Revue d'Economie Théorique et Appliquée ISSN : 1840-7277
Volume 9 – Numéro 1 – Juin 2019 pp. 71-86 eISSN : 1840-751X

The determinants of the economic and financial situation of the public health establishments in Senegal

Mansoum NDIAYE

African Center for Graduate Studies in Management (CESAG)
Research Laboratory in Economics of Saint-Louis (LARES)
Email: mansoum.ndiaye@cesag.edu.sn

Mouhamadou FALL
Gaston Berger University of Saint-Louis (UGB)
Research Laboratory in Economics of Saint-Louis (LARES)
Email: mouhamadou.fall@ugb.edu.sn

Abstract: This paper investigates the economic and financial situation of the public health establishments in Senegal and aims to identify the determinants of the hospital operating deficit. We use a panel data (hospital-year) for a sample of public hospitals from 2007 to 2011. The results underline the significant influence of the global budget and the organizational factors (average bed occupancy rate, average length of stay and bed rotation index) on the operating deficit of public health establishments. We propose then the main lines of a reform of the financing of public hospitals. In occurrence an efficient financing should be based on hospital activity, not on global budget policy.

Keywords: Health, Hospital, Global budget policy, Senegal.

JEL Classification: I10 - I18 - I19.

Les déterminants de la situation économique et financière des établissements publics de santé au Sénégal

Résumé : *Cet article analyse la situation économique et financière des établissements publics de santé au Sénégal, et cherche à identifier les déterminants de leur déficit d'exploitation. Nous utilisons des données de panel (hôpital-année) pour un échantillon d'hôpitaux publics sur la période de 2007 à 2011. Les résultats indiquent l'influence significative de la dotation globale et des facteurs organisationnels (taux d'occupation moyen des lits, durée moyenne de séjour et indice de rotation des lits), sur le déficit d'exploitation des hôpitaux publics. Nous proposons ensuite les grandes lignes d'une réforme du financement des hôpitaux publics. En l'occurrence un financement efficient devrait être basé sur l'activité de l'hôpital, et non sur la politique de budget global.*

Mots-clés : *Santé, Hôpital, Budget global, Sénégal.*

Codes JEL *: I10 - I18 - I19.*

Received for publication: 20170407. Final revision accepted for publication: 20190630

1. Introduction

For several years, the financing of public hospitals has been one of the major concerns of the Senegalese public authorities to offer an easy access to health care to the populations. In Senegal and most of sub-Saharan African countries, the implementation of the costs recovery policy and the participation of the users in the health care financing following the ***Initiative of Bamako***, has allowed the public hospitals to have additional financial resources. ***The Initiative of Bamako*** is a financing and covering health care costs system which was adopted in Bamako (Mali) in 1987 by most of the African countries. It is a policy which is based on a payment principle of all the services provided by the health structures in order to support the health care financing in these African countries.

In Senegal, the hospital reform adopted in 1998 has allowed to set up the public hospitals as Public Health Establishments (PHE) which are endowed with an autonomy of management guided by a logic of performance just as well financial as regarding service of health care. The ***Public Health Establishments*** (PHE) are constituted by the PHE 1, PHE 2 and PHE 3. The PHE 1 corresponds to the sanitary districts, the PHE 2 to the regional hospitals and the PHE to the national hospitals. In this article, we will use indifferently the PHE to point out a National Hospital Center (NHC) or Regional hospital Center (RHC) or to design simply a hospital for some reason or other.

In Senegal, the context of the hospital payment system and financing of hospitals explains the difficulties of access to health care for the population. Indeed, these problems can be attributed to the high care prices which are connected to the financial deficiency of the public hospitals. So, the care prices are defined in a price range and public hospitals must set their care prices in this range. The Senegalese public hospitals are yearly financed by the government through the global budget policy.

The ***global budget policy*** consists of allocating to the public hospitals an annual subsidy intended to the sustainability of expenses by setting the payment system in a price range and the hospitals must respect this price range. This price system varies according to the economic development of the area where the hospital is located. Currently, the public hospitals have two sources of financing: the global budget provided by the government and the appropriate receipts through care prices defined in a price range. However, the global budget of hospitals is not generally sufficient, thus the hospitals experience some financial deficiency meaning operating deficit. Consequently, the public hospitals are constrained to fixe high care prices in order to be self-financed through their receipts while the majority of the Senegalese population is poor. They do not have access to a health insurance and cannot pay these care prices to receive health care in hospitals.

