NP})$ captures the degree of risk-sharing:

$$\Delta logC_{it} = \delta^{NP} + \rho^{NP}\Delta logGDP_{it} + \varepsilon_{it,} \quad 0 \leq \rho^{NP} \leq 1 \qquad (3)$$

where C_{it} is aggregate consumption in country i at time t, ε_{it} is an error term. Using a national account approach, total risk-sharing can be decomposed in four components representing

[9] See Asdrubali et al. (1996), Brennan and Solnik (1989), Sorensen and Yosha (1998) for the seminal papers.

respectively the insurance of income through net factor income from abroad, net fiscal transfers interregional credits, capital appreciation/depreciation. Let us consider the following national accounts identities: GNI = GDP + net income from abroad, national income (NI) = GNI-capital depreciation, disposable national income (DNI) = NI+international transfers, consumption (C) = DNI – net saving. Based on these identities, the different components of risk-sharing are measured by estimating the systems of equations that consist of (3) and the following equations:

$$\Delta logGDP_{it} - \Delta logGNI_{it} = \delta^{FR} + \rho^{FR}\Delta logGDP_{it} + \varepsilon_{it}^{FR}, \quad (4)$$

$$\Delta logGNI_{it} - \Delta logNI_{it} = \delta^{D} + \rho^{D}\Delta logGDP_{it} + \varepsilon_{it}^{D}, \quad (5)$$

$$\Delta logNIP_{it} - \Delta logDNI_{it} = \delta^{T} + \rho^{T}\Delta logGDP_{it} + \varepsilon_{it}^{T}, \quad (6)$$

$$\Delta logDNI_{it} - \Delta logC_{it} = \delta^{S} + \rho^{S}\Delta logGDP_{it} + \varepsilon_{it}^{S}, \quad (7)$$

The upper indices on the coefficient and the residual terms refers to factor revenue (FR), Capital depreciation (D), International Transfers (T) and saving (S). The coefficients ρ^{FR}, ρ^{D}, ρ^{T}, ρ^{S} measure the fraction of asymmetric shocks that are smoothed by factor revenues, capital depreciation, international transfers and saving. ρ^{NP} is a measure the proportion of shocks not smoothed. The five coefficient sum to 1. They are not necessarily positive, since the idiosyncratic shocks on the GDP can amplify the volatility of consumption (de-smoothing).

In the literature risk-sharing indicators are often considered as a measure of the degree of financial integration within a group of countries, though they are based on data capturing financial flows with the rest of the world. However, this interpretation presents a limitation when applied to the African countries because financial flows do not occur as in a "gravity" model and income smoothing has occurred mainly with the rest of the world and not necessarily within the monetary and/or economic unions. Risk-sharing is more likely to tell us something about whether these countries smooth the shocks on consumption through an easier borrowing from the bilateral/multilateral donors, through remittances from diasporas leaving in African and non-African countries or through domestic saving.

Unlike previous studies focusing on risk-sharing in sub-Saharan Africa[10], we assume that the coefficients are time-varying and we estimate them using a rolling window approach to assess their possible instability over time. The reason is that the GDP series from Sub-Saharan African countries exhibit a highest variability than those of the industrialized countries because their

[10] See Nnyanzi (2013), Tapsoba (2010), Yehoue (2011).

economic junctures are driven by shocks that are more volatile. Accordingly, there may be some biases in the estimations under the assumption that the variance of the GDP is constant over time. To take this into account, we build on a rolling window estimate with a fixed width of 10 years beginning in 1970 until 2012. Thus the estimated risk-sharing coefficients for 2000 are obtained through an estimate of the system over the period 1990-2000, the coefficients for 2001 are obtained by the estimation over 1991-2001 and so forth till 2000-2012. We use seemingly unrelated regressions (SUR) with iterated weighted least squares. Common shocks are captured by time fixed effects in the regressions.

Tables 2a to 2d reports the estimates of the smoothing components related to factor income, transfers and saving, together with the degree of smoothing.

INSERT TABLES 2A, 2B, 2C AND 2D ABOUT HERE

The estimates suggest that the smoothing effects have been changing over time and heterogeneous across subgroups of countries.

In WAEMU (Table 2a) risk-sharing has been little at work till the period 1996-2006 with only 5% of the shocks absorbed through factor income. Then, saving has played a heavy influence accounting for roughly 30% to 40% on average of shock smoothing. This portrays a situation of non-integration of the WAEMU with the rest of the world. In the sequel of the paper, we ask the following question: does this lack of risk-sharing dynamics cause a weak co-movement between the WAEMU countries' growth rates?

The picture seems to be rather different for SADC (Table 2b) where the degree of risk-sharing is stronger than in WAEMU and for a longer time period (since 1992). Aggregate risk is shared equally through income factor and saving. In our opinion, the role of factor income in smoothing the asymmetric shocks can be explained by the fact that the group of countries that are members of SADC consists of middle income countries and some of them play a pivotal role in explaining factor and capital mobility within the sub-region (Botswana, South Africa, Mauritius). Moreover the higher risk-sharing could be explained by the fact that the "core" countries in SADC have a high integration with the rest of the world. And the international channel is a vector of stronger integration within the regional group.

In the CAEMC (Table 2c), the smoothing of the negative impact of the idiosyncratic shocks occurs through factor income and transfers with an intensity which is as high as in the SADC (though shock smoothing has ceased since 2009). Since the beginning 1990s the main smoothing factor has been factor income, in spite of a low degree of labor mobility within the

region. One can wonder whether there is an "oil effect" here, since income transfers are principally related to oil income transfers (net transfers from oil companies).

For the remainder of our sample (which includes countries from ECOWAs and EAC), no evidence of risk-sharing smoothing is found.

