Trade Agreements and Per Capita Income Convergence in WAEMU[*] a Difference in Differences Analysis

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Abstract : Economic integration in WAEMU is manifested, among other policies, through tariff reductions in order to reinvigorate economic relationships and trade. This study assesses the impact of the first trade agreement on reducing disparities within WAEMU. The difference in differences analysis shows that this agreement has contributed to the process of real convergence in WAEMU between 1970 and 2003.

JEL classification : F 15, C 23, O 10, R 11.
Keywords : Difference in differences analysis, Economic integration, Real convergence.

Introduction

During the last two decades, the global economy has been marked by vast movements of regional integration in a context of globalization. This renewed interest in regionalism can be interpreted as a necessary condition for better integration of all countries in the world economy, through harmonization of standards for multilateral liberalization trade. According to the prevailing view, trade liberalization, through the proliferation of Regional Trade Agreements, reinforces the interdependence between economies. With free movement of production factors, this process should lead, whatever space in which it occurs, to a homogenization of these economies. In others words, trade liberalization should lead to convergence of the economies involved in this process, i.e. the trend towards equalization of per capita income long-term growth rate or per capita production of different countries or sets of countries.

Sub-Saharan Africa is not excluded from this vast process. It is the context in which the West African Economic and Monetary Union (W.A.E.M.U.) was established. One of this RTAs key objective is to create between members states, a common market based on free movement of people, goods, services, capital and right of establishment of people self-employed or employed, as well as a common external tariff and a common trade policy. It should serve as a catalyst for the real convergence in this integration area.

Like most experiences of integration in developing world particularly within Sub saharan countries, West Africa RTAs have experienced performance disappointing compared to initial objectives. But this part of the continent is among areas in Africa Trade Agreements which have been successful for the volume of trade (Decaluwé, Yazid and Patry, 2001) and reducing disparities in per capita income between countries Member : countries seem to achieve real convergence (Akanni-Honvo, 2003 ; Hammouda et al, 2006). Most previous work on this issue have only verified this process without focusing on the impact of specific economic policies on reducing these disparities.

This work aims to evaluate the impact of the first trade agreement on 1st of July 1996, on reducing disparities in per capita income in W.A.E.M.U.. First of all, I will verify the evidence of reducing disparities within W.A.E.M.U. over 1970 to 2003. Then it will question whether this policy has contributed to real convergence in this area. Finally, I will show and explain the existence of convergence clubs because the absence of significant effects might hide sub-regional disparities among member countries with gains and costs unequally distributed. This trade agreement consists in a total deductible for agriculture, breeding and crafts products and a reduction about 30% on customs duties for industrial products from the area. This customs duties reduction applicable to products approved of the union will increase from 30% to 60 % one year later. I use the σ-convergence approach, based on the standard deviation of per capita income analysis, in order to assess the reduction in disparities among W.A.E.M.U.'s countries. In this respect, I conclude that there is a real convergence process if the variance (or the standard deviation) of the per capita Income decreases over time.

From a graphical perspective, disparities in per capita income appear to be reduced within W.A.E.M.U.. A simple econometric test confirmed this result on the period 1970-2003. Moreover, the difference in differences analysis revealed that the first trade agreement implementation has contributed to reducing disparities in W.A.E.M.U..

The following analysis is organized into three sections. First, Section 1 presents literature overview on the link between integration policy and per capita income convergence. Then, Section

2 presents the data and variables used in the analysis. Lastly, Section 3 describes the empirical strategy and the main results.

1 Trade agreement and per capita income convergence : the related literature.

This section contains two parts. The first deals with theoretical aspects on the measurement of per capita income convergence. The second revisits the empirical studies on the link between integration (Economic and Commercial) and per capita income convergence in developing areas.

1.1 Empirical overview on per capita income convergence in developing countries

The problem of the link between trade reforms and real convergence within South-South countries, remains a concern in the economic literature. Indeed, it has been many writings since the 1990s.

Serranito (2008) shows that for most underdeveloped countries, lower tariffs has no effect on global product growth. For him, the divergence of income per capita seems to be the norm in the case of developing countries. One year before, Guetat and Serranito (2007), placing himself in a framework of stochastic convergence on panel data, have evaluated the process of convergence within the MENA[1] region and led to three conclusions : the process of convergence is characterized by the existence of convergence clubs in this area, there are wide disparities between certain groups of countries within this area, the convergence process is strongly linked to exogenous factors such as the Gulf War, the Israeli-Palestinian conflict.

McCoskey (2002) uses unit root tests and cointegration tests in panel data to verify convergence properties of six indicators of living conditions (the share of public expenditure in GDP, the capital-labor ratio, degree of the economy openness, real output per capita, living standards, the real product per unit of labor) in sub-Saharan Africa. His analysis showed that, overall, the convergence is not carried out while the existence of convergence clubs is pointed out. Particularly concerned with SACU (Southern African Customs Union) and SADC (Southern African Development Community), the author concludes that there is no Convergence for only three indicators namely : the share of public expenditure in GDP, real output per unit of labor and real output per head.

Jones's (2002) study concerning the absolute convergence within ECOWAS[2] have revealed that economies converge with both approach of absolute β-convergence of σ-convergence. He concludes that this area seems to be a unique convergence club within sub-saharan African countries. Dufrénot and Sanon (2005)[3] have also tested the convergence process through the notion of conditional β-convergence. They analyzed per capita GDP convergence in ECOWAS between 1985 and 2003. They lead to a lack of real convergence evidence within ECOWAS member states, which is in contradiction with Jones (2002). They concluded that the economies of ECOWAS are so heterogeneous that each one has a path of long-term growth.