Somehow, we notice inadequacies and inefficacies of the global budget policy of hospital financing with a regular increase of hospital expenditure ending then in budgetary and financial deficit. Our paper deals with the financial situation of public hospitals in Senegal and explains the determinants of the hospital budgetary deficit in order to propose a reform of the financing of public hospitals.

In the literature, we find rarely empirical studies which deal with the problems of hospitals financing in Africa, particularly in Senegal. However, in France, we can find some empirical studies treating these problems in the examples of Studer (2012), Evain and Yilmaz (2012) and Thuaud (2013). Inspired by these authors, we will study the economic and financial situation of public hospitals in Senegal.

The principal objective of our analysis is to identify the factors that determine the operating deficit of Senegalese public hospitals and the causes of the heterogeneity of economic and financial situations through an analysis by dynamic panel. To this principal objective, we can associate two specific objectives. The first one consists of analyzing the economic and financial situation of public hospitals and the second one is an attempt to explain the causes of the budgetary and financial disequilibrium of these hospitals.

To reach our objectives, we have chosen to organize the rest of our work in this way. The second section will be devoted to a statistical analysis of the economic and financial situation of public hospitals in Senegal. The third section will present a brief empirical review of the literature on the determinants of the economic and financial situation of hospitals. In the fourth section, we will describe the econometric methodology used to analyze the determinants of the operating deficit of public hospitals. The fifth section will be an exposure of the results of the estimation just as the discussion. The conclusion and the recommendations in the sixth section will end our work.

2. A statistical analysis of the economic and financial situation of public hospitals in Senegal

In this section, we will first tackle some economic and financial indicator of public hospital in Senegal. Then, we will point out the situation of operating deficit noticed in these hospitals.

Some economic and financial indicators have been used to evaluate the economic and financial situation of some public hospitals in Senegal. Among these indicators, we can retain the added value and gross operating surplus.

During the period 2007-2012, the added values are revealed positive even if they are sometimes weak (See **Table 1**). These values cover most of the time the personnel expenses. This situation is confirmed during these years with the implementation of some directives of the 2008 inter-ministerial committee[1]. We also notice a harshness in the management of public hospitals with a will to balance the accounts.

[1] Among these directives, we can mention the one ensuring a better control of health expenditure.

Table 1: Added values of publics hospitals (Millions of XOF[2])

Hospitals	2007	2008	2009	2010	2011	2012
Principal	0	6 731	6 826	0	6 662	6
A Royer	0	528	527	635	555	596
Fann	962	1 236	1 809	2 036	176	2 040
Dantec	0	85	271	0	2 648	2 212
Thiaroye	271	263	375	0	374	399
Louga	387	374	601	665	0	0
Kaolack	0	837	644	641	374	570

Source: Authors (from the data collected at the Ministry of health)

Concerning the Gross Operating Surplus (GOS), we can notice that some public hospitals such as the PHE of Fann, Dantec, Louga and Kaolack are characterized by recurrent deficits during this period (See **Table 2**). Only the three hospitals located in Dakar (Principal Hospital, Albert Royer children's hospital and Thiaroye psychiatric hospital) have come to realize surpluses. In this group, Principal hospital remains the leader even if we notice some missing data in 2007 and 2010. Louga hospital has got a surplus only in 2009 contrasting with its[2] deficit situations in 2007, 2008 and 2010. Kaolack hospital has remained in deficit all along this period even though it has a budget surplus in 2008. The negative signs of GOS testify a deficit situation and an inability of these hospitals to balance their exploitation considering the operating volume during this period.

Table 2: Gross operating surplus of public hospitals (Millions of XOF)

Hospitals	2007	2008	2009	2010	2011	2012
Principal	0	1 791	1 758	0	1 582	829
A Royer	1	26	30	142	44	33
Fann	-108	-146	369	382	67	525
Dantec	0	-191	-864	94	-435	-1 138
Thiaroye	4	16	49	12	8	16
Louga	-16	-135	179	-55	0	0
Kaolack	0	115	-85	-58	-316	-196

Source: Authors (from the data collected at the Ministry of health)

[2] 1 euro = 655.957 XOF

At the national level, during the period 2007 to 2009, we notice that the mobilized resources do not cover the executed expenses in the public hospitals. In fact, the operating results of these hospitals focus on negative values which respectively are about -1 010 millions XOF, -2 753 millions XOF and -625 millions XOF[3]. These values convey the operating deficits of these hospitals with a worrying situation noted in 2008. This can be explained by the reduction of prices imposed by the government to the hospitals during that year.

