Reducing African Macroeconomic Asymmetries: Could Bilateral Trade Help?

Jules-Armand TAPSOBA *

31st July 2007

Abstract

This paper suggests that the traditional paradigm of Optimum Currency Areas could be misleading for the on-going debate about African monetary integration. Taking the example of trade, we propose a self-fulfilling argument for African monetary unions. Monetary integration increases bilateral trade which in turn, helps macroeconomic synchronization and then improves conditions for the accomplishment of common monetary policy. Our results support such hypothesis for the 53 African countries from 1975 to 2004. As policy recommendation, these findings imply the necessity to adopt a dynamic framework linking the benefits of monetary integration to prerequisites macroeconomic convergence.

JEL Codes: E32, F15, F41.

Keywords: Monetary Union, Bilateral Trade, Business Cycles Synchronization, Optimum Currency Areas, Africa.

*Sampawende_Jules.Tapsoba@ecogestion.u-clermont1.fr, CERDI-Université d'Auvergne, 65 bd François Mitterrand, 63000 Clermont-Ferrand, France. I am grateful to S. Guillaumont-Jeanneney, J-L Combes, S. Guerineau, A. Quijada, L. Bassolé and L. Wagner for helpful suggestions on an earlier version of this article. A summary of preliminary results of the paper is published in Economics Bulletin.

"I argued three decades ago that Africa would be better off with a common currency and an African Central Bank. I have not changed my mind today."

Mundell (2002), p. 56.

"...a naive examination of historical data gives a misleading picture of a country's suitability for entry into a currency union..."

Frankel and Rose (1998), p. 1010.

1 Introduction

It is now well-established that monetary union - hereafter MU - stimulates bilateral trade (see Frankel and Rose 2002), increases the credibility of the monetary policies and ensures price stability (see Alesina and Barro 2002). Because of the multiplicity of currencies and small sizes of African economies, benefits of monetary integration such as price stability, trade, investment, sound fiscal policies and output growth are potentially large. Over 53 states, 39 issue their own currency. The other 15 belong to the CFA arrangement. Actually considering a restrictive definition of monetary unions (groups of countries sharing common currency, common monetary policy and common central bank), there are two African MUs: the WAEMU (West African Economic and Monetary Union) and the CAEMC (Central African Economic and Monetary Community). WAEMU and CAEMC are unusual MUs since members' states have shared common currencies before the adoption of economic union (see appendix A for a brief description of African monetary integration). According to the Optimal Currency Areas (OCA) theory introduced by Mundell (1961), a MU is suitable if asymmetric shocks remain low and trade flows large. First, since common monetary policy cannot be tailored in response to a shock of single country, it is less costly for a set of economies to form a MU if their business cycles are synchronized using historical data (see Mundell 1961, McKinnon 1963). Second, when trade flows are important, saving of transaction costs is substantial and output growth important (see Frankel and Rose 2002, Alesina and Barro 2002).

The European Commission (1990) and Frankel and Rose (1997, 1998) introduced an alternative view about the endogeneity of OCA criteria. They pointed out that traditional analyses are misleading because some benefits of MUs bring country-specific shocks closer together. For example

bilateral trade and shocks synchronization are tightly linked and are both positively affected by MU. Frankel and Rose (1997, 1998) suggest a self-validating of MUs via bilateral trade. They show for OECD (Organization for Economic Cooperation and Development) countries, that bilateral trade augments GDP (Gross Domestic Product) business cycles co-movement and help the accomplishment of common monetary policy and monetary integration. The endogeneity hypothesis was further extended to others OCA criteria such as labor mobility, financial integration and regional risk-sharing mechanisms (see De Grauwe and Mongelli 2005) and confirmed on European data (e.g. Babetskii 2005, Fidrmuc 2005 and Inklaar and al. 2005). MUs are self-fulfilling policy regime through bilateral trade: common monetary policy and common currency stimulate bilateral trade which in turn increases cycles synchronization and a great synchronization of cycles improves conditions for the accomplishment of common monetary policy [1]. By this way, historical data do not provide a full picture of asymmetric shocks within a MU as long as the integration process goes ahead

In Africa, traditional requirements for monetary integration (mainly a high degree of trade integration between prospective members and a high correlation of shocks across countries) are not particularly strong. A range of academic papers demonstrate that bilateral trade flows are small, that low correlation of output and inflation shocks are uncorrelated and that regional risk-sharing is missing [2]. We compute in table 1 a proxy of the magnitude of asymmetric component of GDP and CPI (Consumer Prices Index) among African states. We compute the proportion of asymmetric shocks of the data as the statistic 1-R^2 of the regression of the first difference of the logarithm of variables on countries fixed effects and time fixed effects. Results clearly suggest important asymmetries among African countries: about 86% for GDP growth and 54% for inflation. Then, a right issue for these MUs must be the existence of specific factors which

[1] An alternative view is also defensible on theoretical grounds. Krugman (1991, 1993) and Eichengreen (1992) put forward that trade could lead to the specialization of countries and therefore, could increase the magnitude of asymmetric shocks.

[2] For example, Fielding and Shields (2001) analyze output and inflation correlation within CFA's members from 1963 to 1997 period and obtain that inflation shocks are highly correlated while GDP shocks lowly co-moved. Fielding and al. (2004) show that asymmetric GDP shocks are more important within CAEMC than WAEMU. Fielding and Shields (2005a and 2005b) find that CFA membership does not make a difference in terms of cycles synchronization compared to some African countries. Finally, Yehoue (2005a) puts forward the lack of regional risk-sharing within CAEMC and WAEMU over the 1980-2000 period. These results are not surprising since WAEMU and CAEMC were created more by historical and political impulse than by economical will. Until January 1994, WAEMU and CAEMC worked without economic unions.

reduce asymmetries. As mentioned above, bilateral trade could have such self-validating effect. In this paper, we contribute to the debate about monetary integration in Africa exploring the self-validating property of African bilateral trade. Our intuition is simple. Monetary integration adds force to bilateral trade which in turn, improves conditions for the practice of common monetary policy throughout the synchronization of cycles. We estimate the impact of bilateral trade intensity on cycles synchronization for African countries from 1975 to 2004. We find that African bilateral trade intensity enhances African cycles synchronization and helps African monetary integration. However, synchronization gains are low. The adoption of a MU by African countries who do not actually share monetary policy would lead to a gain of synchronization cycles ranging between 18.6% and 58.8% for output shocks and between 22.5% and 106.7% for inflation shocks.

The remainder of the paper is structured as follows. Section 2 discuss the relevance of the underlying theory of the effect of bilateral trade on cycles synchronization in African context. In section 3, we describe trends in African bilateral trade intensity and African synchronization. Section 4 develops the econometric strategy. Section 5 presents empirical results and some robustness checks. The last section concludes and provides some policy recommendations.

2 Literature debate and African case

The relationship between bilateral trade and cycles synchronization is not clear-cut in economic literature. It could be either negative (divergence argument) or positive (convergence argument) whether most of trade is inter-industry or intra-industry. On the one side, Krugman (1991, 1993) and Eichengreen (1992) argue that more bilateral trade may lead to more specialization of countries according to the theory of comparative advantages. Specialization yield to different industry-specific supply-shocks and desynchronizes business cycles. One the other side, some theoretical reasons advocate that more bilateral trade leads to more cycles synchronization. First, even if countries are differently specialized, according to the Keynesian multiplier, a boom in one country can be transmitted to its trading partner through imports of the booming country Second, Frankel and Rose (1998) argue that industry-specific shocks are more correlated when most of trade is

Table 1: Estimates (in %) of the magnitude of idiosyncratic component (1-R^2): ΔLog GDP and Δ Log CPI, 1965-2005.

		Δ Log GDP	Δ Log CPI
AFRICA		86	54
MUs	WAEMU	81	41
	CAEMC	71	24
	CMA	63	26
RECs	ECOWAS	87	55
	COMESA	74	57
	EAC	84	63
	SADC	66	52
	AMU	71	46

Notes for table 1: To compute the magnitude of asymmetric component, we first run the following regression:

$$\Delta y = \sum_{i=1}^{N-1} \theta_i \delta_i + \sum_{j=1}^{T-1} \theta_j \delta^t + \eta_i^t$$

where δ_i is a country I dummy variable, δ^t is a country i dummy variable and η_i^t the idiosyncratic component. N is the number of countries and T the number of years. Since we do control for country and time fixed effect, the statistic 1-R^2 corresponds to the magnitude of the idiosyncratic component of the variable Δy. WAEMU: West African Economic and Monetary Union, CEMAC: Economic and Monetary Community of Central Africa, CMA: Common Monetary Area, ECOWAS: Economic Community of Western African States, COMESA: Common Market for Eastern and Southern Africa, EAC: East African Community, SADC: Southern African Development Community, AMU: Arab Maghreb Union.

intra-industry [3]. They test and find this argument cycles for 21 OECD countries over 34 years. Fidrmuc (2005) corroborates and explains Frankel and Rose's (1998) findings by the importance of intra-industry trade. When most of trade is intra-industry, aggregate demand shocks (which are common for all sectors) are predominant and drive industry-specific shocks (which are similar across countries). Then intra-industry trade leads to similar supply-shocks across trading partners and to more cycles synchronization.

