

# ANALYSIS OF INFLATION CONVERGENCE IN THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS) ZONE (1987-2021)

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## Abstract

*This study examines the convergence of inflation (country annual average inflation rate) through its determinants vis-à-vis the set convergence criteria in the Economic Community of West African States during the period 1987-2020. The study adopted ex-post factor design in order to answer the research questions. The study undertook unit root test employing Levin, Lin, and Chu (LLC) panel unit root method to check the stationarity of the variables, Auto Regressive Distributed Lag (ARDL) model and Error Correction Model (ECM) to determine whether or not they are co-integrated and a dynamic fixed effect panel data model covering 15 countries over the period under review. The study found that while West African Economic Monetary Union (WAEMU) countries inflation rates fall below the threshold, West African Monetary Zone (WAMZ) inflation rates are beyond the ECOWAS inflation convergence rate of less than or equal to 5 percent, that cross-country differences in inflation rates are attributed to the variation of the output gap, the increase in liquidity, the variation of exchange and interest rates, and the persistent increase in the price level. In the view of targeting the five percent (5 %) percent convergence criterion, the study recommended that changes of traditional country monetary approaches to a supra-national monetary authority that compels compliance to a regional monetary and inflation targets, stimulation of economic growth, lowering of interest rates as well as adoption of a*

*strong and efficient exchange rate mechanism becomes imperative for the ECOWAS member states.*

Keywords: Inflation Convergence, ECOWAS.

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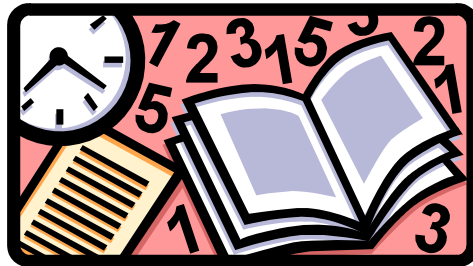


Fig. 1. (a) first picture; (b) second picture

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## Acknowledgements

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#### 1.1 Background to the Study

Before the creation of the West African Economic States (ECOWAS), the collective territory known as West Africa was made up of an aggregation of states that emerged from different colonial experiences. The region’s cultural, linguistic and ecological diversity presents both opportunities and challenges for the integration process. The desire to combine forces politically and economically has always been recognized as a step forward in the effort to engender prosperity in the area. This was in spite of the fact that the first effort at integration dates back to 1945 with the creation of Communauté Financière d’Afrique (CFA) franc that brought the francophone countries of the region into a single currency union.

In 1964, Liberian President William Tubman proposed an economic union for West Africa leading to an agreement which was signed in 1965 by the four states of Côte d’Ivoire, Guinea, Liberia and Sierra Leone. But it was not until May 1975 that the treaty of Lagos, from The Economic Community of West African States (ECOWAS) was signed with the purpose of economic integration and later as political union. In

1976, Cape Verde, one of the two Lusophone countries in the region joined ECOWAS, and in December 2000, Mauritania withdrew its membership because some west African countries recognized the western Sahara region as a breakaway country.

Later on April 20, 2000, in Accra, Ghana, six West African countries: The Gambia, Ghana, Guinea-Conakry, Liberia, Nigeria and Sierra Leone, declared their intention to proceed to monetary union among the non-CFA franc countries of the region by January 2003, as a first step toward a wider monetary union including all the ECOWAS countries in 2004, (Accra Declaration, 2000). The Eco was first planned to be introduced in 2003, but this was postponed several times, to 2005, 2010 and 2014. The start of the currency was then rescheduled to 2015 due to the international economic crisis, and later the December 2009 meeting also established a plan to begin work to merge the Eco with the CFA franc immediately upon the launch of the Eco; this was planned to be achieved by 2020, (ECOWAS convergence criteria report, 2009).

The union now has fifteen member countries of regional organisation with the mandate of promoting economic integration among the countries. The effort of ECOWAS for regional integration has been metamorphosed from trade facilitation to free movement of ECOWAS citizens across the countries, The Heads of State and Government of the Economic Community of West African States (Ouagadougou, June 1989).

For the Eco to be implemented, ten convergence criteria, set out by WAMI, must be met by each member State. These criteria are divided into four primary of which a single-digit inflation rate of not is less than five percent (5%) at the end of each year, a fiscal deficit of no more than four per cent (4%) of the GDP, a central bank deficit-financing of no more than ten per cent (10%) of the previous year's tax revenues, as well as a gross external reserves that can give import cover for a minimum of three months and six secondary criteria comprised of prohibition of new domestic default payments and liquidation of existing ones, tax revenue should be equal to or greater

than twenty (20) percent of the GDP, wage bill to tax revenue equal to or less than thirty five (30) percent, public investment to tax revenue equal to or greater than twenty (20) percent, a stable real exchange rate and a positive real interest rate (WAMI, 2003). ECOWAS desire for economic integration culminates to the adoption of single currency which is the last stage of the monetary union. According to the theory of Optimum Currency Area(OCA), Preferential Trade Agreement (PTA), Free Trade Area (FTA), Customs Union (CU) and Common Market are the initial stages of economic integration, with unification of monetary policy (that is, establishing a single currency) being the next stage. The nature of African continent makes the region to deserve the need for regional economic integration more than other developing countries in the world (Iyoha 2004). Their specific characteristics include poor intra-regional trade, diverse trade and macro policy regimes and infrastructure inadequacy. This general feature seems to be specific to the ECOWAS countries.

The plan to create a second monetary union (in addition to that constituted by the West African Economic and Monetary Union or WAEMU), as well as a full ECOWAS monetary union, raises a number of questions about the advantages and disadvantages of various alternative arrangements and strategies. There is clearly an important political dimension behind the recent initiative, but it is nevertheless important to carefully examine the economic benefits and costs. The institutional design of the non-WAEMU monetary union could take a number of different forms, including the creation of a new currency or the adoption of an existing one, the formation of a single central bank or its coexistence with national central banks, and a peg (e.g., to the euro or a currency basket) or a flexible exchange rate for the external exchange rate policy of the common currency. The second stage, involving the merger of the two currency unions, raises some of the same issues. The second stage also raises additional issues, such as whether the French Treasury's guarantee of convertibility of the CFA franc to the euro, at a fixed parity, would continue.

The adoption of a common monetary policy is part of the process of economic integration. It has to do with member countries giving up their independent monetary policies to have a common central bank responsible for the conduct of monetary policy for the member states. The direct economic cost from transforming to a monetary union is the seigniorage lost from printing money. The gain in terms of low inflation and increased trade and growth is often a core reason for joining a monetary union in spite of the loss of seigniorage associated with it.

Thus, the preference for a monetary union over independent individual monetary policies hinges on the expected benefits of the integration, which include reduction in transaction costs of cross border trade (including exchange cost), increased market size and trade. These factors are growth enhancing in nature, (International Monetary Fund Occasional Paper, 2004).

