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HAS AGRICULTURAL SPECIALIZATION SYNCHRONIZED BUSINESS CYCLES IN THE WAEMU?

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ABSTRACT

This paper analyses the cyclical impact of agricultural productivity shock on macroeconomic fluctuations in West African Economic and Monetary Union (WAEMU) in order to determine its nature covering the period of 1960 to 2021. Since the advantage of an economic union is the reduction of the effects of asymmetric shocks and the better management of symmetric shocks, given the agricultural specialization of member countries, shocks to agriculture should promote the synchronization of business cycles. Our search for sources of synchronization leads us to use a Markov switching model with value added in the agricultural sector as the probability transition variable. Our main results indicate that, in the short term, in Senegal, the agricultural sector is likely to lead the economy into the expansion phase, unlike in Côte d'Ivoire and Mali. As a result of the activities of the agricultural sector, the probability transition parameters show that shocks have permanent effects on economic activity in the expansion phase in Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Niger and Togo. These economies do not exhibit some short-term vulnerability to fluctuations in agricultural commodity prices. The cycles are relatively long for Guinea-Bissau, Mali, and Togo. On the other hand, cycles are shorter in Burkina Faso and Senegal. This may justify the failure of certain economic stimulus policies of the 1980s and 1990s and the withdrawal of state subsidies in the agricultural sector in most of these countries. In addition, the significant differences in the length of the economic cycle in the WAEMU due to the activities of the primary sector show that business cycles have not yet been synchronized. This may confirm the thesis of Prebisch-Singer (1950): the trend towards deterioration in the terms of trade.

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INTRODUCTION

West African Monetary Union (WAMU) was found in 1962 to foster the development of member countries whose economies depend on the primary sector in line with the recommendations of international specialization of comparative advantage. A sector constantly subjected to the instability of commodity prices due to supply and demand shocks. In practice, the hypothesis of Prebisch-Singer (1950) is not far from being confirmed. The trade balance is structurally in deficit at times, particularly in the decades 1980-1990. In this context, there is a gradual deterioration in the terms of trade due to export revenues unable to cover import expenditure on a regular basis. This is particularly the case for Senegal over almost the entire 1965-2014 period and Togo over the 2000-2015 periods (Figure 1), while Niger has experienced certain stability in its terms of trade over the long term. Relative to other regions in Asia and Europe, investment flows are still insufficient, and barriers to intra-regional trade related to transaction costs remain high within the Union.

This situation highlights a certain difficulty in synchronising economic cycles despite a gradual improvement in the intensification of international trade and a single monetary policy. Under these conditions, the establishment of a relationship between agricultural cycles and business cycles is relevant for the analysis of a synchronisation or lag between business cycles in the WAEMU. In this region, all the countries have based themselves on David Ricardo's specialization model. However, regional cooperation and trade integration have been considered in recent decades as better strategies for poverty reduction, macroeconomic stability and increased production in a region. According to Frankel and Rose, (1998), countries of different economic size prior to entering an economic union eventually converge in their business cycle after entry into the union. This approach, referred to as the endogenous Optimal Currency Area (OCA) criterion, follows criticisms of exogenous (OCA) criteria advocated by Mundell, (1961) and Mc Kinnon, (1963). However, in view of the specialisation of member countries in the production of primary products, the criteria that seem to guide WAEMU economies are those of the ex-post (OCA) theory.

Moreover, the integration model adopted in this zone is the opposite of the one recommended by the stages of the Balassa integration, since in 1994, West African Monetary Union (WAMU) became an economic and monetary union (WAEMU). Decades after the weak integration of WAEMU member countries into regional trade to the detriment of international trade, have business cycles between member countries become synchronized? Faced with fluctuations in the prices of primary products, has the agricultural sector become the determinant or the obstacle to this synchronization?.

The objective of this paper is to analyze the effect of business cycles in the agricultural sector on macroeconomic fluctuations in the WAEMU in order to determine the existence of a possible comparative advantage. Within this framework, the analysis of the cyclical impact of the agricultural sector on growth instability shows us whether specialization in primary products can promote economic activity in all member countries. Before giving its implication, for a development strategy, an analysis of co-movements is indispensable. It can make it possible to verify the thesis of Prebisch-Singer, (1950) regarding the deterioration over time of the terms of trade in the WAEMU zone. Thus, the second and third sections deal respectively with the literature review and the theoretical assumptions of the specialization model. We also complete Section 3 with stylized facts by exploring the evolution of the link between primary sector and macroeconomic stability and section 4 with the econometric model and data sources. The estimation of this model leads to a discussion of the results (5) of the analysis of the cyclical effect of agricultural specialisation on the synchronisation of business cycles in the WAEMU. The last section concludes.

