

# **Do African Monetary Unions Make Sense? Evidence Based on Business Cycles Symmetry**

---

Francis Kemegue  
*University of Pretoria*

Ousmane Seck  
*University of Texas - El Paso*

Patrick Kanda  
*University of Pretoria*

---

# Table of Contents

- 1 Introduction
- 2 Context of the Problem
- 3 Related Current Literature
- 4 Focus of this Paper
- 5 The Data
- 6 Results
- 7 Conclusion
- 8 References

# Introduction

- Current problems of Europe reminder of difficulties of monetary arrangements
- Monetary Unions in Africa followed different path to that of Europeans.
- Single currency in Africa likely to happen before effective Economic Integration
- Would the benefits of monetary union appear thereafter?

# Introduction: Are benefits of Monetary Unions Endogenous?

- Traditionnaly benefits of Monetary Unions possible when optimum currency criteria (trade convergence, growth convergence)
- Economically stronger together ? (Viner, 1950)
- Managing regional public goods
- Popular in the period preceding the advent of the Euro (and now?)
- Expected evolution from FTA/Customs Unions/Economic Unions/Monetary Unions/Political Unions

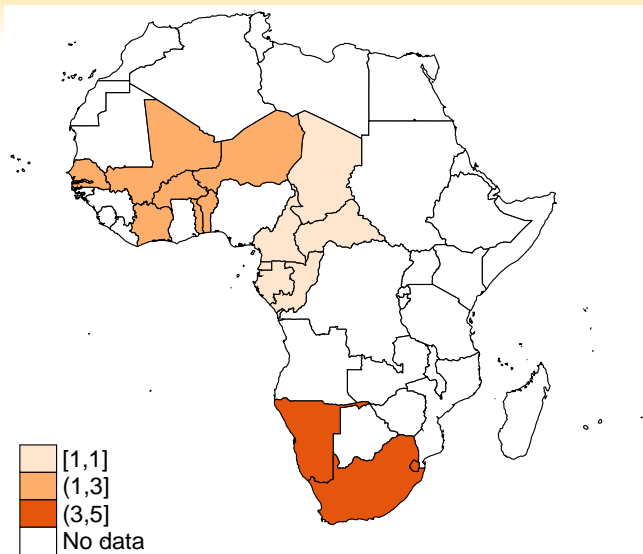
# Introduction: The idea of endogeneity?

- Existence of the Union creates some benefits (Economics of payments systems, fiscal federation)
- Countries more likely to meet optimal criteria, to come after being in monetary union for some time

# Did Benefits Emerge from Creation of Single Currency?

- More stable payment systems (limited seigniorage)
- Lower inflation but also lower growth (Devarajan, Rodrick 1992)
- But reversion of convertibility in the two CFA zone (circa 1994)
- Also lower degree of trade integration

# Current Currency Areas in Africa



# What is known of African institutional arrangements

- Relatively lower trade amongs themselves than with external members.
- Build along colonial lines (Stasavage and Guillaume, 2002)
- Countries usually members of many arrangements (Stasavage and Guillaume, 2002).
- Members usually not common stance when signing agreements with third country(Moneta and Ruffer, 2009).



# African Monetary Unions Lit.

- Benefits not likely even if trade doubles (Masson and Pattillo, 2005)
- No substantial trade increase, trade substitute (Yehoue, 2006) (Fielding and Shields, 2003), (Fielding, Lee, and Shields, 2004)

# Endogeneity of benefits

- Check the endogeneity of benefits in a three steps process
- First check the homogeneity of cycles of countries part of a monetary zone
- Check the transmission of business cycles among countries part of the zones.
- Examine the strenght of the bond of countries in a zone relative to third countries trade partners

# Methodology: homogeneity of Cycles

- Triples test (Razzak, 2001; Randles, Fligner, Policello, and Wolfe, 1980).
- Extract cyclical portion of GDP series using the HP filter
- 

$$f(X_i, X_j, X_k) = \frac{[\text{sign}((X_i + X_j - 2 \times X_k) + \text{sign}((X_i + X_k - 2 \times X_j) + \text{sign}((X_k + X_j - 2 \times X_i)))]}{3}$$

And

$$\eta = \binom{N}{3}^{(-1)} \sum_{i < j < k} f(X_i, X_j, X_k)$$

- HP filter allow modification for annual data
- Cycles may not be really captured but similar component compared across countries

# Methodology: Transmission of cycles

- Put Cyclical components in a VAR.
- VAR appropriate for non stationary data

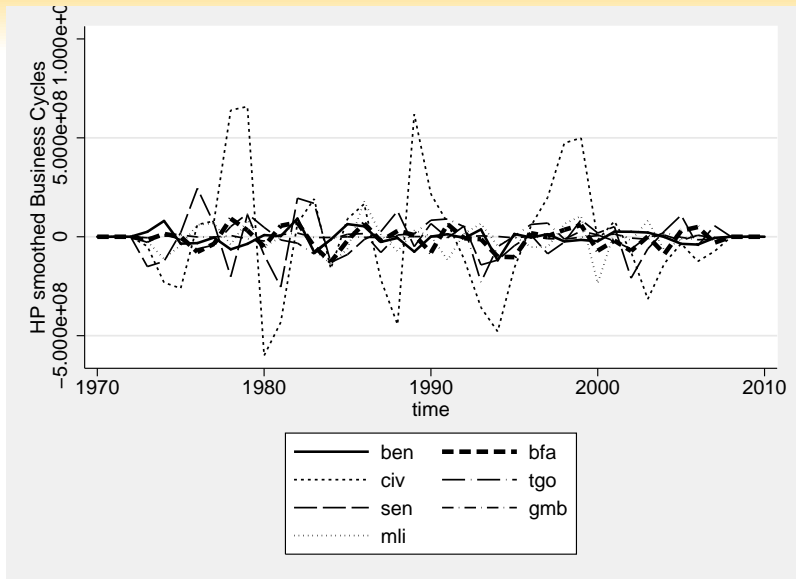
# Methodology: Strenght of Bond between countries

