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External Competitiveness of Benin Agriculture: A Synthetic Dynamic Approach Analysis

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Abstract

This paper analyzes the dynamics of the external competitiveness of agriculture in Benin. External competitiveness is measured by the real exchange rate calculated for agricultural sector. A synthetic dynamic approach combining Natural Real Exchange Rate (NATREX) and Behavioral Equilibrium Exchange Rate (BEER) is used. The analysis of the medium and long term dynamics shows that an increase in real lending interest rates in Benin compared to its partners contributes to loss of competitiveness of Benin's agriculture in the medium run. Policies to improve current preference (joint increase in demand for agricultural goods and government expenditures in the agricultural sector) and total factor productivity (improvement in production and technology) will have a positive effect on the external competitiveness of agriculture in the long run.

Keywords: real exchange rate, competitiveness, agriculture, vector autoregressive model, Benin

Code JEL : C01-D51-F13-F15-F41-Q17

1. Introduction

The contribution of agriculture to growth has been a central concern since the work of Johnston and Mellor (1961). These authors made five proposals showing how increases in agricultural production and productivity contribute to overall economic growth: 1) a substantial increase in demand for agricultural products; 2) an increase in income due to the expansion of agricultural exports; 3) a labor surplus derived mainly from agriculture; 4) a net contribution to the capital required for indirect investment and the expansion of the industry; and (5) an increase in incomes of agriculturalists with a view to stimulating industrial expansion. In Pakistan, Khan (1967) showed that the transformation of agriculture, through increased productivity, allows farmers to meet the food needs of the urban and industrial population (avoiding inflation) on one hand, and frees the agricultural sector to make available up the labor needed for industrial expansion on the other. Kuznets (1971) stated that a competitive agriculture must be able to assume the three main roles of being able to contribute to growth; to increase the incomes of agricultural producers; and to contribute to the financing of other sectors of the economy. In order to enable the agriculture sector to fulfill these roles, agricultural policy reforms are initiated in some countries around the world.

In Benin, several agricultural policy reforms have been implemented since 1990 as documented in government policies. Despite all these reforms, Benin's agricultural sector continues to be undermined by poor performance in terms of effectiveness of policy crafting and implementation. In Benin, there is instability in agricultural Gross Domestic Product (GDP) growth for several years. In addition, there is the instability of agricultural prices and their volatility, combined with a worsening current account deficit, which represented 6.1% of the GDP, compared with 4.2% in 2006. All this is mainly due to the drop in exports of products, especially cotton.

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Owing to these observations, a new orientation has been given to the agriculture since 2016 through the creation of seven agricultural development poles and the promotion of six flagship agricultural sectors: cotton, maize, rice, pineapple, cassava and cassava. This approach aims to develop local potential through the territorialisation of agricultural development. This paper provides indicators for analyzing the competitiveness of Benin's agricultural sector and analyzes the dynamics of this competitiveness.

Several studies have examined the competitiveness of the agricultural sector. Arifin (2013) looked at the competitiveness and sustainability of some agricultural products in Indonesia using the revealed comparative advantage index (ACR). Fenyvesi and Erdeiné Késmárki-Gally (2012) described a system of technological development without which no value-added growth is possible in Hungarian agriculture. Svatoš and Smutka (2012) found that the entry of certain countries into the European Union has made a positive contribution to their agricultural trade and therefore their competitiveness. Rifin (2013) showed that Indonesia has a comparative advantage in cocoa production, as evidenced by the high relative trade advantage index. Goretov et al (2015) concluded in their study that to improve the competitiveness of the agricultural sector, it is important to create favorable conditions, reduce costs and risks, and introduce incentive taxes. The exchange rate approach was used by Krueger, Schiff and Valdes (1973), Schiff and Valdés (1998), Byerlee and Sain (1986), Mboup (2004), Chambers and Just (1981), Cho, Sheldon and McCorriston (2002), Pick (1990). Mboup (2004) shed light on the price competitiveness of the groundnut sector in Senegal by calculating the real exchange rate (RER) of this sector, which corrects the ratio of prices to producers by the nominal exchange rate (NER). However, this study, despite its importance, raises some difficulties: firstly, it is concerned only with one sub-sector of agriculture, the groundnut sub-sector; secondly, it does not analyze in depth the dynamics of the groundnut RCW on the one hand and does not estimate the determinants of the latter on the other hand; thirdly, it does not use modeling tools.

