HEC MONTRÉAL

Is the Economic Community of West African States an Optimum Currency Area?

par

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Résumé

Depuis 2000, la Communauté économique des États de l'Afrique de l'Ouest (CEDEAO) s'est fixé comme objectif d'introduire une monnaie commune, l'éco, dans la région. Cette étude cherche à déterminer si la CEDEAO constitue une zone monétaire optimale (ZMO) en vue de l'adoption de l'éco et à estimer les poids optimaux d'un panier de devises auquel l'éco pourrait être fixé. Pour ce faire, nous appliquons le cadre de la Parité de pouvoir d'achat généralisée (PPAG) conçu par Enders et Hurn (1994) aux taux de change réels (TCR) bilatéraux des nations ouest-africaines afin de détecter les relations à long terme entre les TCR. Ensuite, nous construisons un modèle de correction d'erreur vectorielle (MCEV) que nous estimons par la méthode de Johansen pour déterminer si l'hypothèse de la PPAG tient dans la CEDEAO. Nous construisons également un panier de devises pondéré par les échanges commerciaux qui est composé de l'euro, du dollar américain et de la livre sterling, et nous estimons les poids endogènes en créant un MCEV alternatif. Nos résultats empiriques révèlent que l'hypothèse de la PPAG est vérifiée dans la CEDEAO, satisfaisant ainsi les conditions d'une ZMO. Des analyses additionnelles indiquent également la convergence de l'UEMOA, de la ZMOA et d'autres groupes vers la PPAG. En outre, nous avons constaté que les trois pondérations basées sur les échanges commerciaux ne sont pas adaptées à un panier de devises et nous n'avons pu estimer les pondérations endogènes logiques en raison de limitations méthodologiques. Compte tenu de ces résultats, nous concluons que la CEDEAO est effectivement une ZMO et que les trois monnaies de réserve sont inadéquates pour un panier de devises communes.

Mots-clés

Communauté économique des États de l'Afrique de l'Ouest, Zone monétaire optimale, Parité de pouvoir d'achat généralisée, Taux de change réels bilatéraux, Panier de devises communes

Abstract

Since 2000, the Economic Community of West African States (ECOWAS) has struggled to introduce a common currency, the eco, across the region. This study, therefore, investigates whether the ECOWAS constitutes an Optimum Currency Area (OCA) in view of eventually adopting the eco and attempts to estimate the optimal weights of a basket peg to which the eco could potentially be fixed. To do so, we apply the Generalized Purchasing Power of Parity (GPPP) framework designed by Enders and Hurn (1994) to the bilateral real exchange rates (RER) of West African nations to detect long-run relationships among the RERs. We then construct a VECM which we estimate by the Johansen method to determine if GPPP holds in the ECOWAS. Also, we construct a trade-weighted basket peg composed of the euro, US dollar and pound sterling in addition to estimating endogenous weights by formulating an alternative VECM. Our empirical results reveal GPPP to hold in the ECOWAS, thus satisfying the conditions for an OCA. Further analyses also indicate the convergence of the UEMOA, WAMZ, and other clusters toward GPPP. Moreover, we found the three trade-based weights to be unsuitable for a basket peg and were unable to estimate logical endogenous weights due to methodological limitations. Given these results, we conclude the ECOWAS is indeed an OCA and the three reserve currencies are inadequate for a basket peg.

Keywords

Economic Community of West African States, Optimum Currency Area, Generalized Purchasing Power of Parity, Bilateral Real Exchange Rates, Common Currency Basket

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List of acronyms

ECOWAS Economic Community of West African States

UEMOA West African Economic and Monetary Union

WAMZ West African Monetary Zone

OCA Optimum Currency Area

RER Real Exchange Rate

GPPP Generalized Purchasing Power Parity

PPP Purchasing Power Parity

VECM Vector Error Correction Model

SVAR Structural Vector Autoregression

VAR Vector Autoregression

WAMI West African Monetary Institute

BCEAO Central Bank of West African States

CFA African Financial Community

CEMAC Economic and Monetary Community of Central Africa

GDP Gross Domestic Product

US United States

UK United Kingdom

EUR Euro

GBP Sterling Pound

USD US Dollar

CVE Cape Verdian Escudo

EU European Union

EBID ECOWAS Bank for Investment and Development

WAHO West African Health Organization

GIABA Inter-governmental Action Group against Money Laundering and Terrorism Financing in West Africa

FSRB Financial Action Task Force Style Regional Body

AML/CFT Anti-money Laundering and Combatting the Financing of Terrorism

FDI Foreign Direct Investment

ODA Official Development Assistance

GNI Gross National Income

HHI Herfindahl-Hirschmann Index

EXP Exports

IMP Imports

NA Not Applicable

BEN Republic of Benin

BFA Burkina Faso

CPV Republic of Cabo Verde

CIV Republic of Côte d'Ivoire

GMB Republic of the Gambia

GHA Republic of Ghana

GIN Republic of Guinea

GNB Republic of Guinea-Bissau

LBR Republic of Liberia

MLI Republic of Mali

NER Republic of the Niger

NGA Federal Republic of Nigeria

SEN Republic of Senegal

SLE Republic of Sierra Leone

TGO Togolese Republic

IFS International Financial Statistics

IMF International Monetary Fund

EPU European Payments Union

DMP Debrun, Masson, and Patillo

BCS Business Cycle Synchronization

EMS European Monetary System

CPI Consumer Price Index

USA United States of America

OLS Ordinary Least Squares

ML Maximum Likelihood

WPI Wholesale Price Index

ADF Augmented Dickey-Fuller

KPSS Kwiatkowski-Philipps-Schmidt-Shin

AIC Akaike Information Criterion

BIC Bayesian Information Criterion

LR Likelihood Ratio

ASEAN Association of Southeast Asian Nations

WPI Wholesale Price Index

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Introduction

In the last few decades, various geographical blocs around the world have elected to pursue further economic integration by introducing a common currency. The most notable among these blocs is no doubt the euro area, a group of 19 member states within the European Union that adopted the euro as its sole currency in 2002. However, the implementation of the euro was not immediate; it required careful planning and preparation. Prospective members were expected to adhere to strict macroeconomic convergence criteria specified in the Maastricht Treaty, which was ratified in 1992 (Nkwatoh et al., 2019), a decade before the euro's circulation. After the euro's successful adoption, the Economic Community of West African States (ECOWAS) announced that it would introduce a common currency, the "eco", across the region by 2003. The ECOWAS' initial objective was to establish a monetary union in the West African Monetary Zone (WAMZ) before merging with the existing West African Economic and Monetary Union (UEMOA[1]). However, since then, the implementation of the currency has been postponed five times as no member country has been able to respect all the convergence criteria set by the West African Monetary Institute (WAMI). Following these deferrals, the most recent of which occurring in 2020, the question of whether the ECOWAS indeed forms an Optimum Currency Area (OCA) has resurfaced.

Optimality refers to various measures and concepts which attempt to assess the desirability of joining a currency union (Benczes, 2014). Different criteria have been developed to calculate optimality as precisely as possible. For example, shock symmetry is an

[1]From the French *Union économique et monétaire ouest-africaine*.

important property because asymmetric shocks can hinder monetary integration as their impact can vary across economies. Indeed, Alesina and Barro (2002) note that countries whose output shocks are positively correlated are better suited to form a monetary union. Factor mobility is another a key pre-condition for an OCA (Mundell, 1961). Two regions with high factor mobility will see labor shift easily between regions thus eliminating unemployment and inflationary pressure. Hence, a single monetary policy will satisfy both regions with a rigid exchange rate. Price and wage flexibility is also a crucial mechanism that reequilibrates markets due to adjustments in sticky prices and wages in the presence of an idiosyncratic demand shock (Kunroo, 2015).

Although the abovementioned properties are useful for determining optimality, we focus specifically on the criterion of real exchange-rate (RER) behavior. This stylized fact emphasizes that if the determinants are sufficiently integrated, as is the case in an OCA, the RERs will exhibit common stochastic trends (Enders and Hurn, 1994). Hence, integrated RERs indicate a high level of overall economic integration which is essential for countries seeking to form an OCA.

In this context, the objectives of this study are twofold. Firstly, we seek to empirically determine whether the ECOWAS countries constitute an OCA. If the members are unable to form an optimal union, it will be inadvisable to continue striving toward greater economic integration. Indeed, a suboptimal currency union would unlikely provide the welfare benefits expected from monetary integration and may even impede overall economic performance. Secondly, we investigate the optimal weights of safe-haven currencies[2] that would comprise a basket peg since it is unclear whether France will guarantee the eco's convertibility. Also, the ECOWAS seems determined to create an ecozone at some point whether its members are wholly prepared or not.

Previous studies have partially answered these questions empirically. The vector autoregressive model has been a popular tool among these research efforts in evaluating currency area optimality by assessing the nature of macroeconomic disturbances (Ekong and Onye, 2012; Nkwatoh, 2018; Mati et al., 2019; Adu et al., 2019; El Jai, 2020). Although

[2]A globally traded currency that serves as a reliable and stable store of value (e.g., US dollar).

useful, the reliability of this empirical approach has been criticized given it requires the restrictive assumption that underlying shocks are orthogonal (Gottschalk, 2001). Moreover, extant literature has only suggested which strong currencies may form an optimal basket peg for the eco (Dufrénot and Sugimoto, 2013; Quah, 2016; Simons and Jean Louis, 2018).

In this study, we adopt the Generalized Purchasing Power of Parity (GPPP) framework, a more rigorous method, developed by Enders and Hurn (1994) to answer these questions. This methodology was established since Purchasing Power Parity (PPP) was found to insufficiently explain price and exchange-rate movements in industrialized nations during the post-Bretton Woods period (Enders and Hurn, 1994).

Since its inception, the GPPP approach has often been applied to evaluate the optimality of potential East Asian currency unions (Enders and Hurn, 1994; Liang, 1999; Gao, 2007; Ahn et al., 2006; Mishra and Sharma, 2010; Nusair, 2012). To a lesser extent, GPPP has been used to study European (Bernstein, 2000; Caporale et al., 2011) as well as East (Mkenda et al., 2001) and Southern African (Grandes, 2003; Zerihun and Breitenbach, 2018; Redda et al., 2017) currency unions. This approach was applied to West and Central African countries by Sugimoto (2008) to address these questions, but it has not since reappeared in the eco empirical literature. Our analysis shall therefore revive this dormant methodology for a more current and complete ECOWAS.

This study improves upon Sugimoto (2008) and is expected to contribute to the literature in two main ways. Firstly, it will be the first to apply the GPPP method to an ECOWAS that includes Cabo Verde, Guinea, and Liberia. Indeed, these countries were excluded from the previous analysis due to unavailability of data. Secondly, it will consider the pound sterling in a basket of weighted currencies to which the eco could be pegged. In the previous empirical literature, only the American dollar, euro, and renminbi were considered.

Furthermore, to the best of our knowledge, our study will also be the first to assess the optimality of the future eco union after its 2020 postponement. We hope to present the most up-to-date findings to help policymakers going forward with decisions regarding the

adoption of the eco.

For the purpose of this study, we construct a standard GPPP and an alternate GPPP model. The goals of these models are first to evaluate if the ECOWAS is an OCA and second, to determine the optimal weights of three anchor currencies for a basket peg. To investigate the optimality of an eco union, we employ Johansen (1988) and Johansen and Juselius (1990)'s method of multivariate cointegration. This method allows us to identify whether RERs are cointegrated which, according to our chosen criterion, indicates the existence of an OCA.

Our empirical results reveal GPPP holds since we identify at least one cointegrating vector among the ECOWAS' RERs which indicates the presence of an OCA. Furthermore, we find multiple long-run relationships in the UEMOA and WAMZ in addition to other clusters which is supportive of monetary integration in West Africa. The findings indicate that Cabo Verde could possibly join the already existing UEMOA and Nigeria's presence in a West African currency union noticeably changes the level statistical significance of the results. Regarding the basket peg, we were unable to estimate positive endogenous weights for all three currencies due to imperfections in the GPPP technique. Also, the exogenous trade-based weights only performed well for certain countries in our sample, notably Cabo Verde and Ghana.

This study is structured as follows. Chapter 1 presents an overview of the ECOWAS. Chapter 2 reviews the extant theoretical and empirical literature. Chapter 3 details the data and methodology used in this study. Chapter 4 presents our empirical results. Chapter 5 contains a discussion of our findings. Chapter 6 concludes.

Chapter 1

Overview of the ECOWAS

This chapter presents the ECOWAS, initially as an international organization and then as a future currency union. The ECOWAS consists of various subcomponents and contains a set of institutions, which are in and of themselves efforts toward greater economic integration in the region. It is hence worthwhile to provide a holistic portrait of the ECOWAS to better understand its origins, main components and objectives.

We first describe the ECOWAS' subcomponents: the UEMOA and WAMZ. We then present the various institutions established to facilitate further economic integration. Finally, we recount how the ECOWAS was formed over several decades through efforts made by West African governments with the final stage being the adoption of a single currency.

1.1 The Economic Community of West African States (ECOWAS)

The Economic Community of West African States (ECOWAS) is a supranational political and economic union comprising 15 member countries: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The Community was officially established by the Treaty

of Lagos on May 28^{th}, 1975. The economic community includes a free trade area, a customs union, and a common market with its final goal being full economic integration. This last objective would eventually be accomplished with the adoption of a common currency, the eco, through the creation of a continent-wide monetary union.

The community contains the already existing West African Economic and Monetary Union (UEMOA), the West African Monetary Zone (WAMZ), and Cabo Verde. The ECOWAS is geographically located on the western side of the African continent. It has an estimated population of 387[1] million inhabitants as of 2019 and uses English, French, and Portuguese as its official languages.

The ECOWAS did not come into being overnight as it has evolved over a series of stages with the underlying goal of improving the lives and livelihoods of its citizens. The ECOWAS' original mission was to achieve "collective self-sufficiency" for its member states by creating a single large trade bloc and building a full economic union. This goal has since evolved to include achieving and accelerating sustainable development in the region to raise the standard of living for all West Africans. According to the ECOWAS' 2020 vision, economic cooperation and regional integration remain the most viable and appropriate tools (ECOWAS.int, 2020) for attaining this key objective.

Admittedly, the ECOWAS is not the only attempt that West African nations have made to work together for the collective good. The union mainly consists of two already existing economic subzones: the predominantly francophone UEMOA and the largely anglophone WAMZ, and includes the lusophone country of Cabo Verde as well.

These economic subzones operate independently of each other and merely exist within the larger ECOWAS union. Formal institutional links do not yet exist between the UEMOA or WAMZ and the ECOWAS and there is an uncertainty as to whether France will guarantee the eco's convertibility as it currently does for the CFA franc. Figure 1.1 provides a graphic illustration of the abovementioned geographic and economic divisions. We now describe both of these organizations.

[1]The author's own calculations according to data collected from the World Bank's Data portal.

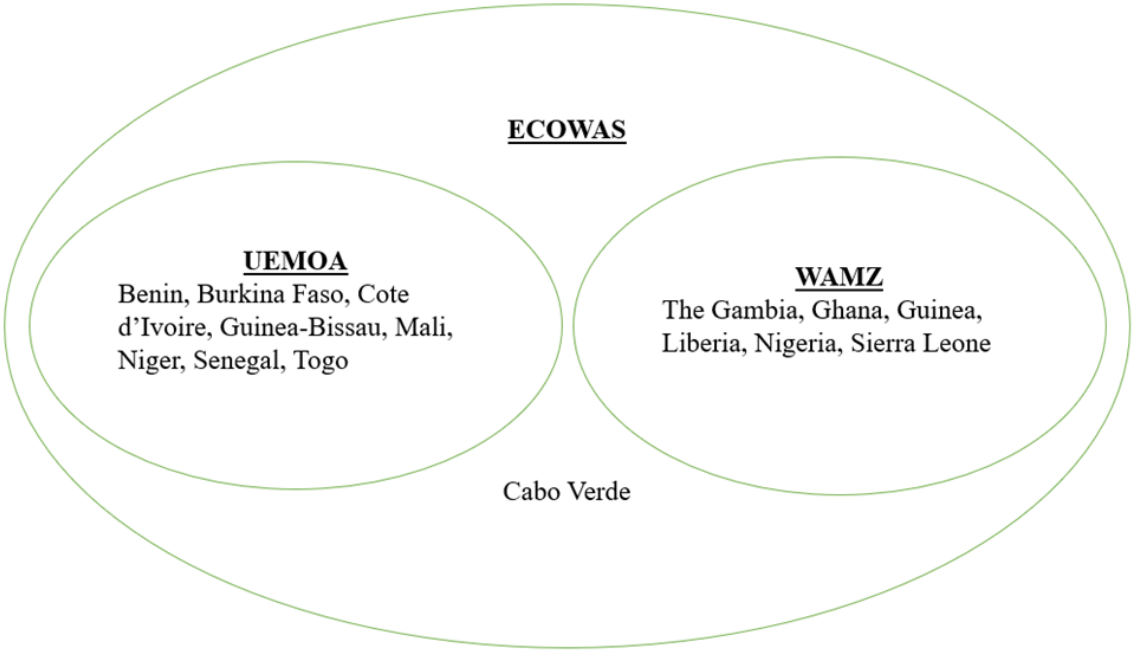

Figure 1.1: Regional Economic Integration in West Africa

1.2 The West African Economic and Monetary Union (UEMOA)

The UEMOA is a monetary union made up of eight nations: Benin, Burkina Faso, Guinea-Bissau, Côte d'Ivoire, Mali, Niger, Senegal, and Togo. All were former French colonies except for Guinea-Bissau which was colonized by Portugal. Being a monetary union, its members all share a single currency, the *Communauté financière africaine* (African Financial Community) CFA franc[2]. The CFA franc is issued by the Central Bank of West African States (BCEAO[3]) located in Dakar, Senegal. Furthermore, the French Treasury acts as a financial guarantor for the convertibility of the CFA franc to the euro. However, this does not come without strings attached. Up until 2020, the UEMOA members were required to deposit at least 50% of their foreign reserves in the French Treasury, the French minister of finance and governor of the Bank of France attended both annual meetings,

[2]The CFA franc is fixed at 1 EUR = 655.957 FCFA.

[3]From the French *Banque Centrale des États de l'Afrique de l'Ouest*.

one of which was always held in Paris (Monde, 2020), and CFA franc banknotes and coins continue to be printed and minted in France, respectively. Due to these requirements, there is much controversy over France's active role in maintaining the stability of the CFA franc. The entire CFA franc system is viewed by many as a neo-colonial mechanism from which France unfairly benefits economically. For example, France can pay for West African imports in CFA francs thereby sparing its foreign currency to maintain its exchange rate (Sylla, 2020).

Incidentally, West Africa is not the only region on the continent that has opted for the adoption of a common currency. The Economic and Monetary Community of Central Africa (CEMAC[4]), which comprises six members located in Central Africa of which five are former French colonies (Cameroon, Central African Republic, Congo, Chad, and Gabon) and one is a former Spanish colony (Equatorial Guinea). These countries all circulate the *Coopération financière en Afrique centrale* (Financial Cooperation in Central Africa) CFA franc, which shares all the abovementioned characteristics with the West African CFA franc. However, these two CFA franc currencies are not mutually exchangeable. Also, the CEMAC is excluded from the ECOWAS since it is not geographically located in West Africa.

1.3 The West African Monetary Zone (WAMZ)

The WAMZ is a monetary zone of six nations including one former American colony (Liberia), four former British colonies (The Gambia, Ghana, Nigeria, and Sierra Leone), and one former French colony (Guinea). Formed in 2000, the organization's overarching goal is to achieve full economic integration (i.e., circulate a common currency) by 2003. Unlike the UEMOA, however, these countries have opted for alternative exchange rate regimes. Presently, they preserve individual currencies that are either anchored to the US dollar or managed by respective central banks or use a floating exchange rate altogether. Notwithstanding, the WAMZ will introduce the eco in the subregion before

[4]From the French *Communauté Économique des États de l'Afrique Centrale*.

it is expanded across the entire ECOWAS. To facilitate this process, the WAMZ has established the WAMI, located in Accra, Ghana. This institute is tasked with undertaking technical preparations for the implementation of a common West African Central Bank and the launch of the eco (Public Relations Unit, 2019). Moreover, the WAMI is responsible for closely monitoring the macroeconomic convergence criteria of all WAMZ member states (Public Relations Unit, 2019).

More specifically, there are four primary and six secondary criteria that each country must meet to move forward with implementing the eco. Table 1.1 displays the convergence criteria.

Primary	**Secondary**
i. Single-digit inflation	i. Prohibition of new & liquidation of existing arrears
ii. Debt-to-GDP ratio $\leq 4\%$	ii. Tax revenue-to-GDP ratio $\geq 20\%$
iii. Limit budget deficit to $\leq 10\%$	iii. Wage bill-to-tax revenue $\leq 35\%$
iv. Gross reserves ≥ 3 months of import cover	iv. Internally-funded public revenue $\geq 20\%$
	v. Positive real interest rate
	vi. Real GDP growth rate $\geq 7\%$

Source: Harvey and Cushing (2015).

Table 1.1: Proposed Macroeconomic Convergence Criteria

However, only Ghana has been able to fulfill every primary criterion in any single fiscal year since 2000. Additionally, the WAMI oversees trade and financial sector integration, payment systems development, and statistical harmonization. A currency union may operate suboptimally if convergence criteria remain unfulfilled or if national financial systems are desynchronized.

Another potential issue facing the WAMZ is that Nigeria is by far the most dominant economy in the region. In 2019, the Nigerian economy accounted for 86.11%[5] of the WAMZ's real Gross Domestic Product (GDP). In comparison, the Gambian, Liberian, and Sierra Leonean economies each contributed less than 1% to the region's total real GDP that same year. This vast size disparity could put Nigeria in an unequal position as for the determination of monetary policy once the eco is adopted. Lastly, Cabo Verde is a small island nation off the coast of Senegal and is not a member of either West African subzone. Be that as it may, Cabo Verde does share a marked similarity with the UEMOA as the Portuguese government guarantees the fixed exchange rate of the Cape Verdean escudo to the euro at 1 EUR = 110.265 CVE. This arrangement is less stringent than the CFA franc agreement since the only condition is that the Cape Verdean government commits to respecting the European Union (EU) Treaty macroeconomic reference criteria (Loureiro et al., 2010). Table 1.2 presents some descriptive characteristics of the ECOWAS members for the year 2019.

1.4 The ECOWAS' Main Institutions

Turning now to the main structural arrangements, the ECOWAS is composed of eight institutions: the Authority of Heads of State and Government, the Council of Ministers, the Community Parliament, the Community Court of Justice, the ECOWAS Commission, the ECOWAS Bank for Investment and Development (EBID), the West African Health Organization (WAHO), and the Inter-governmental Action Group against Money Laundering and Terrorism Financing in West Africa (GIABA). These institutions have different man-

[5] Author's own calculations according to data collected from the World Bank's Data portal.

Country	Population	GDP[a]	GDP per Capita[b]
Benin	11801151	14867.19	1259.81
Burkina Faso	20321378	16708.32	822.20
Côte d'Ivoire	25716544	44419.77	1727.28
Guinea-Bissau	1920922	1220.80	635.53
Mali	19658031	15562.20	791.65
Niger	23310715	13127.41	563.15
Senegal	16296364	25821.12	1584.47
Togo	8082366	5625.95	696.08
Ghana	30417856	57315.91	1884.28
Guinea	12771246	11760.76	920.88
The Gambia	2347706	1913.89	815.22
Liberia	4937374	2548.95	516.26
Nigeria	200963599	477161.83	2374.37
Sierra Leone	7813215	3816.41	488.46
Cabo Verde	549935	2148.96	3907.65

Source: World Bank Open Data. a: Real GDP is in millions of US dollars and uses 2010 as the base year. b: Real GDP per capita is in US dollars and uses 2010 as the base year.

Table 1.2: Descriptive Characteristics 2019

dates, but all aim to realize the vision of raising living standards to guarantee a bright future for the ECOWAS. These key institutions are presented in this subsection.

1.4.1 The Authority of Heads of State and Government

The Authority of Heads of State and Government is considered the supreme institution of the ECOWAS. It is composed of the heads of state and/or government of each member state. The Authority is mainly responsible for the general direction and control of the ECOWAS. The Authority ensures the progressive development and realization of the Community's objectives. More specifically, the Authority determines the general policy of the Community and coordinates economic, scientific, technical, cultural, and social policies among member states. The Authority executes additional administrative tasks such as following up on the achievement of objectives, preparing then adopting Rules of Procedure, and appointing the Executive Secretary and External Auditors. The Authority

meets periodically, elects a new chairman annually, and its decisions are binding on the ECOWAS' member states and institutions.

1.4.2 The Council of Ministers

The Council of Ministers is comprised of the minister in charge of ECOWAS affairs and other ministers from each member state. The Council is primarily responsible for the functioning and development of the Community. More precisely, the Council makes recommendations to the Authority regarding the realization of ECOWAS objectives, designates statutory appointees, approves work programs and budgets, improves the organizational structure of Community institutions, and issues directives on economic integration policies. The Council meets biannually with the minister of ECOWAS affairs acting as the Chairman of the Council and its proposed regulations are binding on member states once approved by the Authority.

1.4.3 The Community Parliament

The ECOWAS' Community Parliament is a legislative assembly that serves as a forum for dialogue, consultation, and consensus on matters concerning regional integration. The Parliament is composed of 115 seats of which each member state is guaranteed a minimum of 5 with the remaining 40 being distributed based on population. Furthermore, the Parliament is divided into two wings: the Political Wing and the Administrative Wing. The former consists of the Plenary which is the Parliament's highest decision-making body and the Bureau, which includes the Speaker, four Deputy Speakers as well as various committees. The latter is overseen by the General Secretariat which provides administrative and technical support for parliamentary activities. This wing is headed by the Secretary-General, currently John Azumah of Ghana.