LITERATURE REVIEW

Since Mc Kinnon, (1961), the criteria for the viability of a currency area have evolved. Indeed, the viability of an optimal currency area depends on a number of factors that are responsible for the fluctuations or synchronization of business cycles. It is important for the exogenous theory of an optimal currency area where fluctuations are synchronous and controlled that it has prior price and wage flexibility and financial integration between countries before joining the union. In addition, integration of the markets for factors of production, goods and services; coordination of fiscal, monetary and national exchange rate policies; similar inflation rates; income correlation and the predominance of symmetrical shocks are required. Finally, there must be a predominance of symmetrical shocks and the existence of an adjustment mechanism to deal with asymmetrical shocks. In principle, if these criteria are met by the member countries of the currency area, it will not be necessary to make adjustments to the nominal exchange rate within the area. Among these criteria, for some authors, it is the non-correlation of production structures (problem of integration of production markets, for example) that is one of the main sources of fluctuations resulting in the non-optimality of growth. For the proponents of the endogenous theory of optimal currency areas, most of these criteria can be satisfied after countries join the union. Kenen, (1969) identifies two main transmission channels for macroeconomic co-fluctuations: sectoral specialisation and nominal shocks. Barrios et al. (2003) show in the case of Europe that sectoral specialisation leads to a certain asymmetry in GDP fluctuations. But it does not appear significant in explaining the reduction in correlations between the business cycles of the United Kingdom and the European Union.

According to the model initiated by Frankel and Rose, (1997, 1998), it is the intensification of international trade that best explains economic fluctuations. And trade integration is positively related to the synchronization of business cycles. However, its effect on the synchronization of business cycles is positive under one condition. If demand shocks dominate business cycle fluctuations, then increased trade integration is expected to increase the transmission of shocks from one country to another through the impact of these shocks on import demand.

The presence of industry-specific shocks may or may not reinforce the effect. In the case of different comparative advantage, trade leads each country to specialize in different industries, under these conditions, the net effect of trade integration on the correlation of business cycles will be negative (Eichengrean, 1992, Krugman, 1993). On the other hand, if trade is mainly intra-industry in nature to the extent that countries' production structures tend to be identical with the increase in trade, trade integration will lead to a high degree of business cycle synchronization. The existence of a positive relationship between trade intensity and cycle synchronization has been empirically validated by Frankel and Rose (1997, 1998), Fontagné *et al*. (1999), Imbs (2004), Babetskii (2005), Fidrmuc (2005), Baxter and Kouparitsas (2005), Calderon et al. (2007), Inklaar *et al*. (2008) and Tapsoba (2011). Authors such as Artis et al. (1999), Clark et al. (2001) have confirmed the positive effect of trade on business cycle synchronization in industrialized countries. Imbs (2000) and Fidrmuc (2001) highlight the role of intra-industry trade. They explain the positive impact of trade intensity on business cycle synchronisation by the nature of trade and the externalities of aggregate shocks. Although, Calderon et al. (2007) estimate that the magnitude of the effect is smaller among developing countries than among industrialized countries. This is confirmed by Tapsoba (2011), in the context of West African economies. Authors such as Erden et al, (2014) analyse the determinants of the international transmission of business cycles to the Turkish economy by examining the channel through which international business cycles are transmitted to Turkey. Applying several panel estimation methods to data from 22 countries from 1998 to 2009, they find that the intensification of trade and financial exchanges represents significant factors in the transmission of business cycles to the Turkish economy. These results highlight in particular the role of trade integration in the synchronisation of business cycles between Turkey and EU countries. At the level of the sectoral transmission of the business cycle Kouparitsas and Baxter (2003) consider the sectoral breakdown of production, imports and exports as a necessary way to analyse the international transmission of business cycles.

Without analyzing the synchronization of business cycles other authors show the effects of specialization on economic activity. In Asia, Taegi et al. (2015) reveal that the pattern of industrial specialization has changed dynamically with economic growth in China. Flynn et al, (2019) determine the role of a commodity such as cocoa in the Ghanaian economy by testing the implication of the Ricardian model which suggests that specialization in cocoa production and export improves the terms of trade. Although cocoa has a stabilizing effect on the Ghanaian economy, its production has become less efficient. Much earlier, the link between business cycle and sectoral fluctuations in Côte d'Ivoire is highlighted by Aka (2009) in a non-linear Markov switching model. His results lead to an interaction between sectors in the business cycle, with an average cycle length per sector of between 4 and 5 years.

Theoretical assumptions

The national accounts distinguish several approaches to calculating GDP, the most common of which is the one that links value added to output. According to the output-side approach, GDP is calculated as the sum of value added (VA), value added tax (VAT) and customs duties (CD).

$$GDP = \sum VA + VAT + CD \quad (1)$$

However, the value added can be calculated in two different ways. One takes into account the calculation by industry and the other by sector of activity. To determine the cyclical impact of agricultural specialisation on gross domestic production (GDP), we use Colin-Clark's analysis based on sectors of activity. They distinguish three main sectors of activity: primary sector, secondary sector and tertiary sector. This sectoral approach to calculating aggregate output indicates that GDP is the result of the sum of value added in

agriculture (VAA), value added in industry (VAI) and value added in services (VAS).

