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**Are There Spatial Dependence effects on Credit Distribution  
in a Monetary Union?**

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*Abstract:* This study investigates the effects of spatial autocorrelation on banking credit distribution in West African Economic and Monetary Union. We used spatial panel fixed effect techniques to make sure that the regional effects highlighted are independent of potential heterogeneity or effects of omitted variables within this monetary union. Also, we check for panel data unit root that allow for cross-sectional correlation due to the presence of international common factor. Our results underline the importance of spatial dependence effects in the estimation of credit distribution.

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## **Are There Spatial Dependence effects on Credit Distribution in a Monetary Union?**

### **II : Introduction**

For the past three decades, the main debate related to the growth financing in Least Developed Countries (LDC) concerns banking credit distributions. In their seminal works, McKinnon (1973) and Shaw (1973) noted that it is less a question of lack of financial resources than a matter of financial distortions caused by the regulation of the interest rates in LDC. When these constraints are so severe that the financial intermediations are functioning under their potential, it appears the well known financial repression. Regarding to this paradigm, an interest rate control policy reduces the rate of return on bank deposits and discourages financial saving. Therefore, the banking intermediation becomes ineffective and the capital accumulation is slowed down (fry, 1995). In the McKinnon-Shaw framework, the solution is to implement financial liberalization reforms that allow banks to price their intermediation services with respect to their charges and/or risky activities. As a result, a high and positive real interest rate served on bank deposits will increase the financial saving and enhance the financial intermediation. Finally, the resulting additional investment will raise the level of the per-capita income related to the economic activity.

Meanwhile, the results of this widely dominating paradigm were under the expectation (Mahar and Williamson, 1998). The neo-structuralisms demonstrated that the financial liberalization policies mistreated the impact of the environment, in particular the segmentation of the financial system. Van Wijnbergen (1983) showed that an increase of the deposit interest rate by affecting the volume on lending funds on the unofficial sector could reduce the total volume of credits in the economy. Furthermore, the perverse consequences of imperfect information (moral hazard, adverse incitation) as an issue of the competition between financial intermediaries were underestimated (Stiglitz, 1994). The financial liberalization can increase the vulnerability to exogenous shocks in countries with important disequilibrium or when the financial sector is weak in terms of risk management, prudential regulation and supervision (Amable and Chatelain, 1995).

Finally, according to the literature it appears the necessity to take into account the characteristics of the financial systems, in particular the organization and the environment.

Hellmann, Murdock and Stiglitz (1997) among others established that under certain characteristics of the financial system (in particular imperfect information), the intervention of the governments can be justified in the way of Market Enhancing View. In what they call financial restraint policies, they suggest a set of incentive measures designed to create rents that banks can only capture if they are engaged in viable intermediation activities. By this way, the banking system can promote financial deepening without taking excessive risk by gambling or looting.

Several empirical studies attempted to evaluate the impacts of financial reforms on banking intermediation in LDC (Fry 1995, Mahar and Williamson, 1998) but by now it seems that the debate is not yet conclude. In this study, we discuss on empirical issues concerning banking credits distribution (CD) in West African Economic and Monetary Union (WAEMU)<sup>1</sup> taking into account spatial dependence effects. In fact, when banks are submitted to the same legal and administrative controls, it is noteworthy to ask about the impacts of their geographical localization in the supply of credits in the different countries, independently of their economic characteristics. Hence, by using spatial panel fixed effect techniques (Elhorst, 2003), we are more confident that the regional effects are independent that potential heterogeneity or effects of omitted variables within this group of countries. To the best of our knowledge, this is the first empirical research accounted for fixed effect panel data spatial autoregressive lag model and/or fixed effect panel spatial error autocorrelation model in the context of WAEMU<sup>2</sup>. The paper is organized as follows. In section 2, we present a description of banking financial intermediation. The Section 3 introduces the methodology related the panel data spatial autocorrelation models applied to our analysis. We discuss the results in Section 4 before we conclude.