1.4.4 The Community Court of Justice

The Community Court of Justice ensures the observance of the law and respect of principles of equity when interpreting and applying the provisions outlined in the ECOWAS Treaty. The Court also plays an advisory and arbitral role in matters of conflict or dispute among member states. The Authority appoints 5 independent judges after recommendation by the Community Judicial Council for a 4-year non-renewable tenure. The Court consists of 3 departments. Firstly, the Registry Department is responsible for the receipt, processing, and service of court processes. Secondly, the Research and Documentation Department is the Court's legal department. Its main functions are conducting in-depth legal research and housing legal reference material in the Court's library. The Administration and Human Resources Department advises on administrative matters and human resource issues in addition to overseeing the activities of Unit and Section heads within the department.

1.4.5 The ECOWAS Commission

The ECOWAS Commission is the main body from which all programs, projects, and activities stem. This administrative instrument is the key driver helping the ECOWAS to better adapt to the international environment and function properly according to global practices. The Commission supports member states' efforts to build their capacities for program implementation. The Commission works closely with the Council of Ministers to implement policies. The Commission makes recommendations and provides advice to the Council on potential regulations. However, these recommendations and advice are unofficial and not legally enforceable. The Commission adopts the regulations as enacted by the Council. The Commission consists of a president, a vice president, and 13 commissioners. Each commissioner heads a separate department such as Human Resources Management, Education, and Private Sector Promotion.

1.4.6 The ECOWAS Bank for Investment and Development

The EBID is a financial institution that funds activities in the private and public sectors across the ECOWAS. Moreover, the EBID aims to promote economic development in the region by financing projects and programs related to industries such as transport, energy, and telecommunications. To do so, the EBID issues direct medium and long-term concessionary and non-concessionary loans to agents in the public sector. In the private sector, the EBID gives short, medium, and long-term loans, issues lines of credit as well as grants or guarantees bonds, notes, and other securities. As for its capital structure, the EBID operates with $1.5 billion (USD), of which 70% is reserved solely for ECOWAS members. The remaining 30% or $450 million, is open to subscription by non-regional members.

1.4.7 West African Health Organization

The WAHO is a regional agency responsible for safeguarding the health of citizens and ensuring coordination of regional health interventions within the ECOWAS. More specifically, the WAHO initiates as well as harmonizes national policies, pools resources, and cooperates with member states to combat health problems in the region. In the past, the WAHO has conceived programs as well as implemented measures to help address diseases such as Malaria, HIV/AIDS, and Ebola. In a secondary capacity, the WAHO implements strategic orientations to support the quality improvement of regional health systems and services in the ECOWAS. After the Authority and the Council, the Assembly of national health ministers is the most important decision-making body of the WAHO. This assembly brings together the health ministers of each member state and it is responsible for handling health issues at the technical level.

1.4.8 The Inter-governmental Action Group against Money Laundering and Terrorism Financing in West Africa

The creation of the GIABA was a major response to protect ECOWAS economies and financial institutions against money laundering. This institution strengthens the capacity of member states to prevent and control money laundering as well as terrorist financing in the ECOWAS. Since the GIABA acts as the Financial Action Task Force Style Regional Body (FSRB) in West Africa, it works closely with regional governments to ensure compliance with international Anti-money Laundering and Combating the Financing of Terrorism (AML/CFT) standards. In addition to member states, the GIABA grants observer status to other nations and intergovernmental organizations which share its objectives and actions. For example, the Egmont Group and São Tomé and Príncipe have been GIABA observers since 2007.

1.5 A Brief History of the ECOWAS

Having presented the main components and institutions part of the ECOWAS, we now provide a brief historical overview of the organization.

Economic cooperation in West Africa is not a recent initiative and dates as far back as the mid-20^{th} century. As the first two independent West African nations, Ghana and Guinea spearheaded the creation of the Union of West African States in 1958. Later, the recently independent Mali joined in 1960. The group then became known as the Ghana-Guinea-Mali Union. The objectives of the union were implementing a common currency across the region, adopting a unified foreign policy, and establishing shared citizenship among its members. However, none of these objectives were ever achieved because of the geographic separation of Ghana from its partners, the political division on the United Nations Operation in the Congo from 1960-61, and the accusation that the then Ghanaian president, Kwame Nkrumah, had supported the 1963 Togolese coup d'état. Due to these issues, among others, the union was promptly dissolved in May 1963 (Brandful, 2013).

In 1971, Sierra Leone and Liberia founded the Mano River Union which aimed to "accelerate the economic growth, social progress, and cultural advancement of [their] two countries... by active collaboration and mutual assistance in matters of common interest in economic, social, technical, scientific, and administrative fields" (Declaration, 1973). However, this goal was hardly achieved since both nations faced civil wars in the following decades which led to the union's eventual dormancy, but not before Guinea joined in 1980. In 2004, however, the three nations revived the union with Côte d'Ivoire joining four years later (TCB-MRU, 2013). In 2016, the union released plans to build a Mano River Union Parliament which will serve to coordinate national legislation of regional importance (Reporter, 2016).

The early 1960s was also a time of nascent regional cooperation for other West African countries who were still French colonies. The Sahel-Benin Union was established in 1958 by Dahomey (present-day Benin), Côte d'Ivoire, Niger, and Upper Volta (present-day Burkina Faso). The union sought to be "... the grouping that worked in the most efficient way for the cause of African unity" (Ministère, 2010). Moreover, the union established a customs union, set up a sinking fund, and coordinated political, economic as well as military policies. However, since national institutions were not yet fully developed, the Sahel-Benin Union was short-lived and replaced by the *Conseil de l'Entente* (Council of the Entente) in 1959. Joined by Togo in 1966, the Council, which still meets annually, seeks to promote subregional economic integration and improve the well-being of its member states' populations. The Council has in the past approved projects such as the construction of hydraulic dams and the installation of solar panels in rural areas with limited access to electricity.

The *Conseil de l'Entente* was not francophone West Africa's sole initiative towards intra-regional cooperation. The *Union Douanière de l'Afrique de l'Ouest* (West African Customs Union) was formed in 1959 to promote the free movement of goods and a single tariff for imported goods (Asongu and Odhiambo, 2020). This union was comprised of Dahomey (present-day Benin), the Federation of Mali (present-day Mali and Senegal), Côte d'Ivoire, Mauritania, and Niger.

After France granted independence to these nations in the early 1960s, however, the union became better structured and was renamed the *Union Douanière des États de l'Afrique de l'Ouest* (Customs Union of West African States). This new union sought to introduce a common external tariff scheme for goods produced by the member states (Asongu and Odhiambo, 2020).

The union was remodified in 1972 to "promote harmonized and balanced development of member states' economies to improve the living standards of their citizens" (Asongu and Odhiambo, 2020) and became known as the *Communauté Économique des États de l'Afrique de l'Ouest* (Economic Community of West African States). Finally, this union became the UEMOA in 1994 after the member countries committed to full economic integration by adopting the CFA franc. Guinea-Bissau joined the union in 1997 after a series of failed attempts at a monetary partnership with Portugal (Mata, 2020).

Amid these efforts to integrate West African economies came the eventual proposition of a wider organization that would include the majority of the countries in the region. In 1964, President William Tubman of Liberia first proposed the idea of a free trade area in a meeting with representatives from Guinea, Côte d'Ivoire, and Sierra Leone. After some deliberations, these nations would go on to sign the Seven Articles of Association for the Establishment of an Economic Community for West Africa on May 4^{th}, 1967, along with nine other West African nations (Zagaris, 1978). These articles approved the gradual advancement toward a regional organization of economic cooperation. In fact, this young organization could be considered a precursor to the modern-day ECOWAS. Although economic cooperation was progressing steadily, General Yakubu Gowon of Nigeria and President Gnassingbé Eyadéma of Togo were dissatisfied with the limited scope of the Articles of Association in 1972. Instead, they desired a more cohesive and integrated community (Zagaris, 1978). A treaty for the West African Economic Community[6] was drafted in 1973 and after two years of careful consideration and examination, was finally signed in Lagos, Nigeria on May 28^{th}, 1975 by the fifteen heads of state of the member countries. Hence, the ECOWAS was born.

[6]Also known as the Treaty of Lagos.

Shortly after the ECOWAS was established, Cabo Verde became the 16^{th} member of the union after ratifying the Treaty of Lagos in 1977. Then throughout the late 1980s and early 1990s, the ECOWAS struggled to achieve its initial objectives of economic stability and closer relations among member states. This was mostly due to the persisting civil wars in Liberia (1989-1997) and Sierra Leone (1991-2002).

The Lagos Treaty was revised in 1993 to better lay out the foundation of an economic union, the implementation of a common currency, and the expansion of the ECOWAS' areas of influence. Mauritania withdrew from the ECOWAS in 1999 due to a lack of solidarity with its neighbors (Masson and Pattillo, 2004). Alternatively, Mauritania wished to focus its efforts on joining the Arab Maghreb Union, with which it shared more cultural similarities.

In 2000, a group of ECOWAS members formed the WAMZ and announced its plan to introduce the eco currency throughout the zone by 2003. As previously mentioned, the WAMZ set up the WAMI in Accra, Ghana in 2001 to assess the feasibility and suitability of a monetary union in addition to eventually printing and minting the physical money. However, the implementation of this common currency was postponed in 2005, 2010, 2014, and most recently in 2020.

These postponements were a result of members' overall economic unpreparedness and the global financial crisis of 2008-09. The initial plan was once the eco had been introduced in the WAMZ, it would be merged with the UEMOA's CFA franc thus creating an all-encompassing West African monetary union. But, the realization of this objective has been prolonged and underprioritized over the last two decades. Nevertheless, in February 2018, a group of West African leaders renewed their commitment to launching the single currency by 2020. As of September 2020, the eco is expected to be implemented within the next three to five years. Table 1.3 summarizes the different steps that led to the creation of the ECOWAS and other efforts toward West African economic integration.

The reason why the ECOWAS or any region would opt for a shared currency is a complex question. As a first step toward an answer, we examine in the following chapter the economic theory on monetary unions and empirical evidence in the ECOWAS. After,

a more formal analysis of the ECOWAS as an OCA and optimal weights of currencies will be developed in the subsequent chapters.

Organization	Years Active	Steps Toward Economic Integration
Union of West African States	1958-63	•Ghana & Guinea form the union in 1958 •Mali joins in 1960 •Union dissolved in 1963
Mano River Union	1971-Present	•Liberia & Sierra Leone form the union in 1971 •Guinea joins in 1980
Sahel-Benin Union	1958-59	•Benin, Burkina Faso, Côte d'Ivoire, & Niger form the union in 1958 •Union dissolved in 1959
Council of the Entente	1966-Present	•Benin, Burkina Faso, Côte d'Ivoire, & Niger form the union in 1959 •Togo joins in 1966
UEMOA	1959-Present	•Renamed the West African Economic & Monetary Union in 1974 •Guinea-Bissau joins the union in 1997
ECOWAS	1967-Present	•13 West African nations form the Economic Community for West Africa •ECOWAS created in 1975 •Cabo Verde joins the ECOWAS in 1977 •Mauritania leaves the ECOWAS in 1999
WAMZ	2000-Present	•Founded by the Gambia, Ghana, Guinea, Nigeria, & Sierra Leone •Liberia joins the zone in 2010

Table 1.3: Organizations Preceding and Co-existing alongside the ECOWAS

Chapter 2

Literature Review

This chapter reviews the extant literature on OCAs as well as on the potential eco union. Firstly, we present the theoretical underpinnings and stylized facts of currency unions. We introduce the concept of monetary union as well as list the costs and benefits associated with a shared currency. Secondly, we present the idea of OCA criteria, summarize key takeaways from its founders, and explore the body of theoretical currency area literature. Lastly, we review the empirical literature on the potential ecozone and monetary integration in West Africa.

2.1 Theoretical Foundations

2.1.1 What is a Monetary Union?

As mentioned above, the ECOWAS' primary objective is to create a monetary union by introducing the eco as its sole currency. Therefore, it is relevant to understand what a monetary union is and why it would be desirable.

Broadly speaking, a currency area can be defined as a geographical region with one or more currencies within which inter-regional exchange rates are permanently fixed, but which are flexible vis-à-vis the outside world (Sorgenfrei, 2011). Independent members may enter a pseudo exchange rate union by maintaining individual central banks and mon-

etary policies, or join a complete exchange rate union by adopting a common monetary policy. In both instances, exchange rates are fixed by a central authority (i.e., government or central bank) and are convertible. Furthermore, capital markets are fully integrated and allow for the free movement of capital throughout the region. A similar monetary arrangement is currency substitution. This phenomenon constitutes the unofficial adoption of a foreign currency, usually the US dollar or euro. In the domestic country, however, the adopted currency is not legal tender but partially replaces the local currency as a store of value, unit of account, or means of payment (Della Valle et al., 2018). Countries may choose to substitute their national currencies to stave off high inflation and stabilize their economies. Additionally, dollarized or euroized economies have no control over the foreign monetary policy or exchange rates. Currency substitution thus plays a similar role to that of a monetary union but, in an unofficial capacity.

Finally, a monetary (or currency) union is the last stage of a currency area in which members share a single currency, a common central bank, and, a union-wide monetary policy. In this case, the exchange rate remains fixed and capital perfectly mobile, however, individual monetary autonomy and control of national foreign-exchange reserves become centralized (Sorgenfrei, 2011). These are only a few of the pros and cons of monetary integration that are presented in the following subsection.

2.1.2 The Costs & Benefits of a Monetary Union

Although a monetary union can be advantageous to the economies involved, it does present certain drawbacks. Nevertheless, a group of states will only decide to form a monetary union if the expected benefits outweigh the costs. Otherwise, it would be wiser to maintain national currencies or seek some alternative monetary arrangement. This subsection, therefore, outlines the major costs and benefits of monetary integration and the adoption of a shared currency. It then identifies the shortcomings of the cost-benefit analysis approach when deciding whether to adopt a common currency.

The expected benefits of a single currency are outlined in the following list.

1. Elimination of transaction costs: Since member countries will share a single currency, they will no longer be a cost associated with currency exchange (De Grauwe et al., 1991).

2. Reduction of exchange rate uncertainty: As there is one currency, households or firms which wish to invest in another country will not need to be concerned with the possible fluctuation of the local currency (De Grauwe et al., 1991).

3. Increased value: A single currency's value may increase as it will be circulated over a broader geographical area and exchanged more frequently by economic agents (De Grauwe, 2000).

4. Increased price transparency: Price discrimination is more difficult when prices are only listed in one currency (Emerson et al., 1992).

5. Lower and more stable inflation: As long as the common central bank aims to ensure price stability, heavily indebted governments will likely be dissuaded from raising inflation to reduce interest obligations and monetize their budget deficits (Sorgenfrei, 2011).

6. Increased international attention: A new currency is likely to attract attention in international money markets which may, in turn, bring in more outside foreign investment (Sorgenfrei, 2011).

7. Increased trade competitiveness: The elimination of external exchange rate volatility and transaction costs often leads to increased trade with the rest of the world (Rose, 2000).

The expected costs of a single currency are presented in the following list.

1. Loss of independent monetary policy: In a monetary union, the common central bank implements monetary policy for the entire union and not just for select nations. Therefore, independent countries can no longer utilize instruments, such as their key rates, to stimulate or stabilize their economies (Steinberg and Walter, 2013).

2. Loss of seigniorage revenues: The interest or return on assets that central banks acquire from lending physical money to commercial banks can constitute a significant source of revenues for countries with few sources of income (De Grauwe, 2000).

3. Greater coordination and administration: The common central bank will generally work closely with national central banks throughout the union which will incur higher administrative costs (Sorgenfrei, 2011).

4. Loss of control over foreign-exchange reserves: Upon entering a monetary union, members must transfer their foreign reserve assets (i.e., foreign currency) to the common central bank (Sorgenfrei, 2011).

5. Negative spillover effects: If certain members join the union with high public debt and deficits, inflation could rise along with interest rates in other countries that would otherwise be unaffected (Kenen and Meade, 2007).

6. Asymmetric shocks: Economic shocks may not affect all economies uniformly (Krugman, 2013), therefore, it could be difficult to deal with them. For example, if a single member were to experience a negative shock, it may require lower interest rates to restabilize its economy, however, the common central bank cannot simply change its monetary policy to accommodate one country.

7. Increased political pressure: In a currency union, economic realities may generate political pressure among members to maintain the new normalcy (Eichengreen and Frieden, 1993).

Cost-benefit Analysis Shortcomings

Evaluating the pros and cons of a currency union through a politico-economic lens provides a broader view of monetary integration. However, it still does not answer one critical question: Why would a country decide to join a monetary union? Simply predicting higher benefits than costs may not be the most reliable or straightforward method when it comes to deciding upon a monetary system for a single, let alone a host of countries.

Other questions also start to branch off from this main question such as: What would drive a group of nations to abandon their national currencies in favor of a shared one? After all, an individual currency is an important symbol of national sovereignty, the administrative costs can be high, and procedural changes can be disruptive when switching monetary regimes. Or why would a small country circulate its own currency while it could easily adopt that of a larger neighbor? This is the case for Liechtenstein, which uses the Swiss franc, for example. Also, under what conditions should a group of countries go forward with the implementation of a common currency?

A currency area must undoubtedly be optimal if its members are to enjoy the benefits of full monetary integration. To define optimality, we turn to the theory of OCAs for a more sophisticated framework to evaluate joining a currency union. This concept is expounded in the following subsection.

2.1.3 Optimum Currency Areas

An OCA is a geographical region that would maximize its economic benefits by maintaining rigid exchange rates within the area (Melvin and Norrbin, 2017). The "optimality" aspect refers to various measures and concepts which attempt to assess the costs and benefits of abandoning a national currency in favor of joining a monetary union (Benczes, 2014). Table 2.1 succinctly presents select properties that have been developed to rationally and accurately calculate optimality. We, however, examine one important criterion, RER behavior, which is outlined in the following subsection.

Real Exchange-rate Behavior

In this study, we focus on the criterion of RER behavior which was developed by Enders and Hurn (1994) to define optimality. This stylized fact emphasizes that if the fundamental macroeconomic variables that determine RERs (e.g., output, prices, current account balance) are sufficiently integrated, as is the case in an OCA, the RERs will share common stochastic trends. This is in line with Mundellian theory which states that within an

OCA, real output levels and expenditure patterns will exhibit similar movement patterns (Mundell, 1961). Extant empirical research has, in fact, verified numerous forcing variables to determine RERs. Branson (1981) designs a theoretical model which confirms that money, prices, and the current account balance all affect exchange rates. Later, MacDonald (1999) examines RERs in a long-run setting. He constructs a model which features factors such as net foreign assets, terms of trade effects, and fiscal balances that are key RER determinants. The author concludes that these variables explain the long-run relationships of various European RERs. Also, Dropsy (1996) reports that the variation in the yen and pound's RERs against the US dollar can be explained by monetary policy in the long run in addition to fluctuations in economic growth and long-term interest rates in the medium run. More recently, Goda and Priewe (2019) determine terms of trade to be a crucial RER component in 15 developing economies. Given these advancements,[1] bilateral RERs are a helpful tool in analyzing if an OCA exists among a group of countries.

Although useful, the abovementioned criterion is merely one feature of currency area optimality. We provide in the following subsections a more holistic view of OCAs. To do so, we present the contributions that pioneered this theory before delving into the extensive body of work that sought to define the appropriate domain of an OCA.

[1] See Edwards (1993); Clark and MacDonald (1999); Driver and Westaway (2003) for further evidence.

Criterion	Key Points
Shock Symmetry	•Asymmetric shocks reduce comovement of business cycles •Central bank cannot adjust monetary policy to satisfy all economies •Contemporaneous shock transmission to other economies
Factor mobility	•Ease with which capital, land, or labor can be relocated or put to an alternate use •High mobility $\rightarrow$ Labor shifts easily $\rightarrow$ No unemployment/inflationary pressure •Central monetary policy satisfies all countries with fixed exchange rate
Price & wage flexibility	•Markets reequilibrate due to adjustments in sticky prices & wages after idiosyncratic shock •Price flexibility increases with higher market concentration
Economic openness	•Economic output divided into tradable and nontradable goods •Openness equals ratio of tradables to nontradables •Fixed exchange-rate regime is preferable in an open economy
Product diversification	•Diversified economies better protected against asymmetric shocks • Shock in one sector may cancel out another in a different sector
Similarity of preferences	•Members have different macroeconomic variable preferences •High inflation & low unemployment vs Low inflation & High unemployment •Low vs high external value of a common currency •Preference for structural reform over interest rate adjustment
Fiscal integration	•Fiscal policy decentralized & left to member states •Fiscal & monetary policy should work together in an OCA •Easier to smooth the impact of a shock & restore equilibrium with fiscal transfers

Table 2.1: Common OCA Criteria

Mundell (1961)

The theory of currency areas was first introduced by Mundell (1961) in his seminal paper entitled: "A Theory of Optimum Currency Areas." In his article, the author theorized that a single currency could create the greatest economic benefit for many regions as opposed to multiple currencies. This was not limited to distinct nations separated by precise boundaries but included eastern and western sides of two countries that transcended legal borders. He concluded that countries sharing strong economic ties may be best suited to adopting a common currency and would benefit most from this arrangement. Perhaps Mundell (1961)'s most important contributions are the need for a high degree of factor mobility as well as price and wage flexibility between regions. These are especially important for a currency area to function optimally (Tanja, 2005). In a currency union, Mundell (1961) explains that labor mobility acts as a mechanism to restore the balance of payments equilibrium following inflation-driven unemployment in a specific region. The author also notes that wage and price flexibility in an economy better facilitate navigating idiosyncratic demand shocks.

McKinnon (1963)

McKinnon (1963) was the second to contribute to this theory and provided the first clear definition of an OCA: "Optimum is used here to describe a single currency area within which monetary-fiscal policy and flexible external exchange rates can be used to give the best resolution of three (sometimes conflicting) objectives: (1) the maintenance of full employment; (2) the maintenance of balanced international payments; (3) the maintenance of a stable internal average price level" (McKinnon, 1963). He also asserts that the degree of trade openness is an important criterion in currency union optimality. The author defines the degree of trade openness as the ratio of tradables to nontradables produced in an economy. The case is more compelling for countries that frequently trade with each other to utilize a single currency as the foreign prices of tradables will most likely be transmitted to the domestic cost of living. Therefore, the exchange rate will have more in-

fluence on wage contracts and prices by causing them to adjust. Accordingly, movements in the exchange rate will be less efficient as a means of changing the terms of trade and as an adjustment mechanism (Tanja, 2005). Finally, McKinnon (1963) stresses that a small open economy would benefit most from joining a currency union.

Kenen (1969)

Kenen (1969) affirms product diversification to be a crucial factor in forming an OCA. A country that exports a single product will be vulnerable to negative demand shocks and, as a result, its export revenue will decline. To restore equilibrium in a fixed exchange rate regime, either prices and wages will decrease, or unemployment will increase. However, a well-diversified economy that exports a variety of products could better cope with demand shocks since a positive shock in one sector and a negative one in another could neutralize each other. Since diversification is not a perfect safety measure against shocks, a macroeconomic disturbance could still affect the entire export sector of an economy. Furthermore, larger economies are often more diversified and have smaller export sectors compared to smaller ones. Therefore, it is essential for smaller open economies in a currency area to diversify their exports. Lastly, Kenen (1969) mentions that should a currency area be affected by an idiosyncratic shock, member countries will be able to mitigate against its effects by sending fiscal transfers from surplus to deficit regions.

Additional OCA Theory Research

A wave of interest closely followed after the publication of Mundell (1961)'s influential paper. From the 1960s to mid-70s, much research was conducted on the optimality of currency areas, with particular attention paid to Europe. Be that as it may, the framework developed by the three pioneers was fragile (Dellas and Tavlas, 2009) with numerous inconsistencies and contradictions causing the research to dwindle before diminishing entirely in the latter half of the 1970s. Hence, currency area research remained dormant for over a decade. However, a renewed interest in currency area theory resurfaced at the be-

ginning of the 1990s as Western European nations started to seriously consider a currency union. As a result, a new body of theoretical literature emerged which complemented earlier research and criticized the unresolved issues that continually plagued currency areas. In both eras, this new literature was mainly interested in defining the frontiers of a currency area. This subject is developed in the next subsection.

2.1.4 What is the Exact Domain of a Currency Area?

As the subtitle suggests, the major question which theoretical research sought to answer was: Where should the borders of a currency area be drawn? Although this is essentially an empirical question (Mundell, 1961), two theoretical approaches were proposed to engage it during OCA theory's heyday, then a third after the theory's revival. Two considerations must be kept in mind while evaluating the usefulness of these methods (Ishiyama, 1975). First of all, these approaches suggest a fixed exchange rate so long as welfare is maximized for a single country as opposed to the entire union. With this in mind, national and global welfare may not always coincide. Second, these approaches compare rigid and flexible exchange rates with each other. In practice, this comparison may not always be relevant.

The Traditional Approach

According to the traditional approach, currency area optimality is determined by achieving fiscal and monetary policy objectives. More specifically, a successful currency area will exhibit full employment, price stability, and balance of payments equilibrium (Ishiyama, 1975). Hence, these qualities indicate where the lines should be drawn in a currency area. This is the criteria-driven approach that was unwittingly applied by the pioneers of currency area theory. As mentioned earlier, Mundell (1961) chooses a high degree of labor mobility as a key criterion for a unified currency area. McKinnon (1963) touched on all of these points while paying special attention to price adjustments as a result of trade openness. Through a macroeconomic lens, Kenen (1969) specifically focuses on external

equilibrium in the context of fixed exchange rates.