The remainder of the paper is organized as follows. Section 2 is relative to the methodology. The results as well as their discussion are presented in section 3. Section 4 concludes the paper.

2. Methodology

2.1. Data

2.1.1. Types of data used

The raw data used range from 1980 to 2015 and are from both national and international databases. The construction of the variables can be described as follows:

- A zone, composed of countries with agricultural trade links with Benin that are not in the same monetary zone as Benin, is defined. These countries, which represent more than 80% of Benin's international trade, are European Union, United States, India, Thailand and Nigeria.
- The calculated RERs for all sectors combined are a geometric mean of the bilateral rates. Each RER is weighted by the average share of the country's agricultural GDP.
- Price indices of tradable and non-tradable goods are calculated.
- The future preference is obtained from consumption, public expenditure and GDP data.
- Technical progress is captured by the total factor productivity (TFP).
- The interest rate differential is the difference between the real interest rates between Benin and its partners as defined above.

2.1.2. Computation of the real effective exchange rate for agriculture (REERAext)

Before the REERAext is calculated, some intermediate variables are constructed. Among these variables, there is the deflator of agricultural value added in each country. The formula is as follows:

$$def_i = \frac{vagrco_i}{vagrcst_i} \times 100$$

With *def_i* the deflator of agricultural added value in country i; vagrbcoi the agricultural added value at current prices in country i; and vagrbcsti the agricultural added value at constant prices in country i. Since there are 6 countries, 6 deflators are calculated. The agricultural added value is derived from the World Development Indicators.

Then, the bilateral RERs between Benin and each of its partners are calculated. If we call RER_{bi} the RER between Benin and its partner i; TCN_{bi} the nominal exchange rate at the uncertain between Benin and partner; def_b the deflator of agricultural added value in Benin; and def_i the deflator of agricultural added value in the partner country, the expression of the RER_{bi} is given by:

$$RER_{bi} = TCN_{bi} \times \frac{def_b}{def_i}$$

The REERAext is then obtained by a geometric average of the RERs between Benin and its partners with a weighting coefficient capturing the average share of each partner in the total value added. So we have:

$$REERAext = \sum_{i=1}^{5} k_i \times RER_{bi}$$

With k_i the weight of partner countryi and 5 being the number of agricultural trading partners.

The choice of the real exchange rate (RER) as a measure of competitiveness is based on the fact that it has properties that make it a good proxy for the international competitiveness of an economy (Edwards, 1989). A decrease in the RER or an appreciation of the RER reflects an increase in domestic costs in the production of tradable goods. If foreign relative prices have not changed, the decrease (increase) in the RER means a loss (gain) of international competitiveness for the nation. Fluctuations in international competitiveness are often justified by real events in the economy. Edwards (1989) argued that real events that can change competitiveness include technological progress, changes in the terms of international trade, changes in taxation policies, etc.

2.1.3. Computation of other variables of the model

The other variables involved in the model are the real interest rate differential between Benin and its partner countries (INT), the difference in preferences for the present between Benin and its trading partners (PREF), the difference in growth rates of total factor productivity between Benin and its partners (GPGF), the overall agricultural factor productivity of Benin (GPGFAB), the Domestic Price Index for exportable agricultural goods (IPIEXP), the Domestic Price Index for agricultural import goods (IPIIM), and the Domestic Non-Tradable Agricultural Goods Index (NTEI).

- The interest rate differential

The interest rate differential formula results from the difference between Benin's real interest rate and the weighted real interest rate of its partners. The real interest rate of country is given by the following formula:

$$TIR_i = \frac{TIB_i}{P_i}$$

with *TIBi* the level of the gross interest rate in the country i ; *Pi* the general level of prices in the country i. The differential in real interest rates between Benin and its partners is the result of the difference between the real rate of interest of Benin and the weighted average of the actual rates of interest of its partners. This average is smoothed using a filter of mobile average in order to eliminate the effects of fluctuations in the short run.

