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The impact of the covid-19 pandemic on public finances in different regions of morocco

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Abstract:

The aim of this article is to study the impact of the COVID-19 pandemic on public finances in different regions of Morocco. Therefore, we have discussed the role of regions as real partners of regional and local development in the fight against epidemics and national disasters. The method used is spatial econometrics to take into account the geographical location. Thus, the results obtained confirm the positive and significant impact of the variables "hospitalization rate by region and total expenditure by region" on the endogenous variable "total resources by region", which means that the regions have invested financial resources during this delicate period characterized by the emergence of COVID-19.

Keywords: COVID-19; public finance; spatial econometrics; financial resources; regions.

Résumé :

Le but de cet article est d'étudier l'impact de la pandémie de COVID-19 sur les finances publiques dans différentes régions du Maroc. C'est pourquoi nous avons évoqué le rôle des régions en tant que des véritables partenaires du développement régional et local dans la lutte contre les épidémies et les catastrophes nationales. La méthode utilisée est l'économétrie spatiale pour prendre en compte la localisation géographique. Ainsi, les résultats obtenus confirment l'impact positif et significatif des variables « taux d'hospitalisation par région et dépenses totales par région » sur la variable endogène « ressources totales par région », ce qui signifie que les régions ont investi de ressources financières durant cette période délicate caractérisée par l'émergence du COVID-19.

Mots-clés : COVID-19 ; finances publiques ; l'économétrie spatiale ; ressources financières ; régions.

1. Introduction

By 2020, COVID-19 has affected nearly every country and millions of people around the world. Given the health, economic, and social challenges it brings, governments in all countries are facing difficult times. By the spring of 2020, more than half of the world's population will be locked up due to strict containment measures. In addition, the pandemic has triggered the worst economic crisis since World War II. Indeed, the economic crisis associated with COVID-19 will affect the public finances of several countries, including the increase in budget and financial resources for emergency response measures, and the capacity of their public finances to meet the challenges of the new health crisis. In this regard, Morocco is facing the challenges posed by the COVID-19 epidemic, such as providing medical care to patients, purchasing supplies, equipment, and putting in place the necessary human resources to contain the COVID-19 epidemic (OECD, 2020).

On January 28, 2021, Morocco launched a national vaccination campaign, which will be rolled out progressively in tranches. According to the instructions of King Mohammed VI, the vaccination campaign aims to provide free vaccinations to all Moroccan citizens aged 17 years and older. During the pandemic, Moroccan authorities took numerous measures to mitigate the impact of these shocks on households and businesses, but COVID-19 still has a significant impact on public finances. In this case, the government has launched an ambitious reform process that could increase potential growth in the medium to long term. Regions and municipalities are at the forefront of crisis and recovery management and are confronted with the asymmetric impact of COVID-19 on public finances. This article highlights the powerful territorial and spatial impact of the COVID-19 crisis.

The purpose of this paper is to answer a major question: **What is the impact of the COVID-19 pandemic on public finances in different regions of Morocco?** We pay attention to this topic, particularly because of the lack of research to examine the geographic and spatial impact of the COVID-19 crisis on public finances in different regions of Morocco.

To this end, the first part of this paper will specifically present the impact of the COVID-19 epidemic on public finances in different regions of Morocco. The second part will discuss the methodology followed and the data used. Finally, the third part will focus on the results.

2. The impact of the COVID-19 epidemic on public finances in different regions of Morocco

Morocco has 12 territorial regions based on advanced regionalization. In addition, the region has a large degree of autonomy, i.e., the region is a legal entity different from the state and has the right to exercise its attributions. Health along with education and sanitation is one of the competencies assigned to the Moroccan region (Badri, 2016). As a result, regions are key actors in the fight against epidemics and national disasters.

2.1.Failures and imbalances

Faced with this delicate and unprecedented period, many regions of Morocco have invested money to mitigate the adverse effects of the coronavirus pandemic. These effects are purely the stopping and suspension of economic activity, which in practice means significant unemployment and a sharp drop in income. The new information and communication technologies have also been used in the region to slow down the spread of the coronavirus pandemic (Ait Ali, et al., 2020).

In this wake, the COVID-19 crisis revealed many previously hidden failures and imbalances, such as the dominance of the informal sector and the lack of health coverage, which increased the distrust of citizens, most of whom find the quality of health services provided is very low. The failure of the health system in most regions and the lack of human resources and hospital centers require the intervention of the state and the private sector to develop the structuring of the health system in the different regions of Morocco and to extend its services. Indeed, the coronavirus pandemic has led to local fiscal imbalances, particularly in terms of the structural expenses of local government activities in a context of lower taxes, recovery of economic activity, and the impact of local government commitments in terms of the fixed structural expenses of their activities (Chami, 2020).

In response to this situation, the government has re-launched the process of advanced regionalization to cope with the negative impact of the pandemic on the economy, as well as emergency plans to mitigate the impact of the current economic crisis that affects all regions. In addition, sectoral strategies to reduce regional inequalities, and the enumeration of priorities that should determine the key points between the national budget and regional finances (Chami, Horani, & Ziani, 2020).