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1. Middle East and North Africa
2. Economic Community of West Africa States
3. Quoted by Gbetnkom, 2006

Akanni-Hanvo (2003) examines the implications of regional trade agreements on the process of convergence (divergence) in developing regions between 1975 and 2000. For him, in Africa, trade agreements do not automatically entail real economic convergence in RTAs areas. Moreover, the so-called conditional convergence (structural), which takes into account structural variables, is generally low. However, there is a dynamic convergence within SACU Africa, ASEAN in Asia and MERCOSUR in Latin America. This process is supported by public investment, the complementary production capabilities, diversification of economic structures and the ability of leaders countries to engage positive externalities on other members of the integration area. Moreover, the border effects have contrasting impacts on the growth process. It also shows that factors such as infrastructure, productive complementarity and the ability of countries to exercise leadership ripple effects in the areas of integration are key factors in the convergence process in Africa, more than reduction of tariffs in the context of trade agreements. In addition, he has shown that there are within these zones *convergence clubs.*

Gbetnkom (2006) tests the hypothesis of convergence within the EMCCAS[4] between 1990 and 2002. It concludes that there are clubs of convergence defined by economic policy choices rather than from the initial human capital endowments of each economy in this area. He also notes that the reduction and elimination of tariff and non tariff barriers are in favor of the convergence of economies and reducing disparities in real per capita income within this integration area.

Another study (Hammouda et al., 2007), highlights the progress in convergence is insignificant despite the considerable efforts made by these economies (in development) in terms of economic integration and trade in particular. These authors conclude that the weak convergence of per capita income in Africa is due mainly to three factors : the low output growth, the failure of previous economic policies and the relatively low FDI inflows. For U. E.M.O.A. specifically, these authors show that this area is experiencing a strong trend towards convergence of income per capita. Disparities in the area of integration, they measure the volatility of GDP per capita are lower in the WAEMU compared to other areas of integration in Africa. And the test of σ-convergence leads to reaffirm the trend towards convergence of per capita income within countries in this area.

However, with a stochastic approach to the evaluation of income convergence between WAEMU's economies and non-WAEMU economies, based on the cointegration test, they conclude that there is no stochastic convergence of incomes. From a method to another, we notice that results are sometimes contradictory. In this study, I try to revisit this issue in the case of WAEMU which seems to be one of the successful economic integration experiments in SSA.

1.2 Theoretical approaches of per capita income convergence

The theoretical literature on per capita income convergence distinguishes several approaches. The differences between these approaches are certainly on the nature of data[5] used but also on derived information. This section presents the main proposed tests and the approach taken in this analysis.

1.2.1 Convergence en panel

It is Islam (1995)[6] who shows the usefulness of panel methods for studying real convergence. Panel methods improve the accuracy estimators and can understand the problems of omitted

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4. Economic and Monetary Community of Central African States
5. Either cross-sectional data or longitudinal data.
6. Quoted by Hammouda et al., 2006

variables through analysis of individual effects. In this analysis, these individual effects are interpreted as reflecting technology differences. Canova and Marcet (1995) estimate the following equation :

$$y_{i,t} - y_{i,t-1} = a_i - b_i \times y_{i,t-1} + \nu_{it} \tag{1}$$

Fixed effects a_i can introduce different steady states. This implies that series converge to a different steady state. Beine, Docquier and Hecq (1998) enrich this approach by performing unit root tests in order to test the stability of theses series. So they are testing the hypothesis that the mean deviations are stationary, i.e. series tend to return to their average. These analysis are based on Gaulier, Hurlin and Jean-Pierre (1997)[7] model :

$$\Delta(y_{i,t} - \overline{y}_t) = a_i - b_i \times (y_{i,t-1} - \overline{y}_{t-1}) + \sum_{j=1}^{p_i} \Delta(y_{i,t-j} - \overline{y}_{t-j}) + \varepsilon_{it} \tag{2}$$

Moreover, this approach allows to test the global convergence of the sample to the same steady state at the same speed (if $b_i = b, \forall i$ with $b > 0$ and $a_i = a_j$ for $i \neq j$), the conditional convergence, convergence to different steady states (if $a_i \neq a_j, \forall i \neq j$) and convergence speeds different for one series to another (if $b_i \neq b_j, \forall i \neq j$). When series are stationary, the mean and the variance of these deviations are constant over time. Accordingly, neither the mean of the difference between series and the variance do not vary over time. The main drawback associated with this approach, is that it relies on the application of identical coefficients for all series on the one hand and proposes a test of global convergence to an average on the other hand because when the whole series diverge, the test may indicate a difference overall. A more detailed analysis of the distribution may be achieved in the analysis of the evolution of distributions or series. The next section discusses is the convergence in distribution approach.

1.2.2 Convergence in distribution et stochastic convergence

Quah (1993a, b, 1994, 1996) has developed a method in order to analyze the evolution of per capita income distribution over time. He used this method to study per capita income convergence within countries. The analysis of the evolution of the distribution can be done with a set of series and in two complementary strategies. Compare distribution at the beginning and at the end of the period, or infer limited distribution, the distribution towards which the observed distribution tends. There is convergence to the same level if the distribution tends to a distribution degenerated at a point. The distribution can be estimated discretely (Quah, 1993a, 1993b) or non parametrically (Desdoigts, 1995[8]) ; Quah 1994, 1996). The method applies to panels with wide temporal dimension in order to accurately estimate distribution and dynamics. The method does not require prior structure relations between series and allows to consider all parameters of the distribution. The analysis reveals the specific behaviors within the distribution : in particular it allows to detect the existence of convergence clubs. This approach is more appropriate for the detection of convergence clubs than the analysis of convergence into clubs.