### **III : Banking organisation in WAEMU: A Rationale for spatial dependence analysis**

The banking financial intermediation activities in West African Economic and Monetary Union are supervised by the Board of directors of the Central Bank of West African States (CBWAS) through the *Banking Law of the Union*<sup>3</sup> (BLU) adopted in October 1990. The BLU specifies the principles of the banking organization as well as the sanctions when a

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<sup>1</sup> WAEMU, composed by Benin, Burkina, Guinea-Bissau (since 1997), Ivory Coast, Mali, Niger, Senegal and Togo, is the West African zone franc monetary area. The common currency is the Franc CFA which had a fixed parity with the Euro. Thereafter, we excluded Guinea because its recently membership in the monetary union (1997).

<sup>2</sup> Similar studies are related to the convergence in Europe (Arbia, 2004).

<sup>3</sup> In French, « la loi bancaire de l'Union ».

bank breaks the law in particular concerning the prudential regulation. According to the principle of the *Single Approval Principle*<sup>4</sup> adopted in January 1999, it is important to note that any credit institution duly approved in one of the States is automatically authorized to carry on its activities in the other member states without having to request a new approval.

More specifically the banking system was progressively liberalized in 1989 and 1993. The CBWAS modified its policy of credit refinancing in October 1989 with the aim to stop the privileged financing of the economics activities by replacing the two principal rates by a single rate named normal discount rate. In order to allow more flexibility to the banking refinancing, the CBWAS sets up a purchase and resale agreement rate<sup>5</sup> which is fixed between the money market rate and the normal discount rate in 1993. The administrative controls on interest rates were progressively removed with the suppression of the loan rate floors in 1989 and the loan rate caps in 1993. This measures was accompanied the same year by the suppression of directed credit programs and the replacement of credits control measures by reserves requirements. All the financial conditions of deposits remunerations were liberalized in 1993 except for private demand deposits (for a short-term and from amount lower than 5,000,000 Francs cfa) and for contractual placements (mainly passbook saving accounts). Furthermore, several measures were taken to improve the functioning of the common money market.

Since the first important financial reforms of 1989, the most important increase of overall bank deposits was observed in Mali, with an annual growth rate of 12.7% per year during the period 1989-2002, while the weak performance was recorded in Niger with a fall of -0.1% in the same period. Specifically, as reported in the Table 1, the time deposits growth rate were inferior than the demand deposits growth rate, except in Benin. Perhaps the non-financial agents have privileged the short-time because the confidence in the banking system is not full recovered after some disastrous experiences of the general banking systems bankrupts in the eighties<sup>6</sup>. The first observation concerning the bank assets is the increase of the short-term credits in the monetary area at a higher rate in 1989-2002 than during the period preceding the reform (1980-1989), except in Burkina, Ivory Cost and Togo. The second observation is that after the financial liberalization (1989-2002) the medium and long time credits (MLT) increased less rapidly than the shirt-time credits. The

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<sup>4</sup> in French, it is said "*le principe de l'agrément unique*".

<sup>5</sup> In French, it is said "*taux de prise en pension*".

<sup>6</sup> For example, the majority of Saving institutions closed in the first part of the eighties.

importance of the short-term credits would be explained by the limited capacities of credits absorption in WAEMU and the banks' behaviour facing to the risk. Indeed, when banks evolved in a risky environment and faced to an important risk of default, they have privileged a short-time commitment<sup>7</sup>.

Table 1: Banking financial intermediation in West African Economic and Monetary Union

|             | Short-time credits |           | Medium and Long time credits |           | Demand deposits |           | Time deposits |           |
|-------------|--------------------|-----------|------------------------------|-----------|-----------------|-----------|---------------|-----------|
|             | 1980-1989          | 1989-2002 | 1980-1989                    | 1989-2002 | 1980-1989       | 1989-2002 | 1980-1989     | 1989-2002 |
| Benin       | -1.88              | 8.21      | 10.72                        | 2.81      | 4.87            | 12.81     | 2.41          | 15.79     |
| Burkina     | 10.91              | 7.75      | 8.61                         | 2.78      | 10.14           | 9.24      | 17.39         | 9.15      |
| Ivory Coast | 5.02               | 0.54      | -1.27                        | 0.30      | 1.29            | 6.39      | 10.68         | 4.62      |
| Mali        | -8.85              | 18.49     | 8.77                         | 5.57      | 11.15           | 13.15     | 28.60         | 11.96     |
| Niger       | -2.84              | 1.67      | 8.77                         | -10.42    | 3.66            | 1.51      | 16.14         | -1.79     |
| Senegal     | 2.96               | 3.47      | 12.93                        | 3.17      | 4.75            | 8.65      | 14.84         | 8.66      |
| Togo        | 1.61               | 1.31      | 11.67                        | 2.81      | 4.78            | 5.55      | 19.05         | 0.31      |

Sources: Based on International Financial Statistics Cd-Rom Database (2004).

