Convergence of the Economies of Nigeria and Cameroon: An Empirical Verification with the Ben-David Model

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Référence
Résumé

L’objet de ce papier est l’étude de la convergence des économies du Nigéria et du Cameroun. Ces pays voisins d’un niveau d’échanges de plus en plus élevé convergent-ils ? Il cherche ainsi, à vérifier d’une part, si les niveaux de vie (revenu par habitant) des deux économies tendent à se rapprocher dans le temps et d’autre part, de déterminer le temps nécessaire pour que les deux pays comblent de moitié l’écart qui les sépare. Le modèle empirique de Ben David (1996) est estimé grâce aux séries temporelles de la WDI. Les résultats montrent que le Cameroun réduit l’écart de revenu par tête qui le sépare du Nigéria. La demi-vie du processus de convergence indique que le Cameroun arrivera à combler la moitié de l’écart qui le sépare du Nigéria en 37 ans toutes choses restant égales par ailleurs. Ainsi, si le Cameroun veut accélérer son rattrapage, l’amélioration de son taux d’épargne, de sa productivité du travail et de son taux de croissance économique doivent être au cœur des politiques économiques.

Mots clés : Convergence économique ; croissance économique ; ouverture commerciale ; modèle de Ben David.

Classification JEL : O40 ; O41 ; F10 ; F22 ; F43 ; C22 ; C41

Abstract

The purpose of this paper is the study of the convergence of the economies of Nigeria and Cameroon. Are these neighboring countries with an increasingly high level of trade converging? It thus seeks, on the one hand, to verify whether the standards of living (income per capita) of the two economies tend to approach each other over time and, on the other hand, to determine the time necessary for the two countries to fill by half the gap that separates them. Ben David's (1996) empirical model is estimated using WDI time series. The results show that Cameroon reduces the per capita income gap that separates it from Nigeria. The half-life of the convergence process indicates that Cameroon will manage to close half of the gap that separates it from Nigeria in 37 years, all things remaining equal. Thus, if Cameroon wants to accelerate its catch-up, the improvement of its savings rate, its labor productivity and its economic growth rate must be at the heart of economic policies.

Keywords: Economic convergence; economic growth; trade openness; Ben David model.
Introduction

In economic theory, economic growth is seen as one of the necessary conditions for the reduction of income disparity. Studies on convergence date back to the neoclassical theory of growth (Ramsey, 1928), (Solow, 1956), (Koopmans, 1965) which suggest that all economies converge in the long run to the same stationarity state and at different speeds¹. In this view, convergence would lead in the long run to an equalisation of GDP per capita, reflecting the 'catching up' of rich nations by poor ones. But from the years 1980, with a global context marked by the increasing rise of income inequalities in the world, theoretical and empirical works on the convergence of economies include endogenous factors (Baumol, 1986), (Romer, 1986), (Barro, 1991), (Barro and Sala-i-Martin, 1991), (Mankiw et al., 1992). The conclusions drawn from their work reject the hypothesis of diminishing returns in capital accumulation and thus exclude the economic mechanism that generates the convergence process. In the same period, some studies paid more attention to the role of trade in the convergence process of economies (Ben David, 1993, 1996). The author endeavours to show that trade openness leads to a reduction in the disparity of per capita income. The conclusion of his work is that "there is a convergence phenomenon within countries selected on the basis of their bilateral trade relations".

Nigeria and Cameroon share a maritime and land border of nearly 1500 km. Cameroon's imports from Nigeria in 1960 represented less than 1% of total imports, rising to 13% in 2003 and 27% in 2005. From 2008 to the present, Nigeria competes with France and China as Cameroon's leading supplier (Nsoa, 2020).

In view of the geographical proximity and the level of trade between Nigeria and Cameroon, this article, through the Ben David model (1996), aims at verifying the economic convergence of Cameroon towards Nigeria on the time series of 1960-2018 (WDI, 2019). If so, in how many years can Cameroon close the income gap with Nigeria? Nigeria was chosen because it is the largest economy on the African continent and Cameroon's largest economic partner in sub-Saharan Africa.

