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Relative Prices of Non-Tradable Versus Tradable Goods and Poverty in Sub-Saharan Africa

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ABSTRACT
This paper assessed the effects of relative prices on poverty in Sub-Saharan Africa. The study covers a sample of 27 countries of Sub-Saharan Africa over the period 1992-2016.The formulation of a dynamic panel model and the estimation using the techniques of generalized moments (GMM) show that the relative prices of tradable goods by non-tradable goods have a negative and significant influence on poverty gap and on the proportion of the poor population in Sub-Saharan Africa. The results involve increasing and diversifying the local supply of manufactured goods and investing in technology to improve the technological balance of payments.
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INTRODUCTION

Poverty remains a major challenge for African countries in general and Sub-Saharan Africa (SSA) in particular. According to the World Bank's Poverty and Shared Prosperity Report (2020), poverty rates have remained at high levels for three decades in SSA. In 2018, 18 of the 20 poorest countries were in sub-Saharan Africa. About 40 percent of the region's population still lived with less than $1.90 a day, and nearly 70 percent had less than $3.20 a day in middle-income countries. This is why poverty was among the priorities of developing countries defined by the UN General Assembly and the Sustainable Development Goals.

By making the fight against poverty a concern, institutions and states have undertaken the implementation of many poverty reduction strategies. Several economic policies have also been adopted to achieve a certain level of growth to significantly reduce poverty. These include the Heavily Indebted Poor Countries (HIPC) Initiative in 1996, Poverty Reduction Strategy Papers (PRSPs) developed in the 2000s under the aegis of international institutions, the Millennium Development Goals (MDGs) in 2000 and the Sustainable Development Goals (SDGs) in 2015.

However, the implementation of different policies has not produced sufficient results to significantly reduce or eliminate poverty in these countries. Moreover, the gap between Sub-Saharan Africa and the rest of the world is larger concerning poverty intensity than for its incidence, and for its severity than for its intensity.

The World Bank (2018) pointed out that Sub-Saharan Africa had the majority of the world's poor and their total number was increasing unlike most other regions of the world. The countries with the highest poverty rates are all in Sub-Saharan Africa with 26 to 40 million additional people pushed into extreme poverty. Also, out of the 28 poorest countries in the world, 27 are in sub-Saharan Africa, with poverty rates above 30 percent.

The persistence of poverty in SSA requires further study of its causes. For the World Bank (2018), SSA was among the areas that needed renewed attention to end extreme poverty in the world. One of the characteristics of these countries is that most of the population is involved in the production of local goods (non-tradable goods), the prices of which change less rapidly, whereas they import a large proportion of manufactured goods (tradable goods), which prices change significantly. These price changes are likely to modify the structure of relative prices, which could affect the living conditions of the population, since relative prices affect purchasing power. With regard to the socio-economic environment, a lot of SSA countries have no influence on international prices which increase their exposure to external shocks. Hence the interest of taking relative prices into account in poverty analysis.

The relationship between relative prices and growth has been the subject of empirical work (SOME and MAIGA, 2021). While theoretical and empirical work has shown that poverty reduction goes hand in hand with economic growth, the link between growth and poverty reduction is not automatic. As DELLEUR (2010) points out, the links between economic growth and poverty reduction are affected by political choices and structural factors, and the constraints imposed by lack of income on individuals are accompanied by their inability to take control of their destiny, which an increase in GDP per capita is not enough to eradicate. The empowerment

DELLEUR (2010) refers to here requires the structural transformation of these economies to reduce their vulnerability to fluctuations in commodity prices, on which they are largely dependent. Hence the need to identify the influence of relative trade prices on poverty in SSA countries.

The links between relative prices and poverty have not been much debated in previous work. As a result, poverty alleviation policies do not take into account this relative price aspect, which may well influence poverty levels in developing countries. In view of the fact that poverty is rife in the SSA region, this article. This research will contribute to the implementation of economic policies to reinforce the effectiveness of growth in reducing poverty.

The rest of the paper is organized around three parts. First, we present the stylized facts to highlight the observed relationships, then the literature review to synthesize the theoretical and empirical work. Finally, we detail the methodology used and the results followed by the interpretations.

I. STYLIZED FACTS ABOUT POVERTY IN SUB-SAHARAN AFRICA

1. Description of Poverty in Sub-Saharan Africa

In general, progress has been made on the African continent in the fight against extreme poverty. For example, the share of the African population living on US$1.90 per day declined from an average rate of 49% in the 1990s to 36% over the period 2009-2016 according to the OECD (2018). However, the number of absolute poor has increased despite the decline in the proportion of the poor (OECD, 2018). Progress has thus been slower particularly in sub-Saharan Africa where poverty indicators remained higher compared to Asian countries (World Bank, 2019).

On average, the proportion of African households with consumption levels below the $1.9/day poverty line fell from 40 percent in 2010 to 34 percent in 2019. Below $3.2/day, the poverty rate increased from 63% to 59%; and below $5.5/day, it increased from 83% to 80% according to the Economic Development in Africa Report 2021 (UNCTAD, 2021). However, inequality has increased between and within African countries. The Gini index, measuring income distribution, ranges from 27.6% (Algeria) to 63.3% (South Africa), where 0% indicates that everyone has the same income and 100% implies that a household receives all income.

