E C O N O M I C S B U L L E T I N

Bilateral Trade and Business Cycles Synchronization: African Monetary Integration Perspective

Tapsoba Jules-Armand
CERDI

Abstract

The European Commission (1990) and Frankel and Rose (1997, 1998) pointed out that the traditional paradigm of Optimum Currency Areas is misleading because some consequences of monetary unions bring country-specific shocks closer together. Trade, for example, is not only a result of monetary union but it also increases business cycles synchronization. We test for the 53 African countries over the 1975-2004 period the hypothesis suggesting that monetary integration adds force to bilateral trade intensity which in turn, improves conditions for the practice of common monetary policy throughout business cycles synchronization. Our results support such argument and suggest some policy recommendations for African monetary integration.

I am grateful to S. Guillaumont-Jeanneney, J-L Combes, S. Guerineau, A. Quijada, L. Bassolé and L. Wagner for helpful suggestions.
Citation: Jules-Armand, Tapsoba, (2007) "Bilateral Trade and Business Cycles Synchronization: African Monetary Integration Perspective." *Economics Bulletin*, Vol. 6, No. 25 pp. 1-15
Submitted: May 7, 2007. **Accepted:** July 24, 2007.
URL: http://economicsbulletin.vanderbilt.edu/2007/volume6/EB-07F40003A.pdf

1 Introduction

It is now well-established that monetary union - hereafter MU - stimulates bilateral trade, increases the credibility of the monetary policies and ensures price stability (see Frankel and Rose 2002). Bilateral trade, policy credibility and price stability rise investment, deepen financial development and thus make economic growth more substantial. We keep the conventional definition of monetary unions which are groups of countries sharing common currency, common monetary policy and, likely, geographical borders. They also have common central bank According to Optimal Currency Areas (OCA) theory initiated by Mundell (1961), a monetary union - hereafter MU - is suitable if asymmetric shocks remain low and if trade flows are large. When asymmetric output shocks occur within a MU, common monetary policy cannot be tailored in response to a single country's shock. Hence, 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). Moreover when trade flows are important, transaction costs' savings could be substantial and consequences on output growth important (see Frankel and Rose 2002).

The European Commission (1990) and Frankel and Rose (1997, 1998) have introduced an alternative view about the endogeneity of OCA criteria. They pointed out that the traditional analysis is misleading because some consequences of MUs bring country-specific shocks closer together. Trade, for example, is not only a result of MU but it also reinforces integration process. Bilateral trade and shocks synchronization are tightly linked and are both positively affected by MU. Frankel and Rose (1997, 1998) suggest, then, that MUs could be self-validating via bilateral trade. They show that bilateral trade fosters GDP business cycles co-movement for OECD countries [1]. Thus, more trade increases business cycles synchronization (hereafter BCS) i.e. reduces asymmetric GDP shocks and facilitates the practice of common monetary policy i.e. monetary integration. The endogeneity hypothesis was further extended to others OCA criteria such as labor mobility, financial integration and regional risk-sharing mechanisms and confirmed on European data (e.g. Babetskii 2005, Fidrmuc 2005 and Inklaar et al. 2005). MUs are self-fulfilling policy regime through bilateral trade [2]. On the one hand, sharing a common monetary policy and a common currency stimulates bilateral trade which in turn increases BCS. On the other, a great BCS improves conditions for the practice of common monetary policy. Historical data do not provide a full picture of asymmetric GDP 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. Trade flows within African countries are small, output shocks are uncorrelated and regional risk-sharing is missing. Then, the endogeneity thesis could be relevant for African macroeconomic integration. The multiplicity of currencies and small sizes of economies make the benefits of monetary integration such as trade, fiscal performance and output growth, potentially large via currency's convertibility and exchange

[1] Organization for Economic Cooperation and Development.