The rest of the article is organised as follows: The presentation of the literature review on the concept of convergence (I). Next, the presentation of the methodology and the variables of the

¹ Solow (1956), "A contribution to the theory of economic growth", in measuring the speed of convergence of economies, he finds that a country's economic growth is positively correlated with the distance to its stationary state. Poor economies converge to the stationary state at a very high speed while rich economies converge to the stationary state at a low speed.
study (II). Then, the empirical results of the estimation of economic convergence and interpretation of the results (III), finally, some recommendations for economic policies (IV).

1. **Review of the literature on the concept of economic convergence**

The analysis of the notion of economic convergence, in particular that of per capita income between rich and poor countries, has given rise to a lively debate from both a theoretical and empirical point of view. In economic literature, several theories explain the convergence of economies.

Theoretically, leaving aside short-term movements, the growth schools have focused on the explanatory factors of long-term growth (Atman Guerchi and Jennifer Hunt, 2004) and also on mechanisms generating convergence or divergence. Several facts constitute the starting point for the analysis of convergence in the neoclassical model. As early as the 1950s, Solow's work predicted that countries would converge towards the same level of GDP per capita, under the hypothesis of diminishing returns and a space where economies are similar in terms of preferences and technologies. In this context, the liberalisation of trade and capital movements is a factor that accelerates convergence. His work also shows that improvements in capital per capita, productivity and increased savings are necessary conditions for economic growth and for poor countries to catch up with industrialised countries towards the equilibrium path. Contrary to neo-classical theories, the endogenous growth theories initiated by the seminal works of (Romer, 1986) and (Lucas, 1988), reject the hypothesis of diminishing returns. They do not predict convergence between rich and poor countries, even when the movement of goods and capital is free. Moreover, Lucas (1988) even thinks that openness and economic integration can delay convergence because trade between countries can lead them to specialise in sectors where they have a comparative advantage, but where there are weak learning effects. In this case, the negative coefficient of the initial per capita income is interpreted as a technological catching up to the level of the leading country. It suggests that regional economic growth is a slow and discontinuous process. Therefore, the catching-up process is a slow and discontinuous process.

The new theories of geographical economics reinforce the new theories of economic growth (Krugman 1981, 1991a, 1995) and (Baumont, 1998). Indeed, these authors stress respectively that the evolution of interregional disparities depends on the confrontation between centrifugal forces (pushing for the dispersion of activities in space) and centripetal forces (leading to their agglomeration), and that regional integration policies, by favouring the

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3 According to Solow (1956), the equilibrium path state reflects the stationary state where the variables of an economy grow at a constant rate and where an increase in the level of investment and the capital stock per capita is no longer beneficial to the economy. At this stage, the effect of capital accumulation is softened and less beneficial. The level of savings per capita ensures that capital per capita is maintained over time in the face of population growth (n) and the rate of capital depreciation (δ).
spatial concentration of productive systems, can increase the growth rate of a geographical area, but cannot improve convergence between countries.

Furthermore, some models developed independently of neoclassical theory and endogenous growth theory show that openness to trade not only affects economic growth rates, but also leads to income convergence.

For the traditional theory of international trade, when countries open up to trade, there is a convergence in the relative prices of goods (Samuelson, 1948). For models developed independently of neoclassical and endogenous growth theory, this convergence of relative goods prices in turn favours convergence in relative factor prices. The equalisation of factor prices does not necessarily imply the equalisation of incomes. In reality, factor prices do not equalise because of large disparities in resources, barriers to trade and technological differences between countries (Ben David and Kimhi, 2000).

Thus, if theoretical literature does not manage to decide on the positive or negative effect of trade openness on economic growth (Young, 1991; Grossman and Helpman, 1991b; Rivera-Batiz and Romer, 1991; Krugman, 1987; Mendez, 1997; Lucas, 1988; Ventura, 1997; Mountford, 1998), empirical work most often observes that international trade is a source of growth and reduction of income disparities between countries. Ben David (1993), shows that the dispersion of per capita incomes between European countries has decreased since these countries liberalised their trade. Furthermore, he finds that convergence is most often present in groups of countries constituted on the basis of their trade relations, whereas it does not appear significantly in groups constructed randomly or on the basis of non-trade variables.