Moreover, this approach opened the door to criticism, debate, and doubt as to what defined relevant criteria for a smooth-functioning currency union. For example, Ingram (1962) explains the need for fixed exchange rate changes disappears under a high degree of financial integration. This is because marginal changes in the interest rates would stimulate adequate equilibrating capital movements across borders. Ingram (1973) and Scitovsky (1958, 1967) further determine a high degree of international financial integration of short and long-term securities to be an essential criterion for an OCA. In another contribution, Ingram (1969) criticizes the three pioneers of OCA theory. The author claims the early models left too little room for money, expressed prices in real terms of trade, and external adjustment only occurred in the current account. According to the author, these oversights ignored characteristics that were essential to currency-area optimality. Also, Fleming (1962) questioned if it would even be feasible to implement a unified fiscal policy to restore external balance via transfer payments. Additionally, certain authors find economic characteristics to be of less importance and deem the similarity of policy attitudes of member countries more pertinent in forming a multi-country currency union (Ingram, 1969; Haberler, 1970; Tower, 1971). More specifically, countries may harbor different preferences about the trade-off between inflation and unemployment. That being said, a nation with low unemployment tolerance would make a poor partner for a country with low inflation tolerance (Willett and Tower, 2015). Following this line of thinking, select contributions to the literature disagreed on the importance of similar inflation rates (Haberler, 1970; Fleming, 1971; Parkin, 1972). The usefulness of this criterion depended on key factors such as the significance of differential rates of inflation and productivity growth, external disturbances as well as the degree of intractability of divergent cost and inflation trends among nations (Ishiyama, 1975). In short, the traditional approach is rather uncomprehensive and does not provide for any general hypothesis (Cesarano, 2006).

The Alternative Approach

The alternative method is more refined and, unlike the traditional approach, provides a unifying framework (Ishiyama, 1975). Instead of judging optimality based on arbitrary exogenous criteria, the alternative approach attempts to balance the costs and benefits of joining a currency union. To do so, this approach entails an in-depth cost-benefit analysis which requires significant conceptual as well as quantitative research, and frequent updating due to the dynamic nature of national economies.

On the one hand, there are several costs to joining a currency union. The major disadvantage is the renouncement of an autonomous monetary policy (Lutz, 1972). Monetary policy is an important domestic instrument on which governments rely to control the money supply and achieve sustainable growth. Therefore, the loss of this internal tool restricts government's indirect control over economic performance. For example, a national central bank will be unable to adjust its key rate to combat inflation or unemployment according to its preferences (Corden, 1972; Willett and Tower, 1976, 2015). What is more, Johnson (1963) points out that governments may no longer print money to stimulate the economy if a central bank is responsible for a union-wide monetary policy. Next, a common currency area may contribute to the deterioration of the employment-inflation relationship if each country has its own distinct Phillips curve (Fleming, 1971). Fixed exchange rates will increase the level of unemployment needed to maintain inflation at a given rate while increasing the inflation rate according to a given level of unemployment in the currency area. A currency union may also limit government's fiscal freedom since independent budgetary policies may need to coordinate with monetary policy to ensure balance-of-payments equilibrium. Arndt (2013) creates a three-country model in which he shows that external balance can be achieved by coordinating both economic policies.

On the other hand, there are indeed advantages associated with full monetary integration. One of the most well-known benefits is a common currency eliminates the costs of money conversion (Ishiyama, 1975) and forward cover required in a flexible exchange rate system to mitigate risk (Willett and Tower, 1976). This is due to the fixed exchange rate

agreement among members of a currency union. Furthermore, rigid exchange rates offer the benefit of risk pooling (Mundell, 1973) and lead to less costly payments adjustment as well as efficiency in resource allocation and money holding (Laffer, 1973). The argument supporting these claims is that economic distress is spread over space and time (Balassa, 1969). Next, Mundell (1973) notes the elimination of speculative capital flows thereby removing the need for monetary control by the economic authorities. This is of course in the context of a large monetary union (Grubel, 1970) since a small number of speculators could collude to influence the market in a modest-sized currency area. Additionally, Williamson (1976) establishes that monetary integration is likely to accelerate fiscal integration as a coordinated approach would incur fewer costs than national efforts. Finally, Kafka (1969) notes that members of a currency union can economize on exchange reserves by granting each other credits to finance intra-regional trade. He further states that if a group pools its reserves, it can save on reserves vis-à-vis a third country if the needs are mutually offsetting. The author confirms the validity of this arrangement, though in a limited-scale capacity, in a later contribution to the literature (Kafka, 2013).

The Equilibrium or Modern Approach

Lastly, the equilibrium or modern approach emerged after OCA theory's resurrection in the early 1990s. This was mainly because the previous evaluative criteria were static and often conflicted in a dynamic setting (Eichengreen, 1992; Krugman, 1993). Moreover, this novel method strays from the Keynesian paradigm in favor of new classical macroeconomics by emphasizing the endogeneity of optimality criteria (Cesarano, 2006). This approach stresses the national border as a key factor in international adjustment as it influences agents' behavior (Cesarano, 1997). The "border effect" exists due to the larger information set from which individual agents benefit within the boundaries of a country. Therefore, the greater availability of information increases market efficiency as well as responsiveness to shocks and policies. Hence, the border acts as an economic barrier inside which optimizing behavior causes equilibrium forces to affect inter-regional adjustment (Cesarano, 2013). Since the optimality criteria stem from adjustment forces

resulting from rational behavior instead of exogenous characteristics, they are now considered endogenous. In a currency union, Cesarano (2011) notes that national borders hinder intra-union adjustment by reducing agents' information set, diversifying institutional settings, and narrowing the range of economic policies. However, the author points to political sovereignty's policy tools as a solution to the deficiencies in the adjustment process caused by national frontiers. Finally, the importance of domestic borders on regional trade has been verified empirically in the recent literature. McCallum (1995) studies the impact of the Canada-U.S. border on regional trade patterns and finds borders to have a decisive effect on continental trade patterns. This is especially compelling given the common history, culture, and institutions of these two nations.

Although these approaches provide criteria that help judge optimality, they do not present a structured theoretical framework to conclusively determine whether a region is an OCA. For this, we rely on primarily quantitative research to assess a region's level of economic readiness for a common currency. Hence, we examine in the following subsection empirical evidence of the ECOWAS' preparedness for the eco as well as other topics that are tied to monetary integration in the region.

2.2 Empirical Evidence

After the successful adoption of the euro in 2002, interest slowly turned to the ECOWAS and its suitability for a monetary union. However, ECOWAS currency union research is underdeveloped and lacking in attention in the empirical literature. This is mostly because of the constant postponements by governments and the overwhelming consensus that West Africa is not yet ready for an all-encompassing monetary union. Nonetheless, there exists a body of literature that attempts to assess the ECOWAS' preparedness for the eco by using a variety of econometric methods. The literature has also addressed related topics that are linked to monetary integration but do not focus directly on the economic readiness for an ecozone.

2.2.1 Is the ECOWAS Ready for a Currency Union?

The following subsection examines the empirical literature on the preparedness for an eco union.

Responses to External Shocks

Contemporary empirical research has indeed assessed whether the ECOWAS is fit for a monetary union by using various econometric techniques. Recently, researchers have sought to better understand the nature of shocks and the ECOWAS members' responsiveness to them. To perform this analysis, several researchers have applied the vector autoregression (VAR) model. Houssa (2008) examines the fluctuations of aggregate supply and demand shocks in the ECOWAS by using the VAR methodology. His results indicate negative as well as low correlations among supply shocks across the region. Furthermore, the WAMZ responds asymmetrically to demand shocks whereas the UEMOA members respond symmetrically to one other. The latter reaction is most likely due to the shared currency in the UEMOA. The author concludes that the ECOWAS would be unable to operate a successful monetary union as different policy responses would be required to readjust all economies following a shock. Next, Mati et al. (2019) construct two empirical models to study inflationary and productivity shocks. The authors then estimate a reduced-form VAR by applying the Blanchard and Quah (1989) decomposition technique. Their findings reveal the shocks to be asymmetric across the entire ECOWAS. They conclude that a full-fledged currency union is inadvisable since a single monetary authority cannot address the idiosyncratic shocks among member states.

External Shock Symmetry, Correlation, & Size

Furthermore, researchers may wish to gain insights into the underlying structure of the ECOWAS when impacted by an external disturbance. To do this, they turn to the Structural Vector Autoregression (SVAR) model. For his part, Chuku (2012) estimates a multivariate SVAR model then computes the correlations of 4 types of disturbances in West

African economies to evaluate the feasibility of a common currency. Unsurprisingly, the results indicate a high degree of symmetry in the correlation of external disturbances. Furthermore, supply, demand, and monetary shock patterns are highly asymmetric. It would therefore be difficult to implement a common currency as different policy responses would be required to address the presence of asymmetric shocks. The author also notes that RER shocks do not converge in the ECOWAS. Thus, a single exchange rate policy would be less than ideal for the region. Similarly, Nkwatoh (2018) evaluates the preparedness of the ECOWAS members for a common currency by analyzing the degree of symmetry and sizes of shocks. To do so, he estimates a 5-variable SVAR model under the assumption that countries will adopt a common currency if shocks are positively correlated. The author finds external supply shocks within the ECOWAS to be symmetric except for Sierra Leone. What is more, demand, supply, and monetary shocks are all asymmetric among member countries. The absolute relative sizes of shocks across the region are high and differ in size as well. The article concludes by suggesting that ECOWAS governments shift the targeted date beyond 2020 to give member states time to fully prepare.

Economic Homogeneity

Since homogeneous economies are often more suitable for a currency union, it is useful to group together similar countries according to a predetermined set of characteristics. A helpful tool that allows for this approach is cluster analysis. Firstly, Bénassy-Quéré and Coupet (2005) employ this technique to delimit groupings of ECOWAS countries to assess the subgroups' optimality as common currency zones. Although the UEMOA is suboptimal on its own, when acting as the core, it can form an OCA when combined with the WAMZ (without Nigeria). Secondly, Tsangarides and Qureshi (2008) use hard and soft clustering methods to gain insights into the similarities of ECOWAS members' economic structures and identify homogeneous subgroups. The authors uncover considerable heterogeneity in the economic characteristics of the UEMOA and WAMZ countries. They conclude that the eco union would be inadvisable.

Cost-benefit Analyses & Welfare

Next, evaluating the pros and cons of a currency union can help decide if monetary integration is indeed desirable. To execute a cost-benefit analysis, some authors have designed and calibrated theoretical models to economic data. Moreover, extant literature follows the underlying assumption that the ECOWAS will only adopt a shared currency if the expected benefits outweigh the costs. Firstly, Debrun et al. (2005) develop then calibrate a theoretical model to West African data to evaluate the proposed eco union. Their model includes trade incentives and a fiscal distortion to account for embezzlement by government officials. After conducting simulations, the authors find fiscal heterogeneities to be more important than asymmetric shocks in determining net gains and losses from a potential ecozone. Furthermore, a currency union is shown to be incentive incompatible for most of the UEMOA although, the model suggests a monetary union would be desirable for the WAMZ countries. Secondly, Masson (2006) calibrates a welfare model to cross-country ECOWAS data. He compares the welfare derived from the existing CFA franc and the WAMZ's independent currencies against that of a shared currency. In the end, all countries turn out to be welfare losers from the adoption of the eco except for Nigeria, the sole gainer. This is likely because Nigeria would have the greatest weight in setting monetary policy due to its dominant economic presence in the region. The author concludes by deciding that a currency union is not the best way for the ECOWAS to address its development challenges. Lastly, Debrun et al. (2011) update and extend their previous work by calibrating a newly developed "DMP" (Debrun, Masson, and Patillo) model to more recent data. In their cost-benefit analysis, they define benefits in terms of a more credible monetary policy while costs derive from real shock asymmetries and fiscal disparities. Their simulations show minimal net welfare gains for all ECOWAS members except for The Gambia, the only net loser. However, a common currency is deemed desirable for the UEMOA but undesirable for the WAMZ when simulated individually. Given this result, the authors conclude by questioning the strategy of first forming a WAMZ currency union instead of simply initiating ECOWAS-wide monetary integration.

Business Cycle Synchronization

Subsequently, business cycle synchronization (BCS) is a key criterion when considering a common currency. This is a result of a single monetary policy being more effective in economies that follow similar cyclical movements in economic activity. Extant literature has applied factor analysis and filtering methods to extract business cycles to investigate synchronization in the ECOWAS. Early on, Celasun and Justiniano (2005) execute dynamic factor analysis to examine the synchronization of fluctuations in productivity among the ECOWAS members. Their results reveal that smaller member states are more harmonized regarding variations in productivity. The authors conclude by recommending select nations group together to form individual currency unions as opposed to embarking on broader monetary integration. More recently, Zouri (2020) utilizes factor analysis based on maximum likelihood (ML) to extract common factors to GDP growth. The author then constructs two alternative measures of synchronization on which he tests the effects of intra-regional trade and financial integration. The results show bilateral trade and regional financial integration to be key BCS determinants in the ECOWAS. Besides, the author determines that the launch of the eco will increase BCS through bilateral trade across the region. Next, Tapsoba (2009) applies the Baxter-King filter to examine the impact of trade integration on BCS to ensure the viability of the ecozone. The author finds trade integration to be a crucial factor in BCS, and if boosted, could even quadruple synchronization throughout the ECOWAS. In the end, he determines an ecozone to be economically viable so long as economic integration is prioritized. Later, Miles (2017) studies whether the ECOWAS has sufficient BCS to operate effectively. To do so, he applies the synchronicity and similarity filtering method developed by Mink et al. (2012) for the eurozone. His findings indicate that the ECOWAS' business cycles are highly unsynchronized. What is more, the results do not support the idea that forming a currency union will in itself improve BCS. Thus, the author recommends the goal of introducing the eco to be shelved for the foreseeable future.

Purchasing Power of Parity

Several studies have investigated the empirical validity of the purchasing power of parity (PPP) hypothesis to assess if the ECOWAS is moving toward further economic integration. In essence, this hypothesis predicts equal price levels across the different integrated economies. Recently, Nathaniel (2019) performs unit root, panel unit root, and panel cointegration tests on the RERs of ECOWAS members. On the one hand, the authors only find PPP to be valid individually across all countries for some tests. On the other hand, their Hadri LM unit root and Pedroni panel cointegration tests reject PPP's validity. Given these mixed results, the authors suggest the ECOWAS cautiously forge ahead with the implementation of the eco. Sugimoto (2008) studies the optimality of setting up a common currency area in West Africa by applying the GPPP model to RERs. He creates clusters of various West African countries before performing the Johansen cointegration test to detect long-term relationships among the RERs. The author finds that the UEMOA, WAMZ, and other combinations satisfy the GPPP condition of common trends. Sugimoto (2008) then applies this same methodology to estimate optimal weights for a common currency basket peg composed of the US dollar and euro. He finds, however, that the UEMOA and WAMZ would require vastly different weights for each currency. Given these results, the author concludes that the coexistence of the UEMOA and WAMZ is more sensible than an ecozone until such a time where both subzones display more convergence. Similarly, Bakar and Luqman (2015) test the validity of long-run PPP in a subset of ECOWAS nations using the GPPP framework and Johansen estimation techniques. A notable difference is that these authors use the real effective exchange rate (REER) instead of the usual RERs. Their empirical results indicate that GPPP holds for the group studied. The authors conclude by reminding the reader of the significant policy implications of their results going forward with the eco union. On a related note, the theoretical framework and estimation techniques used in the latter two articles will later be applied in this present study.

2.2.2 Evidence on Additional Aspects of Monetary Integration

The following subsection examines the literature on different economic and political aspects that are linked to monetary integration.

Fiscal Convergence

Besides economic preparedness for the eco, contemporary research has explored other aspects of monetary integration in the ECOWAS. Firstly, fiscal convergence is vital when considering a common currency as it facilitates effective economic policies across an entire region. Amadou and Kebalo (2019) test the validity of the fiscal convergence criterion limiting the public deficit to 3% of GDP by applying Hansen (1999)'s non-linear approach to panel data. The authors estimate a threshold of 4.74%, therefore, confirming the initial criterion to be pro-growth. However, they note the proposed threshold could be readjusted upward to support greater economic growth. The analysis further posits only four countries are on track to meeting the 3% limit and encourages governments to exercise greater fiscal discipline before possibly adopting the eco. Although theoretical, Hefeker (2010) designs a static macroeconomic model to predict how an eco union would influence governments' incentives to implement structural reforms in their fiscal systems. He further asks how the policy mix differs between symmetric and heterogeneous unions. Once solved, the model reveals that a symmetric monetary union leads to more fiscal distortions and fewer structural reforms. This, the author explains, is because governments no longer internalize their fiscal policies on inflation. In a novel contribution, Magazzino (2016) applies several panel econometric techniques to explore the relationship between public finance variables and economic growth in the ECOWAS. He finds government expenditure as well as revenue to be counter-cyclical and fiscal balance to be anti-cyclical in the ECOWAS. Also, panel stationarity and cointegration analyses reveal a weak long-run relationship between government budget and terms of trade in the WAMZ whereas the UEMOA economies are more interrelated. The author concludes that greater intra-African trade and integration are required to improve the benefits of a monetary union.

Political & Institutional Readiness

Contemporary research has studied political and institutional preparedness within the ECOWAS region. This is important since forming a currency union is not only an economic project but, also a political one that requires the cooperation of national institutions and governments. Aideyan (2016) analyzes how uncooperative regimes might best account for the ongoing difficulty in achieving a single currency. To do so, he applies a constructivist approach that emphasizes the importance of institutions in processes of learning and socialization. In his conceptual analysis, he notes an absence of institutionalized political and economic relationships that promote cooperation as well as coordination throughout the region. Most notably, the ECOWAS lacks a eurozone-type EMS that would be used for attaining consensus among the member states. The author proposes the possible merger of the WAMI and BCEAO as a solution to this issue. Next, Amato and Nubukpo (2020) examine the conditions of political feasibility of the ecozone. More specifically, they pose the external question of what exchange rate regime will be adopted for the eco. There is unintendedly a political side to this as France presently guarantees the value of the CFA franc whereas the non-UEMOA governments all circulate separate currencies. To address this, the authors present three possible scenarios of a single currency with the most preferable being a flexible exchange rate regime and fiscal federalism. In this case, the ECOWAS Commission will be able to respond effectively to asymmetric shocks by using the federal budget and to symmetric shocks by cooperating with the future central bank. Finally, Dufrénot and Sugimoto (2013) take a different approach by addressing the question of which external peg will best achieve internal and external competitiveness. Besides estimating a model for a small exporting economy, they execute counterfactual analyses for four safe-haven currencies: the US dollar, the euro, the yen, and the renminbi. Their simulations show that ECOWAS governments will probably not all agree on the same anchor currency since reserve currencies fluctuate according to the world price of commodities. The authors conclude by acknowledging that the choice of a peg will ultimately be a political decision influenced by individual state preferences.

Bilateral Trade Performance

Lastly, the intensity of intra-regional trade is an important condition when assessing a region's suitability for a monetary union (Frankel and Rose, 1998). A helpful econometric tool used to make this assessment is the gravity model, which considers the trade flows between two countries to be a function of economic mass and geographic distance. Adam and Chaudhry (2014) investigate the currency union effect on aggregate bilateral trade in the ECOWAS. To do so, they estimate a gravity model using the panel dynamic ordinary least squares method. The study finds evidence of significantly positive effects on aggregate intra-ECOWAS trade. More specifically, a currency union is predicted to increase trade by 1.023 and 1.609 times in the short and long terms, respectively. The authors end by reminding policymakers to also make efforts to diversify exports while working toward introducing the eco. Subsequently, Mignamissi (2018) evaluates the potential effect that a shared currency would have on market integration in the ECOWAS. To do this, he estimates an augmented gravity model by pseudo maximum likelihood. This enhanced method accounts for multilateral resistance, intra-national distances, and additional variables such as an indicator to simulate a single currency. The findings show a common currency to have a positive and significant effect on bilateral trade across the region. As expected, however, resistance and distance prove to negatively impact bilateral commerce among member countries. The author concludes by recommending policymakers accelerate the implementation of reforms required before fully forming a monetary union. Finally, Osabuohien et al. (2019) provide empirical insights on the inner-workings of regional trade agreements within the ECOWAS. In their study, they identify bilateral trade barriers that affect trade flows among member states by using an augmented gravity model with Poisson pseudo maximum likelihood estimation. Their results indicate that trade complementarity has a positive and significant effect on bilateral trade in the region. The article ends by asserting that the low quality and quantity of trade-related infrastructure are the main impediments to further economic integration in the ECOWAS.

2.2.3 Concluding Remarks on the Eco Union

Although some studies advocate for the creation of the ecozone (e.g., Sugimoto 2008; Nathaniel 2019), the vast majority of the existing literature agrees the ECOWAS is not yet ready for a shared currency, at least in the short run (e.g., Asongu et al. 2017). Furthermore, indirect indicators of economic preparedness do not point to a stable foundation that would support or help a common currency to thrive. It is therefore unsurprising that the ECOWAS has once again postponed the implementation of its eco. This way, member countries will have ample time to work toward fulfilling the requisite conditions for a more prosperous currency union (Nkwatoh et al., 2019).

Given the postponement of the eco union, an interesting question then becomes: If the ECOWAS is not an OCA, how about its subzones? Recent research has studied the optimality of the WAMZ and UEMOA independently hoping to better understand these two subgroups. The WAMZ is yet to introduce its planned single currency and is not showing signs of being an OCA (Cham, 2011; Alagidede et al., 2012; Asongu, 2013; Harvey and Cushing, 2015; Simons and Jean Louis, 2018).

The UEMOA is showing no indication of being an OCA either (Coulibaly and Gnimassoun, 2013; Quah, 2016; Ndao et al., 2019; Diagne, 2019; Samba and Mbassi, 2020). Even on their own, both currency areas perform suboptimally thus begging the question of why a merger of these two unions would somehow do better. Regardless, the future of the ECOWAS appears to be set, that is to say, the eco will seemingly be introduced at some point. Now that the literature has been introduced, we turn to our empirical analysis in the subsequent chapter to directly determine whether the ecozone is an OCA.

Chapter 3

Data & Methodology

This chapter presents the data and empirical methodology used in our study. As mentioned earlier, our objectives in this research are to determine whether the ECOWAS is an OCA and to estimate an optimal common currency basket peg. To accomplish this, we perform econometric analysis on bilateral RERs because if their determinants are sufficiently interrelated, they will exhibit comovement and have common factors. We first describe our data sources, calculation technique for bilateral RERs, and descriptive statistics. We then present our methodology to determine whether an OCA exists. Lastly, we explain our empirical approach for identifying the optimal weights of a common currency basket peg for the eco.

3.1 Data, Bilateral RERs, & Descriptive Statistics

This study makes use of monthly nominal exchange rate and CPI data that are available in the IFS and BCEAO databases. At the time of writing, several countries have not yet reported their most recent observations to the IMF. Therefore, we turned to national statistical institutes and central banks to complete our dataset. Our sample consists of all 15 ECOWAS member states and covers the January 2006-to-December 2020 period. We also utilize trade data for all ECOWAS countries that originate from the IFS online database. Once again, recent observations were retrieved from Eurostat, USA Trade Online, and the

Office for National Statistics online databases.

As a first step, we start by computing the bilateral RER for each of the ECOWAS countries and the UEMOA subgroup. The euro was taken as the numéraire for each exchange rate while the base for CPI was rescaled to 2015=100. To perform our calculations, we apply the relative PPP approach which measures the RER as the price of foreign goods relative to that of local goods where prices are expressed in a base currency. Simply put, the real exchange rate is the nominal exchange rate adjusted for the relative prices of the foreign and domestic economies. Under the assumption of relative PPP, the real exchange rate, Q, can be expressed as follows:

$$Q = E\frac{P^*}{P} \tag{3.1}$$

where E is the nominal exchange rate and P^* and P are the foreign and domestic prices, respectively. It should be pointed out that we chose relative to absolute PPP in this study. Absolute PPP theory assumes Q is equal to unity in the long run since the price of a single good will be the same at every location so long as transaction costs and trade barriers are eliminated. However, this is rarely verified in the data due to factors such as the violation of the law of one price, heterogeneous consumer preferences, and different relative prices of untradables.

The bilateral real exchange rate is more commonly expressed in logarithmic form, $q_{i,t}$, with *'i'* and *'t'* representing the local country and the period, respectively, as:

$$q_{i,t} = e_{i,t} + p^*_{EUR,t} - p_{i,t} \tag{3.2}$$

where $e_{i,t}$ is the logarithm of the nominal exchange rate against the euro, $p^*_{EUR,t}$ and $p_{i,t}$ are the logarithms of CPI in the euro area and country *'i'*, respectively.

Appendix A provides graphical illustrations of the RER series. As observed, on the one hand, many of the UEMOA series noticeably display similar trends over the period. This can mostly be attributed to their comparable levels of CPI due to homogeneous consumer preferences. Cabo Verde's RER trend closely resembles that of the UEMOA, which also fixes its currency to the euro. The WAMZ countries, on the other hand, exhibit a range of RER trends. Ghana is the only nation whose exchange rate shows an

upward sloping trend. The Gambia and Sierra Leone both have constant trends on average. Finally, Guinea, Liberia, and Nigeria's RER trends are all downward sloping across the study period. To sum up, the UEMOA and Cabo Verde display similar trends with each other while the WAMZ countries exhibit trends different from one another and the euro-pegged economies.

Our descriptive statistics and normality test are presented below in Table 4.1. The descriptive statistics are calculated for individual RER series for each country. We observe similar means and standard deviations for the UEMOA members. This is not unexpected given the fixed nominal exchange rate and similar CPIs. The WAMZ countries, however, display very different means and standard deviations. This indicates misaligned and varying RERs within the subgroup. Also, all series are positively skewed except for Liberia and Sierra Leone. Subsequently, we perform a Jarque-Bera test for normality which matches the skewness and kurtosis of the sample data to determine if they match those of a normal distribution. At the 10% significance level, we can reject the null hypothesis that the data are normally distributed for all RERs except those of Ghana and Sierra Leone.