- run series of pairs of cyclical data component.
- Extract the R2
- Compare the sum R2 to that of trade partners

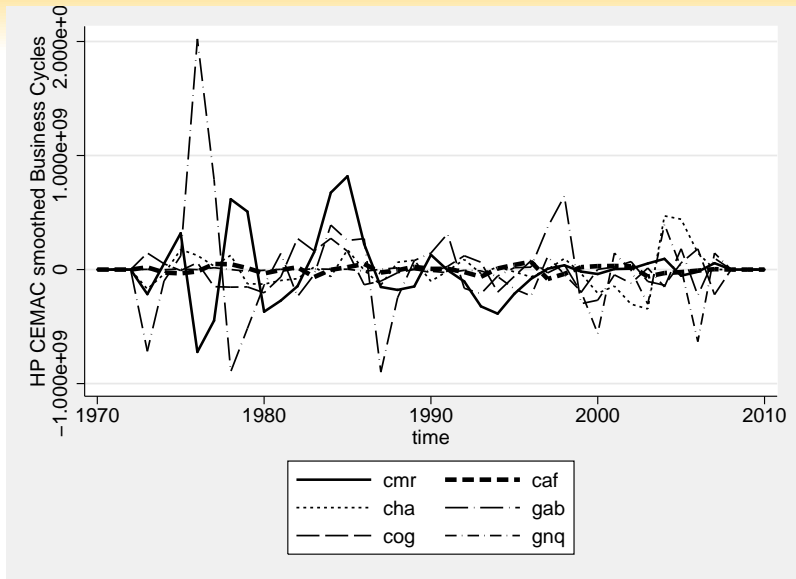
# The data

- Real GDP series for 60 countries.
- 1970 to 2008
- <http://unstats.un.org/unsd/snaama/selbasicFast.asp>

## WAEMU data

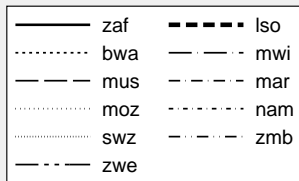
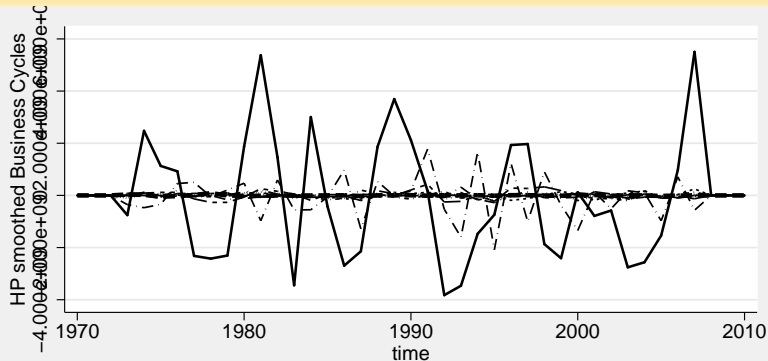


## CEMAC data





## CMA data



# Results :Homogeneity of Cycles 1

Table: Business cycles components Triples test results

	n	nnmin1c2	eta	Ksi1	Ksi2	Ksi3	Variance	stat	Interpretation
Algeria	39	703	0.042273	0.005713	0.021034	0.109324	0.001442	1.113249	Symmetric
Angola	39	703	-0.05161	0.002654	0.017689	0.108447	0.00077	-1.86013	Symmetric
Benin	39	703	-0.01003	0.002	0.013084	0.111011	0.00058	-0.41635	Symmetric
Botswana	39	703	0.091513	0.007673	0.022973	0.102737	0.001869	2.116527	Asymmetric
Brazil	39	703	0.036073	0.003686	0.015666	0.10981	0.000959	1.164562	Symmetric
Burkina Faso	39	703	0.085823	0.006953	0.02209	0.103746	0.00171	2.07519	Asymmetric
Burundi	39	703	0.008425	0.005433	0.020787	0.11104	0.001381	-0.22669	Symmetric
Cameroon	39	703	0.143378	0.003101	0.014802	0.090554	0.000826	4.988373	Asymmetric
Canada	39	703	0.061166	0.002333	0.01782	0.10737	0.000705	2.303906	Asymmetric
Cape Verde	39	703	0.085677	0.006859	0.023434	0.103771	0.001707	2.073879	Asymmetric
Central African Republic	39	703	0.059635	0.004462	0.014972	0.107555	0.001111	1.788811	Symmetric
Chad	39	703	0.076339	0.006013	0.021575	0.105283	0.00151	1.964546	Asymmetric
China	39	703	0.010541	0.002617	0.013374	0.111	0.000711	0.395213	Symmetric
Congo	39	703	-0.0306	0.007515	0.025621	0.110175	0.001869	-0.70786	Symmetric
Cote d'Ivoire	39	703	0.066419	0.004768	0.015284	0.1067	0.001178	1.934959	Symmetric
DRC	39	703	0.007477	0.005262	0.018758	0.111055	0.001322	0.205635	Symmetric
Djibouti	39	703	0.053872	0.005655	0.019404	0.108209	0.001411	1.434361	Symmetric
Egypt	39	703	-0.0279	0.007817	0.02436	0.110333	0.001916	-0.63737	Symmetric
Equatorial Guinea	39	703	0.077798	0.003989	0.01809	0.105059	0.00105	2.400548	Asymmetric
Eritrea	39	703	0.007331	0.005545	0.017138	0.111057	0.001361	-0.19869	Symmetric
Ethiopia	39	703	0.005289	0.002718	0.012278	0.111083	0.000719	0.197186	Symmetric
France	39	703	0.00434	0.003109	0.016743	0.111092	0.000853	0.14862	Symmetric
Gabon	39	703	0.066856	0.003522	0.01873	0.106641	0.000961	2.1563	Asymmetric
Gambia	39	703	0.029726	0.004935	0.018999	0.110227	0.001257	0.838368	Symmetric
Germany	39	703	0.007185	0.002655	0.01313	0.111059	0.000716	0.268448	Symmetric
Ghana	39	703	0.064814	0.0063	0.020883	0.10691	0.001561	1.640266	Symmetric
Guinea	39	703	0.00879	0.004344	0.013044	0.111034	0.001065	-0.26938	Symmetric
Guinea-Bissau	39	703	0.050662	0.005608	0.016949	0.108544	0.001372	1.367783	Symmetric
Japan	39	703	-0.02659	0.003388	0.015534	0.110404	0.000896	-0.88817	Symmetric
Kenya	39	703	0.035343	0.004746	0.016673	0.109862	0.00119	1.024344	Symmetric
Lesotho	39	703	0.033665	0.009236	0.025225	0.109978	0.00222	0.714481	Symmetric