These are also the conclusions obtained in empirical works (Michaely, 1977), (Kormendi and Meguire, 1985), (Barro, 1991), (Levine and Renelt, 1992), (Dollar, 1992), (Easterly, 1993), (Lee, 1993), (Harrison, 1995), (Coe and Helpman, 1995), (Bernard and Jones, 1996), (Ben David and Michael Loewy, 1997), (Edwards, 1997), (Frankel and Romer, 1999), (Barro and Sala-i-Martin, 1995). These authors show that proximity and trade in goods between neighbouring countries is a significant source of economic growth and reduction of per capita income disparities between countries.

2. Methodology and presentation of the study variables
In this section, we present the methodology of the convergence test on the one hand and the variables of the study on the other.

2.1. Methodology of the study
We will present the theoretical model to explain economic convergence.
Theoretical model of the study

In his 1996 paper, Ben David observes the existence of economic convergence among neighbouring countries chosen on the basis of their intense bilateral trade relations. In doing so, to test for convergence between two economies, the following specification is used:

\[(Y_{j,t} - Y_{i,t}) = \lambda (Y_{j,t-1} - Y_{i,t-1}) + \varepsilon_t \quad (1)\]

Where: \(Y_{j,t}\) is the logarithm of the per capita income of the reference country at date "t", i.e. the country with the highest income over the study period. \(Y_{i,t}\) is the logarithm of the per capita income at date 't' of the country with the lowest income level. \(\varepsilon_t\) is the stochastic shock, and \(\lambda\) the convergence or divergence coefficient of the two economies.

Ben David rewrites equation (1) in its extended Dickey-Fuller form (ADF):

\[Z_t = \lambda Z_{t-1} + \sum_{i=1}^{k} C_i X_{t-i} + a_0 + \varepsilon_t\]

Where \(Z_t = Y_{j,t} - Y_{i,t}\), \(k\) is the number of explanatory or control variables, and \(\sum_{i=1}^{k} C_i X_{t-i}\) is the vector of one period lagged exogenous variables and \(a_0\) the constancy of the model.

The number of lags introduced by Ben David in the convergence equation is chosen by the Akaike criterion (AIC)\(^3\). A model with the control variables in first difference in the empirical work shows less robust results, than when only the dependent variable is lagged as an explanatory and the other control variables are represented in level. For this purpose, we added variables to the study model. The extended form of model (1) can be presented as follows:

\[Y^j_t - Y^i_t = \lambda (Y^j_{t-1} - Y^i_{t-1}) + \sum_{j=1}^{k} C_j X_t + a_0 + \varepsilon_t \quad (2)\]

With: \(\lambda\) The convergence coefficient; \(Y^j_t\) The logarithm of the per capita income of the reference country, i.e. the country with the highest income level (Nigeria); \(Y^i_t\) The logarithm of the per capita income of the country with the lowest income level (Cameroon); \(\sum_{j=1}^{k} C_j X_t\) is the set of control variables in the model that are likely to influence convergence and explain the income disparity. \(\varepsilon_t\) the error term.

Equations (1) and (2) are estimated in order to highlight the dynamic character of convergence and the factors likely to explain the income disparity between Nigeria and Cameroon. Indeed, model (1) does not highlight the explanatory factors of the income differential between countries. It only verifies whether trade openness can lead to a convergence of per capita income. The aim of estimating model (2) is to highlight the macroeconomic variables likely to explain the disparity in per capita income between two economies while avoiding bias in the estimation of the convergence parameter. Indeed, when

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\(^3\) Akaike Information Criterion is a measure of the quality of a statistical model proposed by Hirotugu Akaike which allows to penalize a model according to the number of parameters in order to satisfy the parsimony criterion.
a variable capable of explaining the endogenous variable is not taken into account in the model, it is consequently found in the residuals of the regression. Moreover, if this unspecified variable, which is nevertheless capable of influencing the explained variable, is correlated with the specified explanatory variables, the hypothesis of non-correlation between the explanatory variables and the residuals will not be respected (Pinter, 2014).

According to Ben David (1996), if $\lambda > 1$, divergence process between the countries considered. If $\lambda < 1$, convergence process between the countries considered. On the other hand, if $\lambda = 1$, neither convergence nor divergence.

The estimation of equation (1) thus makes it possible to find the value of the convergence coefficient $\lambda$, and consequently to determine the half-life of the convergence process.