Frankel and Rose's (1998) arguments look relevant for African countries. We report the structure of African exports in table 2. On average, African countries export mainly raw material since their manufacturing industries are underdeveloped. Most of this trade is toward industrialized countries according to the low proportion of African bilateral trade. Subsequently, African bilateral trade is much about semi-processed products. For that reason we can suppose that most of African bilateral trade is intra- rather than inter-industry and theoretically act positively on cycles synchronization.

[3] Frankel and Rose (1998) propose a formalization of the impact of bilateral trade on cycles synchronization. Assume a two-country model (D for domestic country and F for foreign country). Each country produces N goods (each good corresponds to one industry). The real output growth of country D is expressed as follows:

$$\Delta Y_t = \sum_{i=1}^{N} \alpha_i u_{it} + v_t + \eta \tag{1}$$

Where ΔY_t denotes the real output growth rate of country D at time t. u_{it} represents the sector i specific deviation of output growth rate at time t from the average country's growth rate v_t; α_i is the share of sector i in total output ($\sum_{i=1}^{N} \alpha_i = 1$) and η is the trend of output growth. The equivalent decomposition for country F is:

$$\Delta Y_t^* = \sum_{i=1}^{N} \alpha_i^* u_{it}^* + v_t^* + \eta^* \tag{2}$$

Assume that sector-specific shocks (but not necessarily sector-specific output shares) are common across countries. We also presume that the u_{it} are independently distributed across both sector and time. We further suppose that the v_t are independently distributed over time and of sector-specific shocks. Disregarding trend effects, cross-countries covariance of output is

$$cov(\Delta Y_t, \Delta Y_t^*) = cov(\sum_{i=1}^{N} \alpha_i u_{it}, \sum_{i=1}^{N} \alpha_i^* u_{it}^*) + cov(v_t, v_t^*) = \sum_{i=1}^{N} \alpha_i \alpha_i^* \sigma_i^2 + \sigma_{v^*,v} \tag{3}$$

Where $\sigma_{v^*,v}$ is the covariance of country-specific aggregate shocks and σ_i^2 is sectoral variance of u_{it}. For a given σ_{v,v^*}, the cross-countries covariance of output growth depends on specialization degree:

- When trade leads to specialization (i.e. most of trade is inter-industry) countries tend to produce and export goods in which they have a comparative advantage. The correlation between sectors shares in output α_i and α_i^* is likely to be negative and the quantity "$\sum_{i=1}^{N} \alpha_i \alpha_i^* \sigma_i^2$" falls.
- When much trade is "within" rather than "between" industries specialization effects become smaller. Less specialization increases the correlation between sectors shares in output α_i and α_i^* and the quantity "$\sum_{i=1}^{N} \alpha_i \alpha_i^* \sigma_i^2$".

The decomposition of countries' GDP by sectors shows that the covariance (then the correlation) of output growth rates depends on bilateral trade.

Then in African monetary integration perspective, we can look for a positive impact of African bilateral trade on cycles synchronization. Whether African bilateral trade is mostly intra-industry or inter-industry, its impact on cycles synchronization is either positive or negative. In order to check the impact of African bilateral trade on cycles synchronization, we estimate the following equation:

$$Corr_{i,j,\tau,\gamma} = \phi + \kappa \cdot TI_{i,j,\tau} + \epsilon_{i,j,\tau,\gamma} \tag{4}$$

Where $Corr_{i,j,\tau,\gamma}$ is the coefficient of correlation between national cycles of the variables γ for a pair of countries i and j over the period τ. As Frankel and Rose (1998), we work with coefficient of correlation in econometric analysis that is the covariance adjusted for the country-specific volatility of aggregate income. The extent to which business cycles are correlated internationally rises or falls depends on how this covariance changes with increased integration. $TI_{i,j,\tau}$ measures the average of bilateral trade indicator over the period τ and $\epsilon_{i,j,\tau}$ denotes numerous others factors which affect cycles synchronization above and beyond the influences of bilateral trade. ϕ and κ are the regression coefficients to be estimated [4]. We are interested in both sign and size of coefficient κ. The sign indicates whether the Krugman's (1991, 1993) and Eichengreen's (1992) specialization effect dominates ($\kappa < 0$) or the Frankel and Rose's (1997, 1998) effect prevails ($\kappa > 0$). The size quantifies the economic importance of this effect. We now turn to empirical investigation in the next section.

3 Lessons from statistical trends

For our empirical analysis, we use data on real Gross Domestic Product, on Consumer Prices Index, on trade (exports and imports) and on bilateral trade (see appendix B for data sources). We form a panel dataset using the pairs of countries of the 53 African countries from 1975 to 2004. We get at most 1378 pairs of countries and divide the period into 3 decades (1975-1984, 1985-1994 and 1995-2004). We first describe statistical trends in bilateral trade intensity and in cycles synchronization of GDP growth and inflation for a better understanding of our intuition. Descriptive statistics analysis reveals that European Commission's (1990) and Frankel and Rose's (1997, 1998) arguments works for inflation cycles while conclusions is ambiguous for output cycles.

[4] The estimation of equation (4) is motivated by the lack of data availability of African data on sectoral trade.

Table 2: Structure of African exports: Average from 1965 to 2004 (% of merchandise in COMTRADE database)

Country	Exports of agricultural raw materials	Exports of food	Exports of manufactures	Exports of ores and metals
Algeria	0.20	3.82	2.87	0.98
Angola	4.63	25.18	11.98	5.38
Benin	36.56	44.53	9.71	6.50
Botswana	0.40	2.96	90.08	6.23
Burkina F.	42.96	46.5	9.70	0.24
Burundi	4.58	90.87	2.70	1.75
Cameroon	18.41	48.66	8.13	7.81
Cape Verde	0.79	17.92	45.8	3.43
CAR	29.40	18.15	42.17	12.00
Chad	75.11	15.94	2.54	0.52
Comoros	0.01	73.63	23.51	0.28
Congo	19.6	5.90	19.34	1.12
DRC	4.35	18.99	5.75	68.19
Côte d'Ivoire	19.73	62.09	10.42	0.54
Egypt	21.38	12.33	28.08	3.98
E. Guinea	21.07	71.86	5.13	1.93
Ethiopia	18.02	70.87	9.32	0.93
Gabon	15.92	1.00	5.32	12.32
Gambia	1.94	84.55	11.36	0.85
Ghana	9.66	66.42	5.12	13.87
Guinea	0.96	4.20	25.46	68.77
Guinea-B.	6.75	88.86	2.44	0.29
Kenya	7.51	54.24	20.20	2.51
Liberia	20.84	6.34	1.58	69.9
Libya	0.07	0.11	1.50	0.03
Madagascar	5.11	70.27	15.12	4.83
Malawi	2.71	87.64	8.30	0.13
Mali	52.24	38.42	7.73	0.39
Mauritania	1.26	17.18	2.7	77.75
Mauritius	0.47	48.62	49.43	0.16
Morocco	3.08	31.92	36.96	25.85
Mozambique	10.21	51.29	10.01	17.37
Namibia	1.06	37.78	49.40	9.68
Niger	3.96	46.88	8.93	38.77
Nigeria	2.17	12.90	0.96	1.41

Continued.

Table 2 continued...

Country	Exports of agricultural raw materials	Exports of food	Exports of manufactures	Exports of ores and metals
Rwanda	8.00	61.63	5.50	19.42
STP	1.03	31.11	64.18	1.33
Senegal	3.57	47.54	24.8	11.06
Seychelles	0.48	52.6	9.78	1.43
Sierra Leone	0.90	32.75	46.60	16.19
Somalia	6.65	89.75	2.13	0.06
South Africa	4.18	12.14	40	12.11
Sudan	44.60	40.79	2.53	0.48
Swaziland	10.24	29.16	59.21	0.39
Tanzania	16.76	62.64	14.89	3.85
Togo	12.10	31.10	15.82	37.81
Tunisia	1.79	17.32	49.78	7.05
Uganda	11.13	77.49	7.61	1.39
Zambia	2.18	4.52	6.5	85.57
Zimbabwe	9.12	44.00	30.42	14.48

Notes: CAR for Central African Republic, DRC for Democratic Republic of Congo and STP for Sao Tome and Principe.