# Results: Homogeneity of Cycles 2

Table: Business cycles components Triples test results

	n	nnminlc2	eta	Ks1	Ks2	Ks3	Variance	stat	Interpretation
Liberia	39	703	0.125141	0.004659	0.019076	0.095451	0.001199	3.613329	Asymmetric
Madagascar	39	703	-0.09735	0.001002	0.015092	0.101634	0.000397	-4.88817	Asymmetric
Malawi	39	703	0.00186	0.00521	0.020192	0.111108	0.001328	0.05104	Symmetric
Maldives	39	703	0.033446	0.003607	0.017677	0.109992	0.000967	1.075593	Symmetric
Mali	39	703	0.053507	0.007055	0.025262	0.108248	0.001769	1.272017	Symmetric
Mauritania	39	703	0.062844	0.00524	0.019595	0.107162	0.001327	1.725215	Symmetric
Mauritius	39	703	0.008061	0.004562	0.020684	0.111046	0.0012	0.232699	Symmetric
Morocco	39	703	0.044316	0.00855	0.02601	0.109147	0.002087	0.969939	Symmetric
Mozambique	39	703	0.040303	0.008449	0.029284	0.109487	0.002105	0.87838	Symmetric
Namibia	39	703	0.005362	0.009295	0.025184	0.111082	0.002232	0.113488	Symmetric
Niger	39	703	0.028778	0.002755	0.016998	0.110283	0.000783	1.028639	Symmetric
Nigeria	39	703	-0.04205	0.007599	0.02351	0.109343	0.001861	-0.97476	Symmetric
Rwanda	39	703	0.042054	0.0016	0.014561	0.109343	0.000515	1.853089	Symmetric
Sao Tome and Principe	39	703	0.075026	0.008331	0.022611	0.105482	0.002002	1.676942	Symmetric
Senegal	39	703	-0.06066	0.006348	0.027475	0.107432	0.001649	-1.49362	Symmetric
Seychelles	39	703	0.073422	0.004804	0.015611	0.10572	0.001189	2.128843	Asymmetric
Sierra Leone	39	703	0.024328	0.004991	0.021021	0.110519	0.001293	0.676658	Symmetric
Somalia	39	703	0.037896	0.004187	0.01722	0.109675	0.001081	1.152431	Symmetric
South Africa	39	703	0.047452	0.005065	0.018971	0.108859	0.001284	1.324495	Symmetric
Sudan	39	703	0.056425	0.002459	0.012421	0.107927	0.000667	2.184683	Asymmetric
Swaziland	39	703	0.014553	0.008077	0.024659	0.110899	0.001974	0.327555	Symmetric
Togo	39	703	0.038042	0.002921	0.012707	0.109664	0.000766	1.374231	Symmetric
Tunisia	39	703	-0.01587	0.002633	0.015201	0.110859	0.000736	-0.58475	Symmetric
Uganda	39	703	0.036729	0.005911	0.019999	0.109762	0.001471	0.957732	Symmetric
UK	39	703	0.05285	0.002863	0.01328	0.108318	0.000761	1.915946	Symmetric
Tanzania	39	703	0.035635	0.003945	0.019093	0.109841	0.001053	1.09792	Symmetric
United States	39	703	-0.04971	0.004438	0.018967	0.10864	0.001154	-1.46349	Symmetric
Zambia	39	703	0.064449	0.006545	0.02037	0.106957	0.001606	1.608246	Symmetric
Zimbabwe	39	703	0.043075	0.004126	0.016488	0.109256	0.00106	1.322971	Symmetric