- The gap in preferences for the present

The preference for the present to the country is given by the formula:

$EPREF_{bi} = \frac{CC_i + CG_i}{CGDP_i}$

where CC_i is the level of final consumption; *CGi* refers to the level of government spending; and *CGDPi* is the GDP. The gap of the preference for the present is the result of the difference between the preference for the present of Benin and the weighted average of the preferences for the present of its partners. This average is smoothed using a moving average filter in order to eliminate short-run fluctuations.

- *The gap in the total factor productivity growth between Benin and its partners*

Total factor productivity growth (gpgf) of country is given by:

$$GPGF_i = GPIB_i - 0{,}3 \times GCAPITAL_i$$

With GPIB the GDP growth rate and *GCAPITAL* the growth rate of the capital. 0.3 represents the elasticity of substitution of capital and labor. The overall productivity of the factors thus calculated is the residue of Solow derived from the neoclassical production technology. The gap in the total factor productivity growth rate is the result of the difference between the total factor productivity growth rate of Benin and the weighted average of its partners. This average is smoothed using a moving average filter in order to eliminate the short-run fluctuations.

- *The total agricultural factor productivity growth in Benin*

The overall agricultural factor productivity in Benin (GPGFAB) is obtained from Solow residual.

- *Index of the prices of tradable goods*
  The choice of tradable agricultural goods is made within the framework of the theory of the dependent economy. There are two tradable goods or sectors at risk in this paper: export and import goods. Agricultural goods are considered as tradable goods if their exports or imports account for more than 10% of their production. Otherwise, these goods are considered to be non-tradable goods or non-exposed sector.

- *Index of the prices of Non-tradable goods*
  In the theoretical framework of the dependent economy, the price of a non-tradable agricultural good at the margin is determined by supply and demand on the domestic market. Thus, in this paper, the agricultural good whose price is determined by the domestic market and whose exports or imports are below 10% of their production is considered as a non-tradable agricultural good.

2.2. The dynamic approach to synthetic

2.2.1. Theoretical justification of the model

The theoretical approach used in this paper combines NATREX and BEER because of their complementarity. These are two dynamic approaches that explicitly highlight the long-run determinants of RER and attempt to incorporate stock effects whose impact on long-term dynamics is fundamental (Duval, 2001). NATREX and BEER have the empirical advantage of relying on modern econometric estimation of time series econometric techniques.

The equilibrium RER results from the simultaneous attainment of internal and external equilibrium for given levels of certain variables such as taxes, international prices, capital and aid flows, technological levels, etc. The internal equilibrium implies that the market for non-tradable goods reveals that the current account and the expected account are in equilibrium in the future. External equilibrium is achieved when the sum of current accounts presents and satisfies the intertemporel budget constraint, where the present value of the state's current account balance is equal to 0. From this point of view, the RER or competitiveness is likely to vary over time depending on the evolution of its present and future fundamentals, contrary to the PPA predictions. The fundamental determinants of equilibrium of RER are those that largely influence internal and external balances. Thus, the RER or competitiveness is categorized into two categories according to the objectives to be achieved, namely internal and external balance.

2.2.2. Decomposition of REERAext into a sum of the tradable sector RER and the relative double price of the non-tradable sector

In order to deepen the analyses by taking into account the applications to the agricultural sector, the decomposition approach of Engel (1999) is used. This decomposition is the breakdown of all sectors into a sum of the RER of the tradable goods sector and the relative double price of the non-tradable goods sector. According to this decomposition, the price index for a country is a weighted average of the prices of tradable and non-tradable goods.

$$p_t = (1-\alpha)p_t^T + \alpha p_t^N$$

With p_t p_t^T and p_t^N representing the logarithm of the price index, the tradable goods price index and the non-tradable goods price index respectively; α is the share that non-tradable goods represent in the price index. Let's write the same formula for the foreigner by putting asterisks.

$$p_t^* = (1-\beta)p_t^{T*} + \beta p_t^{N*}$$

where β is the share of non-tradable in the index of foreign prices. Then the real exchange rate is given by:

$$q_t = x_t + y_t$$

where

$$q_t = s_t + p_t^* - p_t$$

$$x_t = s_t + p_t^{T*} - p_t^T$$
$$y_t = \beta(p_t^{N*} - p_t^{T*}) - \alpha(p_t^N - p_t^T)$$

Here$s_t$is the log is the price of the foreign currency in domestic currency.