However, the most important characteristic of the banking systems is certainly the strong concentration of financial intermediaries in some countries. Although the banks are submitted to same legal and administrative controls, the banking network is very unequally developed (Table 2). For example, since 1993, the banks in activity in Ivory Coast (near the quarter of all the Union in the ten past years) controlled on average more than 40% of the total banking financial intermediation (deposits and credits). The banking financial intermediations performed in 2002, ranged from 2.7% in Niger to 22.6% in Senegal.

Table 2: Banking systems characteristics in West African Economic and Monetary Union

|             | Number of banks <sup>1</sup> |      | Assets balance <sup>1</sup> |      | Financial intermediation <sup>2</sup> |      |
|-------------|------------------------------|------|-----------------------------|------|---------------------------------------|------|
|             | 1993                         | 2002 | 1993                        | 2002 | 1993                                  | 2002 |
|             | Units                        |      | %                           |      | %                                     |      |
| Benin       | 6                            | 7    | 8.1                         | 9.9  | 6.6                                   | 8.5  |
| Burkina     | 11                           | 12   | 6.5                         | 9.8  | 6.1                                   | 9.3  |
| Ivory Coast | 19                           | 20   | 46.2                        | 36.7 | 50.0                                  | 40.3 |
| Mali        | 7                            | 13   | 0.0                         | 13.5 | 6.1                                   | 12.1 |
| Niger       | 8                            | 8    | 3.9                         | 2.9  | 4.2                                   | 2.7  |
| Senegal     | 13                           | 14   | 20.6                        | 21.7 | 20.9                                  | 22.6 |
| Togo        | 9                            | 11   | 7.0                         | 5.3  | 6.2                                   | 4.5  |

Sources: 1. Annual Reports, Commission Bancaire; 2. ISF Cd-Rom database.

<sup>7</sup> See Freixas and Rochet (1998) for an extensive development about bank's behavior in a risky environment.

This banking concentration emphasizes the importance of geographical localization of banks within WAEMU and may be its consequence in term of financial deepening. Indeed, in 2002, there were 34 foreign and regional banks over the 86 in activity<sup>8</sup>. For instance, the *Société Générale* network, a French foreign bank present in five countries, served 18.7% of the clients and represented 15.6% of the total assets of banks (Table 3). In fact, the related question is to know how a supply of credits in Ivory Coast can affect the credit distribution in Niger, in particular when a same bank is established in the two countries.

Table 3: Foreign and regional banks networks, 2002

|                  | BENIN | BURKINA | IVORY<br>COAST | MALI | NIGER | SENEGAL | TOGO | TOTAL | Share of<br>total bank<br>assets in<br>WAEMU | Share of<br>total<br>customers<br>accounts in<br>WAEMU |
|------------------|-------|---------|----------------|------|-------|---------|------|-------|--|--|
| Société Générale |       | 1       | 3              |      |       | 1       |      | 5     | 15.6%  | 18.7%  |
| BNP Paribas      |       | 1       | 3              | 1    |       | 1       | 1    | 7     | 13.2%  | 19.3%  |
| Bank Of Africa   | 2     | 1       | 1              | 2    | 1     | 1       |      | 8     | 8.7%   | 9.3%   |
| Ecobank          | 1     | 1       | 1              | 1    | 1     | 1       | 1    | 7     | 8.1%   | 3.8%   |
| Belgolaise       |       |         | 1              |      | 1     |         | 1    | 3     | 6.0%   | 2.6%   |
| Crédit Lyonnais  |       |         | 1              |      |       | 1       |      | 2     | 4.9%   | 5.0%   |
| Citibank         |       |         | 1              |      |       | 1       |      | 2     | 4.1%   | 0.1%   |
| Total            | 3     | 4       | 11             | 4    | 3     | 6       | 3    | 34    | 60.5%  | 58.9%  |

Sources: 1. Commission Bancaire, Annual Report 2002.