Regarding the stochastic convergence approach, this definition of convergence is based on the concepts of unit root and cointegration in time series analysis. It was introduced by Bernard and Durlauf (1995)[9] in per capita income convergence analysis by assuming a stochastic environment. In general speaking, stochastic convergence tests if long-term forecasts of differences in global product tends to zero over time. If the product series differentiated is a mean zero stationary

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7. Quoted by Gaulier, 2003
8. Quoted by Akanni Hanvo, 2003
9. Quoted by Gbetnkom, 2006

process, so this definition of convergence is satisfied.

1.2.3 Absolute convergence and conditional convergence

Per capita income convergence analysis among a set of countries was used as a test of the neoclassical growth model validity where the share of capital in the production process is a key parameter. However, the direct test of the so-called β-*convergence* relates to the situation where poor countries with very little capital will grow faster than rich countries whose capital stock is larger (Hammouda et al., 2006) : *absolute β-convergence* .

However, Sala-I-Martin (1996) [10] argues that the results of the neoclassical model prediction of convergence based on the assumption that the only differences between countries are in their initial endowments of capital input. But in reality, countries can also be different in terms of technology level, propensity to save and population growth rate. Thus, countries with different technology level and different behavior parameters also have different steady states. Therefore, a more appropriate approach would be *conditional β-convergence* approach instead of *absolute β-convergence* . *Conditional β-convergence* allows to test real convergence between economies with different parameters. One way to do this test of conditional convergence is to keep constant steady state of each economy by introducing a vector explanatory variables in the equation to estimate (Barro and Sala-I-Martin, 1992, 1995, Mankiw and al., 1992 [11]).

Suppose that the absolute β-*convergence* is valid for a set of country $i = 1, 2, ..., N$. Economic growth equation (Barro and Sala-I-Martin, 1995) is given by :

$$log(y_{i,t}) - log(y_{i,t-1}) = a - b \times log(y_{i,t-1}) + \nu_{it} \tag{3}$$

where $y_{i,t}$ means country i income at time t, a and b are constants, ν_{it} is the error term. The condition $-b < 0$ implies absolute convergence assuming that annual growth rate, $log\left(\frac{y_{i,t}}{y_{i,t-1}}\right)$ is inversely related to $log(y_{i,t-1})$.

If all countries have different steady states, the explanatory variables are added into the above equation. The equation of conventional growth model using panel data is given by (Islam, 1995) :

$$log(y_{i,t}) - log(y_{i,t-1}) = \eta_i - \beta \times log(y_{i,t-1}) + \sum_{j=1}^{k} \pi_j log(x_{i,t}^j) + \xi_t + \mu_{it} \tag{4}$$

where $y_{i,t}$ means per capita income, $\beta = e^{-\lambda\tau}$ (λ the convergence rate and τ the period), $x_{i,t}^j$ a set of explanatory variable ($i = 1, 2, ..., k$), η_i country specific effect, ξ_t time specific effect and μ_{it} the error term.

The group of countries considered undergoing a process of convergence conditional if the condition *beta* < 0 is satisfied. The β-convergence for a specific adjustment economic system to its own equilibrium and thus to a balance determined from the system itself. Revenues depart more quickly and initial conditions Therefore countries converge more rapidly than b, (β) is large. Several criticisms have been made on this approach including the adequacy of the convergence process because she suffers from Galton's error [12]. Alongside this approach, there are also

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10. Quoted by Hammouda et al. 2006
11. Quoted by Hammouda et al. 2006
12. The tendency to return the average does not guarantee that the dispersions are reduced to During the time

approaching the σ-convergence presented in the following section.

1.2.4 Sigma convergence

Another theoretical approach to assess per capita income convergence within countries is the σ-convergence. It argues that there is σ-convergence within a group of countries if the dispersion (measured by variance or standard deviation type) of real income per capita in this group decreases over time. In other words, a group of countries experiencing σ-convergence if the standard deviation of real income per capita at the time t is lower than the standard deviation of real income per capita at the time $t - 1$.

Barro and Sala-I-Martin (1995) showed that if a group of countries converges in the sense of absolute β-convergence, the dispersion of income per capita does not necessarily decrease over time within this group of economies. The reason is that these two concepts capture two different aspects. The concept of β-convergence refers to a notion of mobility of the various economies within a given distribution of per capita income (Sala-I-Martin, 1996) while σ-convergence addresses the question of whether or not differences in the distribution of income per capita shrink over time. β-convergence translated into effective behavior mean reversion, the series returned to their natural average following a random shock. When series have the same steady state, the same mean, this property tends to bring all series to the same level, thus reducing the dispersion of the whole series. However, the occurrence of separate random shocks to each series in each period is deviated from this trend and therefore limits the reduction of dispersion.