The real exchange rate is composed of two parts: the relative price of tradable goods between countries (x_t) and another component which is the weighted difference in the relative price of non-traded goods on the prices of tradable goods in each country (y_t)

2.2.3. Econometric specification of the REERAext

Econometrically, the BEER uses Johansen's cointegration approach. It starts from an error-correction model (VECM).

$\Delta X_t = \mu + \sum_{i=1}^{p-1} \emptyset_i \Delta X_{t-i} + \pi X_{t-1} + \varepsilon_t$

with $X_t = [TCR_t, PROD_t, NFA_t, DEM_t, \mu]$ the vector composed of the productivity differential between the domestic and foreign countries (PROD), the net foreign assets position (NFA) and demand factors. High productivity in a country leads to a real appreciation of its currency with evidence of the Balassa-Samuelson effect. The worsening of the NFA must be funded by improving the balance of payments through the real depreciation of the currency of the constants; ε_t _t a white noise; $\emptyset$ the matrix of coefficients of short term; π the backrest force. There exist β and α such that: $\pi = \alpha\beta$ with α the adjustment matrix and β the linearly independent cointegrating vectors of VECM.

The functional form of the NATREX is the following:

$natrex = f(z)$

Vector Z includes the following variables: the terms of trade (tot), productivity (pd), world real interest rate (r*), and public expenditure (g). This set of variables is consistent with NATREX's theoretical foundations. NATREX is unobservable, so the following equation is estimated:

$\text{REER} = \beta_0 + \beta_1 g_t + \beta_2 r_t^* + \beta_3 prd_t + \beta_4 tot_t + \varepsilon_t$

where REER is the real equilibrium exchange rate. According to Obstfeld and Rogoff (1995), when public expenditure (g) increases, relative demand for non-tradable goods also increases, and therefore a relative increase in the price of non-tradable goods (i.e. $\beta_1 > 0$). In the long run, the increase in the world real interest rate (r*) will depreciate the RER (i.e.$\beta_2 < 0$). The improvement in the terms of trade (tot) leads to international capital flows at the level of the tradable sector. And therefore an increase in investment of the domestic economy, which will appreciate the RER (i.e.$\beta_4 > 0$). In the medium run, productivity growth should stimulate investment and, in addition, improve the balance of payments position. In the long run, the accumulation of capital must increase the productive capacity of the economy in general, so the RER will appreciate ($\beta_3 > 0$).

The combination of BEER and NATREX gives the following specification: $REERAext = \beta_0 + \beta_1 PREF_t + \beta_2 \text{INT}_t + \beta_3 GPGF_t + \beta_4 GPGFAB + \beta_5 IPIEXP_t + \beta_6 IPIIMP_t + \beta_7 IPNE_t + \varepsilon_t$

The differential of real interest rates (INT) allows to capture the effect of global interest rates of the NATREX and the position of the external assets net of the BEER. The gap of the preferences for the present (PREF) captures the effect of government spending of the NATREX and demand factors in the beer.

The gap in the rate of growth of overall factor productivity (GPGF) and the overall agricultural factor productivity in Benin (GPGFAB) are productivities highlighted in the beer. The price indices (IPIEXP, IPIIM and IPNE) are variables of the terms of the exchange and the request.

2.2.4. Econometric Estimation

- Before any step, all series (except ratios) are transformed into a natural logarithm. The estimation proceeds in several stages, namely
- Determination of optimal lag using information criteria.
- Unit root tests to ensure the econometric approach to be followed.
- Co-integration analysis using the Johansen method. At this level, the uniqueness of the cointegrating relationships between REERAext and its fundamentals is tested.

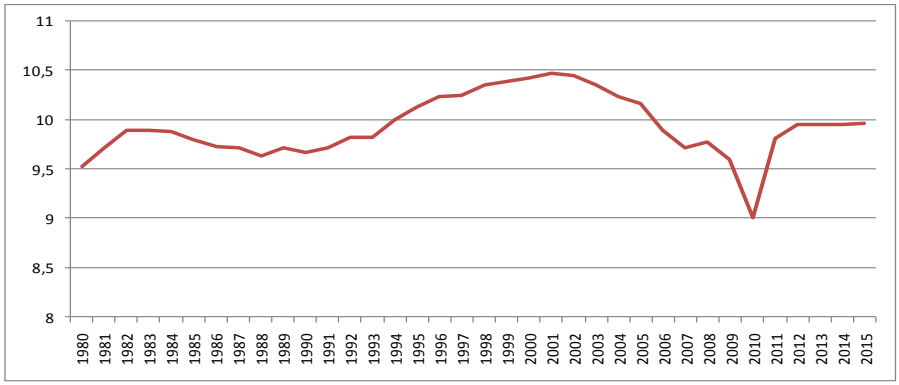
- The estimation of an error correction vector model.
- The estimation of the medium and long run REERAext is done by OLS.