Country	Obs.	Mean	Median	Stan. Dev.	Min.	Max.	Skewness	Kurtosis	Jarque-Bera
BEN	180	6.51	6.5	0.03	6.45	6.58	0.45	-0.27	6.53***
BFA	180	6.49	6.49	0.02	6.44	6.56	0.59	0.08	10.78***
CPV	180	4.72	4.72	0.02	4.68	4.81	0.85	0.7	26.15**
CIV	180	6.51	6.5	0.02	6.46	6.57	0.67	0.27	14.44***
GMB	180	3.86	3.85	0.1	3.59	4.2	0.72	0.93	23.0***
GHA	180	1.28	1.28	0.12	1.02	1.56	0.11	-0.69	3.73
GIN	180	9.29	9.28	0.27	8.84	10.41	0.52	0.34	9.33***
GNB	180	6.49	6.49	0.02	6.45	6.57	0.99	1.08	39.5***
LBR	180	4.79	4.79	0.15	4.47	5.11	-0.13	-0.86	5.77*
MLI	180	6.52	6.51	0.03	6.46	6.6	0.74	-0.07	16.66***
NER	180	6.49	6.49	0.03	6.44	6.57	0.38	-0.3	4.95*
NGA	180	5.59	5.57	0.18	5.27	5.89	0.13	-1.19	10.83***
SLE	180	6.47	6.47	0.02	6.40	6.51	-0.27	0.1	1.31
TGO	180	8.74	8.75	0.08	8.56	8.94	0.2	0.1	60.26***
UEMOA	180	6.52	6.51	0.03	6.46	6.63	1.31	0.99	39.85***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. *Source*: the author's own computation from sample data over the January 2006-to-December 2020 period using publicly available data from the IFS on-line database.

Table 3.1: Descriptive Statistics & Normality Test

3.2 Methodology

This subsection presents our empirical approach in two parts. The first describes our methodology to determine whether the ECOWAS and various clusters form OCAs. We start by expounding the empirical deficiencies in the original PPP metric that triggered the discovery of GPPP. Then, we introduce the GPPP framework that was developed by Enders and Hurn (1994) to circumvent these deficiencies. Within this framework, we explain the theoretical GPPP model, our VECM, and the Johansen estimation technique. The second presents our methodology for calculating the optimal weights of a common currency basket based on previous work by Kawasaki and Ogawa (2003, 2006). We start by presenting the methodology to calculate an optimal basket peg using trade-based weights. Then, we describe the empirical approach used to estimate the endogenous weights. Finally, we explain two χ^2-based tests performed on the exogenous and endogenous weights to verify whether they should be included in the optimal basket peg.

3.2.1 Determination of OCAs

Empirical Failure of PPP

With regard to our first research question, we now explain the empirical issues that inhibited the verification of PPP which eventually triggered the discovery of GPPP.

Simple PPP

Since PPP was not thought to hold in all cases or at all times, early empirical analyses that tested this theory were unable to distinguish between the short and long terms. As discussed earlier, PPP was tested using the OLS technique with regression models based on the following equation:

$$e_t = \alpha + \beta \left(p_t^* - p_t\right) + \upsilon_t \tag{3.3}$$

where α is the intercept and υ_t is an error term at time *'t'*. If PPP holds, the coefficient, β, is equal to unity. This approach saw some success when applied to hyperinflationary economies. Frankel (1985) notably calculated coefficients that were close to one and

asserted that PPP held in high inflation economies. Otherwise, most tests rejected PPP since, as we now know, time series processes often contain empirical features that are inconsistent with the assumptions of stationarity. This topic is presented in the following subsection.

Nonstationarity

As mentioned above, the original PPP is fundamentally flawed because it fails to take into account the nonstationarity of relative prices and exchange rates. More specifically, these series constitute stochastic processes whose unconditional joint probability distributions change over time. Consequently, unconditional higher moments such as the mean, variance, and autocovariance are unconstant functions of time. The source of this nonstationarity is the unit root which is a feature in stochastic processes that causes statistical interference in time series models (Granger et al., 1974). A linear stochastic process contains a unit root if an eigenvalue is equal to one in the process's characteristic equation.

Following this discovery, various autoregressive and stationarity tests were developed to detect the presence of a unit root. This confirmed the nonstationarity of RERs where PPP was rejected by previous empirical methods. To perform these tests, the RER is considered a random walk process in which PPP does not hold. Hence, the null hypothesis assumes a unit root in the RER whereas the alternative hypothesis states that PPP holds in the long run. These unit root tests imposed β is equal to one and verified the stationarity of the logarithmized RER which takes the following form:

$$q_t = e_t + p_t^* - p_t \tag{3.4}$$

The empirical literature then came to the consensus that PPP rarely held in the long run for bilateral RERs in industrialized nations that used floating currencies (Meese and Rogoff, 1988; Mark, 1990). The primary issue with unit root tests is their low power which complicates the discernment between slow mean reversion and a random walk exchange rate. Therefore, the solutions to this problem were simply to extend the length of the dataset or time horizon. The former made use of simultaneous currency pairs in the form of cross-sectional data to generate longer series. This remedy was imperfect, however,

since many studies still could not reject the absence of a unit root (Hakkio, 1984; Abuaf and Jorion, 1990). The latter solution saw greater success in rejecting the presence of a unit root (Frankel, 1985; Edison, 1987) but was met with criticism since it included combining low-variance with high-variance series pre and post-Bretton Woods, respectively. Finally, Lothian and Taylor (1996) managed to reject the random walk hypothesis for a 200-year-long sample which included the Bretton Woods period. Thus, long-term PPP proved to finally hold despite the fixed exchange rate period.

A final complication that arose from nonstationarity is the spurious regression. In this type of regression, the R^2 can be high and the t-statistics statistically significant but, the results are meaningless (Granger et al., 1974). In theory, the R^2 should be low since the variables supposedly have independent stochastic trends. The root of this problem is the assumptions of the classical regression model require that the regressand as well as regressors be stationary and the error term be a white noise. The following subsection describes a technique that was developed to address this issue and has been applied to PPP.

Cointegration

A helpful tool for further analyzing long-term PPP is cointegration, which was formally introduced by Engle and Granger (1987). Two or more variables integrated of the same order are cointegrated if a stationary linear combination of those variables exists. This technique is especially useful for studying PPP because it offers the possibility to test restrictions implied by and different types of PPP (e.g., relative and absolute, with or without an intercept). Also, endogeneity and omitted variables cause fewer problems in this framework.

Although this method improves upon those previously used to test PPP, it does present certain deficiencies. Firstly, rejection of the absence of cointegration null hypothesis occurs less frequently for floating as opposed to fixed currency pairs. Secondly, tests using CPI-based price levels tend to reject less often than those using WPI (Wholesale Price Index)-based prices. This is likely because CPI contains a higher amount of untradables than WPI. In their study, Cheung and Lai (1993) note that these two price-level bases

provide vastly different coefficient estimates. Lastly, the null is rejected more frequently for trivariate (i.e., p^* and p are entered separately) than bivariate (i.e., $p^* - p$ are entered together) systems or when the coefficients are restricted to unity. Adding a constraint weakens the proportionality restrictions which in turn makes the residuals appear stationary. Thus, cointegration seems to reject the absence of a unit root in bilateral RERs, though this is more common in ML than OLS estimation. However, cointegration tests produce better results when estimated over long periods. The next subsection presents the tests that are frequently used to detect cointegration.

Cointegration Tests

There exist two main cointegration tests that are commonly used when the cointegrating vector, β, is unknown and must be estimated. The first is the two-step residual-based test conceived by Engle and Granger (1987). This technique requires β to be estimated in the first stage, and, in the second stage, the VECM is estimated by OLS. The second is the single-step cointegrating rank test developed by Johansen (1988) and Johansen and Juselius (1990) then improved upon by Johansen et al. (1995). Johansen's test directly estimates the VECM by ML techniques through the exploitation of the relationship between the rank of Π and its characteristic roots.

Though useful, certain issues may arise when implementing the Engle-Granger approach. Firstly, there is an implicit normalization of the cointegrating vector in the second stage. This is arbitrary seeing as the cointegrating vector can assume different normalizations thus yielding different results. Secondly, there may be more than one cointegrating vector. The method has no systematic procedure for the separate estimation of multiple cointegrating vectors. Lastly, it is easier to make and carry over a mistake as this technique relies on a two-step estimation procedure.

We therefore opt for Johansen's test in this study because it circumvents the above-mentioned issues and allows for the estimation of multiple cointegrating relationships. Also, it assumes all variables to be endogenous and does not require a regressand. Although, we are aware this approach is subject to asymptotic properties and can yield unreliable results if the sample size is too small. This is not of great concern to us, however,

since we benefit from a 15-year-long sample period with monthly data points.

Given the above-mentioned empirical deficiencies, we present in the following section the GPPP framework which overcomes many of these issues.

Generalized Purchasing Power of Parity

Given the previous empirical issues, Enders and Hurn (1994) developed the Generalized Purchasing Power of Parity (GPPP) approach to explain the stylized facts of RER behavior. The notion of GPPP is that since the forcing variables determining RERs are nonstationary, the RERs are themselves nonstationary. However, bilateral RERs tend to exhibit common stochastic trends as the fundamental macroeconomic determinants are highly integrated. Hence, the bilateral RER between two countries comprising the domain of a currency area should be cointegrated. In other words, there exists a stationary linear combination of nonstationary bilateral RERs within a currency area.

As mentioned earlier in this study, one would expect the fundamental variables to share common trends in an OCA (Mundell, 1961). On the one hand, an OCA exists between two countries if PPP holds which is the case so long as the bilateral RER is stationary. In a multi-country setting, on the other hand, individual RERs are nonstationary. Since the real fundamentals are sufficiently interrelated, they share common factors and a certain grouping of RERs may indeed be stationary. Consequently, GPPP holds in an OCA if the bilateral RERs are cointegrated. We start by presenting the theoretical GPPP framework in the following subsection.

GPPP Model

Following Enders and Hurn (1994), we assume the currency union to be comprised of n countries where the relationship between the RER, $q_{n,it}$, and a set of fundamental macroeconomic variables, x_{it}, for country i, is expressed as:

$$q_{n,it} = x_{it}\beta_i + \varepsilon_{it} \qquad (i = 1,2,\ldots,n) \tag{3.5}$$

where β_i and ε_{it} are a vector of n coefficients and a stationary error term, respectively. We use the currency of country n, the euro, as the anchor currency for this study. The vector x_{it}

contains nonstationary forcing variables such as productivity shocks and the real interest rate. If all its elements are stationary, the RER will be stationary and PPP will hold. However, if a data-generating process is nonstationary, we will reject that PPP holds in the long run. We would then expect the variables on both sides of equation 3.5 to be cointegrated. Also, Liang (1999) points out that stationary macroeconomic variables do not statistically influence the cointegrating relationship and can thus be omitted. Provided each vector of x_{it} contains the same set of nonstationary variables and stacking the RERs together, the system of n equations takes the following form:

$$\begin{bmatrix} q_{n,1t} \\ q_{n,2t} \\ q_{n,3t} \\ \vdots \\ q_{n,nt} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} & \dots & \beta_{1n} \\ \beta_{21} & \beta_{22} & \dots & \beta_{2n} \\ \beta_{31} & \beta_{32} & \dots & \beta_{3n} \\ \vdots & \vdots & \ddots & \vdots \\ \beta_{n1} & \beta_{n2} & \dots & \beta_{nn} \end{bmatrix} \begin{bmatrix} x_{1t} \\ x_{2t} \\ x_{3t} \\ \vdots \\ x_{nt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \vdots \\ \varepsilon_{nt} \end{bmatrix} \tag{3.6}$$

or alternatively:

$$Q_t = \beta X_t + E_t \tag{3.7}$$

In equation 3.7, a stationary linear combination of RERs exists if and only if the rank of β is less than *n-1*. On the one hand, if β has a rank of zero, it is a zero matrix and PPP holds for every bilateral RER. On the other hand, if β has full rank, there is no evidence of a long-term interrelationship among the n economies. However, if β has a rank equal to unity, all RERs share a single common trend. And, since the RERs will be cointegrated, a sufficient interrelationship among their underlying economies would exist therefore satisfying a key precondition for forming an OCA.

Under the simple assumption:

$$rank\,(\beta) = 1 \tag{3.8}$$

the GPPP test can be performed by determining if one cointegrating relationship exists in the following equation:

$$0 = \alpha_1 q_{n,1t} + \alpha_2 q_{n,2t} + \alpha_3 q_{n,3t} + \ldots + \alpha_{n-1} q_{n,n-1t} \tag{3.9}$$

where α_i are weights that are functions of the parameters in the β matrix that represent the different relations among the *n* economies. These weights reflect, for example, trade linkages, technology transfers, immigration, and financial resource movements. Given these theoretical foundations, we turn to our empirical model in the following subsection.

The VECM

The Johansen approach tests the restrictions imposed by cointegration on the unrestricted VAR involving the time series. To test whether the *n-1* countries from an OCA, we structure the VAR in the following notations:

$$Y_t = \mu_t + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_k Y_{t-k} + \varepsilon_t \ , \qquad \varepsilon_t \ IN(0,\ \Sigma) \tag{3.10}$$

$$Y_t' = [q_{n,1t},\ q_{n,2t}, q_{n,3t}, \ldots, q_{n,n-1t}]' \tag{3.11}$$

where Y_t, A_i, k, μ_t, and ε_t, represent an *(n-1)* vector of nonstationary endogenous RERs, a $(n \times 1)$ matrix of parameters, lag length, an intercept and deterministic trend, and a stationary disturbance term. Following the VECM, we rewrite equation 3.10 in first-difference form:

$$\Delta Y_t = \mu_t + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \tag{3.12}$$

$$\Pi = -\sum_{i=1}^{k-1} (I - A_i) \tag{3.13}$$

$$\Gamma_i = -\sum_{j=i+1}^{k} A_j \tag{3.14}$$

$$H_1(r) : \Pi = \theta \alpha' \tag{3.15}$$

where θ is the loading matrix which contains the speed of adjustment parameters in the VECM and the reduced rank, *r*, denotes the number of cointegrating relationships. Granger's representation theorem indicates that if matrix Π has a reduced rank of *r<(n-1)*, there exist *(n-1)*$\times r$ matrices θ and α each with *rank(r)* such that:

$$\Pi = \theta \alpha', \qquad \alpha' Y_t \sim I(0) \tag{3.16}$$

In the subsequent subsection, we explain the technique used to estimate our model and hence determine the existence of an OCA.

The Johansen Test

The Johansen approach estimates the matrix Π from an unrestricted VAR then tests whether we can reject equation 3.15 on the reduced rank of Π. When the matrix is stable, there exists a long-run relationship among the *(n-1)* RERs whose countries can form an OCA (Sugimoto, 2008). The Johansen procedure tests the hypothesis using two likelihood-ratio-type tests, both of which yield the number of cointegrating vectors in the system. The first is the trace test statistic in which the null hypothesis is there are at most r cointegrating vectors where $0 \leq r \leq n$. The trace test statistic is computed as follows:

$$\lambda_{trace} = -N \sum_{i=r+1}^{n} log(1-\lambda_i) \tag{3.17}$$

Where λ_i denote the *n-r* smallest canonical correlations of Y_{t-1} with respect to ΔY_t, corrected for the lag differences and N denotes the sample size. Similarly, the maximum eigenvalue test is computed as follows:

$$\lambda_{max} = -Nlog(1-\lambda_{r+1}) \tag{3.18}$$

Where the null hypothesis is there are r cointegrating vectors against the alternative that there are instead $r+1$. Rejecting H_0 implies the existence of a maximum of r cointegrating vectors. Hence, an OCA exists once a cointegrating vector is identified in either test.

Now that the methodology for determining an OCA has been presented, we explain in the next section our technique for computing the optimal weights of a basket peg for the eco.

3.2.2 Currency Basket Weights

This section describes the empirical approach regarding our second research question of determining the optimal weights of a common currency basket peg.

In this study, we follow the methodology proposed by Kawasaki and Ogawa (2003, 2006) to evaluate a basket of currencies as an anchor to which the eco could be fixed. To

do so, we assume the ECOWAS creates a common currency basket composed of the euro, US dollar, and pound sterling before investigating the long-term sustainability of a basket peg. Furthermore, we consider two types of weights for the currency basket: trade-based and endogenous.

The former defines a trade-weighted currency basket as a common currency basket for stabilizing trade balances. We take this as the objective in investigating the long-run sustainability of adopting a basket peg in the ECOWAS. Since hard currencies rarely fluctuate drastically, a basket currency regime will usually keep trade competitiveness relatively stable (Ogawa et al., 2021). To compute these weights, we calculate the average percentage of import and export flows between the WAMZ as well as ECOWAS and the three regions over our study period using IFS data.

The latter estimates endogenous weights in the common currency basket. These weights are the percentages for which the US dollar and pound sterling account in the estimated cointegrating vector. The weight of the euro is the remainder when the summed weights are subtracted from unity. Finally, we perform LR tests on both sets of weights to determine which currencies should comprise the basket peg.

In the first subsection, we present our approach for using exogenous weights.

Trade-based Weights

We define the exchange rate of country i in terms of the currency basket, Q_{BAS}, as follows:

$$Q_{BAS,i} = Q_{GBP,i}^{\delta} Q_{USD,i}^{\gamma} Q_{EUR,i}^{\xi} \qquad (\delta + \gamma + \xi) = 1 \tag{3.19}$$

Where Q is the RER and δ, γ, and ξ are the weights of the three major currencies. Equation 3.19 can be rewritten in logarithmic form:

$$q_{BAS,i} = \delta q_{GBP,i} + \gamma q_{USD,i} + \xi q_{EUR,i} \tag{3.20}$$

Where q is the logarithm of the RER. So long as all ECOWAS members are included in the currency area, we can write a cointegration equation similar to equation 3.9:

$$0 = \eta_1 q_{BAS,1} + \eta_2 q_{BAS,2} + \ldots + \eta_{n-1} q_{BAS,n-1} \tag{3.21}$$

Given the weights of the three reserve currencies in the basket, the endogenous variables in the *n-1* vector autoregressive model are defined as:

$$X' = \left[q_{BAS,1}, q_{BAS,2}, \ldots, q_{BAS,n-1}\right]' \tag{3.22}$$

We can then use the same ML techniques from the previous section to estimate the following VECM:

$$\Delta X_t = \mathrm{o}_t + \Pi X_{t-1} + \sum_{i=1}^{k-1} \Lambda_i \Delta X_{t-i} + \nu_t \tag{3.23}$$

and test the hypothesis that the reduced rank of Π equals:

$$H_1(r) : \Pi = \upsilon \eta' \tag{3.24}$$

Now that the trade-based weights have been presented, we turn to our approach for calculating endogenous weights in the second subsection.

Endogenous Weights

As with the exogenous weights, we consider the common currency basket area to be comprised of n countries with at least one cointegrating relationship. Hence, equation 3.21 will hold in the long term. We now define the RER as follows:

$$Q_{BAS,i} = Q_{GBP,i}^{\psi} Q_{USD,i}^{\zeta} Q_{EUR,i}^{1-\psi-\zeta} \tag{3.25}$$

Or in logarithmic form:

$$q_{BAS,i} = \psi q_{GBP,i} + \zeta q_{USD,i} + (1-\psi-\zeta) q_{EUR,i} \tag{3.26}$$

We can now substitute equation 3.26 into equation 3.21 to obtain the following:

$$0 = \sum_{i=1}^{n-1} \eta_i q_{BAS,i} = \eta_1 \left\{ \psi q_{GBP,1} + \zeta q_{USD,1} + (1-\psi-\zeta) q_{EUR,1} \right\} + \tag{3.27}$$

$$\eta_2 \left\{ \psi q_{GBP,2} + \zeta q_{USD,2} + (1-\psi-\zeta) q_{EUR,2} \right\} + \ldots + \tag{3.28}$$

$$\eta_{n-1} \left\{ \psi q_{GBP,n-1} + \zeta q_{USD,n-1} + (1-\psi-\zeta) q_{EUR,n-1} \right\} \tag{3.29}$$

Which can be rewritten as:

$$0 = \eta_1\{\psi_1(q_{GBP,1} - q_{EUR,1}) + \zeta(q_{USD,1} - q_{EUR,1}) + q_{EUR,1}\} \tag{3.30}$$

$$+\eta_2\{\psi_2(q_{GBP,2} - q_{EUR,2}) + \zeta_2(q_{USD,2} - q_{EUR,2}) + q_{EUR,2}\} \tag{3.31}$$

$$+\ldots+\eta_{n-1}\{\psi_{n-1}(q_{GBP,n-1} - q_{EUR,n-1}) + \zeta_{n-1}(q_{USD,n-1} - q_{EUR,n-1}) \tag{3.32}$$

$$+q_{EUR,n-1}\} \tag{3.33}$$

Hence,

$$0 = \eta_1\{\psi q_{GBP,EUR} + \zeta q_{USD,EUR} + q_{EUR,1}\} + \eta_2\{\psi q_{GBP,EUR} + \tag{3.34}$$

$$\zeta q_{USD,EUR} + q_{EUR,2}\} + \ldots + \eta_{n-1}\{\psi q_{GBP,EUR} + \zeta q_{USD,EUR} + q_{EUR,n-1}\} \tag{3.35}$$

After some substitutions and rearranging, we obtain the following equation:

$$0 = \psi(\eta_1 + \eta_2 + \ldots + \eta_{n-1})q_{GBP,EUR} + \tag{3.36}$$

$$\zeta(\eta_1 + \eta_2 + \ldots + \eta_{n-1})q_{USD,EUR} + \eta_1 q_{EUR,1} + \eta_2 q_{EUR,2} \tag{3.37}$$

$$+\ldots+\eta_{n-1}q_{EUR,n-1} \tag{3.38}$$

Where the *n+1* dimensional vector autoregressive model is defined by:

$$X' = \left[q_{EUR,1}, q_{EUR,2}, \ldots, q_{EUR,n-1}, q_{GBP,EUR}, q_{USD,EUR}\right]' \tag{3.39}$$

Afterward, we perform the Johansen test to obtain estimated values for the *n+1* elements of the cointegrating vector $H^{*\prime} = [\eta_1^*, \eta_2^*, \ldots, \eta_{n-1}^*, \eta_n^*, \eta_{n+1}^*]'$ where η_i^* are the estimated values of η_i. If the cointegrating vector's rank equals unity, GPPP holds within the group and the RERs are cointegrated with the unique cointegrating vector in equation 3.36 where: $\eta_n^* = \psi^*(\eta_1^* + \eta_2^* + \ldots + \eta_{n-1}^*), \eta_{n+1}^* = \zeta^*(\eta_1^* + \eta_2^* + \ldots + \eta_{n-1}^*)$ Therefore, we use these estimated values to calculate the optimal weights as follows:

$$\psi^* = \frac{\eta_n^*}{\eta_1^* + \eta_2^* + \ldots + \eta_{n-1}^*} \text{ and } \zeta^* = \frac{\eta_{n+1}^*}{\eta_1^* + \eta_2^* + \ldots + \eta_{n-1}^*} \tag{3.40}$$

This means that the estimated optimal weight of the euro is $1 - \psi^* - \zeta^*$.

Now that the two basket-peg methodologies have been introduced, we explain in the final subsection the LR tests that we perform on the weights.

χ^2-based Likelihood Ratio Tests

After GPPP estimation, we perform LR-based tests on the exogenous and endogenous weights to determine their optimality in a common currency basket.

We perform two χ^2-based LR tests on the exogenous weights to test the cointegrating and loading coefficients in our VECM. The first test is a long-run exclusion test to determine if the β parameters contribute to the long-term equilibrium. To execute this test, we estimate a restricted VECM for each RER by testing the hypothesis that a single cointegrating parameter in the vector is null. The second is a weak exogeneity test which tests the null hypothesis that the α coefficient is zero for each RER in our sample. This test indicates which of our variables are endogenous in the model. Both tests are performed separately on the trade-based weights for the WAMZ and ECOWAS.

Regarding the endogenous weights, we examine the optimality of a two-currency basket peg for the WAMZ as well as ECOWAS by testing the significance of the η_n^* and η_{n+1}^* coefficients with the long-run exclusion test. In the case of $\eta_n^* = 0$ or $\eta_{n+1}^* = 0$, the weights of the pound sterling or the US dollar are null in the currency basket. When $\eta_n^* = 0$ and $\eta_{n+1}^* \neq 0$, the basket will only contain the euro and the pound sterling. If $\eta_n^* \neq 0$ and $\eta_{n+1}^* = 0$, the basket will be composed of the US dollar and euro. Should $\eta_n^* = \eta_{n+1}^* = 0$, all currencies will be pegged to the euro.

Chapter 4

Empirical Results

This chapter presents our GPPP estimation results from the models detailed in the previous chapter. Firstly, we conduct preliminary data analysis on our RERs by performing two unit root tests: the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Philipps-Schmidt-Shin (KPSS) tests. Secondly, we present our GPPP estimation results which include the Johansen statistics as well as short and long-run coefficients for several clusters of West African countries. We undoubtedly test whether the ECOWAS, WAMZ, and UEMOA constitute OCAs. Additionally, we consider the ECOWAS and WAMZ without Nigeria as well as the UEMOA with Cabo Verde. Lastly, we attempt to determine the optimal weights of a common currency basket peg for the WAMZ and ECOWAS. In this last analysis, we examine the usefulness of trade-based weights in addition to estimating endogenous weights. Three reserve currencies are considered: the US dollar, euro, and pound sterling.

4.1 Unit Root Tests

We turn now to unit root testing to determine if the RERs in our sample are nonstationary.

As mentioned above, the GPPP approach was established to address the nonstationarity of multiple RERs. Therefore, GPPP only holds if all RERs are individually nonstationary and there is evidence of cointegration. In our preliminary data analysis, we

inspect our RER plots to check for nonstationarity, drift, and a deterministic trend. In Appendix A, the graphed RERs in levels appear nonstationary with non-zero means and linear trends for certain countries. Next, we examine our RER plots in first difference as presented in Appendix B. As observed the RERs appear stationary in first difference as they are centered around a zero mean. However, graphical observation is insufficient to formally establish the presence of nonstationarity. Therefore, we turn to unit root testing techniques to confirm our initial impressions. More specifically, we execute the ADF and KPSS tests for the series in levels as well as in first differences. Following visual evidence, we allow for the presence of an intercept and a time trend in both tests where required.