2.2. Presentation and description of the study variables
In this subsection, we present the explained variable and the explanatory variables of the study.

➢ Presentation of the explained variable.
The explained variable of the model is the logarithm of the gap of income per capita between Nigeria and Cameroon noted (EYNGA_CMR). This variable is an indicator that measures at each date "t" the differential in per capita income between the reference country (Nigeria) and the low per capita income country (Cameroon). As the study concerns Cameroon and Nigeria, two countries using two different currencies (naira for Nigeria and CFA franc for Cameroon), in order not to let the currency parity differential bias the results, we use the per capita income estimated in constant dollars. The use of GDP per capita in constant dollar terms reflects more accurately the real level of income of a country, unlike current dollar income which can be misleading. Indeed, current value income depends on the inflation rate. The graph below shows the annual evolution of per capita income in Cameroon and Nigeria.

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4 Reflects the situation where the living standards (per capita income) of two economies cannot catch up.
5 Represents the time needed for both countries to close half of their income gaps from the steady state.
Figure 1: Evolution of per capita income in Cameroon and Nigeria in constant US dollars from 1960 to 2018.

Source: Authors' construction from WDI data, 2019.

From this graph, we can see that over the study period, Cameroon's per capita income is low compared to that of Nigeria, with the exception of 1982 to 1989. Thus, it is Nigeria that is the reference country in our study and consequently, it is the per capita income of Cameroon that should converge to that of Nigeria. Our explained variable is therefore specified in logarithmic form as: $EY_{H, CMR} = \log Y_{t, NGA} - \log Y_{t, CMR}$.

With $\log Y_{t, NGA}$ the logarithm of per capita income in Nigeria and $\log Y_{t, CMR}$ that of Cameroon. $EY_{H, CMR}$ is therefore the difference in per capita income between Nigeria and Cameroon.

➢ Presentation and description of the study’s explanatory variables.
Since our theoretical model is analysed in terms of the gap, the explanatory variables are also expressed in terms of the gap. Given the autoregressive and dynamic nature of our model, the per capita income gap between Nigeria and Cameroon is lagged by one period.

$EY_{H, CMR_{t-1}} = \log Y_{t-1, NGA} - \log Y_{t-1, CMR}$. The expected sign of the coefficient of this variable is positive and between 0 and 1 since it represents the convergence coefficient between the two economies.

Subsequently, we define the control variables of model (2). These control variables are selected on the basis of the economic literature explaining the income differential between countries. The addition of these variables aims not only to take into account the structural differences of the two economies but also to identify their effects on the income disparity and on the convergence process. These control variables are expressed as deviations. The following control variables are used:

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6 Indeed, according to the neoclassical theory of growth, the income differential between countries is largely explained by differences in population growth rate, savings rate, capital per capita, economic growth rate, factor productivity differential, etc. One of the secondary objectives of this study is also to verify whether the income differential between Nigeria and Cameroon originates from the neoclassical explanation of growth.
- **The logarithm of the difference in population growth rate between the two countries (EnNGA_CMR).**

\[ \text{EnNGA}_{\text{CMR}} = \log(n^\text{NGA}_t) - \log(n^\text{CMR}_t) \]

Where \( \log(n^\text{NGA}_t) \) and \( \log(n^\text{CMR}_t) \) are the logarithms of the population growth rate in Nigeria and Cameroon respectively. \( \text{EnNGA}_{\text{CMR}} \) is the difference in log population growth rates that tracks the evolution of the population growth rate differential between Nigeria and Cameroon.

**Figure 2:** Evolution of the population growth rate in Cameroon and Nigeria from 1960 to 2018

From this graph, we can see that Cameroon's population growth rate is higher than that of Nigeria, except for the period 1976-1979. Given this, the expected sign of the coefficient of the \( \text{EnNGA}_{\text{CMR}} \) variable is positive. Indeed, economic theory teaches us that the higher a country's population growth rate, the lower its per capita income level.

- **The logarithm of the savings rate gap between Nigeria and Cameroon (EsNGA_CM).**

\[ \text{EsNGA}_{\text{CM}} = \log(s^\text{NGA}_t) - \log(s^\text{CMR}_t) \]

Where \( \log(s^\text{NGA}_t) \) and \( \log(s^\text{CMR}_t) \) are the logarithms of the savings rates in Nigeria and Cameroon respectively. \( \text{EsNGA}_{\text{CM}} \) is the difference in log savings rates between Nigeria and Cameroon.

