Determinants of Trade Balance in West African Economic and Monetary Union (WAEMU): Evidence from heterogeneous panel analysis

Yaya Keho |

Published online: 03 Sep 2021.

Submit your article to this journal ↗

Article views: 3624

View related articles ↗

View Crossmark data ↗

Citing articles: 3 View citing articles ↗

*Corresponding author: Yaya Keho, Applied Economics, Ecole Nationale Supérieure De Statistique Et d'Economie Appliquée (Ensea) Abidjan, 08 BP 03 Abidjan, Côte d'Ivoire
E-mail: yayakeho@yahoo.fr

GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Determinants of Trade Balance in West African Economic and Monetary Union (WAEMU): Evidence from heterogeneous panel analysis

Yaya Keho[1]*

Abstract: This study investigates the determinants of the trade balance in West African and Monetary Union (WAEMU) over the period 1975–2017. We employ the Mean Group (MG) estimator along with the grouped mean version of Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) to deal with both endogeneity and cross-country heterogeneity. The results reveal that the trade balance is negatively related to domestic and foreign income whereas real effective exchange rate depreciation improves the trade balance in the long-run. However, the results do not confirm the short-run worsening of trade balance suggested by the J-curve. In the short-run, the trade balance is sensitive only to foreign real income but not to domestic income and real exchange rate. The country-level estimates show heterogeneity in the response of the trade balance to real exchange rate, domestic and foreign income. Overall, the findings of this study suggest that policies aimed at improving the trade balance should focus on the domestic production of imported goods, rather than devaluation.

Subjects: Monetary Economics; Econometrics; International Trade; incl; trade agreements & tariffs

Keywords: Exchange rate; trade balance; panel cointegration; WAEMU
JEL Codeds: C23; F10; F31; O55

ABOUT THE AUTHOR

Yaya KEHO, Ph. D. is currently Professor of Econometrics and Statistics at the National School of Statistics and Applied Economics (ENSEA) of Abidjan, Côte d'Ivoire. He earned his Ph.D. in Economics from the University of Saint Quentin-en-Yveline, at France. He has taught at Many Universities in Africa (Cote d'Ivoire, Benin, Burundi, Cameroon, Senegal). Prof. KEHO has published in many international revues like *South African Journal of Economics, Energy Policy, Energy, International Economic Journal, Empirical Economic Letters, Economics Bulletin, International Journal of Energy Economics and Policy, International Journal of Statistics and Economics, Journal of Statistical and Econometric Methods, International Journal of Economics and Finance, International Journal of Business and Economics, Asian Economic and Financial Review, Asian-African Journal of Economics and Econometrics*. His research interests focus on public finance, energy economics, international economics and applied econometrics.

PUBLIC INTEREST STATEMENT

Trade is an important factor of economic growth of a country through exports and imports of goods and services. Trade balance is defined as the difference between exports and imports. It is a key indicator of a country's competitiveness in the global economy. Therefore, fluctuations of the trade balance is a major concern especially for countries facing chronic trade deficits. This study investigates the determinants of the trade balance of the member countries of the West African Economic and Monetary Union (WAEMU). The results reveal that real exchange rate, domestic and foreign income are playing role in determining the trade balance of WAEMU countries, . Our interest in this study is to contribute in designing economic policies aiming at reducing the dependence of African countries on imports thereby improving their trade balance.

1. Introduction

The balance of trade is the difference between exports and imports of goods and services. It takes the form of surplus if exports exceed imports or deficit when imports are greater than exports. The trade balance is a major component of the balance of payment and a key indicator of a country's health. Its fluctuations is a major concern especially for developing countries facing chronic trade deficits. Therefore, examining its driving factors is important for creating an appropriate trade-led growth strategy.

This study investigates the determinants of the trade balance for the West African Economic and Monetary Union (WAEMU) countries over the period from 1975 to 2017. The WAEMU is made up of eight countries (Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo) which use the CFA Franc as currency. The CFA Franc was pegged to French franc and to the euro since January 1999 at a fixed rate. They follow a common monetary policy under the coordination of the Central Bank of West African States (BCEAO). WAEMU countries are experiencing persistent trade deficits, except for Côte d'Ivoire which records structurally trade surplus. Over the period 1990–1993, the trade balance deficit of the union averaged 10.7% of GDP, and the economic growth rate was 0.3%. In January 1994, the CFA franc was devalued raising the parity rate from 50 CFA francs per French franc to 100 CFA francs per French franc. It was expected that this devaluation would improve the competitiveness and the economic growth of WAEMU countries. From 1994 to 2006, the real effective exchange rate appreciated leading to a loss of competitiveness of 22%. The annual economic growth rate averaged 3.2% over the period 1997–2000. Despite this recovery, the balance of payment of the Union was characterized by persistent trade deficit which increased from 3.2% during 1990–1999 to 7% over the period 2000–2012. The reason for this chronic deficit is higher growth in imports as compared to exports. Like most of the Sub-Saharan African countries, WAEMU countries rely heavily on the export of few primary commodities meanwhile import a lot of manufactured goods, capital goods, raw materials, and intermediate products. According to the Prebisch–Singer Hypothesis, the prices of primary commodities decline relative to those of manufactured goods over the long term, causing a deterioration of the terms of trade. As primary products have a low price elasticity of demand, a decline in their prices tends to reduce export earnings, causing a deterioration of the trade balance. Determining the driving factors of the trade balance of WAEMU countries is important in order to understand the problem leading to chronic trade deficits.

A growing body of empirical studies has investigated the effects of some macroeconomic variables on the trade balance such as real exchange rate, domestic income and foreign income. Most of these studies focused on the effect of real exchange rate on the trade balance with the view of testing the Marshall-Lerner condition and the J-curve effect. The evidence from this literature is mixed and inconclusive. While a number of studies found that real exchange rate depreciation improves the trade balance (e.g., Baharumshah, 2001; Boyd et al., 2001; Kale, 2001; Musila & Newark, 2003), many others reported a negative or insignificant relationship between the two variables (e.g., Akpansung & Babalola, 2013; Bahmani-Oskooee, 1991; Rose, 1991; Rose & Yellen, 1989; Upadhyaya & Dhakal, 1997).

The lack of conclusive evidence regarding the determinants of the trade balance is the primary motivation for this research. The major factors responsible for controversial results in the empirical literature include, *inter alia*, the time period, the data measurement and the estimation method used. At the methodological level, most previous studies have relied on traditional panel estimation methods that assume cross-country homogeneity in the slope coefficients of the trade balance relationship with real exchange rate, domestic and foreign income. Accordingly, this study makes use of the Mean Group (MG) estimator suggested by Pesaran and Smith (1995) and the group mean versions of Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) estimators suggested by Pedroni (2001). It is expected that the effects of real exchange rate, domestic and foreign income on the trade balance differ across countries. To the best of our knowledge, the

paper is the first study that employs heterogeneous panel data estimation techniques in identifying the determinants of trade balance in African countries.

The rest of the study is organized as follows. Section 2 reviews the empirical literature regarding the determinants of the trade balance. Section 3 outlines the empirical model and describes the data. Section 4 reports the econometric methodology of the study. Section 5 discusses the empirical results. Section 6 concludes the study and gives some policy recommendations.