According to the AfDB (2020), if current trends do not change, the extreme poverty rate (population-weighted) will fall from 33.4% in 2018 to only 24.7% in 2030 and the number of extremely poor people will fall slightly by almost 8 million, meaning from 429.1 million in 2018 to 421.2 million in 2030. This means that Africa in general and SSA in particular will not be able to achieve the goal of eradicating extreme poverty by 2030.

2. Anti-poverty policies in Sub-Saharan Africa

Several public policies to fight poverty have been implemented in developing countries and in SSA in particular. These include the Structural Adjustment Policies that the World Bank and the IMF have advocated in Africa since the 1980s. SAPs were developed by the World Bank and the International Monetary Fund in the early 1980s to help developing countries (DCs) return to a healthier economic situation. The Heavily Indebted Poor Countries (HIPC) Initiative, proposed by the World Bank and IMF in 1996 and strengthened in 1999, provided debt relief to highly indebted countries under certain conditions, including a commitment to poverty reduction. However, the majority of African countries still facewidespread poverty. More than 50 percent of the population of sub-Saharan Africa lives on less than a dollar a day. Most social indicators also reveal significant gaps between Africa and other regions of the world. Thus, Structural Adjustment Programs are being replaced by Poverty Reduction Programs.

Starting in 2002, the World Bank based its assistance strategies for low-income countries on Poverty Reduction Strategy Papers (PRSPs), which were designed as instruments for low-income countries to frame their poverty reduction plans. Poverty Reduction Strategy Papers (PRSPs) were thus part of the analytical mechanisms of PRSPs. At the time of the PRSPs, new criticisms of IMF activities in SSA emerged. In addition, IMF-supported programs had made little progress in reducing poverty and income inequality (Salop et al. 2007). In 2000, the international community adopted the Millennium Development Goals (MDGs), with a key agenda of halving poverty in the world's poorest countries by 2015, with a particular focus on African countries. Following the adoption of the MDGs by the international community, the United Nations recommended that all countries align their PRSPs with the MDGs.

On the achievement of poverty reduction targets set out in the MDGs, many countries in Sub-Saharan Africa fall below critical thresholds for development goals according to some indicators. On September 25, 2015, the United Nations General Assembly confirmed its commitment to continue the momentum of the MDGs under a new agenda called the Sustainable Development Goals (SDGs) that will run through 2030. This agenda adopted by the world's political leaders last September at the UN is made of 17 Sustainable Development Goals (SDGs).

II. REVIEW OF THE LITERATURE ON THE RELATIONSHIP BETWEEN RELATIVE PRICES AND POVERTY

2.1. Theoretical aspects

2.1.1. The concept of poverty

On the theoretical level, several works address the foundations of poverty. Booth (1887) and Rowntree (1901) in their conception defined the poor as those who do not have sufficient monetary resources to obtain the goods and services necessary to satisfy their basic needs or to attain a standard of living corresponding to the norms of society. The concept of the physiological minimum forms the basis of traditional analyses of poverty. But the notion of physiological minimum has evolved into the notion of social minimum to take into account some vital needs. Thus, Sen (1973) analyzed poverty in terms of individuals' capabilities, by determining the stock of human capital that each individual needs to integrate into society. Townsend (1979) proposed taking into account the concept of "relative deprivation" in the definition of poverty. For him, an individual is poor because he or she is actually deprived of access to certain goods. The poverty lines defined by the World Bank reflect this Townsend deprivation. There are two approaches to set poverty line: the "absolute" approach and the "relative" approach (Lachaud, 1998).

2.1.2. Theoretical approaches to poverty measurement

Until now, poverty has been a multidimensional concept, and therefore complex and difficult to define (Larivière et al; 1998). In the literature, several indices are used to measure poverty. These include Watts' index (1968), Clark's index (1981) and the indices proposed by Foster, Greer and Thorbecke (1984), which are often used in the literature. Foster, Greer and Thorbecke (1984) proposed three (3) indices for measuring poverty : the incidence index, poverty intensity index and poverty gap index. There are also two (02) main approaches to poverty depending on the criteria taken into consideration : the monetary approach (welfarists[1] or utilitarians) and the non-monetary approach (non-welfarists).

2.2. Theoretical literature on relative prices and poverty

The international environment can have effects on poverty through relative prices. For some, reducing price volatility and improving the terms of trade for agricultural commodities should be taken into account in policies aimed at reducing poverty. In the literature, few theoretical works explicitly address the link between relative prices and poverty. Lahrèche-Révil, (1999) emphasized that the long-term relationship that is empirically observed between relative prices (RPM) and development cannot be formalized theoretically. For him, the level of relative prices constitutes a growth potential for certain countries by determining to a large extent the competitiveness of exports and the attractiveness of territories for direct investment. Nevertheless, a few works on relative prices address these notions.

Since human capital is an important factor in reducing poverty by increasing productivity and income opportunities, one might think, on the basis of the conclusions of De Melo and Robinson (1990), that relative internal prices (RIPs) affect the living conditions of populations. Indeed, they postulate that human capital accumulation depends negatively on the appreciation of the real exchange rate. The real exchange rate determines both the accumulation of human capital (through exports) and physical capital (through direct investment).