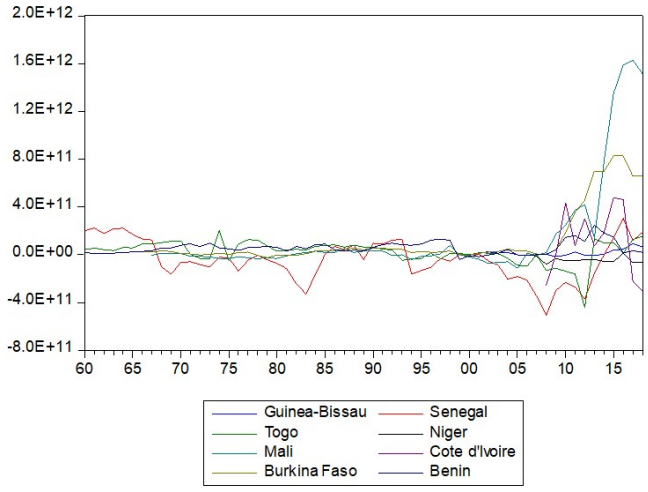
$$GDP = VAA + VAI + VAS \quad (2)$$

The value added of each sector of activity can be a source of macroeconomic fluctuations. Two principles underpin international trade and lead to two forms of exchange. These are the principle of specialization, which leads to complementarities between nations, and the principle of competition. The industrialized countries essentially carry out intra-industry trade among themselves to the extent that there is a differentiated specification of the same generic product. On the other hand, trade between industrialized and developing countries is more inter-industry and is based on differences and specializations. In the case of developing countries based on the model of comparative advantage of primary products, agricultural specialization should lead to productivity gains. A country has a comparative advantage in the production of a good if the opportunity costs of producing it are lower than the opportunity costs of producing the same good in another country (Feenstra and Taylor, 2014). Despite the difference in the sources of comparative advantage in the Ricardian and Heckscher-Ohlin-Samuelson (HOS) models, they lead to the same results. Countries can benefit from trade through specialization in the production of the good in which they have comparative advantage. The HOS model predicts that a country will export the good that makes intensive use of the abundant production factor (Feenstra and Taylor, 2014). Both countries can earn high relative prices by opening up to trade (Feenstra and Taylor, 2014).

However, the fundamental assumption emphasized by HOS that technology is constant across countries is problematic. Such an assumption is not realistic when analysing trade between developed and developing countries where significant disparities in technology are identified. Trade models must therefore capture the role of technology in the determinants of international trade. In the Ricardian model, trade is driven by differences in the technological capabilities of countries. Our analysis of the cyclical impact of agricultural production measured by value added on the economic activity of WAEMU member countries is therefore based on David Ricardo's model. In this model, labour is the only factor of production. Two countries or two groups of countries produce two goods. One produces labour-abundant goods and the other capital-abundant goods. Differences in technology will drive productivity variations between them. These differences in technology lead countries to specialize in producing the good in which they are more efficient and import the rest they need. All countries thus experience gains in trade. Specialization leads to economic growth when the terms of trade improve (Singer, 1950). Labour compensation increases in both countries (groups of countries such as the WAEMU countries and developed countries). Marginal subsistence income needs to generate savings that are invested in capital accumulation (Singer, 1950). However, the extent to which specialization facilitates capital formation depends on the number of assumptions underlying a competitive market and the assumption that favourable terms of trade are transferred to producers in the form of high income (Feenstra and Taylor, 2014). These assumptions are debated and analyzed through the Prebisch-Singer hypothesis.

Prebisch-Singer's hypothesis presents a challenge for the basic results of the Ricardian model, according to which the country that specializes in producing the good for which it has a comparative advantage will experience an improvement in its terms of trade. Prebisch (1950) and Singer (1950) suggest that gains from trade are unevenly distributed. While industrialized countries benefit from a long-term improvement in the terms of trade, this is not the case for developing countries that specialize in the production of commodities. The countries producing these products therefore experience deterioration in their terms of trade over time Singer (1950). Primary products have inelastic price and income while manufactured goods have high income elasticity of demand. The increase in income is the result of a strong increase in demand for manufactured goods. Similarly, the low-price elasticity of demand for primary products suggests that a decline in price will lead to a decline in income in peripheral countries (Gemmill, 1962). The difference in elasticises determines, over time, the fall in the terms of trade of the countries located on the periphery.

