

INTERNATIONAL RISK-SHARING IN THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

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Abstract: This paper identifies risk-sharing mechanisms that work in ECOWAS given the willingness of Heads of State in the region to create a single currency. Indeed, in a monetary union, asymmetric shocks are not problematic if risk-sharing mechanisms, other than exchange rate, are in place to allow countries to adjust to specific shocks. The paper is innovative because it provides more information on the accounting decomposition of national aggregates allowing a better understanding of the different channels of risk-sharing. In addition, the results show that net primary incomes other than net taxes on products, official development assistance and gross saving smooth out asymmetric shocks between ECOWAS countries. Thus, for a better risk-sharing, the countries of the zone must prioritize savings, by actively participating in the expansion of regional credit markets. In addition, fighting corruption increases the effectiveness of official development assistance and the overall effect of net primary incomes.

Keywords: monetary union, asymmetric shocks, risk-sharing, ECOWAS

JEL classification : E21 ; E62 ; F24 ; F35 ; F45 ; O55

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Introduction

In the middle of the 20th century, theories follow one another on the conditions necessary to constitute an optimal currency area (OCA). In fact, at the beginning of the 1960s, several criteria necessary for the establishment of an OCA commonly called the traditional criteria of the OCA were born in a context where there was a controversy between the fixed exchange rate defenders and the flexible exchange promoters. These are mainly mobility in the labor market (Mundell, 1961), the degree of openness of the economy (McKinnon, 1963) and the diversification of the production structure (Kenen, 1969).

However, in view of the inadequacy shown by these so-called static criteria, the literature focus on another criterion which is the similarity of shocks. When the impact of macroeconomic shocks and the speed of adjustment to these shocks are similar across countries, the need for autonomous policies is reduced and therefore the net benefits of introducing a single currency are higher. It is line that the works of Cohen and Wyplosz (1989), Weber (1990) and Bayoumi and Eichengreen (1993) are inscribed. For these authors, the asymmetries of the shocks observed within a monetary union determine its sustainability.

At the end of the 90s, the reflection is renewed and we witness the emergence of endogenous OCA where the question of trade and business cycles synchronization occupy a first place. Frankel and Rose (1998) assume that in the monetary union, an intra-branch specialization tends to develop with the expansion of bilateral trade and consequently the productive structures of the countries come closer together. Thus countries are affected identically by sectoral shocks. This thesis is validated by experience in the Eurozone. Countries such as Spain or Greece, which have very different fluctuations from other member countries before entering the Eurozone, see their cycles come very close to them (Gravet, 2014).

Thus, the absence of ideal ex-ante conditions described in traditional theories does not in any way prevent the ex-post success of a monetary union provided, however, that a gradual synchronization of business cycles based on a deepening of intra-branch trade is observed. Even if, initially, the intra-branch trade can be relatively weak, the exchange dynamics stimulated by monetary union is able to initiate a significant increase of this type of exchange and thus to increase the synchronization of business cycles. In this context, Tapsoba (2009) shows that the heterogeneity of shocks between West African countries must not block political decision for an enlarged monetary union, since the latter ultimately favors the convergence of business cycles.

However, Krugman (1993) shows that monetary integration develops trade within monetary zone and encourages countries to specialize according to their comparative advantages. With the disappearance of currency risk and the intensification of competition, companies will locate their activities where the factor endowment is the most advantageous for their activities in order to be more efficient. An inter-branch specialization of the regions is developing. The productive structures of the member countries therefore tend to diverge after the creation of monetary union. In hindsight, monetary unification in the Eurozone has led to a convergence of business cycles initially, but also to a growing productive specialization of economies (Gravet, 2014).

For Krugman (1993), inter-branch exchanges based on Ricardian specialization inevitably lead to an increase in asymmetric shocks. It is in this line that the risk-sharing theory is situated,

which stipulates that the reinforcement of the economic and financial integration tends to increase the heterogeneity of the productive structures of the countries of zone. But in a context of increasing financialization of the economies, the interregional holding of titles on the production of other regions allows a better risk-sharing in parallel with the rise of specialization.

Risk-sharing is changing the contours of OCA debate. The main criterion is no longer the symmetry of cycles but the decorrelation between consumption and domestic income. This approach theoretically reconciles the presence of strong regional asymmetries in terms of the business cycle thanks to a deep financial integration that allows asset portfolios to be diversified (each region holding an asset from another region whose prices and incomes are not expected to be correlated) and thus share the risk of a real recessionary shock within the currency area (Clévenot and Duwicquet, 2011).

It is undeniable that monetary union accentuates intra-community trade (Bangake and Eggoh, 2008; Carrère, 2004; Rose, 2000). It increases intra-branch trade, thus favoring the synchronization of business cycles (Baxter and Kouparitsas, 2005; Calderon et al., 2007; Inklaar et al., 2008; Frankel and Rose, 1998; Tapsoba, 2009). However, it can increase inter-branch trade and increase the asymmetry of shocks if monetary union leads economies to specialize in sectors where they have comparative advantages (Kalemli-Ozcan et al., 2001; Krugman, 1993). This is why in a monetary union or in the perspective of creating a monetary zone, it is essential to identify risk-sharing mechanisms (Astrubali et al., 1996; Sala-i-Martin et Sachs, 1992; Sorensen et Yosha, 1998; Tapsoba, 2009).

This paper identifies the risk-sharing channels that work in ECOWAS. It is relevant given the willingness of ECOWAS Heads of State to create a single currency in the region. In addition, there are potential gains in social well-being related to the degree of risk-sharing (Kalemli-Ozcan et al., 2001, Balli and Balli, 2011). Today, ECOWAS is made up of two zones. This is WAEMU zone which has eight (8) countries sharing a common currency (CFA franc) and Non-WAEMU zone which has seven (7) countries each with its own national currency. Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo constitute WAEMU. The Non-WAEMU zone consists of Cabo Verde, The Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone.

This paper complements an infrequent and less recent empirical literature on risk-sharing mechanisms in West Africa. The paper is innovative at two levels:

First, it provides further information on the accounting decomposition of national aggregates to better understand the different risk-sharing channels. This is important because the results can be wrong. Indeed, Clévenot and Duwicquet (2011) analyzing risk-sharing mechanisms in the Eurozone consider the difference between Gross National Income (GNI) and Disposal National Income (DNI) as net budgetary transfers while the difference between these represent income transfers (including fiscal transfers). The precision is important because there is no fiscal transfer in the Eurozone.

Moreover, Balli and Balli (2011) to show the contribution of remittances and foreign aid on the smoothing of asymmetric shocks use the difference between GDP and GDP plus foreign aid or remittances that they estimate on GDP, while foreign aid and workers' remittances have to be integrated into current transfers. For this reason, a clarification on the decomposition of

national aggregates deserves particular attention in order to better understand the origin of risk-sharing channels.

Secondly, the study conducts detailed analysis by decomposing some risk-sharing channels. Indeed, Arreaza et al. (1998) for the Organization for Economic Cooperation and Development (OECD) and European countries and Tapsoba (2009) for ECOWAS show that only savings constitute the smoothing mechanism of shocks. These works show that net factor income and net international transfers are ineffective. Through a decomposition of these channels, the present study shows their relevance in the smoothing of asymmetric shocks between the ECOWAS countries.

Analysis focuses on fifteen ECOWAS countries and covers period 1980-2016. The results of the study show that net primary incomes other than net taxes on products, official development assistance and gross saving are the main channels for risk-sharing. In addition, the study shows that the procyclicality of indirect taxes limits the smoothing of shocks via the net primary incomes channel.

The rest of study is organized as follows. The first section introduces a brief overview of the potential risk-sharing channels in ECOWAS, the second section describes the methodology used, the third presents the results of the empirical analysis and the fourth section presents the economic implications of the different results.

I. Net taxes on products, net remittances, official development assistance and risk-sharing mechanism

A monetary union implies the loss of the exchange rate as a macroeconomic adjustment variable in the event of shocks. This loss may be all the more detrimental as member countries are affected by asymmetric shocks. However, the union is not defenseless if it manages to identify other mechanisms capable of dealing with asymmetric shocks. It is in this perspective that many studies have focused on risk-sharing mechanisms (Afonso and Furceri, 2008; Astrubali et al., 1996; Melitz and Zumer, 2002; Sorensen and Yosha, 1998; Tapsoba, 2009, etc.) in a given region.

However, to our knowledge, only Tapsoba (2009) analyzes the risk-sharing channels in ECOWAS. Over the period 1970-2004, he shows that savings is the only risk-sharing channel in the region and contributes to smoothing significantly 22% and 21% of asymmetric shocks in WAEMU and ECOWAS respectively. In addition, he finds that net factor income and net international transfers do not have a significant impact on smoothing shocks in the region.

As Tapsoba (2009), this paper find over the recent period (1980-2016) that gross saving is the only risk-sharing channel in the region and contributes to smoothing significantly 21 % and 20% of asymmetric shocks in WAEMU and ECOWAS respectively, see appendix 1. However, the paper believes that beyond savings, there are other risk-sharing channels in ECOWAS.

Net taxes on products

In a country participating in a monetary union, a counter-cyclical discretionary fiscal policy at the national level is needed to stabilize specific cyclical business fluctuations, when there are nominal or real rigidities in the economy or when alternative adjustment mechanisms such as

price and wage flexibility, labor and capital mobility, financial and fiscal integration are lacking (Huart, 2011). However, in many developing countries, fiscal policy is pro-cyclical (Kaminski et al., 2004; Talvi and Vegh, 2005).

This pro-cyclicality results from the inability of governments to borrow during recession periods due to capital market imperfections (Adler, 2008) and to save during expansion periods due to a voracious effect (Akitoby et al., 2006; Tornell and Lane, 1999)². This inability can also be explained by the unsustainability of the public debt (Alberola and Montero, 2006) or by the poor quality of political institutions or structures (Alesina et al., 2008, Calderon et al., 2004).