2. Literature review

In the theoretical literature, three approaches explain the fluctuations of a country's trade balance. The absorption approach argues that a country's trade balance will improve if total output exceeds total domestic spending. Therefore, currency devaluation will improve the trade balance only if the gap between domestic output and expenditure increases (Alexander, 1959; Harberger, 1950; Meade, 1951). The monetarist approach claims that the balance of payment is essentially a monetary phenomenon and explains its position by the interaction between the demand and supply of money. An excess demand (supply) for foreign goods would require more demand (supply) of the stock of money (Hahn, 1959; Mundell, 1971; Polak, 1957). If the demand of money exceeds money supply, then the excess demand for money will be satisfied by inflows of money from abroad, and this will improve the trade balance. Conversely, if money supply is greater than demand of money, the excess supply of money will be eliminated by outflows of money to abroad and this will worsen the trade balance. The elasticity approach is related to the effect of the exchange rate on the trade balance. It demonstrates that real devaluation of domestic currency has favorable effect on the trade balance if the sum of the price elasticities of exports and imports is greater than one (Lerner, 1944; Marshall, 1923). Real depreciation of the exchange rate makes the domestic goods cheaper for the trading partners and this increases exports of domestic goods and services. As imports are relatively more expensive, quantity of imports decreases resulting in an improvement in the trade balance. However, exports and imports may not react at initial period to real devaluation. Following a depreciation of the exchange rate, the trade balance may worsen and progressively improve, giving a J-curve effect (Magee, 1973).

A growing body of empirical studies have attempted to depict the determinants of the trade balance. From the empirical literature, a number of macroeconomic variables have been proved to explain the trade balance dynamics. These include domestic income, foreign income, exchange rate, foreign currency reserves, money supply, inflation, remittances, and foreign direct investment. The empirical evidence regarding the effects of these factors on the trade balance is inconclusive. For instance, Lal and Lowinger (2002) examined the determinants of the trade balance of seven East Asian countries. The results indicated that real exchange rate, domestic and foreign income are important drivers of trade balance. In a study of Malaysia, Duasa (2007) reported that domestic income has a positive effect on trade balance in line with the absorption approach, while money supply shows a negative effect consistent with the monetary view. There is no significant relationship between trade balance and real exchange rate in the long-run. Yol and Baharumshah (2007) examined the bilateral trade balance between 10 African countries and the U.S. They found that real exchange rate depreciation improves the trade balance in Botswana, Egypt, Kenya, Nigeria, Tunisia, and Uganda, but worsens that for Tanzania and has no effect in Ghana, Morocco and Senegal in the long-run. Furthermore, foreign real income improves the trade balance in Senegal, Tunisia, and Uganda, but worsens that of Egypt and Ghana. Finally, domestic real income was found to worsen the trade balance of Egypt, Ghana, Kenya, and Tunisia, but improves that of Morocco, Uganda, and Tunisia. Ng et al. (2008) applied cointegration techniques to prove that both domestic income and devaluation improve the trade balance in Malaysia. Conversely, an increase in foreign income worsens the trade balance.

Kakar et al. (2010) investigated the case of Pakistan. The results provided strong evidence that trade balance is positively related to domestic income and real exchange rate, and negatively linked to money supply. Adeniyi et al. (2011) examined four West African Monetary Zone (WAMZ) countries,

namely The Gambia, Ghana, Nigeria and Sierra Leone. They confirmed the J-curve effect only in Nigeria. In the case of The Gambia and Ghana, real devaluation initially improves the trade balance and then deteriorates it later. Akpansung and Babalola (2013) found that the trade balance is negatively related to domestic income and positively related to foreign income in Nigeria. There is a negative but insignificant relationship between trade balance and real exchange rate. Shawa and Shen (2013) found that foreign direct investment, human capital, natural resources availability, foreign income and trade liberalization have positive effects on the trade balance of Tanzania. On the other hand, household consumption expenditure, government expenditure, and inflation impact negatively on the trade balance. Real exchange rate does not affect significantly the trade balance. Osoro (2013) investigated the determinants of the trade balance in Kenya. The results showed that both depreciation of the real exchange rate and foreign direct investment have significant favorable effects on the trade balance. Igue and Ogunleye (2014) found evidence that depreciation of the exchange rate leads to an improvement of the trade balance in Nigeria. They also established that domestic income improves the trade balance. In a study on developing and transition countries in Asia, A-d. and Dinh (2014) reported that FDI inflows worsen the trade balance first and then improve it. Further, real depreciation of the exchange rate worsens the trade balance because of the import content of exports. Alege and Osabuohien (2015) investigated the foreign trade of 40 selected Sub-Saharan African countries using panel cointegration approach. They found that exchange rate depreciation in Sub-Saharan African countries may not improve their trade balance, given the heterogeneous structure of the economies and export compositions. Moreover, domestic income was found to be positively related to the trade balance. In the case of Ghana, Anning et al. (2015) reported that real depreciation of the exchange rate leads to a deterioration in the trade balance in the short-run followed by an improvement in the long-run.

Ogbonna (2016) showed that exchange rate depreciation has a long-run positive impact on the trade balance in Benin. Genemo (2017) studied the case of selected African countries using panel cointegration techniques. He found that depreciation of the real exchange rate deteriorates the trade balance in the long-run. Further, an increase in domestic income also increases demand for imports leading to a depreciation of the trade balance in the long-run. Hunegnaw and Kim (2017) examined the effects of the real exchange rate on the trade balance in East African countries. The results showed a positive long-run relationship between the trade balance and the real effective exchange rate in the long-run. Further, there was a positive long-run effect of domestic real income on the trade balance but a negative long-run effect of foreign real income. The results showed a positive but insignificant short-run effect of the exchange rate on the trade balance. The short-run effect of domestic real GDP on the trade balance was positive but insignificant while that of foreign real GDP was positive and significant. Meniago and Eita (2017) studied the case of 39 Sub-Saharan African countries and found no significant relationship between nominal exchange rate and trade balance. This may be attributable to an undiversified export base, the heterogeneous trade structure of Sub-Saharan African countries and low product quality. Trade balance was found to be positively related to nominal domestic income and negatively to nominal foreign income. Ousseini et al. (2017) investigated the main determinants of trade and current account balance of West African Economic and Monetary Union (WAEMU) for the period 1980–2013. The findings revealed a negative and significant effect of money supply, household consumption expenditure on the trade balance. On the contrary, real exchange rate, income, inflation, and investment showed significant and positive effects on the trade balance.

Akoto and Sakyi (2019) investigated the case of Ghana using symmetric and asymmetric autoregressive distributed lag models. The results revealed that depreciation of the exchange rate does not improve the trade balance. Further, household consumption expenditure, government consumption expenditure and domestic prices are negatively and significantly related to the trade balance in the long and short-run. Conversely, foreign income and money supply have a positive and significant relationship with the trade balance in the short-run. Dongfack and Ouyang (2019) found that the real exchange rate depreciation improves the trade balance in the long-run in Cameroon. In addition, domestic income has a positive impact whereas foreign income has a negative impact on the trade

balance. Yazgan and Ozturk (2019) examined the relationship between real effective exchange rate and the bilateral trade flows of 33 countries. For the majority of the countries, the real exchange rate depreciation was found to improve the trade balance in the long-run. Kaya (2020) examined the bilateral trade balance between Turkey and its 25 main trade partners. The results showed that the real exchange rate depreciation leads to an improvement in the trade balance. Keho (2020) examined the impact of FDI on the trade balance in Cote d'Ivoire. The results revealed that domestic income, real effective exchange rate and foreign direct investment are important drivers of the trade balance. The real depreciation of domestic currency was found to improve the trade balance in both the long and short-run. On the other hand, FDI and domestic income have negative relationship with the trade balance in the long-run. Nga (2020) investigated the determinants of the trade balance in Vietnam. He found that foreign direct investment and trade openness have negative effects on the trade balance, whereas the exchange rate is insignificantly related to the trade balance. In a recent study, Keho (2021) found a positive effect of the real exchange rate depreciation and a negative effect of domestic income on the trade balance in Cote d'Ivoire.