The ADF test is an autoregressive test which tests the null hypothesis that a series is *I(1)* or that it contains a unit root against the alternative of stationarity, *I(0)*. The idea is that in an *I(1)* process, the lagged values of y_{t-1} do not provide any relevant information in predicting changes in y_t, except for Δy_{t-i}.

Therefore, we reject the presence of a unit root. Contrarily, a stationary process will exhibit mean reversion and the lagged values will be relevant in predicting changes in y_t. In this case, we would fail to reject the null hypothesis of nonstationarity. Our ADF testing regression takes the following form:

$$\Delta y_t = \delta + \alpha t + \sum_{i=1}^{p} \phi \Delta y_{t-i} + \varepsilon_t \tag{4.1}$$

$$H_0 : \gamma = 0, \qquad H_1 : \gamma < 0 \tag{4.2}$$

Where p is the number of lags, δ is an intercept, αt is a time trend, ϕ captures the temporal dependence, and $\gamma = (\phi - 1)$.

Similarly, the KPSS test is a stationarity test which tests the null hypothesis that a series is *I(0)* or stationary against the alternative of nonstationarity, *I(1)*. More specifically, this test detects stationarity around a deterministic trend, a phenomenon known as trend-stationarity. A trend-stationary process will exhibit mean reversion in the presence of a transitory shock which means the time series will reconverge toward the mean. The opposite is true in a unit root process, an external disturbance will have a permanent

impact on the mean over time which will not reconverge. Our KPSS test decomposes the time series into the sum of an intercept, a deterministic trend, a random walk, and a stationary error term which can be expressed as:

$$y_t = \mu + \alpha t + x_t + \varepsilon_t \tag{4.3}$$

where $x_t = x_{t-1} + \upsilon_t,\ \upsilon_t \sim iid\left(0, \sigma^2\right)$, $H_0 : \sigma^2 = 0$, and $H_1 : \sigma^2 \neq 0$. We fail to reject the null hypothesis when the series, y_t, is stationary.

We use two information criteria to select the optimal lag structure for our unit root tests. These criteria are not formal statistical tests that produce test statistics to compare against critical values with certain distributions. Instead, they are numerical criteria that reflect the tradeoff between the fit and parsimony of a model. We choose the Akaike (AIC) and Bayesian (BIC) information criteria associated with a lag structure, p, for the ADF and KPSS tests, respectively. The AIC and BIC can be expressed as:

$$AIC = -2log(L) + 2\left(p+1\right) \tag{4.4}$$

$$BIC = -2log(L) + \left[log(T)\right]\left(p+1\right) \tag{4.5}$$

where T is the sample size and $log(L) = -\frac{T-\bar{p}}{2}log(2\pi) - \frac{T-\bar{p}}{2}log\left(\sigma^2\right) - \frac{T-\bar{p}}{2}$. The term *-2log(L)* captures the fit of a model p lags. The terms *2(p+1)* and $[log(T)]$ *(p+1)* penalize the models that include too many lags. Minimizing the criteria allows for the selection of a lag structure that leads to a good fit but is nevertheless parsimonious.

Our unit root test results are presented in Table 4.1. As observed, both tests confirm that the RERs are nonstationary in levels but become stationary in first differences at 1% significance. Thus, simple PPP almost certainly does not hold for the ECOWAS and the nonstationary RERs can be used for cointegration analysis.

4.2 GPPP Estimation Results for an OCA

Now that we have confirmed the RERs are nonstationary, we perform cointegration analyses to detect cointegrating relationships in the ECOWAS and various subregions. To

Variable	ADF		KPSS	
	Level	1^{st} Difference	Level	1^{st} Difference
BEN	-2.367 (7)	-8.644 (5)***	1.477 (1)***	0.013 (1)
BFA	-3.081 (1)	-9.938 (1)***	0.635 (1)***	0.021 (1)
CPV	-2.844 (10)	-7.561 (10)***	0.427 (9)***	0.073 (8)
CIV	-1.932 (10)	-7.142 (10)***	1.060 (1)***	0.014 (2)
GMB	-2.665 (1)	-9.681 (10)***	0.846 (1)***	0.033 (1)
GHA	-2.153 (10)	-6.055 (10)***	0.490 (1)***	0.030 (1)
GIN	-1.761 (2)	-10.849 (1)***	5.366 (2)***	0.025 (1)
GNB	-0.547 (1)	-9.988 (1)***	1.504 (1)***	0.101 (1)
LBR	-2.494 (1)	-9.274 (1)***	0.64 (1)***	0.063 (1)
MLI	-1.066 (10)	-7.829 (10)***	1.495 (1)***	0.013 (3)
NER	-2.320 (10)	-7.361 (9)***	0.545 (2)***	0.019 (1)
NGA	-2.612 (3)	-9.268 (2)***	0.56 (2)***	0.033 (2)
SEN	-2.569 (9)	-9.431 (8)***	0.236 (2)***	0.064 (8)
SLE	0.270 (2)	-8.254 (1)***	0.419 (2)***	0.038 (1)
TGO	-1.977 (10)	-6.367 (9)***	0.407 (7)***	0.045 (6)
UEMOA	2.717 (8)	5.113 (10)***	0.398 (7)***	0.020 (1)

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The number of lags selected by the AIC and BIC is in parentheses. *Source:* Author's estimation.

Table 4.1: Unit Root Tests

do so, we make use of the Johansen test as well as compute the normalized long-run and adjustment coefficients. The correct lag order was chosen for each VECM by the multivariate AIC subject to a maximum of 10 lags which takes the following form:

$$AIC = Tlog\left(\left|\hat{\Sigma}_{\varepsilon}\right|\right) + 2N\left(Np+1\right) \tag{4.6}$$

Where N is the number of variables in the system and $\hat{\Sigma}_{\varepsilon}$ is an estimate of the covariance matrix Σ_{ε}. The term $Tlog\left(\left|\hat{\Sigma}_{\varepsilon}\right|\right)$ decreases as the model becomes more efficient and *2N(Np+1)* increases when more lags are added to the model. Our GPPP estimation results are presented in the following subsections.

4.2.1 The ECOWAS

We now present our empirical results starting with the ECOWAS. Our findings are divided into two parts, the Johansen statistics (equations 3.17 and 3.18) and eigenvalues in addition to the short and long-run coefficients (equation 3.15). These results are presented in two subtables per cluster.

Firstly, we find at least one cointegrating relationship in the ECOWAS which is presented in Table 4.2(a). As observed, equations 3.17 and 3.18 yield statistically significant λ_{trace} and λ_{max} statistics at the 5% level with 2 lags selected by equation 4.6. Also, the eigenvalues are less than one, which implies a stable system and reliable cointegration results (Chiemeke, 2010). Since GPPP holds, this result supports the potential for an eco union.

The α coefficients from equation 4.15 are presented in Table 4.2(b) and provide estimates of the short-run adjustment of each RER toward the long-term equilibrium. As observed, all coefficients except Nigeria's are less than one which is a good indication of RER stability in the ECOWAS. These coefficients act as a measure of how quickly each RER converges to GPPP (Beirne, 2008). For example, the Cape Verdean escudo's logarithmized RER against the euro adjusts at a rate of 2.56% per month towards the long-term equilibrium. And, the lower the magnitude of the α coefficient, the slower the speed of adjustment towards the long-term equilibrium. The ECOWAS members tend to adjust at different speeds. Ghana, Guinea, and Nigeria adjust at over 75% each month whereas Cabo Verde and the UEMOA zone adjust at under 12%. Finally, all speed-of-adjustment coefficients are statistically significant therefore, weak exogeneity is not an issue in the ECOWAS.

Also from equation 3.15, the β coefficients are shown in Table 4.2(b). They represent the interrelationships among RERs and can be interpreted as long-run elasticities. The Johansen framework provides normalized cointegrating vectors from which we obtain the β coefficients that are significant at the 1% level. The long-run cointegrating equations are normalized so that Cabo Verde's parameter is equal to unity. Moreover, the sign and

magnitude of the cointegrating vector parameters reflect common policy connections and coordination among members (Beirne, 2008). For example, a 1% increase in the Cape Verdean escudo's RER per euro roughly induces a 0.11% decrease in Nigeria's RER. We observe a mix of positive and negative signs on the coefficients in our sample in addition to mostly low magnitudes. Also, all parameters except that of the UEMOA are below unity in absolute value which is a positive sign toward creating an eco union. Zerihun and Breitenbach (2018) too found long-run coefficients greater than unity in their study of a possible rand union.

4.2.2 The UEMOA

Secondly, we investigate the UEMOA as an OCA using individual RERs unlike the aggregate in the previous and subsequent analyses. As presented in Table 4.3(a), equations 3.17 and 3.18 yield a minimum of 3 cointegrating relationships that are statistically significant at the 5% or 1% levels with 10 lags selected by equation 4.6. This is unsurprising given the UEMOA is an already existing currency union that is naturally economically integrated. This result echoes Sugimoto (2008)'s findings in which two cointegrating vectors were identified after the devaluation of the CFA franc in 1994.

Turning to Table 4.3(b), we observe moderately low absolute speed-of-adjustment coefficients which indicate a sluggish return to the long-term equilibrium in the UEMOA. Our β parameters are all greater than unity in absolute value and certain countries present similar cointegrating coefficients with one other. Enders and Hurn (1994) note in their original model that very large coefficients may indicate dissimilarity in the demand parameters across countries. Finally, all of our cointegrating and loading coefficients from equation 3.15 are statistically significant at either the 5% or 1% level.

4.2.3 The WAMZ

Thirdly, we perform cointegration analysis on the WAMZ countries which are scheduled to adopt the eco initially before expanding to the rest of the ECOWAS. As shown in Table

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0034	194.47**	55.84**
$r \leq 1$	0.0038	138.63	41.67
$r \leq 2$	0.0077	96.96	32.24
$r \leq 3$	0.0083	64.72	21.91
$r \leq 4$	0.0116	42.81	15.50
$r \leq 5$	0.0166	27.31	14.32
$r \leq 6$	0.0209	12.99	6.85
$r \leq 7$	0.0269	6.15	6.15

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) Cointegration Results

RER	β	α
CPV	1.0000	0.0256(0.7203)**
GMB	0.0676 (2.6730)***	0.2819 (1.3500)**
GHA	-0.1455 (-4.9605)***	0.7699 (4.3166)***
GIN	-0.0493 (-2.3607)***	0.9956 (2.5436)***
LBR	0.0917 (3.3321)***	0.3537 (2.1042)***
NGA	-0.1062 (-4.9562)***	1.0833 (6.6373)***
SLE	-0.0643 (-1.9970)***	0.5378 (3.8484)***
UEMOA	-1.6615 (-11.1848)***	0.1128 (3.0374)***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.2: ECOWAS Results

4.4(a), we find at least one cointegrating relationship in the WAMZ. The λ_{trace} statistic from equation 3.17 is significant at 5% whereas the λ_{max} statistic from equation 3.18 is significant at 10% when taking 2 lags selected from equation 4.6. GPPP thus holds in the WAMZ which is supportive of the future monetary union. This finding is identical to Sugimoto (2008)'s result for a restricted WAMZ due to data unavailability.

Looking at Table 4.4(b), we notice small absolute loading coefficients from equation 3.15 which imply a slow return to the long-term equilibrium; Guinea's α coefficient is the largest at roughly 15%. Next, our cointegrating coefficients from equation 3.15 are all

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0039	255.50***	68.96***
$r \leq 1$	0.0069	186.54***	49.85***
$r \leq 2$	0.0084	136.69***	46.21**
$r \leq 3$	0.0125	90.48**	33.93
$r \leq 4$	0.0181	56.55	22.69
$r \leq 5$	0.0238	33.86	14.99
$r \leq 6$	0.0254	18.87	12.12
$r \leq 7$	0.0333	6.75	6.75

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 10.

(a) Cointegration Results

RER	β	α
BEN	1.0000	0.0092 (0.4116)**
BFA	-2.2483 (-3.6741)***	-0.0164 (-0.8965)**
CIV	-6.4201(-5.8554)***	0.0301 (2.0004)***
GNB	2.6679 (4.1760)***	-0.0041 (-0.2356)**
MLI	-2.6074 (-5.0017)***	0.0091 (0.4333)**
NER	4.0037 (6.2328)***	-0.0802 (-4.2979)**
SEN	-6.0620 (-7.5252)***	0.0625 (4.3389)***
TGO	2.3205 (2.8848)***	0.0049 (0.3086)**

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.3: UEMOA Results

less than unity in absolute value except Ghana's and, Nigeria's β parameter is the only positive one. Therefore, all RERs decrease when the Gambia's increases except Nigeria's, which rises. Our short and long-run coefficients are all statistically significant at the 5% or 1% level.

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0025	118.93**	41.48*
$r \leq 1$	0.0033	77.45	26.68
$r \leq 2$	0.0102	50.77	21.28
$r \leq 3$	0.0127	29.48	19.18
$r \leq 4$	0.0139	10.31	5.88
$r \leq 5$	0.0208	4.42	4.42

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) Cointegration Results

RER	β	α
GMB	1.0000	-0.0620 (-1.9471)***
GHA	-1.0333 (-5.6121)***	-0.0164 (-0.8965)**
GIN	-0.7590 (-5.0923)***	0.1507 (2.5294)***
LBR	-0.1316 (-0.7368)**	0.0697 (2.7191)***
NGA	0.4031 (2.5602)**	0.0509 (1.8004)***
SLE	-0.5686 (-2.8601)***	-0.0731 (3.4063)**

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.4: WAMZ Results

4.2.4 The WAMZ without Nigeria

Fourthly, it is relevant to explore the WAMZ minus Nigeria given its economic dominance in the region. Our GPPP estimation results are presented in Table 4.5(a). We find at least one cointegrating vector, but can only reject the Johansen statistics (equations 3.17 and 3.18) at the 10% level with 2 lags selected from equation 4.6. Since GPPP holds, we conclude that Nigeria's presence is unessential in a functional WAMZ monetary union.

In Table 4.5(b), our speed-of-adjustment coefficients from equation 3.15 are less than unity when taken in absolute value and are modest in magnitude. Once again, Guinea's is the largest at approximately 15%. This confirms the WAMZ countries are slow to return

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0024	86.91*	41.48*
$r \leq 1$	0.0037	49.83	26.68
$r \leq 2$	0.0093	28.39	21.28
$r \leq 3$	0.0113	11.01	19.18
$r \leq 4$	0.0188	4.25	5.88

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) Cointegration Results

RER	β	α
GMB	1.0000	-0.0457 (-1.5152)**
GHA	-1.2759(6.4857)***	0.1183 (4.6552)***
GIN	0.8202 (-4.8859)***	0.1508 (2.6886)***
LBR	0.1208 (0.6653)**	0.0604 (2.4888)***
SLE	-0.4110 (-1.8577)***	0.0527 (2.5605)***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.5: WAMZ without Nigeria Results

to the long-term equilibrium. Turning now to our β coefficients from equation 3.15, all except Ghana's are less than one in absolute value. Also, Ghana and Guinea's parameters have changed signs from when Nigeria was included in the estimation. All of our short and long-run coefficients are statistically significant at the 5% or 1% level.

4.2.5 The UEMOA with Cabo Verde

Fifthly, we explore a UEMOA augmented by the addition of Cabo Verde given their similar fixed peg arrangement. As displayed in Table 4.6(a), equations 3.17 and 3.18 yield at least 6 cointegrating vectors that are significant at 1% with 10 lags selected from equation 4.6. This finding is, therefore, supportive of a monetary union that includes both euro-pegged currencies.

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0043	373.93***	83.27***
$r \leq 1$	0.0074	290.66***	67.57***
$r \leq 2$	0.0116	223.08***	63.69***
$r \leq 3$	0.0170	159.39***	50.14***
$r \leq 4$	0.0191	109.26***	35.98*
$r \leq 5$	0.0255	73.28***	31.72**
$r \leq 6$	0.0312	41.55*	21.04
$r \leq 7$	0.0333	20.51	13.02
$r \leq 8$	0.0333	7.49	7.49

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 10.

(a) Cointegration Results

RER	β	α
BEN	1.0000	-0.0364 (-1.8382)***
BFA	-1.7064 (-2.4091)***	0.0134 (0.8582)**
CIV	5.7833 (5.1315)***	-0.0039 (-0.2826)**
GNB	-4.4156 (-6.7359)***	0.0034 (0.2300)**
MLI	4.8136 (6.3081)***	-0.0575 (3.1093)***
NER	-3.3713 (-5.0667)***	0.0379 (2.2483)***
SEN	8.3957 (9.0934)***	-0.0596 (-4.7789)***
TGO	-0.1604 (-0.1977)**	-0.0349 (-2.5787)***
CPV	-3.3434 (-6.4185)***	-0.0355 (-4.0656)***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.6: UEMOA with Cabo Verde Results

Looking at Table 4.6(b), we observe small speed-of-adjustment coefficients from equation 3.15, which is in line with the previous UEMOA analysis. Except for Togo, the cointegrating coefficients from equation 3.15 are all greater than one and are mostly negative, much like in the previous analysis. All coefficients are statistically significant at the 5% or 1% level.

4.2.6 The ECOWAS without Nigeria

Lastly, we consider the case of an eco union without Nigeria, the economic powerhouse of West Africa. As presented in Table 4.7(a), equations 3.17 and 3.18 yield at least one cointegrating vector but only reject the λ_{trace} statistic at 10% and the λ_{max} statistic at 5% with 2 lags which are selected from equation 4.6.

Similar to our previous ECOWAS analysis, the loading coefficients from equation 4.15 vary across member countries as observed in Table 4.7(a). Ghana, Guinea, Liberia, and Sierra Leone return to the long-term equilibrium at rates above 20% while the others return at much slower rates. Our β coefficients from equation 3.15 show a range of mixed signs and non-UEMOA parameters are all less than one in absolute value. Results are presented in Table 4.7(b) and are all statistically significant at the 5% or 1% level.

4.2.7 Concluding Remarks on GPPP in the ECOWAS

Overall, these results are supportive of the ecozone as well as various clusters. The euro-pegged economies, however, show to be more integrated than the WAMZ. This was evidenced by the discovery of multiple cointegrating vectors in the UEMOA and Cabo Verde instead of one in the WAMZ. Therefore, a merger of these subzones may not necessarily lead to a perfectly smooth-running currency union, at least in the short run. After all, we only identified one cointegrating vector in our ECOWAS analysis. Although significant, this does not indicate a high level of economic integration, as we saw in the UEMOA analysis. Besides, Nigeria's presence in the WAMZ and ECOWAS is important. When omitted from the analyses, our results remained significant but visibly changed. Perhaps Nigeria may not be as much of an obstruction to the eco union as was once thought.

Given these results, the next logical step is to decide on a peg for the eco, assuming the Community will decide against a floating currency. As mentioned previously, it is also uncertain whether the French Treasury will guarantee the eco's convertibility as it does the CFA franc and Portugal the escudo. Thus, we attempt to estimate a 3-currency basket peg for the eco in the subsequent section using similar cointegration techniques.

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0185	119.61*	45.03**
$r \leq 1$	0.0422	74.58	22.77
$r \leq 2$	0.0445	51.80	18.20
$r \leq 3$	0.0782	33.60	14.49
$r \leq 4$	0.0972	19.11	8.11
$r \leq 5$	0.1201	11.00	7.68
$r \leq 6$	0.2235	3.33	3.33

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) Cointegration Results

RER	β	α
CPV	1.0000	0.0180 (1.0534)**
GMB	0.3048 (5.3637)***	-0.0326 (-0.3254)**
GHA	-0.3812 (-5.6688)***	0.4768 (5.8105)**
GIN	-0.1729 (-5.0381)***	0.3923 (2.0876)***
LBR	0.1593 (2.9177)***	0.2082 (2.6086)***
SLE	-0.2541 (-3.8933)***	0.2733 (4.1031)***
UEMOA	-2.2126 (-6.6119)***	0.0534 (3.0071)***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Cointegrating & Loading Coefficients

Table 4.7: ECOWAS without Nigeria Results

4.2.8 Optimal Weights for a Common Currency Basket

We now examine the optimal weights of a 3-currency basket peg for the eco. Since the ECOWAS conducts much business and shares a common history with the euro area, we choose the euro a basket-peg component. Furthermore, France and Portugal both act as financial guarantors for the CFA franc and escudo, respectively. The euro is, therefore, a currency worth considering in a basket peg.

Next, we consider the US dollar in our currency basket since it acts as an unofficial anchor currency in the WAMZ. Also, the dollar is the world's most-held reserve currency so a peg may stabilize West African economies hence making them less volatile. Two

Partner	WAMZ	ECOWAS
USA	20.33	14.43
Euro area	70.08	79.21
UK	9.59	6.36

Source: IFS. Average total sum of imports and exports from January 2006 to December 2020.

Table 4.8: Basket Weights (%)

African countries already fix their exchange rates to the US dollar, Djibouti and Eritrea. For these reasons, we deem the US dollar a suitable currency for the eco's basket peg.

Lastly, we consider the pound sterling in our common currency basket peg. The pound is the fourth-most held reserve currency in the world after the US dollar, euro, and Japanese yen. The UK also has many historical ties to certain WAMZ countries of which many are former colonies. Additionally, The UK is an important foreign investor and trading partner with multiple West African nations. Given these close ties to the ECOWAS, we include the pound sterling in our 3-currency basket peg.

Our estimation results for exogenous and endogenous weights are presented in the following subsections. Keeping true to the ECOWAS' timeline, we estimate the weights for the WAMZ and ECOWAS.

4.2.9 GPPP Estimation with Exogenous Weights

We suppose that the weights are given by trade weights which measure the average amount of total trade (imports and exports) each ECOWAS country conducted with the USA, euro area, and UK in percentage over our study period. The trade weights are presented below in Table 4.8. As evidenced in both zones, the euro area is the most significant trading partner on average, followed by the USA, then the UK when taken together in one basket. We calculate different weights for the two zones since the WAMZ would unlikely account for the euro-pegged trade weights when first introducing the eco. Later, we assume the weights would change to reflect trade patterns for the entire ECOWAS.

Zone	H_0	Eigenvalue	λ_{trace}	λ_{max}
WAMZ	*r = 0*	0.0013	117.36**	40.84
	$r \leq 1$	0.0032	76.52	27.05
	$r \leq 2$	0.0101	49.47	20.68
	$r \leq 3$	0.0110	28.78	18.91
	$r \leq 4$	0.0141	9.87	5.82
	$r \leq 5$	0.0205	4.05	4.05
ECOWAS	*r = 0*	0.0035	193.00**	53.62*
	$r \leq 1$	0.0046	139.38	42.97
	$r \leq 2$	0.0078	96.41	29.94
	$r \leq 3$	0.0084	66.47	21.76
	$r \leq 4$	0.0115	44.71	15.65
	$r \leq 5$	0.0155	29.06	14.49
	$r \leq 6$	0.0215	14.57	8.32
	$r \leq 7$	0.0260	6.25	6.25

Source: *, **, and ***indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

Table 4.9: Cointegration Results for a Trade-weighted Basket

Next, we perform cointegration analysis on the weighted RERs. As shown in Table 4.9, equations 3.17 and 3.18 yield at least one cointegrating relationship at 5% significance when taking 2 lags selected from equation 4.6. These results are supportive of trade weights' usefulness in determining the weights of a basket peg for the WAMZ and ECOWAS. These results closely resemble those in our previous analysis with unweighted RERs that confirmed the presence of a cointegrating vector.

Regarding our long-run exclusion test, the results are statistically significant for all WAMZ countries except Liberia and Sierra Leone which means these two countries could be omitted from the OCA. In the ECOWAS, Cabo Verde, Ghana, Nigeria, and the UEMOA are statistically significant. Hence, only these countries' RERs should be included in the long-run relation. Our LR test results for weak exogeneity indicate that Guinea and Nigeria's RERs are unexplained by the model for the WAMZ since they are not statistically significant. The Gambia, Liberia, and the UEMOA are exogenous in the ECOWAS as well. The results of both tests are presented in Table 4.10. In summary, these results

Zone	CPV	GMB	GHA	GIN	LBR	NGA	SLE	UEMOA
WAMZ		11.61^{***}	9.39^{***}	7.92^{***}	0.68	5.31^{**}	0.16	
		2.71^{*}	9.88^{***}	2.43	3.56^{*}	0.79	5.87^{**}	
ECOWAS	10.16^{***}	0.41	5.77^{**}	1.44	1.33	7.12^{***}	0.15	10.0^{***}
	5.27^{**}	0.53	3.4^{*}	3.29^{*}	0.58	10.58^{***}	2.64^{*}	0.1

Source: *, **, and ***indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lags = 1. r = 1. 1 degree of freedom. Test statistics indicate "long-run exclusion" (upper) and "weak exogeneity" (lower).

Table 4.10: χ^2-based Tests for Exogenous Weights

indicate that the WAMZ and ECOWAS cannot form OCAs with these trade weights since they fail the LR tests. They do, however, yield optimistic results for Cabo Verde and Ghana, whose RERs were statistically significant for both tests.