Hénin and Le Pen (1995) and Hart (1995) [13] have proposed another way to analyze the σ-convergence through a dispersion reduction test. The procedure is based on the following equation :

$$log(y_{i,t}) - log(y_{i,t-1}) = a - b \times log(y_{i,t-1}) + \nu_{it} \tag{5}$$

where as previously expected that the level coefficient past is negative. It shows that there is σ-convergence if $\frac{(1-b)^2}{R^2} < 1$, with R^2 the coefficient of multiple correlation between $log(y_{i,t})$ and $log(y_{i,t-1})$. This also means test for student, for example $(1 - b) > 0$, this condition can be written $b > 1 - R$. Therefore the effect convergence resulting from the property back to the mean is sufficiently large to offset the effect of divergence induced by the occurrence of random shocks. This procedure is also up to make a simple econometric test on the linear trend of the evolution of the standard deviation of $log(y_{i,t})$. If the trend is negative and significant we conclude that economies converge.

It is this approach that I revisit in this study because it is the result of two mechanisms firstly the catching-up process (hence the β-convergence) and secondly it takes into account the effect of shocks to which economies are subject to. So, this approach would be able to realize convergence process within a group of country subject to economic reforms and random shocks as W.A.E.M.U.. The following sections present the data used, the methodology adopted and the main results.

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13. Quoted by Gaulier, 2003

2   Data sources

Data are from PWT6.2 database[14]. There are the Gross Domestic Product (GDP) per capita, consumption per capita, investment per capita, public expenditure per capita and per capita net foreign balance. Per capita GDP data are extracted directly from the PWT 6.2 database, while other variables are calculated from information provided by this database. Indeed, we have, for each variable, their share in GDP. Thus, by multiplying each value by GDP per capita, we get the aggregate per capita consumption, per capita investment and per capita government spending. Considering GDP determination according to expenditure view, I derive the net external balance[15]. Data are in millions of U.S. dollars and cover the period 1970-2003.

3   Empirical strategies

Based on a simple statistic index, the variance (or the standard deviation), the notion of σ-convergence is used here in order to analyze per capita income convergence within WAEMU's countries. Figure 1 describes the evolution of the standard deviation of the natural logarithm of WAEMU per capita GDP from 1970 to 2003.
 As, we can see on this figure (figure 1), the standard deviation of the natural logarithm of WAEMU per capita GDP tends to decrease over the period. Moreover, comparing amplitudes of the standard deviation of the logarithm of GDP per capita, they are relatively smaller after 1994, date of WAEMU creation. Thus the levels of GDP per capita would tend toward the average level of WAEMU's GDP per capita. Since 1996, WAEMU has implemented its first trade agreement, starting point of trade reforms to strengthen the integration process. And as we show on the graph (figure 1), this policy seems to reduce disparities within RTAs even if economies do not have the same growth path. I now turn to assess the impact of this specific policy on income convergence. Thus, in this section, I evaluate its impact on the dispersion of GDP per capita between 1970 and 2003 using a difference in differences analysis (Meyer, 1995 ; Slaughter, 2001).

## 3.1   How to implement this methodology here ?

How to evaluate the effect of a reform or policy ? Has the first trade agreement contributed to reducing disparities within the WAEMU ? In recent years, this question has been the focus of a literature econometric rich methodological advances. The available statistical methods are certainly numerous, but their specificities and their assumptions heavily influencing the results. These methods are generally based on a comparison between entities benefiting from the reform that needs to be evaluated and entities do not qualify.

Central to this evaluation approach raises the issue of selectivity bias because the entities using a policy of any kind is a decision to implement an individual choice within in the domain of rationality. If it does not account for this selectivity bias, one may produce biased estimates of the effects of the reform by directly comparing the situations of the two beneficiary groups and non-beneficiaries of the reform. To limit the consequences of selectivity bias, analysts generally build a control group whose observable characteristics are as close as possible those officers reform beneficiaries. This approach is valid only if the selectivity occurs only on the basis of observable

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14. Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006. (188 pays, de 1950-2004)

15. This value obtained by balance includes, according to the accounting equation of GDP, the inventory changes in the economy. I assume that its influence in the determination of GDP in the U. E.M.O.A. is marginal.