As this review clearly shows, there are differences between countries in terms of the determinants of their trade balance. In some countries, the trade balance is significantly related to the real exchange rate, while the relation is not significant for others. There are structural differences between developed and developing countries that may explain heterogeneity in the trade balance behavior. Many developing countries rely on a limited number of primary commodities to generate their export earnings. The Prebisch–Singer Hypothesis argues that the prices of the primary commodities relative to manufactured goods have a downward trend over time. As primary products show a low price elasticity of demand, developing countries will experience chronic trade imbalances compared to other countries that rely on manufactured goods. Although Sub-Saharan African countries export essentially primary goods, they differ with respect to the structure of their trade. Some export cocoa, coffee, cotton whose world prices do not fluctuate like those of crude oil, uranium and other precious metal. Another difference among the countries is the exchange rate regime. Some countries like those of the franc zone have a fixed exchange rate system, while others have adopted a floating exchange rate regime of which they experience considerable fluctuations in the exchange rates.

3. Model and data

3.1. Model specification
To examine the determinants of the trade balance, we use the trade model incorporating real exchange rate, domestic income and foreign incomes as control variables:

$$lnTB_{it} = \beta_{0i} + \beta_{1i}lnY_{it} + \beta_{2i}lnYF_{it} + \beta_{3i}lnRER_{it} + \beta_{4i}D94_{it} + \mu_{it} \qquad (1)$$

where ln represents natural logarithm, TB_{it} denotes the trade balance on goods and services, Y_{it} is real gross domestic income, YF_{it} is foreign real income, RER_{it} is the real effective exchange rate, $D94_{it}$ is a shift dummy variable that takes the value of zero for the period before 1994 and one otherwise, and μ_{it} is an error term assumed to be a white-noise process. The dummy variable D94 was included to account for the effect of the devaluation of the CFA franc in 1994. Our empirical model allows all slope coefficients to vary across countries.

The coefficients on domestic income is expected to be negative. An increase in domestic income will increase domestic demand for goods and services, and subsequently cause a deterioration in the trade balance. Real exchange rate depreciation, that is a decrease in real exchange rate, is expected to improve the trade balance. Hence, the coefficient on real effective exchange rate is expected to bear a negative sign. The coefficient on foreign income is expected to be positive. An increase in foreign income will stimulate exports, and consequently improve the trade balance.

3.2. Data description

The study uses panel data covering the period from 1975 to 2017, for seven member countries of the West African Economic and Monetary Union (WAEMU). The countries under study are: Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, and Togo. The dependent variable of the study is the trade balance measured as the ratio of exports to imports. An increase (decrease) in this ratio indicates an improvement (deterioration) in the trade balance. The explanatory variables are domestic real GDP in constant US dollar as a proxy for domestic income, world real GDP in constant US dollar as a proxy for foreign income, and real effective exchange rate. All variables were transformed into natural logarithm in the empirical analysis. Data on trade balance, domestic real GDP, and world real GDP were extracted from the 2019 World Development Indicators database of the World Bank. Data on real effective exchange rate (RER) were retrieved from the Central Bank of West African States (BCEAO). The indicator for real effective exchange rate is such that an increase (decrease) means a real appreciation (depreciation) of the domestic currency.

The descriptive statistics of the logarithmic transformation of the variables are presented in Table 1. As this Table shows, there is a wide disparity among countries. For instance, domestic income averages about 22.467 in the overall panel and ranges between 21.611 (Togo) and 23.755 (Cote d'Ivoire). The correlation coefficients indicate that real exchange rate and trade balance are positively correlated in three countries and negatively related in four countries. This provides evidence of cross-country heterogeneity in the relationship between the real exchange rate and the trade balance. For the whole panel, the trade balance has a negative relationship with the real exchange rate.

Table 2 reports the correlation matrix among the variables. This Table shows that domestic and foreign income conjugate a positive and significant relationship with the trade balance, whereas the real exchange rate is negatively correlated with the trade balance.

4. Econometric methodology

The empirical investigation of the determinants of trade balance will follow a four-stage process. As a first step, we test for the order of integration of the series by means of unit root tests. In a second step, we examine the existence of a long-run relationship among the variables. The third step provides estimates of the long-run coefficients associated with control variables. Finally the short-run dynamic of the trade balance is estimated.

4.1. Testing for unit root

To check the stationarity of the variables, the study uses panel unit root tests which are stronger than unit root tests in time series data. However, one problem with panel data analysis concerns the issue of heterogeneity. If the countries of the panel show different dynamics in the variables, the unit root test must account for this cross-country heterogeneity. Hence, this study uses the IPS test developed by Im et al. (2003) and the ADF-Fisher Chi-square test suggested by Maddala and Wu (1999) to test the stationarity of the variables. Basically, these tests are extensions of the traditional Augmented Dickey-Fuller (ADF) unit root test for univariate time series modelling. The basic equation for conducting the panel unit root test is as follows:

$$\Delta z_{it} = \alpha_i + \rho_i z_{it} + \sum_{j=0}^{m_i} \gamma_{ij} \Delta z_{it-j} + \varepsilon_{it} \tag{2}$$

where as $\Delta z_{it} = z_{it} - z_{it-1}$, z_{it} represents the variable under consideration, α_i denotes the individual fixed effect, m_i is the lag order, and ϵ_{it} is an error term. Both ρ_i and m_i are permitted to vary across the countries. On the basis of the model, the null hypothesis to be tested is that each series in the panel contains a unit root (*i.e.*, H_0: $\rho_i = 0$ for all *i*) against the alternative hypothesis that some of the individual series are stationary (*i.e.*, H_1: $\rho_i < 0$ for at least one *i*). The IPS test applies the ADF test to individual series and computes the test statistic as the average of all individual ADF statistics.

Table 1. Descriptive statistics of the variables					
Country	**lnTB**	**lnY**	**lnYF**	**lnRER**	**ρ**
Benin	4.110	22.119	31.415	4.793	−0.798*
Burkina Faso	3.765	22.212	31.415	4.766	−0.700*
Cote d'Ivoire	4.746	23.755	31.415	4.663	−0.588*
Mali	4.067	22.456	31.415	4.841	−0.769*
Niger	4.162	22.072	31.415	4.852	0.551*
Senegal	4.245	23.047	31.415	4.835	0.460*
Togo	4.341	21.611	31.415	4.696	0.488*
Panel	**4.205**	**22.467**	**31.415**	**4.778**	**−0.310***

Note: TB, Y, YF and RER, denote trade balance, real GDP, world real GDP, and real effective exchange rate, respectively. TB is defined as 100*X/M, where X denotes exports and M is imports. The figures reported in the Table are the sample average of the variables; ρ refers to the correlation coefficient between trade balance and real effective exchange rate. (*) indicates statistical significance at the 5% level.

Table 2. Correlation matrix between the variables				
Variables	**lnTB**	**lnY**	**lnYF**	**lnRER**
lnTB	1.000			
lnY	0.515*	1.000		
lnYF	0.155*	0.512*	1.000	
lnRER	−0.310*	−0.466*	−0.794*	1.000

Note: TB, Y, YF and RER, denote trade balance, real GDP, world real GDP, and real effective exchange rate, respectively. (*) indicates statistical significance at the 5% level.