3.1 Bilateral trade intensity

We compute two indicators of bilateral trade intensity. The first (denoted TI_1) measures the ratio of bilateral trade relative to total trade of the pair of countries:

$$TI_1 = \frac{X_{i,j,t} + M_{i,j,t}}{X_{i,t} + X_{j,t} + M_{i,t} + M_{j,t}} \tag{5}$$

The second indicator (denoted TI_2) takes into account sizes' effects and normalizes of bilateral trade relative to the total output of the pair of countries:

$$TI_2 = \frac{X_{i,j,t} + M_{i,j,t}}{Y_{i,t} + Y_{j,t}} \tag{6}$$

Where $X_{i,j,t}$ stands for bilateral exports FOB (FOB for free on board) and $M_{i,j,t}$ for bilateral imports CIF (CIF for cost-insurance-freight) of country i toward country j at the time t. $X_{i,t}$ ($M_{i,t}$) refers to total exports FOB (total imports CIF) of country i and $Y_{i,t}$ represents real GDP of country i. We compute decade-average of bilateral trade intensities by pair. Bilateral trade

intensities indicators used in this paper are those introduced by Frankel and Rose (1997, 1998) and by Baxter and Kouparitsas (2005). Bilateral trade could be normalized by the minimum or the maximum of countries' trade or output because bilateral trade is more or less important whether country is small or not. This is not a concern for our approach since we are looking for an impact of trade on cycles synchronization, independently of countries' sizes. Descriptive statistics on African bilateral trade intensities are reported in table 3. The averages of TI_1 and TI_2 are quite low and significantly correlated: bilateral trade accounts for 0.09% of total trade (TI_1) and for 0.03% of GDPs (TI_2). Their coefficient of correlation equals to 0.9001 and is significant at 1%.

3.2 Synchronization of macroeconomic cycles

We use GDP and CPI index as proxies of macroeconomic cycles in order to estimate cycles synchronization. We use of the Baxter and King's (1999) linear band-pass filter to compute deviations from the trend of variables. This filter was specifically constructed for the analysis business cycles co-movement as implied by Baxter and Kouparitsas (2005) [5]. We suppose a common duration for cycles going from 8 to 32 quarters i.e. 2 to 8 years as suggested by Baxter and Kouparitsas (2005) [6]. For each country, we calculate the cyclical component of the logarithm of real GDP and CPI from 1975 to 2004. Then by pair and by decades, we catch cycles synchronization by a simple coefficient of correlation. On average (see table 3), the coefficient of correlation is about 0.0422 for GDP and 0.0876 for CPI. These correlations are low and confirm with the estimates of the magnitude of asymmetries among African countries reported in table 1 [7].

[5] Some authors as Frankel and Rose (1997, 1998), Rose and Engel (2002) and Darvas et al. (2005) use alternative filters such as first difference or Hodrick and Prescott's (1997). In this paper, we rule out the first difference filter because it does not catch the duration and the range of business cycles.

[6] Originally Baxter and King (1999) advise a duration from 6 to 32 quarters which means 1.5 to 8 year. Baxter and Kouparitsas (2005) justify the duration from 2 to 8 years by their sample heterogeneity. However Rand and Tarp (2002) estimate the duration of 6 African countries over the 1980-1999 period and find about 3 years for South Africa (2.95) and Malawi (3), 2 years for Zimbabwe (2.6), Côte d'Ivoire (2.43) and Nigeria (2.38) and finally less than 2 years for Morocco (1.93).

[7] For example, Inklaar et al. (2005) use the Hodrick and Prescott's (1997) filter and find on average, a correlation of 0.68 (1970-1979 period), 0.58 (1979-1987 period), 0.45 (1987-98 period), 0.52 (1999-2003 period) for the 21 OECD countries and 0.61 (1970-1979 period), 0.68 (1979-1987 period), 0.70 (1987-1998 period), 0.65 (1999-2003 period) for the euro zone.

3.3 Temporal changes

In this subsection, we examine bilateral trade intensities and cycles synchronization throughout decades. We first perform the two-sample data means t-tests on the equality of means assuming unequal variances. We find that bilateral trade intensities did not significantly change during the first two decades (1975-1984 and 1985-1994) staying around 0.08% for TI_1 and 0.03% for TI_2 whereas they have substantially improved during last decade (1995-2004) from 0.08% to 0.12% for TI_1 and from 0.03% to 0.05% for TI_2 (see table 3 and Fig. 1B). The evolution of the average of African cycles synchronization is more erratic (see table 3 and Fig. 1A). Roughly null during the first decade (0.0004), synchronization has decreased by half between the two last decades from 0.0844 (1985-1994) to 0.0340 (1995-2004). These changes are statistically robust since the probabilities of the means-differences tests from one decade to another are null. The situation is different for CPI. The synchronization significantly rises from a -0.080 (1975-1984) to 0.1578 (1995-2004). The increase of bilateral trade intensities during the last decade is contemporaneous with the decrease of a desynchronization of output cycles supporting the views of Eichengreen (1992) and Krugman (1991, 1993).

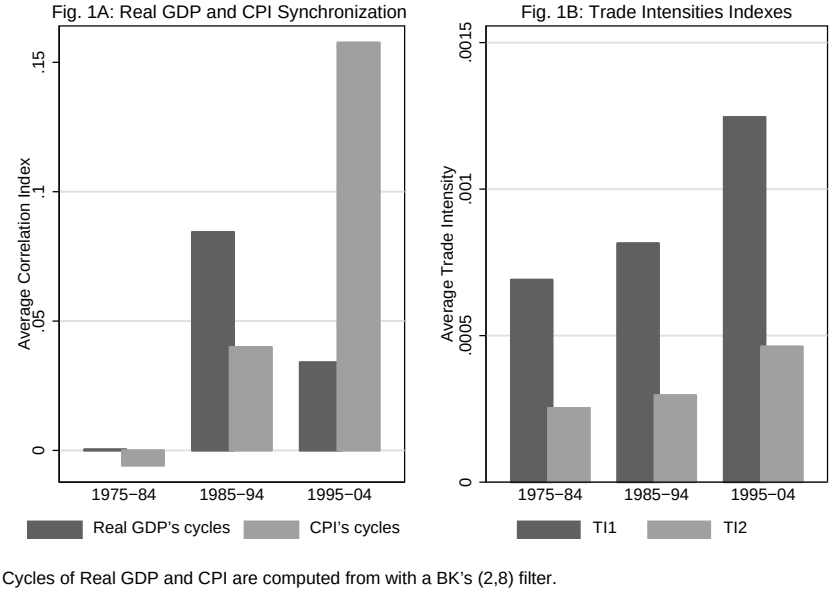
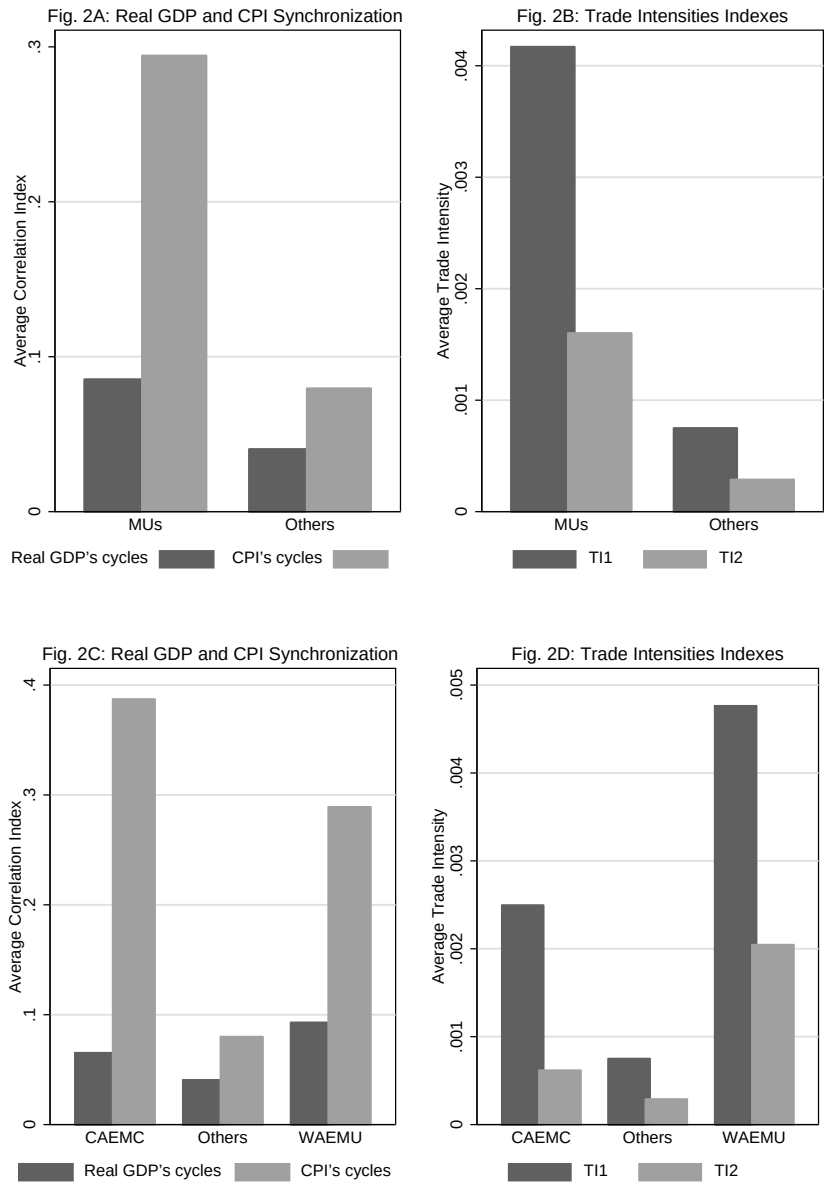


Figure 1: Synchronization of African cycles (GDPs and CPIs) and trade intensity by decades.