[2] An alternative view is also defensible on theoretical grounds. Krugman (1991, 1993) and Eichengreen (1992) put forward that trade could lead to countries' specialization and therefore, could increase the magnitude of asymmetric GDP shocks (see section 2).

rate stability. Over fifty-three African countries, thirty-nine issue their own currency. The other fifteen countries belong to the CFA zone. Except Comoros, CFA's states members form two 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 already shared common currencies before the adoption of economic union. A range of academic papers find that OCA criteria are not fulfilled within WAEMU and CAEMC (see Fielding and Shields 2001, Fielding et al. 2004, Fielding and Shields 2005a and 2005b and Yehoue 2005a). Fielding and Shields (2001) analyze output and inflation correlation within CFA's members over the 1963-1997 period. They obtain that inflationary shocks are highly correlated while GDP shocks lowly co-moved. Fielding et al. (2004) show that asymmetric GDP shocks are more important within CAEMC than WAEMU. Fielding et Shields (2005a et 2005b) find that CFA membership does not make a difference in terms of BCS compared to some African countries. Finally, Yehoue (2005) puts forward the lack of regional risk-sharing within CAEMC and WAEMU over the 1980-2000 period. This is straightforward 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. Then, the right issue for these MUs must be the existence of self-validating factors such as bilateral trade as supported by the endogeneity thesis. This paper estimates the impact of bilateral trade intensity on BCS for African countries from 1975 to 2004. We find that African bilateral trade intensity enhances African BCS and empowers African monetary integration. However, this impact is attenuated by the low level of BCS. The adoption of a MU by African countries who do not actually share monetary policy would lead to a gain of BCS ranging between 18.6% and 58.8%.

The remainder of the paper is structured as follows. Section 2 presents the underlying theory and a brief formalization of the relationship between bilateral trade and BCS. In section 3, we describe the calculations of bilateral trade intensities and BCS. Section 4 develops the econometric strategy and the fifth section presents results and some robustness checks. The last section concludes and provides some critical remarks.

2 The literature debate: divergence or convergence?

The impact of bilateral trade on BCS 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. This specialization desynchronizes output business cycles via different industry-specific supply-shocks. One the other side, some theoretical reasons advocate that more bilateral trade leads to more BCS. First, according to the Keynesian multiplier, business cycles of one country can be transmitted to its trading partner even if countries are differently specialized. For example, if one country experiences a positive supply-shock, it addresses an additional demand to its partner who in turn, increases its supply. Second, Frankel and Rose (1998) argue that industry-specific shocks become more similar and business cycles more correlated when most of trade is intra-industry. They find, on a sample of 21 industrialized countries over 34 years that bilateral trade intensity affects positively BCS. 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 BCS. Business cycles become more desynchronized when countries experience different industry-specific shocks which are more significant when most of trade is inter-industry. Conversely, most intra-industry trade drives aggregate demand shocks and makes industry-specific shocks more analogous and business cycles more similar.

Frankel and Rose's (1998) arguments look relevant for African countries. African manufacturing industries are underdeveloped and Africa exports mainly raw material towards industrialized countries. Subsequently, African bilateral exports are a little processed. For that reason, we can suppose that most of African bilateral trade is intra-industry (which is favorable to BCS) rather than inter-industry (which is against BCS). It seems then logical in an African monetary integration perspective to look for a positive impact of bilateral trade intensity on BCS.

The relationship of bilateral trade on BCS is not clear-cut in economic literature. Whether bilateral trade is mostly intra-industry or inter-industry, the impact is positive or negative. In order to estimate the impact of African bilateral trade on BCS, we built the following equation linking BCS to bilateral trade:

$$Corr_{i,j,\tau} = \phi + \kappa \cdot TI_{i,j,\tau} + \epsilon_{i,j,\tau} \tag{1}$$

Where $Corr_{i,j,\tau}$ is the correlation coefficient of countries' i and j GDP business cycles over the period τ. $TI_{i,j,\tau}$ measures the average of bilateral trade indicator over the period τ and $\epsilon_{i,j,\tau}$ denotes numerous others factors which affect BCS above and beyond the influences of bilateral trade. ϕ and κ are the regression coefficients to be estimated [3]. We are interested in both the sign and the size of coefficient κ. The sign indicates whether the Krugman (1991, 1993) and Eichengreen (1992) specialization effect dominates ($\kappa < 0$) putting forward that more bilateral trade would lead to more idiosyncratic business cycles and hence to lower correlation of economic activity or the Frankel and Rose's (1997, 1998) effect prevails ($\kappa > 0$) suggesting that more bilateral trade would lead to industry-specific shocks that are common across countries. The size quantifies the economic importance of this effect. We now turn to empirical investigation in the next section.

