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ARTICLE

Business Cycle Synchronisation and Regional Migration: Testing the OCA Criteria in the West African Region

Sodiq Olaiwola Jimoh[1,2] · **Soo Y. Chua**[1]

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Abstract
The West African region is on the verge of forming a monetary union. Many studies have examined the feasibility of monetary unions using criteria such as trade and financial integrations. However, labour migration which is one of the criteria has been neglected in previous studies. This study filled the gap by using Abel and Cohen's (Bilateral international migration flow estimates for 200 countries 6(1):1–13, 2019) data between 1996–2019 to examine the impact of migration flows on business cycle synchronisation using the IV-2SLS technique in the West African region. The study reveals that migration flow, specialisation of industry, and financial integrations spur business cycle synchronisation, while regional trade integration does not significantly impact business cycle synchronisation. However, the interactive terms of trade integrations and migration flow positively influenced business cycle synchronisation in the region. These findings suggest a likelihood of optimum currency area in the West African region.

Keywords Business cycle synchronisation · Currency union · Labour migration flows · West Africa · IV-2SLS

JEL Classification F15 · F22 · F41

1 Introduction

The role of human resource migration in the attainment of monetary union cannot be overemphasised. In fact, free labour movement across nations is one of the main criteria of the optimum currency area (OCA), which forms the basis for business cycle synchronisation (Beck 2021). Labour migration can help to reduce international

✉ Sodiq Olaiwola Jimoh
sodiqjimoh7@gmail.com

[1] Economics Programme, School of Social Sciences, Universiti Sains Malaysia, Gelugor, Malaysia

[2] Department of Economics and Development Studies, Kwara State University, Ilorin, Nigeria

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imbalances among countries, thereby fostering an environment in which uniform monetary policy and externally flexible exchange rates can help to achieve macroeconomic stability. The pioneers of OCA, such as Mundell (1961), Mckinnon (1963), and Kenen (1969), emphasised the importance of labour mobility in the attainment of a common currency. According to them, they opined that what defines currency union the most is the fixed exchange rate among countries, central monetary authority, and internal mobility of resources (labour and capital). While explaining the benefits of forming a currency union, Harvey and Cushing (2015) stressed that factor mobility within a region intending to form a currency union makes it easier for macroeconomic shocks to dissipate quickly. Specifically, Mundell (1961) argued that labour force migration would enhance a highly business cycle synchronisation. However, this assertion has not been properly examined.

There exist a myriad of literature on the OCA of different region. Some studies examined the OCA of a region by analysing the correlations of aggregate demand and supply shocks using factor-augmented vector autoregressive (FAVAR) or structural vector autoregressive (SVAR) models (see Debrun et al. 2005; Ahn et al. 2006; Carcel et al. 2015; Samba & Mbassi 2020; Raheem & Nurudeen 2020). Some studies also examined the extent of business cycle co-movement among countries as a basis for forming an OCA using different techniques (see Habimana et al. 2020; Cham 2020; Agba & Madueme 2021). Studies have also examined the effect of trade and financial integrations on business cycle synchronisation (BCS); the impact of the former is clear in the existing literature, while the former produced mixed results in the existing literature (see Akin 2011; Alimi 2015; Kalemli-Ozcan et al. 2013). However, literature is very scant on how labour migration affects business cycle synchronisation, as Beck (2021) has dwelled on this aspect to the best of the author's knowledge. This study is among the very few to devote attention to the aforementioned neglected aspect by examining how intra-regional labour migration affects the business cycle synchronisation in the West African region.

The West African region is chosen as the region of study because the region is on the verge of merging the West African Economic Monetary Union (WAEMU) and the West African Monetary Zone (WAMZ) with a common currency called "ECO." The Economic of West African States (ECOWAS) has also set the primary and secondary criteria for adopting the proposed currency, which ensures the convergence of countries with respect to symmetric shocks. The significance of this paper is novel as it contributes to the literature in threefold. Firstly, the paper explores the relatively uncharted aspect of regional labour migration on business cycle synchronisation in West Africa, which previous studies have not explored. The impact of labour migration on business cycle synchronisation is germane because of wage differentials amongst West African countries, which influences labour movement from one country to another. This movement could mitigate international imbalances among West African countries and hence synchronise the business cycle of countries intending to join the proposed monetary union. Secondly, this study employs a newly released data set on bilateral international migration for West African countries by Abel and Cohen (2019). Lastly, the paper examines the moderating effect of trade integrations on the migration-business cycle co-movement relationships.

This paper is structured into five sections. Following the introduction, the second section expounds on the empirical review. Section three discusses the methodology, while section four presents and interprets the results. Section five presents the conclusion and policy recommendations.