3. Results and Discussion

3.1. Analysis of the medium- and long-term dynamics of Beninese agriculture's external competitiveness

3.1.1. Descriptive Statistics

The analysis of the evolution of the external competitiveness of the Beninese agricultural sector with these partners reveals the existence of six major phases or periods. The first phase was the period from 1980 to 1982, when Benin's agricultural competitiveness improved. The second phase, from 1982 to the early 1990s, was characterized by a decline in competitiveness. The third phase of improving competitiveness is from 1990 to 2000. In the fourth phase between 2000 and 2006, there was a decline in the competitiveness of agriculture. At the beginning of 2006, competitiveness improved but fell sharply from 2007 to 2010. From the end of 2010 to 2012, there is a fifth phase characterized by a further improvement in the competitiveness of agriculture. The sixth phase is marked by relative stability (2012 to 2015).



Graph 1 : Evolution curve of the external competitiveness of agriculture in Benin from 1980 to 2015

Looking at the results contained in Table 1, it can be noted that between 1980 and 2015, the evolution of the competitiveness of agriculture in Benin is not stable. Indeed, the associated probability value is very high (0.88). This confirms the large number of phases mentioned above (5 phases in total). On the other hand, the fundamentals, except for the difference in total factor productivity and the index of domestic prices of export goods, are stable in their evolution.

Table 1 : Descriptive Statistics of the variables

	LTCERAEXT	INT	PREF	GPGF	GPGFAB	IPIEXP	IPIIMP	IPNE
Mean	9.93	3.42	4.06	-2,77	1.84	103,12	100,24	101,26
Median	9.85	1.24	4.30	-2,77	1.91	101,29	100,00	101,02
Maximum	10.47	49.47	5.71	9.81	24,27	131,75	117,39	122,03
Minimum	9.01	-27,12	0.65	-12,91	-46,18	81,00	For 75.47	88,16
Std. Dev.	0.33	11.33	1.15	4.82	12.18	9.66	6.97	5.61
Skewness	-0.20	1.69	-1,59	0.44	-1,76	0.43	-0,54	1.00
Kurtosis	3.18	11,13	5,30	3.80	8.98	4.33	7.86	8.02
Jarque-Bera	0.27	103,43	20.53	1.91	64,23	3.34	33.09	38.93
Probability	0.88	0.00	0.00	0.39	0.00	0.19	0.00	0.00
Sum	317,85	109,30	130,04	-88,62	58,83	3299,89	3207,76	3240,45
Sum Sq. Dev.	3.39	3982,11	40.96	719,42	4600,63	2890,08	1505,82	975,99
Comments	36	36	36	36	36	36	36	36

3.1.2. Unit root and cointegration tests

Two types of statistics are used for the unit root tests of the different variables. These are Phillip-Perron's statistics for variables with trend breaks and Augmented Dickey-Fuller for the others.

These tests make it possible to ascertain the stationnarity of the long-run variables (logarithm of the external real effective exchange rate of the agricultural sector LTCERAEXT, logarithm of the internal real effective exchange rate of the agricultural sector LTCERAINT, difference in preferences for the present between Benin and its trading partners PREF, difference in the growth rates of total factor productivity between Benin and its GPGF partners, total factor productivity, etc.). For the medium-term variables (real interest rate differentials between Benin and the INT partner countries, the domestic price index of exportable IPIEXPs, the domestic price index of importable IPIIMs, the domestic price index of non-tradable IPNEs) which are useful in calculating the real effective exchange rate of the agricultural sector, their stationnarity around zero is also tested. The results from this estimate are presented in Table 2 below. In the light of these results, it appears that the variables LTCERAEXT, LTCERAINT (dependent variables), PREF, IPIEXP and IPIIMP (independent variables) are non-stationary and integrated in order 1. The other independent variables are stationary.