2.2. Price-based indicators related to the banking sector

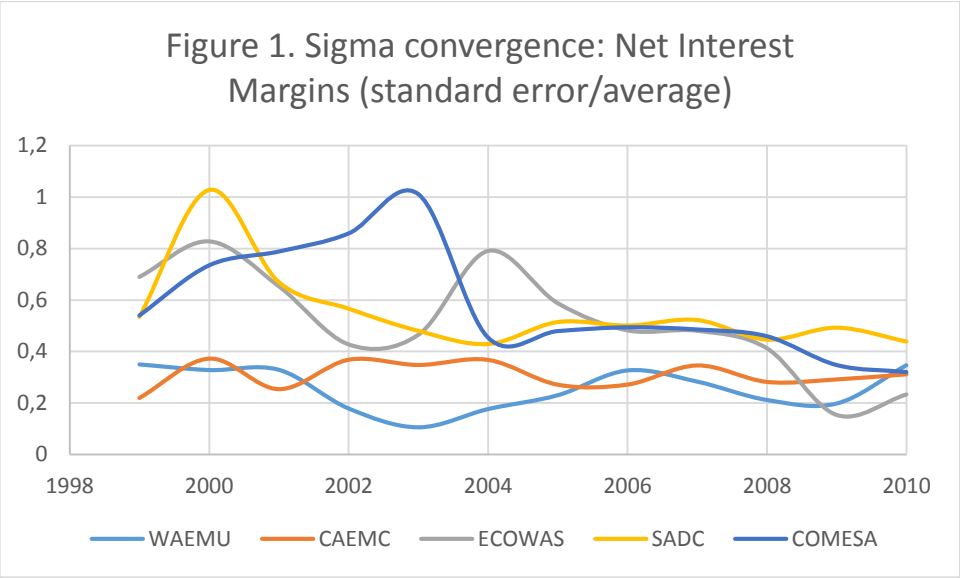
Given the low level of financial development, we rely on a second set of financial integration indicators based on data from the banking sector. In this paper, we propose indicators of the convergence of commercial banks' intermediation margins (Net intermediation margin) and financial performance (ROE), based on time-varying sigma-convergence. Net intermediation margins are defined as the accounting value of bank's net interest revenue as a share of its interest-bearing (total earning) assets while bank ROE is the average Return on Assets (Net Income/Total Equity). Data are taken from the World Bank Financial structure dataset. We assume that convergence of these indicators over time could be seen as signaling a greater integration.

Following the methodology proposed by Sy (2006) to estimate the degree of integration, we build a time series of the cross-sectional dispersion in net interest margins and ROEs. At each period *t*, we calculate the standard deviation of these variables across countries belonging to the same group. The formula is the following:

$$\sigma_t = \left[\frac{1}{n-1}\sum\left(X_{i,t} - \bar{X}_t\right)^2\right]^{\frac{1}{2}} \quad (8)$$

where *i* represents an individual country and *X* the studied variable (NIM or alternatively the ROE). This variable is normalized by the time average. Therefore, we compute the dispersion coefficients.

The main advantage of using cross-sectional dispersions is that, contrary to correlations, they can be calculated at each point in time. When series are highly correlated, as they should be in integrated markets, variables will generally move in the same direction, and cross-sectional dispersion will be low. Alternatively, dispersion will be high when studied variables in different countries drift apart.



In Figure 1, for purpose of illustration, we present the cross-sectional and time-series patterns of NIMs for the different groups of our sample. The graph suggests that net interest margins have globally converged over the period in ECOWAS, SADC and COMESA while the evolution is more contrasted in the franc zone.

The evolution in ECOWAS, SADC and COMESA may be related to an increased competition between more efficient banks as reduced market concentration help lower interest margins in SSA (Ahokpossi, 2013).

Two facts are of interest concerning the franc zone: (1) low levels of sigma-convergence show high similarity in banks' margins among these countries and (2) there is no apparent sign of deeper integration over the last decade.

3. Financial integration and growth correlation: empirical framework

This section examines the effectiveness of financial integration in Sub-Saharan Africa in influencing growth correlation within different subgroups of countries. We do this by considering three models.

3.1. Model 1

In the first model, the endogenous variable is the absolute value of the domestic GDP growth relative to the growth rate of the aggregate GDP within each regional subgroups as defined in Table 1 (SADC, WAEMU, CAEMC and others). The estimated model is as follows:

$$|g_{it} - rg_{it}| = \alpha + \sum_{j=1}^{4} \beta_j \, Fin_{it}^{j} \quad + \delta control_{it} + \varepsilon_{it}^{1} \qquad (9)$$

where g_{it} and rg_{it} are respectively the domestic and regional GDP growth rates in country *I* at time *t*. Fin_{it} is a variable of financial integration (risk-sharing, sigma-convergence of Net interest margin or ROA), $control_{it}$ is a vector of control variables and ε_{it}^{1} is an error component. α, $\beta, \gamma,$ and δ are coefficients and vector of coefficients to be estimated. The coefficient of interest is β which can carries a positive or a negative sign. Assuming that an increase in the variable *Fin* signals a higher financial integration, a negative sign of β would indicate that a strengthened financial integration contributed to reduce the distance between the domestic and regional growth rate. A positive sign of β could be related to a "polarization effect" : Easier access to international or regional credit markets or higher risk-sharing across countries may induce firms in each countries to further specialize. If this hypothesis were to be true, financial integration would be a factor of decoupling of domestic economic growth rates. Equation (9) is estimated by considering both the growth rate of the real GDPs and those of real consumption. Model 1 is estimated using panel least squared accounting for white cross-section heteroscedasticity. In addition to unobserved heterogeneity (individual fixed effect), we introduced observed heterogeneity. Rather than splitting the sample into several sub-samples, we mutiply the financial integration variable by dummy variables representing country membership to SADC, WAEMU, CAEMC or other subgroups. We therefore have four coefficients for β.

3.2. Model 2

In the second model, the endogenous variable is the domestic GDP growth. We consider regional growth and financial integration variables as independent variables, in addition to their cross-term which is our variable of interest. Indeed, the interaction between these variables helps capturing the effects of financial integration on the correlation between domestic and regional growths. Again, the coefficients of these variables are indexed in order to account for heterogeneous effects across subgroups of countries. The estimated model is the following:

$$g_{it} = \alpha + \sum_{j=1}^{4} \beta_{1j}\, rg_{it}^{j} + \sum_{j=1}^{4} \beta_{2j}\, Fin_{it}^{j} + \sum_{j=1}^{4} \gamma_{j}\, rg_{it}^{j} \times Fin_{it}^{j} + \delta control_{it} + \varepsilon_{it}^{2} \quad (10)$$

All the variables have the same definition as in Equation (9). Assuming that an increase in *Fin* means a deeper financial integration, a positive value of γ would mean that a deeper financial integration reinforces the correlation between the domestic and regional GDP growth rates. Conversely a negative coefficient implies a lower correlation. We estimate this equation for both the GDP and consumption growth rates, using panel least squares estimation with White cross-section correction for heteroscedasticity.

3.3. Model 3

Our third model is based on indicators of business cycle synchronization. The measurement of business cycles for African economies raises several problems. First, unlike developed countries, it is still somewhat difficult to find reliable advanced indicators of the business cycles. Secondly, though industrialization has been on the rise over the last decade, many economies owe their economic growth to that of the primary and services sectors. Agricultural output is quite volatile and services are, for a significant part, informal. Therefore, extracting cycles from series of value added in the sector of services might lead to measurement errors. Thirdly, some series measuring the economic activity contains lots of breaks caused by "shocks" like social and political crises.

The paucity of data for the measurement of business cycles in Sub-Saharan Africa has led to adopt "agnostic" approaches based on the statistical filtering of national account data.