# Results :Transmission of Cycles 1

	(1)					
	CMR	CAF	TCD	COG	GNQ	GAB
L.CMR	-0.932*** (-1.06e+14)	-0.999*** (-1.51e+14)	-3.559*** (-3.06e+14)	-1.890*** (-2.04e+14)	-3.148*** (-2.54e+14)	-2.262*** (-1.58e+14)
L2.CMR	-3.238*** (-3.07e+14)	-2.434*** (-3.08e+14)	-4.433*** (-3.18e+14)	-3.379*** (-3.05e+14)	-5.039*** (-3.40e+14)	-4.709*** (-2.75e+14)
L3.CMR	-2.941*** (-2.37e+14)	-2.721*** (-2.92e+14)	-2.915*** (-1.78e+14)	-2.945*** (-2.26e+14)	-4.751*** (-2.72e+14)	-4.976*** (-2.47e+14)
L.CAF	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
L2.CAF	2.029*** (8.00e+13)	1.721*** (9.05e+13)	5.358*** (1.60e+14)	4.611*** (1.73e+14)	4.271*** (1.20e+14)	6.702*** (1.63e+14)
L3.CAF	8.233*** (2.94e+14)	7.213*** (3.43e+14)	10.68*** (2.89e+14)	9.760*** (3.31e+14)	10.30*** (2.61e+14)	18.19*** (3.99e+14)
L.TCD	-0.0913*** (-1.35e+13)	0.265*** (5.21e+13)	0.409*** (4.58e+13)	0.687*** (9.67e+13)	0.354*** (3.72e+13)	1.753*** (1.59e+14)
L2.TCD	0.640*** (8.45e+13)	0.527*** (9.28e+13)	0.660*** (6.60e+13)	0.872*** (1.10e+14)	0.280*** (2.63e+13)	1.909*** (1.55e+14)
L3.TCD	0.841*** (2.01e+14)	0.630*** (2.01e+14)	1.207*** (2.18e+14)	1.203*** (2.73e+14)	1.550*** (2.63e+14)	1.832*** (2.69e+14)
L.COG	-1.088*** (-6.07e+13)	-0.819*** (-6.09e+13)	-1.419*** (-6.00e+13)	-0.658*** (-3.49e+13)	2.987*** (1.18e+14)	-4.819*** (-1.65e+14)
L2.COG	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
L3.COG	1.400*** (1.46e+14)	1.461*** (2.03e+14)	0.942*** (7.43e+13)	1.108*** (1.10e+14)	-0.391*** (-2.90e+13)	3.838*** (2.46e+14)
L.GNQ	0.996*** (1.34e+14)	0.806*** (1.44e+14)	1.235*** (1.25e+14)	1.172*** (1.50e+14)	-0.176*** (-1.68e+13)	2.610*** (2.15e+14)
L2.GNQ	1.897*** (2.36e+14)	1.892*** (3.14e+14)	2.846*** (2.68e+14)	2.576*** (3.05e+14)	2.051*** (1.82e+14)	5.112*** (3.92e+14)
L3.GNQ	0.777*** (1.08e+14)	0.0973*** (1.81e+13)	0.119*** (1.26e+13)	0.106*** (1.40e+13)	-0.639*** (-6.34e+13)	0.209*** (1.79e+13)
L.GAB	1.977*** (1.59e+14)	2.609*** (2.80e+14)	3.227*** (1.97e+14)	3.453*** (2.64e+14)	5.123*** (2.93e+14)	6.650*** (3.30e+14)
L2.GAB	2.274*** (1.37e+14)	1.895*** (1.53e+14)	0.949*** (4.34e+13)	2.122*** (1.22e+14)	3.542*** (1.52e+14)	3.959*** (1.47e+14)
L3.GAB	-1.995*** (-1.07e+14)	-1.990*** (-1.42e+14)	-1.747*** (-7.11e+13)	-1.790*** (-9.14e+13)	-1.228*** (-4.69e+13)	-4.381*** (-1.45e+14)
_cons	2.076*** (1.55e+14)	1.988*** (1.97e+14)	2.419*** (1.36e+14)	3.423*** (2.42e+14)	3.061*** (1.62e+14)	6.440*** (2.95e+14)

t statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

# Results :Transmission of Cycles 2

	(1)						
	BEN	BFA	CIV	GNB	MLI	SEN	TGO
L.BEN	-0.726*** (-3.71)	0.386 (1.94)	-0.460 (-0.93)	1.325 (1.43)	-0.648 (-0.85)	-0.671 (-0.66)	-0.505 (-0.41)
L2.BEN	-0.591** (-2.62)	-0.233 (-1.01)	-0.701 (-1.23)	2.527* (2.37)	-0.837 (-0.95)	-0.730 (-0.62)	-1.503 (-1.06)
L3.BEN	-0.602*** (-3.34)	-0.470** (-2.56)	-1.199** (-2.64)	-0.588 (-0.69)	-2.037*** (-2.89)	-2.524*** (-2.67)	-3.475** (-3.06)
L.BFA	0.185 (1.26)	-0.171 (-1.14)	0.546 (1.47)	-0.307 (-0.44)	0.466 (0.81)	0.376 (0.49)	0.112 (0.12)
L2.BFA	0.0911 (0.82)	-0.171 (-1.52)	-0.288 (-1.03)	0.157 (0.30)	0.0113 (0.03)	0.199 (0.34)	0.473 (0.68)
L3.BFA	0.491** (3.05)	0.196 (1.20)	1.144** (2.82)	0.562 (0.74)	1.743** (2.77)	2.378** (2.82)	2.753** (2.72)
L.CIV	0.710*** (5.59)	0.0198 (0.15)	1.259*** (3.93)	0.259 (0.43)	0.705 (1.42)	1.347* (2.03)	1.296 (1.62)
L2.CIV	-0.138 (-1.05)	-0.404** (-3.01)	-0.527 (-1.59)	-0.732 (-1.18)	-0.917 (-1.78)	-1.269 (-1.84)	-0.861 (-1.04)
L3.CIV	0.374** (2.81)	0.432** (3.18)	0.964** (2.87)	0.233 (0.37)	2.098*** (4.02)	2.688*** (3.85)	3.092*** (3.68)
L.GNB	0.0349 (0.81)	0.0600 (1.37)	0.260* (2.40)	-0.0670 (-0.33)	0.192 (1.14)	0.245 (1.08)	0.273 (1.01)
L2.GNB	-0.153*** (-3.76)	-0.0574 (-1.38)	-0.256* (-2.49)	-0.324 (-1.68)	-0.223 (-1.40)	-0.339 (-1.59)	-0.393 (-1.53)
L3.GNB	0.0151 (0.42)	-0.0786* (-2.13)	0.0502 (0.55)	-0.130 (-0.76)	-0.266 (-1.88)	-0.170 (-0.89)	-0.266 (-1.17)
L.MLI	0.547*** (3.52)	0.0497 (0.31)	0.706 (1.80)	0.404 (0.55)	0.552 (0.91)	1.307 (1.61)	1.973* (2.02)
L2.MLI	0.282* (2.33)	0.200 (1.62)	0.252 (0.83)	-0.133 (-0.23)	-0.273 (-0.58)	0.103 (0.16)	0.290 (0.38)
L3.MLI	0.208 (1.51)	0.0198 (0.14)	0.592 (1.71)	0.244 (0.37)	0.0879 (0.16)	0.369 (0.51)	1.088 (1.26)
L.SEN	-0.627*** (-4.38)	0.0970 (0.66)	-0.372 (-1.03)	1.569* (2.31)	0.274 (0.49)	0.255 (0.34)	0.0872 (0.10)
L2.SEN	-0.462** (-2.83)	-0.127 (-0.76)	-0.668 (-1.62)	1.403 (1.81)	-0.905 (-1.41)	-1.428 (-1.67)	-1.314 (-1.27)
L3.SEN	-0.131 (-0.87)	0.253 (1.65)	-1.191** (-3.14)	1.565* (2.20)	-0.302 (-0.51)	-0.602 (-0.76)	-1.029 (-1.09)
L.TGO	-0.588 (-1.29)	-0.235 (-0.51)	-1.615 (-1.41)	3.012 (1.40)	-0.0594 (-0.03)	-1.092 (-0.46)	-0.599 (-0.21)
L2.TGO	-0.0911 (-0.26)	0.754* (2.14)	0.205 (0.23)	-1.603 (-0.98)	1.703 (1.26)	1.463 (0.81)	0.680 (0.31)
L3.TGO	-1.479*** (-4.59)	-0.631 (-1.92)	0.0313 (0.04)	0.0776 (0.05)	-0.320 (-0.25)	0.678 (0.40)	0.402 (0.20)
_cons	0.215 (1.08)	0.0649 (0.32)	0.469 (0.93)	1.218 (1.28)	1.012 (1.29)	1.596 (1.52)	2.168 (1.72)

† statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Results :Transmission of Cycles 3

	(1)				
	BWA	LSO	NAM	ZAF	SWZ
L.BWA	-0.0822 (-0.54)	-0.165 (-0.44)	-0.0688 (-0.15)	-0.00820 (-0.01)	-0.257 (-0.20)
L2.BWA	0.0669 (0.48)	0.0634 (0.19)	0.123 (0.29)	0.0814 (0.16)	-0.831 (-0.71)
L3.BWA	-0.368** (-2.80)	-0.697* (-2.17)	-0.138 (-0.34)	-0.315 (-0.64)	1.047 (0.95)
L.LSO	0.141 (1.03)	0.290 (0.87)	0.399 (0.94)	0.242 (0.48)	1.369 (1.20)
L2.LSO	0.0233 (0.25)	-0.585** (-2.60)	0.121 (0.42)	0.148 (0.43)	1.220 (1.58)
L3.LSO	0.198 (1.70)	0.127 (0.45)	0.352 (0.98)	0.324 (0.75)	-0.225 (-0.23)
L.NAM	0.0417 (0.16)	-0.694 (-1.11)	-0.340 (-0.43)	-0.344 (-0.36)	5.257* (2.44)
L2.NAM	0.0689 (0.29)	0.0666 (0.12)	0.292 (0.40)	0.638 (0.73)	2.679 (1.35)
L3.NAM	-0.119 (-0.42)	-0.124 (-0.42)	-0.127 (-0.42)	0.237 (0.73)	1.637 (1.35)