This paper argues that the pro-cyclical nature of fiscal policy in Africa (Thornton, 2008) restricts the smoothing of shocks through the income channel in ECOWAS. In order to verify this, the paper looks at the ability of net taxes on products to smooth out asymmetric shocks or not in the region. These taxes have the advantage of being testable in the study. They are relevant given their importance in achieving the macroeconomic convergence objectives of the region.

In the perspective of creating a single currency in ECOWAS, macroeconomic convergence criteria following those of the Maastricht Treaty (1992) must be respected by the member countries. Among these criteria is the ratio budget balance to GDP which must be less than or equal to -3%. This first-order criterion forces each country in the zone to increase these tax revenues in order to meet the desired standard.

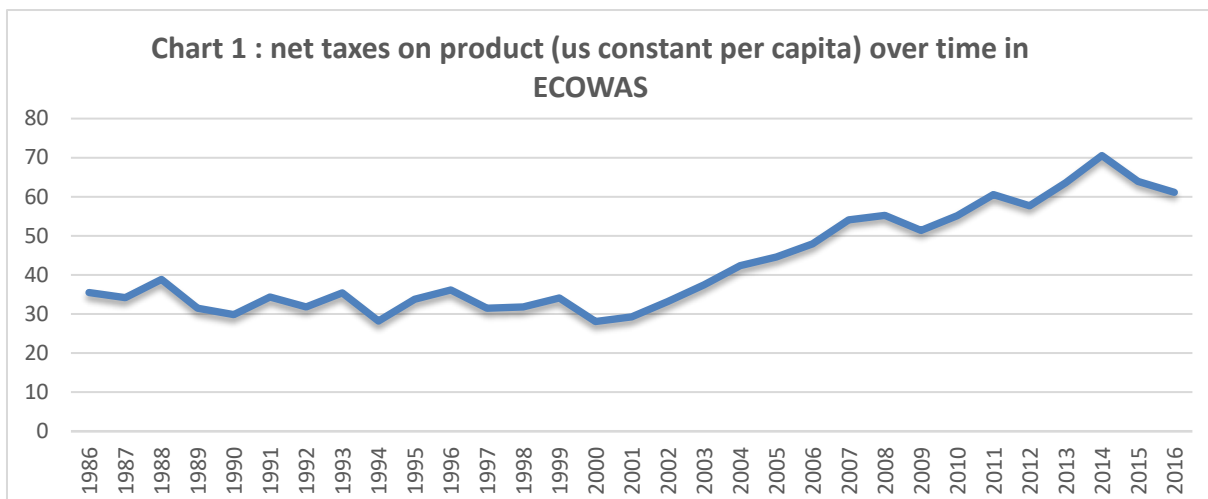
Indeed, according to public revenue statistics in Africa (2017)³, tax revenues have increased over the period 2000-2015. However, despite this increase, the budget deficit remains high. According to the ECOWAS Convergence Report (2017) for 2016, only Guinea, Liberia and Nigeria have a ratio of budget balance to GDP of less than or equal to -3%. The persistent fiscal deficit of West African countries is driving policy makers to new tax regulations such as higher taxes on products.

As a reminder, tax revenues are revenues from direct taxes (income tax, corporate tax) and indirect taxes. Indirect taxes (or taxes on products) are taxes that are incorporated into the price of goods and services. Taxes on products are taxes due per unit of good or service produced or exchanged. They consist mainly of value added tax and indirect taxes such as the domestic tax on petroleum products, tobacco tax, registration fees, and so on.

Taxes (net of subsidies) on products are a way for West African states to reduce their budget deficits because they account for more than half of tax revenues according to data from the public finance statistics of the International Monetary Fund and the World Bank. Thus, the reduction of the budget deficit essentially involves an increase in taxes on products. For this purpose, Chart 1 shows that since 2000, net taxes on products have steadily increased in the region. This is not surprising since it was in December 1999 through decision A / DEC.7 / 12/99 that the macroeconomic convergence criteria were adopted by the ECOWAS Heads of State (ECOWAS Convergence Report, 2010). Since then, new tax regulations have emerged in order to meet the budget norm.

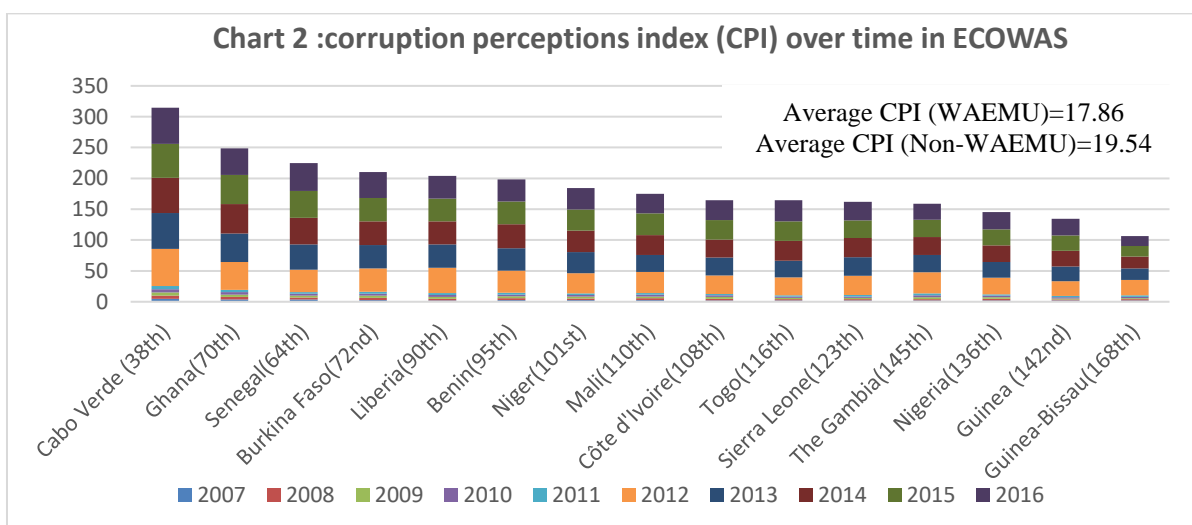
² Tornell and Lane (1999) show that the existence of a limited number of pressure groups is enough to distort economic policy, especially fiscal policy, leading to over-consumption (voracity) to the detriment of growth.

³ Source: OECD/ATAF/AUC (2017), Revenue Statistics in Africa 2017, OECD Publishing, Paris.
<http://dx.doi.org/10.1787/9789264280854-en-fr>



Source: World Bank.

Taxation is therefore one of the main means available to West African governments to mobilize resources. However, it is often compromised by significant losses resulting from tax evasion and misappropriation of state revenues (African Governance Report, 2016). Thus, while fiscal policy may be a mechanism for stabilizing shocks (Sala-i-Martin and Sachs, 1992; Bayoumi and Masson, 1995), it is clear that it can be a barrier to risk-sharing under a corrupt government.



Source: Transparency International.

Note: from 2007 to 2011; 10 (uncorrupted) ≤ CPI ≤ 0 (extremely corrupted), from 2012 to 2016; 100 (not corrupted) ≤ CPI ≤ 0 (extremely corrupted).

For this purpose, Alesina et al. (2008) develop a model in which voters observe the state of the economy but cannot verify how much of government revenues are appropriated as rents by the state apparatus. The voters do not expect budget surpluses to accrue primarily to national savings, but rather to be squandered on rents. As a consequence, voters push for increased expenditures (tax cuts, higher government spending or transfers) in good times, so as to be able as far as possible to 'get their piece of the cake'. This public pressure forces the government into procyclical public spending, and even borrowing. Their empirical results support the hypothesis that fiscal policy is more procyclical in countries where corruption is more widespread.

Since 1995, Transparency International has been compiling all countries according to the corruption perceptions index. The statement made in his reports is unambiguous: the majority of African countries are very poorly classified. Indeed, chart 2 shows over the period 2007-2016 that only Cabo Verde is out of the red zone of corruption ($CPI \geq 5 \cdot 5 + 50 \cdot 5 = 275$).

Among the 176 countries ranked in 2016, Cabo Verde is at 'the top of the pack' in ECOWAS, ranking 38th in the world, followed by Ghana in 70th place. The 'worst students' in the region are Guinea-Bissau, ranked 168th in the world, followed by Guinea in 142nd place. On average, chart 2 indicates that WAEMU countries are more corrupt than Non-WAEMU countries over the period (2007-2016).

Corruption is omnipresent in Africa and weakens its economies. Indeed, corruption makes Africa lose a quarter of its GDP. Africa's corruption-related activities cost an estimated \$ 148 billion each year, or about 25 percent of Africa's average GDP (Executive Secretary of the United Nations Economic Commission for Africa, 2018). Arifari (2006) indicates that corruption in Africa is higher in customs administrations. Tanzi and Davoodi (1997) agree that direct and indirect taxes are more affected by corruption than other government revenues.