4.2.10 GPPP Estimation with Endogenous Weights

In the second stage of our basket-peg section, we begin by performing cointegration analysis on the RERs which include the euro's RERs against the pound and dollar as numéraires. We display our cointegration results in Table 4.11 which show that equations 3.17 and 3.18 yield at least one cointegrating relation in the WAMZ and at least 7 in the ECOWAS that are statistically significant a the 5% and 1% levels, respectively. Using the multivariate AIC from equation 4.6, we determined the optimal lag structure to be 2 for the WAMZ and 10 for the ECOWAS. Next, we calculate the optimal weights using the β coefficients from equation 3.15. However, we obtain unexpected signs for the pound in the WAMZ and the US dollar in the ECOWAS. Also, many of the weights we compute for ranks 2 to 7 for the ECOWAS are greater than unity. These two issues have previously been documented in the literature (Kawasaki and Ogawa, 2006; Sugimoto, 2008). We further confirm GPPP to be an unreliable method to estimate the optimal weights of a common currency basket. We present our estimated weights in Table 4.12 which, nevertheless, convey a critical message. Regardless of the weights' accuracy, the results indicate the order of importance of all three currencies. The euro is undoubtedly the

Zone	H_0	Eigenvalue	λ_{trace}	λ_{max}
WAMZ	$r = 0$	0.0028	193.05**	51.37
	$r \leq 1$	0.0038	141.68*	38.27
	$r \leq 2$	0.0093	103.40	29.91
	$r \leq 3$	0.0103	73.50	25.02
	$r \leq 4$	0.0131	48.48	19.31
	$r \leq 5$	0.0155	29.17	17.39
	$r \leq 6$	0.0193	11.78	6.80
	$r \leq 7$	0.0251	4.98	4.98
ECOWAS	$r = 0$	0.0044	594.59***	153.14***
	$r \leq 1$	0.0094	441.45***	107.63***
	$r \leq 2$	0.0102	333.82***	94.02***
	$r \leq 3$	0.0180	239.81***	70.89***
	$r \leq 4$	0.0187	168.92***	57.34***
	$r \leq 5$	0.0286	111.59***	35.13*
	$r \leq 6$	0.0341	76.45***	33.83**
	$r \leq 7$	0.0425	42.63**	18.22
	$r \leq 8$	0.0470	24.41*	16.81
	$r \leq 9$	0.0594	7.60	7.60

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2 for the WAMZ. Lag = 10 for the ECOWAS.

Table 4.11: Cointegration Results for an Endogenous Basket

Zone	USD	GBP	EUR
WAMZ	7.17	2.85	89.98
ECOWAS	33.3	18.83	47.87

Source: Author's own calculations .

Table 4.12: Estimated Endogenous Weights (%)

heaviest-weighted currency, followed by the US dollar, then the pound sterling in both zones. These results somewhat resemble the trade weights which indicate the same order of importance. Finally, long-run exclusion test results are presented in Table 4.13. In the case of the WAMZ, only the US dollar is significantly different from zero at the 10% level. Therefore, the optimal basket is composed solely of the euro. Regarding the ECOWAS, we fail to reject the weight of the US dollar is naught whereas we reject the pound and

Zone	USD	GBP	Both
WAMZ	2.81*	1.15	2.88
ECOWAS	0.73	16.7***	16.87***

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. $r = 1$.

Table 4.13: χ^2-based Test for Optimal Basket

both currencies are zero at the 1% level. Hence, the optimal common currency basket is composed of the pound and euro.

Chapter 5

Discussion

In this chapter, we examine our results and their implications through a critical lens. Firstly, we perform robustness checks for each of our GPPP estimations by replacing the euro as the numéraire with the US dollar and pound. Secondly, we compare our results with those in the contemporary GPPP literature and discuss the policy implications of our results and those in the extant literature.

5.1 Robustness Check

To verify the robustness of our results, we re-estimate our GPPP models for an OCA using the US dollar and pound sterling as base currencies instead of the euro for each cluster. As these two safe-haven currencies are relatively stable like the euro, we expect similar results. This test is important because it allows us to confirm the validity of our findings. Therefore, we deem our initial results to be robust if we obtain similar findings with the other two currencies. More specifically, we look for a similar number of cointegrating relationships, comparable Johansen statistics (equations 3.17 and 3.18), and close eigenvalues.

5.1.1 The ECOWAS

In our initial analysis, we found at least one cointegrating relation at 5% significance where the λ_{trace} as well as λ_{max} statistics equaled 194.47 and 55.84, respectively. Also, the eigenvalue at $r=0$ was 0.0034.

As observed in Table 5.1(a), our robustness check for the ECOWAS with the US dollar numéraire identifies at least two cointegrating vectors and very similar λ_{trace} and λ_{max} statistics (203.28 and 57.81, respectively). Furthermore, our λ_{trace} statistic is statistically significant at 1% while the λ_{max} is rejected at the same level as the previous analysis. This verification also yields an eigenvalue equal to 0.0028 which is very close to our initial 0.0034. Our second cointegrating vector of which the λ_{trace} statistic is significant at the 10% level further confirms the ECOWAS to be an OCA.

Table 5.1(b) contains our robustness check for the ECOWAS with the pound sterling as the base currency which identifies at least two cointegrating vectors. As observed, the λ_{trace} and λ_{max} statistics (202.31 and 60.02, respectively) are both statistically significant at the 1% and 5% levels, respectively, and are close to the initial results. The eigenvalue, 0.0032, is also very similar to 0.0034 in the previous estimation. Like in our first robustness check, our additional cointegrating vector of which the λ_{trace} statistic is significant at the 10% and the λ_{max} is significant at 5% further supports the existence of an OCA.

These similar overall findings support the robustness of our initial results.

5.1.2 The UEMOA

Turning to the UEMOA, we found in our first analysis at least three cointegrating relations where, on the one hand, the λ_{trace} statistic equaled 255.50, 186.54, 136.69, and 90.48 from ranks zero to three. Also, the first three statistics were significant at 1% while the last one was significant at 5%. On the other hand, the λ_{max} statistics equaled 68.96, 49.85, and 46.21 for ranks zero to two. The first two statistics were statistically significant at 1% while the last one was significant at 10%. The eigenvalues were equal to 0.0039, 0.0069, 0.0084, and 0.0125 for ranks zero to three, respectively.

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0028	203.28^{***}	57.81^{**}
$r \leq 1$	0.0058	145.47^{*}	44.09
$r \leq 2$	0.0088	101.38	29.01
$r \leq 3$	0.0097	72.37	22.05
$r \leq 4$	0.0117	50.32	18.20
$r \leq 5$	0.0150	32.13	16.41
$r \leq 6$	0.0219	15.72	10.69
$r \leq 7$	0.0277	5.03	5.03

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0032	202.31^{***}	60.02^{**}
$r \leq 1$	0.0043	142.29^{*}	47.78^{**}
$r \leq 2$	0.0052	94.50	31.05
$r \leq 3$	0.0094	63.46	22.90
$r \leq 4$	0.0121	40.56	17.62
$r \leq 5$	0.0160	22.94	9.47
$r \leq 6$	0.0235	13.47	7.73
$r \leq 7$	0.0286	5.74	5.74

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(b) Pound Sterling

Table 5.1: ECOWAS Robustness Check

As observed in Table 5.2(a), our robustness check for the UEMOA with the US dollar numéraire yields at least four cointegrating relations and shows very similar λ_{trace} and λ_{max} statistics. Our λ_{trace} statistics are significant at 1% for ranks zero through three like in the previous analysis. However, the US dollar estimation yields a λ_{trace} statistic equal to 88.90 for $r \leq 3$ that is statistically significant at 10%, unlike the 90.48 which was significant at 5% in the first analysis. Although the last rank's level of significance changes, we still determine the existence of an OCA. Our λ_{max} statistics, although similar, also show

different levels of significance. This however, does not change our final conclusion of an OCA. When $r = 0$, $r \leq 1$, and $r \leq 2$, we reject H_0 of r cointegrating vectors at 5% for the first statistic then 10% for the other two statistics, respectively. In our previous analysis, we rejected the λ_{max} statistics at 1% for ranks zero and one while we rejected at 5% for rank two. This verification also yields very similar eigenvalues as the first estimation.

Next Table 5.2(b) presents our robustness check for the UEMOA with the pound sterling as the base currency and yields four cointegrating relations. As observed, our λ_{trace} statistics are quite similar to the initial values for each rank and are significant at the same levels. Our λ_{max} statistics for ranks zero and one, however, are noticeably larger than those we initially estimated but remain significant at 1%. At $r = 0$, the pound sterling-based estimation yields a λ_{max} statistic equal to 78.34 while the previous estimation yielded 68.96. The difference is even more pronounced at $r \leq 1$, where the pound sterling-based estimation yields 49.85 while the first estimation yielded 65.97. The λ_{max} statistics for the euro-based and pound sterling-based estimations remain quite close at 46.21 and 41.77, respectively. However, the λ_{max} statistic is only significant at 10% in the robustness check while it was significant at 5% with the euro numéraire. Finally, the euro and pound sterling-based estimations yielded similar eigenvalues.

Hence, we consider our initial estimation to be robust since the alternate base currencies provide comparable results.

5.1.3 The WAMZ

Regarding our initial WAMZ estimation results, we found at least one cointegrating relation at 5% and 10% significance where the λ_{trace} as well as λ_{max} statistics equaled 118.93 and 41.48, respectively. Also, the eigenvalue at $r=0$ was 0.0025.

As observed in Table 5.3(a), our US dollar-based estimation yields no cointegrating vectors. Our λ_{trace} and λ_{max} statistics equal to 107.76 and 38.07, respectively. The λ_{trace} statistic is strikingly higher than in the first estimation while the λ_{max} statistic is comparable. Also, neither of the Johansen statistics is statistically significant at the 10%, 5% or

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0040	242.01^{***}	67.47^{**}
$r \leq 1$	0.0062	174.54^{***}	47.22^{*}
$r \leq 2$	0.0085	127.32^{***}	42.48^{*}
$r \leq 3$	0.0118	84.84^{*}	28.04
$r \leq 4$	0.0146	50.32	22.33
$r \leq 5$	0.0212	32.13	15.78
$r \leq 6$	0.0233	15.72	11.44
$r \leq 7$	0.0315	5.03	7.26

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0033	274.98^{***}	78.34^{***}
$r \leq 1$	0.0062	196.64^{***}	65.97^{***}
$r \leq 2$	0.0106	130.67^{***}	41.77^{*}
$r \leq 3$	0.0121	88.90^{**}	28.43
$r \leq 4$	0.0148	60.47	23.01
$r \leq 5$	0.0209	37.46	20.02
$r \leq 6$	0.0310	17.45	11.48
$r \leq 7$	0.0356	5.97	5.97

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(b) Pound Sterling

Table 5.2: UEMOA Robustness Check

1% level. The eigenvalue, 0.0024, is remarkably close to 0.0025 in the previous analysis.

We are unable to identify any cointegrating vectors in our pound sterling-based robustness check which is presented in Table 5.3(b). In this verification, we find non-significant λ_{trace} and λ_{max} statistics that equal 108.36 and 40.90, respectively. Like in the US dollar-based estimation, the λ_{trace} statistic is smaller than the previously estimated value whereas the λ_{max} statistic is quite similar. Also, the eigenvalue, 0.0019, is comparable to the 0.0025 in the initial estimation.

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0024	107.76	38.07
$r \leq 1$	0.0050	69.69	24.61
$r \leq 2$	0.0074	45.08	18.05
$r \leq 3$	0.0096	27.03	13.71
$r \leq 4$	0.0129	13.32	9.04
$r \leq 5$	0.0193	4.28	4.28

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0019	108.36	40.90
$r \leq 1$	0.0032	67.46	28.83
$r \leq 2$	0.0058	38.63	18.76
$r \leq 3$	0.0100	19.87	10.65
$r \leq 4$	0.0150	9.22	5.76
$r \leq 5$	0.0205	3.47	3.47

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(b) Pound Sterling

Table 5.3: WAMZ Robustness Check

Although our estimated values are similar, neither robustness check yields statistically significant estimates. Therefore, we cannot confirm whether our initial findings are robust.

5.1.4 The WAMZ without Nigeria

In our original estimation for the WAMZ without Nigeria, we found at least one cointegrating relation at 10% significance where the λ_{trace} as well as λ_{max} statistics equaled 86.91 and 41.48, respectively. Also, the eigenvalue at *r=0* was 0.0024.

As observed in Table 5.4(a), our US dollar-based estimation yields no cointegrating vectors. Our λ_{trace} and λ_{max} statistics equal to 80.20 and 28.70, respectively. The λ_{trace}

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0032	80.20	28.70
$r \leq 1$	0.0042	51.50	24.65
$r \leq 2$	0.0073	26.85	13.51
$r \leq 3$	0.0129	13.34	7.60
$r \leq 4$	0.0149	5.74	5.74

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0020	79.09	35.24*
$r \leq 1$	0.0035	43.86	23.08
$r \leq 2$	0.0058	20.78	10.71
$r \leq 3$	0.0122	10.07	6.41
$r \leq 4$	0.0180	3.66	3.66

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. T-statistics are in parentheses.

(b) Pound Sterling

Table 5.4: WAMZ without Nigeria Robustness Check

statistic is comparable as in first estimation while the λ_{max} statistic is noticeably lower. Also, neither of the Johansen statistics is statistically significant at the 10%, 5% or 1% level. The eigenvalue, 0.0032, is relatively close to 0.0025 in the previous analysis.

Turning now to our pound sterling-based robustness check which is presented in Table 5.4(b), we only identify one cointegrating vector. In this verification, we find a non-significant λ_{trace} statistic equal to 79.09 at $r = 0$. For the same rank, our λ_{max} statistic equals 35.24 and is significant at 10%. Hence, we determine the existence of an OCA. Unlike in the US dollar-based estimation, both Johansen statistics are close to those from the previous analysis. Also, the eigenvalue, 0.0020, is comparable to 0.0024 from the initial estimation.

Given these mixed results, we cannot confirm the robustness of our initial results.

5.1.5 The UEMOA with Cabo Verde

Regarding our initial findings for a UEMOA with Cabo Verde, we detected at least 7 cointegrating vectors. On the one hand, we obtained λ_{trace} statistics equal to 373.93, 290.66, 223.08, 159.39, 109.26, 73.28, and 41.55. The first six statistics were significant at 1% while the last one was significant at 10%. On the other hand, our λ_{max} statistics equaled 83.27, 67.57, 63.69, 50.14, 35.98, and 31.72 for ranks zero through five. The first four statistics were significant at 1% while the the last two were significant at 10% and 5%, respectively. For ranks zero through 6, the eigenvalues were 0.0043, 0.0074, 0.0116, 0.0170, 0.0191, 0.0255, and 0.0312.

Turning now to our robustness check with the US dollar in Table 5.5(a), we identify five cointegrating vectors. Our λ_{trace} statistics are significant at 1% from ranks zero through three then at 5% at $r \leq 4$. They also vary slightly from our initial estimation. At $r = 0$ and $r \leq 1$, we obtain 375.69 and 286.80, respectively. These values are similar to the original 375.93 and 290.66 from our first estimation and are also significant at 1%. However, the values start to differ more dramatically from the second rank onward. This divergence is also observed across the eigenvalues starting at $r \leq 2$. A similar pattern emerges with respect to our λ_{max} statistics that are significant at 1% for ranks zero through three then at 5% for rank four. At $r \leq 2$, we observe a markedly different value, 86.82, compared to 67.57 in our previous analysis. Finally, the eigenvalue at $r \leq 3$ is much smaller than the 0.0170 from our first estimation.

Table 5.5(b) presents our robustness check for the UEMOA using the pound sterling as the base currency. In this verification, we detect the presence of six cointegrating vectors. Our λ_{trace} statistics are significant at 1% from ranks zero through three then 5% at $r \leq 4$ and 10% at $r \leq 5$. Like our first robustness check, the pound sterling-based results yield somewhat different statistics from our original findings for the first two ranks. At $r = 0$, λ_{trace} equals 408.68 compared to 373.93 in our first analysis. At $r \leq 1$, the robustness check result yields 305.82 while we obtained 290.66 previously. These differences, however, cease from the second rank onward. Next, our λ_{max} statistics

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0033	375.69^{***}	88.89^{***}
$r \leq 1$	0.0052	286.80^{***}	86.82^{***}
$r \leq 2$	0.0094	199.98^{***}	59.19^{***}
$r \leq 3$	0.0010	140.78^{***}	49.70^{***}
$r \leq 4$	0.0216	91.08^{**}	41.42^{**}
$r \leq 5$	0.0253	49.67	18.08
$r \leq 6$	0.0294	31.58	16.79
$r \leq 7$	0.0400	14.80	9.12
$r \leq 8$	0.0401	5.67	5.67

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 10.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
$r = 0$	0.0044	408.68^{***}	102.86^{***}
$r \leq 1$	0.0071	305.82^{***}	96.25^{***}
$r \leq 2$	0.0109	209.57^{***}	54.50^{***}
$r \leq 3$	0.0126	155.07^{***}	52.82^{***}
$r \leq 4$	0.0208	102.25^{**}	39.68^{**}
$r \leq 5$	0.0267	62.58^{*}	22.80
$r \leq 6$	0.0274	39.77	19.72
$r \leq 7$	0.0432	20.06	12.46
$r \leq 8$	0.0454	7.60	7.60

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 10.

(b) Pound Sterling

Table 5.5: UEMOA with Cabo Verde Robustness Check

are significant at 1% for ranks zero through three, then at 5% for rank four. We observe a similar pattern to our λ_{trace} statistic where the λ_{max} statistics differ from those in the initial estimation for $r = 0$ and $r \leq 1$. At these ranks, we obtain 102.86 and 96.25 compared to 83.27 and 67.57 in our previous analysis. However, the similarity reappears at $r \leq 2$ onward. Lastly, our eigenvalues are close to those in the first estimation.

These results therefore point to robustness in our original estimation.

5.1.6 The ECOWAS without Nigeria

In regard to our initial results for the ECOWAS without Nigeria, we identified at least one cointegrating vector at 10% and 5% significance where the λ_{trace} as well as λ_{max} statistics equaled 119.61 and 45.03, respectively. The eigenvalue at $r = 0$ was 0.0185.

As observed in Table 5.6(a), our robustness check yields at least one cointegrating vector for the ECOWAS without Nigeria when taking the US dollar as the numéraire. We observe similar λ_{trace} (127.32) as well as λ_{max} (43.80) statistics that are significant at 10% and 5%, respectively, which are close to the 119.61 and 45.03 in the previous estimation. Also, we reject the λ_{trace} and λ_{max} statistics at 10% and 5% instead of at 5% and 10%, respectively, as was the case in the previous estimation. The eigenvalue, 0.0110, is close to the 0.0185 in the original results.

Turning to the pound sterling-based robustness check in Table 5.6(b), we find at least one cointegrating relation. At $r = 0$, our λ_{trace} statistic equals 122.45 and is significant at 10%, similar to the initial 119.61 which was significant at the same level. Although we find a comparable λ_{max} value of 41.66, it is not statistically significant at 10%, 5% or 1%. The eigenvalue, 0.0128, is close to the original 0.0185.

Hence, we conclude this estimation to be robust as we find similar results with the other reserve currencies.

5.2 Comparison of Results & Policy Implications

Now that we have confirmed the solidity of our results, we examine in the following section the results in the relevant literature and policy implications of our findings.

5.2.1 GPPP Literature

As mentioned previously in this study, we partly based our empirical analysis on an already existing study of West Africa, Sugimoto (2008), with which we find comparable results. In our GPPP analysis of the ECOWAS, we found one cointegrating vector over

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0110	127.32**	43.80*
$r \leq 1$	0.0334	83.52	29.33
$r \leq 2$	0.0564	54.19	21.10
$r \leq 3$	0.0794	33.09	14.74
$r \leq 4$	0.1118	18.35	10.34
$r \leq 5$	0.1519	8.02	6.04
$r \leq 6$	0.2181	1.97	1.97

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(a) US Dollar

H_0	Eigenvalue	λ_{trace}	λ_{max}
r = 0	0.0128	122.45*	41.66
$r \leq 1$	0.0348	80.79	30.35
$r \leq 2$	0.0469	50.45	17.86
$r \leq 3$	0.0830	32.59	15.43
$r \leq 4$	0.0955	17.16	8.55
$r \leq 5$	0.1567	8.60	6.31
$r \leq 6$	0.2087	2.29	2.29

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Lag = 2.

(b) Pound Sterling

Table 5.6: ECOWAS without Nigeria Robustness Check

the 2006-20 period. Due to data unavailability, Sugimoto (2008) estimated restricted GPPP models containing a mix of UEMOA and WAMZ countries to gauge the level of integration between these two subregions from 1975 to 1993. When including the Gambia or Ghana with a subset of UEMOA members, the author detected at least one cointegrating relation. However, he was unable to identify any long-run relationships when Nigeria was added to the UEMOA. These results closely resemble ours since we found at least one cointegrating relationship thereby confirming economic integration among the UEMOA and non-UEMOA countries. Furthermore, Nigeria's presence or absence from a model

seems to change the results considerably. When excluding Nigeria from our ECOWAS estimation, we were only able to find a long-term relationship significant at 10%. This common anomaly may be an indicator of Nigeria's importance and dominance in the region.

Next, Sugimoto (2008) estimates GPPP models for the UEMOA and WAMZ for the 1994-2007 period. Once again, we find comparable, but not identical results. The author detects at least three cointegrating relationships within the UEMOA whereas our results exhibit at least four. This is no doubt due to the UEMOA members' gradual convergence over time from sharing a single currency. For the WAMZ, Sugimoto (2008)'s analysis uncovered at least two cointegrating relations while we only found one. The only difference is we included Liberia, which joined the WAMZ in 2010, in our sample. A possible explanation for this variation could be that the WAMZ is becoming increasingly disintegrated and hence more reliant on outside trading and investing partners.

Finally, we encountered similar issues as Kawasaki and Ogawa (2006); Sugimoto (2008) when estimating our endogenous weights. In their articles, the authors obtain negative values and figures above unity for the endogenous weights of a common currency basket in East Asia and West Africa. In the former study, the authors were unable to estimate positive weights for their entire sample, the ASEAN in addition to the Republic of Korea and China. We had a similar final result as we found seven cointegrating vectors for the ECOWAS of which each contained at least one negative value, and vectors two through seven yielded weights greater than 100%. Only the weights provided by the first cointegration vector made sense except for the negative pound weight. These results are displayed below in Table 5.7 where r represents the rank of the cointegrating vector. Also, our findings with the exogenous trade weights are similar to those in Kawasaki and Ogawa (2006) who determined the US dollar, euro, and yen to form an adequate common currency basket for a subset of their total sample, the ASEAN and China. In our study, only Cabo Verde and Ghana proved to be able to form an OCA with the three trade weights. Therefore, these trade weights are inappropriate for an optimally-weighted common currency basket peg for the eco.

CUR \ *r*	1	2	3	4	5	6	7
USD	33.30	454.26	-25.98	-21.78	-20.33	76.23	-12.47
GBP	-18.83	-325.44	16.98	8.04	-22.20	-75.95	6.55
EUR	85.54	28.81	109.00	113.74	142.53	99.71	105.92

Source: Author's own calculations.

Table 5.7: Estimated Endogenous Weights for the ECOWAS (%)

5.2.2 Policy Implications

Our results can have different policy implications than those in the recent literature. The following subsection explains how our findings differ from those in mainstream research and how policymakers should approach further monetary integration in West Africa.

As mentioned earlier, the majority of empirical literature advocates against the creation of an eco union. Contrarily, our results go against the grain by justifying the ECOWAS as an OCA given the cointegrated exchange rates. Other research sought to assess the preparedness for an eco union with alternate techniques such as shock identification (Houssa, 2008; Chuku, 2012; Nkwatoh, 2018; Mati et al., 2019), cluster analysis (Bénassy-Quéré and Coupet, 2005; Tsangarides and Qureshi, 2008), welfare analysis (Debrun et al., 2005; Masson, 2006; Debrun et al., 2011), or BCS (Celasun and Justiniano, 2005; Miles, 2017; Zouri, 2020). For the most part, they have determined the ECOWAS is not yet ready for a single currency. So, the question of why our results differ from this near-unanimous agreement is certainly of interest.

Our methodology differs from those used in the literature as the RER is composed of forcing variables that reflect the economic structure of each economy. We can infer that, since the RERs are cointegrated, the ECOWAS economies are highly integrated and can form an OCA. However, the RER is only a single variable and it would be unwise to form a currency union solely on the results yielded from the RER as this is only one aspect of monetary integration. Instead, a holistic approach needs to be taken that considers all facets of monetary integration. Our results, however, suggest the ECOWAS members are gradually becoming ready for an OCA and some subzones are already highly integrated.

It would be of great interest to agents to take steps toward fostering further economic integration to better prepare for the eco's adoption. For example, Cabo Verde could explore a possible union with the UEMOA seeing as they are already highly integrated. However, a potential issue with this would be the difference in the exchange rate as the Cape Verdean escudo is stronger than the CFA franc. Also, our results do not indicate that the WAMZ needs to first adopt the eco before expanding across the rest of the region since GPPP held in both regions. This same conclusion was drawn by Debrun et al. (2011) in their cost-benefit analysis. Finally, we were unable to determine an optimal basket peg for the eco and the trade weights proved to be less than ideal. If France does not guarantee convertibility and the eco does not float, further research will be required to decide an optimal peg. However, this mostly boils down to being a political decision that has not yet been made as of the writing of this study.

Conclusion

Given the eco's 2020 postponement, the main objective of this study was to determine if the ECOWAS indeed constitutes an OCA. To accomplish this, we applied the GPPP framework developed by Enders and Hurn (1994) to individual West African bilateral RERs. This framework assumes that RERs are nonstationary and consist of fundamental macroeconomic variables. Moreover, GPPP holds in the long run if a stationary linear combination of RERs exists. In this case, a group of countries may form an OCA. We then performed cointegration analysis to determine if the bilateral RERs were cointegrated as this would signal a high level of regional integration, an ideal quality for OCA candidates. In our analysis, we constructed a VECM from which we estimated the Johansen statistics that indicate the number of cointegrating relations among the RERs for the ECOWAS in addition to five different subgroups of West African countries.

The second objective of this master's thesis was to identify an optimally-weighted common currency basket peg for the eco. This question is of special interest since no exchange rate regime has yet been determined and it is uncertain whether France will guarantee the eco's convertibility. To determine these weights, we apply the same GPPP framework and cointegrating estimation techniques as in our previous empirical analysis. We initially constructed a basket peg using trade-based weights and the US dollar, euro, and pound sterling's RERs for the ECOWAS and WAMZ. Next, we computed endogenous weights for the three safe-haven currencies. To do so, we estimated cointegrating vectors for the US dollar and pound sterling then calculated their overall weights within the vectors with the euro serving as the reference.