There has been increasing efforts by member states for monetary integration in the ECOWAS region. The ECOWAS Trade Liberalisation Scheme (ETLS) is the instrument expected to produce the Free Trade Area of the region while the joint ECOWAS-WAEMU Common External Tariff (CET) is the instrument expected to produce the Customs Union of the region. With these structures and the compliance on the ECOWAS protocol on free movement of persons and goods, a common market is obtained in the region, The Heads of State and Government of the Economic Community of West African States (Ouagadougou, 30th day of June 1989).

The West African Monetary Agency (WAMA), which is the agency for the coordination of the ECOWAS Monetary Cooperation Programme (EMCP), does a joint multilateral surveillance mission with ECOWAS and West African Monetary Agency (WAMI) in order to assess the stance of member states with respect to the ETLS, CET, macroeconomic convergence and other areas of institutional and macroeconomic harmonisation. Other areas of institutional harmonisation assessed are Payment

Systems Development and Statistical Harmonisation, (Joint mission ECOWAS, WAMA and WAMI communiqué, 2014)

Nevertheless, there has been a significant gap in the inflation performance across ECOWAS member States. Having been set as one of the primary convergence criterion for the creation of monetary union of the ECOWAS region, inflation convergence becomes a serious concern as countries fail to meet up with 5% convergence rate. Some countries like West African Monetary Zone (WAMZ) have up to two (2) digits' inflation rate over a quite long period of time. Inflation convergence remain one of the conditions to set up an Optimal Currency Region (OCR), (ECOWAS convergence criteria report, 2016).

### **1.2 Statement of the Problem**

ECOWAS members States desire for economic integration culminates to the adoption of single currency which is the last stage of the monetary union. Under an Optimum Currency Area (OCA) theory, inflation rates will be equalized across countries within a monetary union due to the high integration of labour, product and capital markets, common monetary policy, (ECOWAS convergence criteria report, 2016).

However, there has been a significant gap in the inflation performance across ECOWAS member States. Being a primary convergence criterion for the creation of monetary union of the ECOWAS region, inflation convergence becomes a serious concern as countries fail to meet up with the five percent (5%) convergence rate. Some countries like the West African Monetary Zone (WAMZ) sub region have up to two (2) digits' inflation rate over a quite long period of time making inflation convergence to remain one of the main obstacle to set up an Optimal Currency Region, WAMI, 2015).

In response to these problems, this study aims at finding the factors underlying the different conduit of inflation, studying its convergence and stability across the

ECOWAS member States and finally draw some policy conclusions for a smooth and effective implementation of the OCA. Understanding what drives inflation in these economies is important for many reasons. First, high inflation reduces welfare and contribute to social inequality. Second, these economies are exposed to a larger number of shocks, both endogenous and exogenous. In case of an external shock, different policies may be implemented depending on its degree of persistence. Third, high inflation reduces international competitiveness and may have adverse implications on output and Forth, inflation is one of the primary convergence criteria which is very difficult to meet by most of the countries.

The study intends to identify the reasons behind the heterogeneous inflation performance of countries across the Economic Community of West African States countries vis-à-vis to the inflation convergence set by ECOWAS multilateral convergence council. The impact of a large number of variables such as output gap, broad money supply, nominal effective exchange rates, real interest rates, and general price level on the inflation differentials is being assessed. The assessment is check whether the inflation rates over period time of each member States falls or other within the preset benchmark of less than or equal to five (5%). Thus the study of inflation convergence compelled the analysis of inflation differentials vis-à-vis to the ECOWAS inflation convergence criteria.

The non-convergence to the preset 5% convergence criteria of the heterogeneous annual average member States inflation rates has been one of the most recurrent macro-economic problems that can be explained within the orbit of five factors as described below:

- i. The level of output gap is crucial for determining inflationary pressures in the economy. A large negative output gap suggests inflation should be low. A positive output gap is where growth is above the trend rate of growth, should lead to inflationary pressures.

- ii. Too much money in circulation causes inflation which is a major challenge for every central bank and the government to adopt appropriate monetary policy framework to ensure price stability because as the money supply rises in an uncontrolled manner so does the price level and lead to high inflation, (Friedman, 1968),
- iii. The problem of high inflation is also the result of high exchange rate, a depreciation in the exchange rate causes inflation to increase, therefore making import prices more expensive.
- iv. The variation of interest rate influences inflation, low interest rate translates to more money available for borrowing, making consumers spend more. The more consumers spend, the more the economy grows, resulting in a surge in demand for commodities, while there's no change in supply. An increase in demand which can't be met by supply results in inflation.
- v. The persistent increase in the price of goods and services in the economy and
  - i) The reduction of the value of the money used to buy goods and services result in the increase of the inflation rates.

Therefore, questions that agitate the research mind, which this research seeks to find answers to, are; to what extent variation of output gap affects inflation rates dispersion in the ECOWAS countries? How does increase in money supply ( $M_2$ ) contribute to the fluctuation of inflation rates in the ECOWAS member States? What is the effect of the variation of nominal effective exchange proportion on inflation rates in the ECOWAS member States? To what extent has the increase of real interest rate affected inflation rates in the ECOWAS member States? Does increase in price level have any impact on the inflation dispersion across the ECOWAS member States?

ii)

The main objective of the empirical exercise is to analyse the variation of inflation differentials in ECOWAS member States. The study concentrates at identifying the

reasons behind the heterogeneous inflation performance of countries across West Africa. The variation of real output gap, problems in money supply, fluctuation in exchange and interest rates, lack of desired credit allocation to the private and public sectors as well as the persistent increase in the price of goods and services in the economy are being assessed in a dynamic panel data model covering 15 ECOWAS countries over the period under review.

### **3.2 Theoretical Framework**

The theoretical framework for this study is drawn from Keynesian models used to analyse inflation in the European area and from various models that have been used to analyze the inflation differentials in the euro area (i.e. the degree of non-convergence of prices {Hofmann and Remsperger (2005), Angeloni and Ehrmann (2007), Altissimo et al. (2005), and Honohan and Lane (2003)}). In particular, the empirical methodology specified for this study draws from Honohan and Lane (2003) and Horvath and Koprnicka (2008) who focus their attention to finding the relationship between inflation differentials and the role of exchange rate channel, output gap, fiscal policy, and the countries' relative price level in a panel of euro area countries using annual data over 1999-2001.

This study advances from various inflation models that have been used to analyze the inflation differentials in the euro area (i.e. the degree of non-convergence of prices) {Honohan and Lane (2003), Hofmann and Remsperger (2005), and in the WAMZ member States.

### **2.3 Empirical Review**

Empirical evidence on the impact of output gap, nominal exchange rate (NEER), money supply ( $M_2$ ), real interest rate, and general price level for the determination of inflation differentials across Euro area and ECOWAS countries is diverse.

For instance,

An empirical study was conducted by Honohan and Lane (2003) in European Monetary Union area. They analyzed the sources of divergent of national inflation rates among EMU member countries in panel regressions for the 1999-2001 periods using pooled OLS at first and later pooled GMM Estimation method. Their results show that a considerable proportion of the inflation differentials in the euro zone over 1999-2001 can be systematically related to a small number of macroeconomic variables. They show that a member country's external exposure, the cyclical position and the price level convergence are vital determinants of inflation differentials in the euro area. The output gap is consistently important in all specifications. As might be expected, the variable is relatively more important for the domestically-generated inflation measures (the GDP deflator and wages) than for the broader indices. In addition, exchange rate movements have had a substantial effect on inflation movements and inflation differentials in EMU.