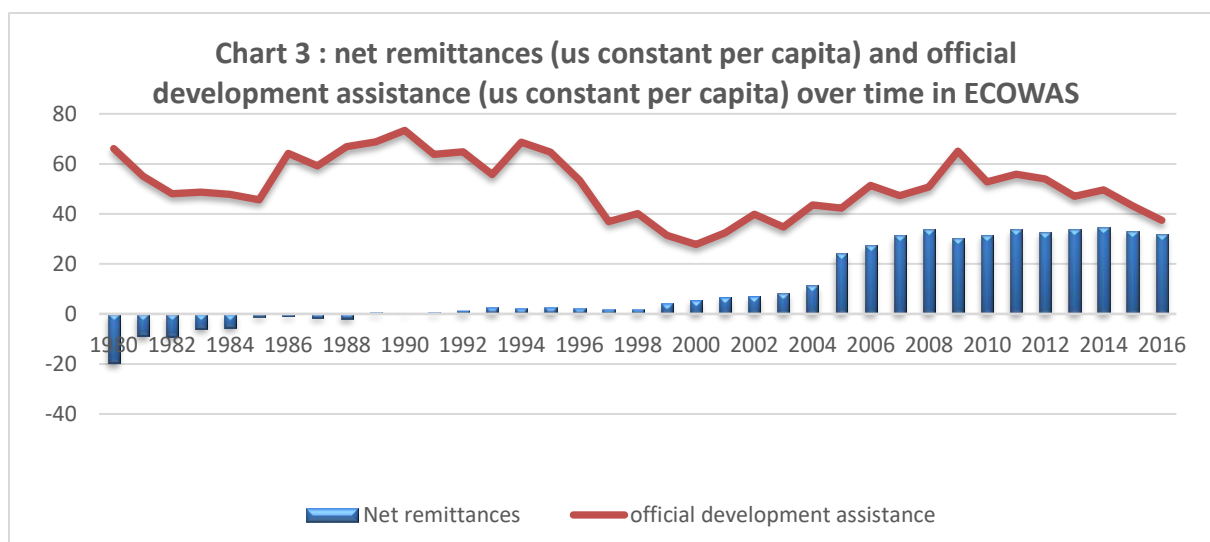
Thus, the inability of tax revenues to smooth shocks can result from corrupt customs administrations. As corruption is a recurring phenomenon in West Africa, it is not fortuitous to think that tax policy in the region is potentially pro-cyclical. This pro-cyclical bias in tax policy may constrain the income channel's ability to smooth out shocks. To verify this, the study analyzes the contribution of net taxes on products to the smoothing of asymmetric shocks between ECOWAS countries.

Net remittances and official development assistance

Over the last decade, remittances have grown much faster than other private capital flows and official development assistance (ODA), and have thus become an essential source of external financing for developing countries (Ebeke and Le Goff, 2010). In ECOWAS, chart 3 shows that net remittances increase over time. During the 1980s, remittances outflows on average by ECOWAS countries were higher than remittances inflows in the region. From 1990 the trend is reversed.

The increase from the 1990s in the net remittances is not surprising. Indeed, calculations based on population censuses indicate that the countries of the region shelter in 2006 about 7.5 million migrants from another West African country, nearly 3% of the regional population. This rate, which has been rising since 1990, is higher than the African average (2%) and far exceeds that of the European Union which is 0.5% (Sahel and West Africa club, 2007).

In addition, according to the World Bank's migration and remittances factbook report (2011), remittances to Africa have increased significantly over the past decade. They are estimated at about \$ 40 billion in 2010, nearly double their 2005 level and four times that of 2000. At the WAEMU level, the amount of funds received from migrants also quadrupled between 2000 and 2011. Flows identified through formal channels increased from \$ 323.1 billion in 2000 to \$ 1353 billion in 2011. The increase of remittance inflows in the region is consistent with the overall dynamics observed in developing economies, particularly with the steady increase in the number of migrants and the rapid development of money transfer companies (BCEAO, 2013).



Source: World Bank.

Given its importance in the region, remittances deserve special attention from ECOWAS leaders as they can help stabilize business fluctuations. Indeed, the stabilizing effect of remittances is justified by the assumption that they are guided by "altruistic behavior". Under this assumption, remittances flows are contra-cyclical because migrants tend to send more when the economy of origin suffers or has suffered shock. For this purpose, Balli and Rana (2015), based on a sample of 86 developing countries, show over the period 1990-2010 that remittances are an important means of risk-sharing. The extent of risk-sharing via these transfers is around 5% on average. In addition, they show that the diversification of migrants' destination locations, the amount of remittances and remittances from distant countries further facilitate risk-sharing.

Chart 3 shows that ODA reached its maximum level in the late 1980s. This is not surprising since the period from 1986 to 1993 is characterized by the growing scale of financial unbalances, with disastrous consequences for the indebtedness of states, economic growth and, more generally, the economic and financial viability of West African States (Revue d'économie financière, 2013). The post-devaluation period of the CFA franc in 1994 is experiencing an acceleration of economic growth in ECOWAS. This growth has been accompanied by a drop in ODA.

ODA has been rising since the adoption of the Millennium Development Goals (MDGs) in 2000. These objectives include the reduction of extreme poverty and child mortality, the fight against several epidemics including AIDS, access to education, gender equality, and the implementation of sustainable development. The amount of ODA decreases from 2010 due to the crisis in the euro area and the end of the Millennium Development Program in 2015.

ODA can thus represent a mechanism for smoothing shocks as it plays a major role in financing the needs of West African governments. Indeed, when a country faces a recession, the amount of ODA increases to stimulate economic growth and reduce poverty. The increase in ODA is able to provide insurance against domestic production shocks. In this sense, Yehoue (2011) finds over the period 1980-2005 that ODA from France contributes to smoothing respectively 66% and 50% of shocks in the Central African Economic and Monetary Community (CEMAC) and in WAEMU .

From the foregoing, this paper finds it necessary to analyze the capacity of these external financing to smooth shocks in ECOWAS.

II. Methodological framework

The objective of this paper is to estimate the proportion of production shocks absorbed by risk-sharing channels.

To better understand how the degree of risk sharing is measured, this section proposes a simple risk-sharing model and a conceptual framework for measuring the different risk-sharing channels in ECOWAS. For this, the paper is based on Asdrubali et al. (1996), Sorensen and Yosha (1998), and Yehoue (2011).

Simple model

This simple model highlights the key equation that governs risk-sharing among countries. This model is based on Yehoue (2011).

Suppose that the world consists of two countries, a home country (H) and a foreign country (F). Let us think of the gross domestic product (GDP) as being a tradable good. The period per capita output is an exogenous random variable with a commonly known probability distribution. The paper assume that the representative consumer in home and foreign countries is risk averse and maximises the expected utility. The focus here is on risk-sharing between countries and not within a country. Therefore, consumers within each country are assumed to be identical in the sense that they have the same utility function, the same stochastic endowment and are subject to the same realisation of uncertainty.

Assuming that asset markets are complete, the home country faces a single budget constraint in period zero and chooses a consumption plan by solving the following maximization problem:

$$\underset{\{c^H_{xt}\}}{\text{Max}} \int_0^\infty e^{-\delta t} \sum_{xt} \sigma_{xt} u(c^H_{xt}) dt \quad \text{s/c} \quad \int_0^\infty \sum_{xt} p_{xt} c^H_{xt} dt \leq \int_0^\infty \sum_{xt} p_{xt} GDP^H_{xt} dt \quad (1)$$

Where GDP^H_{xt} and c^H_{xt} are the per capita output and consumption in state of nature x_t that occurs with probability σ_{xt} , and p_{xt} is the price in period zero of a period t state xt contingent unit of consumption. The discount factor is assumed to be common to all consumers and denoted by $\delta \in (0,1)$. The foreign country also solves a similar maximisation problem. Prices are normalised in the following sense:

$$\int_0^\infty \sum_{xt} p_{xt} dt = 1 \quad (2)$$

Consequently, assuming that endowments are bounded makes the integral in the budget constraint well-defined. Denoting the home country's Lagrange multiplier by μ^H , the first-order conditions with respect to consumption and μ^H can be written as follows:

$$e^{-\delta t} \sigma_{xt} u'(c^H_{xt}) = u^H p_{xt}$$

$$\int_0^\infty \sum_{xt} p_{xt} GDP^H_{xt} dt = \int_0^\infty \sum_{xt} p_{xt} c^H_{xt} dt \quad (3)$$

Let us denote the population of the home country by n^H , and the foreign country population by n^F . The market-clearing condition for any state of the nature x_t can be expressed as follows:

$$n^H c^H_{xt} + n^F c^F_{xt} = n^H GDP^H_{xt} + n^F GDP^F_{xt} \quad (4)$$

Let us consider a CRRA (constant relative risk aversion) utility function:

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma} \quad (5)$$

Then $u'(c) = 1/c^\gamma$, and making use of equations (2), (3) and (4), one can derive an expression for the price of a state contingent security as follows:

$$p_{xt} = \frac{1}{\int_0^\infty e^{-\delta t} \sum_{xt} \sigma_{xt} dt} e^{-\delta t} \frac{\sigma_{xt}}{n^H (c^H_{xt})^\gamma + n^F (c^F_{xt})^\gamma} \quad (6)$$

Noticing that $\sum_{xt} \sigma_{xt} = 1$ and $\int_0^\infty e^{-\delta t} dt = 1/\delta$, one can eliminate p_{xt} using equations (2) and (6). In addition, using the market-clearing condition (4) and noticing that the world is a closed economy and consumes its entire GDP, one can denote the world consumption by $c^w_{xt} = (n^H GDP^H + n^F GDP^F)/(n^H + n^F)$ and get :

$$c^H_{xt} = k^H c^w_{xt} \quad (7)$$

Where k^H is a constant which is specific for the home country. A similar equation can be derived for the foreign country, that is:

$$c^F_{xt} = k^F c^w_{xt} \quad (8)$$

Equations (7) or (8) is fundamental, as will become clear below, and governs the dynamics of risk-sharing among countries. The constant k^H (respectively k^F) captures the share of home-country (respectively foreign-country) consumption in world consumption. Notice that the constant k does not depend either on time or the state of the world; k is simply country specific and only reflects each country's power in the risk-sharing arrangement. Therefore, from equations (7) or (8), one learns that the consumption of a country is the same fraction of world output in all periods and all states of the world. In other words, equations (7) or (8) show that risk is fully shared among countries if the consumption of each country co-moves with world consumption, but does not co-move with the country-specific shocks.