The foundations that drive such consideration are presented by Brueckner (2003). The author defines a spatial reaction function that explains how a decision for an economic agent depends on the importance of decisions takes by other agents. On this basis, he develops two theoretical models for these strategic interactions. The first framework is referred as a spillover model. Although a given agent chooses the level of realization for a decision variable, its objective reaction function is affected by the values of the realization chosen by the other agents. The second framework, called the resource flow model, is illustrated by an indirect effect of the chosen value of the realization of the decision variable by the other agents. In resource flow model, the principal interaction between a given agent and the other is a consequence of the resources distributed among them with

<sup>8</sup> The majority are branches of French banks (*Société Générale*, *BNP-Paribas* and *Crédit-Lyonnais*), Belgian (*Belgolaise*), American (*Citibank*, *Bank of Africa*) and West African regional group (*Ecobank*).

taking into account the characteristics and the decisions taken by each of them. Without loss of generalities, the equilibrium solution for a given agent in these two models is given by a reaction function depending on its own characteristics and the value of the realization of the decision variable chosen by the other agents. The spatial models are derived by restricting the set of the interacting agents to an arrangement of the regional units and specifying a linear functional form for the reaction function (Anselin, 2003). In our case, the interacting agents are banks in their role of credit distribution intermediaries in WAEMU.

#### **IV : Modelling spatial dependence effects**

##### **IV. 1 : Data set**

Our empirical framework is derived from Demetriades and Luintel (1997). An indicator of financial deepening is regressed on a wealth indicator and a set of variables that captured the financial policy impacts.

Among the standard measures suggested by King and Levine (1993), we retained as dependant variable the logarithm of the ratio of banking credits served to the private sector on gross domestic product (LFDV). The logarithm of real GDP per capita is used to measure the level of income (LTYH) with an expected positive effect. As we supposed that the financial reforms can affect the credit distribution by several channels, two variables are took into account. The first variable is supposed to capture the cost of the banking financing. The best measure is maybe the debtor interest rate but the lack of long time series conducted us to use as a proxy the real discount rate (RIR)<sup>9</sup>. This indirect effect of financial reforms is expected to be negative since a high level of RIR must discourage to borrow from banking system as the banks will shift the discount rate increase on the debtor interest rate. As second variable, we created a financial policies indicator (DEPF) following the methodology proposed by Arestis and Demetriades (1997) to capture the direct effect of financial reforms. DEPF is a synthetic indicator, which summarizes the joint influence of the various types of financial policy based on the principal components

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<sup>9</sup> RIR is calculated from discount rate and the current rate of inflation given the Fisher's relation Thus the inflation expectations are assumed to be static.



pondered by their respective proportional weight<sup>10</sup>. The expected impact can be negative or positive. The first case occurs in accordance with the McKinnon-Shaw financial liberalization framework: more financial liberalization (i.e. a decrease of DEFP) is supposed to increase credit distribution. Contrariwise, a positive impact means that these kind of reforms have impeded the banking credit to private sector as predicted by neo-structuralists or by the financial constraint approaches.

The generic functional form of our credit distribution equation is as follow:

$$LFDV_{it} = \beta_1 LTYH_{it} + \beta_2 RIR_{it} + \beta_3 DEFL_{it} + \varepsilon_{it} \quad \text{eq. 1}$$

with  $N$  regions ( $i = 1, \dots, N$  naming spatial units) and  $T$  time periods where  $\varepsilon_{it}$  is the disturbance assumed to be normally distributed with zero mean ( $E(\varepsilon_{it}) = 0$ ) and to have constant variance ( $E(\varepsilon_{it}^2) = \sigma^2 I_N$ ). LFDV, LTYH and the nominal discount rate are from IMF International Financial Statistics Database; we have calculated RIR and DEPF. The data set concerns seven of the eight countries of the WAEMU, except Guinea, over the period 1970-2002.

#### IV. 2 : The panel data Spatial dependence models

The spatial arrangement that characterizes the banking network is defined by the weighted bilateral distances (BWD) provided by Clair and al. (2004). The BWD are calculated from the inter-city distances between the biggest cities in the two countries weighted by the proportion of the population of the city and the sensitivity of the trade flows to bilateral distances. They are presented as a  $N \times N$  spatial weight matrix,  $W$ , with  $w_{i,j}$  its  $(i, j)^{th}$  element ( $i, j = 1, \dots, N$ ).