They draw some policy conclusions for the accession countries that are hoping to join EMU. At one level, the Irish 'outlier' experience is reviewed; at another, it is estimated. They highlight the role played by differential exposure to euro exchange rate movements in explaining inflation divergence.

Again, Honohan and Lane (2003) posit that, given the very high interest rates previously experienced, whether measured in nominal, exchange-rate corrected, or real terms, it was always clear that EMU accession would lead to a sizable step reduction in interest rates and a reduction in their volatility.

Hofmann and Remsperger (2005) examined inflation differentials in the Euro area. Their empirical analysis of inflation differentials is carried out by panel generalized method of moments (GMM) over the period 1999Q1-2004Q2. Their results suggest that the observed inflation differentials are mainly influenced by differences in cyclical positions and

fluctuations of the effective exchange rate combined with a rather high level of inflation persistence, while the proxies of price level convergence do not come out significantly. Hofmann and Remsperger (2005) also find that the degree of inflation persistence depends on the past monetary policy regime and expectations. Their results indicate that countries with a history of low and stable inflation rates exhibit zero persistence, while the persistence is rather high otherwise. Given this finding, the authors conclude that the monetary policy of the Euro system geared at delivering and maintaining low and stable inflation rates in the euro area should reduce inflation persistence in the future.

The long-run determinants of inflation differentials in the euro area are examined by Altissimo et al. (2005). In first part of their study, the authors analyze evidence on the statistical features of observed dispersion in headline inflation rates as well as changes in the components of the consumer price indexes in the euro area. Their findings suggest that most of the dispersion in European inflation occurs in the services category of the EU's harmonized consumer prices. In the second part of the study, the authors build a dynamic factor model to investigate the sources of dispersion in sector-based measures of dispersion in, on the one hand, a common component driven by common factors, and on the other hand, an idiosyncratic component.

Altissimo et al. (2005) conclude that their outcomes are in contrast with the supposition that real exchange rate is primarily driven by regionally asymmetric productivity shocks in the traded sector. Indeed, they point instead to relative variations in productivity in the non-traded sector as the main cause of price and inflation differentials, with shocks to productivity in the traded sector being largely absorbed by movements in the terms of trade in the regional economies.

Angeloni and Ehrmann (2007) propose a stylised 12-country model of the euro area represented by aggregate demand and aggregate supply equations and use it to analyze the

inflation and output differentials observed across the euro area over the period 1998Q1-2003Q2. Angeloni and Ehrmann (2007) point out that the main source of differentials in the early years of the euro area have been aggregate demand or potential output shocks, followed by domestic cost-push disturbances, while euro exchange rate shocks come only third. Moreover, the authors emphasize that inflation persistence have played a central role in amplifying and perpetuating inflation differentials within the monetary union. They claim that for plausible parameter values even small changes in persistence can produce dramatic changes in the inflation differentials. The paper also concludes that a tight control of average area-wide inflation around a target tends to reduce the inflation differentials.

Horvath and Koprnicka (2008) examine the determinants of inflation differentials in a panel of the new European Union member states vis-à-vis the euro area in 1997-2007 using panel GMM Estimation model. Their main results are that exchange rate appreciation and higher price level in the new EU members is associated with narrower inflation differential vis-à-vis the euro area, while fiscal deficit and positive output gap seem to contribute to higher inflation differential. Nevertheless, the effect of price convergence on inflation differentials is found to be dominating in these countries. Their study shows that a country with price level 20% below the euro area average is likely to exhibit inflation nearly one percentage point above the euro area. They therefore concluded that real convergence factors rather than cyclical variation are more important for inflation developments in the new EU members, as compared to the euro area.

Dele Balogun examined the determinants of inflation differentials in a panel of West African Monetary Zone (WAMZ) states vis-à-vis its set benchmark for macroeconomic convergence from 2000 to 2009. Using a stylized 5-country model of WAMZ area, Dele Baloun shows that the differences in national inflation is analyzed in light of country specific shocks or differences in the monetary transmission mechanisms. The main results show macroeconomic (price) stabilization around a desired target was not attained. Over

the sample period, the un-weighted average regional inflation rates were most often above a single digit target and vary widely among the countries. The major monetary policy instruments determinants of inflationary divergence are the pursuit of distorted interest rates, exchange rates overvaluation and expansionary monetary policies, which penalized credit and accentuated output supply/demand gaps.

Mihaela Gurbulea, (2015) used the Least Square Dummy Variable Corrected (LSDVC) panel data methodology to analyse the factors that influence inflation in countries across Central and Eastern Europe. Introducing the annual percentage change in the exchange rate of the national currency vis-à-vis the USD, in euro country panel (2003–2013) he shows that a positive change is associated with the devaluation of the currency, while a decrease in the exchange rate reflects its appreciation. Therefore, that devaluations is expected to make imports more costly and will translate into higher Inflation and vice-versa. Results also point out to a pass-through from import prices and exchange rate fluctuations to the inflation. The author also showed that the positive effect of the imports share in GDP is coupled with the findings concerning the effect of import prices and exchange rate fluctuations. Therefore, countries that experience a depreciation of their currency will see this effect translated from higher import prices to higher inflation. All together, the estimation results for these variables suggest that CEE countries are exposed to external shocks that may cause volatility in the exchange rates and translate into volatility of inflation.

Nkwatoh (2018) on his part employed descriptive statistics to determine whether ECOWAS countries have met all the macroeconomic convergence criteria making them fit for a monetary union. The analyses indicate that no ECOWAS country has met all the convergence criteria at a given point in time implying that the level of macroeconomic convergence in the region still remains inadequate relative to the set targets. However, WAEMU sub-set economies have met three of the criteria -public debts to GDP Ratio,

deficits including grants, annual percentage inflation rate. The simple reason according to the study is that WAEMU is an existing monetary union with a common stabilization policy.

Ndiaye A. (2021) in his study of Exchange Rate and Inflation rate convergence in among ECOWAS countries, wanted to see if the difference between the fixed exchanges rate regime of the WAEMU countries on the one hand and the flexible regimes of the WAMZ countries on the other hand, is a factor of non-convergence of inflation rates. To do so, he first applied the Granger causality tests to look at the causality between exchange rate and inflation; he then used an inflation differential model (IDM) to identify the factors of convergence or non-convergence of inflation rates between WAEMU and WAMZ. The results show that WAMZ countries, due to their flexible exchange rate regimes, are subject to exchange rate pass-through (ERPT), unlike their WAEMU neighbours. Moreover, the results of the estimates of the inflation differential model (IDM) reveal that neither the evolution of the output nor that of the money supply, on both sides, explain the non-convergence of the inflation rates between WAEMU and WAMZ countries, but they show that the non-convergence of the inflation rates is significantly linked to the difference in the evolution of the exchange rates.