In this context of deficits, it is important to examine the evolution of operating deficits which affect almost the entire Public Health Establishments (PHE) in Senegal. By analyzing the descriptive statistics of variables (See **Appendix 1**), we can note that in the PHE 3, the standard deviation of the operating deficit is almost twice higher than that of the PHE 2. Thus, we can admit that the evolution of the deficits obfuscates some disparities within each level.

After having dealt with the situation of public hospitals in Senegal which has remained in deficit during this period 2007-2012, we will examine empirical studies which analyze the economic and financial situation of hospitals in general.

3. A review of literature

The problem of the economic and financial situation of hospitals has received a particular attention these last years, as shown by the empirical literature which dealt with this theme. In the most of our cases, the studies have been done in the hospital system in France.

Yilmaz (2011) had dedicated a study to measure the degree of economic performance of the health establishments in France. These descriptive works highlighted an improvement in the financial situation of public hospitals with a downturn in the deficit of these hospitals in 2008 thanks to an increase of receipts connected to the hospital activity and the global subsidies. Also, this deficit downturn can be also attributed to the increase in investment which had allowed an economic and financial recovery of those public hospitals.

In the same sense, Thuaud (2013) had examined the budgetary standing of the profit-making private clinics in France. His study reveals a global budgetary standing surplus which was connected to an increase of net profitability further to the increasing number of hospitalizations in the services of general medicine, surgery, obstetrics and odontology.

We also note other empirical studies which concern mainly the questions of productivity. Studer (2012) had measured the productivity of the French public hospitals by defining an index of global productivity by means an estimated Cobb-Douglas (1928) production function over the period 2003-2007. The productivity can be defined as the part of the activity which is not explained by the observable

[3] These data were collected at the Ministry of health in 2014 and concerned the seven hospitals above such as Principal, A. Royer, Fann, Dantec, Louga and Kaolack.

characteristics of the hospitals of which the size and an index of technical wherewithal (Studer, 2012). The results underline the importance of the variables that are the index of technical wherewithal, the number of beds and the medical and administrative staff. Also, the study reveals that the strongest productivity of hospitals having a more important activity in surgery or in obstetrics. Dormont and Milcent (2011) analyzed the heterogeneity of hospitals productivity between the public and private sectors in France. In their study, they depict that the private clinics have been more productive than the public hospitals. In this same way, Yilmaz and Frikha (2012) analyzed the productivity of the French public hospitals during the period 2003-2009. Their results highlight the size effect of hospitals given that the concomitant increase of the size and the productivity must respect a certain limit. These authors had also showed the presence of positive yields on scale for the small-sized hospitals, but negative for the large-sized ones.

It is important to show that the productivity analysis by these authors gives only a partial aspect of the economic performance of hospitals. The question of the economic performance seems more and more present in the debates on the hospital, mainly through the concepts of efficiency and inefficiency. In this way Mané (2012) analyzed the economic performance of the Senegalese public hospitals through the concept of the technical efficiency which considers only the physical quantities of inputs and outputs. The results of his study show that hospitals could reach an average level of efficiency allowing them to improve their production of care by using the same resources. According to Mané (2012), the "small-sized hospitals" have less than 200 beds. The hospitals whose number of beds is between 200 and 300 are the "average-sized hospitals" and the hospitals of more than 300 beds are the "large-sized hospitals".

The results have highlighted the effect of the hospitals' size because the average-sized hospitals got better scores of efficiency than the small-sized hospitals. However, the large-sized hospitals didn't have better scores than the small-sized hospitals *a fortiori* the average-sized hospitals. Although this empirical study analyzes the economic performance by means of the technical efficiency, it did not consider the financial difficulties of the public hospitals in Senegal.