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7 Indeed, for the standard of living or income per inhabitant to improve, the increase in economic activity measured by GDP is greater than the population growth rate.
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Figure 3: Evolution of savings rate in Nigeria and Cameroon

Source: Authors’ construction from WDI, 2019.

The data available are from 1981 to 2018. In doing so, Chart 3 shows that Nigeria has higher savings rates than Cameroon with the exception of the periods 1985-1986, 1987-1997 and 2016-2018. The expected sign of the coefficient of this variable is positive since economic theory establishes positive links between the savings of an economy and its level of per capita income.

- The logarithm of the capital per capita gap between Nigeria and Cameroon (EKHNGA_CMR).

\[
EKHNGA\_CMR_t = \log(K_{NGA}^t) - \log(K_{CMR}^t),
\]

Where \(\log(K_{NGA}^t)\) and \(\log(K_{CMR}^t)\) are respectively the logarithms of capital per capita in Nigeria and Cameroon. The evolution of the capital per capita gap variable between the two economies (EKHNGA_CMR) is given by the graph below.

Figure 4: Evolution of capital per capita in Nigeria and Cameroon.

Source: Authors’ construction from WDI data, 2019.

With regard to the evolution of capital per capita in the two economies, our database has data from 1982 to 2018. Nigeria has higher levels of capital per capita than Cameroon. The expected sign of the parameter of this variable is positive. Indeed, the higher the level of capital per capita of an economy compared to its neighbour, the higher the output per capita of that country compared to its neighbour (except in the case of diminishing returns to capital).

Indeed, economies that improve their level of savings also improve their level of investment and, in turn, their output and income level.
The logarithm of the economic growth rate differential between Nigeria and Cameroon (ETPIBNGA_CM).  
\[ ETPIBNGA_CM_t = \log(\text{TPIB}_{t,NGA}) - \log(\text{TPIB}_{t,CMR}) \]

With \( \log(\text{TPIB}_{t,NGA}) \) and \( \log(\text{TPIB}_{t,CMR}) \) being the logarithms of economic growth rates in Nigeria and Cameroon respectively. \( ETPIBNGA_CM_t \) the difference between the logarithms of growth rates in Nigeria and Cameroon.

**Figure 5**: Trends in economic growth rates in Nigeria and Cameroon.

Source: authors’ construction from WDI, 2019.

We note that the economic growth rate of the Nigerian economy is sometimes above that of the Cameroonian economy and sometimes below. It thus appears that the two economies show mixed trends in their economic growth rates.

The econometric specification of models (1’) and (2’) is as follows:

(1’) \[ \log(\text{Y}_{t,NGA}) - \log(\text{Y}_{t,CMR}) = \lambda [\log(\text{Y}_{t-1,NGA}) - \log(\text{Y}_{t-1,CMR})] + \epsilon_t \]

(2’) \[ \log(\text{Y}_{t,NGA}) - \log(\text{Y}_{t,CMR}) = \lambda [\log(\text{Y}_{t-1,NGA}) - \log(\text{Y}_{t-1,CMR})] + C_1 [\log(n_{t,NGA}) - \log(n_{t,CMR})] + C_2 [\log(s_{t,NGA}) - \log(s_{t,CMR})] + C_3 [\log(KH_{t,NGA}) - \log(KH_{t,CMR})] + C_4 [\log(TPIB_{t,NGA}) - \log(TPIB_{t,CMR})] + C_o + \epsilon_t \]

Overall, the effect of each of the model’s control variables (2’) on income disparity (\( EYHNGA_CM_t \)) would be analysed according to the sign of its coefficient. Thus, a negative coefficient means that the variable considered leads to a decrease in income disparity.

Conversely, a positive coefficient means that the variable increases the disparity in per capita income between the two countries.

**3. Empirical results and interpretation of the model coefficients**

For the estimation of the model, we use the ordinary least squares method on a first order autoregressive model with control explanatory variables. This estimation method allows us to obtain a fitting line such that the sum of its distances to the different points representing the data is as minimal as possible. Consequently, it minimises the impact of experimental errors by adding information to the econometric measurement process and, in turn, provides a better
understanding of the phenomenon under study, particularly by offering considerable information for both interpretation and analysis.