## **2.4 Gaps in Literature**

First, unlike older studies that focus only on the inflation differentials in the WAMZ or WAEMU from the ECOWAS region, this study widens the country coverage by adding up together the 15 ECOWAS countries. Second, latest data are used in this work in order to focus on the more recent inflation differentials performance of the countries analyzed in the study. Third, the study accounts for the impact of a bigger range of variables on the inflation differentials across the ECOWAS region. This is the gap this study intends to fill.

## **3.1 Research Methodology**

To achieve the object of this inferential study, Ex-post facto design is used by obtaining panel data, that is a combination of cross-section (15 countries) and time series data covering the period of 1987 to 2016. The major advantages of conducting an ex-post facto study are that the data are already collected, obtaining permission to conduct the study is less involved than enrolling participants, and less time is involved in conducting the study than creating new data.

This inferential study was drawn from Altissimo et al. (2005), and Angeloni and Ehrmann (2007)}. In particular, the empirical methodology specified for this study draws from Honohan and Lane (2003) and Horvath and Koprnicka (2008) who focus their attention to finding the relationship between inflation differentials and the role of exchange rate channel, output gap, fiscal policy, and the countries' relative price level in a panel of euro area countries using annual data. This inferential study analyses a panel data; that is a combination of cross-section (15 countries) and time series data covering the period of 1987 to 2016. The annual data on inflation, output gap, money supply, exchange and interest rates as well as general price level were collected from each participating country statistical (monetary or financial) databases and/or other international organizations' websites such IMF database, ECOWAS website, WAMA Website, World outlook, and KOEMA (World bank database).

Firstly, descriptive statistics on inflation differentials was conducted to confirm the dichotomy of inflation rates across the countries. Secondly, unit root, correlation analysis, ARDL bounds test, granger causality test and error correction mechanism were employed to determine both the short and long run relationship as well as the causal effects in the parameters.

Hausman test was conducted for choosing the most appropriate model and a general fixed effect (FEM) panel regression analysis was carried out to establish the aggregate effect of

independents variables over inflation differentials, also post estimation diagnostic was carried out in order to check the non-existence of serial correlation of the residuals as well as the stability of the model.

### 3.4 Model of the Study

Many studies have been carried out on the modeling of inflation in the Euro area, in Africa and particularly in West Africa. The model for this study was draws from Keynesian models used to analyse inflation in the European area, it draws specifically from the methodology applied in the study aimed at finding inflation differentials in the Euro area through exchange rate, output gap, fiscal policy and the countries' general price level, {(Honohan and Lane, 2003),(Horvath and Koprnicka, 2008)} in a panel of euro countries using data covering the period of 1999-2001. Honohan and Lane (2003) postulated a fairly general specification for inflation differentials as:

$$\pi_{it} - \pi_t^E = \beta(Z_{it} - Z_t^E) + \delta[(P_{it-1} - P_{it-1}^*) - (P_{t-1} - P_{t-1}^{E*})] + \varepsilon_{it} \text{-----} (1)$$

where  $\pi_{it}$  and  $\pi_t^E$  are the annual national and euro zone inflation rates respectively,  $Z_{it}$  and  $Z_t^E$  denote national and euro area variables that exercise short-term influence on the inflation rate,  $P_{it}$  and  $P_t^E$  denote the national and Euro price levels,  $P^*$  and  $P^{E*}$  are the national and euro zone long-run equilibrium price levels.

In a long run, the national price tends to be the same as the regional price leading to the simplification of equation (1) as:

$$\pi_{it} - \pi_t^E = \beta\beta(Z_{it} - Z_t^E) + \delta[(P_{it-1} - P_{t-1}) + \varepsilon_{it} \text{-----}]$$

- (2)

According to Horvath and Koprnicka (2008), the variables can be a linear combination into a time dummy, so equation (2) can be written as:

$$\pi_{it} = \phi_t + \beta Z_{it} + \delta P_{it-1} + \varepsilon_{it} \text{-----}$$

-(3)

### 3.5 Model Specification

The empirical approach to this model is rigorously rooted from the theories of the above inflation models. Macro-economy or price theory is fundamentally the stabilisation of the prices. This study aimed at exploring the determination of inflation differentials, so it follows the same analysis of Horvath and Koprnicka (2008), but with some modifications in the vector  $Z$  equated to  $[\Delta NEER_{it-1}, FISC_{it}, GAP_{it}]$  (i.e.  $Z = [\Delta NEER_{it-1}, FISC_{it}, GAP_{it}]$ ). Where  $\Delta NEER_{it-1}$  is the lagged change of nominal effective exchange rate,  $GAP_{it}$  denotes the output gap,  $FISC_{it}$  represents the fiscal deficit and  $P_{it-1}$  is the lagged price level. In this study, the  $Z$  is now equated to  $[\Delta NEER_{it-1}, GAP_{it}, M2_{it}, Int_{it}]$  where  $\Delta NEER_{it-1}$  is the lagged change in nominal exchange rate of the national currencies to the US \$, their dominant reserve currency,  $GAP_{it}$  denotes the output put gap, that is the difference between the actual GDP (at constant price expressed in the United States Dollars) and the potential GDP, while  $M2_{it}$  is money supply, which is an important component of independent monetary policy targets of WAMZ as well as WAEMU and Cap verde countries, and finally,  $Int_{it}$  represent the real interest. With the empirical inputs of this study equation (3) now becomes our empirical model and can be re written as:

$$INF_{it} = \phi_t + \beta_1 \Delta NEER_{it-1} + \beta_2 GAP_{it} + \beta_3 M2_{it} + \beta_4 Int_{it} + \delta P_{it-1} + \varepsilon_{it} \text{-----} (4)$$

INF = Annual average country inflation rate

$\Phi$  = Cross-sectional fixed effects

$M_2$  = Money supply

NER= Nominal effective exchange rate

Gap = Output gap

Int = real interest rate

$P$  = Price level

$\epsilon_{it}$  = Error term

$\beta_1$ – $\beta_4$  = Coefficients of the Explanatory Variables

$\delta$  = Coefficient regression of the aggregate Price level

$i$  = Cross section (countries)

$t$  = Time

### 3.5.1 A priori Expectation

- i.  $\beta_1$  is predicted to negate inflation as the divergent paths of inflation across countries might also be determined by structural external factors such as the exchange rate.
- ii.  $\beta_2$  is expected to be positive as inflation differentials across countries may also arise when their business cycles are not synchronized.
- iii.  $\beta_3$  is expected to be positive as the money supply rises in an uncontrolled manner so does the price level and lead to high inflation.
- iv.  $\beta_4$  is predicted to be negative as the real interest rate can overheat the inflation.
  - i.  $\delta$  is expected to be negative as the aggregate price is one of the structural factors that contribute to the differences in inflation across countries is the price level convergence.
  - ii.