Evolution of the link between primary sector and macroeconomic stability: The history of the economies of WAEMU member countries shows a link between the primary sector and macroeconomic stability. A series of economic shocks led the governments of these countries to use the price of raw materials as an adjustment variable. Commodity export earnings and commodity marketing has been an instrument of public finance since their independence. In 1964, for example, world commodity prices fell and drastically reduced the producer prices of some commodities. This decline in prices led to the economic downturn that persisted until early 1980s. Primary specialisation has political and macroeconomic implications in relation to periods of socio-political instability. This instability is linked to the fall in the prices of primary products, the oil shocks of the 1970s followed by the debt crises triggered in the 1980s. During this period, the deterioration of the terms of trade in all WAEMU member countries reflects the many economic and financial imbalances in these countries. Indeed, the following graph shows that during the first two decades (1960-1980), countries such as Benin, Burkina Faso and Mali recorded more or less stable and generally positive terms of trade fluctuations. Over this period as a whole, Senegal, on the other hand, recorded strong fluctuations in terms of trade, which deteriorated sharply between 1968-1985. This period also marks the strong instability of commodity prices. In the last decade, an improvement in the terms of trade was noted for all WAEMU member countries. This situation could determine the high economic growth rates recorded (1% to 7%) for WAEMU as a whole.



Source: Computed by author

Graph 1. Evolution of the terms of trade in the WAEMU

On graph 2 in the appendix, the cyclical-trend decomposition of the Hodrick-Prescott filter shows that the series of economic growth rates for WAEMU countries are affected by cyclical and trend components. The cyclical component generally indicates a break point. This suggests that these series evolve according to two regimes: expansion for the ascending phase and recession for the descending phase.

Econometric modelling and data sources: Linear regression is one of the main tools of econometric and statistical analysis. However, there is growing recognition of the relevance of non-linear models, particularly in the macroeconomic analysis of regime-switching relationships. Markov switching models are important in the history of economic analysis. For details see Goldfeldet Quandt, (1973a); Maddala, (1986); Hamilton, (1994); Frühwirth-Schnatter, (2006); Hamilton, (1989) model of output fluctuations is a notable example of a specification of a regime-switching model with constant probability transition parameters. Alternatively Diebold, Lee, and Weinbach

(1994), and Filardo, (1994) adopt two-state models that employ time-dependent probability transition variables. The specification of Model (3) based on theoretical model (2) allows us to specify a regime-switching model with time-dependent probability transition.

$$GDP_t = \alpha VA_t + \varepsilon_t \quad (3)$$

ε_t test a white noise, GDP_t represents the economic growth rate in each WAEMU member country, when VA_t represents the value added of agriculture as a percentage of GDP(gross domestic product) for each member country and α a parameter affecting this value added. The Markov switching model makes it possible to separate the expansion and recession phases for forecasting break points. Using this model, it is possible to determine the transition probability P_i for an economy to move from one regime to another or from an expansion phase to a recession phase and vice versa. Similarly, it is possible to know the probability P_j for an economy to remain in the same regime (Hamilton, 1989). Moreover, the recent international financial crises, 2007-2008 in the United States, followed by the crisis in the euro area, have given rise to renewed interest in forecasting economic downturns. In particular, for macroeconomic performance indicators, the most important of which are output and employment. Thus, Markov switching vector autoregression models (MSVAR) make it possible to recognise, at any time, a probability of occurrence of an unobservable variable with values in the set $\{1,...,K\}$. This set is supposed to follow a Markov chain at $\ll k \gg$ states. In this framework, the unobservable variable noted (S_t) is assumed to represent the current state of economic activity and the number $\ll k \gg$ of regimes is generally assumed to be two or three. The variable (S_t) follows a chain from Markov to K regimes, i.e. for any t, (S_t) depends only on (S_{t-1}).

$$\forall_i, j = 1,...,K \; ; P(S_t = j / S_{t-1} = i, S_{t-2} = i, ...) = P(S_t = j / S_{t-1} = i) = P_{ij} \quad (4)$$

The coefficients $(P_{ij})_{i,j=1,...,K}$ are called transition probabilities. They measure the probability of an economy staying in one regime or moving from one regime to another. For a given regime i, the following equality is obtained:

$$p_{i1} \left| p_{i2} \right| ... / \; p_{ik} = 1. \quad (5)$$

In each state i, the probability p_{i1} is a measure of the persistence of state i. The model parameters are estimated by maximum likelihood using a filtering algorithm. This estimation makes it possible to recover for each period t the filtered probability of belonging to regime i for

$$i = 1,...,K; P(S_t = X_t, ..., X_1, \theta) \quad (6)$$

Thus, at any given moment, it will be possible to infer that the economic activity is in the strong regime (growth) that has the highest filtered probability. Starting from the previous Markov chain (S_t) it is possible to define different types of Markov switching econometric models whose parameters and structure depend on the regime in which the Markov chain is located. For example, we define the autoregressive p -order, AR_p, regime-switching model X_i with Z_i as an exogenous variable if it satisfies the following equation:

$$X_t = \mu(S_t) + \varphi_1 \left[X_{t-1} - \mu(S_{t-1}) \right] + ... + \varphi_p \left[X_{t-p} - \mu(S_{t-p}) \right] + \sum_{i=1}^{k} \alpha_i Z_i + \varepsilon_t \quad (7)$$