3 Calculations of bilateral trade intensity and business cycles synchronization

To estimate the impact of African bilateral trade intensity on BCS, we build a panel dataset of 1378 pairs (at most) of the 53 African countries over 3 decades (1975-1984, 1985-1994 and 1995-2004).

[3] The estimation of equation (1) is motivated by the lack of data availability of African data on sectoral trade.

3.1 Bilateral trade intensity

We use the International Monetary Fund's bilateral trade database (Direction of Trade 2005) to calculate bilateral trade intensity. We compute two indicators of bilateral trade intensity. The first catches the magnitude of bilateral trade relative to total trade of the pair of countries. We normalize bilateral trade by total trade (denoted TI_1):

$$TI_1 = \frac{X_{i,j,t} + M_{i,j,t}}{X_{i,t} + X_{j,t} + M_{i,t} + M_{j,t}} \tag{2}$$

The second measure TI_2 enables us to take into account the effects of countries' size effects on trade:

$$TI_2 = \frac{X_{i,j,t} + M_{i,j,t}}{Y_{i,t} + Y_{j,t}} \tag{3}$$

Where $X_{i,j,t}$ stands for bilateral exports FOB and $M_{i,j,t}$ for bilateral imports CIF 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 [4]. We compute decade-average bilateral trade intensities for each pair of countries [5]. Descriptive statistics on African bilateral trade intensities are reported in table 1. 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 correlation coefficient equals to 0.9001 and is significant at 1%.

3.2 Business cycles synchronization

We compute countries' GDPs business cycles with the Baxter and King's (1999) linear band-pass filter. We focus on this filter since it was built specifically for business cycles co-movement analysis as implied by Baxter and Kouparitsas (2005) [6] We suppose a common duration for countries' GDPs business cycles going from 8 to 32 quarters i.e. 2 to 8 years as suggested by Baxter and Kouparitsas (2005) and Calderón et al. (2002). Originally Baxter and King (1999) advise a duration from 6 to 32 quarters which means 1.5 to 8 year [7]. For each country, we calculate the cyclical component of the logarithm of the real GDP over the 1975-2004 period. Then by pair, we catch BCS by a simple correlation coefficient over a

[4] FOB for free on board and CIF for cost-insurance-freight.

[5] 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 the trade impact on BCS independently of countries sizes.

[6] 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 take into account the duration and the range of business cycles. The Hodrick and Prescott's (1997) filter is used as robustness check in the section 5.2. Thus, we only describe BCS compute with the Baxter and King's (1999) linear filter.

[7] 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).

decade. We denote this BCS indicator Corr. BP. Descriptive statistics on African BCS are reported in table 1. On average, the correlation coefficient is about 0.0422 [8].

4 Econometric methodology

We use three different techniques to estimate equation (1) linking bilateral trade intensity to BCS: the Ordinary Least Squares (OLS), the Two-Stage Least Squares (2SLS) and the countries-specific fixed effect (FE). We include in all regressions an intercept and dummies decades for 1985-1994, 1995-2004 in order to catch a possible common temporal change across pairs of countries. We also correct estimations for the heteroskedasticity using clustering method because pairs of countries' observations may not be independent throughout decades [9]. Then standard errors reported are clustered by pairs of countries [10]. We first estimate the impact of bilateral trade intensity on BCS using simple OLS. However, the OLS technique maybe inappropriate to identify the impact of bilateral trade intensity on BCS since countries with business cycles highly connected are likely to trade more (or less) during common expansions (or recessions). Furthermore BCS and bilateral trade intensity are positively associated to the adoption of MU. For these reasons, we apply the Two-Stage Least Squares (2SLS) technique to estimate equation (1). Following Frankel and Rose (1998), we use basic variables from the gravity model as instrumental variables of bilateral trade intensities: the logarithm of distance between the pair of countries, a dummy variable for common border and a dummy variable for common language). Since we are using more instrumental variables than endogenous variables we check that instruments collectively capture the independent variation in the right-hand-side variables. We first perform an F-test to make sure that excluded instruments are relevant to bilateral trade intensities at the fist-stage of the 2SLS method. We report the simple partial R^2 and the Shea's (1997) partial R^2 of excluded instruments at the first-stage. We also report the F-stat form of the Cragg-Donald's statistic. This statistic has been suggested by Stock and Yogo (2002) for weak instrument test. The Hansen-Sargan test of overidentifying restrictions, consistent to heteroskedasticity and autocorrelation, checks the validity of excluded instruments. Lastly, the countries-specific FE allows us to overcome a possible bias of omitted variables. In fact, there are not theoretical arguments to explain the BCS with only 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 [11].