Maddala and Wu (1999) developed a Fisher-type test that combines probability values from individual unit root tests. The test statistic for the panel is computed as:

$$\lambda = -2\sum_{i=1}^{n}\ln(p_i) \tag{3}$$

where p_i is the *p-value* from the ADF unit root test for cross-section *i*. The null and alternative hypotheses are the same as for the IPS test. Under the hypothesis of cross-sectional independence, the MW test statistic has a Chi-square distribution with *2 n* degrees of freedom.

4.2. Testing for cointegration

To examine the existence of a long-run relationship among the variables, we employ Pedroni (2004) residual-based test for cointegration. This test allows for heterogeneity among cross-sectional units of the panel. To briefly describe this test, we write the long-run relationship between the variables as follows:

$$y_{it} = \alpha_i + \beta_i x_{it} + \mu_{it} \tag{4}$$

where y_{it} is the dependent variable and $x_{it} = (lnY_{it}, lnYF_{it}, lnRER_{it})$ is the vector of explanatory variables, assumed to be cointegrated with slope β_i, which may vary across countries; μ_{it} is a stationary disturbance term.

The test collects the residuals from Eq.(4) and performs ADF test using the following regression for each country:

$$\Delta\hat{\mu}_{it} = p_i\hat{\mu}_{it} + \sum_{j=0}^{k_i}\gamma_{ij}\Delta\hat{\mu}_{it-j} + e_{it} \tag{5}$$

Based on various statistical methods, Pedroni (2004) has developed seven different statistics to test for cointegration. Four of them refer to as within-dimension (pooled) while three are based on between-dimension (group mean). The within dimension approach pools the autoregressive coefficients across countries. The group mean tests are based on averages of the individual autoregressive coefficients associated with unit root tests applied to the residuals of each panel member. For the tests based on within-dimension, the null hypothesis is H_0: $\rho_i = 0$ for all i, against the alternative H_1: $\rho_i = \rho < 1$. For the tests based on between-dimension the null hypothesis is H_0: $\rho_i = 0$ for all i and the alternative is H_1: $\rho_i = <1$ for each i. For the seven statistics, critical values were tabulated by Pedroni through Monte Carlo simulations. If the values of the statistical tests are lower than their respective critical values, then the null hypothesis of no cointegration can be rejected.

4.3. Estimation methods

In the presence of cointegration, we proceed with estimation of the long-run relationship among the variables. Traditional panel data estimators (*i.e.*, random effects, fixed effects, and GMM) impose homogeneity of all slope coefficients, allowing only the intercept to vary across groups. If the effect of a factor on the trade balance varies across countries, forcing a single coefficient on the entire panel may result in an inconsistent estimate. The assumption of slope homogeneity is difficult to reconcile with observed patterns of trade balance across WAEMU countries: except Cote d'Ivoire, the other countries record structural trade deficit. Another major concern with standard panel estimation methods is about the possible endogeneity stemming from some regressors, notably real exchange rate and domestic income. While higher income level is expected to result in higher trade flows, in turn, higher income level could be brought about by higher trade flows. In other words, trade flows and domestic real income may be mutually causal. Therefore, for the analysis of the determinants of the trade balance in WAEMU countries, we use the dynamic Mean Group (MG) estimator designed by Pesaran and Smith (1995) in the ARDL framework along with the grouped mean versions of Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) suggested by Pedroni (2000, 2001). These estimators not only perform better in small samples but also control for the likely endogeneity of the regressors and serial correlation. The grouped mean estimators are derived by averaging the individual cross-section estimators. They provide consistent estimates of the sample mean of the long-run coefficients in presence of cross-sectional heterogeneity and suffer from much lower small sample size distortions than the pooled estimators (Pedroni, 2001).

To explain the FMOLS and DOLS estimators, we consider the long-run relationship between the variables as follows

$$y_{it} = \alpha_i + \beta_i'x_{it} + \mu_{it}$$
$$x_{it} - x_{it-1} = \varepsilon_{it} \tag{6}$$

where the variables y_{it} and x_{it} are non-stationary, and the vector error terms $e_{it} = (\mu_{it}, \varepsilon_{it})' \square$ I(0) have asymptotic covariance matrix $\Omega_i = L_iL_i'$, where L_i is a lower triangular decomposition of Ω_i. This covariance matrix can be decomposed as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i'$, where Ω_i^0 is the contemporaneous covariance and Γ_i is a weighted sum of autocovariances. The group-mean panel FMOLS estimator for the coefficient β is given as:

$$\hat{\beta}_{FMOLS} = \frac{1}{n}\sum_{i=1}^{n}\left[\left(\sum_{t=1}^{T}(x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)'\right)^{-1}\left(\sum_{t=1}^{t}(x_{it} - \bar{x}_i)y_{it}^* - T\hat{\gamma}_i\right)\right] \tag{7}$$

where y_{it}^* is the transformed variable to correct for endogeneity, and γ_i the parameter for adjustment of serial correlation, defined as follows

$$y_{it}^* = (y_{it} - \bar{y}_i) - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta x_{it} \qquad (8)$$

$$\hat{y}_i = \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \left(\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0 \right) \qquad (9)$$

The DOLS estimator provides a robust correction of endogeneity and serial correlation by augmenting the panel cointegration equation with leads and lags of the first differenced explanatory variables. More precisely, the DOLS estimator is obtained by running the following regression:

$$y_{it} = \beta_i' x_{it} + \sum_{j=-p1}^{p2} \gamma_{ij}' \Delta x_{it-j} + \mu_{it} \qquad (10)$$

where *p1* denotes the maximum lead length and *p2* is the maximum lag length chosen using AIC criterion.

The group-mean panel DOLS estimator for the vector of coefficients β is given by:

$$\hat{\beta}_{DOLS} = \frac{1}{n} \sum_{i=1}^{n} \left[\left(\sum_{t=1}^{T} z_{it} z_{it}' \right)^{-1} \sum_{t=1}^{T} z_{it} y_{it}^* \right] \qquad (11)$$

where $z_{it} = (x_{it} - \bar{x}_i, \Delta x_{it-q}, \ldots, \Delta x_{it+q})$ and $y_{it}^* = y_{it} - \bar{y}_i$, with $\bar{y}_i = \sum_{t=1}^{T} y_{it}/T$ the mean for each group and similarly for $\bar{x}_i$.

The Mean Group estimator suggested by Pesaran and Smith (1995) considers an ARDL model for trade balance, as follows:

$$y_{it} = \sum_{j=1}^{m} \phi_{ij} y_{it-j} + \sum_{j=0}^{n} \gamma_{ij}' x_{it-j} + \alpha_i + \mu_{it} \qquad (12)$$

This model can be re-specified as an error-correction equation:

$$\Delta y_{it} = \lambda_i \left(y_{it-1} - \beta_i' x_{it} \right) + \sum_{j=1}^{m-1} \phi_{ij} \Delta y_{it-j} + \sum_{j=0}^{n-1} \gamma_{ij} \Delta x_{it-j} + \alpha_i + \mu_{it} \qquad (13)$$

The ARDL error-correction model is estimated for each country and mean group estimator computes averages of the individual cross-section coefficients. The Mean Group estimation allows the short and long-run parameters to be estimated jointly and alleviates the problem of endogeneity through the inclusion of sufficient lags of the variables. Additionally, it can be applied when the variables are of mixed orders of integration, namely I(0) and I(1).