2 Literature Review

The relationship between business cycle synchronisation and regional labour migration could be explained by the OCA theory, which explains how the migration of human resources could serve as one of the key determinants of business cycle synchronisation. However, the empirical literature is scanty on the aspect of OCA due to the unavailability of regional migration data. The major empirical review of related studies is discussed below.

The study by Frankel and Rose (1998) set the pace for other studies on the determinants of business cycle synchronisation. In their study, they examined whether trade linkages among countries intending to form a monetary union yield highly correlated business cycle synchronisations. Their study found that trade integrations synchronised the business cycle of countries. In addition, their study argued that the mobility of labour is likely to reduce the cost of losing monetary independence of countries intending to join a currency union. Beck (2019) investigated 43 determinants of business cycle synchronisation in the European Union (EU). The study employed a Bayesian model average of dynamic panels for EU countries between 1999–2011. The result shows that migration spurs business cycle synchronisation, which is in line with the findings of Krugman (1993) as well as Beck (2013). Also, the study revealed that apart from the stock of migration, exchange rate variability, production structure similarity, intra-industry trade, and capital mobility are the key determinants of business cycle synchronisations in the EU. Using Leamer's approach, Baxter and Kouparitsas (2005) examined business cycle synchronisation determinants of 100 developed and developing countries. The study found that trade integrations and the development nature of countries are found to have a positive influence on the business cycle, while countries with a common currency and industrial structure do not have a significant impact on the business cycle.

Similarly, Antonakakis and Tondl (2014) study applied simultaneous equation models to examine the impact of economic integrations on business cycle synchronisation. The study covers the period between 1995–2012 and found that trade and foreign direct investment spurs business cycle synchronisation, reduction in the level of income disparities among countries also improves business cycle synchronisation, while financial discipline and exchange rate fluctuations negatively affect business cycle synchronisation. This is in line with the study of Calderón et al. (2007), which found that trade integrations positively impact business cycle synchronisation in developed and industrial countries. The study revealed that trade integrations have a greater influence on the business cycle synchronisation of developing countries than industrial countries. It attributed the difference in the degree of specialisation between the two sets of countries.

The study by Imbs (2004) factored in the roles of specialisation, trade, and financial integrations on business cycle synchronisation using the system simultaneous equation model. The study found that trade and financial integrations spur business cycle synchronisation, and business cycle synchronisation specialisation depends on the level of gross domestic product (GDP) per capita of countries. In contrast, Alimi (2015) examined the impact of financial and trade integrations on business cycle synchronisation in some Northern African countries with their main partners in Europe. The study applied a generalised method of the moment (GMM), with data between 1980–2010. The study found that specialisation and trade integrations positively influence business cycle synchronisation, while financial integration does not influences business cycle synchronisation. On another note, the study of Kalemli-Ozcan et al. (2013) documented a negative impact of financial market integrations on business cycle synchronisation.

The study of Akin (2011) is somewhat similar to the study of Alimi (2015), where the former found that global financial integration (on average) does not influence the business cycle. Akin (2011) employed GMM and 3SLS methods and found that trade integrations and economic structures are the main drivers of the business cycle. However, financial market integrations have a mixed impact on business cycle synchronisation in different pairs of economies.

Beck (2021) examined the relationship between migration flows and business cycles in 24 European countries, using annual data between 1990–2015. The study measured business cycle synchronisation by computing the correlation coefficients of cyclical fluctuations of GDP using the Cristiano-Fitzgerald filter. The study employed a Bayesian model average of dynamic panels and found that labour force mobility enhances business cycle synchronisation, which indicates that the EU is closer to meeting the OCA criteria. In another view, while examining the determinants of stock of labour migrations among the Organization for Economic Co-operation and Development (OECD) countries, Beine et al. (2019) found a reverse causality between the stock of labour migration and business cycle co-movement.

3 Data and Method

3.1 Description of Variables and Data Source

This research relies on data from the Abel and Cohen (2019) bilateral migration flows data which covers five years consecutive intervals and corresponds to other variables intervals used in this study. The Abel and Cohen (2019) migration flows data has two main limitations: It reflects the idiosyncratic reports of migrant stocks and does not capture the cultural affinity shared by the migrant-sending and receiving countries. The former is considered an unavoidable limitation, while the latter has been addressed in this study with the inclusion of country-specific specialisation of the industry as part of the determinants of BSC. This is pertinent as most West African countries are well known for agricultural business, and their co-movement in their respective output depends on the sector. This study also utilises the country-specific specialisation data from the United Nations Industrial Development (UNIDO) database. In addition,

the trade integration data was computed using the International Monetary Fund (IMF) direction of trade statistics, interest and exchange rate variations were computed using data from the IMF statistical database. Population and real GDP data are sourced from the World Bank Development Indicators, and financial integration was computed using data sourced from the World Bank Development Indicators. The data were obtained for sixteen West African countries from 1996–2019. The measurement and description of the variables are presented in Table 1