Using the limit case that is the logarithmic utility, one derives a closed-form solution for k^H . To this end, making use of the budget constraint which binds at an optimum and of equations (2) and (3), one can solve for k^H ; that is

$$k^H = \delta \int_0^{\infty} e^{-\delta t} \sum_{xt} \sigma_{xt} \frac{n^H GDP^H_{xt}}{n^H GDP^H_{xt} + n^F GDP^F_{xt}} dt \quad (9)$$

One notices from equation (9) that the share k of home-country consumption in world consumption is the discounted expected share of its future output in the world. From the expression of k it is clear that each country's power in the risk sharing agreement is related to the country's size in terms of population and to its GDP per capita, that is, its aggregate GDP.

Notice that full risk-sharing implies perfect consumption smoothing in the sense that standard intertemporal Euler equations can be derived from the full risk-sharing conditions, namely (7) or (8). But the reverse is not necessary true. As a matter of fact, Sorensen and Yosha (1998) noted that if asset markets are complete, there is full risksharing and perfect consumption smoothing. However, if asset markets are not complete, full risk-sharing will typically not be satisfied, but perfect consumption smoothing may still hold. Taking the logarithms and the time differences of equation (7), the constant will disappear and one can get

$$\Delta \log c^H_{xt} = \Delta \log (n^H GDP^H_{xt} + n^F GDP^F_{xt}) \quad (10)$$

An important empirical implication of equation (7) is that under full risk-sharing, the consumption of an economic agent (a country here) is not sensitive to the agent's idiosyncratic shocks, in particular, income shocks. A number of studies have tested this proposition. The majority of these studies reject the assumption of full risk-sharing (Cochrane, 1991; Townsend, 2004, Hayashi et al., 1996; Obstfeld, 1994).

Asdrubali et al. (1996) and Sorensen and Yosha (1998) reorient this literature from simply testing full risk-sharing to quantifying the extent to which risk is shared within a group of economic agents (countries in this case). As they rightly point out, even if full risksharing is rejected, it is interesting to identify the exact channels through which risk is shared and to quantify the amount of risk-sharing obtained via each channel. They develop a framework where the amount of risk shared through different channels can be estimated.

This paper follows their path by taking equation (7) or (8) as a benchmark, quantifies the deviation from this benchmark, and interprets it as the amount of risk that is not shared. The method of measuring the deviation from full risk sharing is presented below.

Decomposition of the cross-sectional variance of GDP

Risk-sharing literature is faced with the lack of information on bilateral flows that can serve as a vehicle for inter-state sharing of asymmetric shocks. This limit is bypassed by Asdrubali et al. (1996), Sorensen and Yosha (1998). These authors develop the method of decomposing the variance of the GDP growth rate, which makes it possible, from the multilateral flows in the national accounts, to identify the risk-sharing channels between a group of countries.

Consider the identity, holding for any period t :

$$GDP_i = \frac{GDP_i}{GNI_i} \times \frac{GNI_i}{DNI_i} \times \frac{DNI_i}{(C+G)_i} \times (C+G)_i \quad (11)$$

Where all the magnitudes are in per capita terms, and i is an index of countries. To stress the cross-sectional nature of the derivation, paper suppress the time index.

Table 1 : national aggregates

National aggregates	Composition
Gross Domestic Product (GDP)	GDP = sum of value added + taxes on products - subsidies on products (which are not allocated to sectors and branches of activity).
Gross National Income (GNI)	GNI = GDP + primary incomes received from the rest of the world - primary incomes paid to the rest of the world
	Primary incomes \equiv income associated with the production process (compensation of employees, taxes and subsidies on products and production) + income associated with the ownership of financial and other nonproduced assets (property income, investment income).
Disposal National Income (DNI)	DNI = GNI + current transfers received from the rest of the world - current transfers to the rest of the world
	Current transfers \equiv current taxes on income + social contributions + social benefits + current international cooperation + workers' remittances, etc.
Gross saving (GS)	GS = DNI - private (C) and public (G) final consumption.

Sources : Nations Unies, Commission Européenne, Organisation de Coopération et de Développement Economiques, Fonds Monétaire International, Banque Mondiale. (2008). Système de Comptabilité Nationale (SNC).

Based on table 1, the national accounting identities that are relevant here are: $GNI = GDP + net\ primary\ incomes$; $DNI = GNI + net\ current\ transfers$ and $(C+G) = DNI - gross\ saving$. The identity (11) makes it possible to describe the phenomenon of cyclical stabilization. Indeed, if only GDP varies after the shock, while the other aggregates are unchanged, then full stabilization has been obtained. If GDP varies and GNI remains unchanged, the stabilization is achieved in the first stage by the net primary incomes. If GNI varies and DNI remains constant, then cyclical smoothing is provided by the net currents transfers. If gross saving also smoothing the entire shock, consumption remains constant while GDP , GNI and DNI vary. Finally, if the total consumption also changes, it means that a share of the shock is not smoothed.

Taking the logs and difference, multiplying both sides of the identity (11) by $\Delta \log GDP_i$ (minus its mean), and taking the cross-sectional average lead to the following variance decomposition:

$$\text{var}[\Delta \log(\text{GDP})_i] = \text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{GDP})_i - \Delta \log(\text{GNI})_i] + \text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{GNI})_i - \Delta \log(\text{DNI})_i] + \text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{DNI})_i - \Delta \log(\text{C}+\text{G})_i] + \text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{C}+\text{G})_i] \quad (12)$$

Dividing (12) by $\text{var}[\Delta \log(\text{GDP})_i]$, one gets $1 = \beta^l + \beta^T + \beta^S + \beta^u$ where, for example :

$$\beta^l = \frac{\text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{GDP})_i - \Delta \log(\text{GNI})_i]}{V[\Delta \log(\text{GDP})_i]}$$

is the ordinary least squares estimate of the slope in the cross-sectional regression of $(\Delta \log \text{GDP}_i - \Delta \log \text{GNI}_i)$ on $\Delta \log(\text{GDP})_i$; and similarly for β^T and β^S .

The last coefficient in the decomposition is given by:

$$\beta^u = \frac{\text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{C}+\text{G})_i]}{V[\Delta \log(\text{GDP})_i]}$$

Which is the ordinary least squares estimate of the slope in the cross-sectional regression of $\Delta \log(\text{C}+\text{G})_i$ on $\Delta \log(\text{GDP})_i$.

The paper interpret β^u as the fraction of shocks to GDP that is not smoothed. The coefficients β^l , β^T , β^S are interpreted as the fraction of shocks absorbed through , net primary income flows, net current transfers, and gross saving, respectively. If consumption satisfies equation (7) or (8), $\beta^l + \beta^T + \beta^S = 1$ and $\beta^u = 0$. If not, $\beta^l + \beta^T + \beta^S < 1$ and $\beta^u > 0$.

Indeed ,if there is full risk-sharing, that is, if equation (7) or (8) holds, then $\text{cov}[\Delta \log(\text{GDP})_i, \Delta \log(\text{C}+\text{G})_i] = 0$, and hence $\beta^u = 0$. If full risk-sharing is not achieved, then consumption in country i varies positively with idiosyncratic shocks to country i 's output, and $\beta^u > 0$. A cross-sectional regression of consumption on output, controlling for fluctuations in world consumption is, therefore, a test of full risk-sharing⁴. If full risk-sharing is achieved through income insurance via net primary income flows, GNI will satisfy equation (7) or (8). Then $\text{cov}[\Delta \log(\text{GNI})_i, \Delta \log(\text{GDP})_i] = 0$ and hence $\text{cov}[\Delta \log(\text{GDP})_i - \Delta \log(\text{RNB})_i, \Delta \log(\text{GDP})_i] = \text{var}[\Delta \log(\text{GDP})_i]$, implying $\beta^l = 1$.

Suppose that full risk-sharing is not achieved through income insurance via net primary income flows, but is achieved through the combination of net primary income flows and net current transfers. Then DNI will satisfy equation (7) or (8) and, by analogous reasoning, $\beta^l + \beta^T = 1$, and since consumers in each country will consume their DNI , $\beta^u = 0$. Similarly, if the full risk-sharing allocation is achieved through net primary income flows, net current transfers, and savings, $(\text{C}+\text{G})$ will satisfy equation (7) or (8). Then, by analogous reasoning, $\beta^l + \beta^T + \beta^S = 1$ and $\beta^u = 0$.

⁴ This is precisely the test suggested by Cochrane (1991), Mace (1991) and Townsend (1994). They test for full risk-sharing by running cross-sectional (or panel) regressions of consumption on income, controlling for aggregate movements in income and consumption.

Until then, the methodological framework is identical to Tapsoba (2009). For its contribution, this study states that the net primary incomes channel and the net current transfers channel can be decomposing into several risk-sharing channels.

Indeed if: $\text{primary incomes} \equiv \text{compensation of employees} + \text{net taxes on products} + \text{property income} + \text{investment income (direct investment, portfolio investment)}$.