For Cardoso (1993), relative external prices (terms of trade) affect investment through income and profitability in the export goods sector. Thus, a deterioration in the terms of trade lowers income and reduces private

[1] A school that defines social welfare exclusively in terms of utility functions, i.e. the satisfaction of preferences, and advocates the role of the welfare state.

investment. While an improvement in the terms of trade will have a positive effect on the economy as a whole, thus contributing to poverty reduction.

In the same logic, it is believed that relative domestic prices (RDPs) can influence foreign direct investment, which in turn contributes to the growth and development of countries, which may affect the level of poverty. According to the mechanism of Klein and Rosengren (1994), the depreciation of the RRP decreases the cost of internationally immobile factors (particularly labor) and attracts direct investment when foreign investors choose the least costly location. Indeed, a country's capital is made up of human and physical capital, which is accumulated domestically, and of foreign accumulation through direct investment, which is supposed to be sensitive to the level of relative prices like the RER (Lahrèche-Révil, 1999).

Lahrèche-Révil (1999) believes that a temporary misalignment of the real exchange rate could influence the level of development or long-term growth. For him, the depreciation of the real exchange rate, by attracting direct investment and stimulating exports, allows a country to accumulate capital (physical and human), and to gradually escape the underdevelopment trap. On the other hand, he points out that this mechanism is called into question in countries with very low levels of development where the capital stock is very low. In these countries, as in SSA, he believes that real depreciation may not produce the expected effects (accumulation of the capital stock) to overcome the trap, since excessive undervaluation may have perverse effects. He justifies the perverse effect that may cancel out the potential benefits of depreciation in the sense that these countries are highly indebted in foreign currency and any depreciation increases the debt burden, something that may be a constraint to economic development.

Rodriguez and Rodrik (2000), stated that specialization in sectors that are not very dynamic (for example, countries that specialize in the export of raw materials) will have a negative impact on growth and may affect the level of poverty in these countries.

2.3. Empirical literature on the relationship between relative prices and poverty

Variations in the terms of trade (relative external prices) of primary products, the main rent products of SSA countries, and in relative internal prices (prices of tradable goods compared to non-tradable goods), could lead to an imbalance in the balance of trade and affect the living conditions of the population when it is known that the prices of non-tradable products (local goods) evolve less rapidly than tradable products (manufactured goods).

In this respect, Williamson (1997) uses the relative price factor to show that there is a positive correlation between globalization and convergence. In fact, according to him and in accordance with the theory of international trade, a convergence of the relative price factor occurred over the period 1870 to 1913 with an increase in inequality in rich countries and a decrease in poor countries. Some authors, without speaking directly of poverty, were already making the link between appreciation of the RER and unemployment. Joly et al (1996) indicate that any variable likely to increase equilibrium unemployment is likely to induce an appreciation of the real exchange rate, which makes it possible to limit the rise in equilibrium unemployment. They take the example of an increase in the cost of domestic capital (induced by an increase in the risk premium on interest rates or by capital taxation), which causes an increase in equilibrium unemployment and an appreciation of the real exchange rate.

In an analysis of a sample of 21 countries, (Larèche-Evil, 1999) finds that the relative price level influences growth in these countries and that a developing country could benefit from the depreciation of its real exchange rate to grow faster. In fact, according to him, the depreciation of the real exchange rate attracts direct investment and stimulates exports, thus allowing the country to accumulate capital and gradually initiate development. He points out, however, that a geographical extension of the theoretical framework suggests that in the presence of an underdevelopment "trap", the poorest countries cannot take advantage of an undervaluation of their real exchange rate to grow faster, unlike "intermediate" countries. He justifies this by the fact that in these countries, where the capital stock is very low, it is likely that real depreciation will not allow the accumulation of a sufficient capital stock to overcome the trap, especially since excessive undervaluation is likely to have perverse effects.

Cogneau and Robilliard (2001) found that a decline in rural poverty and a slight increase in urban poverty can occur in Madagascar following an increase in the world price of the agricultural cash crop (improvement in relative trade prices). This could be explained by the fact that this country exports a large proportion of agricultural products. Given that the poverty rate and the depth and severity of poverty are higher in rural areas, changes in the relative prices of agricultural and informal goods determine the real income of households, depending on the structure of their income and consumption. One implication is that development strategies

based on formal/urban sector growth must lead to an improvement in relative agricultural prices (terms of trade) to effectively reduce poverty by inducing income redistribution to agricultural/rural households.

Similarly, changes in relative trade prices (terms of trade) can reduce or increase the income gain from the additional purchasing power of consuming lower-priced goods. This can affect the level of poverty. A trade measure that leads to lower selling prices can have a direct effect on the poor either through a positive effect on consumers through lower prices or a negative effect on farmers through lower prices, plus an impact on factor demand (Cling, 2006).

The results of the empirical work in Diallo's (2006) dissertation show that in a sample of African and non-African countries, the depreciation of the RER favors the poor, provided that income inequalities are not gross and that institutions function adequately. He concludes that real exchange rate depreciation can be a powerful tool for poverty reduction if it is complemented by other policies.

The study by Ivanic and Martin (2008) found that an increase in domestic prices of internationally traded food products by the same amount as their world prices would increase the percentage of poor people in several low-income countries in the world and in Africa by as much as four to five percentage points. Wodon (2008) reached the same conclusion about the poverty rate if domestic prices of food traded on world markets were to pass on half the increase in world prices. These studies also highlight the fact that relative food prices at the international level could affect poverty at the domestic level in SSA.