Our estimation framework is as follow. In a first step, we estimate a ‘traditional’ fixed effect model (FE-OLS) that is to say without spatial consideration (equation 1). Then, we

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<sup>10</sup> Each type of financial policy is codified through a dummy variable that takes the value 1 if a control exists and 0 otherwise. The proportional weight of a principal component is obtained by the ratio of its contribution in explaining the variation of the policy variables in the total of the variation and so on for the seven other principal components retained. For our concern, we identify 12 relevant issues of financial policy related to the interest rate controls, the reserve requirements and the directed credit programs. Meanwhile, as these countries have a common monetary and financial policy, we include two others indicators to differentiate the direct impact indicator in each country: the ratio of broad money that allows to take into account the relative performance of the payment system (King and Levine, 1993) and the ratio of foreign reserves which permit to consider the appropriate coverage of monetary creation by the foreign reserves. DEPF incorporates the seven largest principal components, which account for 99% of the overall variation underlying policies variables.

check for the presence of spatial autocorrelation given the Lagrange Multiplier test based on the Ordinary Least-Square residuals (LMsem) as proposed by Anselin (1988):

$$LMsem = \frac{1}{tr(W + W') \cdot W} \cdot \left( \frac{\hat{\varepsilon}'W\hat{\varepsilon}}{\sigma^2} \right)^2 \quad \text{eq. 2}$$

$\rightarrow \chi^2(1)$

where  $\hat{\varepsilon}$  represents the FE-OLS residuals and W the spatial weight matrix. In case of rejection of the null hypothesis of no-spatial dependence, the second step would be to correct these spatial dependence nuisances. Among the several ways to include these spatial dependences in an econometric estimation (Anselin and Bera, 1998), we estimated a fixed effect spatial error model (FE-SEM) and a fixed effect spatial autoregressive model (FE-SAR). Following the estimation framework proposed by Elhorst (2003), the FE-SEM equation that correct spatial dependence in the residuals is as:

$$LFDV_{it} = \beta_1 LTYH_{it} + \beta_2 RIR_{it} + \beta_3 DEFL_{it} + \varphi_{it} \quad \text{with} \quad \varphi_{it} = \delta W \varphi_{it} + \varepsilon_{it} \quad \text{eq. 3}$$

We also try to correct the spatial dependence nuisance by including a spatially lagged independent variable in eq. 1 since these noises can be a consequence of a missing variables (Anselin, 1988). Such FE-SAR process is presented as:

$$LFDV_{it} = \rho W LFDV_{it} + \beta_1 LTYH_{it} + \beta_2 RIR_{it} + \beta_3 DEFL_{it} + \varepsilon_{it} \quad \text{eq. 4}$$

To detect if the spatial dependence still exist we implement the Lagrange Multiplier Spatial Autoregressive Model test (LMsar) based on the FE-SAR residuals as proposed by Anselin (1988). The statistic of the test is as follow:

$$LMsar = \frac{\hat{\varepsilon}'W\hat{\varepsilon}}{\hat{\sigma}^2 \left[ tr(W \cdot W + W'W) - \left( tr(W \cdot WA^{-1} + W'WA^{-1}) \right)^2 \text{var}(\hat{\rho}) \right]} \quad \text{eq. 5}$$

$\rightarrow \chi^2(1)$

where  $A = (I_n - \hat{\rho}W)$  and  $\text{var}(\hat{\rho})$  is the maximum likelihood estimate of the variance of the spatial parameter ( $\hat{\rho}$ ) in the eq. 4. The null hypothesis is no spatial correlation in the residuals of FE-SAR model.

In practice, a fixed effect model can be estimate by OLS with variables taken in deviation of their average in time and then eliminating the intercept term (Baltagi, 2001). However,

in the presence of spatial autocorrelation, the most related literature use the maximum likelihood technique to estimate the equation with demeaning the variables (for eliminating the specific effect) as specified by Elhorst (2003).