A great panoply of techniques exists to extract business cycle data. Widely used techniques include calculating the residuals of GDP series from different filters (HP, Baxter-King, unobserved components), using innovations from VAR models, considering lagged differences of GDP series, or adopting frequency domain approaches[11]. A limitation in the use of most of these techniques is that they grounded on an underlying parametric process, the assumptions of which may affect GDP estimates significantly.

[11] For recent applications to sub-Saharan African countries, see Coleman (2011), Hitaj et al. (2013), Mafusire and Brixiova (2013), Ssozi (2011)

For these reasons, we choose a method of dating the major peaks and troughs of domestic business cycles that differs from traditional approaches, using the Bry and Boschan algorithm, which has the advantage of being nonparametric and thereby not requiring any assumption on the underlying data generation process of the GDP series. Peaks and troughs are defined as local extrema. Using the following pair of binary variables$(\Lambda_t, \mathrm{V}_t)$, where $\Lambda_t = 1$ indicates a peak and $\mathrm{V}_t = 1$ indicates a trough, we retain the following definitions:

$$\Lambda_t = \mathbf{1}\{(GDP_t - GDP_{t-2}) > 0, (GDP_t - GDP_{t-1}) > 0, \\ (GDP_{t+2} - GDP_t) < 0, (GDP_{t+1} - GDP_t) < 0\} \tag{11a}$$

$$\mathrm{V}_t = \mathbf{1}\{(GDP_t - GDP_{t-2}) < 0, (GDP_t - GDP_{t-1}) < 0, \\ (GDP_{t+2} - GDP_t) > 0, (GDP_{t+1} - GDP_t) > 0\} \tag{11b}$$

where $\mathbf{1}(x)$ equals 1 if x is true and zero otherwise. This allows identifying the periods between a peak and a trough with a recession (or contraction) and periods between troughs and peaks as expansion phases.

The next question is how to measure business cycle synchronization. In the African context, the authors who have investigated this issue primarily rely on dynamic factor models[12]. However, as noted by Kemegue and Seck (2014), these approaches suffer the criticism of being benchmarked by backward looking aggregate factors. To avoid this problem, a non-parametric approach can be retained that also captures changing dynamics in the co-movements of the economic activities. We define an index of concordance of the domestic business cycle phases based on Harding and Pagan (2002). However, instead of considering only the fraction of time the countries are in the same cycle phase, we distinguish between situations in which the co-movements in GDPs occur during expansions and recessions. Moreover, we calculate indices of business cycle de-synchronization. In the following formula, a domestic country is represented by the index i, while j refers to the other countries in the group. For the latter, we adopt the following convention. If, in a given subgroup of countries, a majority of member countries is experiencing a recession (resp. an expansion), then the group is considered as being in recession (resp. in expansion). For each time t, we thus define the following index:

$$C_t^{ij} = S_t^i S_t^j + (1 - S_t^i)(1 - S_t^j) \tag{12}$$

[12] See Carmignani (2009), Houssa (2008)

To define business cycle synchronization, S_t^k is defined respectively as $\wedge_t^k$ and $\vee_t^k$ $(k = i, j)$. For business cycle de-synchronization, for a couple of variables (S_t^i, S_t^j), we set $S_t^i = \wedge_t^i$ (or $\vee_t^i$) and $S_t^j = 1 - \wedge_t^j$ (or $1 - \vee_t^j$).

After defining the indicators of business cycle, the econometric methodology adopted to study the role of financial integration is based on a Probit model. This choice can be motivated by data limitations: a precise extraction of expansion and recession phases from GDP series remains difficult, and, in spite of the development of more robust methodologies, highly controversial. For African GDP series, the issue is aggravated by the lack of benchmark to compute filtered series. Because GDP series follow irregular fluctuations rather than regular cycles, any measure of the latter should at best be considered as a proxy with a certain degree of uncertainty. To illustrate this, assume that y_i^{*E} and y_j^{*E} represent the "true" unobserved values of the GDP during expansion in countries i and j, and that the computed series using our filter are y_i^E and y_j^E. What we say is that, even if the latter series are "biased" estimates of their true value, the important point is the fact that the two economies are experiencing an expansion though we can't measure precisely how big the expansion is. A synchronization of the two business cycles can thus be described by the following notation (where C_t^{ij} is defined by Equation 2, when $S_t^i = \wedge_t^i$ and $S_t^j = \wedge_t^j$):

$$C_t^{ij} = \begin{cases} 1, & if\ y_{it}^{*E} > 0 \text{ and } y_{jt}^{*E} > 0 \\ 0, & otherwise \end{cases} \tag{13}$$

We proceed in a similar way to characterize synchronization during recession and asynchronous phases. It is worthy highlighting that since our endogenous variables are constituted of 0 and 1 they can be interpreted as probabilities.

Our main goal is therefore to assess the probability that the countries' GDP co-move or evolve in opposite directions in the expansion and recession phases of their business cycles. Specifically, we want to see whether the information content of our financial integration variables has predictive power in forecasting business cycle synchronization or de-synchronization.

As so far as the paper also pursues the objective of testing whether there are differences amongst different sub-groups of countries concerning the link between financial integration and the co-movement of business cycles, this grants us the possibility of adding observed heterogeneity to

the usual unobserved heterogeneity (as with models 1 and 2). The estimated equation is as follows:

$$\Pr(C_t^{ij} = 1/X) = \alpha + \sum_{j=1}^{4} \beta_j \, Fin_{it}^{j} \quad + \sum_{k=1}^{2} \gamma_k Res_{it}^{k} + \delta control_{it} + \varepsilon_{it}^{1} \qquad (14)$$

where Φ is either the standard normal CDF (probit). X is the matrix of observations of the independent variables. Using the estimate of β for each subgroup of countries, we compute the average partial effect of a higher degree of financial integration on the probability that a country evolves in a similar business cycle phases than the majority of the others in the same subgroup. The estimation of the coefficient is performed using the Mundlak-Chamberlain estimator on random effects model. This allows for a serial correlation in the unobserved variables determining the endogenous variable and relies on the assumption of a correlation between the fixed effects and the explanatory variables.

4. Data and definition of the independent variables

The period under examination cover the years from 2000 to 2012 and we consider 31 countries listed in Table 1. The real GDP and consumption data are taken from the Word Development Indicators (WDI) on a yearly frequency between 1980 and 2012. The independent variables are defined as follows.

4.1.- Financial integration variables

As a first variable of financial integration, we use an indicator of risk-sharing measured over the period 2000-2012. It is defined as follows. Based on our regression in Tables 2a to 2d, we consider the degree of smoothing of asymmetric shocks, taking the estimated value when the coefficients are statistically significant and putting a zero in the indicator when the coefficients is not significant. For the years 2000, we consider the coefficient obtained by the rolling regression over 1990-2000, for 2001 we take the results of the rolling regression over 1991-2011 and so forth. Accordingly, what is referred as the degree of risk-sharing in a given year corresponds to the degree of risk-sharing during the 10 years preceding and until this year. An increase in this indicator of risk-sharing therefore reflects a deeper financial integration.