Avom and Carmignani, (2008) in their work on "poverty, growth and redistribution" consider the external sector including the terms of trade in their macroeconomic framework with variables that may influence poverty. According to them, developing countries are generally characterized by a secular deterioration of their terms of trade, the repercussions of which on their various economies are amplified by their very high dependence on oil for some, and on agriculture for others. They therefore advocate economic diversification because, while a positive terms of trade shock has a very positive impact on poverty reduction, a negative shock will have the opposite result, given that in agricultural economies, fluctuations in international commodity prices increase the risk of negative terms of trade shocks, especially because commodities are often exported in their raw state.

Since the early 1980s, the SSA region has struggled to find its way to development because the volatility of commodity prices and the fall in terms of trade, combined with low levels of international aid, have led to an explosion in the external debt of African countries, thus jeopardizing the prospects for development and poverty reduction. In explaining poverty in SSA, taking into account inter-sectoral terms of trade suggests that in the absence of a growth differential between sectors, poverty declined by -1.3 to -7.0 percent, considering real GDP/head, while the decline was in the range of -3.6 to -18.6 percent, referring to real expenditure .

According to the World Bank (2014), in some SSA countries where cotton exports account for 5-8 percent of GDP, and cotton production employs up to one-third (1/3) of the population, falling prices could lead to a decline in cotton exports, causing a decline in real income, a contraction of the domestic economy, a widening of current account deficits, and an increase in poverty.

III. EMPIRICAL ANALYSIS OF THE EFFECTS OF RELATIVE PRICES ON POVERTY

3.1. Econometric approach

Following the example of Guillaumont and Kpodar (2004), we use a model to determine the level of poverty that takes into account the relative prices of tradable goods compared to non-tradable goods. Indeed, they use this model to estimate the effect of financial development on poverty reduction in a sample of developing countries. A similar model has also been used by several authors in previous studies (Lahimer (2009), Dollar and Kraay, 2000; Ravaillon, 1997).

We thus use an equation explaining the indicators on the basis of monetary poverty. The poverty model equation is as follows (Guillaumont and Kpodar, 2004; Jeanneney and Kpodar, 2008):

The equation of the poverty model is as follows :

$$P_{i,t} = \alpha_0 + \alpha_i X_{i,t} + \mu_0 + \varepsilon_{i,t} \qquad (1)$$

We specify this dynamic panel model for our research. We consider an indicator of the relative prices of tradable versus non-tradable goods measured by the real effective exchange rate (REER) and a set of existing explanatory variables from the literature. These are economic growth, gross secondary school enrollment, financial

development, and the unemployment rate. We estimate two equations with two poverty indicators. These are the poverty gap and the poor population ratio. The equations to be estimated are as follows :

$$Poverty\ gap_{i,t} = \propto_0 + \propto_1 Poverty\ gap_{i,t-1} + \propto_2 GDPC_{i,t} + \propto_3 REER_{i,t} + \propto_4 SSE_{i,t} + \propto_5 FD_{i,t} + \propto_6 Ump_{i,t} + \mu_0 \quad (2)$$

$$Ratio\_poor_{i,t} = \propto'_0 + \propto'_1 Ratio\_poor_{i,t-1} + \propto'_2 GDPC_{i,t} + \propto'_3 REER_{i,t} + \propto'_4 SSE_{i,t} + \propto'_5 FD_{i,t} + \propto'_6 Ump_{i,t} + \mu_0 \quad (3)$$

With REER: real effective exchange rate (price of tradable goods relative to non-tradable goods), GDPC: GDP per capita, SSE: gross secondary school enrollment ratio, FD: financial development, and Ump: unemployment rate; ∝i: coefficients to be estimated, μ: country-specific effect, ε: error term, i the country index, and t the measurement year.

3.2. Definition and measurement of variables

The dependent variables

Several studies on poverty have focused on its monetary aspect, particularly studies on the determination of poverty (Ravallion, 1996). For the dependent variables, we use two direct indicators of poverty. These are (i) the poverty gap relative to the $1.90 a day threshold, of which we have named « Ecart_Pauvre » and (ii) the ratio of the poor population to the $1.90 a day threshold, name « Ratio_Pauvre ». The poverty gap can reflect both the extent of poverty and its incidence. It is an important determinant of the likelihood of leaving poverty. It reflects the shortfall in earnings to get back above the poverty line (assuming that the non-poor have a zero shortfall). The ratio of the poor population to the $1.90 a day threshold (Ratio_poor) is the percentage of the population living below the poverty line. This indicator may also reflect the national poverty rate. (BenRejeb, 2014).

The explanatory variables

We consider a number of determinants of poverty among the explanatory variables (Guillaumont and Kpodar, 2004) :

The real exchange rate (REER): the variable of interest representing the relative prices of tradable goods compared to non-tradable goods. An increase in the relative price of non-tradable goods results in an appreciation of the equilibrium real exchange rate. This tendency for the relative price of non-tradable goods to rise is equivalent to an increase in the income of these actors and an increase in the purchasing power of tradable goods. This could have an effect on poverty reduction. Its expected sign is negative (Melo and Robinson, 1990).