Where $\mu(S_t)$ is the mean of the process at time t and where ε_t is a Gaussian white noise process of unknown finite variance σ^2 which may also be regime dependent. The parameters φ_p and φ_1 may also depend on S_t. In this model, the economic growth rates of each WAEMU member country can alternate between two regimes under the influence of agricultural production translated by value added. There is a probability of transition from the expansion regime to the recession regime (or vice versa) depending on the evolution of value added over time. A correlation between the GDPs of WAEMU member countries is analysed in order to know how economic fluctuations in the union are driven by a cycle of primary product activity. To do so, we use primary sector value added as a probability transition variable from expansion to recessionary regimes. To this end, we study the significance of the probability transition parameters and compare their impact on the growth rate in each country, depending on the regime, through the coefficient $\mu(S_t)$ in a uni-variaty framework. We also compare the duration dependence properties of expansion or recession and the likely duration of each regime for each business cycle in order to analyze their co-movements. This is the study of the synchronization of economic growth rates across member countries using the Markov regime-switching forecasting model proposed by Filardo (1994), Filardo and Gordon (1998), taken up by Kim et al. (2008). In the formulation of the time-dependent probability transition model, it is possible to study the synchronization of business cycles across WAEMU countries with the probability transition variable value added in the agricultural sector. To show the extent to which business cycles are synchronized in the WAEMU, as a result of agricultural specialization, we seek to determine whether the effect of a shock on the agricultural sector is transmitted symmetrically with economic activity. We define (S_t) as an unobservable or latent variable governed by two regimes of a Markov chain of order 1 with a probability transition matrix as follows:

$$P_{ij}(S_t = i / S_{t-1} = j, z_{t-k}) = \begin{pmatrix} P_{11}(z_{t-k}) & 1 - P_{22}(z_{t-k}) \\ 1 - P_{11}(z_{t-k}) & P_{22}(z_{t-k}) \end{pmatrix} \quad (8)$$

With P_{ij} the probability of passing from regime j at time $t-1$ for regime i at time t and t, $j = 1,2$ with $\sum_{j=1}^{2} P_{ij} = 1$ for all $\forall_{ij} \in \{1,2\}, k$ is a lag value. The functional form that links z_{t-k} to P_{ij} is logistic:

$$P_{11}(z_{t-k}) = \frac{\exp^{(\theta_{1,1} + \theta_{1,2} z_{t-k})}}{1 + \exp^{(\theta_{1,1} + \theta_{1,2} z_{t-k})}} \; regime\,1 \quad (9)$$

$$P_{22}(z_{t-k}) = \frac{\exp^{(\theta_{2,1} + \theta_{2,2} z_{t-k})}}{1 + \exp^{(\theta_{2,1} + \theta_{2,2} z_{t-k})}} \; regime\,2 \quad (10)$$

The logistic specification responds to the consideration of the probabilities of non-symmetric realizations, with two regimes associated with small and large values of the leading probability variables. Thus, these probabilities contain information on the probability of remaining in or leaving a given regime (either regime 1 or regime 2) k periods after a change in z occurs. Thus, y and z are growth rates, with regimes 1 and 2 capturing expansions and recessions, or regimes with low and high growth rates. The high growth rate regime is not selected a-priori, but is determined endogenously by the data. Suppose, for example, that the data contained in the estimated coefficients μ_1 with a positive sign and μ_2 with a negative sign. Regime 1 could then be interpreted as an expansion and regime 2 as a recession. Suppose in equation (4) that $\theta_{1,2}$ is positive. This means that any increase (resp. decrease) in z increases P_{11},i.e. the probability that y remains in regime 1 (resp. $1 - P_{11}$, i.e. the probability that y exits regime 1) k periods later. A negative coefficient indicates a reduction in the probability of remaining in the expansion regime. We have a similar interpretation for $\theta_{2,2}$. For example, a negative coefficient ($\theta_{2,2} < 0$) indicates that any decrease (rep. increase) in z increases the probability of remaining in regime 2 (or exiting regime 2). If it turns out that the coefficients $\theta_{1,2}$ and $\theta_{2,2}$ are not significant, it is deduced that the