3.2 Theoretical Foundation and Model Specifications

Although, several theories suggest the drives of business cycle synchronisations. For instance, Kenen (1969), Frankel and Rose (1998) and Krugman (1993) suggested that trade intensities enhance business cycle synchronisations, while Kose and Yi (2002) suggested that the correlations of GDP determine business cycle co-movement and not trade intensity. The theory of Backus et al. (1992) argues that a more integrated financial market reduces the correlation of output and investment. Imbs (2004) argues that the business cycle of countries that share similar economic characteristics tends to synchronise similarly. Based on these theoretical facts, Eq. (1) summarises the theoretical background of the drivers of business cycle synchronisation.

$$Y_{ijt} = \gamma_0 + \gamma_1 X_{ijt} + \vartheta_{ijt} \tag{1}$$

Where Y_{ijt} represent the BCS of countries i and j, while X_{ijt} represent a set of drivers of BCS such as trade intensity, financial market integration and similarity in the

Table 1 Measurement and description of variables

Variable	Description and measurement
Business cycle synchronisation (BCS)	This is measured and represents the correlations of the cyclical fluctuations of real GDP using the Christiano-Fitzgerald filter
Regional trade flows (ITF)	This represents the bilateral trade flows from countries *i–j*. It is computed using the exports of countries to their counterpart countries within West Africa
Financial Integration (FINT)	This represents the flow of finance between countries *i* and *j*. it is computed by dividing the aggregate foreign assets and liabilities by its gross domestic product and by taking the natural logarithms of the products of the financial integrations of countries *i* and *j* at time *t* (Wälti 2011)
Population (POP)	This represents the population of each country in the West African region
Exchange rate Variations (ERV)	This represents the variations in the exchange rate. It is computed using the standard deviations of the nominal exchange rates of the West African countries
Interest rate Variations (IRV)	This represents the variations in the interest rates. It is computed using the standard deviations of the lending rates of the West African countries
Specialisation of Industry (Spec)	This represents the sectoral real value added for each West African countries

Source Authors compilations

economic structure of countries. Modifying Eq. (1) and introducing more explanatory variables such as migration flows, exchange rate variations, interest rate variations, population and specialisation of industry produced Eq. (2). Since the existing theories have shown ambiguity on the effect of the above variables on business cycle synchronisations, the expected signs of the variable parameters could be either positive or negative.

Equation (2) is mainly constructed to empirically examine the relationship between migration flows and business cycle synchronisation and the interaction effect of regional trade flows on the relationship between the two variables. The equation is modelled after the works of Imbs (2004) and Beck (2021).

$$\begin{aligned} \mathrm{BCS}_{it} =& \beta_0 + \beta_1 \mathrm{Mig}_{it} + \beta_2 \mathrm{ITF}_{it} + \beta_3 \mathrm{FINT}_{it} + \beta_4 \mathrm{Spec}_{it} + \beta_5 \mathrm{ERV}_{it} \\ &+ \beta_6 \mathrm{IRV}_{it} + \beta_7 \mathrm{POP}_{it} + \beta_8 \mathrm{Mig} * \mathrm{ITF}_{it} + \epsilon_{it} \end{aligned} \tag{2}$$

The acronyms of all the variables in Eq. (2) are described in Table 1, $\beta_1 - \beta_8$ represent the parameters to be estimated, and ϵ_{it} is the stochastic error terms. This study employed the panels of ordinary least squares, such as fixed effect (FE) and random effect (FE) techniques. Also, the instrumental variable two-stage least squares technique was employed to correct for the likelihood of heteroscedasticity and endogeneity, which are peculiar to panel analysis. Specifically, the two-stage instrumental variable technique accounts for country-specific effects and possible reverse causality. Also, it solved the identification problem that may arise as a result of correlations between the residual term and some of the explanatory variables (Acosta et al. 2008).