### 4.1 Data Presentation

Data from fifteen (15) ECOWAS countries covering the period of 30 years, from 1987 to 2016, are presented in Tables 4.1.1 to Table 4.1.15 (see Appendix A), a matrix composed of columns and rows. The columns represent country code, years of observations, inflation rates (Inf), output gap (Gap), nominal exchange rates (NER), money supply ( $M_2$ ), real

interest rate (Int) and general price level or price index (P), respectively. The rows represent annual data, on each variable (both dependent and independents)

## 4.2 Data Analysis Results

### 4.2.1 Descriptive Statistics Analysis Result

**Table 4.1: Descriptive Statistics of Country, ECOWAS, WAEMU and WAMZ**

|        | Mean  | Med.  | Max.  | Min.   | SD    | Sk.  | J.Bera    | Prob. | Sum      | S. Sq. Dev. | Obs. |
|--------|-------|-------|-------|--------|-------|------|-----------|-------|----------|-------------|------|
| BN     | 4.03  | 2.15  | 38.53 | -1.34  | 7.38  | 3.64 | 321.35    | 0     | 120.83   | 1,577.62    | 30   |
| BF     | 2.78  | 2.1   | 25.18 | -2.68  | 5.21  | 2.81 | 153.05    | 0     | 83.49    | 787.08      | 30   |
| CV     | 3.9   | 2.51  | 26.08 | -0.81  | 5.07  | 3.16 | 195.7     | 0     | 117.12   | 744.62      | 30   |
| CI     | 3.59  | 3.65  | 10.65 | -2.48  | 3.21  | 0.28 | 0.51      | 0.78  | 107.61   | 297.95      | 30   |
| GM     | 6.79  | 5.55  | 23.53 | 0.84   | 4.98  | 1.56 | 21.64     | 0     | 203.63   | 719.34      | 30   |
| GH     | 21.58 | 17.3  | 59.46 | 8.7    | 12.17 | 1.35 | 12.06     | 0     | 647.53   | 4,295.80    | 30   |
| GC     | 16.15 | 10.88 | 66.67 | 1.01   | 15.15 | 1.75 | 25.01     | 0     | 484.58   | 6,659.75    | 30   |
| GB     | 18.69 | 3.98  | 80.79 | -3.5   | 25.52 | 1.09 | 6.04      | 0.05  | 560.62   | 18,893.30   | 30   |
| LB     | 8.34  | 8.05  | 17.5  | 1.3    | 3.16  | 0.47 | 3.56      | 0.17  | 250.1    | 289.36      | 30   |
| ML     | 2.7   | 1.4   | 23.18 | -6.24  | 5.42  | 1.99 | 54.86     | 0     | 80.95    | 851.21      | 30   |
| NE     | 2.46  | 1.45  | 36.04 | -7.8   | 7.53  | 2.97 | 207.49    | 0     | 73.84    | 1,644.17    | 30   |
| NG     | 20.77 | 12.54 | 72.84 | 5.4    | 18.95 | 1.48 | 11.72     | 0     | 623      | 10,413.88   | 30   |
| SL     | 27.85 | 13.26 | 178.7 | -35.8  | 41.48 | 2.05 | 46.18     | 0     | 835.57   | 49,886.36   | 30   |
| SN     | -1.32 | -0.24 | 5.9   | -32.29 | 6.44  | -3.8 | 403.47    | 0     | -39.59   | 1,202.15    | 30   |
| TG     | 3.29  | 1.8   | 28.14 | -1.02  | 5.71  | 3.09 | 181.19    | 0     | 98.77    | 946.15      | 30   |
| WAEMU  | 4.57  | 1.69  | 80.79 | -32.29 | 11.94 | 3.55 | 2,931.77  | 0     | 1,096.03 | 34,071.28   | 240  |
| WAMZ   | 16.91 | 10.7  | 178.7 | -35.8  | 21.44 | 3.68 | 3,470.65  | 0     | 3,044.41 | 82,254.31   | 180  |
| ECOWAS | 9.44  | 4.58  | 178.7 | -35.8  | 17.24 | 4.05 | 14,250.62 | 0     | 4,248.05 | 133,404.20  | 450  |

Source: Authors Computation, 2017 (Eview-9.5)

Table 4.1 shows that the inflation rates mean and median of only WAEMU (Bénin, Burkina Fasso, Côte d'Ivoire, Guinée Bissau, Mali, Niger, Togo and Sénégal) individual countries have perform better than their WAMZ counterpart and meet up with the ECOWAS

inflation convergence criteria rate of less than or equal to 5 per cent (5%). This result can also be seen through the individual country inflation rates over the sample period under study, even though it is not the case for the single country of Guinea Bisseau (mean = 6.79 and median = 5.55) which nearly attained the inflation convergence criteria of  $\leq 5\%$ .

On the other hand, over the same period, the average regional inflation rates of WAMZ countries (Guinea Conakry, Gambia, Ghana, Liberia, Nigeria and Sierra Leone) were most often above a single digit target and vary widely from one country to another (See Table 4.1). The mean and the median average inflation rates stood at 16.91 and 10.70 per cent respectively surpassing the less than 5 per cent convergence criteria rate. Indeed, Table 4.1 and individual country table show that except for Gambia and Liberia, all the WAMZ countries have had astonishing records of double digit inflation. The WAMZ country that recorded the minimum inflation rate during the study period is Gambia at an average of 6.79 per cent while Nigeria recorded the maximum average inflation rate of 72.84 per cent. Table 4.1 also shows that for more than half of the period under review, both Gambia and Liberia recorded single digit inflation with the median statistics estimated at 5.55 and 8.05 per cent, respectively.

In general, the inflationary pressures appear relatively subdued in most economies during the review period. Even in countries where the rates of inflation remained high, such as in Ghana, they exhibited a declining trend. Inflation rates (annual average) in the region varied from -1.8 percent (Mali) to 17.5 percent (Ghana). In nine of the countries, the rates recorded in 2016 were lower than what prevailed in 2015, while in five others the reverse occurred. In Guinea, the rate of inflation remained the same in both years. Unlike 2015 when only one country (Ghana) recorded double digits' inflation, the number increased to three (Ghana, Nigeria, Sierra Leone) in 2016, (ECOWAS-Convergence-report, 2016).

#### 4.2.2 Correlation Analysis Result

**Table 4.2: Correlation Matrix**

|     | INF  | GAP  | NER  | M2    | INT   | P     |
|-----|------|------|------|-------|-------|-------|
| INF | 1.00 | 0.03 | 0.44 | -0.21 | -0.05 | -0.20 |

|     |       |       |       |       |       |       |
|-----|-------|-------|-------|-------|-------|-------|
| GAP | 0.03  | 1.00  | -0.01 | -0.06 | 0.08  | 0.04  |
| NER | 0.44  | -0.01 | 1.00  | -0.12 | -0.03 | -0.08 |
| M2  | -0.21 | -0.06 | -0.12 | 1.00  | 0.21  | 0.33  |
| INT | -0.05 | 0.08  | -0.03 | 0.21  | 1.00  | 0.00  |
| P   | -0.20 | 0.04  | -0.08 | 0.33  | 0.00  | 1.00  |

*Source: Authors Computation, 2017 (Eview-9.5)*

It should be noted that in table 4.2 the diagonal values in the correlation matrix are all equal to 1 because the correlation between a variable and itself is always 1. In practice, this number isn't useful to interpret.