effect of the productivity of the agricultural sector measured by the value added as a percentage of GDP on the business cycle of the country concerned is not informative in the probability of an expansion or recession (diffusion) occurring. These effects will be compared across countries to better identify possible co-movements in the business cycles of the countries concerned. Moreover, the choice of the typology of economic cycles is decisive for the analysis of synchronisation. Among the multitude of empirical works on cyclical analysis, a certain amount of confusion appears as to the definition of cycles. However, it is important to know exactly which type of cycle one is trying to date and then track in real time. In the empirical literature on the business cycle, three types of cycles can be distinguished. Namely, the business cycle, the growth cycle which concerns the output gap, and the acceleration cycle which is actually the growth rate cycle. These different cycles have different characteristics (see Anas and Ferrara 2004, Zarnowitz and Ozyldirim, 2006). Originally, the business cycle refers to the series level (log-), as defined by Burns and Mitchell (1946). It is the cycle of the activity level. In contrast, the growth rate cycle is described by phases of acceleration and deceleration that are interest for short-term analysis in countries that are not often affected by recession. It is this type of cycle that we use in our study, and which gives us the results of the MSVAR model estimates. In addition, our variables are selected following a review of the literature. The data we use in this study are annual and come from the World Bank's World Development Indicator (2019) database for the period 1960-2018. They concern eight (8) WAEMU countries, namely, Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, Togo and Guinea Bissau.

RESULTS AND INTERPRETATIONS

The impact of the value added of agriculture on the GDP growth rate is greater in the high regime phase (expansion) than in the low regime phase (recession) in countries such as Benin, Burkina Faso, Côte d'Ivoire, Senegal, and Mali. For these countries, economic fluctuations are procyclical in nature, but the impact of agricultural production is relatively greater in the recession phase than in the expansion phase for Guinea-Bissau, Niger, and Togo.

recession, which means that the growth cycle does not follow the agricultural cycle for these countries. On the other hand, the GDP of Burkina Faso, Côte d'Ivoire and Mali show positive growth rates in both expansion and recession phases. Moreover, the probability transition parameters from recession to expansion are positive and significant for Senegal, negative and significant for Côte d'Ivoire and Mali. The value added of agriculture plays an important role in output fluctuations in these countries. The transition parameters indicate a dependence on the expansion state due to the primary sector in Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Niger and Togo. In Côte d'Ivoire, Mali and Senegal the transition parameters of probability transition from recession to expansion are significant at 5% level. The probabilities of transition between these two regimes are low for Côte d'Ivoire and Mali with about 7%, and relatively higher for Senegal (91%). In Senegal, the agricultural sector is likely to lead the economy in the expansion phase in the short term, unlike Côte d'Ivoire and Mali. These economies are not vulnerable to commodity price fluctuations in the short term. As regards the average length of economic cycles, due to the effect of the primary sector, it varies according to the country. The average length of the business cycle in Benin is 4.478 years, 2.673 years in Burkina Faso, 11.513 years in Guinea-Bissau, 9.955 years in Mali, 1.648 years in Senegal and 10.337 years in Togo. By adding the expansion and recession phases, only the length of the business cycle in Benin (9 years) has the characteristics of the Juglar cycle or average cycle which requires cyclical regulation in the event of a shock to the agricultural sector. The opposite is true for Burkina Faso (5.34 years) and Senegal (3.2 years), whose cycle duration is relatively short. These significant differences reflect certain heterogeneity of economic fluctuations in the WAEMU due to the activities of the primary sector. MS-AR (1): Markov switching autoregression model with $p=1$. Note: The superscript (1) shows the significance at 10% level, the superscript (2) shows significant at 5% level, the superscript (3) shows significant at 1% level. The lag value is $k=1$ retained comes from the tests on the selection criteria of AIC, SC, and FPE carried out. The first line of the table represents the impact of agricultural added value (VA) on GDP in Benin, Cote d'Ivoire, Bissau Guinea, Mali, Senegal, Niger and Togo respectively (Note also that P is the GDP level for each country cited above).

Table 1. Analysis of business cycles in WAEMU with VA of agriculture as a probability transition variable