Gross secondary school enrollment ratio (SSE): Social investments in education and health could help affect poverty rates (Freeman, 2001). SSE is expressed as a percentage and is the ratio of the total number of students enrolled in secondary school to the total population of official secondary school age. This variable negatively influences poverty (Lachaud, 2003).

Economic growth (GDPC): Some authors have considered that growth is good for the poor (Dollar and Kraay, 2002). Some even admit that economic growth is the surest way to significantly and sustainably reduce poverty in Africa[2]. Ravallion (2001) also highlighted the importance of economic growth in relation to poverty. A negative sign is expected at this level.

Financial development (FD): Financial development can improve the access of the poor to financial services. Financial development reduces absolute poverty and inequality, particularly by increasing the incomes of the poor (Honohan, 2004; Beck et al., 2004). Financial development is measured by the ratio of private sector credit to GDP (Honohan, 2004). Its expected sign is negative.

Unemployment rate (Ump) : Employment provides opportunities for income and improved living conditions and thus prospects for escaping from poverty. It is expressed as a percentage (by dividing the number of unemployed by the active population, all multiplied by 100). Unemployment is the main cause of poverty (Blank and Blinder, 1986). A positive sign is expected for this variable.

[2] Patrick Honohan et Thorsten Beck, (2005) ; « La finance au service de l'Afrique ». Banque internationale pour la reconstruction et le développement/Banque mondiale.

3.3 Model estimation method

To estimate the effects of relative prices on poverty in SSA, we estimate two equations specified in a dynamic panel by taking into account two relative price indicators: the terms of trade and the real effective exchange rate. The two equations to be estimated are the poverty gap and the proportion of the population living below the poverty line.

The consideration of four-yearly data leads to a strong reduction in the sample size (t becomes very small) making it difficult to use cointegration techniques and error correction models. Thus, to estimate our two (02) models in panel data, we use the GMM method in system developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). Indeed, the dynamic panel formulation (presence of the lagged dependent variable) makes the OLS and GCM estimators inefficient and non-convergent. The GMM method, which has the advantage of taking into account the correlation between the endogenous variable and the error term, is an appropriate estimation technique for a dynamic panel. It also provides solutions to the problems of simultaneity bias, reverse causality, omitted variables, control of individual and temporal specific effects and endogenous bias of the variables (Guillaumont and Kpodar, 2004). The choice of this method is also justified by the fact that the individual dimension of the panel is relatively larger than its temporal dimension (Roodman, 2009a, 2009b).

Arellano and Bover (1995) and Blundell and Bond (1998, 2000) show that in the case of highly persistent series, it is preferable to use a system generalized method of moments estimator, which combines the GMM estimator in difference with additional conditions on the level equations.

Thus, the system GMM estimator is the most appropriate for this empirical analysis since the time dimension of the sample is quite small

This estimator assumes the verification of the following conditions:

(i) $$E[\Delta K_{i,t}\eta_i^*] = E[\Delta I_{i,t}\eta_i^*] = E[\Delta nop_{i,t}\eta_i^*] = E[\Delta dht_{i,t}\eta_i^*] = 0 \qquad (4)$$

(ii) $$E[\Delta y_{i,2}\eta_i^*] = 0 \qquad (5)$$

The first condition establishes that the explanatory variables (except the lagged first difference dependent variable) in first difference are uncorrelated with the individual effect. The second condition states that the dependent variable in first difference at t=2 is uncorrelated with the individual effect.

The system GMM estimator of Blundel and Bond (1998), combines the first difference equations with the level equations. The instruments in the first-difference equation are expressed in level, and vice versa.

sont exprimés en niveau, et vice versa.

$$\Delta Y_{i,t} = \beta \Delta Y_{i,t-1} + \varphi \Delta X_{i,t} + \Delta v_t + \Delta \varepsilon_{i,t} \qquad (6)$$

$$Y_{i,t} = \beta Y_{i,t-1} + \varphi X_{i,t} + v_t + \varepsilon_{i,t} \qquad (7)$$

However, to test the robustness of our results, we can also estimate the model by GMMs in difference.

Two tests are associated with the GMM estimator in dynamic panel: the Hansen overidentification test and the Arellano and Bond autocorrelation test will allow us to test the validity of lagged variables as instruments.

3.4. Nature and source of data

The data are from the World Bank database (WDI, 2020) and cover the period from 1992 to 2016 for 27 SSA countries. However, annual poverty data are not available for the period, so we constructed a base from the four-yearly data. This resulted in the transformation into seven non-overlapping sub-periods (Ahmed, 2016 ; Gaies, 2017).

IV. RESULTS AND INTERPRETATIONS

4.1. Descriptive analysis

Here we do a descriptive analysis of the data focusing on the dependent variables and the explanatory variables of interest.

4.1.1. Descriptive statistics

Table 1 gives the central tendency and dispersion characteristics of these variables. We note that there is a strong disparity on all the variables in SSA as can be seen from the coefficients of variation. The most variable distribution is the poverty gap (with a minimum of 0.1%, a maximum of 63.6%, an average of 21.40 and a coefficient of variation of 0.75), which is certainly due to the specific policies of each country in the fight against poverty. The least variable distribution remains the relative internal prices (with an average of 113.32 and a coefficient of variation of 0.47). This could be explained by the similarity of the products traded by this area. The average proportion of the poor population is 48.23% over the period with a high coefficient of variation.