# Strenght of bond 1

Table: Comovement of WAEMU Countries Cycles

	ben	bfa	civ	gmb	mli	sen	tgo	bra	chn	hkg	nld	rus	gbr	bel	can	fra	deu	ind	ita	jpn
ben	1.00	0.03	0.04	0.02	0.02	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.04	0.01	0.04	0.00	0.02	0.06	0.03	0.00
bfa	0.03	1.00	0.12	0.00	0.13	0.00	0.07	0.00	0.00	0.02	0.01	0.07	0.01	0.03	0.02	0.00	0.01	0.02	0.01	0.01
civ	0.04	0.12	1.00	0.00	0.08	0.05	0.14	0.01	0.00	0.07	0.01	0.05	0.04	0.00	0.00	0.04	0.00	0.08	0.00	0.09
gmb	0.02	0.00	0.00	1.00	0.01	0.01	0.02	0.03	0.02	0.00	0.03	0.00	0.08	0.01	0.02	0.00	0.05	0.00	0.06	0.01
mli	0.02	0.13	0.08	0.01	1.00	0.05	0.02	0.00	0.00	0.15	0.06	0.00	0.01	0.15	0.05	0.06	0.04	0.00	0.06	0.05
sen	0.01	0.00	0.05	0.01	0.05	1.00	0.00	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.03	0.01	0.02	0.03	0.00	0.00
tgo	0.00	0.07	0.14	0.02	0.02	0.00	1.00	0.02	0.00	0.00	0.09	0.04	0.05	0.17	0.03	0.12	0.15	0.04	0.16	0.22
bra	0.01	0.00	0.01	0.03	0.00	0.02	0.02	1.00	0.16	0.13	0.07	0.00	0.07	0.09	0.15	0.01	0.01	0.00	0.15	0.00
chn	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.16	1.00	0.12	0.04	0.00	0.05	0.01	0.02	0.00	0.02	0.28	0.01	0.01
hkg	0.02	0.02	0.07	0.00	0.15	0.00	0.00	0.13	0.12	1.00	0.09	0.00	0.13	0.17	0.12	0.08	0.08	0.08	0.20	0.23
nld	0.01	0.01	0.01	0.03	0.06	0.00	0.09	0.07	0.04	0.09	1.00	0.04	0.20	0.68	0.31	0.55	0.62	0.11	0.58	0.15
rus	0.01	0.07	0.05	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.04	1.00	0.19	0.06	0.21	0.13	0.00	0.20	0.05	0.04
gbr	0.04	0.01	0.04	0.08	0.01	0.01	0.05	0.07	0.05	0.13	0.20	0.19	1.00	0.22	0.43	0.43	0.13	0.10	0.34	0.30
bel	0.01	0.03	0.00	0.01	0.15	0.00	0.17	0.09	0.01	0.17	0.68	0.06	0.22	1.00	0.33	0.68	0.51	0.07	0.73	0.20
can	0.04	0.02	0.00	0.02	0.05	0.03	0.03	0.15	0.02	0.12	0.31	0.21	0.43	0.33	1.00	0.31	0.08	0.10	0.34	0.05
fra	0.00	0.00	0.04	0.00	0.06	0.01	0.12	0.01	0.00	0.08	0.55	0.13	0.43	0.68	0.31	1.00	0.49	0.10	0.66	0.28
deu	0.02	0.01	0.00	0.05	0.04	0.02	0.15	0.01	0.02	0.08	0.62	0.00	0.13	0.51	0.08	0.49	1.00	0.01	0.58	0.34
ind	0.06	0.02	0.08	0.00	0.00	0.03	0.04	0.00	0.28	0.08	0.11	0.20	0.10	0.07	0.10	0.10	0.01	1.00	0.01	0.07
ita	0.03	0.01	0.00	0.06	0.06	0.00	0.16	0.15	0.01	0.20	0.58	0.05	0.34	0.73	0.34	0.66	0.58	0.01	1.00	0.29
jpn	0.00	0.01	0.09	0.01	0.05	0.00	0.22	0.00	0.01	0.23	0.15	0.04	0.30	0.20	0.05	0.28	0.34	0.07	0.29	1.00
prt	0.04	0.02	0.03	0.00	0.02	0.01	0.08	0.00	0.01	0.03	0.38	0.01	0.14	0.50	0.06	0.58	0.42	0.01	0.47	0.18
kor	0.00	0.03	0.01	0.00	0.13	0.00	0.06	0.02	0.02	0.40	0.05	0.01	0.09	0.08	0.03	0.05	0.09	0.01	0.14	0.27
tur	0.00	0.01	0.01	0.04	0.00	0.02	0.01	0.00	0.02	0.21	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.06	0.01	0.15
usa	0.06	0.00	0.04	0.06	0.02	0.03	0.05	0.04	0.01	0.15	0.34	0.10	0.51	0.27	0.66	0.34	0.16	0.11	0.26	0.21

## Strenght of bond 2

Table: Regressions of CEMAC Countries Cycles

	CMR	CAF	TCD	COG	GNQ	GAB	CAN	CHN	FRA	DEU	NGA	GBR	ZAF	USA
CMR	1.00	0.72	0.02	0.56	0.36	0.49	0.45	0.40	0.44	0.56	0.39	0.53	0.53	0.56
CAF	0.72	1.00	0.01	0.61	0.44	0.80	0.55	0.66	0.45	0.75	0.51	0.76	0.74	0.76
TCD	0.02	0.01	1.00	0.22	0.28	0.07	0.17	0.19	0.28	0.20	0.43	0.23	0.23	0.22
COG	0.56	0.61	0.22	1.00	0.63	0.67	0.91	0.54	0.79	0.77	0.76	0.78	0.80	0.80
GNQ	0.36	0.44	0.28	0.63	1.00	0.44	0.56	0.58	0.71	0.58	0.60	0.67	0.67	0.68
GAB	0.49	0.80	0.07	0.67	0.44	1.00	0.71	0.68	0.62	0.91	0.69	0.89	0.88	0.89
CAN	0.45	0.55	0.17	0.91	0.56	0.71	1.00	0.50	0.81	0.78	0.74	0.79	0.81	0.79
CHN	0.40	0.66	0.19	0.54	0.58	0.68	0.50	1.00	0.56	0.70	0.59	0.78	0.77	0.78
FRA	0.44	0.45	0.28	0.79	0.71	0.62	0.81	0.56	1.00	0.77	0.76	0.79	0.82	0.80
DEU	0.56	0.75	0.20	0.77	0.58	0.91	0.78	0.70	0.77	1.00	0.84	0.97	0.97	0.97
NGA	0.39	0.51	0.43	0.76	0.60	0.69	0.74	0.59	0.76	0.84	1.00	0.86	0.87	0.85
GBR	0.53	0.76	0.23	0.78	0.67	0.89	0.79	0.78	0.79	0.97	0.86	1.00	0.99	0.99
ZAF	0.53	0.74	0.23	0.80	0.67	0.88	0.81	0.77	0.82	0.97	0.87	0.99	1.00	0.99
USA	0.56	0.76	0.22	0.80	0.68	0.89	0.79	0.78	0.80	0.97	0.85	0.99	0.99	1.00