So let's consider: $GNI^* = GDP + \text{net taxes on products}$ and $GNI = GNI^* + \text{other net primary incomes (including net compensation of employees, net property income and net investment income)}$

As far as, if: $\text{current transfers} \equiv \text{current taxes on income} + \text{social contributions} + \text{social benefits} + \text{current international cooperation} + \text{workers' remittances, etc.}$

So let's consider: $DNI^* = GNI + \text{net remittances}$; $DNI^{**} = DNI^* + \text{official development assistance}$ and $DNI = DNI^{**} + \text{other net current transfers (including current taxes on income, social contributions, social benefits...)}$

This implies that equality (11) becomes:

$$GDP_i = \frac{GDP_i}{GNI^*_i} \times \frac{GNI^*_i}{GNI_i} \times \frac{GNI_i}{DNI^*_i} \times \frac{DNI^*_i}{DNI^{**}_i} \times \frac{DNI^{**}_i}{DNI_i} \times \frac{DNI_i}{(C+G)_i} \times (C+G)_i \quad (13)$$

The empirical strategy just described results in the following regressions:

$$\left\{ \begin{array}{l} \Delta \log GDP_{i,t} - \Delta \log GNI^*_{i,t} = \alpha^f_t + \beta^f \Delta \log(GDP)_{i,t} + \varepsilon^f_{i,t} \\ \Delta \log GNI^*_{i,t} - \Delta \log GNI_{i,t} = \alpha^{ol}_t + \beta^{ol} \Delta \log(GDP)_{i,t} + \varepsilon^{ol}_{i,t} \\ \Delta \log GNI_{i,t} - \Delta \log DNI^*_{i,t} = \alpha^R_t + \beta^R \Delta \log(GDP)_{i,t} + \varepsilon^R_{i,t} \\ \Delta \log DNI^*_{i,t} - \Delta \log DNI^{**}_{i,t} = \alpha^A_t + \beta^A \Delta \log(GDP)_{i,t} + \varepsilon^A_{i,t} \\ \Delta \log DNI^{**}_{i,t} - \Delta \log DNI_{i,t} = \alpha^{oT}_t + \beta^{oT} \Delta \log(GDP)_{i,t} + \varepsilon^{oT}_{i,t} \\ \Delta \log DNI_{i,t} - \Delta \log(C+G)_{i,t} = \alpha^S_t + \beta^S \Delta \log(GDP)_{i,t} + \varepsilon^S_{i,t} \\ \Delta \log(C+G)_{i,t} = \alpha^u_t + \beta^u \Delta \log(GDP)_{i,t} + \varepsilon^u_{i,t} \end{array} \right. \quad (14)$$

$$\text{With: } \beta^f + \beta^{ol} + \beta^R + \beta^A + \beta^{oT} + \beta^S + \beta^u = 1 \quad (15)$$

Where α_t are year fixed effects (FE). Heterogeneity cannot be treated as random effects in this framework. The random effects model is appropriate if one is drawing N countries or individuals randomly from a large population. This is usually the case for household panel studies, where care is taken in the design of the panel to make it representative of the population about which one is trying to make inferences (Yehoue, 2011). In such a case N is usually large and a fixed effects model would lead to significant loss of degree of freedom (Baltagi, 2005). The fixed effects model is an appropriate specification here because the focus is on the fifteen specific (not randomly drawn) ECOWAS zone countries and inference here is conditional on these countries.

$\beta^f, \beta^{oI}, \beta^R, \beta^A, \beta^{oT}$ are interpreted as the fraction of shocks smoothed respectively by the *net taxes on products (f)*, *other net primary incomes (oI)*, *net remittances (R)*, *official development assistance (A)*, and *other net current transfers (oT)*.

Formally, the study shows that the smoothing of shocks via indirect taxes is measured through the regression of $(\Delta \log GDP_{i,t} - \Delta \log GNI^*_{i,t})$ on $\Delta \log(GDP)_{i,t}$ instead of $[\Delta \log(DNI)_{i,t} - \Delta \log(DNI + \text{indirect taxes})_{i,t}]$ on $\Delta \log(GDP)_{i,t}$ as do Afonso and Furceri (2008). Similarly, the study shows that the smoothing of shocks via remittances and ODA is measured respectively by the regression of $(\Delta \log GNI_{i,t} - \Delta \log DNI^*_{i,t})$ on $\Delta \log(GDP)_{i,t}$ and $(\Delta \log DNI^*_{i,t} - \Delta \log DNI^{**}_{i,t})$ on $\Delta \log(GDP)_{i,t}$ and not through the regression $[\Delta \log GDP_{i,t} - \Delta \log(GDP + \text{remittances} / \text{ODA})_{i,t}]$ on $\Delta \log(GDP)_{i,t}$ as do Balli and Balli (2011).

Estimation strategy

The basic model (14) above as formulated normally involves jointly estimating seven equations. For this purpose, the study uses the SUR (Seemingly Unrelated Regression) estimation method which takes into account heteroscedasticity and the contemporary correlation of residues between equations. The SUR method usually takes into account the individual correlation at a given period, while assuming zero correlation between two hazards as soon as the periods are different (see Biorn, 2004). Since the study does not individually constrain the coefficients β , they can be greater than 1 or even negative. A negative coefficient β is interpreted as an exacerbation of the shock concerned or the risk-sharing channel is itself the cause of a shock. The only constraint is on the sum of the coefficients.

Several observations are worth noting about the estimates. First, according to Melitz and Zumer (2002), the last equation of the model (14) is redundant and because of identity (15), only six of the seven coefficients β can be correctly estimated jointly. Melitz and Zumer (2002) therefore estimate the proportion of asymmetric shocks compensated respectively by the different risk-sharing channels by considering only the first six equations of the model (14) with a predetermined value of β^u . According to the authors, the only estimate of the last equation that can agree with the interpretation of the coefficients based on the GDP decomposition is a perfect fit (R-squared = 1), which is generally unlikely.

The study estimates in isolation the last equation of the system (14) by two-step General Least Squares (GLS)⁵ and then the other six equations, jointly by the SUR method while imposing the constraint (15).

Sample and data

The data used in this paper come from the World Bank's World Development Indicators (WDI). The estimate is based on annual data from 1980 to 2016 and covers the fifteen ECOWAS countries. The variables are in constant terms (US 2010) and expressed per capita. They are also transformed into logarithms. Due to the unavailability of some data, the panel data is unbalanced.

⁵ The first step corrects country heteroscedasticity and first order autocorrelation AR (1) by the Cochrane-Orcutt method. The second step applies Ordinary Least Squares (OLS) without constraints on the coefficients; see Tapsoba (2009) and Yehoue (2011).

III. Results and interpretations

Baseline Results

Table 2 summarizes the baseline results. The results show over the period 1980-2016 that 21.1% (1-0.789) of asymmetric shocks are smoothed between the WAEMU countries; 32.63% (1-0.6737) of asymmetric shocks are smoothed between Non-WAEMU countries, and 27.83% (1-0.7217) of asymmetric shocks are smoothed between ECOWAS countries.

Table 2: baseline results

	WAEMU	Non-WAEMU	ECOWAS	ECOWAS (without Guinea and Guinea- Bissau)
Net taxes on products (β^f)	-0.0575** (0.0295) R ² =0.5069	0.0559*** (0.02) R ² =0.4818	0.0263 (0.0263) R ² =0.2307	0.0345* (0.0186) R ² =0.2488
Other net primary incomes (β^{ol})	0.0761** (0.037) R ² =0.4346	0.0455 (0.0512) R ² =0.5899	0.0713** (0.0343) R ² =0.2554	0.0636* (0.0365) R ² =0.2670
Net primary incomes (β^l)	0.0186 N=130	0.1014 N=94	0.0976 N=224	0.0981 N=199
Net remittances (β^R)	0.0356** (0.0176) R ² = 0.359	-0.0129 (0.016) R ² =0.3403	0.0095 (0.0105) R ² =0.2363	-0.0011 (0.0102) R ² =0.2663
Official development assistance (β^A)	0.0198 (0.0658) R ² = 0.3178	0.1165** (0.0592) R ² = 0.365	0.108*** (0.0411) R ² =0.1543	0.1122*** (0.0385) R ² =0.1991
Other net current transfers (β^{oT})	-0.0423 (0.0751) R ² =0.2618	-0.1132* (0.063) R ² =0.3677	-0.1075** (0.045) R ² =0.1213	-0.106*** (0.042) R ² =0.1639
Net current transfers (β^T)	0.0131 N=130	-0.0096 N=99	0.01 N=224	0.0051 N=199
Gross saving (β^S)	0.1793*** (0.0555) R ² = 0.2805 N=130	0.2345*** (0.0606) R ² =0.5276 N=99	0.1707*** (0.0398) R ² =0.2198 N=224	0.1686*** (0.0411) R ² =0.2353 N=199
Not Smoothed (β^u)	0.789*** (0.0782) N=214	0.6737*** (0.1724) N=116	0.7217*** (0.0843) N=330	0.7282 (0.0878) N=304
Sum of coefficients	1.0000	1.0000	1.0000	1.0000
Year FE	Yes	Yes	Yes	Yes

Source : Author.

Note: ECOWAS is made up of WAEMU and Non-WAEMU countries. The last equation (β^u) is estimated by two-step General Least Squares (GLS) and the others by the SUR method. (.) standard deviation; N, number of observations; *** p<0.01, ** p< 0.05, * p<0.1.

These results indicate a greater diversification of portfolios of assets in the Non-WAEMU zone than in the WAEMU zone. This is not surprising since financial integration is higher in the Non-WAEMU zone than in the WAEMU zone, see appendix 2-a. Since the WAEMU zone is less financially integrated than the Non-WAEMU zone, the Non-WAEMU zone shares the risks better than the WAEMU zone, which is in line with the risk-sharing theory that financial and economic integration leads to a better risk-sharing between countries.

As Tapsoba (2009), table 2 indicates that savings play a significant role in smoothing shocks. Indeed, it contributes significantly at the 1% threshold to smooth 17.93%; 23.45% and 17.07% of asymmetric shocks respectively in WAEMU zone, in the Non-WAEMU zone and in ECOWAS. In addition, by decomposing the net primary incomes channel, the results show a procyclicality of net taxes on products that restricts the smoothing of asymmetric shocks via net primary incomes between WAEMU countries.

However, other net primary incomes contribute to smoothing significantly at the 1% threshold; 7.61% of asymmetric shocks between countries in the region. In the Non-WAEMU zone, on the other hand, net taxes on products contribute to smoothing significantly at the 1% threshold; 5.59% of asymmetric shocks between countries in the region. In the ECOWAS zone, other net primary incomes contribute to smoothing significantly at the 5% threshold; 7.13% of asymmetric shocks between countries in the region.