5. Empirical results

Before proceeding with the analysis of the determinants of trade balance, we first of all check the order of integration of the variables by means of panel unit root tests. The results are portrayed in Table 3. As can be seen from this Table, both IPS and ADF-Fisher tests indicate that the null hypothesis of unit root cannot be rejected for all variables at the 5 percent level of significance. However, the null hypothesis of unit root is rejected when applied to the first differences of the variables. Thus, we can regard the variables as being integrated of order one.

After checking the stationarity of the variables, we test whether there is a long-run relationship among them. The results of panel cointegration tests are reported in Table 4. They show that six of the seven test statistics reject the null hypothesis of no cointegration.

The individual country cointegration test results are reported in Table 5. With the exception of Mali, the cointegration test statistics developed by Johansen and Juselius (1990) reject the null hypothesis of no cointegration in favor of at least one cointegrating vector in the other six countries. Both the Trace and Max-eigen statistics simultaneously identify one cointegrating vector in Benin, Cote d'Ivoire, Niger, and Togo. In addition, while the Max-eigen test statistic fails to identify a cointegrating relation, the Trace statistic suggests one cointegrating relation in the case of Burkina Faso and Senegal. Thus, according to the Johansen test, trade balance is cointegrated with real exchange rate, domestic income and foreign income in six of seven countries. Overall, the results from individual and panel analysis provide support for the existence of a long-run relationship between trade balance, real exchange rate, domestic and foreign income.

Having established the existence of cointegration among the variables, we next set out to estimate the long-run effects associated to explanatory variables using Mean Group, FMOLS, and DOLS estimators. Table 6 displays the results at individual as well as panel levels. The panel results show that the long-run elasticity of the trade balance with respect to real exchange rate is statistically significant and negative in FMOLS, indicating that a depreciation of the real exchange rate leads to an improvement in the trade balance of WAEMU as a whole. The point estimate indicates that trade balance is inelastic with respect to changes in the real effective exchange rates (*i.e.*, the absolute value of elasticity is less than one). The depreciation of real effective exchange rate by one percent improves the trade balance by approximately 0.405% in the whole panel. Intuitively, the real depreciation of the domestic currency will decrease export prices and increase those of imports, inducing export quantity to rise and import quantity to decrease, thereby improving the trade balance. This finding suggests that quantity effects dominate price effects in the long-run. The long-run improving effect of the real exchange rate depreciation on the trade balance is consistent with many studies (e.g., Anning et al., 2015; Boyd et al., 2001; Dongfack & Ouyang, 2019; Kakar et al., 2010; Lal & Lowinger, 2002; Ogbonna, 2016; Ousseini et al., 2017) but contradicts with others (e.g., A-d. & Dinh, 2014; Akpansung & Babalola, 2013; Meniago & Eita, 2017; Nga, 2020; Shahbaz et al., 2011).

Furthermore, trade balance has a negative long-run relationship with both real domestic income and foreign income. As domestic income increases, people demand more goods and services, which in turn increases imports, resulting in lower trade balance in the long-run. This finding endorses Genemo (2017) and Keho (2020) who found a negative relationship between domestic income and the trade balance in selected African countries, and Cote d'Ivoire, respectively. But the finding contradicts with Hunegnaw and Kim (2017), Ousseini et al. (2017) who reported a positive long-run effect of domestic real GDP on the trade balance in East African countries, WAEMU, and Uganda, respectively. Also, an increase in foreign income results in a decrease in the demand for locally produced goods and this would reduce exports from WAEMU countries, causing a deterioration in the trade balance. Dongfack and Ouyang (2019) came out with similar finding in the case of Cameroon. Ng et al. (2008) also reported a negative relationship between foreign income and trade balance in Malaysia. If the growth in foreign income is due to an increase in the foreign production of import-

Table 3. Results of panel unit root tests				
	Level		**First difference**	
	IPS test	**ADF-Fisher test**	**IPS test**	**ADF-Fisher test**
lnTB	−0.834 [0.201]	24.386 [0.041]	−13.364* [0.000]	161.200* [0.000]
lnY	8.451 [1.000]	0.111 [1.000]	−12.328* [0.000]	148.615* [0.000]
lnYF	3.325 [0.999]	1.467 [1.000]	−10.611* [0.000]	121.885* [0.000]
lnRER	−0.321 [0.374]	11.943 [0.610]	−12.439* [0.000]	154.715* [0.000]

Notes: TB, Y, YF and RER, denote trade balance, domestic real GDP, world real GDP, and real effective exchange rate, respectively. The tests equations include individual effects and *p-values* are given in brackets. Optimal lag length was determined using AIC with a maximum of 5. The asterisk * denotes rejection of the null hypothesis of unit root at the 5% significant level.

cogent ·· economics & finance

Table 4. Results of pedroni panel cointegration tests

Statistics	Without trend		With trend	
	Statistic	**Prob.**	**Statistic**	**Prob.**
Within-dimension				
Panel v-Statistic	−0.299	0.617	−1.721	0.957
Panel rho-Statistic	−2.439*	0.007	−2.459*	0.007
Panel PP-Statistic	−4.051*	0.000	−5.262*	0.000
Panel ADF-Statistic	−4.029*	0.000	−4.181*	0.000
Between dimension				
Group rho-Statistic	−2.331**	0.009	−1.449**	0.073
Group PP-Statistic	−5.516*	0.000	−5.945*	0.000
Group ADF-Statistic	−4.441*	0.000	−4.702*	0.000

Note: The lag orders are chosen by Akaike information criterion with a maximum set to five. The asterisks * and ** denote significance at the 5% and 10% levels, respectively.

substitute goods, then their imports will decline as income increases. Alternatively, this finding may be explained in the view of the Prebisch–Singer Theory. Many Sub-Saharan countries export a small number of primary commodities whose prices relative to manufactured goods decline over time, according to the Prebisch–Singer Hypothesis. Manufactured goods have a greater income elasticity of demand than primary products. Therefore, as foreign income rise, the demand for manufactured goods will increase more rapidly than demand for primary products. Consequently, the volume of exported primary products from African countries will not increase substantially. In addition, as these products have a low price elasticity of demand, a decline in their prices will reduce nominal export earnings, causing a deterioration of the trade balance. The significant relationship between domestic and foreign income and the trade balance suggests that domestic and foreign shocks are the driving forces of the trade balance in WAEMU countries. The most important variable affecting the trade balance is real foreign demand shock whose coefficient is the largest in absolute value.

As expected, the country-level results show considerable heterogeneity in the relationship between trade balance and its determinants. The elasticity of trade balance with respect to real exchange rate

Table 5. Individual Johansen cointegration test results

Country	Trace statistic					Max-Eigen statistic			
	r = 0	*r = 1*	*r = 2*	*r = 3*		*r = 0*	*r = 1*	*r = 2*	*r = 3*
Benin [2]	66.643*	36.565	17.259	3.582		30.078**	19.306	13.676	3.582
Burkina Faso [1]	66.570*	43.071*	21.760	7.027		23.499	21.311	14.732	7.027
Cote d'Ivoire [2]	74.545*	31.669	12.294	4.428		42.876*	19.374	7.866	4.428
Mali [1]	57.792	31.922	14.333	6.066		25.869	17.589	8.266	6.066
Niger [2]	69.521*	30.742	12.657	5.194		38.779*	18.084	7.463	5.194
Senegal [1]	64.871*	39.690	18.654	6.982		25.180	21.036	11.671	6.982
Togo [1]	61.771**	31.160	9.492	3.502		30.611**	21.667	5.989	3.502

Note: (*) and (**) denote rejection of the null hypothesis at the 5% and 10% significance levels, respectively. The model includes a time trend variable. Figures in front of each country refer to the lag length as determined by Akaike information Criteria (AIC).