In the first part of our analysis, our empirical results indicated a positive and significant degree of integration among the ECOWAS economies as we identified at least one cointegrating relationship. Since GPPP held, we concluded that the ECOWAS is an OCA. Furthermore, we analyzed various clusters of West African nations to evaluate if smaller currency unions could be assembled before or instead of continent-wide monetary integration. We determined the UEMOA to be highly integrated, presenting multiple cointegrating vectors whereas the WAMZ was also integrated, but to a lesser degree. Both subzones were found to be OCAs which is supported in the GPPP literature (Sugimoto, 2008). Our results generally show robustness when we estimate the RERs with the US dollar or pound sterling as the base currency.

In the second part of our analysis, we encountered methodological issues that have previously been documented in the literature and did not estimate logical weights. We obtained unexpected signs for the estimated weights, however, each analysis showed the order of importance should be given to the euro, US dollar, and pound sterling, in that sequence. Additionally, we found many erroneous weights which were greater than unity in subsequent cointegrating ranks. The trade-based weights did not fare much better as the weights of these three currencies did not constitute an optimal basket peg. Although, we did find the trade weights to work well for Cabo Verde and Ghana which yielded statistically significant results in our LR tests. Thus, this specific combination of trade weights was only suitable for a subset of ECOWAS countries. In the end, we conclude that further research will be required to determine an optimal basket peg if the ECOWAS decides on a fixed exchange rate regime.

We were faced with two main limits in our empirical study. Firstly, we were unable to include a longer sample period because CPI data were unavailable for countries such as Liberia and Sierra Leone before 2006. However, we did manage to obtain data for every period from 2006 to 2020 without having to restrict our sample due to missing observations. As mentioned previously, we had 15 years of monthly observations, so we were unconcerned with the Johansen technique's poor performance in small samples. Although our period length was adequate, we certainly would have benefited from a longer

one. Secondly, we were obliged to restrict our RER samples of the UEMOA members during the cointegration analysis of the ECOWAS and instead use an aggregated RER. This was because the Johansen technique uses Osterwald-Lenum (1992) critical values that are only calculated for up to 11 variables. Fortunately, the CFA franc's nominal exchange rate against the euro was identical for all countries and the CPI was very similar due to homogeneous consumer preferences across the UEMOA. Perhaps future techniques that allow for additional variables will yield more reliable results for the ecozone.

As a future research avenue, it could be especially useful to explore an optimal exchange rate regime for the ECOWAS, flexible or rigid. Few, if any, empirical analyses have so far considered a floating exchange rate for the eco union. Such a study could premise the regime choice on members' responsiveness to external monetary shocks then execute counterfactual analyses by using VAR modeling techniques and performing simulations. This we leave to future research.

Bibliography

Abuaf, N. and Jorion, P. (1990). Purchasing power parity in the long run. *The Journal of Finance*, 45(1):157–174.

Adam, A. M. and Chaudhry, I. S. (2014). The currency union effect on intra-regional trade in economic community of west african states (ecowas). *Journal of International Trade Law and Policy*.

Adu, R., Litsios, I., and Baimbridge, M. (2019). Real exchange rate and asymmetric shocks in the west african monetary zone (wamz). *Journal of International Financial Markets, Institutions and Money*, 59:232–249.

Ahn, C., Kim, H.-B., and Chang, D. (2006). Is east asia fit for an optimum currency area? an assessment of the economic feasibility of a higher degree of monetary cooperation in east asia. *The developing economies*, 44(3):288–305.

Aideyan, O. (2016). Political and institutional prerequisites for monetary union: Assessing progress in the economic community of west african states (ecowas). *Politics & Policy*, 44(6):1192–1212.

Alagidede, P., Coleman, S., and Cuestas, J. C. (2012). Inflationary shocks and common economic trends: Implications for west african monetary union membership. *Journal of Policy Modeling*, 34(3):460–475.

Alesina, A. and Barro, R. J. (2002). Currency unions. *The Quarterly Journal of Economics*, 117(2):409–436.

Amadou, A. and Kebalo, L. (2019). Single currency in ecowas: Is the proposed fiscal convergence criterion pro-growth? *African Development Review*, 31(4):423–433.

Amato, M. and Nubukpo, K. (2020). A new currency for west african states: The theoretical and political conditions of its feasibility. *PSL Quarterly Review*, 73(292):3.

Arndt, S. W. (2013). Joint balance: Capital mobility and the monetary system of a currency area. *The Economics of Common Currencies, edited by Harry G. Johnson and Alexander K. Swoboda (London, 1973)*, pages 196–209.

Asongu, S. (2013). Real and monetary policy convergence: Emu crisis to the cfa zone. *Journal of Financial Economic Policy*, pages 20–38.

Asongu, S., Nwachukwu, J., and Tchamyou, V. (2017). A literature survey on proposed african monetary unions. *Journal of Economic Surveys*, 31(3):878–902.

Asongu, S. A. and Odhiambo, N. M. (2020). Foreign direct investment, information technology and economic growth dynamics in sub-saharan africa. *Telecommunications Policy*, 44(1):101838.

Bakar, A. N. and Luqman, A. O. (2015). Purchasing power parity in west african monetary zone. *International Journal of Management and Applied Science*, 1(7):144–149.

Balassa, B. (1969). Regional monetary integration of the developing countries: Comment. *Monatary problems of the international economy (University of Chicago Press, Chicago)*, pages 151–156.

Beirne, J. (2008). Real exchange rate dynamics and monetary integration in crisis-affected regions. *Journal of International and global Economic studies*, 1(2):1–25.

Bénassy-Quéré, A. and Coupet, M. (2005). On the adequacy of monetary arrangements in sub-saharan africa. *World Economy*, 28(3):349–373.

Benczes, I. (2014). The globalization of economic. *The Sage Handbook of Globalization*, page 133.

Bernstein, D. J. (2000). Generalized purchasing power parity and the case of the european union as a successful currency area. *Atlantic Economic Journal*, 28(4):385–395.

Blanchard, O. J. and Quah, D. (1989). The dynamic effects of aggregate demand and supply disturbances. *The American Economic Review*, 79(4):655–673.

Brandful, W. G. (2013). *Personal Reflections of a Ghanaian Foreign Service Officer-Whither Ghanaian Diplomacy?* Dorrance Publishing.

Branson, W. H. (1981). Macroeconomic determinants of real exchange rates. *NBER Working Paper*, (w0801).

Caporale, G. M., Ciferri, D., and Girardi, A. (2011). Are the baltic countries ready to adopt the euro? a generalized purchasing power parity approach. *The Manchester School*, 79(3):429–454.

Celasun, O. and Justiniano, A. (2005). Synchronization of output fluctuations in west africa: Implications for monetary unification. *Unpublished manuscript, International Monetary Fund, Washington DC*.

Cesarano, F. (1997). Currency areas and equilibrium. *Open Economies Review*, 8(1):51–59.

Cesarano, F. (2006). Optimum currency areas: a policy view. *PSL Quarterly Review*, 59(239).

Cesarano, F. (2011). The political and economic dimension of monetary unions. *Open Economies Review*, 22(5):985–996.

Cesarano, F. (2013). The optimum currency area puzzle. *International advances in economic research*, 19(3):259–271.

Cham, T. (2011). Why join a monetary union? theoretical answers for policy makers in the west african monetary zone (wamz). *Journal of Economic Cooperation & Development*, 32(4):1–20.

Cheung, Y.-W. and Lai, K. S. (1993). Finite-sample sizes of johansen's likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and statistics*, 55:313–328.

Chiemeke, C. C. (2010). On an optimum currency area for the gcc countries: An analysis of the economic impact on the kuwait economy. *International Review of Business Research Papers*, 6(4):295–309.

Chuku, C. (2012). The proposed eco: should west africa proceed with a common currency? *Munich Personal RePEc Archive*, pages 1–35.

Clark, P. B. and MacDonald, R. (1999). Exchange rates and economic fundamentals: a methodological comparison of beers and feers. In *Equilibrium exchange rates*, pages 285–322. Springer.

Corden, W. M. (1972). *Monetary integration*. International Finance Section, Princeton University Princeton.

Coulibaly, I. and Gnimassoun, B. (2013). Optimality of a monetary union: New evidence from exchange rate misalignments in west africa. *Economic Modelling*, 32:463–482.

De Grauwe, P. (2000). *ECONOMICS OF MONETARY UNION CHAPTER 8*.

De Grauwe, P., Vanhaverbeke, W., et al. (1991). Is europe an optimum currency area? evidence from regional data. Technical report, CEPR Discussion Papers.

Debrun, X., Masson, P., and Pattillo, C. (2005). Monetary union in west africa: who might gain, who might lose, and why? *Canadian Journal of Economics/Revue canadienne d'économique*, 38(2):454–481.

Debrun, X., Masson, P. R., and Pattillo, C. (2011). Should african monetary unions be expanded? an empirical investigation of the scope for monetary integration in sub-saharan africa. *Journal of African Economies*, 20(2):104–150.

Declaration, T. M. R. (1973). The mano river declaration.

Della Valle, G., Kota, V., Veyrune, R., Cabezon, E. R., and Guo, S. (2018). Euroization drivers and effective policy response: An application to the case of albania. *IMF Working Paper*.

Dellas, H. and Tavlas, G. S. (2009). An optimum-currency-area odyssey. *Journal of International Money and Finance*, 28(7):1117–1137.

Diagne, M. W. (2019). The west african economic and monetary union: Optimality revisited. *Journal of Quantitative Economics*, 17(3):541–549.

Driver, R. L. and Westaway, P. F. (2003). Concepts of equilibrium exchange rates. *Exchange rates, capital flows and policy*, pages 98–124.

Dropsy, V. (1996). Macroeconomic determinants of exchange rates: a frequency-specific analysis. *Applied Economics*, 28(1):55–63.

Dufrénot, G. and Sugimoto, K. (2013). West a frican single currency and competitiveness. *Review of Development Economics*, 17(4):763–777.

ECOWAS.int (2020). Vision 2020. `https://www.ecowas.int/about-ecowas/vision-2020/`. Accessed: 2021-04-06.

Edison, H. J. (1987). Purchasing power parity in the long run: A test of the dollar/pound exchange rate (1890-1978). *Journal of Money, Credit and Banking*, 19(3):376–387.

Edwards, S. (1993). Exchange rates, inflation and disinflation: Latin american experiences. *NBER Working Paper*, (w4320).

Eichengreen, B. (1992). Is europe an optimum currency area? In *The European Community after 1992*, pages 138–161. Springer.

Eichengreen, B. and Frieden, J. (1993). The political economy of european monetary unification: an analytical introduction. *Economics & Politics*, 5(2):85–104.

Ekong, C. N. and Onye, K. U. (2012). On the feasibility of a common currency in west africa: Evidence from a multivariate structural var. *Current Research Journal of Economic Theory*, 4(4):120–131.

El Jai, Y. (2020). How feasible is the eco currency? a study of ecowas business cycles synchronicity.

Emerson, M., Gros, D., and Italianer, A. (1992). *One market, one money: an evaluation of the potential benefits and costs of forming an economic and monetary union*. Oxford University Press on Demand.

Enders, W. and Hurn, S. (1994). Theory and tests of generalized purchasing-power parity: Common trends and real exchange rates in the pacific rim. *Review of International Economics*, 2(2):179–190.

Engle, R. F. and Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, pages 251–276.

Fleming, J. M. (1962). Domestic financial policies under fixed and under floating exchange rates. *Staff Papers*, 9(3):369–380.

Fleming, J. M. (1971). On exchange rate unification. *the economic Journal*, 81(323):467–488.

Frankel, J. A. (1985). International capital mobility and crowding out in the us economy: imperfect integration of financial markets or of goods markets? Technical report, National Bureau of Economic Research.

Frankel, J. A. and Rose, A. K. (1998). The endogenity of the optimum currency area criteria. *The Economic Journal*, 108(449):1009–1025.

Gao, H. (2007). Optimal currency area: An empirical study on selected east asian economies. *Frontiers of Economics in China*, 2(4):594–606.

Goda, T. and Priewe, J. (2019). Determinants of real exchange rate movements in 15 emerging market economies. *Center for Research in Economics and Finance (CIEF), Working Papers*, (19-13).

Gottschalk, J. (2001). An introduction into the svar methodology: identification, interpretation and limitations of svar models. Technical report, Kiel working paper.

Grandes, M. (2003). Macroeconomic convergence in southern africa: the rand zone experience.

Granger, C. W., Newbold, P., and Econom, J. (1974). Spurious regressions in econometrics. *Baltagi, Badi H. A Companion of Theoretical Econometrics*, pages 557–61.

Grubel, H. G. (1970). The theory of optimum currency areas. *The Canadian Journal of Economics/Revue canadienne d'Economique*, 3(2):318–324.

Haberler, G. (1970). The international monetary system: some recent developments and discussions. *Money in the International Economy*, pages 115–124.

Hakkio, C. S. (1984). A re-examination of purchasing power parity: A multi-country and multi-period study. *Journal of International Economics*, 17(3-4):265–277.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of econometrics*, 93(2):345–368.

Harvey, S. K. and Cushing, M. J. (2015). Is west african monetary zone (wamz) a common currency area? *Review of Development Finance*, 5(1):53–63.

Hefeker, C. (2010). Fiscal reform and monetary union in west africa. *Journal of International Development: The Journal of the Development Studies Association*, 22(1):86–102.

Houssa, R. (2008). Monetary union in west africa and asymmetric shocks: A dynamic structural factor model approach. *Journal of Development Economics*, 85(1-2):319–347.

Ingram, J. C. (1962). *Regional payments mechanisms: The case of Puerto Rico*. University of North Carolina Press.

Ingram, J. C. (1969). Comment: the currency area problem. *Monetary problems of the international economy*, pages 95–100.

Ingram, J. C. (1973). *The case for European monetary integration*. International Finance Section, Princeton University.

Ishiyama, Y. (1975). The theory of optimum currency areas: a survey. *Staff Papers*, 22(2):344–383.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2-3):231–254.

Johansen, S. et al. (1995). *Likelihood-based inference in cointegrated vector autoregressive models*. Oxford University Press on Demand.

Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with appucations to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2):169–210.

Johnson, H. G. (1963). Equilibrium under fixed exchanges. *The American Economic Review*, 53(2):112–119.

Kafka, A. (1969). Regional monetary integration of the developing countries./monetary problems of the international economy. university of chicago ress.

Kafka, A. (2013). Optimum currency areas and latin america. In *The Economics of Common Currencies (Collected Works of Harry Johnson): Proceedings of the Madrid Conference on Optimum Currency Areas*, page 210. Routledge.

Kawasaki, K. and Ogawa, E. (2003). Possibility of creating a common currency basket for east asia. *China's Economic Development and Structural Change in East Asia*, pages 142–204.

Kawasaki, K. and Ogawa, E. (2006). What should the weights of the three major currencies be in a common currency basket in east asia? *Asian Economic Journal*, 20(1):75–94.

Kenen, P. B. (1969). The theory of optimum currency areas: an eclectic view. In *Essays in International Economics*, pages 163–182. Princeton University Press.

Kenen, P. B. and Meade, E. E. (2007). *Regional monetary integration*. Cambridge University Press.

Krugman, P. (2013). Revenge of the optimum currency area. *NBER Macroeconomics Annual*, 27(1):439–448.

Krugman, P. R. (1993). On the relationship between trade theory and location theory. *Review of International Economics*, 1(2):110–122.

Kunroo, M. H. (2015). Theory of optimum currency areas: a literature survey. *Review of market integration*, 7(2):87–116.

Laffer, A. B. (1973). Two arguments for fixed rates. *The economics of common currencies*, pages 25–34.

Liang, H. (1999). *Do Hong Kong SAR and China constitute an optimal currency area? An empirical test of the generalized purchasing power parity hypothesis*, volume 1999. International monetary fund.

Lothian, J. R. and Taylor, M. P. (1996). Real exchange rate behavior: the recent float from the perspective of the past two centuries. *Journal of political economy*, 104(3):488–509.

Loureiro, J., Martins, M. M., and Ribeiro, A. P. (2010). Cape verde: the case for euroisation. *South African Journal of Economics*, 78(3):248–268.

Lutz, F. (1972). Foreign exchange policy and european economic integration. *Machlup, Gutowsky, and Lutz (1972)*, 107:23.

MacDonald, R. (1999). What determines real exchange rates? the long and the short of it. In *Equilibrium exchange rates*, pages 241–284. Springer.

Magazzino, C. (2016). Fiscal variables and growth convergence in the ecowas. *African Journal of Economic and Management Studies*, 7(2):147–163.

Mark, N. C. (1990). Real and nominal exchange rates in the long run: An empirical investigation. *Journal of international economics*, 28(1-2):115–136.

Masson, P. R. (2006). New monetary unions in africa. *Economie internationale*, (3):87–105.

Masson, P. R. and Pattillo, C. (2004). *The monetary geography of Africa*. Brookings Institution Press.

Mata, M. E. (2020). *The Portuguese Escudo Monetary Zone: Its Impact in Colonial and Post-colonial Africa*. Springer.

Mati, S., Civcir, I., and Ozdeser, H. (2019). Ecowas common currency. *Investigación económica*, 78(308):89–119.

McCallum, J. (1995). National borders matter: Canada-us regional trade patterns. *The American Economic Review*, 85(3):615–623.

McKinnon, R. I. (1963). Optimum currency areas. *The American economic review*, 53(4):717–725.

Meese, R. and Rogoff, K. (1988). Was it real? the exchange rate-interest differential relation over the modern floating-rate period. *the Journal of Finance*, 43(4):933–948.

Melvin, M. and Norrbin, S. (2017). *International money and finance*. Academic Press.

Mignamissi, D. (2018). Monnaie unique et intégration par le marché en afrique: le cas de la ceeac et de la cedeao. *African Development Review*, 30(1):71–85.

Miles, W. (2017). How feasible is the west african eco currency union? an investigation using synchronicity and similarity measures. *Journal of Economic Studies*, 44(4):650–664.

Ministère (2010). MinistÈre de l'intÉgration africaine: «quelle intÉgration rÉgionale pour la cÔte d'ivoire post-crise?».

Mink, M., Jacobs, J. P., and de Haan, J. (2012). Measuring coherence of output gaps with an application to the euro area. *Oxford Economic Papers*, 64(2):217–236.

Mishra, R. K. and Sharma, C. (2010). Real exchange rate behavior and optimum currency area in east asia: Evidence from generalized purchasing power parity. *International Review of Financial Analysis*, 19(3):205–213.

Mkenda, B. K. et al. (2001). Is east africa an optimum currency area? *Göteberg University Department of Economics Working Paper*, 41.

Monde, L. (2020). La france acte officiellement la fin du franc cfa en afrique de l'ouest. *Le Monde*.

Mundell, R. A. (1961). A theory of optimum currency areas. *The American economic review*, 51(4):657–665.

Mundell, R. A. (1973). Uncommon arguments for common currencies. *The economics of common currencies*, pages 114–132.

Nathaniel, O. O. (2019). Validity of purchasing power parity (ppp) hypothesis in the ecowas (1980–2017). *Emerging Economy Studies*, 5(2):141–156.

Ndao, S., Nenovsky, N., and Tochkov, K. (2019). Does monetary integration lead to income convergence in africa? a study of the cfa monetary area. *Portuguese Economic Journal*, 18(2):67–85.

Nkwatoh, L. S. (2018). Appraisal of the preparedness of ecowas towards a common currency. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah*, 6(1):125–142.

Nkwatoh, L. S., Abdullahi, Y. Z., and Aliyu, C. U. (2019). Past and current european monetary union crises: Lessons for the envisaged west african monetary union. *International Journal of Economics and Financial Issues*, 9(4):50.

Nusair, S. A. (2012). Is the gulf cooperation council an optimum currency area? *The Developing Economies*, 50(4):351–377.

Ogawa, E., Ito, T., and Sasaki, Y. (2021). Costs, benefits, and constraints of the basket currency regime. pages 1–51.

Osabuohien, E. S., Efobi, U. R., Odebiyi, J. T., Fayomi, O. O., and Salami, A. O. (2019). Bilateral trade performance in west africa: A gravity model estimation. *African Development Review*, 31(1):1–14.

Osterwald-Lenum, M. (1992). A note with quantiles of the asymptotic distribution of the maximum likelihood cointegration rank test statistics. *Oxford Bulletin of Economics and statistics*, 54(3):461–472.

Parkin, M. (1972). An overwhelming case for european monetary union. *The Banker*, 122:1139–1142.

Public Relations Unit, M. o. F. R. o. G. (2019). West african monetary zone (wamz) 2018 end-year statutory meetings.

Quah, C.-H. (2016). A diagnostic on the west african monetary union. *South African Journal of Economics*, 84(1):129–148.

Redda, E. H., Muzindusti, P.-F., et al. (2017). Does sadc constitute an optimum currency area? evidence from generalised purchasing power parity. In *Proceedings of Economics and Finance Conferences*, number 4807771. International Institute of Social and Economic Sciences.

Reporter, F. S. (2016). Mano river union countries to establish legislative body.

Rose, A. K. (2000). One money, one market: the effect of common currencies on trade. *Economic policy*, 15(30):08–45.

Samba, M. C. and Mbassi, C. (2020). Business cycle synchronization: A reassessment of the optimum currency area theory within the cfa franc zone. *Journal of African Business*, 21(1):126–144.

Scitovsky, T. (1958). *Economic theory and western integration*. Allen & Unwin.

Scitovsky, T. (1967). The theory of balance-of-payments adjustment. *Journal of Political Economy*, 75(4, Part 2):523–531.

Simons, D. and Jean Louis, R. (2018). Monetary union in west africa and business cycles synchronicity: New evidence. *The World Economy*, 41(10):2828–2848.

Sorgenfrei, C. (2011). *Optimum Currency Areas: A Monetary Union for Southern Africa*. Diplomica Verlag.

Steinberg, D. and Walter, S. (2013). The political economy of exchange rates. *Handbook of Safeguarding Global Financial Stbility: Political, Social, Cultural, and Economic Theories and Models*, 2:27–36.

Sugimoto, K. (2008). Does west africa form an optimum currency area? a generalized ppp approach. *Osaka Economic Papers*, 58(2):225–245.

Sylla, N. S. (2020). The franc zone, a tool of french neocolonialism in africa. *Jacobin*. Accessed: 2021-04-06.

Tanja, B. (2005). The theory of optimum currency areas: A literature review. *Privredna kretanja i ekonomska politika*, pages 53–78.

Tapsoba, S. J.-A. (2009). Trade intensity and business cycle synchronicity in africa. *Journal of African Economies*, 18(2):287–318.

TCB-MRU (2013). Technical assistance and capacity building to mano river union (tcb-mru).

Tower, E. (1971). Financial policy under alternative exchange-rate systems. *The Journal of Finance*, 26(3):805–806.

Tsangarides, C. G. and Qureshi, M. S. (2008). Monetary union membership in west africa: A cluster analysis. *World Development*, 36(7):1261–1279.

Willett, T. D. and Tower, E. (1976). *The theory of optimum currency areas and exchange-rate flexibility*, volume 11. International Finance Section, Department of Economics, Princeton University.

Willett, T. D. and Tower, E. (2015). 50. the concept of optimum currency areas and the choice between fixed and flexible exchange rates. In *Approaches to greater flexibility of exchange rates*, pages 407–415. Princeton University Press.

Williamson, J. (1976). The implication of european monetary integration for the peripheral areas. *Economic Sovereignty and Regional Policy, Gill and Macmillan, Dublin*, pages 105–21.

Zagaris, B. (1978). The economic community of west african states (ecowas): An analysis and prospects. *Case Western Reserve Journal of International Law*, 10(1):93–122.

Zerihun, M. F. and Breitenbach, M. C. (2018). Is sadc an optimal currency area? evidence from the generalized purchasing power parity test. *Economic Change and Restructuring*, 51(2):173–188.

Zouri, S. (2020). Business cycles, bilateral trade and financial integration: Evidence from economic community of west african states (ecowas). *International Economics*, 163(2):25–43.