The estimation of model (1') by the OLS method as can be seen from table 1 below, presents a non-zero, statistically significant, positive convergence coefficient between 0 and 1, which guarantees convergence between Nigeria and Cameroon. This coefficient equal to 0.981 confirms the hypothesis that Cameroon is reducing its per capita income gap with Nigeria. This result reflects not only the process of convergence of the GDP per capita of the two economies but also a change in their production structure. Thus, the value of the convergence coefficient obtained from the estimation of model (1') corroborates with the explanation of the economic theory according to which the geographical proximity of two countries which exchange goods and services influences the convergence of the incomes per capita. Indeed, geographical proximity and free movement increase incomes through interactions between countries (exchange of production processes and ideas, technology diffusion, investment) and these interactions are reflected in the mobility of goods and people (Ortega and Peri, 2014; Ben David, 1996).

Table 1: Value of the convergence coefficient from the estimation of model (1').

<table>
<thead>
<tr>
<th>Dependent variable : EYHNGA_CMR,</th>
<th>EYNGA_CMR (-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Coefficient</td>
</tr>
<tr>
<td>EYNGA_CMR (-1)</td>
<td>0.981682</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.028111</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>34.92152</td>
</tr>
<tr>
<td>Prob.</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Authors, based on our estimates from Eviews 9.

As for the estimation of model (2'), as can be seen from Table 2 below, the coefficient of convergence is also non-zero, statistically significant, positive and between 0 and 1. This coefficient equal to once again verifies 0.8767 the hypothesis of income convergence between Nigeria and Cameroon despite the inclusion of other explanatory variables. From this estimate, it also follows that the income disparity between Nigeria and Cameroon is 99% (R² adjusted =0.9944) 10 by their income disparity in period 't-1', their differential in population growth rate, savings rate, capital per capita and their disparity in productivity. Indeed, from Table 2, an increase in the population growth gap (EnNGA_CMR) of 1% between the two economies leads to an acceleration of their income differential by 0.4%. This positive effect on the income differential can be explained by the fact that the high population growth rate leads to a decrease in per capita income. A high population growth rate leads in

9 For more details, see the table in Annex 1.

10 R² Adjusted measures the explanatory power of the model as a whole. In other words, it measures the degree to which all the exogenous variables in the model explain or influence the endogenous variable. (See table in Annex 2).
the long run to a high population and thus to a burden for the state. The state has to provide health, security, education, housing and employment for the population. This can lead to a depletion of the wealth available to the state, especially when these populations are less productive and less competitive.

Concerning the savings rate gap between the two economies (EsNGA_CMR), the model estimation shows that an increase of 1% leads to an increase in income disparity of 0.01%. This is in line with the expected results of the study. Indeed, according to the exogenous growth theory, both the capital stock and the output of an economy depend on its level of savings. A low level of savings leads to a low level of investment and consequently to a decrease in production and therefore in income. Thus, the low level of savings in Cameroon compared to Nigeria, as shown in graph 3, is a brake on the growth of its level of per capita income and thus accentuates the disparity of production and therefore of income between the two economies. As for the capital per capita gap (EkHNGA_CM), a 1% increase in the capital per capita gap between Nigeria and Cameroon leads to a decrease in the income differential of 0.02%, which seems paradoxical from an economic point of view because the level of capital per capita and the level of production per capita are strongly constrained by each other. However, over the study period, the level of capital per capita is high in Nigeria and low in Cameroon as shown in graph 4. This situation should lead to an increase in the output gap and income disparity between the two countries. This is not the case. However, this result can be explained by assuming a decreasing return on capital. Indeed, according to the predictions of Solow's (1956) convergence model, when capital per capita increases over time and due to the law of diminishing returns, the growth rate of the economy decreases and therefore the output per capita. Solow (1956) concludes that countries with a low initial capital stock per capita, such as countries with a low level of income per capita, experience high economic growth rates when their capital stock per capita increases. On the other hand, countries with a high initial capital stock such as rich countries have low economic growth rates when they increase their capital stock. This reasoning could explain the sign of the coefficient of the EkHNGA_CM variable. Indeed, with trade between Nigeria and Cameroon, the high level of capital per capita in Nigeria in the long run has no longer had any effect on its per capita output (income per capita). Cameroon, on the other hand, which has a low level of capital per capita, with its openness to trade with Nigeria, registers a transfer of capital over time, which leads to an increase in its per capita production (income per capita), thus reducing the income disparity that separates it from Nigeria.