Furthermore, in the above correlation matrix of table 4.2, the highest correlation coefficient between two distinct variables is +0.44. That denotes a weak positive correlation between the two distinct variables. This implies that none of the regressors has perfect or exact linear representations with one another. The conclusion is that the variables under investigation do not suffer from any multi-collinearity problem.

#### 4.2.3 Unit Root Test Result

**Table 4.3.1: Summary of Unit Root Test at Level**

| No. | Variable       | H <sub>0</sub> : | Method | $\tau$ Value | pValue | Decision          | Conclusion      |
|-----|----------------|------------------|--------|--------------|--------|-------------------|-----------------|
| 1   | INF            | has unit root    | LLC    | -6.44        | 0      | Reject null       | Stationary I(0) |
| 2   | GAP            | has unit root    | LLC    | -4.81        | 0      | Reject null       | Stationary I(0) |
| 3   | M <sub>2</sub> | has unit root    | LLC    | 2.47         | 0.99   | Don't Reject null | Not stationary  |
| 4   | NER            | has unit root    | LLC    | -0.25        | 0.4    | Don't Reject null | Not stationary  |
| 5   | INT            | has unit root    | LLC    | -5.40        | 0      | Reject null       | Stationary I(0) |
| 6   | P              | has unit root    | LLC    | 4.81         | 1      | Don't Reject null | Not stationary  |

*Source: Authors Computation, 2017 (Eview-9.5)*

From the table 4.3.1 above, it was discovered that the variables *Inf*, *GAP* and *INT* were found

to be stationary at level, that is; they are integrated at level (I (0)), at one percent (1%) significant level. However, all the other three variables namely *M<sub>2</sub>*, *NER* and *P* used in the analysis were found not to be stationary at level. The analysis went further to study the

stationary of these variables at first difference which results is depicted in table 4.3.2 below.

**Table 4.3.2 Unit Root Test at first DifferenceResult**

| No. | Variable       | H <sub>0</sub> : | Method | $\tau$ Value | pValue | Decision    | Conclusion      |
|-----|----------------|------------------|--------|--------------|--------|-------------|-----------------|
| 1   | INF            | has unit root    | LLC    | -6.44        | 0      | Reject null | Stationary I(0) |
| 2   | GAP            | has unit root    | LLC    | -4.81        | 0      | Reject null | Stationary I(0) |
| 3   | M <sub>2</sub> | has unit root    | LLC    | -7.50        | 0      | Reject null | Stationary I(1) |
| 4   | NER            | has unit root    | LLC    | -15.22       | 0      | Reject null | Stationary I(1) |
| 5   | INT            | has unit root    | LLC    | -5.40        | 0      | Reject null | Stationary I(0) |
| 6   | P              | has unit root    | LLC    | -1.87        | 0.01   | Reject null | Stationary I(1) |

*Source: Authors Computation, 2017 (Eview-9.5)*

Table 4.3.2 shows that all the other three variablesnamely M2, NER and P that were not stationary at level, they are stationary after first difference, i.e they are integrated of order 1 (I (1)) at one percent (1%) significant level. None of the variables is stationary at second difference; that is none of the variables under investigation is I (2). Thus the table presents a mixture of I (0) and I (1) variables, but no I (2) variables. This condition requires Bounds test for co-integration, Pesaran et al. (2001),

#### **4.2.4 ARDL Bounds Test for Co-integration Result**

The ARDL Bounds test for co-integration requires a procedure formed of lag selection before the model estimation, as well as post estimation diagnostics such as residual test for serial correlation, model dynamic stability check and then the Bounds Testing.

##### **4.2.4.1 Lag SelectionResult**

The result of the VAR lag order criteria in fifteen best models for the endogenous variables INF, GAP, NER, M2, INT and P and the exogenous variable “C” over the sample period along with various lag selection criterion including Akaike information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quinn information criterion (HQ). This study chooses the Schwarz information criterion (SIC) highlighted

in green which the highest LR statistics and optimal lag one (1) for the ARDL model specification.

#### 4.2.4.2 ARDL Model Estimation Result

Before carrying out the bounds test of co-integration, there is need to ascertain that the residuals of the ARDL model are not serially correlated as well as they are dynamically stable.

**Table 4.5 ARDL Model Estimation Results**

Dependent Variable: D(INF)  
Method: Panel Least Squares  
Date: 05/14/19 Time: 14:09  
Sample (adjusted): 1989 2016  
Periods included: 28  
Cross-sections included: 15  
Total panel (balanced) observations: 420

| Variable           | Coefficient | Std. Error            | t-Statistic | Prob.    |
|--------------------|-------------|-----------------------|-------------|----------|
| C                  | 5.170742    | 1.487689              | 3.475689    | 0.0006   |
| D(INF(-1))         | -0.052760   | 0.045432              | -1.161295   | 0.2462   |
| D(GAP(-1))         | -0.061728   | 0.081136              | -0.760799   | 0.4472   |
| D(NER(-1))         | -0.018288   | 0.020377              | -0.897495   | 0.3700   |
| D(M2(-1))          | 0.072818    | 0.060143              | 1.210742    | 0.2267   |
| D(P(-1))           | 0.025638    | 0.062600              | 0.409559    | 0.6823   |
| INF(-1)            | -0.364890   | 0.041323              | -8.830270   | 0.0000   |
| GAP(-1)            | 0.043061    | 0.061330              | 0.702122    | 0.4830   |
| NER(-1)            | 0.063348    | 0.029068              | 2.179338    | 0.0299   |
| M2(-1)             | 0.017400    | 0.035457              | 0.490750    | 0.6239   |
| P(-1)              | -0.049330   | 0.016401              | -3.007859   | 0.0028   |
| R-squared          | 0.211893    | Mean dependent var    | -0.447905   |          |
| Adjusted R-squared | 0.192624    | S.D. dependent var    |             | 11.31239 |
| S.E. of regression | 10.16464    | Akaike info criterion |             | 7.501549 |
| Sum squared resid  | 42257.88    | Schwarz criterion     |             | 7.607366 |
| Log likelihood     | -1564.325   | Hannan-Quinn criter.  |             | 7.543373 |
| F-statistic        | 10.99650    | Durbin-Watson stat    |             | 2.050473 |
| Prob(F-statistic)  | 0.000000    |                       |             |          |

Source: Authors Computation, 2017 (Eview-9.5)

The result of table 4.5 shows that the adjusted R squared ( $=0.19$ ) statistics is small which has no significant implication in the particular case of the panel ARDL model. However, the probability of F ( $=10$ ) statistics equals to zero (0) less than one (1) percent, means that the

model is overall fit and the Schwarz criterion criteria equals to 7.6 is significant, which means that the criterion selection is the best. Moreover, the final bound test for the long run associations is performed after the residuals serial correlation and the dynamic stability test. The result is shown in the bound testing for cointegration below.