Thus, the procyclicality of net taxes on products in WAEMU limits the absorption capacity of shocks through net primary incomes. The procyclicality of net taxes on products in the WAEMU can be explained by the high degree of corruption in the region, see chart 2. To verify this, the study excludes Guinea and Guinea-Bissau, which are among the most corrupt countries in ECOWAS according to Transparency International. Table 2 (last column) shows that net taxes on products contribute at the 10% threshold to smooth 3.45% of asymmetric shocks in the region. The results also show a slight increase in the absorptive capacity of shocks through primary incomes and ODA from 9.76% to 9.81% and from 10.8% to 11.22% respectively. As a result, reducing corruption increases the effectiveness of the net taxes on products channel and ODA in smoothing asymmetric shocks between ECOWAS countries.

Moreover, by decomposing the net current transfers channel, table 2 indicates that net remittances (respectively official development assistance) contribute to a significant smoothing at the 5% threshold; 3.56% (respectively 11.65%) of asymmetric shocks between the WAEMU countries (respectively Non-WAEMU). Finally, the results show in ECOWAS that official development assistance contributes to smoothing significantly at the 1% threshold; 10.8% of asymmetric shocks between countries in the region.

Thus, other net current transfers such as social contributions or social benefits probably limit the shock absorption capacity of net current transfers. The procyclicality of other net current transfers is not surprising because social contributions or social benefits, for example, tend to increase in expansion period and decline in recession period.

In a context of increasing financialization of economies, a period analysis is used to assess the degree of risk-sharing over time. It is also a way of judging the robustness of the different results.

Degree of risk-sharing over time

Previous estimates are conducted over the period (1980-2016). In this section, the idea is to analyze the degree of risk sharing over time while testing the robustness of the different results above. For this, the analysis focuses on the sub-periods: (1980-1999) and (2000-2016). The decomposition of the sub-periods is based on the fact that since 2000, net taxes on products, net remittances, and official development assistance have increased significantly, see charts 1 and 3.

Table 3: Degree of risk-sharing over time

	WAEMU		Non-WAEMU		ECOWAS	
	1980-1999	2000-2016	1980-1999	2000-2016	1980-1999	2000-2016
Net taxes on products (β^f)	-0.0353 (0.0589) R ² =0.577	-0.0499* (0.031) R ² =0.2917	0.0676** (0.0297) R ² =0.6047	0.0553** (0.0268) R ² =0.2705	0.0224 (0.0357) R ² =0.2612	0.0336* (0.018) R ² =0.1753
Other net primary incomes (β^{o1})	0.0489 (0.0628) R ² =0.5609	0.077* (0.044) R ² =0.2533	0.027 (0.1098) R ² =0.6191	0.0529 (0.0456) R ² =0.4614	0.0947 (0.0792) R ² =0.2623	0.0536* (0.0291) R ² =0.2387
Net primary incomes (β^I)	0.0136 N=38	0.0271 N=89	0.0946 N=37	0.1082 N=55	0.1171 N=95	0.0872 N=144
Net remittances (β^R)	0.0114 (0.0153) R ² =0.5412	0.0455* (0.0257) R ² =0.3295	0.0027 (0.0176) R ² =0.4036	-0.0273 (0.0243) R ² =0.3187	0.013 (0.0116) R ² =0.2836	0.0075 (0.0154) R ² =0.2274
Official development assistance (β^A)	0.0337 (0.074) R ² =0.5886	0.0265 (0.0917) R ² =0.1973	0.0053 (0.0754) R ² =0.4409	0.2312*** (0.0879) R ² =0.2454	0.0514 (0.0563) R ² =0.2407	0.1501*** (0.0562) R ² =0.1025
Other net current transfers (β^{oT})	-0.0717 (0.0792) R ² =0.5537	-0.0318 (0.1067) R ² =0.1629	-0.0191 (0.0807) R ² =0.4719	-0.2019** (0.0879) R ² =0.3058	-0.0831 (0.061) R ² =0.2067	-0.1329** (0.0617) R ² =0.0894
Net current transfers (β^T)	-0.0266 N=38	0.0402 N=89	-0.0111 N=37	0.002 N=55	-0.0187 N=95	0.0247 N=144
Gross saving (β^S)	0.171*** (0.0469) R ² =0.6209 N=38	0.2732*** (0.0815) R ² =0.1638 N=89	-0.0377 (0.1158) R ² =0.5047 N=37	0.314*** (0.0732) R ² =0.3747 N=55	0.0484 (0.0743) R ² =0.2971 N=95	0.2542*** (0.0468) R ² =0.1522 N=144
Not Smoothed (β^u)	0.842*** (0.091) N=95	0.6595*** (0.1449) N=114	0.9542*** (0.2073) N=37	0.5758*** (0.2263) N=77	0.8532*** (0.0937) N=132	0.6339*** (0.1287) N=191
Sum of coefficients	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Source : Author.

Note: ECOWAS is made up of WAEMU and Non-WAEMU countries. The last equation (β^u) is estimated by two-step General Least Squares (GLS) and the others by the SUR method. (.) standard deviation; N, number of observations; *** p<0.01, ** p<0.05, * p<0.1.

Table 3 shows that the degree of risk-sharing has increased over time. Indeed in the WAEMU zone; 15.8% (1-0.842) of asymmetric shocks are smoothed over the period (1980-1999) against 34.05% (1-0.6542) over the period (2000-2016). Similarly in the Non-WAEMU zone; 4.58% (1-0.9542) of asymmetric shocks are smoothed over the period (1980-1999) against 42.42% (1-0.5758) over the period (2000-2016). Finally, in the ECOWAS, 14.68% (1-0.8532) of asymmetric shocks are smoothed over the period (1980-1999) against 36.61% (1-0.6339) over the period (2000-2016). These results implicitly underline the idea that the financial and economic integration of countries increases the degree of risk-sharing, see appendix 2-b.

In addition, table 3 indicates that whatever the zone considered, the increase in the degree of risk-sharing is mainly linked to gross saving. In the WAEMU zone for example, 17.1% of asymmetric shocks are smoothed over the period (1980-1999) against 27.32% over the period (2000-2016). The increase over time in the absorptive capacity of asymmetric shocks via gross saving is not surprising. Indeed, ECOWAS has three stock exchanges: a regional stock exchange of the WAEMU (La Bourse Régionale des Valeurs Mobilières, created in 1998) submitted to the Regional Council of Public Savings and Financial Markets (CREPMF) and two national stock exchanges one Ghanaian (Ghana Stock Exchange, created in 1989) and the other Nigerian (Nigeria Stock Exchange, created in 1960).

According to the Nigeria Stock Exchange, the stock market index ranges from 127.3 in 1985 to 5266.4 in 1999 and from 8111 in 2000 to 24770.52 in 2010. According to the Ghana Stock Exchange, the stock index ranges from 70.25 in 1990 to 736.16 in 1999 and from 857.98 in 2000 to 1689.09 in 2016. According to the CREPMF, the volume of stock market transactions ranges from 10.6 billion CFA franc in 1998 to 409 billion CFA franc in 2016. The stock market (respectively bonds) ranges from 1018.9 (0) billion CFA franc in 1998 to 7706 (2509) CFA franc in 2016. The BRVM composite index ranges from 98.05 in 1998 to 292.2 in 2016.

Moreover, the WAEMU interbank market grew from 66 banks in 1991 to 122 banks in 2015, that to say an increase of 85%. The share of deposits and borrowings in GDP increased from 16.4% in 1991 to 35.3% in 2015 (BCEAO annual reports). Over time, WAEMU through its Central Bank has made considerable efforts and financial resources to structure and deepen the Union's capital market (Bationo, 2018). In this line, the paper can mention the creation of the Union Deposit Guarantee Fund in 2014, which protects savers and encourages the collection of savings, as well as the creation of a regional solidarity bank in 2005 to support economic actions to fight against poverty.

Table 3 also shows an increase over time in the absorptive capacity of shocks via net remittances and official development assistance respectively in the WAEMU zone and in the Non-WAEMU zone. These results are in line with the results in table 2 given to the significant evolution of these financial flows since 2000. In ECOWAS, for example, 5.14% of asymmetric shocks are smoothed via official development assistance over the period (1980-1999) against 15.01% over the period (2000-2016).

Finally, table 3 shows an increase over time of the absorption capacity (respectively exacerbation) of shocks via net taxes on products in the ECOWAS (WAEMU). These results are also consistent with the results in table 2 given to the significant evolution of net taxes on products since 2000. In ECOWAS for example, 2.24% of asymmetric shocks are smoothed via net taxes on products over the period (1980-1999) against 3.36% over the period (2000-2016).

The effectiveness of net taxes on products to smooth asymmetric shocks between ECOWAS countries in the 2000s is not surprising. Indeed, the Heads of State of the region, aware of the serious consequences of corruption on investment, economic growth and democracy; convinced of the need to adopt preventive and repressive measures to combat corruption, defined the anti-corruption protocol in December 2001. Its purpose is to promote and strengthen, in each of the member states, the development of effective mechanisms to prevent, suppress and eradicate corruption. These preventive measures have reduced the degree of corruption in ECOWAS and favored a better smoothing of asymmetric shocks via net taxes on products.

The sub-period analysis consolidates the different results from table 2. The results remain unchanged. In particular, the robustness of the various risk-sharing channels over the period 2000-2016 is particularly noticeable. This is not surprising since financial and economic integration over time allows for better risk-sharing among ECOWAS countries.