[8] For example, Inklaar et al. (2005) use the Hodrick and Prescott's (1997) filter and find on average, a correlation coefficient 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.

[9] 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.

[10] However, we do not correct for the spatial dependencies in computing covariance matrices. The observation of the pair of countries A and B may depend on the observation of the pair of countries B and C.

[11] Moreover 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 Results

5.1 Baseline estimation results

5.1.1 Results

Basic results are presented in table 2. They confirm our intuition. We obtain a positive and significant impact of African bilateral trade intensity on African BCS. More African bilateral trade leads to more BCS which in turn is favorable to monetary integration. The estimated coefficient is significant at the 1% level and equals to 4.45 (for TI_1) and 14.43 (for TI_2) with OLS technique. Coefficients magnitudes are much stronger with 2SLS technique: 6.14 for TI_1 and 18.26 for TI_2. Excluded instruments are all significant at 1% for bilateral trade intensity at the first stage. The logarithm of distance between countries of pair affects negatively bilateral trade intensities while both the dummy variable for common border and the dummy variable for common language increase bilateral trade intensities. The simple partial R^2 and the Shea's (1997) partial R^2 suggest that instruments explain about 20% of the variance of bilateral trade intensities. The Hansen-Sargan's J-statistic feebly accepts the validity of instruments: the null hypothesis is accepted at 19% for TI_1 and 12% for TI_2. The F-test of excluded instruments corroborates this finding. The Cragg-Donald's statistics show that baseline specifications are not affected by weak-instruments problems since 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 countries' fixed effects reduces the sizes of the impact of bilateral trade intensity on BCS: from 6.14 to 2.14 for TI_1 (which remains significant at 10%) and from 18.26 to 7.58 for TI_2 (which remains significant at 5%).

5.1.2 Interpretation of results: the impact of the adoption of monetary union by African pairs of countries

In order to make results economically meaningful, we compute changes of BCS which would result from the adoption of MU by pairs of countries without MU arrangement. We suppose that if a pair of countries forms a MU, then, on average, their bilateral trade intensity would reach the level of bilateral trade intensity between MU's pairs, ceteris paribus. Bilateral trade intensities are four to six times much higher for MUs than others pairs of countries: 0.0042 (against 0.0007 for TI_1) and 0.0016 (against to 0.0003 for TI_2) [12]. 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). The significant impact of bilateral trade intensity on BCS goes from 2.14 to 6.14 with TI_1 and from 7.58 to 18.26 with TI_2. This rise in bilateral trade intensities increases in turn the correlation coefficient of countries' GDP business cycles from 0.0075 to 0.0215 (when using TI_1) and from 0.0099 to 0.0237 (when using TI_2) [13]. The synchronization level rises from 0.0403 to 0.0478 (0.0403 + 0.0075) or to 0.0618 (0.0403 + 0.0215) when using TI_1 and from 0.0403 to 0.0502 (0.0403 + 0.0099) or to 0.0640 (0.0403 + 0.0237) when using TI_2. These modifications are important in terms

[12] See Table 1, p. 10 for calculations.