Table 6. Long-run estimates of the trade balance								
Country	**MG**			**FMOLS**			**DOLS**		
	lnY	**lnYF**	**lnRER**	**lnY**	**lnYF**	**lnRER**	**lnY**	**lnYF**	**lnRER**
Benin	−3.600* [−3.394]	−3.163** [−1.694]	−0.240 [−0.584]	−2.317* [−3.624]	−1.228 [−0.945]	−0.577* [−2.096]	−2.986* [−3.971]	−2.614** [−1.755]	−0.369 [−1.201]
Burkina Faso	−1.710 [−1.446]	−9.845* [−2.648]	3.334** [1.765]	−0.197 [−0.265]	−6.228* [−2.571]	−0.369 [−0.358]	−3.789* [−4.394]	−15.752* [−2.545]	4.262* [4.297]
Cote d'Ivoire	−0.625* [−3.040]	0.002 [0.001]	−1.578* [−3.751]	−0.599* [−5.453]	0.768 [1.010]	−1.119* [−6.178]	−0.863* [−5.125]	−0.972 [−0.711]	−1.398* [−4.619]
Mali	1.918* [2.498]	−1.914 [−0.785]	−1.391* [−2.408]	1.090* [2.040]	1.334 [0.781]	−0.668** [−1.679]	3.176* [5.237]	−11.410* [−4.612]	−3.201* [−9.027]
Niger	−0.126 [−0.328]	−1.463 [−0.731]	−1.064** [−1.683]	−0.262 [−1.119]	−0.408 [−0.336]	−0.758* [−2.050]	−1.346* [−2.189]	−13.077* [−3.173]	0.193 [0.269]
Senegal	−1.044** [−1.861]	−6.417* [−2.100]	1.046 [1.330]	−0.841* [−2.721]	−2.364** [−1.713]	0.462 [1.058]	−3.276* [−3.170]	0.575 [0.104]	0.307 [0.253]
Togo	−0.430* [−1.956]	−1.213 [−1.120]	0.199 [1.124]	−0.267* [−1.965]	−0.860 [−1.176]	0.193 [1.556]	−0.397 [−0.609]	−0.205 [−0.061]	0.744* [2.205]
Panel	**−0.802** [−1.**271**]	**−3.431*** [−2.**602**]	**0.043** [0.**067**]	**−0.485*** [−2.**844**]	**−1.283*** [−2.**323**]	**−0.405*** [−2.**196**]	**−1.354*** [−5.**014**]	**−6.208*** [−5.**075**)	**0.076** [0.**292**]

Note: The dependent variable is the trade balance (TB) defined as log(X/M), where X and M are exports and imports, respectively. Y is domestic real GDP, YF is world real GDP, and RER is the real effective exchange rate. The model includes a time trend and a dummy variable taking value 1 from 1994 to 2017 and zero otherwise. The optimal lag length was selected based on the AIC criterion with maximum lag set to 3. Figures in brackets are *t*-statistics. (*) and (**) indicate significance at the 5% and 10% levels, respectively.

is statistically significant in six countries but carries a negative sign in four countries (Benin, Cote d'Ivoire, Mali, Niger) with an elasticity ranging between −3.201 (Mali) and −0.577 (Benin). This finding suggests that a depreciation of the real exchange rate would improve the trade balance of these four countries. Conversely, a depreciation of the real exchange rate would deteriorate the trade balance in Burkina Faso and Togo, as the elasticity is positively signed. The insignificant coefficient on real exchange rate in the case of Senegal implies that the trade balance of this country does not respond significantly to movements in the real effective exchange rate in the long-run. For Marshall-Lerner condition to hold, the coefficient of real exchange rate should be negative, *i.e.* depreciation of the real exchange rate leads to improvement in the trade balance. The findings of this study provide evidence supporting the Marshall-Lerner condition in four of the seven countries. It follows that the policy of exchange rate depreciation may not have the desired effects of improving the trade balance in all WAEMU countries.

A significant negative long-run effect of domestic real income was found in six countries (Benin, Burkina Faso, Cote d'Ivoire, Niger, Senegal, and Togo). This suggests that an increase in domestic income in each of these countries will stimulate the demand for imported goods, hence leading to a deterioration of the trade balance. Unexpectedly, an increase in domestic real income causes the trade balance to improve in Mali, which implies that the supply side factors are the driving force in improving trade balance in that country. Similarly, the long-run effect of foreign real income is statistically significant and surprisingly negative in five countries (Benin, Burkina Faso, Mali, Niger, Senegal), implying that an increase in world income causes the trade balance to deteriorate. In the case of Cote d'Ivoire and Togo the trade balance is not significantly related to world income.

After estimated the long-run relationship between the variables, the error correction model was estimated to analyze the short-run dynamics of the trade balance. Results are displayed in Table 7. The coefficient on the lagged error correction term (ECT) has the expected negative sign and is statistically significant for all countries as well as the panel. This provides additional evidence in support of the presence of a long-run relationship among the variables. The magnitude of this coefficient indicates the response of trade balance to deviation from the long-run relationship. For the panel, the trade

cogent -- economics & finance

Table 7. Short run results from mean group estimation				
Country	**ΔlnY**	**ΔlnYF**	**ΔlnRER**	**ECT**
Benin	1.934* [2.500]	0.729 [0.472]	0.008 [0.028]	−0.654* [−4.540]
Burkina Faso	−1.399* [−2.121]	4.588* [2.557]	−1.017* [−3.661]	−0.371* [−3.733]
Cote d'Ivoire	−0.359 [−1.140]	0.098 [0.079]	0.266 [1.421]	−0.712* [−5.249]
Mali	−0.687 [−1.273]	−0.726 [−0.377]	0.556** [1.644)	−0.819* [−5.324]
Niger	−0.026 [−0.064)	1.656 [0.972]	0.708* [2.316]	−0.717* [−4.690]
Senegal	0.710*[1.986]	0.261 [0.257]	−0.291** [−1.796]	−0.312* [−2.813]
Togo	0.634 [1.578)	0.956 [0.630]	−0.121 [−0.447]	−1.072* [−6.153]
Panel	**0.115** [**0.280**]	**1.080**** [**1.665**]	**0.015** [**0.071**]	**−0.665*** [−6.**771**]

Note: The dependent variable is ΔTB defined as Δln(X)-ΔlnM, where X and M are exports and imports, respectively. Y denotes domestic real GDP, YF is world real GDP, and RER is the real effective exchange rate. *t*-statistics are enclosed in brackets. The asterisks * and ** indicate significance at the 5% and 10% levels, respectively.

balance does not respond significantly to domestic income and real exchange rate in the short-run. Thus, real exchange rate cannot be used for correcting deficit in trade balance in the short-run. Meanwhile, the world income has a positive and significant coefficient, meaning that world economic growth improves trade balance in the short-run. Other things remain the same, a one percent increase in foreign real income leads to about 1.08 percentage point increase in the trade balance. Thus, world economic growth is playing a significant role in improving the trade balance of WAEMU.