FIGURE 1 – Evolution of the standard deviation of the natural logarithm of WAEMU per capita GDP from 1970 to 2003
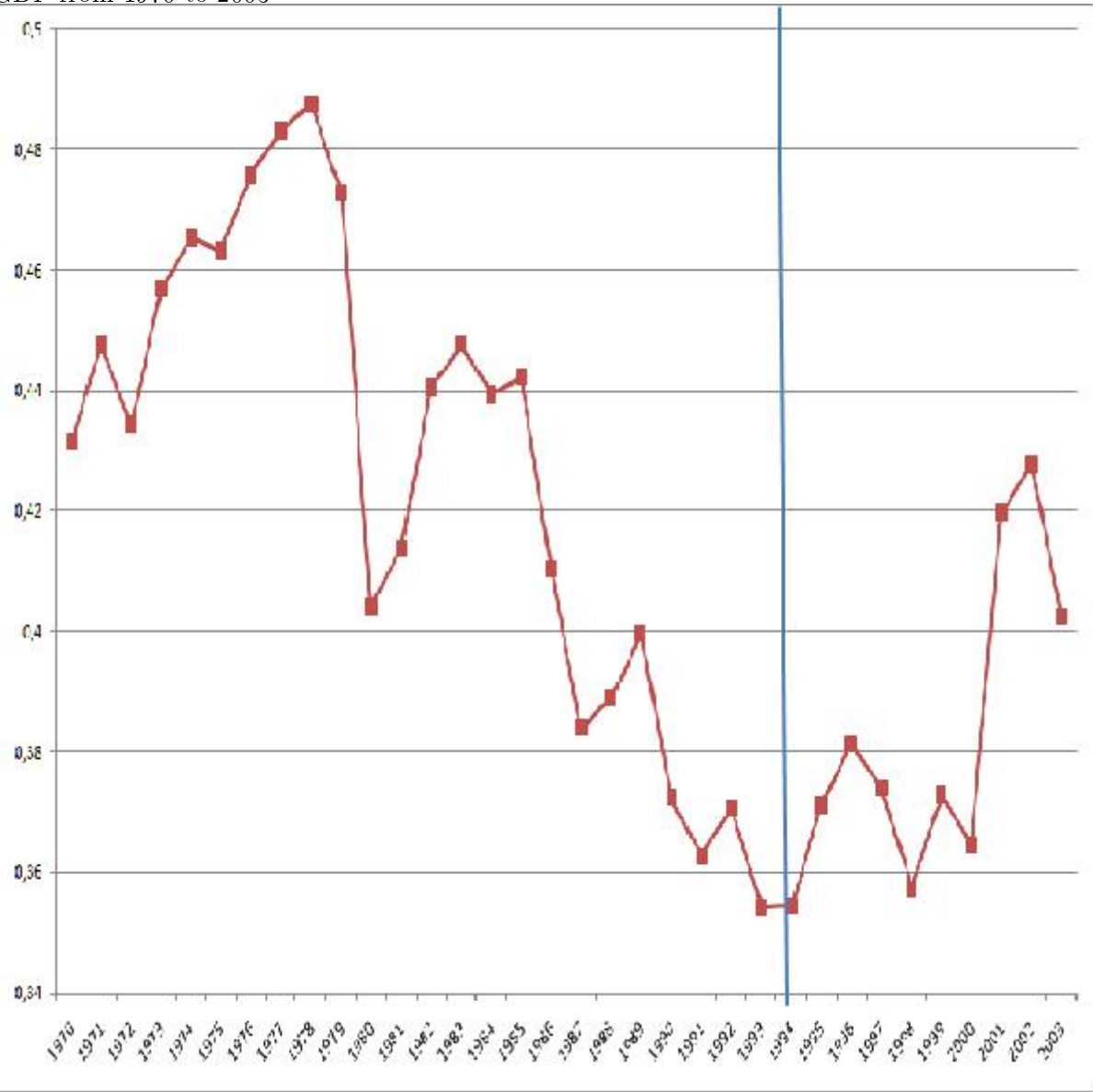
Source : Penn World Table 6.2 data

characteristics. It is not deemed too restrictive by statisticians and econometricians who prefer the hypothesis of selectivity from both observable characteristics and unobservable. It was under this premise that we examine the effect of the entry into force of discount on reducing inequalities within the WAEMU with the double-differences estimator.

3.2   Equation to estimate

The approach in this study is based on the Slaughter (2001). However, the model proposed by Slaughter does not consider any structural variable. This could limit the interpretations. Indeed, he regressed the dispersion of GDP per head indicator variables to assess the impact of trade liberalization. While basing ourselves on the foundation of economic geography and endogenous growth theories, the forces that drive the creative process of regional development based more or less unequal also on variables with explicit geographic component. These variables include productivity (Lopez-Bazo et al., 1999), trade and transport infrastructure (Krugman and Venables, 1995, 1996), technology and knowledge spillovers (Martin and Ottaviano, 1999), factor mobility (Krugman, 1991a, 1991b ; Puga, 1999), local competition (Fujita and Thisse, 1997) [16].

That's why the structural variables : per capita consumption (a proxy for domestic demand of the economic area), public spending per head (a proxy for public infrastructure spending), capital expenditure by head (A proxy for technology and knowledge spillovers) and the balance net external head (to take into account the trade as a variable convergence factor), were retained in the model proposed in this study. They influence the regional economic growth, regional distribution of economic activities and regional inequalities.

Denote by y_t, c_t , i_t , g_t and nx_t respectively, the GDP per head, per capita consumption, investment per capita public expenditure per capita and per capita net foreign balance. According to the expenditure approach [17], per capita GDP is as follows :

$$y_t = c_t + i_t + g_t + nx_t \tag{6}$$

with $nx_t = \frac{X_t - M_t}{POP}$. The total variance of y_t is :

$$Var(y_t) = Var(c_t) + Var(i_t) + Var(g_t) + Var(nx_t) + 2 \sum_{1 \leq i < j \leq 4}^{4} cov(X_{it}, X_{jt}) \tag{7}$$

with $X_{it} = (X_{1t}, X_{2t}, X_{3t}, X_{4t}) = (c_t, i_t, g_t, nx_t)$. Then,

$$\sigma_r^j(y_t) = \gamma_0 + \sum_{i=1}^{4} \gamma_i \sigma(X_{it}) + \varepsilon_{rt}^j \tag{8}$$

where γ_0 is a constant. I assume in equation (11) that, the standard deviation of per capita GDP depends on the standard deviation of each of its components. From this relationship, the equation to estimate is as follows :

$$\sigma(y_t) = \gamma_0 + \sum_{i=1}^{4} \gamma_i \sigma(X_{it}) + \sum_{k=1}^{3} \alpha_k D_k + \beta_1 t + \beta_2 t D_r + \beta_3 t D_j + \beta_4 t D_r^j + \varepsilon_{rt}^j \tag{9}$$

where t denote the period, $i = 1, 2, 3, 4$, $k \in \{1, 2, 3\}, D_k = (D_1, D_2, D_3) = (D_r, D^j, D_r^j)$, with

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16. Quoted by Akanni Hanvo, 2003

17. The equilibrium relationship macro used is as follows : $PIB_t = C_t + G_t + I_t + X_t - M_t$. Assume that the investment households is taken into account in private investment.