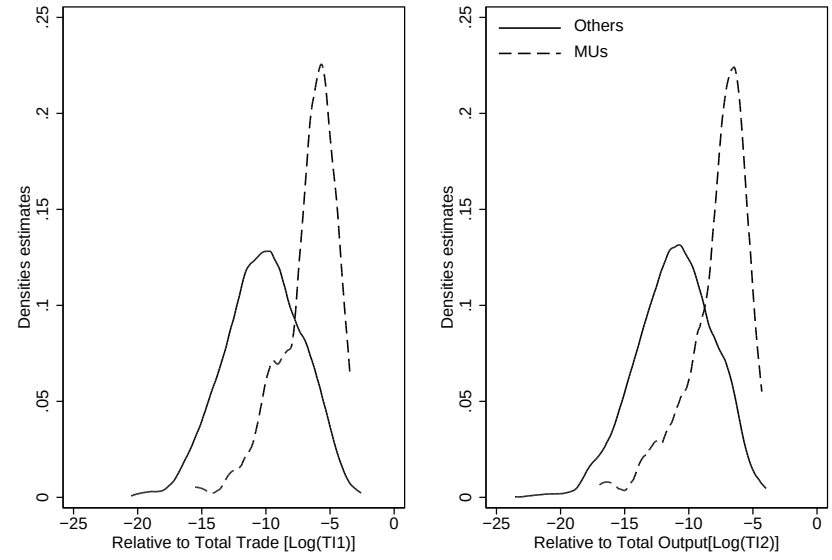
3.4 Difference of African monetary unions

We now turn to the analysis of differences due to the MU membership. The comparison across pairs of countries reveals that bilateral trade intensities are four to six times higher for MUs: on average, bilateral trade intensities are about 0.42% (against 0.07%) with TI_1 and 0.16% (against 0.03%) with TI_2. This finding is particularly strong for WAEMU's members. P-values of means-difference support these differences (see table 3, Fig. 2B, Fig. 2D). Previous papers also get that African MUs trade about three times more than others countries (see for example Carrère 2004 and Tsangarides et al. 2006). Conclusion is somewhat similar for synchronization. The cycles of output and inflation are more correlated for MU pairs. On average, the coefficient of correlation of GDP cycles equals to 0.0853 for MU pairs against to 0.0403 for others. Likewise, the coefficient of correlation of CPI cycles equals to 0.3179 against 0.0794. Again WAEMU's members have macroeconomic cycles more correlated. These differences are statistically robust (see table 3, Fig. 2A and Fig. 2C). We also estimate density of trade intensities and cycles synchronization by MU membership using kernel density estimates. Distributions are clearly different for MU pairs (see Figure 3 and Figure 4). Their bilateral trade is deeper and their business cycles more correlated. This support the European Commission's (1990) and Frankel and Rose's (1997, 1998) view.



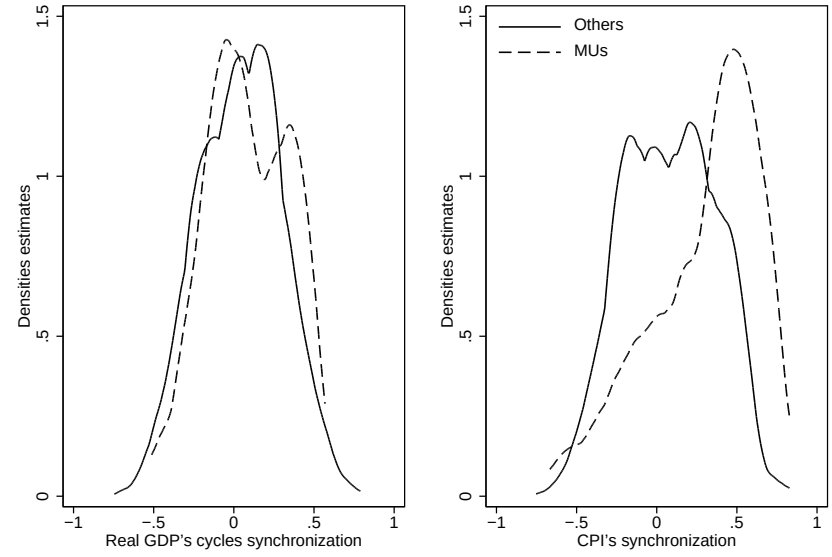
Cycles of Real GDP and CPI are computed from with a BK's (2,8) filter; MUs for pairs in Monetary Union.

Figure 2: Synchronization of African cycles (GDPs and CPIs) and trade intensity by monetary union membership.



MUs for monetary unions.

Figure 3: Densities estimates of African trade intensity (in Logarithm) by monetary union membership.



MUs for monetary unions.

Figure 4: Densities estimates of the synchronization of African cycles (GDPs and CPIs) by monetary union membership.

Table 3: Descriptive statistics: synchronization of cycles and trade intensity.

Variables	Mean						Minimum	Maximum	Number of observations
	Total	1975-1984	1985-1994	1995-2004	MUs	Others			
Correlation of GDPs	0.0422	0.0004	0.0844 (0.00)	0.0340 (0.00)	0.0853 (0.04)	0.0403	-0.7454	0.7893	3170
Correlation of CPIs	0.0876	-0.0080	0.0395 (0.00)	0.1578 (0.00)	0.3179 (0.00)	0.0794	-0.7525	0.8323	2272
TI_1	0.0009	0.0007	0.0008 (0.43)	0.0012 (0.04)	0.0042 (0.00)	0.0007	0	0.0761	2310
TI_2	0.0003	0.0003	0.0003 (0.38)	0.0005 (0.01)	0.0016 (0.00)	0.0003	0	0.0189	2610

Notes: MU denotes pairs of countries forming monetary union. Probabilities means-differences tests (Two-sample data t-tests on the equality of means assuming unequal variances) are in parentheses: more probability is weak more means are different. Means-differences tests compare two consecutive periods. Cycles of GDP and CPI are filtered with the Baxter and King's (1999)filter BK (2,8). TI_1 bilateral trade intensity relative to total trade and TI_1 bilateral trade intensity relative to total output.

4 Econometric strategy

We use three different techniques to estimate the impact of bilateral trade intensity on cycles synchronization by the Ordinary Least Squares (OLS), the Two-Stage Least Squares (2SLS) and the countries-specific fixed effect (FE). We include in estimates an intercept and dummies for decades 1985-1994, 1995-2004. We also correct for the heteroskedasticity using cluster method [8]. We start by the OLS estimate as a benchmark. However, the OLS technique maybe inappropriate to identify the impact of bilateral trade on cycles synchronization because of simultaneity bias and omitted variables bias. First, countries with business cycles highly connected are likely to trade more (or less) during common expansions (or recessions). Second, cycles synchronization and bilateral trade are positively associated to the adoption of MU. Third, there are not theoretical arguments to limit the explanation of cycles synchronization to bilateral trade. In a context of multiple equilibriums, sharing a common language, a common border and same information can coordinate the choice of the desired equilibrium. Variables such as geography, production similarity or trade similarity could explain cycles synchronization. We then apply the technique Two-Stage Least Squares (2SLS) to estimate to overcome the limits of OLS. Following Frankel and Rose (1998), we use basic variables of the gravity model as instrumental variables of bilateral trade intensity: the logarithm of distance between the main cities of countries within the pair of countries, a dummy variable for common border and a dummy variable for common language. We check that instruments are collectively relevant to bilateral trade intensity in the fist-stage of the 2SLS method. We perform an F-test and compute the partial R^2 of instruments. The partial R^2 measures the contribution of instruments in the explanation of the variance of endogenous regressor. We also report the F-statistic of the Cragg-Donald's weak instrument test. This statistic has been suggested by Stock and Yogo (2002)

[8] Observations of pairs may not be independent over decades. For example for the pair of countries A and B, the first decade observation may affect either (or both) the second or the third decade observation. Then standard errors reported are clustered by pairs of countries. However, we do not correct for the spatial dependencies in computing covariance matrices. The observation of the pair of countries A and B may also depend on the observation of the pair of countries B and C.

[9] and Hansen-Sargan χ^2 [10]. Another way to deal with the simultaneity bias and omitted variables bias is the estimation with countries fixed effects. We do not control for the logarithm of distance between the pair of countries, a dummy variable for common border and a dummy variable for common language since they are used as instruments for the first-stage of the 2SLS technique.