Impact of VA on GDP	PBE	PBF	PCIV	PGB	PML	PNR	PSE	PTO
μ_1	4,523 (0,340) (3)	6,492 (0,321) (3)	8,201 (0,644) (3)	4,031 (0,635) (3)	16,172 (2,925) (3)	3,403 (0,664) (3)	5,001 (0,539) (3)	5,231 (1,138) (3)
μ_2	-2,812 (1,068) (3)	1,526 (0,427) (3)	0,448 (0,668)	-21,615 (3,328)	3,431 (0,519) (3)	-16,448 (0,557) (3)	-1,005 (0,747)	-9,697 (2,715) (3)
$AR(1)$	0,098 (0,110) (3)	-0,370 (0,168) (3)	-0,220 (0,164) (3)	-0,068 (0,158)	-0,265 (0,181)	0,054 (0,141)	-0,255 (0,199)	0,463 (0,155) (3)
$Log\sigma$	0,711 (0,110) (3)	0,525 (0,128) (3)	1,271 (0,116) (3)	1,438 (0,110) (3)	1,361 (0,129) (3)	1,481 (0,099) (3)	0,843 (0,131) (3)	1,415 (0,119) (3)
$\theta_{1,1}-VA$	0,059 (0,015)	0,025 (0,015) (1)	0,107 (0,034) (3)	0,063 (0,015) (3)	-0,490 (82,753)	0,0723 (0,017) (3)	0,009 (0,031)	0,078 (0,020) (3)
$\theta_{2,1}-VA$	0,579 (110,488)	-0,003 (0,016)	-0,094 (0,028) (3)	0,424 (775,251)	-0,067 (0,018) (3)	0,493 (289,326)	0,129 (0,061) (3)	0,019 (0,032)
MV	-140,072	-140,090	-164,21	-143,177	-148,892	-174,859	-149,690	-175,720
P_{11}	0,857 (0,048)	0,688 (0,016)	0,9440 (0,025)	0,9503 (0,013)	0,000 (0,000)	0,9533 (0,032)	0,5450 (0,009)	0,9321 (0,030)
P_{12}	0,142 (0,048)	0,311 (0,016)	0,0559 (0,025)	0,0496 (0,013)	1,000 (0,000)	0,0466 (0,032)	0,4549 (0,009)	0,0678 (0,030)
P_{21}	0,999 (0,000)	0,470 (0,002)	0,0760 (0,030)	1(0,000)	0,069 (0,028)	0,9999 (0,000)	0,911(0,037)	0,6661 (0,029)
P_{22}	0,001 (0,000)	0,529 (0,002)	0,9239 (0,030)	0 (0,000)	0,930 (0,028)	0,0001 (0,000)	0,0889(0,037)	0,3388 (0,029)
Expansion time	7,957 (2,981)	3,223 (0,175)	25,980 (23,996)	22,027 (7,386)	18,910 (12,750)	1,000 (0,000)	1,0995(0,046)	1,515(0,066)
Recession time	1,000 (0,000)	2,123 (0,012)	17,330 (13,084)	1,000 (0,000)	1,000 (0,000)	48,120 (57,430)	2,1989 (0,045)	19,160 (12,179)

Source: Author

When agricultural value added is used as the leading variable, its effect becomes negative in recession for Benin, Guinea-Bissau, Niger, Senegal, and Togo. In other words, when agricultural production is on the rise, the economies of these countries may find themselves in

Driven by agricultural specialization, the cycles are relatively long for Guinea-Bissau, Mali, and Togo. On the other hand, the cycles are shorter in Burkina Faso and Senegal and have an average length in Benin. This may justify the failure of certain economic stimulus

policies of the 1980s and 1990s and the withdrawal of state subsidies in the agricultural sector in most of these countries.

CONCLUSION

This paper analyses the cyclical impact of one of the determinants of macroeconomic fluctuations in the WAEMU, agricultural production, using a Markov switching regime model covering the period of 1960 to 2021. Since the advantage of an economic union is the management of symmetric shocks, given the agricultural specialization of member countries, shocks to agriculture should favour the synchronization of business cycles. Our main results show that under the effect of shocks on agriculture, Burkina Faso, Côte d'Ivoire and Mali show positive growth rates in both expansion and recession phases. Taking into account the significant probability transition parameters from recession to expansion for countries such as Senegal, Côte d'Ivoire and Mali, the value added of agriculture plays an important role in economic fluctuations. The transition parameters indicate a dependence of the expansion state under the effect of the primary sector in Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Niger and Togo. This suggests that these shocks have permanent effects. In other words, a negative agricultural productivity shock is not likely to dampen economic expansion in these countries in the short term. In Senegal alone, the agricultural sector is likely to lead the economy from the recessionary phase to the expansionary phase in the short term. This economy is vulnerable to fluctuations in commodity prices in the short term, and the large differences in length of economic cycle in the WAEMU due to the activities of the primary sector show that business cycles have not yet synchronized. But the reasons may also be related to the diversification of economies, difficulties in harmonizing policies sector at community level, and the weakness of intraregional trade. Economic policies in union should take greater account of these causes in formulation of development strategies.