In perspective to analyze the financial difficulties of hospitals, Kafando and al. (2011) showed the grave consequences of the free access to health care policy on the running of hospitals in Niger. Indeed, considering the delays of reimbursement of the health care costs by the government, the free access to health care policy caused financial difficulties ending in budgetary deficits for hospitals. In this sense, Leye and al. (2013) showed, from a qualitative approach by individual interviews, that the national hospitals of Senegal have met with financial difficulties. These problems are caused by the slowness and the insufficiency of the reimbursement of health care costs by the government through the "***Plan Sésame***" which is a free access to health care policy granted to the elderly of 60 and more years old, implemented since 2006 in Senegal. So, the government has increasing debts towards the public hospitals.

Evain and Yilmaz (2012) examined the economic profitability of health establishments in France from a dynamic panel of public hospitals and private clinics. In their study, these authors compared the economic profitability to a profit function which is measured by the operating margin. For the estimations, these authors have used a dynamic model from a panel data by the instrumental method of variables and the Generalized Method of Moments (GMM)[4]. The results of estimation underline a significant influence of the beds occupancy rate and size hospital effect (two variables of production factor) and the average length of stays (variable of activity), but also the global budget on the operating margin of hospitals.

According to our objective, we can be inspired by this model of Evain and Yilmaz (2012) to develop our econometric study which tries to explain the operating deficit of public hospitals in Senegal from the activities and production factors. This study will demonstrate the necessity of reforming the financial system of public hospitals from global budget to activity financing which is based on the principle of pricing activity.

4. Methodology: A dynamic panel analysis

To expose our approach, we shall present at first a specification of our model and at second our method of estimation.

4.1. The specification of the model: a presentation of data and variables

Our study is based on a database which is founded on three sources: accounting and financial data, data of activity and data relative to factors of production. All these data are obtained from an enquiry at the Direction of health establishments and the National service of sanitary information of Ministry of Health and Social action in Senegal.

In the light of our empirical literature and by inspiring of the model of Evain and Yilmaz (2012), we have developed our model in order to analyze the determinants of operating deficit of public hospitals in Senegal. Having both an individual dimension (hospital) and a temporal dimension (year), we will use the panel data.

The equation with double index of the dynamic model spells as follows:

$$\ln\_DE_{it} = \alpha_i + \delta \ln\_DE_{it-1} + \beta_1 \ln\_DOT_{it} + \beta_2 DMS_{it} + \beta_3 TOM_{it} + \beta_4 IRL_{it} + \beta_5 LIT_{it} + \beta_6 \ln\_CONS_{it} + \beta_7 DEC_{it} + \varepsilon_{it}\ , \text{ with } |\delta| < 1\ ; \quad i = 1, \dots, N \text{ and } t = 1, \dots, T \qquad \textbf{(1)}$$

i = hospital, t = year, α_i is the constant and specific term to the hospital i. The term ε_{it} is random and allows to take into account the unobserved heterogeneity between hospitals. δ et β_k are the coefficient of variables. k is the number of variables, $k = 1, \dots, 7$ and ε_{it} is the term of error which is supposed to be distributed according to a Normal law with an expected value equal to zero and a variance = σ^2. ln represents the logarithmic operator and the other parameters are the variables which will be described below.

[4] This method (GMM) was proposed by Arellano and Bond (1991), developed later by Blundell and Bond (1998).

Our model to be estimated, defined by the equation **(1)** includes on one hand, the dependent variable $(\boldsymbol{DE_{it}})$ which represents the operating deficit of hospital (i) at the period (t). On the other hand, we have the lagged dependent variable and the other independent variables which we can describe as follows:

- The lagged dependent variable $(\boldsymbol{DE_{it-1}})$ is the operating deficit lagged by one year.

- The variable $(\boldsymbol{DOT_{it}})$ is the amount of the global subsidy which the government allocates annually to the public hospitals through its policy of global budget.

- The variable $(\boldsymbol{DMS_{it}})$ indicates the average length of stay. It indicates on average, the number of days which the in-patients stay in the hospital. It is an indicator of activity which reflects the quality and intensity of the medical care given to in-patients.

- The variable $(\boldsymbol{TOM_{it}})$ is the average beds occupancy rate. It allows to evaluate annually the optimal number of beds occupied by the in-patients, considering the hospital capacity in beds. It is a variable relative to production factor of hospitals.

- The variable $(\boldsymbol{IRL_{it}})$ means the bed rotation index. It is an indicator of activity that measures the frequency of beds use in a hospital. It quantifies the frequency a bed was successively occupied by patients during the hospitalizations.

- The variable $(\boldsymbol{LIT_{it}})$ represents the number of beds available in the hospital.