5 Empirical Results

5.1 Basic Results

Basic results are presented in table 4. They confirm the intuition of the paper. We obtain a positive and significant impact (at least at 10%) of African bilateral trade intensity on African cycles synchronization. The estimated coefficient for the synchronization output shocks is between 2.14 and 6.14 with TI_1 and between 7.58 and 14.43 with TI_2. The F-test of instruments is significant at 1% in the first stage [11]. The partial R^2 suggests that instruments explain about 20% of the variance of bilateral trade intensity. The Hansen-Sargan's J-statistic feebly accepts the validity of instruments: the null hypothesis is accepted at 19% with TI_1 and 12% with TI_2. The statistic of Cragg-Donald does not reject the validity of instruments (tabulate values are largely greater than critical values). All of these tests comfort us that instruments used in this paper reasonably fit bilateral trade intensities. The inclusion of fixed effects reduces the sizes of the impact of bilateral trade intensity on the synchronization of cycle (from 6.14 to 2.14 with TI_1 and from 18.26 to 7.58 with TI_2). Results are similar for the synchronization inflation shocks. The estimated coefficient is significant at least at 5%. Its size is between 5.11 and 22.18 with TI_1 and between 18.23 and 65.18 with TI_2. However the results obtained with 2SLS are weak because the Hansen-Sargan's J-statistic is not significant and reject the validity of instruments.

We interpret economically estimates by computing potential gains of synchronization if African

[9] The null hypothesis of Cragg-Donald states that the instruments are weak, even if parameters are identified. Critical values depend on the number of included endogenous regressors (here n = 1), the number of instrumental variables (here $K_2 = 3$), and the desired maximal bias of the 2SLS estimator relative to OLS (10%). They are taken from Stock and Yogo (2002) and based on 2SLS bias, the significance level is 5% (see table 2, p. 60).

[10] The Hansen-Sargan test of overidentifying restrictions, consistent to heteroskedasticity and autocorrelation, checks the validity of instruments. The joint null hypothesis of the Hansen-Sargan test is that the instruments are uncorrelated with the error term, and that the instruments are correctly excluded from the estimated equation. Under the null hypothesis, the Hansen-Sargan's J statistic is distributed as χ^2 in the number of overidentifying restrictions.

[11] We do not report these estimates. We get that the logarithm of distance between countries of pair affects negatively bilateral trade intensity. The dummy variable for common border and the dummy variable for common language increase bilateral trade intensity.

countries adopt MUs. We assume that, ceteris paribus, on average, bilateral trade would catch up the actual level observed within MUs. Compared to others pairs of countries, bilateral trade intensity is four to six times much higher within MUs: 0.0042 (against 0.0007) with TI_1 and 0.0016 (against to 0.0003) with TI_2 The adoption of MU would increase bilateral trade intensity by 0.0035 for TI_1 (0.0035 = 0.0042 - 0.0007) and by 0.0013 for TI_2 (0.0013 = 0.0016 - 0.0003). We first compute the gains for the synchronization of output. The significant impact of bilateral trade intensity on synchronization of output cycles goes from 2.14 to 6.14 with TI_1 and from 7.58 to 18.26 with TI_2. The potential rise in bilateral trade intensity augments coefficient of correlation of output cycles by 0.0075 to 0.0215 (with TI_1) and by 0.0099 to 0.0237 (with TI_2) [12]. The synchronization level rises from 0.0403 to 0.0478 (0.0403 + 0.0075) or to 0.0618 (0.0403 + 0.0215) with TI_1 and from 0.0403 to 0.0502 (0.0403 + 0.0099) or to 0.0640 (0.0403 + 0.0237) with TI_2. These modifications are important in terms of percentage change from 18.6% to 53.3% with TI_1 and from 24.6% to 58.8% with TI_2. The computations for the synchronization of inflation cycles suggest a gain from 0.0794 to 0.0973 or to 0.1571 (with TI_1) and from 0.0794 to 0.1031 or to 0.1641 (with TI_2). In terms of percentage change, gains are between 22.5% and 97.9% with TI_1 and between 29.8% and 106.7% with TI_2 Approximately, if African countries adopt common currency and common monetary policy, it could lead to sizeable gains in shocks similarity between 18.6% to 58.8% for output and between 22.5% and 106.7%. These estimates are important and could help the debate on African monetary integration.

[12] See Table 3, p. 15 for calculations. 0.0075 = 0.0035*2.14, 0.0215 = 0.0035*6.14, 0.0099 = 0.0013*7.58 and0.0237 = 0.0013*18.26.

Table 4: Synchronization of cycles and trade intensity: baseline estimates.

	Correlation of GDPs						Correlation of CPIs					
	OLS	2SLS	FE	OLS	2SLS	FE	OLS	2SLS	FE	OLS	2SLS	FE
TI_1	4.45^{***}	6.14^{*}	2.14^{*}				5.11^{**}	22.18^{***}	5.46^{**}			
	(1.45)	(3.43)	(1.24)				(2.32)	(6.39)	(2.12)			
TI_2				14.43^{***}	18.26^{*}	7.58^{**}				23.28^{***}	65.18^{***}	18.23^{***}
				(4.00)	(9.53)	(3.26)				(6.66)	(15.02)	(6.55)
F-test[a]		12.95			17.29			9.77			13.97	
		(0.00)			(0.0)			(0.00)			(0.00)	
Partial R^2		0.20			0.21			0.20			0.21	
Hansen-Sargan [b]		$\chi(2)$= 3.27			$\chi(2)$= 4.26			$\chi(2)$=28.68			$\chi(2)$=31.94	
		(0.19)			(0.12)			(0.00)			(0.00)	
Cragg-Donald[c].		169.39			207.90			120.48			152.26	
		(22.30)			(22.30)			(22.30)			(22.30)	
R^2	0.02	0.02	0.11	0.02	0.02	0.11	0.07	0.02	0.28	0.09	0.06	0.29
Observations	2016	2016	2016	2349	2349	2349	1481	1481	1481	1683	1683	1683
Number of pairs	872	872	872	925	925	925	736	736	736	784	784	784

Notes: All regressions include an intercept and decade-specific dummies (1985-1994, 1995-2004) and corrected for the heteroskedasticity with clusters method. OLS for Ordinary Least Squares, 2SLS for Two-Stage Least Squares (2SLS) and FE for the countries' specific "fixed effect". [a]: F-test of instruments, p-values in parentheses. The partial R^2 of %excluded instruments how much instruments contribute in explaining the variance of endogenous regressor at the first-stage of the 2SLS. [b]: Hansen-Sargan J statistic, p-values in parentheses. The Hansen-Sargan test of overidentifying restrictions, consistent to heteroskedasticity and autocorrelation, checks the validity of excluded instruments. [c]: Cragg-Donald's statistic, critical value in parentheses. The F-stat form of the Cragg-Donald's statistic is the statistic of the Stock and Yogo's (2002) weak instrument test. The null hypothesis is that the instruments are weak, even if parameters are identified. The test rejects the null hypothesis if tabulate value exceeds the critical value. Critical values depend on the number of included endogenous regressors (here n = 1), the number of instrumental variables (here $K_2 = 3$), and the desired maximal bias of the 2SLS estimator relative to OLS (10%). They are taken from Stock and Yogo (2002) and based on 2SLS bias, significance level is 5% (see table 2, p. 60). Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

5.2 Robustness checks

Descriptive statistics suggest that bilateral trade intensity and cycles synchronization are much higher within MUs. We then check whether the endogeneity of OCA criteria is (or not) a direct phenomenon of MU membership. To do that, we estimate with countries' fixed effects the impact a dummy variable MU (taking the value 1 when the pair forms a MU and 0 otherwise) on cycles synchronization. Results are reported in table 5. We get that MU membership increase directly the synchronization of inflation cycles while it is not significant for output shocks [13]. When MU membership in included in estimate, bilateral trade intensity is still significant (except for TI_1 and the synchronization of output shocks). We furthermore look for a conditioning effect MU membership and bilateral trade intensity by adding a multiplicative variable MU*TI. We get that this effect is not significant (except for TI_1 and synchronization of output cycles). These estimates imply that there is no clear evidence of conditioning effects of MU membership which only acts directly on the synchronization of inflation shocks. The observed endogeneity of OCA criteria on African data is not due to the MU membership. It is a bilateral trade phenomenon.