In the light of these results, it is therefore justified to test the existence of a long-run relationship between the external real effective exchange rates of the agricultural sector and its long-run fundamentals, which are the difference in preferences for the present between Benin and its trading partners, the difference in the growth rates of total factor productivity growth rates between Benin and its partners, and the total agricultural factor productivity in Benin.

Table 2 : Stationnarity test of variables (unit root)

The variables	**Statistical test**		**Critical Values**			**Conclusion**
			1%	5%	10%	
LTCERAEXT	Z(Rho)	-6,09	-23,26	-18,35	-15,88	Non stationary I(1), non-audit to the long term of the APP
	Z(t)	-1,78	-4,32	-3.57	-3,22	
DLTCERAEXT***	Z(Rho)	-46,23	-23,14	-18,28	-15,84	Stationary
	Z(t)	-5,31	-4,33	-3,58	-3,22	
LTCERAINT	Z(t)	-2,02	-4,33	-3,58	-3,22	Non stationary I(1), non-audit to the long term of the APP
DLTCERAINT***	Z(t)	-4,51	-4,34	-3,58	-3,23	Stationary
INT**	Z(t)	-3,96	-4,33	-3,58	-3,22	I stationary(0)
PREF	Z(t)	-1,99	-4,33	-3,58	-3,22	Non stationary I(1)
DPREF***	Z(t)	-4,75	-4,34	-3,58	-3,23	Stationary
GPGF**	Z(t)	-3,93	-4,33	-3,58	-3,22	I stationary(0)
GPGFAB**	Z(t)	-3,80	-4,33	-3,58	-3,22	I stationary(0)
IPIEXP	Z(t)	-2,80	-4,33	-3,58	-3,22	Non stationary I(1)
DIPIEXP***	Z(t)	-6,95	-4,34	-3,58	-3,23	Stationary
IPIIMP	Z(t)	-3,13	-4,33	-3,58	-3,22	Non stationary I(1)
DIPIIMP***	Z(t)	-5,92	-4,34	-3,58	-3,23	Stationary
IPNE***	Z(t)	-5,79	-4,33	-3,58	-3,22	I stationary(0)

***=significantat 1% ; **=significantat 5%

Once the uniqueness of the cointegrating relationship is demonstrated, an error-correction vector model (see Table 3) is estimated to show that it is a real exchange rate equation. In total, eight (8) equations are estimated using an error-correction vector model (VCEM):

$$\Delta Y_t = \Pi Y_{t-1} + \Omega_1 \Delta Y_{t-1} + \rho X_t + \mu + \varepsilon_t$$

where Y_t is the vector (4,1) composed of D(LTCERAEXT), D(PREF), D(GPGF), and D(GPGFAB) ; $\prod$ et Ω_1 are two matrices (4,4) of coefficients ; X_t is the vector (4,1) composed of D(INT), D(IPIEXP), D(IPIIMP), and D(IPNE) ; ϱ et μtwo vectors (4,1) of coefficients andε_t a vector (4,1) de residues I(0).