We further consider the variables based on sigma-convergence of Net interest margin and ROA. This variables can be thought of as being "common" factors to the different subgroups of countries since they have only a time-varying dimension. Indeed, we consider the cross-section

standard error for each year between 2000 and 2012. Increased financial integration is therefore captured by a reduction in the cross-country standard error across time.

4.2. Control variables

While examining the role of financial integration, other factors make the economies more or less exposed to asymmetric shocks. Most studies investigating how the African economies could swift away from idiosyncratic shocks suggest that, in addition to deeper financial integration, their occurrence could be dampened by trade linkages, more convergent macroeconomic policies, national capacities to absorb common international shocks, and a reduction of structural asymmetries[13].

With respect to this, we consider the following control variables which capture separate channels through which the countries' cycles affect each other: terms of trade, real effective exchange rates, financial stress in the industrialized countries, changes in M2 over GDP ratio, inflation rate and public debt as share of GDP.

These variables have been shown to be robust determinants of growth accelerations and decelerations in the African countries[14]. Our question is whether they are equally effective as financial integration in explaining business cycle co-movements.

The dependence of the African countries to globalization is captured here by an index of financial stress indicator proposed by Balakrishnan et al. (2009). This control variable is important because a high vulnerability to international financial shocks could be a motivation to deepen financial integration of the African markets. Inflation and the debt over GDP ratio are taken as proxies of monetary and fiscal policies. M2 as share of GDP accounts for the degree of development of the banking sector, which is a pre-requisite for financial integration and could influence the effects of the bank-based indicator (defined above as the sigma-convergence of Banks' ROE). Terms of trade and the real exchange rate are retained to reflect possible asymmetric shocks to the trade balance.

All the data are taken from WDI over the period 2000-2012. In the Probit regression, some of the control variables are measured in terms of their deviations to the average of the subgroup:

[13] See Tapsoba (2009), Wang et al. (2007).

[14] For recent papers, see Mansajala and Papageorgiou, Sala and Trivin (2014), Tsangarides (2012).

terms of trade, real effective exchange rate, inflation rate, the ratio of debt over GDP, changes in the ratio of M2 over GDP.

5. Results: Does financial integration strengthen or weaken growth correlation?

5.1. Basic regression based on models 1 and 2

Tables 3a and 3b report the results of the estimates of Model 1, while Tables 4a and 4b set out the estimates of Model 2. In the first regression, the control variables, except the financial stress variable, are expressed in terms of deviations of a country's variable to the average of its regional group.

The results in both tables suggest that financial integration only rarely reduces the distance between the domestic countries' GDP growth and the regional GDP growth (the same for consumption growth). Indeed, the coefficients related to the different subgroups of countries are often statistically non-significant. Risk-sharing and the convergence of net interest margins reinforce the GDP growth correlation only in CAEMC.

From Table 4a and 4b, there is no strong evidence that a deeper financial integration strengthens the correlation between countries' GDP (or consumption) and the regional GDP (or consumption). Many coefficients γ are still insignificant. When statistically coefficients are obtained, the conclusions remains inconclusive in the sense that their sign varies across the subgroups of countries. For SADC, a deeper financial integration reduces the correlation between the GDP and consumption growth rates, while for CAEMC, the sign often turns to be positive.

INSERT TABLES 3a, 3b, 4a, 4b ABOUT HERE

Regarding the correlation between the GDPs, the estimates in Table 4a and 4b suggest that there exists an apparent strong link which is attributable to factors other than a deeper financial integration. Indeed, we see that, whichever variables used (risk-sharing, net interest margin, ROA), the estimated coefficients measuring the direct impact of a higher regional growth rate on domestic growth are often positive and statistically significant (an increase in the regional growth more than proportionally raises domestic growth).

All in all, the above findings do neither suggest a marked effect, nor an uncontroversial positive effect of financial integration (as measured by our variables of risk-sharing, net interest margin

and ROA) on the correlation of GDP and consumption growths. This could be explained by several factors. First, as shown in Table 2a to 2d, the degree of shock smoothing through risk-sharing is weak (in the best cases roughly less than half of the asymmetric shocks to consumption are smoothed). Secondly, though the recent years have witnessed substantial convergence of the regulatory frameworks in the financial sector, and in spite of the fact that the building of this sector is taking the form of a pan-African banking sector, some structural factors still hinder access to wider credit market: banking inclusion, high interest rates, and informational asymmetries. Thirdly, our measures of the proximity of the GDP growths are constructed based on the notions of correlation or distance of log changes of the GDPs and do not take into account the asymmetries inherent to the business cycles. The impact of financial integration on the GDP co-movements may vary according to the alternation between expansions and recessions and omitting this can lead to ambiguous interpretations. We now examine this issue by considering the results based on Model 3.

5.2. Financial integration and output correlation: the role of asymmetries

To study the effects of the asymmetric links between financial integration and the GDP growth co-movements, we consider the estimates based on our equation (14).

Before that, we briefly comment on our findings in Table 5. This table displays the number of coincidences found over the period 2000-2012 based on the index (12). These numbers are expressed in absolute value and as share of total observations. In the first two columns, the latter can be thought of as the degree of synchronization between the expansion and recession phases. In the other two columns it is relevant to see it as an indicator of de-synchronization.

Inspection of the values in the table indicates an evident co-movement of domestic countries' fluctuations vis-à-vis the others' during expansions (except in the other countries) and recessions. In SADC and WAEMU, the countries are more similar in times of expansions than during recessions. In CAEMC they seem to be synchronized with equal strength whatever the business cycle phases, reflecting the large weight of oil exports in their GDP or exports (albeit different according to the share of oil export in GDP). It is also noteworthy that the business cycle phases are less disparate (de-synchronized) when a sub-region evolves in expansion than in recessions. Indeed, we see that the fractions of coincidences in the fifth column are generally higher than in the fourth column. The asynchronous connections between the business cycle

phases thus suggest that the positive shocks hitting a group of countries have been more idiosyncratic than the negative shocks occurring in bad times (during recessions).

INSERT TABLE 5 ABOUT HERE

Tables (6a) to (6d) present the results from estimating Equation 14 when we distinguish between groups of countries according to their membership to economic unions: SADC, WAEMU, CAEMC and others. We report the average partial effects estimated using the Chamberlain-Mundlack estimator on a random effect model.