We also verify the validity of our baseline results as we control for total trade and monetary and fiscal policies coordination (multivariate approach). International trade may be a good proxy of external shocks which could affect cycles synchronization. External shocks acts on synchronization through Keynesian multiplier or through international trade technological spillovers. When two countries trade more with the rest of world, their business cycles will be more synchronized if global economy is either favorable or unfavorable for them. We compute total trade indicator (TT) by normalizing the total trade of a pair of countries by the sum of their GDPs:

$$TT = \frac{X_{i,t} + X_{j,t} + M_{i,t} + M_{j,t}}{Y_{i,t} + Y_{j,t}} \tag{7}$$

Where $X_{i,t}$ ($M_{i,t}$) is total exports (imports) of goods of country i and $Y_{i,t}$ ($Y_{i,t}$) is the country's i (j) GDP. Another explanation of cycles synchronization is the coordination of monetary and

[13] This finding supports in some extent, the Fielding and Shields's (2005a and 2005b) results. Using a limited group of developing countries including members of WAEMU, CAEMC and ECCU (ECCU for the Eastern Caribbean Currency Union), they show that the MU membership does not necessary help cycles synchronization. Baxter and Kouparitsas (2005) also find that MU membership is not a robust determinant of cycles synchronization. They noted that their conclusions are different to Rose and Engel's (2002) estimates of a positive and significant effect of MU on cycles synchronization.

fiscal policies. The impact of policies coordination on cycles synchronization is different whether the policies generate asymmetric shocks or respond to a shock. According to business cycles theories, economic fluctuations have three main sources: supply-shocks, demand shocks and shocks coming from policymakers. If macroeconomic policies produce idiosyncratic fluctuations, cycles become more desynchronized while responses to asymmetric shocks increase synchronization. The coordination of macroeconomic policies augments synchronization when they pursue stabilization objectives and do not generate idiosyncratic fluctuations. The impact of policies' coordination on synchronization is not obvious in literature (e.g. Clark and van Wincoop 2001, Corsetti and Pesanti 2002, Shin and Wang 2003,2004 and Darvas et al. 2005) [14]. We compute use a simple coefficient of correlation of primary deficit or surplus as share of GDP in % (denoted Corr. Fiscal) as a proxy of the coordination fiscal policies. We also measure the coordination of monetary policy (denoted Corr. Monetary) by a coefficient of correlation of money supply (M1) growth. We re-estimate equation (4) by adding TT, Corr. Fiscal and Corr. Monetary to right-hand-side variables. Results are reported in table 6. Bilateral trade intensity is still positive and relevant to cycles synchronization at least at 5% (except for output shocks and TI_1 with fixed effect estimate). The sizes of estimated coefficient remain unchanged. The effect of total trade on synchronization is negative for output shocks and not clear for inflation shocks. We get that the coordination of monetary policies increases synchronization. Estimated coefficient is significant. However, we interpret the coordination of monetary policies with precaution since our proxy is endogenous. Money supply highly depends on output and inflation shocks. The coordination of fiscal policies is not significant for the synchronization of output shocks. The result is not clear for the synchronization of inflation shocks.

Controlling for the effect of MU membership, for total trade and for the coordination of fiscal and monetary policies do not change the positive and significant impact of bilateral trade on cycles synchronization.

[14] For example, Corsetti and Pesenti (2002) show in a theoretical model that in the absence of bilateral trade and financial integration, monetary unions could be self-validating through common monetary policies. Clark and van Wincoop (2001) find that the coordination of fiscal and monetary policies coordination do not impact on synchronization of American and European cycles from 1963 to 1997. As explain by authors, the result does not mean that the coordination of policies do not affect synchronization because the effect could be null if coordination generates and responds to shocks. Shin and Wang (2003, 2004) also get that the coordination of fiscal and monetary policies does not affect East Asian the synchronization of cycles. Darvas et al. (2005) estimate the effect of fiscal convergence on the synchronization of cycles on a sample of OECD countries and obtain a negative and robust effect.

Table 5: Monetary union, trade intensity and synchronization of cycles.

	Correlation of GDPs					Correlation of CPIs				
MU	0.03	0.00	-0.01	-0.02	-0.02	0.14***	0.12***	0.10***	0.11**	0.09**
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
TI_1		2.10		1.06			4.09*		3.49	
		(1.29)		(1.55)			(2.41)		(2.97)	
TI_2			7.77**		5.51			14.35*		13.83
			(3.40)		(3.80)			(7.35)		(8.94)
MU*TI_1				6.21*					3.35	
				(3.48)					(4.48)	
MU*TI_2					12.51					2.42
					(9.11)					(11.94)
Observations	3170	2016	2349	2016	2349	2285	1481	1683	1481	1683
R^2	0.09	0.11	0.11	0.11	0.11	0.23	0.29	0.30	0.29	0.30
Number of Pairs	1277	872	925	872	925	1071	736	784	736	784

Notes: All regressions include an intercept and decade-specific dummies (1985-1994, 1995-2004) and corrected for the heteroskedasticity with clusters method. MU is a dummy variable MU taking value 1 when the pair of the countries forms a monetary union. FE for countries' specific fixed effect. Clustered robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6: Synchronization of cycles, trade intensity, total trade and policies coordination

	Correlation of GDPs						Correlation of CPIs					
	OLS	2SLS	FE	OLS	2SLS	FE	OLS	2SLS	FE	OLS	2SLS	FE
TI_1	3.56**	6.88**	2.05				7.07***	17.43***	7.46***			
	(1.68)	(3.34)	(1.52)				(2.67)	(5.80)	(1.97)			
TI_2				13.95***	18.60**	9.32**				28.80***	47.68***	23.11***
				(4.99)	(9.12)	(3.90)				(8.52)	(14.47)	(7.98)
TT	-0.10***	-0.10***	-0.03	-0.10***	-0.10***	-0.01	0.02	0.03	-0.11	0.00	0.01	-0.12
	(0.03)	(0.03)	(0.09)	(0.03)	(0.03)	(0.08)	(0.03)	(0.03)	(0.09)	(0.03)	(0.03)	(0.09)
Corr. Fiscal	0.01	0.01	0.01	0.01	0.01	0.01	0.05*	0.05*	0.05*	0.04	0.04	0.05**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
Corr. Monetary	0.04*	0.04*	0.04*	0.04*	0.04*	0.04*	0.21***	0.20***	0.14***	0.21***	0.20***	0.14***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
F-test[a]		10.35			16.86			8.59			16.13	
		(0.00)			(0.00)			(0.00)			(0.00)	
Partial R^2		0.24			0.28			0.22			0.26	
Hansen-Sargan[b]		$\chi(2)$= 2.17			$\chi(2)$= 2.65			$\chi(2)$=34.57			$\chi(2)$=36.40	
		(0.34)			(0.27)			(0.00)			(0.00)	
Cragg-Donald[c]		133.24			194.45			101.26			128.93	
		22.30			22.30			22.30			22.30	
R^2	0.02	0.02	0.15	0.02	0.02	0.15	0.11	0.09	0.38	0.12	0.11	0.38
Observations	1253	1253	1253	1260	1260	1260	1096	1096	1096	1102	1102	1102
Number of pairs	712	712	712	719	719	719	652	652	652	658	658	658

Notes: Robust standard errors in parentheses. [a]: F-test of instruments, p-values in parentheses. [b]: Hansen-Sargan J statistic, p-values in parentheses. [c]: Cragg-Donald's statistic, critical value in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. See table 4 for notes.

6 Concluding remarks

This paper argues that African bilateral trade could reduce macroeconomic asymmetries. We estimate the impact of bilateral trade intensity on the synchronization of output shocks and inflation shocks from the 1975-2004. We get a positive and robust coefficient. We check whether this effect is not driven by MU membership, by the impact of external shocks and policies' coordination. We have also compute synchronization gains due to the adoption of MU arrangement by African countries that are not actually. Estimates suggest an important relative gains between 18.6% and 58.8% for output shocks synchronization and between 22.5% and 106.7% for inflation shocks synchronization. These gains synchronization might be more important because we only use official IMF's trade data which underestimate (surely) the real bilateral trade in the African context. African informal trade is certainly much higher and a single currency reduces both formal and informal trade transaction costs.

Our results add insights into policies debate on the on-going African monetary integration. In addition to macroeconomic convergence criteria, the promotion of bilateral trade by dropping tariff, non-tariff and infrastructures barriers would accelerate the synchronization of African business cycles and facilitate projects of monetary integration in progress in Africa (for details on African monetary integration see appendix A and Economic Commission for Africa's policy research report 2004). Finally, we are aware that these results do not include the effect of others factors such as similarity of trade and of productive structure used in recent papers (see Imbs 2004, Fidrmuc 2005, Baxter and Kouparitsas 2005). Such data are very difficult to collect for African countries. However, the originality of this paper remains the optimistic view on African monetary integration. We propose that African MUs could be self-validating by taking the example of bilateral trade.

Appendix

A African monetary integration

Monetary integration is crucial for regional economic integration and unified common market. A strong monetary integration is required for regional integration objectives to go beyond free trade agreements or custom unions. In Africa, the multiplicity of currencies and the small size of African economies make monetary integration even stronger. 39 over 53 issue their own currency and the other fifteen belong to the CFA zone. There also exists a monetary area in southern Africa which is unusual monetary union.