Table 3 : Vector error correction estimates

Error Correction:	**D(LTCERAEXT)**	**D(int)**	**D(pref)**	**D(GPGF)**	**D(GPGFAB)**	**D(IPIEXP)**	**D(IPIIMP)**	**D(IPNE)**
CointEq1	-0.05***	0.29	-0.06	0.86	-2,48	-2,62	-5,28***	-6,15***
	(-2,99)	(0.07)	(-0.36)	(0.62)	(-0,68)	(-1,07)	(-2,49)	(-4,26)
D(LTCERAEXT(-1))	-0.63***	-4,42	-0.15	15,12	-12,41	-9,26	9.80	13.42
	(4.34)	(-0.13)	(-0.11)	(1.37)	(-0,43)	(-0.48)	(0.58)	(1.17)
D(int(-1))	-0.001	-0.51*	0.001	0.04	-0,00	0.10	-0,19	-0.03
	(-1.03)	(-1,93)	(0.12)	(0.51)	(-0.04)	(0.64)	(-1,43)	(-0.37)
D(pref(-1))	-0.04***	1.15	-0,55***	2.59***	-2,18	0.03	-2,13	-2,17
	(-2,65)	(0.31)	(-3.25)	(2.07)	(-0.66)	(0.02)	(-1.12)	(-1,67)
D(GPGF(-1))	-0.01***	0.76	-0.04	-0.26	0.06	-0.42	-0.64	-1.05***
	(-2,58)	(0.86)	(-1,20)	(-0.89)	(0.09)	(-0,82)	(-1,45)	(-3,45)
D(GPGFAB(-1))	0.001	0.09	-0.01	0.10	-0.30	-0,19	0.006	0.14**
	(1.38)	(0.48)	(-1,61)	(1.47)	(-1,66)	(-1.60)	(0.06)	(2.04)
D(IPIEXP(-1))	0.006***	0.08	-0,006	-0.09	0.52	-0.41	0.52***	0.29**
	(3.31)	(0.21)	(-0.33)	(-0,67)	(1.46)	(-1,71)	(2.52)	(2.06)
D(IPIIMP(-1))	0.001	-0.09	-0.01	-0.08	0.31	0.08	-0.73***	-0.22
	(0.68)	(-0.28)	(-1,23)	(-0,68)	(1.01)	(0.42)	(-4,06)	(-1,82)
D(IPNE(-1))	0.005	-0,31	0.04	-0.06	-0.49	0.79	0.98***	0.43
	(1.58)	(-0.42)	(1.20)	(-0.25)	(-0.74)	(1.76)	(2.53)	(1.65)
C	-0.002	0.27	0.12	-0.39	0.68	0.14	-0.10	-0.28
	(1.18)	(0.09)	(0.85)	(-0.37)	(0.24)	(0.07)	(-0.06)	(-0.26)
RMSE	0.07	16,69	0.75	5.57	14.63	9.84	8.48	5.78
R-squared	0.66	0.33	0.55	0.59	0.56	0.68	0.59	0.79
ADF on tailings	-4,97***	-5,87***	-4,51***	-5,65***	-4,65***	-5,90***	-5,82***	-5,38***
Chi2	33,51	8.64	20,84	25.09	21,82	36,31	24.87	64,30
P>Chi2	0.00	0.56	0.02	0.00	0.01	0.00	0.00	0.00

The figures in parentheses are the Z statistics

***=meaning to 1%; **=meaning to 5%; *=meaning to 10%

Table 3 indicate that the statistical properties of the eight equations are generally satisfactory. Residues are stationary under the ADF tests, uncorrelated except for real interest rate deviations (RITDs) where the probability of a two-point difference is high. Stationarity of the results reveal that there is a cointegrating relationship between all model variables. Moreover, from the eight estimated equations, it appears that only the first equation offers a coefficient of negative and significant return force, even at 1%. This leads us to conclude that the cointegrating relationship, thus highlighted, is indeed an exchange rate equation. Thus, when a long-term imbalance occurs, the callback force is exerted only on the real exchange rate. The other variables, especially the fundamentals, are (slightly)"exogenous".

The medium- and long-term fundamentals account for more than 2/3 in the explanation of the variation of the real effective exchange rate of agriculture in Benin. A positive variation of 1 point in the preference for the present is at the origin of the 0.04 point drop in short-term REERAext, which is a drop in the external competitiveness of the agricultural sector in Benin. This situation, in line with short-term theoretical predictions, results either from the appreciation of the nominal effective exchange rate or from the rise in the level of domestic prices of importable goods.

Indeed, an increase in the preference for the present (increase in household consumption and/or increase in government spending) puts upward pressure on the prices of any good (tradable, non-tradable, agricultural, and non-agricultural). The result is that REER Aext is being valued, which is indicative of declining competitiveness.

This result confirms Edwards' (1989) predictions that an increase in the domestic price of importable, due to permanent import taxation, ultimately leads to an appreciation of the real exchange rate in the long run. An improvement in the overall productivity of factors (i. e. technical progress) by 1 point in Benin with to its partners, contributes to a 0.01 point decrease in REERAext in the short term. This is consistent with the predictions of the Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964) that an acceleration in technical progress is likely to appreciate the real exchange rate. The strong growth of overall factor productivity in Benin compared to its agricultural trading partners tends to appreciate the real effective exchange rate of the agricultural sector but in a less strong way. The coefficient of the domestic price index for exportable goods is positive (0.006) and significant. An increase in the relative internal prices of agricultural export goods results in an improvement in the external competitiveness of the agricultural sector in Benin.