- The variable $(\boldsymbol{CONS_{it}})$ indicates the number of consultations of patients in the hospital. It is an indicator of activity which evaluates the patients who come to the hospital for a diagnostic or a treatment but are not hospitalized.

- The variable $(\boldsymbol{DEC_{it}})$ means the number of dead in the hospital. This variable is an indicator of activity which reflects the quality of the medical care given to the patients.

4.2. The method of estimation

In order to analyze the determinants of operating deficit of Senegalese public hospitals, we use a model of dynamic panel described by the equation **(1).** The use of this model allows to take into account the unobserved heterogeneity between the hospitals and the dynamic situation of hospitals in terms of operating deficit.

The estimation of a dynamic model by the classic estimators as the estimation by the Ordinary Least Squares (OLS) estimator yield biased and not convergent results. These misleading results are due to the presence of the lagged dependent variable among the exogenous variables. That causes a correlation with term of error (Anderson and Hsiao, 1982). In order to reduce the difficulties due to the presence of bias during the estimation, the literature provides estimation methods in dynamic panel.

Referring to some authors (Bruno, 2005a; Bun and Kiviet, 2003; Kiviet, 1999 and Kiviet, 1995, etc.), we have chosen the Least-Squares Dummy Variable Corrected (LSDVC) estimator for our model of dynamic panel. This estimator is considered as

more impressive than the other estimator because it remains more adapted to the short dimension of our sample. Bun and Kiviet (2003) and Bruno (2005b) showed that the use of the Method of Generalized Moments can yield biased results, and the bias is all the more important as the temporal dimension of the sample is short. In fact, our sample is composed of 16 public hospitals ($N = 16$) (with public health establishments of level 2 and public health establishments of level 3) and covers the period from 2007 to 2011 ($T = 5$). According to Bun and Kiviet (2003), the performance of this estimator is justified by the fact that it calculates the corrected bias of the Lead-Squares Dummy Variable (LSDV) estimators. This dynamic specification improves significantly the quality of the estimations but presents the inconvenience "to lose" one year of observation. Consequently, in our estimation, no coefficient will be estimated for the year 2007.

Among, the bias of LSDV estimator, Bun and Kiviet (2003) have defined three type of bias written by B_i for $i = 1, 2, 3$, as the three following relations:

$$B_1 = c_1(T^{-1}) \quad \textbf{(2)}$$

$$B_2 = B_1 + c_2(N^{-1}T^{-1}) \quad \textbf{(3)}$$

$$B_3 = B_2 + c_3(N^{-1}T^{-2}) \quad \textbf{(4)}$$

N represents the number of individuals, T indicates the number of periods and the c_i are the coefficients.

The LSDVC estimator is defined by the corrected bias of the LSDV estimator, according to the following expression:

$$LSDVC_i = LSDV - B_i \quad \textbf{(5)}$$

$LSDV$ is the LSDVC of equation **(1).**

To find out the estimation of B_i, Bruno (2005b) proposed the estimation methods used by Anderson and Hsiao (1982), Arellano and Bond (1991) and Blundell and Bond (1998). For our model, we have chosen the LSDVC estimator proposed by Arellano and Bond (1991) which suppose a strict exogeneity of regression variables.

Before presenting our estimation results, we first present a descriptive analysis of variables (see **Appendix 1**).

5. The Results and Discussions

In this part, we present the results of our model with the help of LSDVC estimator dynamic sample group (See **Table 3**). To conclude to the robustness of our results in dynamic specification, these results call for confirmation through estimators with permanent effects or uncertain effects. Hausman specification test (1978) has led us to choose a model with uncertain effects to consider the unobserved heterogeneity between public hospitals. In this sense, the results obtained with LSDVC estimator respect generally the tendency of the results with the estimation of the model with uncertain effects (See **Appendix 2**).

In a purpose of testing the sensitivity of the results, we have proceeded to three specifications of the model. In each of the two tables of the results (See **Table 3** and **Appendix 2**), we observe three columns (M1, M2 and M3) which point out a model estimated by adding successively independent variables until we find out the principal model. We have started with the variables (global subsidy, average length of stay, average rate occupancy) (M1). Then, we have added bed rotation index and the number of consultations (M2). At last, we have introduced the number of dead (M3).