The financial integration variables and the control variables have a very low power in predicting the strength of recessions across subgroups of countries. Indeed, based on the computation of the percentage of correct predictions of the endogenous variable in Tables 6b and 6d, we obtain a goodness-of-fit which is extremely small (in the best case, 12% and very often only 1% and 2%). The model appears to predict better the occurrence of co-movement in the GDP growth during expansions (as suggested by Table 6a). The predictability accuracy is also improved when the endogenous variable is the degree of de-synchronization between a country's expansion and the other countries' recession (Table 6c). We therefore focus our comments on the results of Tables 6a and 6c.

INSERT TABLES (6a) to (6d) ABOUT HERE

In Table 6a, the regression with net interest margin as the financial integration variable outperforms the other two models with risk-sharing and ROA variables, since 32% of the endogenous variable is correctly predicted against respectively 11% and 12% for the other two models. The same feature is observed in Table 6c where the number of correct predictions jumps to 41%. Comparing Tables 6a and 6c, the regressions with net interest margin and ROA suggest that financial deepening weakens the links between outputs during expansions and increases the de-synchronization between the business cycles when a country experiences an expansion while the neighbors are in recession (the coefficients for SADC, WAEMU and CAEMC are positively signed in Table 6a and carry a negative sign in Table 6c). This finding plays in favor of the assumption of "polarization within the region". The heterogeneity of the economic fundamentals between countries leads to loan activities that are more risky in some countries than in others.

When financial integration is measured by risk-sharing variables, during expansions a higher risk sharing does feed back into higher output correlation in WAEMU and CAEMC (the

coefficients are positively signed and statistically significant in Table 6a). However, this happens only if the sub-region as a whole is also experiencing an expansion. When a country experiencing an expansion is out-of-phase with the neighbors, the coefficients turn to be negative (see Table 6c). This observation is also in line with the hypothesis of polarization of economic activities within the two sub-regions. For WAEMU and CAEMC, one explanation may be that the domestic financial markets are shallow. For SADC, in line with conventional findings in frontier and emerging economies, what seems to be at play is called "asset substitutability" with a concentration of capital flows to the richest countries of the sub-group (South Africa, Botswana, and Mauritius). Since financial investment is likely to grant higher returns in these countries, it makes the sub-group more exposed to asymmetric shocks.

All in all, our main and new findings regarding the role of financial integration on business cycle synchronization point to a higher "polarization" during a process of higher financial integration. This is in line with the theoretical literature providing an argument suggesting that risk-sharing across countries induces productive specialization, thereby increasing the vulnerability to their own idiosyncratic shocks. This argument, usually evoked for developed countries, may also hold for the African countries whose production activities have often been substitutable rather than complements (though they are members of economic unions), particularly when the risk sharing is analyzed vis-à-vis the rest of the world

Concerning the control variables, the results suggest that smoothing through positive shocks on the terms of trade is not substantial (non-significant coefficients in Table 6a), but can sometimes de-correlate the cycles (positive and statistically significant estimates in Table 6c). Changes in M2 to GDP ratio (compared to the average changes in the neighbor countries) is found to exert a systematically significant role, both on business cycle synchronization and de-synchronization.

The other control variables seem to be informative of the dynamics of the endogenous variables in Table 6c. Shocks on the real exchange rate increases the de-synchronization of the business cycle phases,

4.-Conclusion

The question as whether financial integration (both within the Sub-Saharan African countries and between these countries and the rest of the world) could be a channel for higher economic integration in Sub-Saharan Africa (as measured by the correlation of output/consumption

growth and index of business cycle synchronization) is acquiring key importance in the policy circles. No studies so far have examined this question empirically, probably due to the paucity of the development of the African financial markets (though progress is on the rise). This paper tries to fill this gap. Our innovations consists in *i)* tackling this issue by considering different countries groupings (to account for observed heterogeneity), *ii)* building on intuitions by disentangling situations whereby synchronization occurs in periods of recessions and expansion and by also taking into account the impact of financial integration on the de-synchronization of the business cycles, *iii)* quantifying the potential for time-varying risk-sharing and price-based indicators of convergence.

Our study suggests that using the correlation between the GDP growths or a distance variable between domestic and regional GDP growth is not necessarily a good way of tackling this issue, as the financial integration variable appears to be uninformative in the regression. It is better is considering an indicator of business cycle synchronization and de-synchronization, specifically to disentangle between the influence of risk-sharing and price-based indicators during times of expansion and recessions.

Our main results are threefold. First, it seems that the financial integration variables are not informative about the likelihood of observing co-movements between the recession phases (after controlling for different variables influencing the business cycle). Secondly, our estimates portray a situation in which both risk-sharing and the convergence of price-based indicators lead to economic specialization rather than to a convergence of the expansion phases. Thirdly, the price-based indicators provide better information than risk-sharing variables to account for business cycle synchronization.

Appendix

1.-Projects of monetary unions in Sub-Saharan Africa

INSERT TABLE A1 ABOUT HERE

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Table 1. Countries in our sample

South Africa (S,SADC)	Tanzania (S, others)	Togo (W, WAEMU)	Sierra Leone (W, others)
Angola (S, SADC)	Uganda (S, others)	Cameroun (W, CAEMC)	
Botswana (S, SADC)	Zambia (S, SADC)	Central Afr. Republic (W, CAEMC)	
Kenya (S, others)	Zimbabwe (S, SADC)	Chad (W, CAEMC)	
Lesotho (S, SADC)	Benin (W, WAEMU)	Congo (W, CAEMC)	
Malawi (S, SADC)	Burkina Faso (W, WAEMU)	Equatorial Guinea (W, CAEMC)	
Mauritius (S,SADC)	Côte d'Ivoire (W, WAEMU)	Gabon (W, CAEMC)	
Mozambique (S,SADC)	Mali (W, WAEMU)	The Gambia (W, others)	
Namibia (S, SADC)	Niger (W, WAEMU)	Ghana (W, others)	
Swaziland (S, SADC)	Senegal (W, WAEMU)	Nigeria (W, others)	

Note: S,W means Southern and Western. SADC: southern African Development Community, WAEMU: West African Economic and Monetary Union, CAEMC: Central African Economic and Monetary Community, others: Uganda, Tanzania, Kenya, the Gambia, Nigeria, Ghana, Sierra Leone. Due to data unavailability and sample size, no EAC group was created.