Appendix A – Logarithm of Monthly Bilateral RERs in Levels Jan 2006-Dec 2020

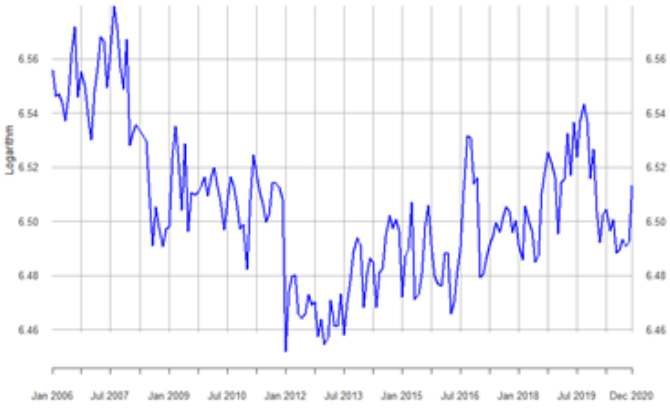

Figure 1: Benin

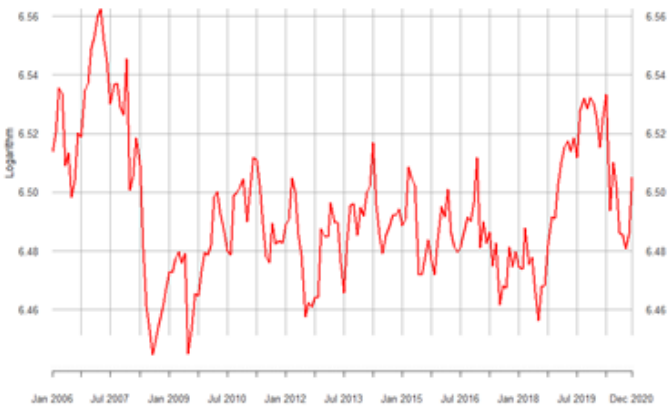

Figure 2: Burkina Faso

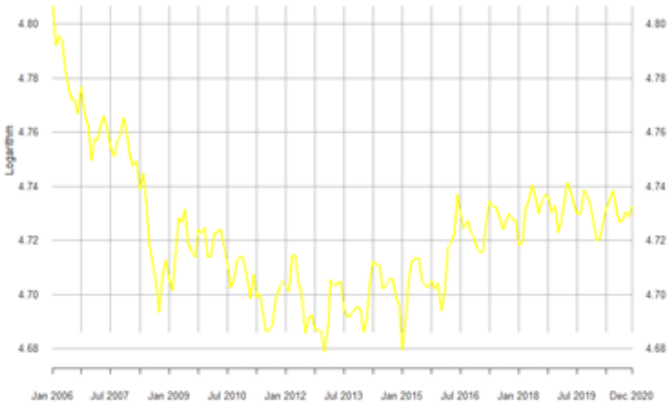

Figure 3: Cabo Verde

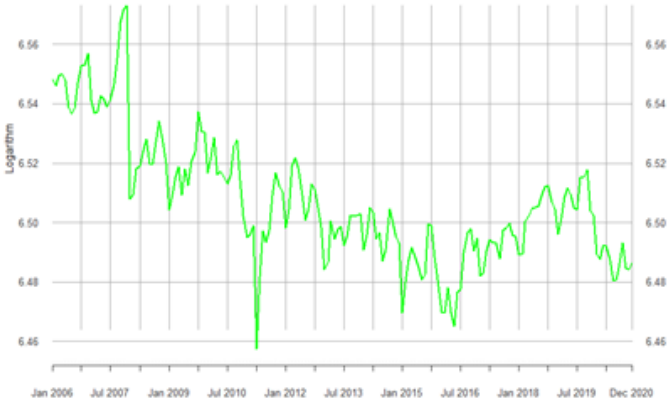

Figure 4: Côte d'Ivoire

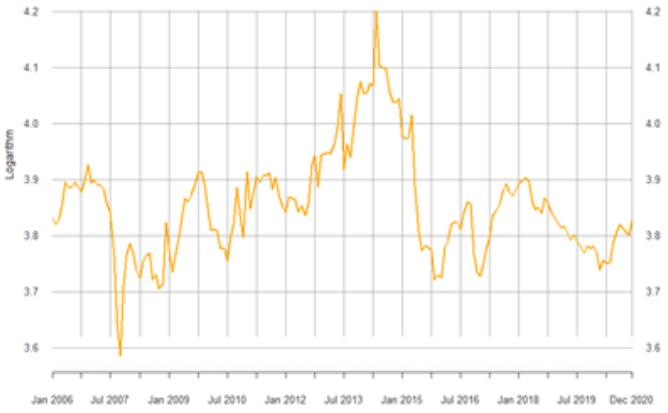

Figure 5: The Gambia

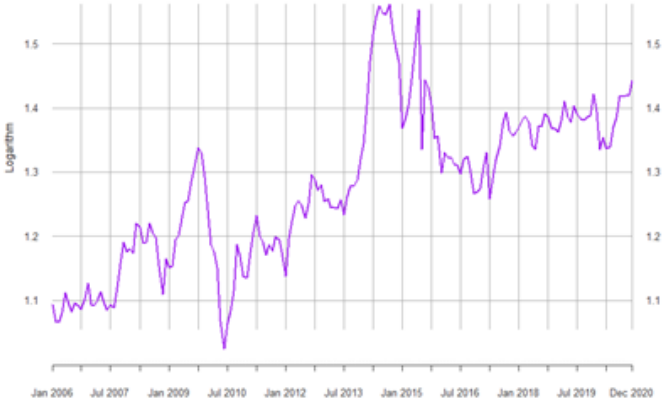

Figure 6: Ghana

Figure 7: Guinea

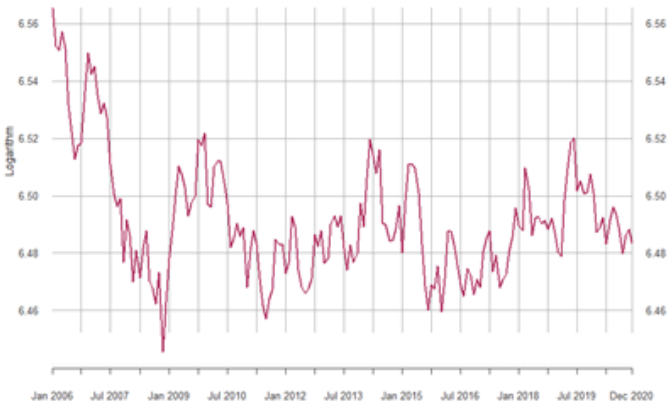

Figure 8: Guinea-Bissau

Figure 9: Liberia

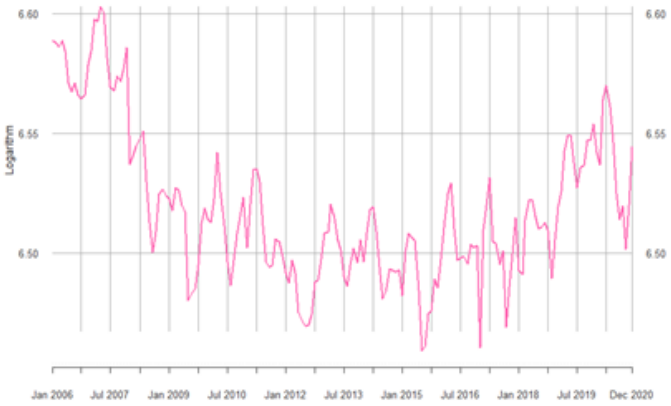

Figure 10: Mali

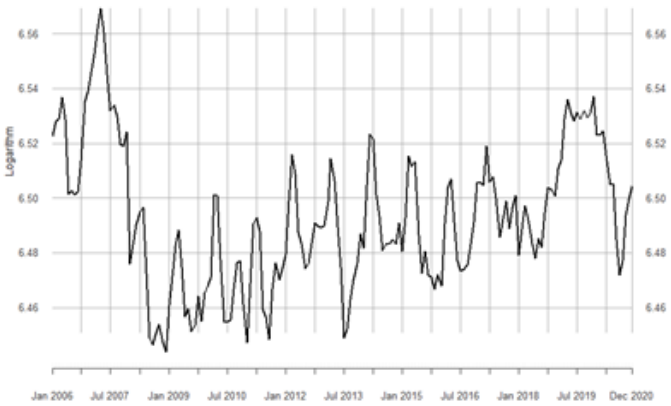

Figure 11: Niger

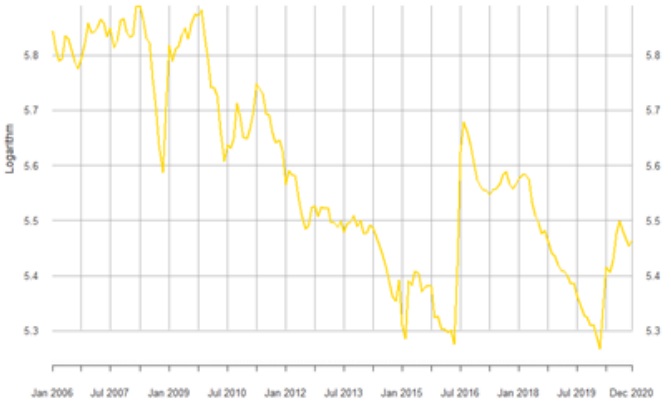

Figure 12: Nigeria

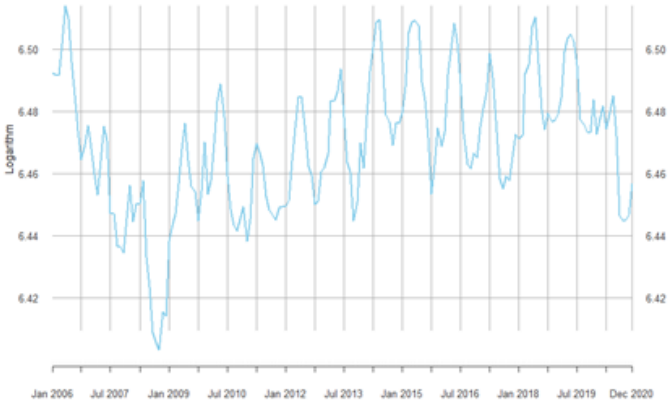

Figure 13: Senegal

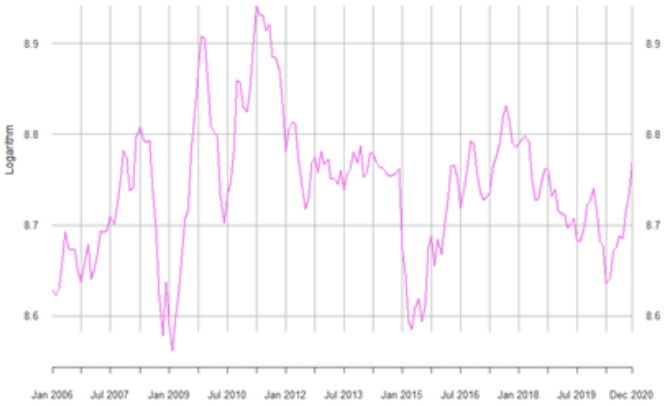

Figure 14: Sierra Leone

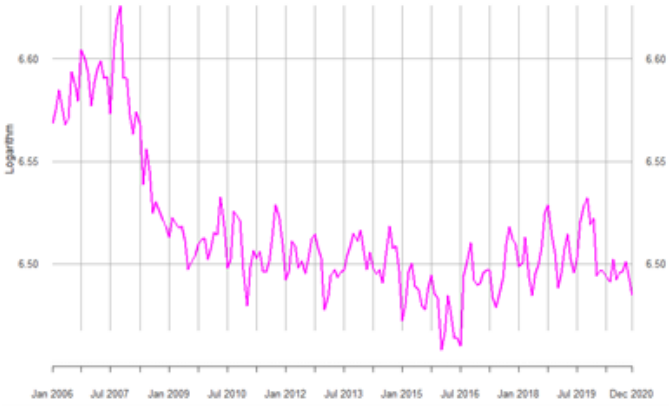

Figure 15: Togo

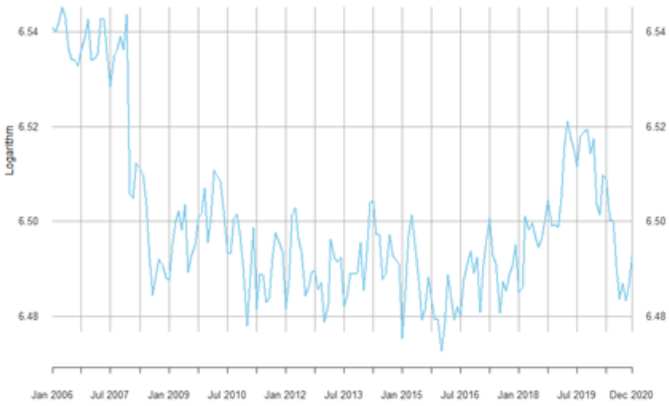

Figure 16: The UEMOA

Appendix B – Logarithm of Monthly Bilateral RERs in First Difference Jan 2006-Dec 2020

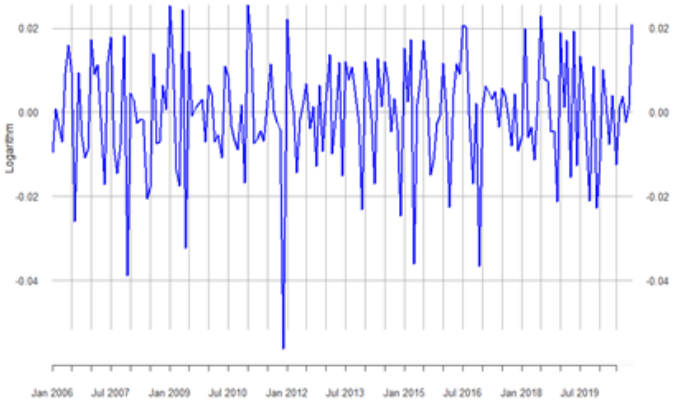

Figure 17: Benin

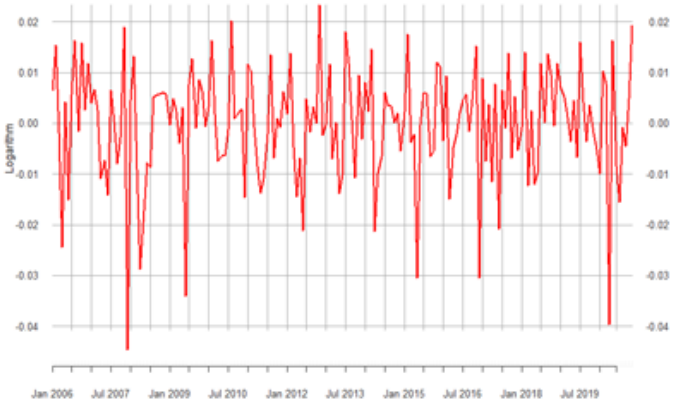

Figure 18: Burkina Faso

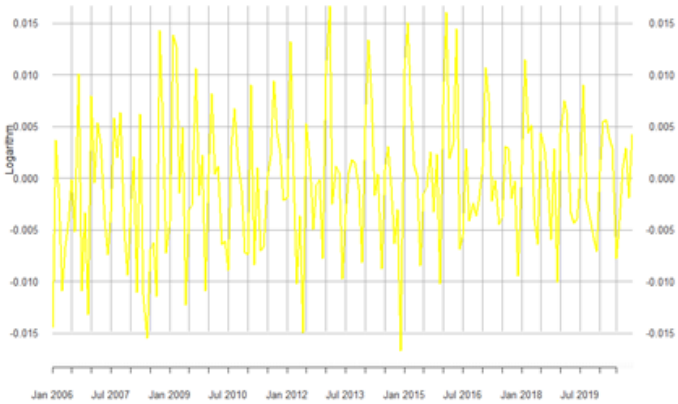

Figure 19: Cabo Verde

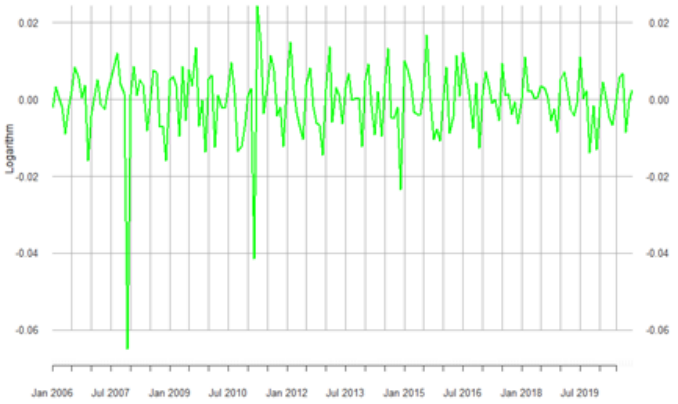

Figure 20: Côte d'Ivoire

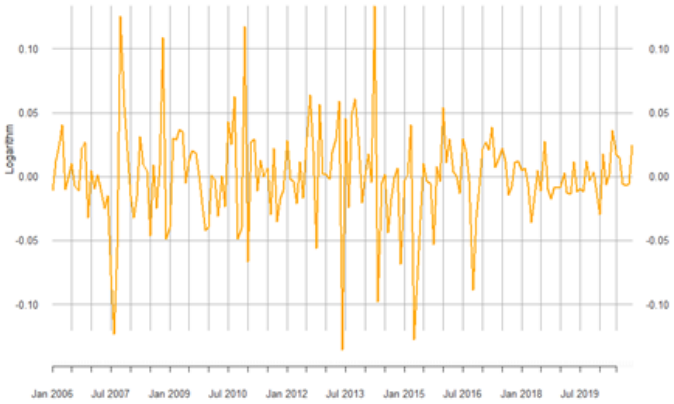

Figure 21: The Gambia

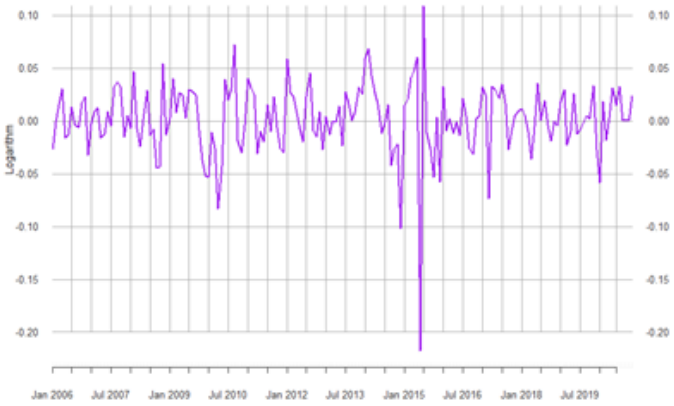

Figure 22: Ghana

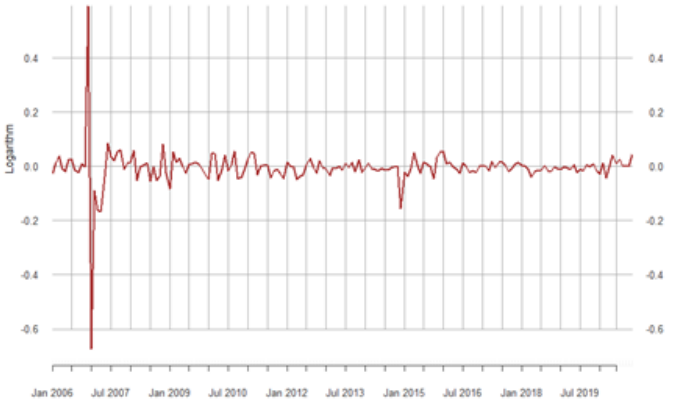

Figure 23: Guinea

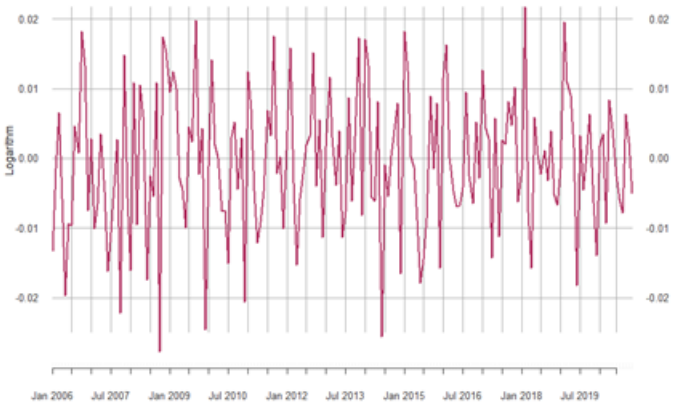

Figure 24: Guinea-Bissau

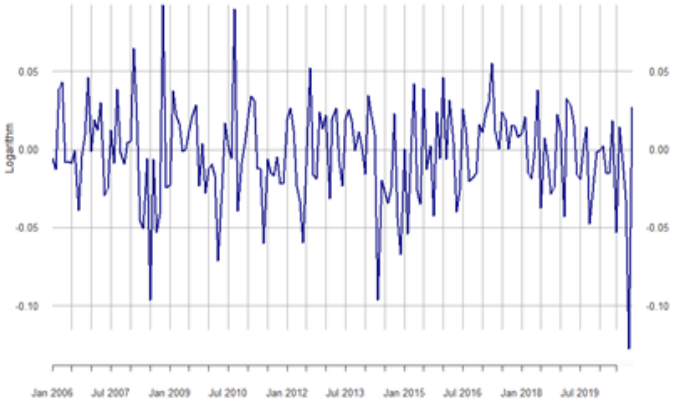

Figure 25: Liberia

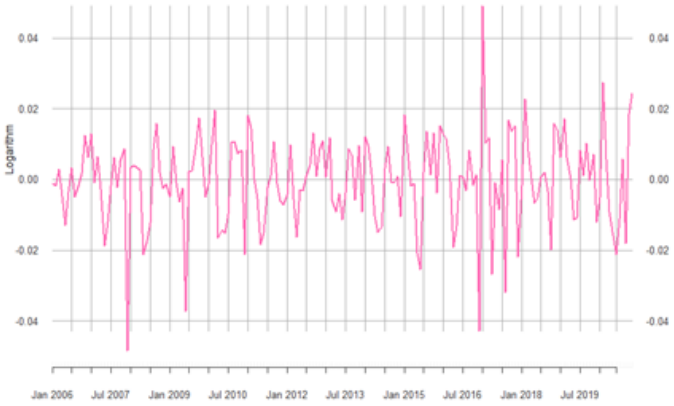

Figure 26: Mali

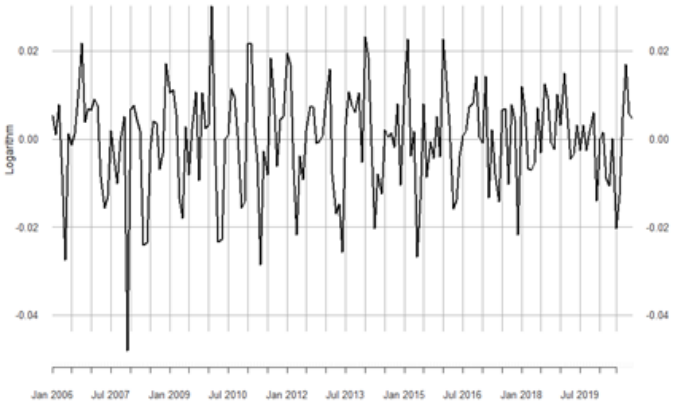

Figure 27: Niger

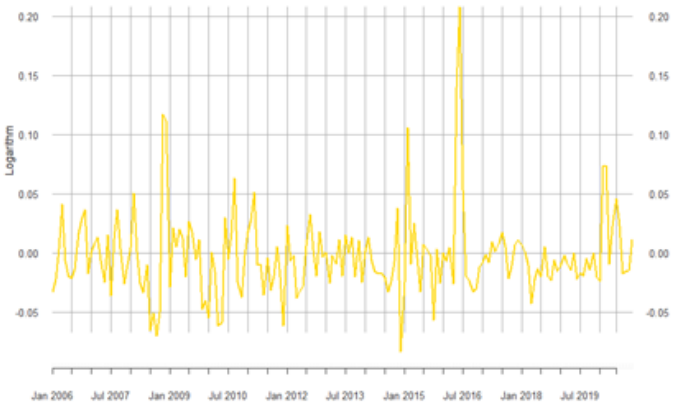

Figure 28: Nigeria

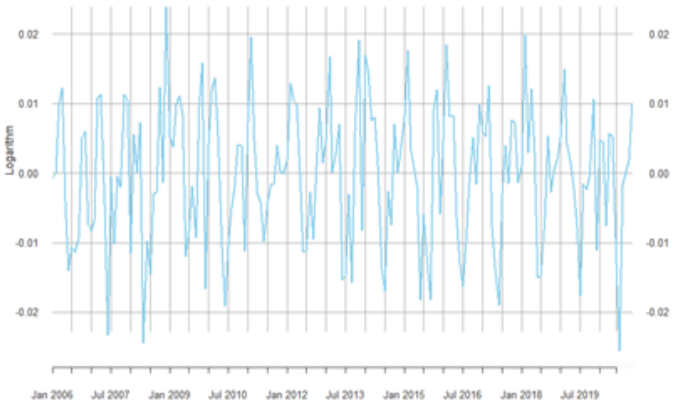

Figure 29: Senegal

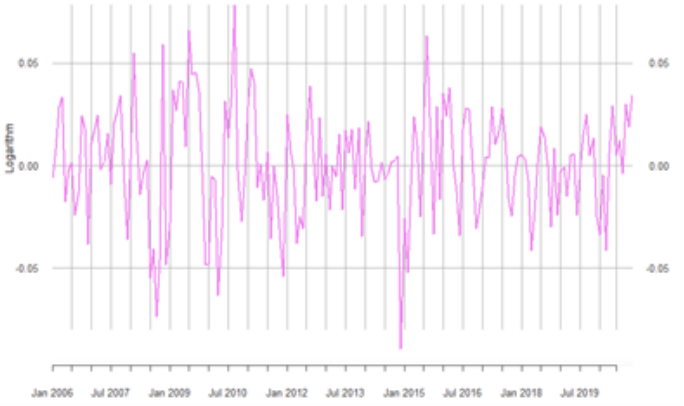

Figure 30: Sierra Leone

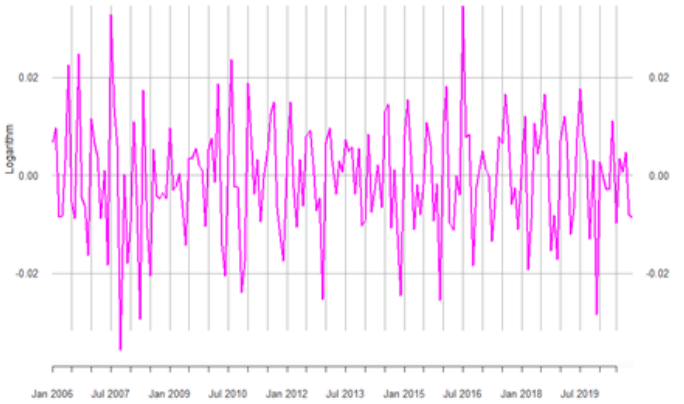

Figure 31: Togo

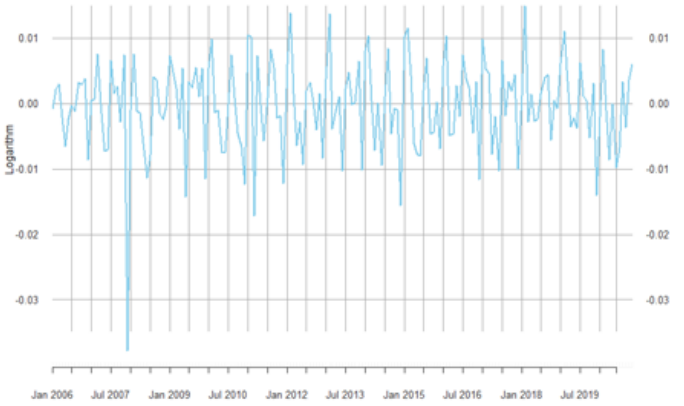

Figure 32: The UEMOA