4 Result and Discussion

Table 2 presents the summary statistics, which describes the variables used in this study in terms of mean, standard deviation, minimum and maximum observations. The mean value of ITF indicates that the average intra-regional trade flows with the West African region is 363.49. The summary statistics also show that financial

Table 2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ITF	95	363.4932	500.0605	2.770557	3285.775
FINT	96	28.61907	145.5825	−42.452	1643.077
RGDP	96	2.76E+10	8.01E+10	2.41E+08	4.82E+11
POP	95	1.83E+07	3.57E+07	395533	2.01E+08
ERV	95	118.6276	160.4834	56.22844	2203.363
Spec	96	2.96E+09	7.59E+09	353839	4.73E+10
IRV	96	84.08877	45.69931	41	201
Mig	96	94627.93	13646.77	64541.89	115273.7

Source Authors computation

Table 3 Correlation analysis

	BCS	FINT	ITF	POP	ERV	Spec	IRV	Mig
BCS	1							
FINT	−0.0544	1						
ITF	0.2133*	−0.0449	1					
POP	−0.1091*	0.0663	0.0299	1				
ERV	0.0979	0.2654*	−0.0414	−0.0293	1			
Spec	0.8806*	−0.0524	0.2423*	−0.038	0.1507*	1		
IRV	0.4251*	−0.0878	−0.1606*	0.0421	0.0386	0.4544*	1	
Mig	−0.0829	−0.1662*	−0.1080*	−0.0649	−0.0702	−0.1027*	−0.0158	1

***, **, * Denote significance at 1%, 5% and 10% respectively

Source Authors computation

Table 4 Panel stationary test

Variable	Level	First difference
BCS	−4.249***	−4.161***
FINT	−0.896	−3.288***
Mig	2.610	−4.665**
ITF	−1.991	−3.768***
POP	−4.232***	−4.062***
Spec	−1.289	−2.616***
ERV	−1.461**	−6.931***
IRV	−4.345***	−7.844***

***, **, * Denote significance at 1%, 5% and 10% respectively

Source Authors' computation

integration is less than trade integration in the West African region. Another important variable used in this study is the labour migration flows within the West African region, which has an average of 94627.90 within the year under review. This implies that the movement of labour from one country to another has improved in recent years.

Table 3 shows the correlation analysis, which showcases the nature of the relationship between the variables used in this study. The coefficient of correlation ranges between −1 and 1, indicating negative and positive associations, respectively. Among all the variables, trade integrations, specialisation, and interest rate variations have positive and significant associations with the business cycle synchronisations in the West African region. Also, the correlation coefficient falls below 0.9, which suggests no likelihood of multicollinearity among the variables.

Table 4 presents the Pesaran (2007) second-generation panel unit root test, which accounts for cross-sectional dependence in panel analysis. There is no evidence of unit root at levels for financial integration (FINT), migration flows (MIG), trade flows (ITF), and specialisation (SPEC), while business cycle synchronisation (BCS),

Table 5 Panel cointegration test

Kao cointegration test	Statistic	*p* value
Modified Dickey-Fuller t	− 1.8204	0.0344
Dickey-Fuller t	− 1.6181	0.0532
Augmented Dickey-Fuller t	− 4.2787	0.0000
Unadjusted modified Dickey-Fuller t	− 1.4910	0.0680
Unadjusted Dickey-Fuller t	− 2.4000	0.0000

Source Authors computation

Table 6 Tests of endogeneity

Test	*P* values
Durbin (score) chi2	28.3816 ($p = 0.0000$)
Wu-Hausman F(2,339)	15.0044 ($p = 0.0000$)

Source Authors computation

population (POP), exchange rate variations (ERV) and interest rate variations (IRV) has unit root at levels. All the variables are found to be stationary at first difference. In summary, the result shows the presence of unit root, which implies that all series are stationary in either level or first difference or both. Hence, all series are integrated at orders 1(0) and I(I).

Table 5 presents the Kao (1999) panel cointegration test, which examines the long-run relationship among the variables used in this study. The probability values of all the variables are less than 0.05, which means that the null hypothesis of no cointegration is rejected. This implies all series (BCS, Mig, ERV, IRV, POP, ITF, FINT and Spec) are cointegrated and that the estimation technique would not produce spurious results.

This study employed the Durbin and Wu Hausman statistics to ascertain the presence of endogeneity peculiar to panel analysis. The probability values of Durbin and Wu in Table 6 indicate endogeneity, which suggests a likelihood of reverse causality among the dependent and explanatory variables used. Hence, its presence does not favour both estimates of FE or RE techniques. The IV-2SLS is specifically designed to address the endogeneity problem. The coefficient of financial integration of the IV-2SLS in Table 7 produced a positive and significant impact on business cycle synchronisation. This implies that a unit increase in financial integration induces business cycle synchronisation by 16.6 units in the West African region. This result contradicts the finding of Imbs (2004), which suggested that financial integration does not have a direct effect on business cycle synchronization. The justification for the positive impact of financial integration on business cycle is due to the recent increase in intra-regional financial transactions, which moves redistributes finance from surplus to deficit countries. This process enhances the rate at which countries respond to shocks symmetrically, which is a good signal for the proposed currency union in the region.