The economic growth rate gap variable (ETPIBNGA_CM), on the other hand, gives an expected result that is consistent with the explanation of economic theory. Indeed, output per
capita or income per capita is equal to the ratio of output (GDP) to population. A fall in the growth rate of an economy signals a fall in its output and, in turn, its income. Given that the reference country for our study is Nigeria, an increase in economic growth differentials leads to an increase in income disparity with Cameroon. This is reflected in the sign of the coefficient of the variable ETPIBNGA_CMR. Indeed, according to the results of our study, an increase in the economic growth rate differential of 1% between Nigeria and Cameroon leads to an increase in the per capita income disparity of 0.025%.

**Table 2**: Values of the convergence coefficient and the different parameters from the estimation of the model (2').

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.074754</td>
<td>0.035707</td>
<td>2.093540</td>
<td>0.0507</td>
</tr>
<tr>
<td>EYNGA_CMR(-1)</td>
<td><strong>0.876664</strong></td>
<td>0.063262</td>
<td>13.85762</td>
<td>0.0000</td>
</tr>
<tr>
<td>EnNGA_CMR</td>
<td>0.406117</td>
<td>0.274112</td>
<td>1.481572</td>
<td>0.1557</td>
</tr>
<tr>
<td>EsNGA_CMR</td>
<td>0.011251</td>
<td>0.008963</td>
<td>1.255331</td>
<td>0.2254</td>
</tr>
<tr>
<td>EKHNGA_CMR</td>
<td>-0.020859</td>
<td>0.014516</td>
<td>-1.436995</td>
<td>0.1679</td>
</tr>
<tr>
<td>ETPIBNGA_CMR</td>
<td>0.025140</td>
<td>0.003706</td>
<td>6.783444</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Source**: Authors, based on our estimates from Eviews 911.

In conclusion, the empirical results in Table 1 and 2 indicate that there is a chance that Cameroon's income given the proximity and bilateral trade with the Nigerian economy, converges to that of Nigeria. To another extent, this convergence can be explained by the border/neighbourhood market effect, migration, the openness of the two economies to the sea, the similarity of natural resources and partly linguistic, the currency parity differential in favour of Cameroon. All these factors constitute assets that allow Cameroon to benefit from the beneficial effects of trade openness and geographical proximity with Nigeria.

The statistical tests on model (2') are given in the appendix. These tests lead us to say that overall, the fit is good and the model has been well specified. There is convergence of income in the long run between Nigeria and Cameroon and the differences in terms of demographic growth, in terms of savings rate, the differences in terms of capital per capita and the differences in terms of economic growth rate explain 99% of the income differential observed between Nigeria and Cameroon. Since the hypothesis of convergence between the two economies is verified, it is important to determine the convergence horizon and policy recommendations.

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11 For more details on the estimation, see Annex 2.
Determination of the half-life of the convergence process.

In this subsection, we determine the rate of convergence or the time needed for Cameroon to close half the gap with Nigeria. To this end, we will use the method proposed by Ben David (1996).

According to Ben David, the half-life noted "t" is given by the following formula:

\[ t = \frac{\log 0.5}{\log \lambda} \]  

(3)

With \( \lambda \) the convergence coefficient. The estimation of equations (1') and (2') yielded the values of \( \lambda=1 \ 0.9817 \) and \( \lambda=2 \ 0.8767 \). Therefore, the half-lives formulated through equation (3) are given by:

\[ t_1 = \frac{\log 0.5}{\log 0.9817} \approx 37 \text{ years}. \quad \text{And} \quad t_2 = \frac{\log 0.5}{\log 0.8767} \approx 5 \text{ years}. \]

The calculation of the half-life of the convergence process of model (1') indicates that Cameroon will manage to close half of the gap separating it from Nigeria in 37 years, all other things being equal. As for model (2'), the calculation of the half-life indicates that it will take Cameroon 5 years to reduce by half the income gap separating it from Nigeria. Structural differences as explanatory factors of convergence in model (2') therefore tend to further reduce the income disparity and accelerate the convergence process of the two economies. This is explained by the geographical proximity and the trade exchange which by their positive effects, come to compensate the negative effects of the structural differences on the level of income per capita of the countries. This improvement in convergence may also be due to the dynamism of the Cameroonian population, which is increasingly communicating with increased mobility of capital, savings and the free movement of goods and people between the two countries.