Beforehand we have to test the order of integration of the variables. We implement panel data unit root tests that allow for cross-sectional correlation due to the presence of common factors because it's “ (...) a genuine economic issue linked to the importance of international, regional, sectorial or individual dependencies in the dynamics”<sup>11</sup>. For this purpose, we perform the cross-sectional Augmented Im Pesaran Shin panel data unit root test proposed by Pesaran (2003)<sup>12</sup>. The test is based on the estimated idiosyncratic component of a panel data series. Indeed, the author considers a dynamic linear heterogeneous panel model and assumes that the error terms have an unobserved one-common-factor structure accounting for cross-sectional correlation and an idiosyncratic component. Considering that last process, the author estimates a standard augmented Dickey-Fuller regression with cross-sectional averages of lagged levels and first differences of the individual series. From this estimation, he derives the individual cross-sectionally augmented Dickey-Fuller statistic noted  $t_i(N, T)$ . The cross-sectional augmented Im, Pesaran and Shin test is based on a modified  $t - bar$  statistic (noted CIPS), which is a simple average of the individual cross-sectionally Augmented Dickey-Fuller statistics:

$$CIPS = \frac{1}{N} \sum_{i=1}^N t_i(N, T) \quad \text{eq. 6}$$

The asymptotic distribution of the modified t-statistic is free of nuisance parameter as  $N \rightarrow \infty$  and for any fixed  $T > 3$ . The inference about a non-stationary process (the null hypothesis) can be done from the simulated critical value of CIPS for various sample sizes.

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<sup>11</sup> Hurlin (2004), p.3.

<sup>12</sup> For a comprehensive survey of these tests, see Hurlin *op. cit.* The paragraph is significantly relied on his paper.

**V : The results**<sup>13</sup>

Table 4 reports the panel data unit root tests result<sup>14</sup>. From the CIPS-test, LFDV and DEFL appear to be not stationnaries at the level of 5%. Consequently, we suspected the logarithm of the ratio of credit on GDP and the direct impact of financial indicator to contain an unit root. The same panel data unit root test on the first difference of LFDV and DEFL (respectively dLFDV and dDEFL) indicated that these variables are stationnaries at 1%. According to our panel data unit root test results, the per capita growth rate (TYH) and the real discount rate (RIR) are both stationnaries in level.

Table 4: Pesaran (2003) Panel data unit root tests

|                | <b>LFDV</b> | <b>dLFDV</b> | <b>DEFL</b> | <b>dLFDV</b> | <b>TYH</b> | <b>RIR</b> |
|----------------|-------------|--------------|-------------|--------------|------------|------------|
| CIPS           | -2.32       | -5.51*       | -2.23       | -3.30*       | -5.87*     | -5.45*     |
| <i>p-value</i> | [0.06]      | [0.01]       | [0.10]      | [0.01]       | [0.01]     | [0.01]     |

\* (respectively \*\*): significant at 1% (respectively 5 %).

The spatial dependence tests results are summarized in Table 5. The Lagrange Multiplier test on the Ordinary Least-Square residuals (LMsem) leads to reject the null hypothesis of no spatial correlation at 95% level of confidence. In other words, the FE-OLS estimation exhibits significant spatial correlation in the residuals. The estimated coefficient of the spatially correlated errors ( $\delta$ ) in the fixed effect spatial error model estimation (eq. 3) appears significantly with 99% level of confidence. The Lagrange Multiplier test conducted on the fixed effect spatial autoregressive residuals comes out with a marginal probability of 0.34 indicating that we cannot reject the null hypothesis of no spatial dependence in the residuals of eq. 4. In addition, the estimated coefficient of the spatially lagged dependent variable ( $\rho$ ) in FE-SAR is strongly significant with 99% level of confidence. At last, the CIPS unit root test conducted on the residuals of both fixed effect spatial error model and fixed effect spatial autocorrelation equation shown that the residuals are stationnaries.

<sup>13</sup> The CIPS test is conducted from programs provided by Hurlin C and the spatial regression were achieved with the programs provided by Elhorst on their respective web site. We adapted the Lagrange multiplier tests from Elhorst's programs and Lesage's Matlab Spatial estimation Toolbox. All the programs used are available upon request

<sup>14</sup> The maximum lag order allowed in the Augmented Dickey-Fuller representation is two.