Looking at the country estimates, the short-run elasticity of trade balance with respect to real exchange rate is negative and significant in Burkina Faso and Senegal, implying that the real exchange rate depreciation would improve the trade balance of these two countries in the short-run. Other things remain the same, when the exchange rate depreciates by one percentage point, the trade balance appreciates by about 1.1 and 0.3 percentage points in Burkina Faso and Senegal, respectively. Conversely, there is a positive and significant relationship between the exchange rate and the trade balance in Mali and Niger, suggesting that depreciation of the real exchange rate would worsen the trade balance. More precisely, a depreciation of the real exchange rate by one percentage point brings about 0.6 and 0.7 percentage points depletion in the current year balance of trade in Mali and Niger, respectively. Thus, the responsiveness of the trade balance reflects the existence of the J-curve effect only in the case of Mali and Niger. The coefficient on real exchange rate is insignificant in Benin, Cote d'Ivoire, and Togo.

The results also show that the trade balance is positively related to domestic real income in Benin and Senegal, and negatively in Burkina Faso. Other things remain the same, a one percentage increase in the country's real GDP brings about an improvement in the trade balance by 1.9 and 0.7 percentage points in Benin and Senegal, respectively. Conversely, a one percentage increase in domestic real income causes about a 1.4 percentage point drop in the trade balance in Burkina Faso. The negative response of the trade balance to domestic income in Burkina Faso supports the Keynesian argument that an increase in income leads to increased demand for foreign goods, thus deteriorating the trade balance. The result for foreign income shows that an increase in world economic growth causes an improvement in the trade balance only in Burkina Faso. For the other six countries, the effect of foreign income on the trade balance is not significant.

6. Conclusion
This study has examined the determinants of the trade balance of West African Economic and Monetary Union (WAEMU) over the period 1975–2017. Based on the empirical literature, domestic income, foreign income and the real effective exchange rate were used as potential determinants of the trade balance. The trade balance was defined by the ratio of exports to imports. After determining the order of integration of the variables by mean of panel unit root tests, cointegration tests confirm the existence of a long-run relationship among the variables at both

country and panel levels. For the purpose of estimating the long-run coefficients, Mean Group, grouped mean versions of Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) estimators have used to deal with endogeneity, serial correlation and heterogeneity. The results for the panel indicate that trade balance is negatively related to real effective exchange rate, domestic and foreign income. This finding implies that a real depreciation of the exchange rate will lead to an improvement in the trade balance in the long-run. Further, the trade balance worsens as real domestic income and foreign income increases. The results from the short-run estimates show that trade balance is sensitive only to foreign real income but not to domestic income and real exchange rate. This suggests that a depreciation of real exchange rate does not impact on the trade balance in the short-run. Such a finding is not consistent with the theory of the J-curve for WAEMU as a whole. The country-level results show cross-country heterogeneity in the relationship between real exchange rate, domestic income, foreign income and the trade balance.

The implication of the study is that real exchange rate adjustments can ensure long-run favorable balance of trade in WAEMU as a whole. But there are only four out of the seven countries for which the real exchange rate depreciation would improve the trade balance (Burkina Faso, Cote d'Ivoire, Mali, and Niger). This suggests that devaluation-based policies may not be effective in improving the situation of all WAEMU countries. As WAEMU countries are locked together in a fixed exchange rate system, they cannot use directly devaluation to improve their trade balance. As major actor of the monetary policy, local financial markets should be controlled for so that they cannot bring into collapse the currency market. Governments should ensure a low degree of exchange rate pass-through to domestic prices in order to stabilize the real effective exchange rate.

The study also reveals that domestic demand plays a role in driving the trade balance in WAEMU. Consequently, the study recommends that policies aimed at correcting deficit in the trade balance should focus on the domestic production of imported-substituted goods, rather than real devaluation of domestic currency. Given the long-run downward trend in prices of export commodities, WAEMU countries should diversify their export portfolio to include manufactures or services.

The findings of this study show that the controversy on the determinants of the trade balance is far from over. The reasons behind the inconclusive evidence could be different estimation methods, data, control variables and nonlinearity. To this regard, it is worth noting that this study is not free of shortcomings. First, we have used the aggregate trade balance between each member country of WAEMU with the rest of the world. As each country has different export and import prices with its trade partners, the impact of exchange rate, domestic and foreign income on the trade balance may vary across trade partners. Exchange rate depreciation may improve the trade balance with one country, but at the same time, it may worsen the trade balance with another country. Using aggregated trade data, the results may suffer from aggregation bias. Second, our analysis did not consider the possibility of asymmetric effects of exchange rate on the trade balance. It was assumed that the effect of exchange rate change on the trade balance is symmetric. If this assumption does not hold, results from linear model may be misleading. Recently, the possibility that the trade balance responds differently to the exchange rate appreciations and depreciations has been rising in the economic literature as a relevant issue. We intend to investigate these lines of research in future works.

Author details
Yaya Keho[1]
E-mail: yayakeho@yahoo.fr
[1] Applied Economics, Ecole Nationale Supérieure De Statistique Et d'Economie Appliquée (Ensea) Abidjan, 08 BP 03 Abidjan, Côte d'Ivoire.

References
A-d., T. T., & Dinh, T. T. B. (2014). FDI inflows and trade imbalances: Evidence from developing Asia. *European Journal of Comparative Economics, 11*(1), 147–169.

Adeniyi, O., Omisakin, O., & Oyinlola, A. (2011). Exchange rate and trade balance in West African Monetary Zone: Is there a J-Curve? *The International Journal of Applied Economics and Finance*, 5(3), 167–176. https://doi.org/10.3923/ijaef.2011.167.176

Akoto, L., & Sakyi, D. (2019). Empirical analysis of the determinants of trade balance in post-liberalization Ghana. *Foreign Trade Review*, 54(3), 177–205. https://doi.org/10.1177/0015732519851632

Akpansung, A. O., & Babalola, S. J. (2013). Effects of real exchange rate on trade balance: Empirical evidence from Nigeria. *Asian Journal of Empirical Research, 3* (5), 605–617.

Alege, P. O., & Osabuohien, E. S. (2015). Trade-Exchange rate Nexus in Sub-Saharan African countries: Evidence from panel co-integration analysis. *Foreign Trade Review*, 50(3), 151–167. https://doi.org/10.1177/0015732515589440

Alexander, S. S. (1959). Effects of devaluation: A simplified synthesis of elasticities and absorption approaches. *American Economic Review*, 49(1), 21–42.

Anning, L., Riti, J. S., & Yapatake, K. T. (2015). Exchange rate and trade balance in Ghana-Testing the validity of the Marshall-Lerner condition. *International Journal of Development and Emerging Economics, 3* (2), 38–52.