3.1.3. Medium- and long-term dynamics of REERAAext and over-adjustment

The medium- and long-term equilibrium real external exchange rate of agriculture is estimated using ordinary least squares (MCOs). The results from this estimate are presented in Table 4 below. The real external exchange rate of agriculture is lowered on its medium (INT, IPIEXP, IPIIM) and long term fundamentals (PREF, GPGF, GPGFAB). To these fundamentals are added the advanced and delayed variations of long-term fundamentals in accordance with the Stock and Watson method. This method improves the asymptotic properties of the estimate and makes it easier to interpret Student statistics.

The analysis of the medium- and long-term dynamics (Table 4) shows a fairly high coefficient of determination, which shows that the various fundamentals of the agricultural sector's real effective exchange rate (REERAext) are a significant explanation for this. The stationarity of the residue also reveals a cointegrating relationship between REERAext and its fundamentals. An increase in real lending interest rates in Benin of 1 point compared to its partners would contribute in the medium term, to generate losses of competitiveness of Beninese agriculture by 3 points, thus reflecting the appreciation of REERAext. Indeed, strong growth in real interest rates in Benin, by increasing the cost of credit, is driving down investment in agricultural projects. This situation does not allow capital and therefore agricultural economic growth to be boosted. This would partly be responsible, in the case of Benin, for a sharp increase in public expenditure in the agricultural sector, thus creating a deficit in the public accounts. Unfortunately, this Keynesian government deficit policy has not yet solved the medium-term competitiveness problem of the agricultural sector. Domestic prices of agricultural import goods act in such a way as to reduce the external competitiveness of agriculture in the medium term. Increasing them by 1 point reduces competitiveness by 9 points. However, in the long term, however, policies to improve current preference (joint increase in demand for agricultural goods and government expenditure in the agricultural sector) and overall factor productivity (improvement of production levels and technology) by 1 percentage point respectively, have a positive effect on the external competitiveness of the agricultural sector by 68 and 22 percentage points respectively.

Table 4 : Real exchange rate of the medium and long term

The variables	**LTCERAEXT**		**LTCERAEXT of medium term**		**LTCERAEXT of long-term**	
	Coefficient	*T-Statistic*	*Coefficient*	*T-Statistic*	*Coefficient*	*T-Statistic*
INT	-0.03	- 3.64	-0.03	- 3.64	-	-
PREF	0.68	2.68	0.68	2.68	0.68	2.68
GPGF	0.22	8.6	0.22	8.6	0.22	8.6
GPGFAB	-0.09	-9,16	-0.09	-9,16	-0.09	-9,16
IPIEXP	0.001	0.27	0.001	0.27	-	-
IPIIMP	-0.09	-10,81	-0.09	-10,81	-	-
IPNE	0.12	22.62	0.12	22.62	-	-
Adjusted R-squared= 0.914; Durbin-Watson STAT= 2.47; DFA on tailings= -6,11***						

4. Conclusion

This paper used real exchange rate theory and sectoral macroeconomics theory to analyze the dynamics of the external competitiveness of Benin's agricultural sector. But before, a macroeconomic indicator for analyzing the external competitiveness of the agricultural sector was constructed.

The analysis of the medium- and long-term dynamics showed that an increase in real lending interest rates in Benin compared to its partners would contribute in the medium term, to generate losses of competitiveness of Beninese agriculture. Indeed, strong growth in real interest rates in Benin, by increasing the cost of credit, is driving down investment in agricultural projects. This situation makes it impossible to boost capital and therefore agricultural economic growth. This would partly be responsible, in the case of Benin, for a sharp increase in public expenditure in the agricultural sector, thus creating a deficit in the public accounts. Unfortunately, this Keynesian government deficit policy has not yet solved the medium-term competitiveness problem of the agricultural sector. Domestic prices of agricultural import goods act in such a way as to reduce the external competitiveness of agriculture in the medium term. In the long term, policies to improve current preference (joint increase in demand for agricultural goods and government expenditure in the agricultural sector) and overall factor productivity (improvement of production and technology) have a positive effect on the external competitiveness of the agricultural sector.

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