#### 4.2.4.3 ARDL Residuals serial Correlation Test Result

The test for serial correlation of the residuals of the above model (Table 4.5) is carried out by using autocorrelation correlation function (ACF) with the null hypothesis “There is no serial correlation” against the alternative “There is serial correlation”.

**Table 4.6 ARDL Residuals serial Correlation Test Result**

|                             |                     |   |        |        |        |       |
|-----------------------------|---------------------|---|--------|--------|--------|-------|
| Sample: 1987 2016           |                     |   |        |        |        |       |
| Included observations: 420  |                     |   |        |        |        |       |
| Null: No serial correlation |                     |   |        |        |        |       |
| Autocorrelation             | Partial Correlation |   | AC     | PAC    | Q-Stat | Prob  |
|                             |                     |   |        |        |        |       |
| . .                         | . .                 | 1 | -0.032 | -0.032 | 0.4311 | 0.511 |

**Source: Authors Computation, 2017 (Eview-9.5)**

Table 4.6 shows that the probability of Q-Stat ( $= 0.511$  or 51.1%) is far greater than even the 10% significant level, that makes the Q statistics to be highly statistically significant leading to the acceptance of the null hypothesis and conclude that there is no serial correlation in the residuals.

## ECM Model Estimation Results

Zeta ( $\xi$ ) = -0.69 the speed of adjustment toward long run equilibrium, it is negative and statistically significant as its p value is 0.00 which is below 5% confident interval. If the system is moving out of equilibrium in one direction, it will be pooled back to equilibrium by  $\xi$ . It is the speed at which the system corrects itself to equilibrium each period.

## ECM Serial Correlation Result

The test for serial correlation of the residuals of model (4.4) is carried out by using autocorrelation correlation function (ACF) with the null hypothesis “There is no serial correlation” against the alternative “There is serial correlation”.

### 4.2.6 Granger Causality Test

Long run test causality is carried by panel Granger causality pairwise under null hypothesis of “No causality” running from the series under studies, at 5% significant level. Result is shown in the table 4.11

### Granger Causality Test Results

The results of granger causality test presented on table 4.11 reveals that;

- i. In equations 2, 4 and 9, the null hypothesis of “no Granger causality” is significantly rejected at 5% significance level for the relationship between the annual average inflation rate and the nominal effective exchange rate, the annual average inflation rate and the general price level, the nominal effective exchange rate and the general price level with both a  $p$  value of 0.00%. And conversely, the null hypothesis of “no Granger causality” is strongly significantly rejected for the relationship between the nominal effective exchange rate and the annual average inflation rate, the general price level and the annual average inflation rate, so also the general price level and the nominal effective exchange rate with

both a  $p$  value of 0.00%. Thus, test results document bidirectional causality of Granger type between the above cited variables.

- ii. Additionally, in equations 1, 3, 5 and 7 with  $p$  values largely greater than 5% the study found no significant indication of causality between the annual average inflation rate and the variation of output gap, the annual average inflation rate and the money supply, the same goes for the variation of output gap and the nominal exchange rate, so also the variation of output gap and the general price level. Equally, the hypothesis of “no Granger causality” is highly significantly accepted at 5% significance level for the relationship between the variation of output gap and the annual average inflation, the money supply and the annual average inflation rate, so also the nominal exchange rate and the variation of output gap, as well as the general price level and the output gap.
- iii. Finally, equations 6, 8 and 10 expose a highly significant one-directional acceptance of the null hypothesis of “no Granger causality” at 5 % significance level for the relationship between the variation of output gap and money supply with  $p$  value of 95%, the money supply and the nominal effective exchange rate with  $p$  value of 44%, as well as money supply and the general price level with  $p$  value of 57% on one hand; on the other, in contrary, the null hypothesis of “no Granger causality” is significantly rejected at 5% significant level for the relationship between the variation of money supply and output gap with  $p$  value of 5%, the nominal effective exchange rate and money supply with  $p$  value of 0.00%, as well as the general price level and the money supply with  $p$  value of 0.00%. Thus, test results document bidirectional causality of Granger type between the above cited variables

#### **4.2.7 Estimation of the Long Run Model (LRM)**

Restatement of the Long Run Model.

$$INF_{it} = \phi_t + \beta_1 GAP_{it} + \beta_2 M_{2it} + \beta_3 NER_{it-1} + \beta_4 INT + \delta P_{it-1} + \varepsilon_{it}$$

(4) The estimation of the long run model (4) requires a choice of the appropriate method of estimation between the Random effect model and Fixed effect model as requisite in the panel data estimation. That can be done by conducting Hausman test.

#### 4.2.7.1 Choice of the appropriate Model Result

**Table 4.12: Hausman Test Outcome**

| Correlated Random Effects – Test<br>Hausman Test<br>Equation: Untitled<br>Test period random effects |                       |              |        |
|------------------------------------------------------------------------------------------------------|-----------------------|--------------|--------|
| Test Summary                                                                                         | Chi -Sq.<br>Statistic | Chi-Sq. d.f. | Prob.  |
| Period random                                                                                        | 33.564448             | 4            | 0.0000 |

Source: Authors Computation, 2017 (Eviews-9.5)

Table 4.12 shows that the p value equals to 0.00 percent is less than 5 percent, this leads to the rejection of the null hypothesis of “Random effect is appropriate” and the acceptance of the alternative hypothesis and conclude that Fixed effect model is appropriate.

#### Estimation of the LRM Results

**Table 4.13.0 Country specific fixed Effect**

Source: Authors Computation, 2017 (Eviews-9.5)

|     |         |       |       |       |       |       |      |      |      |       |      |       |      |      |      |
|-----|---------|-------|-------|-------|-------|-------|------|------|------|-------|------|-------|------|------|------|
| 4.3 | COUNTRY | BN    | BF    | CV    | CI    | GM    | GH   | GB   | GC   | ML    | LB   | NE    | NG   | SL   | SN   |
|     | Effect  | -1.75 | -2.77 | -1.13 | -2.43 | -0.22 | 4.20 | 7.03 | 1.61 | -2.77 | 1.02 | -2.68 | 3.51 | 4.26 | -5.2 |

#### Discussion of the Findings

Restatement of representation of estimated Long Run Model in table 4.13 in EViews

$$INF = 6.43 + 0.37*INF (-1) - 0.02*GAP + 0.17*NER - 0.01*M2 - 0.09*INT - 0.03*P (-1)$$

|    |           |            |        |        |        |        |        |
|----|-----------|------------|--------|--------|--------|--------|--------|
| SE | (0.81)    | (0.03)     | (0.03) | (0.01) | (0.02) | (0.03) | (0.01) |
| t* | 7.9210.56 | -0.6712.98 | -0.21  | -2.56  | -2.71  |        |        |

The results of table of table 4.13 reveal the following;