Table 7 Coefficient estimation

Variables	RE BCS	FE BCS	IV-2SLS BCS
FINT	5.585	5.585	16.681**
	(6.091)	(6.218)	(7.495)
ITF	− 1.870	2.975	− 8.637
	(1.850)	(2.178)	(10.349)
POP	− 156.6***	− 188.9*	− 197.5***
	(32.73)	(100.8)	(39.75)
ERV	− 32.209***	− 35.517***	− 5.671***
	(4.393)	(4.413)	(1.968)
Mig	66.003	47.654	27.202**
	(55.079)	(56.286)	(12.946)
Spec	10.56***	9.991***	10.95***
	(0.159)	(0.276)	(0.463)
IRV	− 6.347***	− 7.779***	− 4.982
Mig*ITF	(2.066)	(2.269)	(5.487)
	0.00002	− 0.031*	0.695***
	(0.00001)	(0.017)	(0.029)
Constant	2.587	6.337	− 1.767
	(5.990)	(6.866)	(1.415)
Sargan Test			431.332***
Breauch-Pagan Test			949.02***
Observations	96	96	96
R-squared		0.837	0.907
Number of country	16	16	

***, ** & * denote significance at 1%, 5% & 10%, respectively. The instruments are D.FINT, D.ITF, D.POP, D.ERV, D.Mig, D.Spec and D.IRV

Source Authors computation

The coefficient of trade integration shows that it does not have a significant impact on business cycle synchronisation. This contradicts the findings of Beck (2021) and Imbs (2004), who found that trade openness and intra-industry trade integrations positively influenced business cycle synchronisation. However, the interactions of labour migration flow and trade integrations positively impacted business cycle synchronisation levels in the West African region. This implies that the free flow of goods coupled with an improved migration of human resources improves the business cycle synchronisation. The coefficients of population and exchange rate variance negatively impacted business cycle synchronisation in the West African region. West Africa is the second most populous region in Africa; the negative impact of population on business cycle synchronisation implies that the rising population of this region serves as hindrance to business cycle synchronisation. On the other hand,

an increase in the exchange rate variance reduces the level of business cycle synchronisation in the West African region.

The coefficient of labour migration flows produced a positive and significant impact on business cycle in the West African region. A unit increase in labour migration flows induces BCS by 27.2 units. This finding is in line with the study of Beck (2021), who found a positive association between labour migration and business cycle synchronisation. The zero travel restrictions within ECOWAS borders make it easier for labour to move within the region. This movement of skilled labour from surplus to deficit countries positively influences the business cycle in the region. Also, the coefficient of specialisation of industry produced a positive and significant impact on the business cycle synchronisation. This is in agreement with Alimi (2015) findings, which found a positive association between specialisations and business cycle synchronisation. The interest rate variations do not have a significant impact on the business cycle synchronisation of the West African region.

Finally, the results of the post-estimation tests uphold the reliability of the estimation technique used. The R-squared is very high, which indicates that a significant proportion of the dependent variable is explained by the explanatory variables. Also, the estimates of the IV-2SLS fulfil the Sagan test for over-identifying restrictions, suggesting that the instruments included are valid.

5 Conclusion

With the interest of the West African region to adopt a common currency, this study examines how labour migration flows influence the level of business cycle synchronisation as one of the OCA criteria for forming a monetary union. The study utilized the Christiano-Fitzgerald filter to compute the business cycle synchronisation for the 16 West African countries between 1996–2019. It also adopted the newly released migration flows of Abel and Cohen (2019). The estimates of IV-2SLS revealed that migration flow, specialisation of industry, and financial integrations spur business cycle synchronisation, while regional trade integration does not have a significant impact on business cycle synchronisations. However, the interactive term of trade integrations and migration flows positively influenced business cycle synchronisation in the West African region. These findings suggest a likelihood of optimum currency area in the West African region. The positive impact of labour migration on business cycle implies that it reduces international imbalances among countries, thereby fostering an environment in which uniform monetary policy and externally flexible exchange rates can help to achieve macroeconomic stability in the West African region.

This study recommends that the ECOWAS should not only focus on trade and finance integration alone in an attempt to unify the West African region with a uniform currency but also implement more policies that would productively enhance the free flow of humans within the region. The free flow of finance, goods, and

humans would allow countries to respond to shocks symmetrically and also make macroeconomic shocks dissipate quickly.

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Declarations

Conflict of Interest On behalf of all my co-author, I declare that we do not have any conflict of interest with any person or any institution.

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