IV. Implications in terms of economic policies

In monetary union, heterogeneous shocks are not problematic if mechanisms, other than the exchange rate, are in place to allow countries to adjust to specific shocks. The study identifies three channels to smooth asymmetric shocks between ECOWAS countries: net primary incomes other than net taxes on products, official development assistance, and gross saving. In addition, the results show, in a context of increasing financialization of economies, the degree of risk-sharing increase over time in ECOWAS. These results imply that ECOWAS can overcome the obstacle of asymmetric shocks through risk-sharing strategies.

ECOWAS countries must therefore prioritize, in terms of financial innovation, the role of savings and financial institutions by actively participating in the expansion of regional credit markets. The establishment of an operational financial market is essential for the amortization of shocks. To do this, bringing banks closer to their customers, either physically or virtually, as well as improving internal management, will reduce average transaction costs in the region. In addition, promoting competition among banks by diversifying operators, financial products and services will facilitate financial inclusion.

The creation of regional banks, where savings from different countries can be pooled, is absolutely necessary. Indeed, regional or international credit markets (regional stock market, interbank market or securities market) can be a response to asymmetric shocks by serving as supports for regional savings. Households, businesses and governments in a country in temporary difficulty can benefit from savings from expanding partners if financial markets are developed. Conversely, during boom periods, a nation can place its savings surplus in these same financial markets.

Addressed directly to governments, public aid is easy to steal. In West Africa, where corruption is omnipresent, this aid is often used to enrich public authorities with little regard for the collective interest. This is why the effectiveness of official development assistance is often called into question because it does not make it possible to significantly finance large resilience projects for the benefit of vulnerable populations. In addition, the mobilization of resources by the state is often compromised by significant losses resulting from tax evasion and

misappropriation of state revenues. Thus the effectiveness of ODA and primary incomes channel passes through a fight against corruption.

To this end, enhanced transparency and accountability are essential requirements of good governance and, ultimately, the reduction of corruption. In addition, the lack of a participatory approach by West African populations leaves room for corruption. For that, West African states should adopt and enforce processes that enable citizens, including vulnerable groups, to participate in development planning and policy development. Finally, the establishment of economic governance (institutional architecture that allows the management of macroeconomic policies) in ECOWAS can help reduce corruption.

Conclusion

This study analyzes the risk-sharing mechanisms in ECOWAS over the period 1980-2016. The study relies on the method of decomposing the variance of GDP growth rate to identify the risk-sharing channels that operate in ECOWAS. The results of the study show that the heterogeneity of the ECOWAS countries should not be an obstacle to the project of creation of a monetary union because there are mechanisms other than the exchange rate, which can be set up for allow countries to adjust after specific shocks. Indeed, the results show that net primary incomes other than net taxes on products, official development assistance and gross saving are the main channels for risk-sharing in ECOWAS. Even if the asymmetry of the cycles is an obstacle to the monetary union, this should not prevent ECOWAS from creating a single currency because the study also shows an increase over time of the smoothing of asymmetric shocks between the countries of the region.

Several implications for monetary union arise from these results. Monetary union in West Africa is possible because the latter stimulates intra-community trade and thus synchronizes cycles. However, even if monetary union in ECOWAS tends to increase the heterogeneity of productive structures by stimulating inter-branch exchanges in the zone, this is not a problem because there are mechanisms to smooth asymmetric shocks. Thus, for a better risk-sharing, the countries of the region must prioritize, in terms of financial innovation, the role of savings and financial institutions by actively participating in the expansion of regional credit markets. The fight against corruption in the region must be on the agenda in order to contribute to the effectiveness of official development assistance and to reduce the procyclicality of indirect taxes.

Bibliography

- Afonso, A. & Furceri, D. (2008). EMU enlargement, stabilization costs and insurance mechanisms. *Journal of International Money and Finance*, 27, 169-187.
- Adler, G. (2008). Original sin and procyclical fiscal policy: two sides of the same coin? IMF Working Paper, (8).
- Akitoby, B., Clements, B., Gupta, S. & Inchauste, G. (2006). Public spending, voracity, and Wagner's law in developing countries. *European Journal of Political Economy*, 22 (4).
- Alberola, E. & Montero, J. M. (2006). Debt sustainability and procyclical fiscal policies in Latin America. Banco de España Working Paper, (0611).

Alesina, A., Tabellini, G. & Campante, F., R. (2008). Why is fiscal policy often procyclical? *Journal of the European Economic Association*, 6(5), 1006-1036.

Arifari, N., B. (2006). We don't eat the papers: corruption in transport, customs and the civil forces. Extrait de *Everyday Corruption and the State. Citizens and Public Officials in Africa*, Giorgio Blundo and Jean-Pierre Olivier de Sardan, eds. Londres: Zed Books.

Arreaza, A., Sorensen, B. E. & Yosha, O. (1998). Consumption Smoothing through Fiscal Policy in OECD and EU Countries. Working Paper (6372), National Bureau of Economic Research (NBER).

Asdrubali, P., Sorensen, B. & Yosha, O. (1996). Channels of Interstate Risk-sharing: United States 1963-90. *Quarterly Journal of Economics*, 111 (4), 1081-1110.

Balli, F., & Balli, H. O. (2011). Income and consumption smoothing and welfare gains across Pacific Island countries: the role of remittances and foreign aid. *Economic Modelling*, 28(4), 1642-1649.

Balli, F., & Rana, F. (2015). Determinants of risk sharing through remittances. *Journal of Banking & Finance*, 55, 107-116.

Bangake, C. & Eggoh, J. (2008). The impact of currency unions on trade: Lesson from CFA franc zone and implications for proposed African Monetary Unions. Centre for Socio-economic Dynamics and Cooperation of the University of Bergamo, *Savings and Development*, 33(1), 61-72.

Baltagi, B., H. (2005). *Econometric Analysis of Panel Data*, (3rd edn). John Wiley & Sons Ltd Press: Chichester, West Sussex, United Kingdom.

Bationo, B., F. (2018). Politique monétaire et de change- Le franc CFA, un choix optimal pour l'union monétaire ouest-africaine, *L'Harmattan*, collection études africaines.

Baxter, M. & Kouparitsas, M. A. (2005). Determinants of Business Cycle Comovement: a Robust Analysis. *Journal of Monetary Economics*, 52 (1), 113-157.

Bayoumi, T., Masson, P. (1995). Fiscal flows in the United States and Canada: Lessons for monetary union in Europe. *European Economic Review*, 39, 253-274.

Bayoumi, T. & Eichengreen, B. (1993). Shocking Aspects of Monetary European Monetary Unification. In Giavazzi, F. and Torres, F. (eds). *The Transition to Economic and Monetary Union in Europe* (Cambridge: Cambridge University Press).

BCEAO. (2013). Synthèse des résultats des enquêtes sur les envois de fonds des travailleurs migrants dans les pays de l'UEMOA. Direction Générale des Etudes Economiques et de la Monnaie.

Biorn, E. (2004). Regression system for unbalanced panel data: a stepwise maximum likelihood procedure. *Journal of Econometrics*, 122, 281-91.

Caldéron, C., Chong, A. & Stein E. (2007). Trade Intensity and Business Cycle Synchronization: are Developing Countries Any Different? *Journal of International Economics*, 71 (1), 2-21.

- Calderon C., Duncan, R. & Schmidt-Hebbel, K. (2004). Institutions and cyclical properties of macroeconomic policies. Central Bank of Chile Working Papers, (285).
- Calero C., Bedi S. & Sparrow, R. (2009). Remittances, liquidity constraints and human capital investments in Ecuador. *World Development*, 37 (6), 1143-1154.
- Carrère, C. (2004). African Regional Agreements: Impact on Trade with or without Currency Unions. *Journal of African Economies*, 13 (2), 199-239.
- Clévenot, M. & Duwicquet, V. (2011). Partage du risque interrégional. Une étude des canaux budgétaires et financiers aux États-Unis et en Europe. *Revue de l'OFCE*, 119.
- Cochrane, J., H. (1991). A simple test of consumption insurance. *Journal of Political Economy*, 99,957– 976.
- Cohen, C. & Wyplosz, C. (1989). The European Monetary Union: An Agnostic Evaluation. C.E.P.R, Discussion Paper.
- Ebeke, C., E. & Le Goff, M. (2010). Impact des envois de fonds des migrants sur les inégalités de revenu dans les pays en développement, *Revue économique*, 61(6),1051-1074
- Frankel, J. A. & Rose, A. K. (1998). The Endogeneity of the Optimum Currency Area Criteria. *Economic Journal*, 108 (449), 1009-1025.
- Gravet, I. (2014). Zone euro et spécialisation productive. Ressources en sciences économiques et sociale, Ecole Normale Supérieure de Lyon.
- Hayashi, F., Altonji, J. & Kotlikoff, L. (1996). Risk-sharing between and within families. *Econometrica*, 64, 261–294.
- Huart, F. (2011). Les politiques budgétaires sont-elles contra-cycliques dans la zone euro ? *Revue de l'OFCE*, 116.
- Inklaar, R., Jong-A-Pin, R. & de Haan J. (2008). Trade and Business Cycle Synchronization in OECD countries A Re-examination. *European Economic Review*, 52(4), 646-666.
- Kalemli-Ozcan, S., Sorensen, B. & Yosha, O. (2001). Regional Integration, Industrial Specialization and the Asymmetry of Shocks across Regions. *Journal of International Economics*, 55,107–137.
- Kaminski, G., Reinhart C. & Vegh, C. (2004). When it rains it pours: procyclical capital flows and macroeconomic policies. NBER Macroeconomic Annual 2004, edited by Mark Gertler and Kenneth Rogoff. MIT Press.
- Kenen, P. (1969). The Theory of Optimum Currency Areas: an Eclectic view. Monetary Problems of the International Economy, R. Mundell and K. Swoboda, University of Chicago Press.
- Krugman, P. (1993). Lessons of Massachusetts for EMU. In Francisco Torres et Francesco Giavazzi, eds, Adjustment and Growth in the European Monetary Union, Cambridge University Press.
- Mace, B., J. 1991. Full insurance in the presence of aggregate uncertainty. *Journal of Political Economy*, 99, 928–956.