[13] 0.0075 = 0.0035*2.14 and 0.0215 = 0.0035*6.14
0.0099 = 0.0013*7.58 and 0.0237 = 0.0013*18.26

of percentage change from 18.6% to 53.3% with TI_1 and from 24.6% to 58.8% with TI_2. If African countries adopt common currency, it could lead to a gain in BCS from 18.6% to 58.8%. However, because of the low level of initial BCS, changes remain small.

5.2 Robsutness checks

We apply various robustness checks to validate our estimates.

The first robustness test is whether the impact of bilateral trade intensity on BCS is a direct or conditioning phenomenon of MU membership (see table 3). We obtain no direct effect of MU on BCS since the associated coefficient is not significant. We also find that the impact of TI_1 on BCS is strengthened by MU membership while the effect of TI_2 is not. Those results seem to be, at best, puzzling and not clear-cut. Our interpretation is that there is no clear evidence of direct and conditioning effects of MU membership. These findings support the Fielding and Shields's (2005a and 2005b) and the Baxter and Kouparitsas's (2005) results.

We also verify the validity of our baseline results as we control for multilateral trade and monetary and fiscal policies coordination (a multivariate approach). Results are reported in table 4. We find that the impact of multilateral trade is negative and significant (except when we use countries' fixed effects technique). Fiscal policies similarity is no longer significant effect on BCS while the coordination of monetary policies increases significantly the BCS. Above all, our bilateral trade intensity indicators still have a positive and robust effect on BCS.

The last robustness check is about the choice of the filter. We apply the Hodrick and Prescott's (1997) filter (HP filter) to compute GDP business cycles. We then follow Ravn and Uhlig (2002) by setting $\lambda = 6.25$ for annual data. We re-estimate equation (1) by changing the BCS measure (see table 3). Correlation coefficient between the HP filter measure and the Baxter and King's (1999) filter measure is about 0.8251 and is statistically robust at 1% (see table 1 for a description of BCS throughout decades and across MU membership with the HP filter). The impact of bilateral trade intensity remains positive but is only significant with OLS estimates while the impact of multilateral trade does not change (results not shown). The use of HP filter reduces the robustness of our estimates but we are still confident about the relevance of ours results using the Baxter and King's (1999) filter which is two-side filter (i.e. the band-pass filter identifies both short and long cycles) and was built in order to analyze business cycles synchronization (see Baxter and Kouparitsas 2005). Controlling for the effect of MU membership and multilateral trade and the use of an alternative filter do not change much the impact of bilateral trade intensity on BCS.

6 Concluding remarks

This paper argues that the impact of African bilateral trade on BCS over the 1975-2004 period is positive and robust. We check whether this effect is not driven by MU membership specifically, by the impact of multilateral trade or by the filtering technique. We have moreover tried to provide more economic interpretation of our estimates by assuming the adoption of MU arrangement by African countries that are not and by computing BCS changes. Fig-

ures show important relative gains between 18.6% and 58.8% but the synchronization levels still remain low. The impact of bilateral trade on BCS might be more important since we only use official IMF's trade data which underestimate 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.

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 the African monetary integration. More trade thus brings African business cycles closer together and could add force to various projects of monetary integration in progress. Finally, we are aware that these results do not take into account others possible controls mentioned in recent papers such as similarity of trade and of productive structure (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. It provides some insights on the fact that African MUs could be self-validating through bilateral trade.

References

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

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

Baxter, M., and M. A. Kouparitsas (2005): "Determinants of Business Cycle Co-movement: a robust analysis," *Journal of Monetary Economics*, 52(1), pp. 113–157.

Calderón, C., A. Chong, and E. Stein (2002): "Trade Intensity and Business Cycle Synchronization: Are Developing Countries Any Different?," Working Papers Central Bank of Chile 195, Central Bank of Chile.

Darvas, Z., A. K. Rose, and G. Szapáry (2005): "Fiscal Divergence and Business Cycle Synchronization: Irresponsibility is Idiosyncratic," NBER Working Papers 11580, National Bureau of Economic Research, Inc.