4. Economic policy recommendations and measures

The proposals allow for the identification of policies that are favourable and likely to close the gap between Cameroon's and Nigeria's per capita income levels. Indeed, the long-run equilibrium state depends on policies that modify structural parameters such as the population growth rate, the savings rate, the level of capital per capita, factor productivity and that shift the production frontier. Based on the empirical results of this study, the policy recommendations in relation to the estimation findings are twofold.

4.1. Improving savings for sustained growth

An economy is only as rich as its level of savings. Indeed, the higher the savings, the higher the growth should be, because savings are a determinant of investment and production. The increase in production will therefore lead to an increase in exports (improvement of the trade balance) and income. The increase in savings transformed into projects improves both the
productive capacity of the economy and overall income. As long as the income growth rate is higher than the population growth rate, per capita income increases. The improvement of the savings rate could be achieved through a good optimisation of taxation, i.e. an improvement of the quality of flat-rate taxes as well as income taxes. Improving the economy's savings rate could also be achieved through the implementation of job creation strategies which in turn improve the level of household income and thus the economy's savings rate.

4.2. Improving the growth rate of the economy: an imperative for reducing income disparities

According to the results of this study, improving Cameroon's economic growth rate is a necessary condition for improving its per capita income level. Indeed, if countries such as the Asian dragons are converging towards the rich countries, this is largely due to an improvement in their economic growth rates. As we have seen from this study, a decline in the growth rate of the Cameroonian economy leads to negative income disparities with Nigeria. To close the gap with Nigeria, an improvement in the growth rate is imperative for Cameroon. This improvement in the growth rate can be achieved by improving the quality of institutions, which reduces transaction costs and avoids the implementation of distorting policies. Ensuring the protection of property rights favourable to FDI. Providing tax incentives to reduce tax burdens and facilitate business creation. Promoting inclusive institutions in which political power is democratically distributed to allow for an economic organisation in which everyone can reap the benefits of their activity, with everyone being equal before the law.

Conclusion

This study focuses on the economies of Nigeria and Cameroon, two countries that are very close to each other culturally, geographically and through trade relations that date back to the period of independence. The central question of the study is whether this geographical proximity and bilateral trade have contributed to a significant reduction in disparities in living standards and consequently favoured the process of convergence of per capita income between the two economies. And if this convergence is possible, it is important to determine how long it will take for the two countries to close the income gap between them by half for the future. To do this, we have adopted an empirical approach based on the econometric approach of Ben David (1996). The choice of control variables likely to influence the income differential was made on the basis of the economic literature explaining the income differential between countries: the demographic growth rate, the savings rate, the capital per capita and the economic growth rate.

Several results emerge from this study. First, we show through the Ben David (1996) model, that there is a convergence of per capita income between Nigeria and Cameroon. This
convergence improves when control variables such as the population growth rate and the per capita savings rate are added to the models. Then, the calculation of the half-life of the convergence process leads us to highlight the convergence horizon. The calculation of the half-life of the convergence process indicates that Cameroon will manage to fill half of the gap separating it from Nigeria in thirty-seven (37) years, all other things being equal. It indicates that it will take Cameroon five (5) years to halve the income gap with Nigeria when the control variables are interchanged. Structural differences as explanatory factors of convergence therefore tend to further reduce the income disparity and accelerate the convergence process of the two economies. Finally, we identified the following as fundamental factors in the income differential between the two countries: population growth rate, savings rate, capital per capita and economic growth rate. Furthermore, our estimates show that Cameroon would benefit more from the geographical proximity and trade openness with Nigeria by putting in place a number of policies aimed at improving the fertility rate, the level of savings and factor productivity.
Bibliographical references


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