# Strenght of bond 3

Table: Comovement of CMA and Trade Partners Countries Cycles

	lso	bwa	mwi	moz	nam	zaf	swz	zmb	zwe	bra	chn	hkg	nld	rus	gbr	bel	can	fra	deu	ind	ita	jpn	prt	kor	tur	usa
lso	1.00	0.00	0.00	0.02	0.06	0.02	0.10	0.00	0.05	0.00	0.02	0.01	0.03	0.02	0.10	0.02	0.01	0.12	0.07	0.06	0.02	0.01	0.00	0.00	0.00	0.00
bwa	0.00	1.00	0.00	0.02	0.03	0.03	0.04	0.01	0.01	0.04	0.01	0.01	0.11	0.03	0.21	0.23	0.10	0.26	0.10	0.02	0.11	0.00	0.00	0.00	0.00	0.00
mwi	0.00	0.00	1.00	0.01	0.00	0.00	0.01	0.06	0.03	0.06	0.01	0.00	0.07	0.01	0.01	0.03	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
moz	0.02	0.02	0.01	1.00	0.00	0.22	0.05	0.15	0.26	0.02	0.01	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
nam	0.06	0.03	0.00	0.00	1.00	0.04	0.10	0.00	0.01	0.08	0.03	0.21	0.01	0.08	0.00	0.11	0.00	0.02	0.02	0.00	0.06	0.00	0.00	0.00	0.00	0.00
zaf	0.02	0.03	0.00	0.22	0.04	1.00	0.14	0.12	0.11	0.12	0.10	0.23	0.16	0.15	0.07	0.28	0.25	0.12	0.04	0.17	0.30	0.01	0.00	0.00	0.00	0.00
swz	0.10	0.04	0.01	0.05	0.10	0.14	1.00	0.05	0.02	0.01	0.00	0.01	0.04	0.05	0.00	0.02	0.03	0.00	0.01	0.08	0.01	0.00	0.00	0.00	0.00	0.00
zmb	0.00	0.01	0.06	0.15	0.00	0.12	0.05	1.00	0.06	0.00	0.02	0.08	0.00	0.00	0.03	0.00	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
zwe	0.05	0.01	0.03	0.26	0.01	0.11	0.02	0.06	1.00	0.00	0.01	0.03	0.00	0.00	0.06	0.00	0.04	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
bra	0.00	0.04	0.06	0.02	0.08	0.12	0.01	0.00	0.00	1.00	0.16	0.13	0.07	0.00	0.07	0.09	0.15	0.01	0.01	0.00	0.15	0.00	0.00	0.00	0.00	0.00
chn	0.02	0.01	0.01	0.01	0.03	0.10	0.00	0.02	0.01	0.16	1.00	0.12	0.04	0.00	0.05	0.01	0.02	0.00	0.02	0.28	0.01	0.00	0.00	0.00	0.00	0.00
hkg	0.01	0.01	0.00	0.01	0.21	0.23	0.01	0.08	0.03	0.13	0.12	1.00	0.09	0.00	0.13	0.17	0.12	0.08	0.08	0.08	0.20	0.00	0.00	0.00	0.00	0.00
nld	0.03	0.11	0.07	0.01	0.01	0.16	0.04	0.00	0.00	0.07	0.04	0.09	1.00	0.04	0.20	0.68	0.31	0.55	0.62	0.11	0.58	0.00	0.00	0.00	0.00	0.00
rus	0.02	0.03	0.01	0.00	0.08	0.15	0.05	0.00	0.00	0.00	0.00	0.00	0.04	1.00	0.19	0.06	0.21	0.13	0.00	0.20	0.05	0.00	0.00	0.00	0.00	0.00
gbr	0.10	0.21	0.01	0.00	0.00	0.07	0.00	0.03	0.06	0.07	0.05	0.13	0.20	0.19	1.00	0.22	0.43	0.43	0.13	0.10	0.34	0.00	0.00	0.00	0.00	0.00
bel	0.02	0.23	0.03	0.02	0.11	0.28	0.02	0.00	0.00	0.09	0.01	0.17	0.68	0.06	0.22	1.00	0.33	0.68	0.51	0.07	0.73	0.00	0.00	0.00	0.00	0.00
can	0.01	0.10	0.01	0.01	0.00	0.25	0.03	0.00	0.04	0.15	0.02	0.12	0.31	0.21	0.43	0.33	1.00	0.31	0.08	0.10	0.34	0.00	0.00	0.00	0.00	0.00
fra	0.12	0.26	0.00	0.00	0.02	0.12	0.00	0.02	0.01	0.01	0.00	0.08	0.55	0.13	0.43	0.68	0.31	1.00	0.49	0.10	0.66	0.00	0.00	0.00	0.00	0.00
deu	0.07	0.10	0.01	0.00	0.02	0.04	0.01	0.04	0.00	0.01	0.02	0.08	0.62	0.00	0.13	0.51	0.08	0.49	1.00	0.01	0.58	0.00	0.00	0.00	0.00	0.00
ind	0.06	0.02	0.01	0.00	0.00	0.17	0.08	0.00	0.01	0.00	0.28	0.08	0.11	0.20	0.10	0.07	0.10	0.10	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00
ita	0.02	0.11	0.00	0.01	0.06	0.30	0.01	0.00	0.00	0.15	0.01	0.20	0.58	0.05	0.34	0.73	0.34	0.66	0.58	0.01	1.00	0.00	0.00	0.00	0.00	0.00
jpn	0.12	0.07	0.03	0.02	0.00	0.08	0.00	0.00	0.00	0.00	0.01	0.23	0.15	0.04	0.30	0.20	0.05	0.28	0.34	0.07	0.29	0.00	0.00	0.00	0.00	0.00
prt	0.05	0.21	0.02	0.04	0.04	0.05	0.01	0.00	0.04	0.00	0.01	0.03	0.38	0.01	0.14	0.50	0.06	0.58	0.42	0.01	0.47	0.00	0.00	0.00	0.00	0.00
kor	0.03	0.00	0.00	0.08	0.02	0.09	0.01	0.00	0.03	0.02	0.02	0.40	0.05	0.01	0.09	0.08	0.03	0.05	0.09	0.01	0.14	0.00	0.00	0.00	0.00	0.00
tur	0.00	0.02	0.11	0.00	0.07	0.02	0.09	0.09	0.02	0.00	0.02	0.21	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.00
usa	0.11	0.11	0.00	0.00	0.00	0.06	0.00	0.01	0.10	0.04	0.01	0.15	0.34	0.10	0.51	0.27	0.66	0.34	0.16	0.11	0.26	0.00	0.00	0.00	0.00	0.00