$X_{it} = (X_{1t}, X_{2t}, X_{3t}, X_{4t}) = (c_t, i_t, g_t, nx_t)$, and $\sigma(.)$ the standard deviation of natural logarithm of variables. D_r, D^j and D_r^j denote respectively a dummy variable that takes the value 0 before the first trade agreement and 1 after, another dummy variable that identifies the group of countries and takes the 1 for WAEMU countries, the group of treated countries and 0 for the control group and finally a dummy variable that takes the value 1 if $D_r = 1$ and $D^j = 1$ et 0 otherwise. The parameter of interest is β_4, the coefficient of tD_r^j in equation 12 (Slaughter, 2001). ε_{rt}^j denotes the residual term which varies according to the group of countries and between the two periods (before and after the reform). Furthermore I assume that $E[\varepsilon_{rt}^j/D_{rt}^j] = 0$, ie in the absence of policy, $\beta_4 = 0$.

In accordance with the schedule of raising barriers, the year 1997 was chosen as the critical date for the empirical evaluation. This date seems reasonable given that the implementation of preferential tariffs took place in 1996, and Guinea Bissau has joined the union in 1997. Equation 12 is estimated by the method of Ordinary Least Squares (OLS) robust [18]. We obtain asymptotically unbiased estimators and efficient. Two models estimated are presented : a model incorporating all variables structural and the other does not take into account [19].

To estimate the double-differences, it is necessary to identify the group of treated individuals and construct (determine) the (s) group (s) control. First, the treated group consists of eight (8) UEMOA countries : Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo. Next, we consider all other areas of integration in Africa south of Sahara : the non-UEMOA ECOWAS, CEMAC, COMESA, SADC, SACU and EAC, among which groups can be selected to serve as counterfactual (control group) in this analysis. A last group of control is built, the group *AFRICA*, from a method that takes into account the characteristics unobservable. In the next section, these different groups of countries are presented and I will justify the choice of groups identified as counterfactuals in this analysis.

3.3 Control groups

Control groups should be very similar to the groups of Treaties (Meyer, 1995 ; Slaughter, 2001). We consider six (6) groups of countries that are experiences of Increased integration in Africa south of Sahara. A seventh group is built using the Agglomerative Hierarchical Clustering (AHC). This method has the advantage of taking into account the possible selectivity bias in the construction of the control group.

A total of seven (7) control groups covering all potential areas of Intergas in Africa south of Sahara. Firstly, in West Africa, only the ECOWAS countries not part of the UEMOA is the group outside WAEMU ECOWAS [20]. Then in other regions of sub-Saharan Africa, five groups

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18. It was careful to check each time the assumptions necessary for the application of this method of estimation : the contemporary assumption of exogeneity (the model is linear, well-specified, the variables are stationary, and only weakly dependent are not perfectly collinear), the autocorrelation of errors, heteroscedasticity errors

19. Other possibilities for the model were estimated to check the robustness of the influence of structural variables on the variable of interest

20. The ECOWAS, the Economic Community of African States West. Founded in 1975, it currently comprises 15 members are Benin, Burkina Faso, Côte d'Ivoire, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sierra leone, Senegal, Togo. All that we consider in ECOWAS, only seven countries not members of WAEMU.

for our attention. CEMAC in Central Africa[21]. Then in Southern Africa, COMESA[22], SADC[23] and SACU[24]. Then in East Africa is the ABC footnoteThe EAC (East African Community), Community of African States in the East was founded in 1999. It is the youngest of economic groupings in Africa. It includes : Burundi, Kenya, Rwanda, Tanzania, Uganda.
. Finally, the last group named *AFRICA* is constructed by applying factor analysis followed by a Classification Agglomerative Hierarchical Clustering (AHC) on all African countries south of Sahara. The classification variables here are the level of GDP per capita and the level of per capita net foreign balance. This is a random approach that would reduce selection bias. It considers the joint distribution of per capita GDP and Balance Net foreign. It sets the country and we consider the evolution of these two variables from 1980 to 2003. Belong to the same class, the countries with the same distribution of GDP per capita and net external balance over the period considered. Applying PCA followed by the AHC led to a partition into four classes. All countries C.E.D.E.A.O. and C.E.M.A.C. occur in the same group of countries with 17 other countries[25]. They were selected to constitute the last control group.

A key issue remains, among these seven groups, which would be good for the counterfactual analysis of double differences ? The counterfactual must be comparable to the control group in terms of the variable of interest. In other words, the evolution of the dispersion of GDP per capita of the potential counterfactual (or control group) should have similar characteristics to that of the interest group. It recalls that the only difference between the control group and the group of interest is the first trade agreement. Ultimately, the control groups *AFRICA* and CEMAC seem to be good counterfactual for assessing the impact of trade policy. The group *AFRICA* is chosen (automatically) because its construction is made at random and changing the variable of interest in this group appears similar to the group treated especially after 1994. However, regarding the CEMAC group, history of economic facts and developments in economic integration process are the main arguments that can retain more of the behavior of the variable of interest. In fact, the CEMAC was created in 1994 so does WAEMU. Member countries have suffered similar ups and downs associated with mutations global economy. The oil shocks of the 1970s to the devaluation of the CFA franc in 1994 through the Structural Adjustment Plans (SAPs), CEMAC and WAEMU have responded almost identically to face these shocks. The structure of member economies, economic development patterns and Social responsibility seems he makes these areas, two areas of integration with the same economic destiny. With the foregoing, the assessment is made by considering these two control groups. The results are presented in the next section.