Table 3: Results of estimations of the dynamic model
Endogenous Variable: Operating Deficit

Exogenous Variables	(M1)	(M2)	(M3)
Operating deficit set back a year	0.405 (3.28)***	0.349 (2.69)***	0.338 (2.69)***
Global budget	- 0.775 (2.12)**	- 0.703 (1.84)*	- 0.598 (1.62)
Average length of stay	0.011 (0.46)	0.034 (1.28)	0.046 (1.83)*
Average bed occupancy rate	- 0.223 (1.43)	-1.074 (2.72)***	-1.241 (3.06)***
Bed rotation index		0.009 (2.08)**	0.009 (2.08)**
Number of beds		- 0.001 (1.10)	- 0.001 (1.73)*
Number of consultations		0.077 (1.16)	0.041 (0.62)
Number of dead			0.000 (1.87)*
Number of observations	64	64	64

Source: Authors (from the results of the estimation with STATA11.0)

Notes: The symbols ***, ** and * indicate respectively statistical significances at threshold of 1%, 5% et 10% and the values in brackets are the t of Student.

5. 1. The influence of economic and budgetary variables

The operating deficit backward a year, pointing out the persistence of the deficit, presents a positive coefficient and statistically significant at the threshold of 1% in all three estimated models. The average of coefficients associated with the persistence of the deficits in the three models is estimated at 0.36. In other words, we conclude to an operating deficit of 4 months and 10 days per year in a hospital.

The global subsidy affects favorably public hospital operating deficit, with a significant effect in the first two models and a non-significant effect in the last model. Conceived as being favorable, the negative effect on the deficit is quite normal insofar as an increase of hospital global subsidy improves the operating deficit thanks to an increase of operating resources. In fact, an increase of 10% of the subsidy leads to, *ceteris parubis,* an increase of the resources on average 6.92% and therefore a decrease of the operating deficit. This result is comparable with Evain and Yilmaz's (2012) because an increase of 10% of subsidies acts positively and significantly on the operating margin of public hospitals in France on average 3%.

5.2. The variables of activity increase the operating deficit

The patients' average length of stay has a positive effect on the operating deficit. This variable is significant at the threshold of 10% only on the third model (M3). This result complies with Evain and Yilmaz's (2012), to a slight difference, their coefficients are higher. Four our case, the coefficients are not enough strong, they are estimated at 0.03. An increase of the patients' average length raises the operating deficit. Economically, this situation can be explained by a rising of hospital expenses in response to the increase of the resources used by patients during these additional days. Then, we can admit that the hospitals, having the length of stay shorter than the average [5], are most successful to reduce their operating deficit.

Though significant everywhere at the threshold of 5%, the bed rotation index has a positive effect of 0.9% on hospital deficit. The positive influence suggests patients' high rotation index implies an upward trend of hospital expenses in response to the increase of the resources used by every new patient. This situation leads to a worsening of the hospital operating deficit.

The number of dead considered as an activity variable is positively correlated with public hospital operating deficit. Though its coefficient is only significant at the threshold of 10%, the number of dead has an effect approximately nil. The positive effect is explained by the fact that in hospitals, a high number of dead during a year can cause an increase of the expenses. This increase of expenses is linked to an improvement of the technical capacity through the efforts displayed to increase the care quality and fight against in-hospital mortality. The evident consequence is the accentuation of the operating deficit in these hospitals.

5. 3. An increase in factors of production reduce the operating deficit

The estimations have underlined a negative and significant of average bed occupancy rate on the operating deficit of hospitals. The average of the coefficient relative to bed occupancy rate in M2 and M3 is about -1.16. This coefficient shows that an increase in 1% of this rate reduce relatively the hospitals operating deficit of 1.16%. We can admit that a high average occupancy rate means an efficient use of beds in the hospital. Economically, it could be interpreted as a good optimization of the factors of

[5] This average is about 6 (See **Appendix 1**)

production and thus a rationalization of the resources used to cover operating expenses in the department of hospitalization. Then, this optimization entails a decrease of operating deficit of public hospitals. This result can be compared to those of Evain and Yilmaz (2012) who confirm that a high bed occupancy rate means a decrease of the operating deficit of public hospitals in France.

The number of beds in the hospital is relatively correlated to the operating deficit of hospitals. Only one significant coefficient at the threshold of 10 % is found in the third model (M3). The increase of number of beds reduces very appreciably the operating deficit of hospitals. In other words, an increase of number of beds does not entail immediately a reduction of hospitals operating deficit. This increase in number of beds must be followed with an effective management of beds occupancy and rotation to optimize the factors of production.