A.1 The CFA zone

The history of the CFA zone is closely linked to the colonial relationship between France and some African countries. The CFA monetary arrangement was established by France on 9th September 1939 and subsequently formalized on 26th December 1945 when France ratified the treaty of Bretton Woods [15]. There are two MUs within the African CFA zone: the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CAEMC) [16]. The WAEMU groups Benin, Burkina-Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo whereas the CAEMC gathers Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea and Gabon. Each MU has its own central bank and issues its own currency. The Central Bank of West African States (CBWAS) issues the *Franc de la Communauté Financière Africaine* (FCFA) [17] and he Central Bank of Central African States (CBCAS) provides the *Franc*

[15] Togo joined the zone on 27th November 1963 while Mali, after leaving in 1962, expressed its desire to re-join the union in 1967 which became effective on 1st June 1984. Until to this date, Mali has issued its own currency the Mali Franc (MF). The parity with French Franc was 1 MF = 0.01 FF. Cameroon joined the union in June 1961. Equatorial Guinea left the peseta zone for CFA In 1985. Guinea-Bissau also joined in April 1997. Mauritania and Madagascar left the zone in June-July 1973. On 26th December 1945, the parity of the FCFA with French Franc (FF) was fixed to 1 FCFA = 1.70 (FF). It was modified three times: *(i)* 1 FCFA = 2.00 FF in 17th October 1948, *(ii)* 1 FCFA = 0.02 FF in 27th December 1958 and *(iii)* 1 FCFA = 0.01 FF in 11th January 1994 (1 FCFA = 0.0133 FF for Comoros). Since 1st January 1999, the FCFA is pegged to Euro at the rate 1 FCFA = 0.001524 Euro.

[16] The French name of WAEMU is UEMOA i.e. *Union Economique et Monétaire Ouest Africaine* while CAEMC stands for CEMAC i.e. *Communauté Economique et Monétaire de l'Afrique Centrale*.

[17] *Banque Centrale des Etats de l'Afrique de l'Ouest* (BCEAO) in French. It was created in April 1959 followed by the West African Customs Union (WACU) on 9th June 1959. The name of WACU in French is Union Douanière de l'Afrique de l'Ouest (UDAO). The WACU became the West African States Customs Union (WASCU) in June 1966 (Union Douanière des Etats de l'Afrique de l'Ouest-UDAEO- in French).

de la Coopération Financière en Afrique Centrale (FCFA) [18]. Each central bank has to pool reserves at the union level (except sums which are necessary to their current treasury and those relating to their transactions with IMF) and has to deposit at least 65% (50% since April 2005) of these reserves in an account, the *compte d'opérations*, detained by French treasury.

In May 1962, the treaty of West African Monetary Union (WAMU) is signed on the basis of CBWAS and WACU. In 1972-1973, a set of reforms aiming to give more responsibility to African states and to empower the central bank took place: CBWAS' headquarter was moved from Paris to Dakar in 1978 and the proportion of French representatives in executive board was reduced from 1/3 to 1/7 (see Guillaumont-Jeanneney 2006). In January 1994 after the devaluation of 1994, the WAMU changed into economic and monetary union, the WAEMU. The objectives of WAEMU were mainly the creation of a common and unified market (tariff obstacles to regional trade were suppressed in 2002), the monitoring and policies' coordination. The CAEMC follows the same path. A set of reforms aiming at the africanization of institution also took place in November 1972. The CBCAS' headquarter also moved from Paris to Yaoundé in 1977. After the devaluation of 1994, the union signed a treaty of economic and monetary community.

A.2 The Common Monetary Area

The Rand area or the Common Monetary Area (CMA) was established in 1974 (the prior name was Rand Monetary Agreement) on the basis The Southern African Customs Union (SACU) [19]. It groups South Africa, Namibia, Lesotho and Swaziland. In 1976, Botswana left the CMA but remained member of SACU. The CMA is not a MU in the full meaning. Each state issues its own currency but follows South African monetary policy The zone works de *de facto* as a currency board (see Masson and Pattillo 2001). The CMA replaced the RMA, its predecessor, on 1st April 1986 with the signing of the trilateral monetary agreement. Namibia joined in 1992 shortly after

[18] *Banque des Etats d'Afrique Centrale* (BEAC) in French. It was also created in April 1959 followed by the Equatorial Customs Union (ECU) on 7th December 1959. The French name of ECU is Union Douanière Equatoriale (UDE).

[19] SACU is the oldest Customs Union in the world. It was established in 1910 as a Customs Union Agreement between the then Union of South Africa and the then High Commission Territories of Bechuanaland, Basutoland and Swaziland. With the advent of independence for the Territories, the 1910 Agreement was updated and re-launched on December 11, 1969 with the signing of an agreement between the Republic of South Africa, Botswana, Lesotho and Swaziland. The updated 1969 agreement officially came into force on 01 March, 1970. After Namibia's independence in 1990, it joined SACU as its fifth member. The 1969 Agreement was re-negotiated in 1994 leading to the current SACU 2002 Agreement that came into force on 15 July, 2004.

independence.

A.3 The East African currency

A monetary integration also took place in East Africa. The parts of East Africa ruled by the British (Kenya, Uganda and Tanganyika and, in 1936, Zanzibar) adopted in 1922 a single common currency, the East African shilling. The newly independent countries of East Africa remained part of the Sterling Area (i.e., the local currencies were fully and freely convertible into British Pounds). The relentless depreciation of the East African shilling in the late of the 1960s and the early of the 1970s, led to the disintegration of the Sterling Area in 1972. A result of a divergence of inflation targets, currencies and interest rates diverged and strict monetary discipline evaporated. The East African Currency Area was formally ended in 1977.

A.4 The on-going monetary integration in Africa

The introduction of Euro as the single currency of the European Monetary Union (EMU) in 1999 has renewed policymakers' interest in monetary integration projects around the world: the Euro area (the issue of the entry of United Kingdom, Sweden and Denmark), the East Asia Currency Union by 2030 (China, Thailand, Indonesia, Malaysia, Brunei, South Korea, Vietnam, Singapore, The Philippines and Japan), in South Asian Association for Regional Cooperation by 2020 (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka), the Central American Monetary Union Council (Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua), the Gulf Cooperation Council Monetary Union by 2010 (Saudi Arabia, Qatar, Bahrain, Oman, Kuwait, and the United Arab Emirates).

In August 2003, the governors of African Central Banks Association promoted the idea of a single continental currency and a common central bank by 2021. More ambitiously, a single currency for the whole Africa is also an official objective and a pillar of African unity. A common currency was already an objective if the Organization of African Unity, created in 1963 and the associated African Economic Community, agreed in 1991 throughout the Abuja treaty. The project for common currency is an integral part of the newly-formed African Union (successor of the OAU). The strategy for achieving African currency relies on using the regional economic communities as building blocks. Regional currencies would merged into a single African currency at the latest

by 2028 according to the official timetable outlined in the Abuja Treaty setting up the African Economic Community (see Masson 2006). According to this, regional MUs are in planning stage in East, West and Southern Africa.

On 30th November 1999, Kenya, Uganda, and Tanzania signed a treaty to revive the former East African Community (EAC). The EAC came into force on 7th July 2000. The first major step in establishing the East African Federation is customs union in East Africa signed in March 2004 and commenced on 1st January 2005. Under the terms of the treaty, Kenya, the biggest exporters of the three countries, pays duty on its goods entering Uganda and Tanzania until 2010 based on a declining scale. A common system of tariffs is applied to other countries supplying the three countries with goods. Rwanda and Burundi joined the EAC the 17th June 2007. The community planned to adopt a common currency, the East African Shilling, by referendum by September 2009. A political federation is also planned for January 2010.

The Economic Community of West African States (ECOWAS) also opts for a MU. At present, eight francophone countries of West Africa share a common currency in the CFA zone. In April 2002 at a summit of the ECOWAS in the Ghanaian capital, Accra., Ghana, Nigeria, Liberia, Sierra Leone, Gambia and Guinea agreed to set up a second MU by 2009: the West African Monetary Zone (WAMZ). Liberia has expressed an interest in joining the zone. In long run the two MUs must merged (see Bénassy-Quéré and Coupet 2005). In May 2005, the deadline of the project was postponed to December 2009 because of some convergence difficulties [20].

In February 2005 the Countries within the 13-member Southern African Development Community (SADC) planned to form a MU by 2016. A communiqué after the August 2006 summit of SADC leaders in Maseru, Lesotho has called for united customs union by 2010, followed by a common, market by 2015, a monetary union by 2016, and a single currency by 2018 (see Masson 2006) [21].

[20] At the beginning of the zone, convergence criteria were set as follows: The primary criteria specify that inflation must be reduced to under 5% by 2003. The countries must also ensure they have enough foreign currency reserves to cover at least three months of imports by the end of 2000, and six months of imports by the end of 2003. Central bank financing of each country's budget deficit would be limited to 10% of the previous year's tax revenue.