Table 1 : Statistiques descriptives

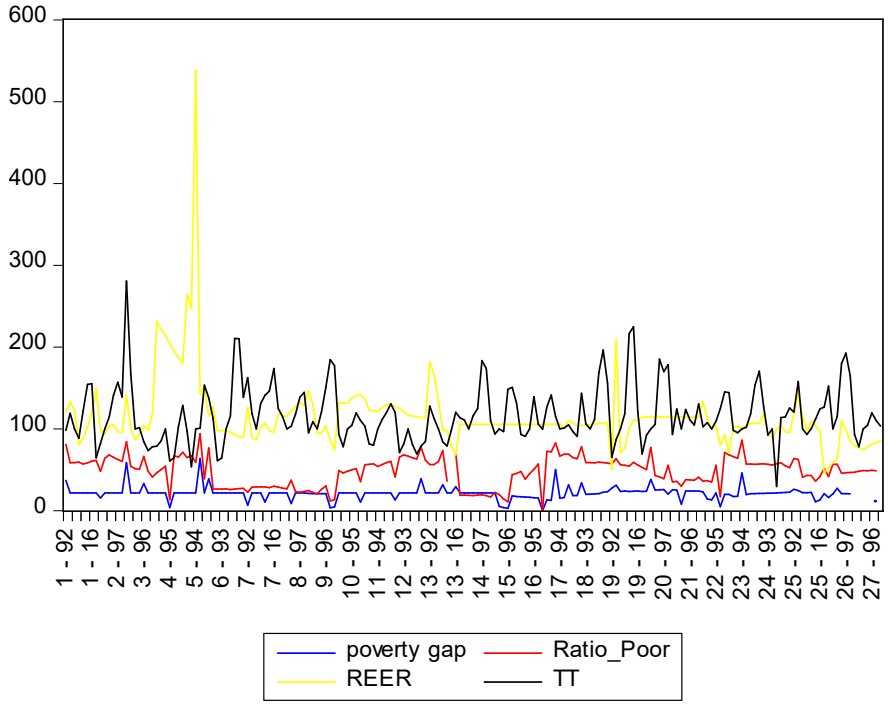
Variable	Mean	Standard deviation	Min	Max	Coef, of variation
Poverty gap	21,40	16,23	0,1	63,6	0,75
Ratio_poor	48,23	25,67	0,5	94,1	0,53
REER	113,32	53,41	46,02	538,40	0,47

Source: Author's calculation based on WDI 2020 data

4.1.2. Evolution of some variables

We show in the same graph 1, the joint evolution of relative price variables and poverty variables in SSA.

Figure 1: Evolution of poverty gap, the poor population ratio, the real exchange rate and the terms of trade in SSA from 1992 to 2015



Source: Author's calculation based on WDI 2020 data

The changes in the various variables give an idea of the direction of variation of each variable in relation to the others. In general, these three variables move in a sawtooth pattern with peaks and troughs at times. However, a similar trend can be observed between poverty gap and the CER and between the proportion of the population in poverty and the CER. Even if the relationship between relative price indicators and poverty indicators cannot be clearly defined, the fact remains that for some countries the same movements on relative prices are observed on poverty indicators in the opposite direction for some years.

4.2 Preliminary tests

Preliminary tests were carried out to support the validity of the econometric results.

The results of the two stationarity tests reveal that not all variables are stationary in level. The cointegration test (table 3) revealed that the null hypothesis of no cointegration (Hurlin and Mignon (2007) cannot be rejected, so we conclude that there is no significant cointegration. Consequently, the use of cointegration techniques or error-correction models is less relevant.

Table 2 : Results of the cointegration tests

	Intra Dimension	**Inter Dimension**	
Panel v-Statistic	-1,192	Group rho-Statistic	-2.022**
	(0,76)		(0,06)
Panel rho-Statistic	1,98	Group PP-Statistic	1,838**
	(0,85)		(0,99)
Panel PP-Statistic	1,654	Group ADF-Statistic	0,822
	(0,77)		(0,88)
Panel ADF-Statistic	1,514		
	(0,93)		

Source : Author's calculations based on data from WDI-2018

The results of the autocorrelation test (table 3) confirm the presence of an AR(1) effect for the residuals, and we accept the absence of an AR(2) effect, which is consistent with the assumptions of the GMM estimator. The choice of these tests is justified by the very approach of the model. The validity of the instruments used in GMM regressions is tested using Sargan's over-identification test. The results of Sargan's test validate the choice of instruments at the 5% threshold for both estimators.