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

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

Fidrmuc, J. (2005): *Prospects For Monetary Unions after the Euro*.chap. The Endogeneity of the Optimum Currency Area Criteria and Intra-industry Trade: Implications for EMU Enlargement, pp. 55–76. in De Grauwe, Paul and Mélitz, Jacques.

Fielding, D., K. Lee, and K. Shields (2004): "The Charasteristics of Macroeconomic Shocks in the CFA Franc Zone," *Journal of African Economies*, 13(4), 488–517.

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

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

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

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

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

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

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

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

Inklaar, R., R. Jong-A-Pin, and J. de Haan (2005): "Trade and Business Cycle Synchronization in OECD Countries - a Re-examination," CESifo Working Paper Series 1546, CESifo GmbH.

Krugman, P. (1991): *Geography and Trade*. MIT Press, Cambridge.

——— (1993): *The Transition to Economic and Monetary Union Europe*chap. Lessons of Massachusetts for EMU, pp. 241–61. New York: Cambridge University Press.

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

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

Ravn, M. O., and H. Uhlig (2002): "On adjusting the Hodrick-Prescott filter for the frequency of observations," *The Review of Economics and Statistics*, 84(2), 371–375.

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

Shea, J. (1997): "Instrument Relevance in Multivariate Linear Models: A Simple Measure," *The Review of Economics and Statistics*, 79(2), 348–52.

Stock, J. H., and M. Yogo (2002): "Testing for Weak Instruments in Linear IV Regression," NBER Technical Working Papers 0284, National Bureau of Economic Research, Inc.

Yehoue, E. B. (2005): "International Risk Sharing and Currency Unions: The CFA Zones," IMF Working Papers 05/95, International Monetary Fund.

Table 1: Descriptive statistics: business cycles synchronization, trade intensity and total trade.

Variables	Mean						Minimum	Maximum	Number of observations
	Total	1975-1984	1985-1994	1995-2004	MUs	Others			
Corr. BP	0.0422	0.0004	0.0844	0.0340	0.0853	0.0403	-0.7454	0.7893	3170
			(0.00)	(0.00)	(0.04)				
Corr. HP	0.0565	0.0119	0.0935	0.0583	0.1147	0.0548	-0.7941	0.8554	3421
			(0.00)	(0.01)	(0.07)				
TI_1	0.0009	0.0007	0.0008	0.0012	0.0042	0.0007	0	0.0761	2310
			(0.43)	(0.04)	(0.00)				
TI_2	0.0003	0.0003	0.0003	0.0005	0.0016	0.0003	0	0.0189	2610
			(0.38)	(0.01)	(0.00)				

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. Corr. BP denotes BCS compute with the Baxter and Kouparitsas's (2005) (2,8) filter, Corr. HP represents the Hodrick and Prescott's (1997) ($\lambda = 6.25$) filter,TI_1 bilateral trade intensity relative to total trade and TI_1 bilateral trade intensity relative to total output.

Table 2: Trade intensity and Business Cycles Synchronization: Baseline estimations.

	Dependent Variable: Corr. BP					
	OLS	2SLS	FE	OLS	2SLS	FE
TI_1	4.45***	6.14*	2.14*			
	(1.45)	(3.43)	(1.24)			
TI_2				14.43***	18.26*	7.58**
				(4.00)	(9.53)	(3.26)
		First-Stage			First-Stage	
Log. Distance		-0.0009***			-0.0004***	
		(0.0002)			(0.0000)	
Border		0.0041***			0.0012***	
		(0.0010)			(0.0003)	
Language		0.0007***			0.0002***	
		(0.0002)			(0.0000)	
F-test of excluded		F(3, 871) = 12.95			F(3, 924) = 17.29	
instruments		p = 0.00			p = 0.00	
Shea's (1997) partial R^2		0.20			0.21	
Partial R^2		0.20			0.21	
Hansen-Sargan's		$\chi(2) = 3.27$			$\chi(2) = 4.26$	
J-statistic		p = 0.19			p = 0.12	
Cragg-Donald's stat.		169.39			207.90	
Critical value		22.30			22.30	
R^2	0.02	0.02	0.11	0.02	0.02	0.11
Observations	2016	2016	2016	2349	2349	2349
Pairs of countries	872	872	872	925	925	925

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". 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. The Hansen-Sargan test of overidentifying restrictions, consistent to heteroskedasticity and autocorrelation, checks the validity of excluded instruments. 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). Clustered robust standard errors in parentheses. * significatif à 10; ** significatif à 5%; *** significatif à 1%.