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21. The CEMAC is the Economic and Monetary Community of Central Africa. It is composed of Cameroon, the Centrafique, Congo, Gabon, Equatorial Guinea, Chad. It is the twin sister of UEMOA for six countries in Central Africa. They have the same history and member countries using the CFA franc as its currency.

22. this is an acronym that means in English Common Market for Eastern and Southern Africa (Common Market for Southern Africa and Oreientale). It is a union douranière created in 1993. It includes : Angola, Burundi, Comoros, Djibouti, DRC, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, Zimbabwe

23. The English means SADC Southern African Development Community. It is the Community Development in Southern Africa. It was established in 1992 and consists of 15 countries, namely South Africa, Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozanbique, Namibia, DRC, Seychelles, Swaziland, Tanzania, Zambia and Zimbabwe.

24. in English means SACU Southern Africa Customs Union. It is the Customs Union of Southern Africa, established in 1910. It is the oldest customs union in Africa south of Sahara. It is composed of : South Africa, Botswana, Lesotho, Swaziland, Namibia. She has had revisions in 1990.

25. Burundi, Comoros, Democratic Republic of Congo, Ethiopia, Kenya, Madagascar, Malawi, Mauritania, Mozambique, Rwanda, Sao Tome and Principe, Somalia, Sudan, Tanzania, Uganda, Zambia and Zimbabwe.

4 Has the first trade agreement contributed to reducing disparities within WAEMU ?

Two models were estimated to assess the impact of economic integration on the reduction of disparities within the WAEMU. The first takes into account the influence of structural variables on the convergence process, while the second is an assessment by not integrating them (Slaugther, 2001). This approach will understand the potential impact of changes in the level of consumption per head, per capita investment, government spending and net trade balance reported per capita on reducing disparities within the WAEMU. Indeed, we assume here that the process of real convergence is also dependent on EU policies to reduce disparities in per capita consumption, per capita investment, public investment per capita and per capita current transaction. For example, to build a processing plant seed cotton in Côte d'Ivoire and Mali, will not have the same external effects (positive or negative) at the community level. Ideally, the location of any community should take comparative advantages and potential positive externalities. Mali is among the top ten countries producing cotton[26] in the world and the largest producer of cotton in the WAEMU zone. Cotton is after the gold, the second largest source of export earnings. For this reason and given the difficulties encountered by this culture against foreign competition, it would be wise to implement this plant. That would boost an increase in the rate of economic growth and participate in improve the living standards of people. All things being equal, the EU GDP would experience a relative increase and they tend to harmonize the standard of living in the area.

In the model with structural variables, the results of the assessment (Table 5) show that the reduction of tariffs has contributed to reducing disparities within the WAEMU. The sign associated to β_4 in the estimate is negative and significant (-0.0216). Further structural variables excepted level of investment per head would have a significant impact on reducing disparities within the WAEMU. This would mean that any policy at EU level to reduce the volatility of per capita consumption, public expenditure per capita and per capita trade balance would lead to improved living conditions in the WAEMU area. The coefficients are positive and significant. The above conclusions are confirmed by the results of estimating the model without the structural variables (Table 2). The implementation of the first preferential tariff in WAEMU has contributed significantly to reducing disparities within the WAEMU. For the CEMAC and the Africa group, the coefficients are negative and significant. They are worth -0.043 and -0.0272.

Overall, it appears that in both models, the discount has contributed to reducing disparities in the WAEMU. Moreover, apart from investment of the portfolio, any reduction of disparities in the structural variables contribute significantly to reducing also differences between countries. What happens in each convergence club identified ? Checking the status for each club, the full model is estimated by keeping control groups ECOWAS, CEMAC and Africa focusing in particular on results obtained with the Africa Group. Tables 7, 8 and 9 show respectively the results for the club 1, 2 and 3. For a club, integration induces a convergence of these economies. The parameter of interest is negative and significant sign. Moreover, the reduction of the dispersion of consumer spending and investment contribute to reduce income disparities between the economies this club. It is also the dispersion of net external balance also has a positive impact on reducing disparities within the club. An intensification of foreign trade between these economies would tend to reduce the overall deficit of trade balance could lead to a reciprocal enhancement of welfare in each economy of the club. For the club 2, the results (Table 9) show that the first discount has no significant impact on reducing income disparities. Not only the parameter of interest has a very low value but it is not significant although a negative sign. However, the volatility of the level of per capita consumption and expenditure per capita have a positive impact on the dispersion

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26. Production in thousand bales, 2003-2004

TABLE 1 – Estimations results with structural variables

coefficients	CEMAC	AFRIQUE
Consumption per capita	0.636***	0.867***
	(5.60)	(6.70)
Public expenditure per capita	0.095**	0.188***
	(2.27)	(3.71)
Investment per capita	0.091**	-0.0299
	(2.05)	(-0.72)
Foreign balance per capita	0.027**	0.0118*
	(2.03)	(1.80)
Parameter for interest	-0.025	-0.0216***
	(-1.67)	(-4.02)
Constant	0.162	0.008
	(1.17)	(0.09)
Number of country	6	17
Number of observations	68	68
R^2	0.981	0.9259

Note : t- student values are in bracket with *, ** and ***
respectively the significance of coefficients at 10%, 5%
et 1% level
Source : PWT6.2 data, author's calculations.