Table 3 : Results of the autocorrelation tests

	GMM in system		**GMM in difference**	
	Ratio_poor model	**Poverty gap model**	**Ratio_poor model**	**Poverty gap model**
Sargan test (p-value)-AR(1)	-2,22 (0,02)	-2,59 (0,009)	-3,03 (0,002)	-2,44 (0,015)
Sargan test (p-value)-AR(2)	-1,38 (0,16)	-1,44 (0,14)	-0,17 (0,86)	0,16 (0,87)

Source : Author's calculations based on data from WDI-2020

4.3. Presentation of the results of the estimates of the effect of relative prices on poverty and discussion

4.3.1. Results of the estimates

The results of the GMM estimations are summarized in Table 4:

Table 4: GMM estimation results

	GMM en system		GMM in difference	
	Ratio_poor	**Poverty gap**	**Ratio_poor**	**Poverty gap**
Var	Coef (t-stat)	Coef (t-stat)	Coef (t-stat)	Coef (t-stat)
L1Var_dep	-0,33*** (-3,35)	-0,25** (-2,02)	-0,56*** (-5,01)	-0,434*** (-5,25)
REER	-0,065** (-2,11)	-0,099*** (-4,87)	-0,25** (-2,11)	-0,06*** (-3,67)
GDPC	-16,47** (-2,26)	-17,24** (-2,52)	-27,2** (-2,23)	-14,44** (-2,35)
Ump	-0,702 (1,03)	7,23*** (3,17)	0,29* (1,92)	0,028 (0,94)
SSE	0,06 (1,26)	-7,39 (-0,67)	0,08 (0,91)	-17,58* (-1,85)
FD	-0,32** (-2,03)	-0,039 (-0,61)	-0,03 (-0,13)	-0,251* (-1,70)
Hansen test (p-value)	13,40 (0,41)	8,77 (0,64)	1,77 (0,094)	1,13 (0,95)
Sargan test (p-value)- AR(1)	-2,22** (0,02)	-2,59*** (0,009)	-3,03*** (0,002)	-2,44** (0,015)
Sargan test (p- value)-AR(2)	-1,38 (0,16)	-1,44 (0,14)	-0,17 (0,86)	0,16 (0,87)
Number of instruments	21	21	14	14

***,** and * are the significance at 1%, 5% and 10% respectively. The values (...) represent the values of the student t or Z of the normal distribution whereas they represent the p-values in the case of the tests.
Hansen J or Sargan test: Ho: Non-correlation of the instruments with the residuals (instrument validity test).
Arellano-Bond test: Ho: absence of autocorrelation.

Source: Author's calculations based on data from WDI-2020

On the global validation of the estimates, we test for each estimate, the two assumptions on which the GMM estimator in system is based. These are (i) the validity of the instruments used and (ii) the absence of second-order autocorrelation (AR(2)) in the residuals and the first-order negative autocorrelation (AR1). According to the estimation results, the same trend is observed both in the explanation of poverty ratio and in the explanation of poverty gap for both estimators.

On the individual significance of the variables, we interpret the results of the GMM estimator in system which performs better than the first difference estimator, for finite samples as shown by Blundell and Bond (1998). The results show that the coefficient related to the relative prices of tradable versus non-tradable goods (real effective exchange rate) is negative and statistically significant at the 5% level on both poverty equations. This means that a 1 percentage point increase in the real effective exchange rate leads to a 0.06 percentage point reduction in poverty gap and a 0.1 percentage point reduction in poor population ratio at the 5% threshold.

4.3.2. Discussion of the results

Regarding the overall validity of the model, the Sargan over-identification test, the results are non-significant at the 5% level. Therefore, we cannot reject the null hypothesis of the validity of the instrumentsand that they are uncorrelated with the error term. Also, the Arellano-Bond test does not allow us to reject, at the 5% threshold, the null hypothesis of no second-order autocorrelation, which shows that there is no second-order autocorrelation (AR2) of the errors of the equations in difference. Furthermore, the results show that the coefficient values of the

lagged variables of the dependent variables are negative and significant at the 5% level. The results of these specification tests validate our regression estimates.

The results show a negative and significant effect of the relative prices of tradable goods compared to non-tradable goods on the poverty gap and on the poor population ratio. Indeed, the real exchange rate change consists of the modification of the relative price of domestic and international goods. The appreciation of the REER increases the cost of tradable goods and leads to an increase in the demand for local products, because in small economies, imports can be purchased on the international market at world prices, but the supply of non-tradable goods can only be provided, by definition, by local producers (Joly et al., 1996). This increase in demand for local products will cause their prices to rise in response to supply (Adam, 2005).

As the ERER appreciates, resources are released from the production of tradable goods to that of non-tradable products, as this appreciation of the real effective exchange rate leads to a contraction of the tradable goods sector relative to that of non-tradable products. In catching-up economies such as Sub-Saharan Africa, and in accordance with the Balassa-Samuelson effect (1964), the exchange rate should tend to appreciate in real terms. In an expansionary or catching-up phase, productivity changes are generally more rapid in the tradable goods sector. This tend to reduce the relative price of tradable goods in the economy compared to non-tradable goods and thus to raise the real exchange rate. Under such conditions, productivity in the tradable goods sector tends to rise faster on average than in the non-tradable goods sector. This will tend to raise the relative price of non-tradable goods to tradable goods, more than abroad, and so the real exchange rate tends to rise. And since in our economies a large part of the population lives on income from the non-tradable sector, this tendency for the relative price of non-tradable goods to rise is equivalent to an increase in the income of these actors and an increase in the purchasing power of tradable goods. Our results also corroborate findings from many previous work (Adam, 2005; Jonglez, 2009).

However, some authors found that overvaluation is a brake on growth, whereas undervaluation stimulates growth (Edwards, 1993, Lahrèche-Révil, 1998). For Jonglez (2009), the increase in the real exchange rate will be to the detriment of exporting industries, which are sometimes essential to long-term growth.