Besides, it's important to notice that reducing the factors of production in hospitals will not decrease the operating deficit of hospitals because of the inadequacy of created resources in these hospitals.

6. Conclusion and Recommendations

The aim of our study was to analyze the economic and financial situation of Senegalese health public establishments financing through the global budget policy and to identify the determinants of operating deficit by using a model of dynamic panel concerning a sample of 16 public hospitals over the period from 2007 to 2011. Our econometric study is preceded by a statistical analysis of economic and financial indicators which describes the economic and financial situation of health public establishments in Senegal. It emerges from this statistical analysis that financial resources of public hospitals cannot cover their expenditure during that period. This situation ends in some budgetary and financial deficits for the public hospitals. It's in this context that our empirical analysis intervenes to investigate the determinants of the hospitals operating deficits in Senegal.

The results of our study underline, on one hand, the negative and significant influences of the average bed occupancy rate and global budget; and on the other hand, the positive and significant effects of the average length of stay (variable of activity) on the hospital operating deficit.

As economic policies implications, we can suggest:

- Firstly, the politics of global budget has not been effective to absorb the hospital operating deficit. The inefficiency is due to the inadequacy of global budget allocated by the government to the public hospitals.
- Secondly, the global budget is not allocated according to hospital activity although an efficient financing should be based on hospital activity. Then, we propose to reform the financial system of the public hospitals in Senegal, with a view to take into account hospital activity in health care budget. It's about the "activity financing".

- Thirdly, we can claim that this reform would present a real advance in the adequacy of the budget to the reality of hospital activity. Besides, it would enable to decrease the hospital budgetary deficit and to reduce the inequalities of access to health care for the Senegalese population.

7. Bibliographic References

Anderson, T. W., Hsiao, C. (1982), « Formulation and estimation of dynamic models using panel data », *Journal of Econometrics* 18, 47-82.

Arellano, M., Bond, S. (1991), « Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations », *The Review of Economic Studies* 58 (2), 277-297.

Blundell, R., Bond, S. (1998), « Initial conditions and moment restrictions in dynamic panel data models », *Journal of Econometrics* 87, 115-143.

Bruno, G. S. F. (2005a), « Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models », *Economics Letters* 87, 361-366.

Bruno, G. S. F. (2005b), « Estimation and inference in dynamic unbalanced panel data models with a small number of individuals », *Working Paper* N°165. Milan: Università Bocconi- CESPRI.

Bun, M. J. G., Kiviet, J. F. (2003), « On the diminishing returns of higher terms in asymptotic expansions of bias », *Economics Letters* 79, 145-152.

Dormont, B., Milcent, C. (2012), « Comment évaluer la productivité et l'efficacité des hôpitaux publics et privés ? Les enjeux de la convergence tarifaire », *Economie et Statistiques* 455 et 456, 143-173.

Douglas, P., Cobb, C. (1928), « A theory of production », *American Economic Review* 18.

Evain, F., Yilmaz, E. (2012), « Les déterminants de la rentabilité économique des établissements de santé », *Economie Publique* 28 et 29 (1 et 2), 317-349.

Hausman, J. A. (1978), « Specification Tests in Econometrics », *Econometrica* 46 (6), 1251-1271.

Kafando, Y., Mazou, B., Kouanda, S., Ridde, V. (2011), « Les retards de remboursements liés à la politique de gratuité des soins au Niger ont des effets néfastes sur la capacité financière des formations sanitaires », *Etudes et Travaux* N°1 9, Niamey : Laboratoire d'études et de recherches sur les dynamiques sociales et le développement local.

Kiviet, J. F. (1995), « On bias, inconsistency and efficiency of various estimators in dynamic panel data models », *Journal of Econometrics* 68, 53-78.

Kiviet, J. F. (1999), « Expectation of expansions for estimators in a dynamic panel data model: Some results for weakly exogenous regressors » in : Hsiao C., K. Lahiri., L. F. Lee., M. Pesaran, M. H. (eds.), *Analysis of panel data and limited dependent variables*, Cambridge University Press, Cambridge.