Table 5: Fixed effect spatial panel data Estimation results

| Dependent variable:         | dLFDV   |   |   |
|-----------------------------|---|---|---|
|                             | Fixed effect Ordinary<br>Least Square<br>(FE-OLS) | Fixed effect Spatial<br>Auto-Regressive<br>(FE-SAR) | Fixed effect spatial<br>error model<br>(FE-SEM) |
| TYH                         | -0.254<br>[0.25]                                  | -0.275<br>[0.18]                                    | -0.318<br>[0.11]                                |
| RIR                         | 0.249<br>[0.09]                                   | 0.238<br>[0.08]                                     | 0.384*<br>[0.02]                                |
| dDEFL                       | 0.235*<br>[0.00]                                  | 0.176*<br>[0.00]                                    | 0.247*<br>[0.00]                                |
| Rho                         |   | 0.396*<br>[0.00]                                    |   |
| Delta                       |   |   | 0.434*<br>[0.00]                                |
| Lagrange Multiplier (LMsem) | 5.128*<br>[0.02]                                  |   |   |
| Lagrange Multiplier (LMsar) |   | 0.907<br>[0.34]                                     |   |
| R <sup>2</sup>              | 0.10  | 0.22  | 0.24  |
| CIPS                        |   | -5.516*<br>[0.01]                                   | -5.485*<br>[0.01]                               |

N=7; T=32 (1971-2002). Corresponding p-values are in brackets. \* (respectively \*\*): significant at 1% (resp. 5%).

The first point resulting from the estimations (Table 5) is that taking into account the spatial dependence (by including a spatially lagged variable or by correcting the residuals) improves the fit of the model. The R<sup>2</sup> statistics related to the FE-SEM and FE-SAR estimations are at least two times greater than the R<sup>2</sup> in FE-OLS estimation. Secondly, the FE-SEM regression seems to provide a better explanation of credit distribution than the FE-SAR estimation according to the R<sup>2</sup> statistics, which are respectively 22 and 24%. In addition, in the FE-SAR estimation, the real discount rate (RIR) is not statistically significant at 10% while in FE-SEM estimation the coefficient became significant with a marginal probability of 2%. It's noteworthy to indicate that as already highlighted by the previous spatial tests the bias on the estimated coefficients clearly appear when we compare the results of the fixed effect ordinary least square equation and the fixed effect spatially error autocorrelation model. The positive impact of both FE-SEM and FE-SAR indicates that there exists strong space interdependence between banks concerning credit distribution in WAEMU. Thereafter, we based our analysis on the FE-SEM results.

The per capita growth rate appears with a non-significant and unexpected negative sign. One can explain this result by the fact in WAEMU, an important part of the population is excluded from the banking system preferring the informal intermediaries services. As such,

the banking credit distribution seemed not to be representative of the capabilities of the population. The positive correlation between real discount rate and bank credits is also unexpected. In fact, this result indicates that despite the decrease of the discount rate as a result of financial reforms the bank credits have not proportionally grew up. Furthermore, the financial reform index has a significantly positive impact. It seems that the financial reforms have not encouraged the banks to distribute more credits. In fact, this is not very surprising as after the financial liberalization reforms of 1989 and 1993 the banking sector in WAEMU were characterized by an excess of liquidities<sup>15</sup>. We found elsewhere empirical evidences that the banks make the choice to comfort their financial margins than increasing the credit distribution (cf. Ary Tanimoune, 2003). One can suppose that the financial system reforms are not efficient enough to incite banks to redistribute in the form of more credits the rents they collected consecutively to the financial liberalization.

## **VI : Concluding remarks**

This paper provides an empirical evidence of spatial dependence impacts on banking credit distribution in West Africa Economic and Monetary Union. We use spatial fixed effect panel data techniques to be assured that the regional effects are independent of the potential heterogeneity within this monetary area.

Our results highlight two issues. The first point is the importance of spatial autocorrelation effect in the estimation of banking credit distribution in WAEMU. At the very least, we must take care of the spatial dependence effects in an estimating framework of the banking credit distribution in West African Economic and Monetary Union. Ignoring the additional information provided by spatial arrangements may lead to an inappropriate specification. The second point is that the results of the financial reforms conducted in 1989 and 1993 seems not to be in accordance with the financial repression paradigm. The direct and indirect impacts of these reforms both indicate that the bank credit distribution have not increased as expected. These results showed the limitations of reforms based on pure market mechanisms.

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<sup>15</sup> Cf. Zone Franc, Annual Report (2003).

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