# Intensity of Comovements WAEMU

Table: WAEMU Intensity of Comovement

	waemuall	waemuweigh	nonwaemuweigh	WAEMUrelativintensity	avgWAEMU	avgnonWAEMU
ben	0.12	0.26	0.74	0.35	0.02	0.02
bfa	0.36	0.56	0.44	1.29	0.05	0.02
civ	0.43	0.47	0.53	0.89	0.06	0.03
gmb	0.08	0.16	0.84	0.19	0.01	0.02
mli	0.32	0.29	0.71	0.40	0.05	0.05
sen	0.13	0.39	0.61	0.63	0.02	0.01
tgo	0.25	0.17	0.83	0.20	0.04	0.07

# Intensity of Comovements CAEMC

Table: CEMAC Intensity of Comovement

	totalall3	cemacweigh	noncemacweigh	CEMACrelativintensity	avgenoncemac	avgecemac
cmr	0.49	0.27	0.73	0.36	0.02	0.02
caf	0.97	0.07	0.93	0.08	0.05	0.01
cha	0.73	0.25	0.75	0.33	0.03	0.03
cog	0.70	0.11	0.89	0.12	0.04	0.01
gnq	0.33	0.52	0.48	1.09	0.01	0.03
gab	0.44	0.38	0.62	0.62	0.02	0.03
bra	1.25	-0.53	1.53	-0.35	0.11	-0.11

# Intensity of Comovements CMA

Table: CMA Intensity of Comovement

	cmaall	cmaweigh	noncmaweigh	cmarelativintensity	avgCMA	avgnonCMA
iso	0.26	0.27	0.73	0.36	0.01	0.05
bwa	0.14	0.08	0.92	0.09	0.01	0.10
mwi	0.12	0.25	0.75	0.34	0.02	0.02
moz	0.73	-15.93	16.93	-0.94	-0.05	0.01
nam	0.25	46.69	-45.69	-1.02	-0.14	0.04
zaf	0.67	0.25	0.75	0.33	0.05	0.14
swz	0.50	0.70	0.30	2.35	-0.11	0.02

# Conclusion

- Cycles of Countries part of Monetary Zone not Homogenous
- Apparent Transmission for countries mostly oil producers
- Strength of integration weak among member countries compare to trade partners.

## References

- Fielding, D., K. Lee, and K. Shields (2004). The characteristics of macroeconomic shocks in the cfa franc zone. Working Papers UNU-WIDER Research Paper, World Institute for Development Economic Research (UNU-WIDER).
- Fielding, D. and K. Shields (2003, April). Economic integration in west africa: Does the cfa make a difference? Discussion Papers in Economics 03/8, Department of Economics, University of Leicester.
- Masson, P. and C. Pattillo (2005). *The monetary geography of Africa*. Brookings Inst Pr.
- Moneta, F. and R. Ruffer (2009). Business cycle synchronisation in east asia. *Journal of Asian Economics* 20(1), 1 – 12. Fabio Moneta and Rasmus Ruffer.
- Randles, R., M. Fligner, G. Policello, and D. Wolfe (1980). An asymptotically distribution-free test for symmetry versus

asymmetry. *Journal of the American Statistical Association*, 168–172.

Razzak, W. A. (2001). Business cycle asymmetries: International evidence. *Review of Economic Dynamics* 4(1), 230 – 243.

Stasavage, D. and D. Guillaume (2002). When are monetary commitments credible? parallel agreements and the sustainability of currency unions. *British Journal of Political Science* 32(1), 119–146.

Viner, J. (1950). The customs union issue. *New York* 101.

Yehoue, t. B. (2006). The cfa arrangements: More than just an aid substitute? *Économie internationale* 107, p. 107–133.