Table 2a. Income smoothing by national account components: 2000-2012 (WAEMU)

WAEMU

	Degree of smoothing	Factor income		Tansfers		Saving	
	Coeff.	Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
1990-2012	0,25	0,03	1,1	-0,02	-0,35	0,25**	3,66
1990-2000	0	0,04	0,94	-0,04	-0,48	0,13	1,5
1991-2001	0,05	0,05**	2,02	-0,08	-0,95	0,13	1,55
1992-2002	0,05	0,05**	2,01	-0,07	-0,83	0,07	0,82
1993-2003	0,05	0,05*	1,65	-0,07	-0,84	0,16*	1,8
1994-2004	0,07	0,07**	2,38	-0,03	-0,33	0,13	1,39
1995-2005	0	0,04	1,44	-0,04	-0,48	0,09	0,97
1996-2006	0,04	0,04*	1,77	-0,04	-0,52	0,13	1,36
1997-2007	0,26	0,05*	1,98	0,03	0,53	0,21**	2,3
1998-2008	0,31	0,04	0,82	-0,02	-0,45	0,31***	3,42
1999-2009	0,41	0,04	0,84	-0,01	-0,2	0,41***	4,21
2000-2010	0,49	0,03	0,68	-0,02	-0,21	0,49***	4,4
2001-2011	0,39	0,03	0,65	-0,02	-0,24	0,39***	3,18
2002-2012	0,44	-0,03	-0,53	0,06	0,75	0,44***	3,47

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 2b. Income smoothing by national account components: 2000-2012 (SADC)

	Degree of smoothing	Factor income		Tansfers		Saving	
	Coeff.	Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
1990-2012	0,37	0,22***	4,57	-0,009	-0,84	0,15**	2,34
1990-2000	0,16	0,16*	1,72	-0,029	-1,29	-0,03	-0,32
1991-2001	0	-0,03	-0,34	-0,036	-1,55	0,128	1,13
1992-2002	0,18	-0,05	-0,61	-0,04*	-1,75	0,182*	1,69
1993-2003	0,15	0,15**	2,11	-0,02	-1,18	0,04	0,42
1994-2004	0,37	0,22***	2,89	-0,03	-1,5	0,17*	1,66
1995-2005	0,47	0,23***	3,18	-0,02	-0,84	0,24**	2,47
1996-2006	0,58	0,29***	5,43	0,0086	0,56	0,29***	3,05
1997-2007	0,43	0,27***	5,14	0,006	0,44	0,165*	1,75
1998-2008	0,47	0,23***	4,67	0,006	0,66	0,24***	2,93
1999-2009	0,52	0,21***	4,29	0,003	0,34	0,31***	3,66
2000-2010	0,54	0,26***	5,47	0,0038	0,39	0,28***	3,5
2001-2011	0,52	0,25***	5,48	0,004	0,52	0,27***	3,52
2002-2012	0,55	0,26***	5,7	-0,004	-0,55	0,29***	3,98

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 2c. Income smoothing by national account components: 2000-2012 (CAEMC)

	Degree of smoothing	Factor income		Transfers		Saving	
	Coeff.	Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
1990-2012	0,3	0,24**	2,04	0,06**	2	0,30*	1,79
1990-2000	0,28	0,28**	2,13	0,06	1,61	0,37	1,62
1991-2001	0,9	0,41***	3,52	0,11***	3,17	0,49**	2,48
1992-2002	0,54	0,43***	2,79	0,11***	2,6	0,36	1,63
1993-2003	0,9	0,38**	2,17	0,10**	2,17	0,49**	2,12
1994-2004	0,41	0,32*	1,88	0,09**	2,06	0,34	1,51
1995-2005	0,39	0,30*	1,76	0,09*	2,28	0,35	1,52
1996-2006	0,41	0,31*	1,88	0,10**	2,42	0,35	1,52
1997-2007	0,37	0,28*	1,67	0,09**	2,33	0,35	1,52
1998-2008	0,52	0,39**	1,99	0,13**	2,54	0,32	1,16
1999-2009	0,58	0,44**	2,14	0,14**	2,57	0,45	1,61
2000-2010	0,58	0,08	0,4	0,05	0,85	0,58*	1,86
2001-2011	0	0,18	0,88	0,07	1,26	0,21	0,89
2002-2012	0	-0,27	-1,04	-0,05	-0,64	-0,29	-0,95

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 2d. Income smoothing by national account components: 2000-2012 (others)

	Degree of smoothing	Factor income		Tansfers		Saving	
	Coeff.	Coeff.	T-ratio	Coeff.	T-ratio	Coeff.	T-ratio
1990-2012	0	0,04	0,77	0,009	0,21	0,05	0,36
1990-2000	0	0,07	0,74	0,03	0,74	-0,05	-0,22
1991-2001	0	0,11	1,08	0,04	1,29	-0,004	-0,016
1992-2002	0	0,05	0,65	0,03	0,92	0,03	0,14
1993-2003	0	0,16	1,63	0,04	1,14	-0,05	-0,21
1994-2004	0,05	0,12	1,51	0,05*	1,86	-0,004	-0,02
1995-2005	0,05	0,13*	1,66	0,05*	1,82	-0,00014	-0,0006
1996-2006	0	0,03	0,35	0,04	1,46	-0,07	-0,347
1997-2007	0	0,03	0,38	0,04	1,32	-0,11	-0,49
1998-2008	0,05	0,04	0,46	0,05**	2,56	-0,13	-0,56
1999-2009	0,06	0,07	0,86	0,06***	2,82	-0,12	-0,52
2000-2010	0	0,04	0,55	0,05	0,57	-0,09	-0,43
2001-2011	0	0,03	0,39	0,04	0,46	0,12	0,63
2002-2012	0	-0,02	-0,37	-0,03	-0,31	0,25	1,45

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 3a. Financial integration and GDP growth correlation

Endogenous variable : domestic GDP growth relative to regional GDP growth

Table 3a. Financial integration and GDP growth correlation

Method: panel least squares with cross section fixed effects
Endogenous variable : domestic GDP growth relative to regional GDPgrowth

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	0.26	0.41	0.07	0.49	-0.08	-0.92
WAEMU	-0.60	-0.99	-0.076	-0.177	-0.107	-0.43
CAEMC	2.39***	3.28	0.92***	3.24	0.95	1.03
Others	17.74	0.64	-0.133	-0.64	-0.131	-0.86
Control variables						
Terms of trade	-0.006	-1.36	-0.005	-1.35	-0.008*	-1.88
Financial stress	-0.07	-0.62	-0.04	-0.472	-0.036	-0.38
Real exchange rate	0.006	1.12	0.005	1.17	0.007	1.50
Changes in M2 (% GDP)	-0.014***	-2.70	-0.013***	-3.41	-0.014***	-3.41
Inflation rate	-0.0003	-1.19	-0.0002	-1.26	-0.00034	-1.59
Debt/GDP	-0.008***	-2.51	-0.008	-1.81*	-0.009**	-2.07
Adjusted R^2	0.34		0.34		0.32	

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 3b. Financial integration and consumption growth correlation

Endogenous variable : domestic consumption growth relative to regional consumption growth