[21] South Africa's central bank governor Tito Mboweni said after a meeting of SADC central bank governors in Cape Town: "The idea as I said is that by about 2016 there should be a SADC monetary union - by definition a SADC common currency"; Mboweni told reporters in reply to the question "What the currency is going to be?" "I don't know - that will be a subject of negotiation and discussion". (Source: from Reuters, South Africa, see also The Single Global Currency Association)

B Data sources

Data	Sources
Bilateral trade of goods and services expressed in current dollar	Direction Of Trade, IMF 2005
A dummy variable if countries of a pair share a common border	CIA Factbook 2005
A dummy variable if countries of a pair speak at least a common official language	CIA Factbook 2005
Distance between the most big cities of countries of the pair expressed in kilometers	CERDI
Primary deficit or surplus as share of GDP in %	World Bank Africa Database 2006
Exports Free On Board of goods and services (Balance of Payments) expressed in current dollar	World Development Indicators 2006
Imports Cost Insurance Fret of goods and services (Balance of Payments) expressed in current dollar	World Development Indicators 2006
Money supply (M1) as % of GDP	World Development Indicators 2006
Nominal GDP expressed in current dollar	World Development Indicators 2006
Real GDP expressed in dollar of 2000	World Development Indicators 2006
Consumer Prices Index (basis 100 in 2000)	World Development Indicators 2006

References

Alesina, Alberto and Robert J. Barro, "Currency Unions," *The Quarterly Journal of Economics*, May 2002, *117* (2), pp. 409–436.

Babetskii, Ian, "Trade Integration and Synchronization of Shocks: Implications for EU enlargement," *Economies of Transition*, January 2005, *13* (1), pp. 105–158.

Baxter, Marianne and Michael A. Kouparitsas, "Determinants of Business Cycle Comovement: a robust analysis," *Journal of Monetary Economics*, January 2005, *52* (1), pp. 113–157.

___ **and Robert G. King**, "Measuring Business Cycles: Approximate Band-Pass Filters For Economic Time Series," *The Review of Economics and Statistics*, November 1999, *81* (4), 575–593.

Bénassy-Quéré, Agnès and Maylis Coupet, "On the Adequacy of Monetary Arrangements in Sub-Saharan Africa," *The World Economy*, 03 2005, *28* (3), 349–373.

Carrère, Céline, "African Regional Agreements: Impact on Trade with or without Currency Unions," *Journal of African Economies*, June 2004, *13* (2), pp. 199–239.

Clark, Todd E. and Eric van Wincoop, "Borders and business cycles," *Journal of International Economics*, October 2001, *55* (1), pp. 59–85.

Corsetti, Giancarlo and Paolo Pesenti, "Self-Validating Optimum Currency Areas," NBER Working Papers 8783, National Bureau of Economic Research, Inc February 2002.

Darvas, Zsolt, Andrew K. Rose, and György Szapáry, "Fiscal Divergence and Business Cycle Synchronization: Irresponsibility is Idiosyncratic," NBER Working Papers 11580, National Bureau of Economic Research, Inc August 2005.

ECA, *Assessing Regional Integration in Africa. Chapter: "Money and Finance"*, UNECA (United Nations Economic Commission for Africa), May 2004, ECA (Economic Commission for Africa) Policy research report avalaible at http://www.uneca.org/aria/.

Eichengreen, B., "Should the Maastricht Treaty be Saved?," Princeton Studies in International Economics 74, International Economics Section, Departement of Economics Princeton University, 1992.

European-Commission, "One market, One money. An Evaluation of the Potential Benefits and Costs of Forming an Economic and Monetary Union," *European Economy*, October 1990, (44), 347p. Brussels: Commission for the European Communities.

Fidrmuc, Jarko, *Prospects For Monetary Unions after the Euro. Chapter: "The Endogeneity of the Optimum Currency Area Criteria and Intra-industry Trade: Implications for EMU Enlargement"*, in De Grauwe, Paul and Mélitz, Jacques, May

Fielding, David and Kalvinder Shields, "Modelling Macroeconomic Shocks in the CFA Franc Zone," *Journal of Development Economics*, Octobre 2001, *66* (1), 199–224.

___ **and** ___ , "Do Currency Unions Deliver More Economic Integration than Fixed Exchange Rates? Evidence from the Franc Zone and the ECCU," *Journal of Development Studies*, August 2005, *41* (6), pp. 1051 – 1070.

___ **and** ___ , "The Impact of Monetary Union on Macroeconomic Integration: Evidence from West Africa," *Economica*, November 2005, *72* (288), pp. 683–704.

___ **, Kevin Lee, and Kalvinder Shields**, "The Charasteristics of Macroeconomic Shocks in the CFA Franc Zone," *Journal of African Economies*, December 2004, *13* (4), 488–517.

Frankel, Jeffrey A. and Andrew K. Rose, "Is EMU more justifiable ex post than ex ante?," *European Economic Review*, 1997, *41* (3-5), pp. 753–760.

___ **and** ___ , "The Endogeneity of the Optimum Currency Area Criteria," *The Economic Journal*, July 1998, *108* (449), pp. 1009–1025.

___ **and** ___ , "An Estimate Of The Effect Of Common Currencies On Trade And Income," *The Quarterly Journal of Economics*, May 2002, *117* (2), pp. 437–466.

Grauwe, Paul De and Francesco P. Mongelli, "Endogeneities of Optimum Currency Areas - What Brings Countries Sharing a Single Currency Closer Together?," Working Paper Series 468, European Central Bank April 2005.

Guillaumont-Jeanneney, Sylviane, "L'independance de la Banque Centrale des Etats de l'Afrique de l'Ouest: une Réforme est-elle souhaitable?," *Revue d'Economie du Developpement*, Mars 2006, (1), 45–77.

Hodrick, Robert J. and Edward C. Prescott, "Postwar U.S. Business Cycles: An Empirical Investigation," *Journal of Money, Credit and Banking*, February 1997, *29* (1), 1–16.

Imbs, Jean, "Trade, Finance, Specialization, and Synchronization," *The Review of Economics and Statistics*, October 2004, *86* (3), pp. 723–734.

Inklaar, Robert, Richard Jong-A-Pin, and Jakob de Haan, "Trade and Business Cycle Synchronization in OECD Countries - a Re-examination," CESifo Working Paper Series 1546, CESifo GmbH 2005.

Krugman, Paul, *Geography and Trade*, MIT Press, Cambridge, July 1991.

___ , *The Transition to Economic and Monetary Union Europe. Chapter: "Lessons of Massachusetts for EMU"*, New York: Cambridge University Press,

Masson, Paul R., "Currency Unions in Africa: Is the Trade Effect Substantial Enough to Justify Their Formation?," Working Paper Series 06-08, Rotman School of Management November 2006. forthcoming in The World Economy.

___ **and Catherine Pattillo**, "Monetry Union in West Africa (ECOWAS): Is It Desirable and How Could It Be Achieved?," *IMF Occasional Paper*, 2001, (204), 46p.

___ **and** ___ , *The Monetary Geography of Africa*, Brookings Institution Press, Washington, DC, 2004.

McKinnon, Robert I., "Optimum Currency Areas," *American Economic Review*, september 1963, *53* (4), pp. 717–725.

Mundell, Robert A., "A Theory of Optimal Currency Areas," *American Economic Review*, Septembre 1961, *51* (4), pp. 667–665.

___ , "Does Africa Need a Common Currency?," in "Defining Priorities for Regional Integration," Vol. 3 of *African Development Forum.* Economic Commission for Africa (ECA) ECA Addis Ababa March 2002, pp. 45–57.

Rand, John and Finn Tarp, "Business Cycles in Developing Countries: Are They Different?," *World Development*, December 2002, *30* (12), pp. 2071–2088.

Rose, Andrew K. and Charles Engel, "Currency Unions and International Integration," *Journal of Money, Credit and Banking*, November 2002, *34* (4), 1067–89.

Shin, Kwanho and Yunjong Wang, "Trade Integration and Business Cycle Synchronization in East Asia," *Asian Economic Papers*, 2003, *2* (3), pp. 1–20.

___ **and** ___ , "Trade Integration and Business Cycle Co-movements: the case of Korea with other Asian countries," *Japan and the World Economy*, April 2004, *16* (2), pp. 213–230.

Stock, James H. and Motohiro Yogo, "Testing for Weak Instruments in Linear IV Regression," NBER Technical Working Papers 0284, National Bureau of Economic Research, Inc November 2002.

Tapsoba, Jules-Armand, "Bilateral Trade and Business Cycles Synchronization: African Monetary Integration," *Economics Bulletin*, July 2007, *6* (25), 1–15. URL: http://economicsbulletin.vanderbilt.edu/2007/volume6/EB-07F40003A.pdf.

Tsangarides, Charalambos G., Pierre Ewenczyk, and Michal Hulej, "Stylized Facts on Bilateral Trade and Currency Unions: Implications for Africa," IMF Working Papers 06/31, International Monetary Fund February 2006.

Yehoue, Etienne B., "Currency Bloc Formation as a Dynamic Process Based on Trade Network Externalities," IMF Working Papers 04/222, International Monetary Fund December 2004.

___ , "International Risk Sharing and Currency Unions: The CFA Zones," IMF Working Papers 05/95, International Monetary Fund May 2005.

___ , "On the Pattern of Currency Blocs in Africa," IMF Working Papers 05/45, International Monetary Fund March 2005.