Leye, M. M. M., Diongue. M., Faye, A., Coumé, M., Faye, A., Tall, A. B., Niang, K., Wone, I., Seck, I., Ndiaye, P., Dia, A.T. (2013), « Analyse du fonctionnement du plan de prise en charge gratuite des soins chez les personnes âgées ‘’Plan Sésame’’ au Sénégal », *Santé Publique* 25(1),101-106.

Mané, P. Y. B. (2012), « Analyse de l'efficience des hôpitaux du Sénégal : Application de la méthode d'enveloppement des données », *Pratiques et Organisation des Soins* 43 (4), 277-283.

Studer, N. (2012), « Quelles évolutions récentes de la productivité hospitalière dans le secteur public ? », *Economie et Statistique* 455 et 456, 175-202.

Thuaud, E. (2013), « La situation économique et financière des cliniques privées à but lucratif en 2011 », *Etudes et résultats* N°859, Direction de la Recherche, des Etudes, de l'Evaluation et des Statistiques (DREES).

Yilmaz, E. (2011), « Le redressement des comptes des hôpitaux publics observé en 2008 se poursuit en 2009 », *Etudes et Résultats* N°746, DREES.

Yilmaz, E., Frikha, S. (2012), « La productivité hospitalière dans le secteur public entre 2003 et 2009 », Collection *Etudes et Statistiques*, DREES.

8. Appendixes

Appendix 1: Descriptive Statistics of variables.

At national level					
Variables	**Average**	**Standard deviation**	**Minimum**	**Maximum**	**Number of observations**
ln_DE	20.7622	0.8522277	19.15158	22.78643	80
ln_DOT	19.93807	0.720481	19.16262	21.35016	80
DMS	6.375	3.159775	2	16	80
TOM	0.530125	0.2245924	0.06	1.36	80
IRL	35.4875	20.3252	4	136	80
LIT	283.325	129.5929	48	509	80
ln_CONS	10.66604	0.7498893	8.215548	11.73055	80
DEC	466.4125	299.8628	3	1274	80
Level 2 hospitals (PHE 2)					
Variables	**Average**	**Standard deviation**	**Minimum**	**Maximum**	**Number of observations**
ln_DE	20.40745	0.5178912	19.15158	21.23666	40
ln_DOT	19.42027	0.166403	19.16262	19.71321	40
DMS	4.425	0.930605	2	6	40
TOM	0.436	0.1886089	0.06	1.36	40
IRL	39.3	22.46502	4	136	40
LIT	314.225	117.2445	118	509	40
ln_CONS	10.3598	0.725936	8.215548	11.41776	40
DEC	390.85	183.9205	63	700	40
Level 3 hospitals (PHE3)					
Variables	**Average**	**Standard deviation**	**Minimum**	**Maximum**	**Number of observations**
ln_DE	21.11696	0.9720259	19.4218	22.78643	40
ln_DOT	20.45586	0.688353	19.51929	21.35016	40
DMS	8.325	3.399755	4	16	40
TOM	0.62425	0.2200686	0.13	1.14	40
IRL	31.675	17.38757	8	68	40
LIT	252.425	135.3307	48	509	40
ln_CONS	10.97228	0.6478639	8.796339	11.73055	40
DEC	541.975	369.5971	3	1274	40

Source : Authors (from the data collected at the Ministry of health).

Appendix 2: Results of estimation of the model with uncertain effects

Endogenous Variable: Operating Deficit

Exogenous Variables	**(M1)**	**(M2)**	**(M3)**
Global budget	-1.038 (7.39)***	-0.946 (6.20)***	-0.968 (6.06)***
Average length of stay	0.057 (2.59)***	0.082 (3.00)***	0.086 (3.04)***
Average bed occupancy rate	-0.410 (2.51)**	-1.160 (2.77)***	-1.194 (2.84)***
Bed rotation index		0.008 (1.89)*	0.008 (1.91)*
Number of beds		-0.001 (1.50)	-0.001 (1.52)
Number of consultations		0.021 (0.33)	0.011 (0.17)
Number of dead			0.000 (0.64)
Constant	0.209 (0.08)	2.068 (0.70)	1.593 (0.51)
Number of observations	80	80	80
R^2	0.7799	0.7847	0.7804

Source: Authors (from the results of the estimation with STATA11.0)

Notes: The symbols ***, ** and * indicate respectively statistical significances at threshold of 1%, 5% et 10% and the values in brackets are the t of Student.