Table 3b. Financial integration and consumption growth correlation

Method: panel least squares with cross section fixed effects

Endogenous variable : domestic consumption growth relative to regional consumption growth

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	0.73	0.51	-0.11	-0.39	-0.10	-1.14
WAEMU	-2.46	-1.17	-0.08	-0.09	-0.32*	-1.86
CAEMC	-1.06	-0.69	2.87***	5.00	-3.09	-1.02
Others	-16.47	-0.82	0.76*	1.79	0.34	0.71
Control variables						
Terms of trade	-0.016*	-1.78	-0.006	-0.78	-0.01	-1.27
Financial stress	0.44**	2.30	0.31*	1.69	0.44*	1.95
Real exchange rate	-7×10^{-5}	-0.007	-0.004	-0.456	-0.0017	-0.14
Changes in M2 (% GDP)	-0.013	-1.59	-0.01	-1.34	-0.013	-1.27
Inflation rate	0.00015	0.34	0.0003	0.78	0.0002	0.42
Debt/GDP	-0.006	-0.59	-0.004	-0.44	-0.006	-0.47
Adjusted R^2	0.41		0.41		0.41	

Note :*,*** : statistically significant at 10% and 1%

Table 4a. Financial integration and GDP growth correlation. Endogenous variable: domestic GDP growth

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Regional GDP growth						
SADC	1.19**	2.32	1.13	1.04	1.06***	4.20
WAEMU	0.71***	5.32	0.67***	5.72	0.46***	2.56
CAEMC	0.76***	3.35	-0.24	-0.33	0.58	0.55
Others	0.37	0.88	0.04	0.13	-0.026	-0.076
Financial integration						
SADC	2.60**	2.28	0.14	0.215	0.20	1.08
WAEMU	-0.74	-0.82	0.103	0.34	-0.64	-1.12
CAEMC	-1.76	-1.51	-0.65***	-3.18	-0.27	-0.16
Others	-13.46	-0.53	-0.54	1.30	-0.52	-0.91
Financial integration × Regional GDP growth						
SADC	-1.36	-1.39	-0.198	-0.54	-0.26**	-2.01
WAEMU	-0.019	-0.05	0.018	0.12	0.36	1.04
CAEMC	1.09**	2.45	0.38**	2.25	0.69	0.65
Others	0.28	0.03	0.106	0.77	0.18	1.00
Control variables						
Terms of trade	-0.005	-1.45	-0.006*	-1.66	-0.006**	-2.07
Financial stress	-0.02	-0.35	-0.04	-0.405	-0.045	-0.51
Real exchange rate	-0.008	-1.43	-0.007	-1.27	-0.008	-1.37
Changes in M2 (% GDP)	0.005	0.63	0.005	0.65	0.005	0.73
Debt/GDP	-0.013***	-3.14	-0.01***	-2.95	-0.01***	-3.00
Inflation rate	0.0003	1.23	0.00027	1.06	0.0003	1.16
Adjusted R^2	0.35		0.35		0.35	

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 4b. Financial integration and consumption growth correlation

Method: panel least squares with cross section fixed effects
Endogenous variable : Consumption growth

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Regional consumption growth						
SADC	2.32***	10.69	0.89	0.88	1.39***	8.28
WAEMU	1.30***	3.00	1.29***	3.15	0.90	1.53
CAEMC	2.65***	11.05	-1.18**	-2.14	1.80***	3.38
Others	0.58***	7.84	0.77***	2.78	0.68***	5.42
Financial integration						
SADC	4.46***	3.78	-0.60	-1.17	-0.29***	-3.01
WAEMU	0.97	0.49	0.28	0.44	-0.512	-0.32
CAEMC	-0.96	-0.50	-1.25*	-1.83	-4.78***	-2.66
Others	-7.53	-0.29	-0.18	-0.51	-0.10	-0.59
Financial integration × Regional consumption growth						
SADC	-1.97***	-3.40	0.18	0.57	9×10^{-5}	0.001
WAEMU	-1.42	-0.86	-0.21	-0.97	0.208	0.247
CAEMC	-1.28***	-3.70	0.73***	5.48	0.172	0.34
Others	0.77	0.16	-0.08	-0.80	-0.09	-1.39
Control variables						
Terms of trade	-0.006	-0.56	-0.009	-0.92	-0.003	-0.33
Financial stress	0.33**	2.26	0.284**	2.23	0.30*	1.94
Real exchange rate	0.008	0.46	0.01	0.56	0.007	0.39
Changes in M2 (% GDP)	0.01	1.01	0.01	1.23	0.01	1.17
Debt/GDP	0.003	0.28	0.035	0.297	0.0033	0.30
Inflation rate	-0.0006	-0.73	-0.0006	-0.82	-0.0005	-0.64
Adjusted R^2	0.32		0.32		0.32	

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 5. Number of coincidences, synchronization and idiosyncratic shocks

Domestic country	Expansion	Recession	Expansion	Recession
		SADC		
# coincidences	73	46	24	39
Fraction of total observations	0,40	0,25	0,13	0,21
		WAEMU		
# coincidences	41	19	9	22
Fraction of total observations	0,39	0,18	0,09	0,21
		CAEMC		
# coincidence	28	26	10	14
Fraction of total observations	0,36	0,33	0,13	0,18

		Divers		
# coincidence	14	27	49	10
Fraction of total observations	0.15	0,30	0,44	0.11

Table 6a. Financial integration and business cycle synchronization during expansions
Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

Table 6a. Financial integration and business cycle synchronization during expansions
Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	0.154	0.154	0.101	1.57	0.032	0.67
WAEMU	0.475***	4.92	0.314***	13.86	0.098	1.59
CAEMC	0.167***	∞	0.078***	∞	0.05	0
Others	-52.92***	∞	-1.95***	-31.59	-6.62***	-95.03
Control variables						
Terms of trade -subregion(terms of trade)	-0.012	-0.595	-0.00024	-0.013	-0.02	-0.99
Financial stress	0.04	0.583	0.0316	0.421	0.04	0.478
Real exchange rate-subregion REER	-0.013	-0.167	-0.046	-0.646	-0.01	-0.143
Changes in M2 -Regional changes in M2 (%GDP)	-0.01***	-175.3	-0.022***	-224.08	-0.03***	-359.41
Inflation rate-subregional inflation	-0.00002	-0.034	-0.000014	-0.02	-0.000026	-0.036
Debt/GDP -subregional debt/GDP	-0.000715	-0.006	-0.00052	-0.032	-0.000577	-0.023
Prediction	*y=0*	*y=1*	*y=0*	*y=1*	*y=0*	*y=1*
$P(y = 1) \leq 0{,}5$	248	127	221	96	239	125
$P(y = 1) > 0{,}5$	13	15	32	46	22	17
% correct	95.01	10.56	87.74	32.39	91.57	11.97
% incorrect	4.98	89.44	12.26	67.61	8.43	88.03