Baharumshah, A. (2001). The effect of exchange rate on bilateral trade balance: New evidence from Malaysia and Thailand. *Asian Economic Journal*, 15(3), 291–312. https://doi.org/10.1111/1467-8381.00135

Bahmani-Oskooee, M. (1991). Is there a long-run relation between the trade balance and the real effective exchange rate of LDCs? *Economics Letters*, 36(4), 403–407. https://doi.org/10.1016/0165-1765(91)90206-Z

Boyd, D., Caporale, G. M., & Smith, R. (2001). Real exchange rate effects on the balance of trade: Cointegration and the Marshall–Lerner condition. *International Journal of Finance and Economics*, 6(3), 187–200. https://doi.org/10.1002/ijfe.157

Dongfack, L. P. S., & Ouyang, H. (2019). The impact of real exchange rate depreciation on Cameroon's trade balance: Is devaluation a remedy for persistent trade deficits? *Journal of Economic Integration*, 34(1), 189–213. http://dx.doi.org/10.11130/jei.2019.34.1.189

Duasa, J. (2007). Determinants of Malaysian trade balance: An ARDL bound testing approach. *Global Economic Review*, 36(1), 89–102. https://doi.org/10.1080/12265080701217405

Genemo, K. B. (2017). Effect of exchange rate on trade balance in major East African countries: Evidence from panel cointegration. *European Business and Management*, 3(6), 95–104. https://doi.org/10.11648/j.ebm.20170306.11

Hahn, F. H. (1959). The balance of payments in a monetary economy. *Review of Economic Studies*, 26 (2), 110–125. https://doi.org/10.2307/2296169

Harberger, A. C. (1950). Currency Depreciation, Income, and the Balance of Trade. *The Journal of Political Economy*, 58(1), 47–60. https://doi.org/10.1086/256897

Hunegnaw, F. B., & Kim, S. (2017). Foreign exchange rate and trade balance dynamics in East African countries. *The Journal of International Trade & Economic Development*, 26(8), 979–999. https://doi.org/10.1080/09638199.2017.1327611

Igue, N. N., & Ogunleye, T. S. (2014). Impact of real exchange rate on trade balance in Nigeria. *African Development Review*, 26(2), 347–3578. https://doi.org/10.1111/1467-8268.12086

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53–74. https://doi.org/10.1016/S0304-4076(03)00092-7

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169–210. https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x

Kakar, M. K., Kakar, R., & Khan, W., & Waliullah. (2010). The determinants of Pakistan's trade balance: An ARDL cointegration approach. *The Lahore Journal of Economics*, 15(1), 1–26.

Kale, P. (2001). Turkey's trade balance in the short and the long run: Error-Correction modeling and cointegration. *The International Trade Journal*, 15(1), 27–56. https://doi.org/10.1080/088539001300005440

Kaya, A. I. (2020). Real exchange rate and trade balance in Turkey: Evidence from heterogeneous panel data. *Panoeconomicus*, 1–23. Advance online publication. https://doi.org/10.2298/PAN161208007K

Keho, Y. (2020). Impact of foreign direct investment on trade balance: Evidence from Cote d'Ivoire. *International Journal of Economics and Finance*, 12 (7), 113–124. https://doi.org/10.5539/ijef.v12n7p113

Keho, Y. (2021). Real exchange rate and trade balance dynamics in Cote d'Ivoire. *International Journal of Economics and Financial Issues*, 11(1), 61–70. https://doi.org/10.32479/ijefi.10857

Lal, A., & Lowinger, T. (2002). The J-curve: Evidence from East Asia. *Journal of Economic Integration*, 17(2), 397–415. https://doi.org/10.11130/jei.2002.17.2.397

Lerner, A. P. (1944). *The economics of control: Principles of welfare economics*. Macmillan Company.

Maddala, G., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(S1), 631–652. https://doi.org/10.1111/1468-0084.0610s1631

Magee, S. P. (1973). Currency contracts, pass through, and devaluation. *Brookings Papers of Economic Activity, 1* (1), 303–325. https://doi.org/10.2307/2534091

Marshall, A. (1923). *Money, credit and commerce*. Macmillan & CO.

Meade, J. E. (1951). *The balance of payments*. University Press.

Meniago, C., & Eita, J. H. (2017). The effects of exchange rate changes on Sub-Saharan Africa trade. *International Journal of Sustainable Economy*, 9(3), 213–230. https://doi.org/10.1504/IJSE.2017.085065

Mundell, R. A. (1971). *Monetary Theory*. Goodyear.

Musila, J. W., & Newark, J. (2003). Does currency devaluation improve the trade balance in the long run? Evidence from Malawi. *African Development Review*, 15(2-3), 339–352. https://doi.org/10.1111/j.1467-8268.2003.00076.x

Ng, Y.-L., Har, W.-M., & Tan, G.-M. (2008). Real exchange rate and trade balance relationship: An empirical study on Malaysia. *International Journal of Business and Management*, 3(8), 130–137. https://doi.org/10.5539/ijbm.v3n8p130

Nga, N. T. V. (2020). Analysis of the determinants of trade balance: A case study of Vietnam. *Journal of Applied Finance & Banking*, 10(3), 21–35.

Ogbonna, B. C. (2016). Trade balance effect of exchange rate devaluation in Benin republic: The empirical evidence. *IOSR Journal of Economics and Finance, 7* (2), 33–43.

Osoro, K. (2013). Kenya's foreign trade balance: An empirical investigation. *European Scientific Journal, 9* (19), 176–189. https://doi.org/10.19044/esj.2013.v9n19p%25p

Ousseini, A. M., Hu, X. J., & Aboubacar, B. (2017). WAEMU trade and current account balance deficit analysis: A panel VAR approach. *Theoretical Economics Letters*, 7(4), 834–861. https://doi.org/10.4236/tel.2017.74060.

Pedroni, P. (2000). Fully modified OLS for heterogeneous cointegrated panels. *Advances in Econometrics*, 15, 93–130. DOI: 10.1016/S0731-9053(00)15004-2

Pedroni, P. (2001). Purchasing power parity tests in cointegrated panels. *The Review of Economics and Statistics*, 83(4), 727–731. https://doi.org/10.1162/003465301753237803

Pedroni, P. (2004). Panel cointegration; asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory*, 20(3), 597–625. https://doi.org/10.1017/S0266466604203073

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68(1), 79–113. https://doi.org/10.1016/0304-4076(94)01644-F

Polak, J. J. (1957). Monetary analysis on income formation and payments problems. *International Monetary Fund Staff Papers*, 6(1), 1–50. https://doi.org/10.2307/3866128

Rose, A. K. (1991). The role of exchange rates in a popular model of international trade, does the Marshall Lerner condition hold. *Journal of International Economics*, 30(3–4), 301–316. https://doi.org/10.1016/0022-1996(91)90024-Z

Rose, A. K., & Yellen, J. L. (1989). Is there a J-curve? *Journal of Monetary Economics*, 24(1), 53–68. https://doi.org/10.1016/0304-3932(89)90016-0

Shahbaz, M., Awan., R., & Ahmad., K. (2011). The exchange value of the Pak-Rupee and Pak-Trade Balance: An ARDL bounds testing approach. *Journal of Developing Areas*, 44(2), 69–93. https://doi.org/10.1353/jda.0.0108

Shawa, M. J., & Shen, Y. (2013). Analysis of the determinants of trade balance: Case study of Tanzania. *International Journal of Business and Economics Research*, 2(6), 134–141. https://doi.org/10.11648/j.ijber.20130206.13

Upadhyaya, K. P., & Dhakal, D. (1997). Devaluation and the trade balance: Estimating the long run effect. *Applied Economics Letters*, 4(6), 343–345. https://doi.org/10.1080/135048597355276

Yazgan, M. E., & Ozturk, S. S. (2019). Real exchange rates and the balance of trade: Does the J-curve effect really hold? *Open Economies Review*, 30(2), 343–373. https://doi.org/10.1007/s11079-018-9510-3

Yol, M. A., & Baharumshah, A. Z. (2007). Estimating exchange rate and bilateral trade balance relationships: The experience of Sub-Saharan African countries. *South African Journal of Economics*, 75(1), 35–51. https://doi.org/10.1111/j.1813-6982.2007.00104.x

Cogent Economics & Finance (ISSN: 2332-2039) is published by Cogent OA, part of Taylor & Francis Group.

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com