- i. The coefficient of output gap (GAP) is negative indicating negative relationship between output gap and annual inflation rates in the Economic Community of West African States (ECOWAS) during the period 1987-2016, that is, a unit increase in the output gap leads to a decrease of the annual average inflation rates by 0.03 or 3 % in the ECOWAS member States, holding other variables constant. It is obvious that this negative sign is contrary to the a-priori expectations. Horvath & Koprnicka (2008) find a positive correlation between the output gap and inflation in the EURO area. A negative output gap is a situation where actual GDP is less than potential GDP. Furthermore, the t-statistics value of output gap coefficient equals to -0.67 below the tabula value of 1.70, its probability p value equals to 0.50 or 50% is far ahead the 5 % significant level, which means that GAP is not statistically significant. This leads to the acceptance of the null hypothesis ( $H_{01}$ ) and to the conclusion that output gap does not have a positive impact on the inflation differentials in the ECOWAS member States.
- ii. The coefficient of the variation nominal exchange (NER) is positive indicating positive relationship between the nominal effective exchange rate and the annual average inflation rates in the Economic Community of West African States (ECOWAS) during the period 1987-2016. The study found that a unit increase in the variation nominal effective exchange rate will lead to an increase of the annual average inflation rates by 0.17 or 17% in the ECOWAS region, holding other variables constant. It is also contrary to the a-priori expectations. This could be explained by the fact that the larger economies (Nigeria and Ghana) in the ECOWAS sub-region have their exchange rate depreciating over a longer period,

therefore making import prices more expensive. The result is similar to the findings of Honohan and Lane (2003) who found in their study on the subject matter that exchange rate movements have had a substantial effect on inflation movements and inflation differentials in European Monetary Union (EMU). Also, Mihaela Gurbulea, (2015) in euro country panel (2003–2013) shows that a positive change is associated with the devaluation of the currency, while a decrease in the exchange rate reflects its appreciation.

- iv) Furthermore, this study reveals that there is significant relationship existing between nominal exchange rate (NER) and annual average inflation rates since the sig-value (0.00) is less than 5 % significance level. The result also discloses that NER has significant impact on the variable INF since the t-statistic (12.98) is greater than  $\alpha$  of 0.05. So the null hypothesis ( $H_{02}$ ) can be rejected, meaning that Variation in nominal effective exchange (NER) rates have a positive effect on the inflation differentials in the ECOWAS member States.
- iii. The coefficient of money supply or liquidity (M2) is negative indicating negative relationship between money supply and annual average inflation rates in the Economic Community of West African States (ECOWAS) during the period 1987-2016. This means that a unit increase in the liquidity leads to 0.01 or 1% decrease in the annual average inflation rates in the ECOWAS member States during the period 1987-2016, holding other variables constant. It is clear that the findings are contrary to the a priori expectations. However, (Friedman, 1968) suggests that as the money supply rises in an uncontrolled manner so does the price level and lead to high inflation.
- v) Furthermore, the results show that the t-statistics value of the coefficient of the variable M2 equals to -0.21 is far below the tabula value (=1.70), its probability p value (= 0.83 or 83%) is far greater the 5 % significant level, which means that M2 is not statistically significant. This leads to the acceptance of the null hypothesis

( $H_{03}$ ) and to the conclusion that money supply does not have a positive impact on the inflation differentials in the ECOWAS member States.

- iv. The coefficient of real interest rate (INT) is negative indicating negative relationship between real interest rate and annual average inflation rates in the Economic Community of West African States (ECOWAS) during the period 1987-2016, that is, a unit increase in the real interest rate leads to a decrease of the annual average inflation rates by 0.09 or 9 % in the ECOWAS member States, holding other variables constant. The result from Table 4.13 reveals that there is significant relationship existing between money real interest rate (INT) and annual average inflation rates since the sig-value (0.01) is less than 5 % significance level. The result also reveals that the independent variable INT has significant impact on the variable INF since the t-statistic (-2.26) is greater in absolute value than  $\alpha$  of 0.05. So the null hypothesis ( $H_{04}$ ) can be rejected, meaning that increase in real interest (INT) has a negative impact on the inflation differentials in the ECOWAS region. Contrary to Honohan and Lane (2003) who found that, real interest rate and inflation have positive relationship.
- v. The coefficient of general price level (P) is negative indicating negative relationship between general price level and annual average inflation rates in the Economic Community of West African States (ECOWAS) during the period 1987-2016. The results show that a unit increase in the general price level will lead to 0.03 or 3% decrease in the annual average rate of inflation in ECOWAS members States, holding other variables constant. Furthermore, the results reveal that. reveal that the independent variable P has significant impact on the variable INF since the t-statistic (-3) is greater in absolute value than  $\alpha$  of 0.05. So the null hypothesis ( $H_{05}$ ) can be rejected, meaning that increase in the general price level (P) has a negative impact on the inflation differentials in the ECOWAS region. This confirms the rational expectation theory that past high level of consumer prices drives future

inflation. Also, the finding is in accordance with Horvath and Koprnicka (2008) who found that price level in the new EU members contributes in narrowing inflation vis-à-vis the euro area.

Moreover, the intercept of 6.43 shows that if all factors are equal to zero (0), the mean inflation rate would be equated to that value of 6.43.

Also, it should be noted a priori that the auto-regressive aspect of the model makes the immediate previous lag (INF (-1)) of the dependent variable (INF) to be included as independent variable. The coefficient of the immediate previous lag of inflation (INF (-1)) is 0.41 which means that a unit increase in the immediate previous lag of inflation increases the rate of inflation (INF) by 0.41 or 41% in the ECOWAS member States holding other variables constant during the period during the period 1987-2016. Similarly, table 4.13 shows that the probability p value (= 0.00 or 0%) of the INF(-1) coefficient is far less than 5 % significant level, also, its t-statistics is on the high side. So the immediate previous lag of the inflation is highly statistically significant leading to the conclusion that it accounts for the determination of the convergence of inflation in the ECOWAS members States. The finding confirms Mihaela Gurbulea, (2015) findings, that inflation expectations in CEE countries are backward-looking, he found the significance of the lagged inflation validates the use of a dynamic panel data model in analyzing inflation across CEE.

The overall estimate of the fixed effects constant  $\phi_i$ , shows significant variation in its value across the participating countries in ECOWAS area. Whereas, it exhibited a negative spread from the regional average in most of countries, including the entire WAEMU countries, Gambia and Cape Verde, the countries with low records of inflation, it is positive for the Gambia, Ghana, Guinea Bissau, Guinea, Nigeria,

and Sierra Leone that have poor records of inflation control vis-a-vis to the convergence.

#### 4.4 Policy Implication of the Findings

The push towards forming a single currency union in West Africa has led to a greater degree of inflation synchronization across different countries. This study suggests the following policy perspective;

- i. Finding institutional mechanisms that minimize the risk of real exchange rate overshooting is a high priority.
- ii. Furthering research on the appropriate role for discretionary fiscal policy in regional stabilization must be a high priority for European macroeconomists.
- iii. Establishing bilateral arrangements for stabilizing exchange rates between the national currency and the currencies of “fringe” trading partners (Honohan, 1999). With enlargement both of the WAEMU and the WAMZ members States, the potential gains from such arrangements will already be largely secured and, in any case, would have little impact compared to the volatility of bilateral exchange rates vis-à-vis major trading partners such as China, and Europe.
- iv. Coordination of adequate measures should be taken for boosting local production and transformation of natural resources.

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