With respect to our control variables, we find that the coefficient on per capita income is negative and significant at the 5% level. An increase in GDP per capita leads to a reduction in the proportion of the population that is poor and in poverty gap. Indeed, it is recognized that growth is a necessary (but not sufficient) condition for poverty reduction through the creation of employment and other economic opportunities (Ravallion and Chen, 1997 ; Boukhatem and Mokrani, 2012).

The coefficient associated with financial development is negative and statistically significant at the 5% level on poverty gap. Indeed, finance provides opportunities to accumulate assets and increase income and contributes to helping economic agents to cope with economic shocks and reduce their vulnerability to adverse situations, which could mitigate the risk of falling into poverty (Claessens and Feijen, 2006).

Unemployment has a positive effect on poverty, particularly on the poor population ratio. Indeed, the coefficient associated with unemployment is positive and significant at the 5% level. The employment constitutes, through the income that it is supposed to provide to the employee, a fundamental element of the individual's well-being.

4.3.3. Robustness test

To test the robustness of our results, we repeat the GMM estimates in the system by varying the number of delays. The results presented in Appendix 2 give us the same trend with respect specifically to the influence of relative prices on the two poverty indicators in SSA.

Table 5 : Estimation results with delay variation

GMM en système

Var	**Ratio_poor model** Coef (t-stat)	**Poverty gap model** Coef (t-stat)
L1Var_dep	0,18***	-0,28***
	(2,64)	(-2,76)
REER	**-1,07***	**-0,002***
	(-3,25)	**(-2,59)****
GDP/C	-0,64***	0,011
	(-10,75)	(0,46)
ump	-0,062	0,012***
	(-1,35)	(3,04)
SSE	-0,19	0,06**
	(-0,84)	(2,61)
FD	-0,001	-0,16
	(-0,11)	(-0,32)
Hansen test (p-value)	10,03	7,70
	(0,53)	(0,74)
Sargan test (p-value)-AR(1)	-1,82***	-2,51***
	(0,04)	(0,010)
Sargan test (p-value)-AR(2)	-1,38	-1,30
	(0,16)	(0,24)
Nomber of d'nstruments	21	21

Source: Author's calculations based on data from WDI-2020

CONCLUSION

This paper has allowed us to assess the effects of relative prices of tradable versus non-tradable goods on poverty in Sub-Saharan Africa. The study covers a sample of 27 sub-Saharan African countries over the period 1992-2016. Estimates were made using a dynamic panel econometric model through model formulation and estimation using generalized method of moments (GMM) techniques. The results showed that relative prices have a positive influence on poverty reduction. In particular, the relative prices of tradable goods compared to non-tradable goods have a negative and significant influence on poverty gap and on the proportion of poor people. Thus, an appreciation of the real exchange rate, by influencing the reallocation of resources, would be favorable for poverty reduction. We tested the robustness of the results with the GMM estimator in difference and the GMM estimator in system with variation of the number of lags.

Relative prices can therefore be considered as an instrument in poverty reduction policies. However, some authors denounce the perverse effects of a strong appreciation of the real effective exchange rate. It would therefore be interesting to consider research on a possible appreciation threshold beyond which an increase in the real effective exchange rate would be unfavorable to poverty reduction.

In terms of economic policies, our results imply:

Increasing and diversifying the local supply of manufactured goods, with a view to mitigating the effects of relative price variations on the living conditions of the population and promoting the transfer of skills from the non-tradable to the tradable goods sector.

Improving the capital stock to improve the technological balance of payments with job creation opportunities. This will allow a reallocation of resources to reduce the large share of the population dependent on the non-tradable goods sector in favor of the tradable goods sector, which prices evolve more rapidly.

Increase the population's stock of human capital through job creation. This should enable a reallocation of resources to reduce the large proportion of the population dependent on the non-tradable goods sector, in favor

of the more rapidly evolving tradable goods sector. This will help to reduce income inequalities and alleviate poverty in sub-Saharan African countries.

The limitation of this study lies in the availability of data, particularly poverty data, which determined the choice of study period, which is not very recent and does not cover all countries in sub-Saharan Africa. Looking ahead, it would be necessary to consider research on a possible threshold beyond which an increase in the real effective exchange rate would be detrimental to poverty reduction.

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Appendix

Appendix 1 : List of countries

1	Benin	15	Kenya
2	Botswana	16	Lesotho
3	Burkina Faso	17	Malawi
4	Burundi	18	Mali
5	Cameroon	19	Mauritius
6	Central African Republic	20	Niger
7	Chad	21	Nigeria
8	Democratic Republic of Congo	22	Rwanda
9	Congo	23	Senegal
10	Ivory Coast	24	Sierra Leone
11	Equatorial Guinea	25	Togo
12	Gabon	26	Uganda
13	Gambia	27	Zambia
14	Ghana		

Source : Author's

Appendix 2 : Results of Sargan's identification test

	GMM in system		GMM in difference	
	Ratio_poor model	**Poverty gap model**	**Ratio_poor model**	**Poverty gap model**
Sargan suridentification test	13,40 (0,41)	8,77 (0,64)	1,77 (0,094)	1,13 (0,95)

Source : Author's calculations based on data from WDI-2020

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