TABLE 2 – Estimation results without structural variables

Coefficients	CEMAC	AFRIQUE
β_4	-0.043**	-0.0272***
	(-2.54)	(-3.69)
Constant	0.092***	0.487***
	(71.17)	(35.16)
Number of country	6	17
Number of observations	68	68
R^2	0.981	0.9259

Note : t- student values are in bracket with *, ** and ***
respectively the significance of coefficients at 10%, 5%
et 1% level
Source : PWT6.2 data, author's calculations.

Table 3 – Estimations results for club 1 : Bénin, Burkina Faso, Guinée Bissau, Mali.

variables	C.E.D.E.A.O	C.E.M.A.C.	Afrique
Consumption per capita	0.864***	0.645***	0.758***
	(16.62)	(6.97)	(7.27)
Public expenditure per capita	-0.135	-0.026	-0.080
	(-1.47)	(-0.48)	(-0.87)
Investment per capita	0.078	0.165***	0.152**
	(1.49)	(3.59)	(2.05)
Foreign balance per capita	0.025**	0.023*	0.019*
	(2.11)	(1.82)	(1.68)
Parameter of interest	-0.009	-0.05**	-0.039***
	(-0.81)	(-2.77)	(-4.35)
Constant	-0.097*	0.147	-0.015
	(-1.95)	(1.26)	(-0.15)
Number of country	7	6	17
Number of observations	68	68	68
R^2	0.984	0.988	0.961

Note : t- student values are in bracket with *, ** and ***
respectively the significance of coefficients at 10%, 5%
et 1% level
Source : PWT6.2 data, author's calculations.

of GDP per capita in this club. Thus, any reduction in the volatility of these aggregates in this club is likely to improve living conditions in the economies of the club. Finally, for the club 3, the first preferential tariff induces a real convergence of these economies. The club consists of Côte d'Ivoire and Senegal has benefited from the positive effects of the entry into force of this trade policy. The parameter of interest is negative and significant at the 5% (Table 5). Once again, the per capita consumption and the level of public expenditure per head play an important role in this process within the club. After this analysis it is clear that per capita consumption and government spending have an important role in reducing disparities between the economies of the WAEMU. The process of real convergence is significant for countries with relatively rich in that area. However, the methodology has limitations. Indeed, in this double-difference approach, the choice of control groups is a determining factor in the analysis.

Conclusion

This study aims to assess the impact of preferential tariff on the first real convergence in the WAEMU. The approach is the σ-convergence because it takes into account both the phenomena of retrofitting (β-convergence) and secondly it considers the impact specific subject which could be studied economies. This analysis shows that there is a significant reduction of income disparities by head in the WAEMU between 1970 and 2003. Also the first trade agreement has reduced significantly the disparities in the WAEMU over this period.

Therefore, potential diversion and / or trade creation arising are unevenly distributed between member countries. The differences are increasingly present in the WAEMU.

In addition, community projects with a choice of location and / or can significantly reduce the achievement gaps between levels of per capita consumption, are very favorable to the improvement

TABLE 4 – Estimation results for club 2 : Niger, Togo.

variables	C.E.D.E.A.O	C.E.M.A.C.	Afrique
Consumption per capita	0.758***	0.522***	0.651***
	(13.86)	(3.88)	(3.80)
Public expenditure per capita	0.185**	0.081	0.193**
	(2.08)	(1.47)	(2.21)
Investment per capita	0.047	0.099**	0.061
	(1.09)	(2.24)	(0.97)
Foreign balance per capita	-0.016	0.006	-0.008
	(-0.73)	(0.33)	(-0.58)
Parameter of interest	0.022**	-0.009	-0.0002
	(2.44)	(-0.46)	(-0.02)
Constant	-0.165**	0.274*	-0.007
	(-2.62)	(1.87)	(-0.06)
Number of country	7	6	17
Number of observations	68	68	68
R^2	0.971	0.983	0.951

Note : t- student values are in bracket with *, ** and ***
respectively the significance of coefficients at 10%, 5%
et 1% level
Source : PWT6.2 data, author's calculations.

TABLE 5 – Estimation results for club 3 : Côte d'Ivoire, Sénégal.

variables	C.E.D.E.A.O	C.E.M.A.C.	Afrique
Consumption per capita	0.776***	0.638***	0.838***
	(23.21)	(5.25)	(5.94)
Public expenditure per capita	0.297***	0.161**	0.352***
	(5.72)	(2.66)	(6.88)
Investment per capita	0.011	0.055*	0.007
	(0.55)	(1.95)	(0.28)
Foreign balance per capita	0.013	0.023**	0.012
	(1.25)	(2.02)	(1.45)
Parameter of interest	-0.006	-0.015	-0.017**
	(-1.03)	(-0.84)	(-2.17)
Constant	-0.263***	0.162	-0.148*
	(-6.94)	(1.30)	(-1.99)
Number of country	7	6	17
Number of observations	68	68	68
R^2	0.982	0.983	0.951

Note : t- student values are in bracket with *, ** and ***
respectively the significance of coefficients at 10%, 5%
et 1% level
Source : PWT6.2 data, author's calculations.

of living conditions, all things being equal. For the dispersion of per capita consumption has a positive and significant impact on the dispersion of income per capita.

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