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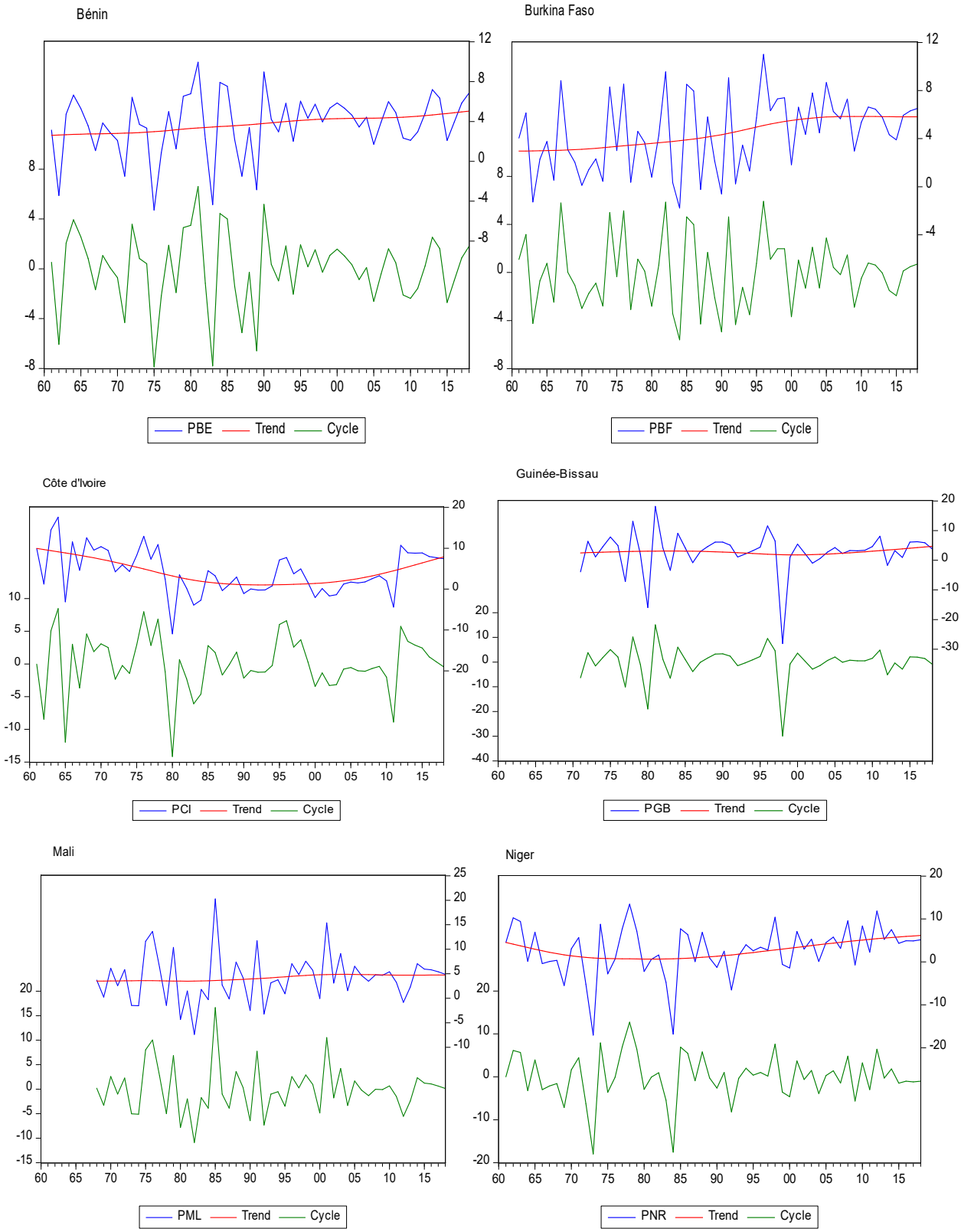
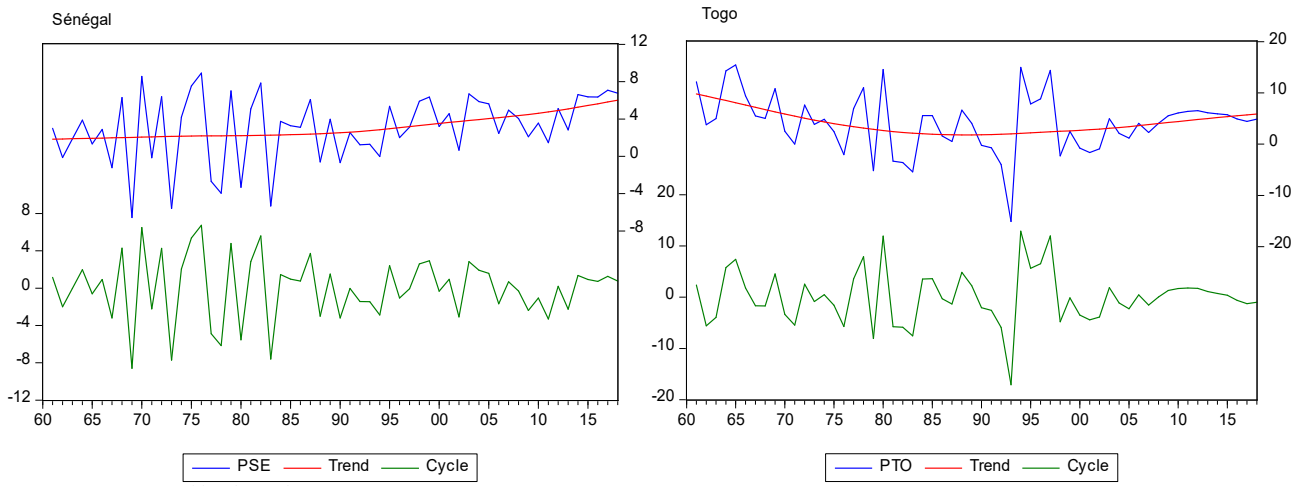
Annex





Source: Computed by the authors

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