Table 3: Monetary union, trade intensity and Business Cycles Synchronization.

	Dependent Variable: Corr. BP				
	FE				
	(1)	(2)	(3)	(4)	(5)
TI_1		2.10		1.06	
		(1.29)		(1.55)	
TI_2			7.77**		5.51
			(3.40)		(3.80)
TI_1*MU				6.21*	
				(3.48)	
TI_2*MU					12.51
					(9.11)
MU	0.03	0.00	-0.01	-0.02	-0.02
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
R^2	0.09	0.11	0.11	0.11	0.11
Observations	3170	2016	2349	2016	2349
Pairs of countries	1277	872	925	872	925

Notes: All regressions include an intercept and decade-specific dummies (1985-1994, 1995-2004) and corrected for the heteroskedasticity with clusters method. MU denotes a dummy variable MU taking value 1 when pair of the countries form a monetary union. OLS for Ordinary Least Squares, 2SLS for Two-Stage Least Squares (2SLS) and FE for the countries' specific "fixed effect". Clustered robust standard errors in parentheses. * significatif à 10; ** significatif à 5%; *** significatif à 1%.

Table 4: Trade intensity, multilateral trade, policies coordination and business cycles synchronization.

	Dependent Variable: Corr. BP					
	OLS	2SLS	FE	OLS	2SLS	FE
TI_1	3.56**	6.88**	2.05			
	(1.68)	(3.34)	(1.52)			
TI_2				13.95***	18.60**	9.32**
				(4.99)	(9.12)	(3.90)
TT	-0.10***	-0.10***	-0.03	-0.10***	-0.10***	-0.01
	(0.03)	(0.03)	(0.09)	(0.03)	(0.03)	(0.08)
Corr. Fiscal	0.01	0.01	0.01	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Corr. Monetary	0.04*	0.04*	0.04*	0.04*	0.04*	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
		First stage			First stage	
Log. Distance		-0.0010***			-0.0004***	
		(0.0003)			(0.0001)	
Border		0.006***			0.0020***	
		(0.0015)			(0.0003)	
Language		0.0006**			0.0002*	
		(0.0003)			(0.0001)	
F-Test of excluded		F(3, 711) = 10.35			F(3, 718) = 16.86	
instruments:		p = 0.0000			p = 0.0000	
Shea's (1997) partial R^2		0.24			0.28	
Partial R^2		0.24			0.28	
Hansen-Sargan's		$\chi(2) = 2.17$			$\chi(2) = 2.65$	
J-statistic		p = 0.34			p = 0.27	
Cragg-Donald Stat.		133.24			194.45	
Critical value		22.30			22.30	
R^2	0.02	0.02	0.15	0.02	0.02	0.15
Observations	1253	1253	1253	1260	1260	1260
Pairs of countries	712	712	712	719	719	719

Notes: See Table 2, p. 11 for notes. Clustered robust standard errors in parentheses. * significatif à 10; ** significatif à 5%; *** significatif à 1%.

Table 5: Trade intensity and Business Cycles Synchronization: Hodrick and Prescott's (1997).

	Dependent Variable: Corr. HP					
	OLS	2SLS	FE	OLS	2SLS	FE
TI_1	4.04**	6.15	1.19			
	(1.69)	(3.78)	(1.49)			
TI_2				13.86***	15.90	4.79
				(4.80)	(10.92)	(3.83)
R^2	0.01	0.01	0.12	0.01	0.01	0.12
Observations	2190	2190	2190	2511	2511	2511
Pairs of countries	910	910	910	964	964	964

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". See table 2, p. 11 for 2SLS notes (we do not present first-stage in this table because it is exactly the same as table 2). Clustered robust standard errors in parentheses. * significatif à 10; ** significatif à 5%; *** significatif à 1%.