Note : **,*** : statistically significant at 5% and 1%

Table 6b. Financial integration and business cycle synchronization during recessions
Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

Table 6b. Financial integration and business cycle synchronization during recessions

Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	-0.02	-0.174	-0.119***	-3.61	-0.037	-0.76
WAEMU	-0.291***	-4.24	-0.394***	-38.57	-0.17***	-3.94
CAEMC	-0.056	-0.04	-0.08***	-6.23	-0.04**	-2.69
Others	0.445***	10.38	-0.08**	-2.21	0.009	0.21
Control variables						
Terms of trade -subregion(terms of trade)	-0.004	-0.309	-0.028**	-2.33	-0.009	-0.67
Financial stress	-0.03	-0.63	-0.015	-0.325	-0.03	-0.56
Real exchange rate-subregion REER	0.05	0.837	0.07**	2.03	0.05	0.87
Changes in M2 -Regional changes in M2 (%GDP)	-0.004***	-121.5	0.03**	736.32	0.017***	3.99
Inflation rate-subregional inflation	0.000015	0.04	0.000005	0.01	0.000016	0.03
Debt/GDP -subregional debt/GDP	-0.00043	-0.006	-0.00051	-0.05	-0.00045	-0.027
Prediction	*y=0*	*y=1*	*y=0*	*y=1*	*y=0*	*y=1*
$P(y = 1) \leq 0{,}5$	293	109	281	97	293	109
$P(y = 1) > 0{,}5$	0.0	1.0	12	13	0.0	1.0
% correct	100	0.01	95.90	11.82	100	0.9
% incorrect	0.0	0.99	4.09	88.18	0.0	99.1

Note :*, **,*** : statistically significant at 10%, 5% and 1%

Table 6c. Financial integration and business cycle synchronization (country: expansion, others : recession)

Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	-0.12***	-5.21	-0.065***	-52.11	-0.048***	-6.91
WAEMU	-0.63***	-65.15	-0.22***	-618.72	-0.21***	-37.88
CAEMC	-0.148	-0.95	-0.058***	-147.81	-0.172***	-142.80
Others	3.92***	∞	0.03***	26.22	0.056***	9.00
Control variables						
Terms of trade -subregion(terms of trade)	0.029***	15.26	0.078***	183.89	0.095	48.27
Financial stress	-0.003	-0.326	0.007***	4.13	0.007	1.03
Real exchange rate-subregion REER	-0.126***	-10.79	-0.151***	-51.80	-0.16***	-12.71
Changes in M2 -Regional changes in M2 (%GDP)	-0.136***	∞	-0.131***	∞	-0.14***	∞
Inflation rate-subregional inflation	-0.0003***	-5.08	-0.0001***	-8.33	-0.00017	-4.02
Debt/GDP -subregional debt/GDP	0.000026	0.0022	-0.000021	-0.076	-0.00004	-0.026
Prediction	*y=0*	*y=1*	*y=0*	*y=1*	*y=0*	*y=1*
$P(y = 1) \leq 0{,}5$	323	70	308	45	319	62
$P(y = 1) > 0{,}5$	4	6	19	31	8	14
% correct	98.77	7.89	94.19	40.79	97.55	18.42
% incorrect	1.23	92.11	5.81	59.21	2.45	81.58

Note :**,*** : statistically significant at 5% and 1%

Table 6d. Financial integration and business cycle synchronization (country : recession, others:recession)

Probit estimation (random effect : Chamberlain-Mundlak) - Average partial effect

	Risk-sharing		Net interest margin sigma-convergence		ROA Sigma convergence	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Financial integration						
SADC	0.097**	2.42	0.042***	6.18	0.004	0.30
WAEMU	0.26***	10.97	0.146***	53.76	0.037**	2.23
CAEMC	0.09***	∞	0.033	∞	0.004	∞
Others	-36.73	∞	-1.46***	-78.27	-5.05***	-272.53
Control variables						
Terms of trade -subregion(terms of trade)	-0.03***	-7.53	-0.02***	-3.66	-0.03***	-4.83
Financial stress	-0.011	-0.652	-0.015	-0.65	-0.01	-0.526
Real exchange rate-subregion REER	0.07***	3.95	0.04*	1.91	0.06**	2.75
Changes in M2 -Regional changes in M2 (%GDP)	0.06***	∞	0.05	∞	0.05***	∞
Inflation rate-subregional inflation	-0.00004	-0.281	-0.00003	-0.19	-0.00004	-0.174
Debt/GDP -subregional debt/GDP	0.0008	0.026	0.0009	0.18	0.0009	0.136
Prediction	*y=0*	*y=1*	*y=0*	*y=1*	*y=0*	*y=1*
$P(y=1) \leq 0{,}5$	328	74	328	74	328	74
$P(y=1) > 0{,}5$	0.0	1	0.0	1	0.0	1.0
% correct	100	1.33	100	1.33	100	1.33
% incorrect	0.0	98.66	0.0	98.66	0.0	98.66

Note **,*** : statistically significant at 5% and 1%

Table A1. Convergence criteria in Monetary Unions Projects in Sub Saharan Africa

	First rank convergence criteria in 2013				
African Union Projects	Inflation	Global fiscal deficit/GDP	International reserves (in months of import)	Public Debt/GDP	Government financing from the Central Bank
EAC	≤ 8 %	≤ 3 %	≥ 4,5	≤ 50 %	-
WAMZ	≤ 5 %	≤ 4 %	≥ 6	-	≤ 10 % of tax receipts of year n-1
AU	≤ 3 %	≤ 3 %	≥ 6	-	0 %
SADC (2012-2018)	≤ 5 %	≤ 3 %	≥ 6	≤ 60 %	≤ 5 % of tax receipts of year -1
COMESA (2011-2015)	≤ 3 %	≤ 4 %	≥ 5	-	0 %

Monetary Unuion Projects

EAC : East African Community, with 5 member countries (Burundi, Kenya, Uganda, Tanzania and Rwanda).
WAMZ : West African Monetary Zone, 6 member countries (Gambia, Sierra Leone, Guinéa, Ghana, Nigeria and Liberia). Initially set for January 2003, then postponed to July 2005, then January 2010, the merger between in West African Monetary zone and WAEMU is now envisaged for 2020.
AU : African Union, 53 African countries.
SADC : Southern African Development Community, 15 member countries, of which South Africa, Lesotho, Namibia and Swaziland, which has a common currency, the south African Rand, and based on the use of currency board mechanisms.
COMESA : Common Market for Eastern and Southern Africa, 19 member countries, of which, Burundi, Comoros, Djibouti, Egypt, Libya and Rwanda

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