McKinnon, R. (1963). *Money and Capital in Economic Development*. Washington, DC: Brookings Institution.

Mundell, R. A. (1961). A Theory of Optimal Currency Areas. *American Economic Review*, 51 (4), 667-665.

Méltiz, J. & Zumer, F. (2002). Partage du risque dans l'Union Européenne. Expériences interrégionales et internationales. *Revue de l'OFCE*, hors-série, 300-323.

Obstfeld, M. & Rogoff, K. (2000). The six major puzzles in international macroeconomics: is there a common cause? NBER Working Paper Series, 7777.

Obstfeld, M. (1994). Are industrial-countries consumption risks globally diversified? In *Capital Mobility: The Impact on Consumption, Investment, and Growth*, Leonardo L, Assaf R (eds). Cambridge University: New York.

Rapport sur la gouvernance en Afrique IV (2016). Mesurer la corruption en Afrique : prendre en compte la dimension internationale. Nations Unies, Commission économique pour l'Afrique.

Revue d'économie financière (2013). Les fusions-Acquisitions, 50 ans d'unions monétaires africaines, crises immobilières et crises financières, *Revue trimestrielle de l'association d'économie financière*, (110).

Rose, A.K. 2000. One money, one market: Estimating the Effect of Common Currencies on Trade. *Economy Policy*, 17, 7-46.

Sala-i-Martin, X. & Sachs, J. (1992). Fiscal Federalism and optimum currency areas: Evidence for Europe from the United States. In Matthew Canzoneri, Vittorio Grilli et Paul Masson, eds., *Establishing a central bank: Issues in Europe for lessons from the U.S.*, Cambridge University Press.

Sorensen, B. & Yosha, O. (1998). International risk-sharing and European Monetary Unification. *Journal of International Economics*, 45, 211-238.

Tapsoba, S. J-A. (2009). Hétérogénéité des chocs et viabilité des unions monétaires en Afrique de l'Ouest. *Revue Economique et Monétaire*, (5), 38-63.

Talvi, E. & Vegh, C. (2005). Tax base variability and procyclicality of fiscal policy. *Journal of Development Economics*, 78, 156-190.

Tanzi, V. & Davoodi, H. (1997). Corruption, public investment and growth. Working Paper WP/97/139. <http://www.imf.org/external/pubs/ft/wp/wp97139.pdf>.

Thornton, J. (2008). Explaining procyclical fiscal policy in African Countries. *Journal of African Economies*, 17(3), 451-464.

Tornell, A & Lane, P. (1999). Voracity and growth. *American Economic Review*, 89, 22-46.

Townsend, R., M. (1994). Risk and insurance in village India. *Econometrica*, 62, 539-591.

Yehoue, E. (2011). International Risk-sharing and Currency Unions: The CFA Zones. *Journal of International Development*, 23, 936-958.

Weber, A., A. (1990). European Economic and Monetary Union and Asymmetries and adjustment problems in the European Monetary System: Some empirical evidence. European Economy (special edition), Brussels: Commission of the European Communities, 180-207.

World Bank. (2011). Migration and Remittances Factbook

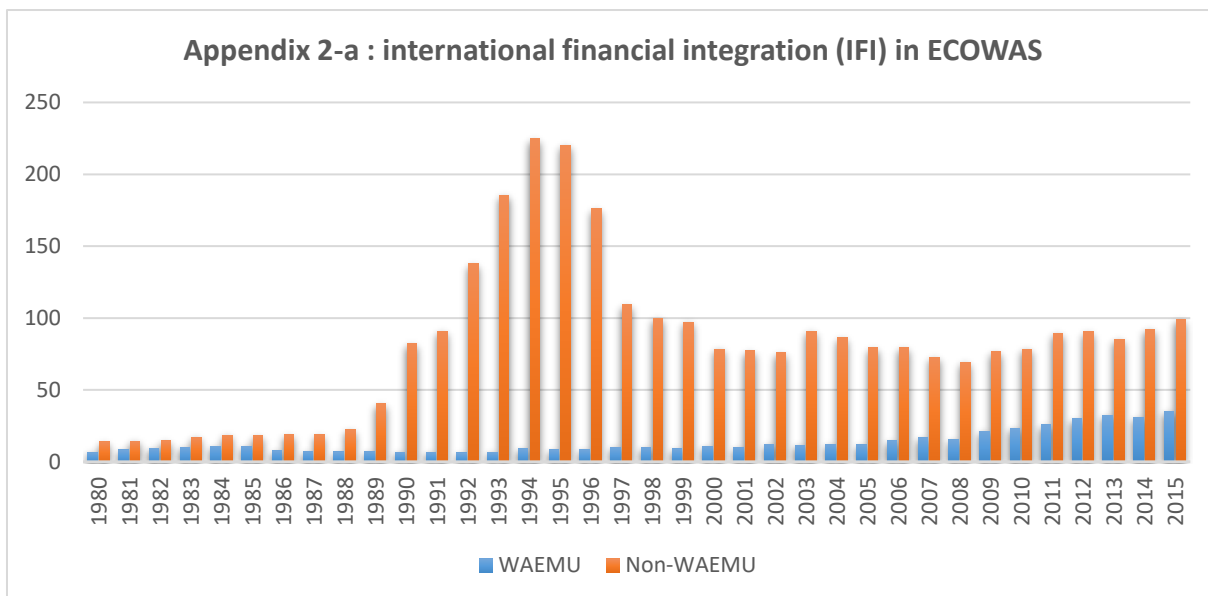
Appendices

Appendix 1: international risk-sharing in ECOWAS over the period 1980-2016

	WAEMU	Non-WAEMU	ECOWAS
Net primary incomes (β^I)	0.0067 (0.0245) $R^2=0.1738$ N=162	0.0655 (0.1813) $R^2=0.2162$ N=112	0.0751 (0.0819) $R^2=0.0914$ N=274
Net current transfers (β^T)	-0.0049 (0.0403) $R^2=0.1949$ N=162	-0.0105 (0.0304) $R^2=0.3026$ N=112	0.0037 (0.0227) $R^2=0.1237$ N=274
Gross saving (β^S)	0.2091*** (0.0473) $R^2=0.2388$ N=162	0.2713 (0.1855) $R^2=0.2878$ N=112	0.1995** (0.0853) $R^2=0.1262$ N=274
Not Smoothed (β^u)	0.789*** (0.0782) N=214	0.6737*** (0.1724) N=116	0.7217*** (0.0843) N=330
Sum of coefficients	1.0000	1.0000	1.0000
Year FE	Yes	Yes	Yes

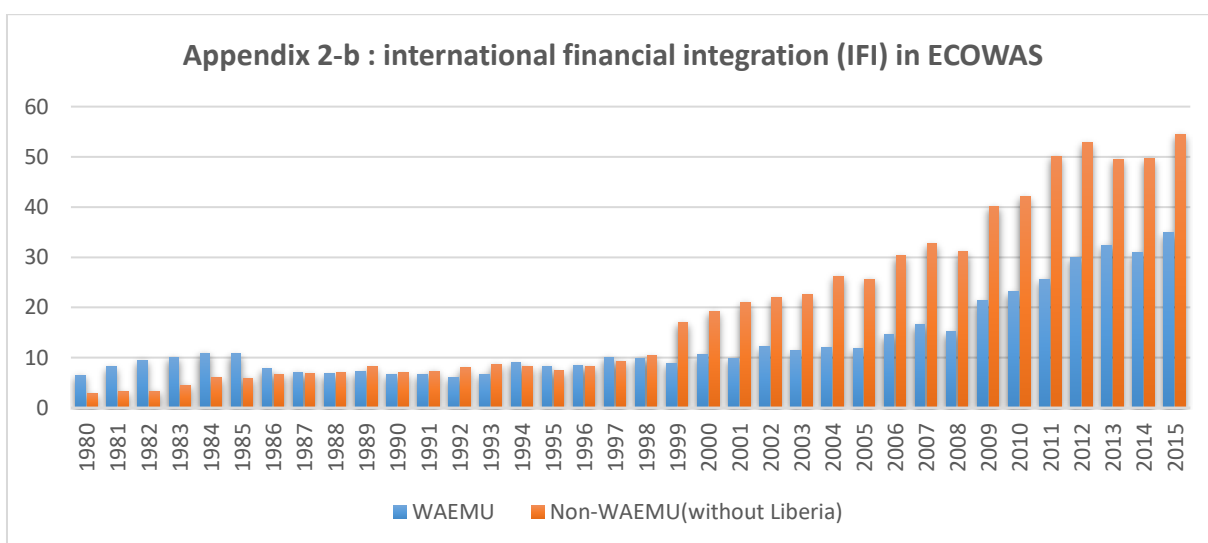
Source: Author.

Note: ECOWAS is made up of WAEMU and Non-WAEMU countries. The last equation (β^u) is estimated by two-step General Least Squares (GLS) and the others by the SUR method. (.) standard deviation; N, number of observations; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The model and estimation strategy are explained in the methodological framework.



Source: Philip R. Lane and Gian Maria Milesi-Ferretti (2017), "International Financial Integration in the Aftermath of the Global Financial Crisis," IMF Working Paper 17/115

Note: IFI = (stocks of aggregate foreign assets and liabilities)/GDP



Source: Philip R. Lane and Gian Maria Milesi-Ferretti (2017), "International Financial Integration in the Aftermath of the Global Financial Crisis," IMF Working Paper 17/115

Note: IFI = (stocks of aggregate foreign assets and liabilities)/GDP