2.2.Measures adopted by the State

On the health, economic and social level, in accordance with the Royal High Directives, the government has issued two decrees that allow local authorities to participate in the fight against the epidemic and its effects. One of the contents of the two decrees is to modify the budget, without deliberations of their councils. These changes can be made by special authorization or transfer decisions, signed by them and approved by the walis and governors of the Kingdom's prefectures and provinces. The main purpose of these budgetary modifications is to intervene immediately and urgently to avoid the aggravation of the disease epidemic and to mobilize all means to protect the lives of people and ensure their safety. In addition, the appropriations thus made must be specifically linked to expenditures related to the fight against the pandemic (BELKOUCH, BELMAHI, BATTAS, ADENNOUN, BELLOUT, & LAGOUTTE, 2020).

In addition, efforts by the State and local authorities to curb the spread of the coronavirus have been reinforced by the Communal Hygiene Offices and health structures to ensure the disinfection of public places, the observation of family deaths, and the management of remains in municipal morgues and autopsies. These efforts require hygiene and protection measures to avoid any risk of spreading pandemics through emergency supplies of materials, equipment, products, supplies and safety equipment, as well as the personal protection necessary to prevent contamination. Within this framework, the local authorities must make available to the prefectural and provincial committees the means available, including vehicles equipped for disinfection operations.

In addition to the series of drastic measures to contain the coronavirus pandemic, the social component is also the main priority of the State and the local authorities. The formulation of a number of soft and flexible administrative measures can allow activities in important sectors of the national economy and ensure social cohesion. Within this framework, measures have been taken to ensure the continuity of public institutions and enterprises and their activities by limiting restrictions and derogating from existing legislative and regulatory provisions related to the state of health emergency (Frimousse & Peretti, 2020). In response to the major challenges posed by the COVID-19 pandemic, the government has adopted new measures (e.g., the digital transformation project in the modernization of the administration) aimed at simplifying procedures, strengthening traceability, and improving services to citizens and businesses.

3. Methodology and data used :

The modeling followed is spatial econometrics to help explain the ability to consider geographic location in the analysis of the impact of the COVID-19 epidemic on public finances in different regions of Morocco.

3.1.Methodology

3.1.1. Spatial autocorrelation

According to Legendre (Bera & Yoon, 1993), "spatial autocorrelation describes the average similarity of values in a series to values located" in the neighborhood. In other words, the value of a variable in a given location may not be unrelated to the values taken by that same variable in other nearby locations. Phenomena located at one place influence other phenomena located nearby, which in turn interact with other phenomena that are spatially close. All of these interdependencies reveal some level of organization of the values of a variable in space.(Dubé & Legros, 2014, p. 70)

Moran's index (Moran 1950) is used to measure the level of spatial autocorrelation of a variable and to test its significance. It is equal to the ratio of the covariance between contiguous observations (defined by the spatial interaction matrix) to the total variance of the sample (Jayet, 2001)

This index is calculated according to the following formula:(Mihai, Schaeffer, Torre, & Bray, 2014)

$$I_{Moran} = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\,(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Where i,j= spatial units; n = number of spatial units; x_i is the value of the variable in unit i; $\bar{x}$ is the mean of x; and w_ij are the elements of the spatial interaction matrix, defined in the form of contiguity, distances, or common boundaries.

3.1.2. Spatial econometric models

The linear regression model (LRM): in econometrics, a linear regression model is a regression model that attempts to develop a linear relationship between a variable to be explained, and one

or more variables, called explanatory variables. The linear regression model takes the following form:

$$Y=X\beta+\varepsilon \quad (1)$$

Y represents the dependent variable, X represents the explanatory variables used, β is the vector of parameters to be estimated and ε is the error term. Once a spatial autocorrelation phenomenon is neglected in the model specification, but included in the data generating process, in this case OLS does not work, the estimators are biased and inconsistent.

The spatial autoregressive model (SAR) consists in correcting this bias by incorporating a "lagged endogenous variable" WY in the equation of the model numbered (1) and taking into account the spatial autocorrelation relative to the dependent variable Y. This model is adapted to cases of global spatial autocorrelation. The model takes the following form:

$$Y=\rho\, WY + X\beta+\varepsilon \quad (2)$$

$$\varepsilon=\lambda V\varepsilon+u$$

ρ and λ autoregression coefficients,unknown, W andV are known neighborhood matrices, X matrix of fixed explanatory variables, β vector of unknown parameters. This model tests for spatial dependence to estimate the impact of other explanatory variables.

Spatial error model (SEM): The spatial error model (SEM) consists of specifying a process of spatial dependence of errors in a regression model. In order to introduce spatial autocorrelation in the econometric model. The SEM model is specified as follows:

$$Y=X\beta+\varepsilon \quad (3)$$

$$\varepsilon=\lambda V\varepsilon+u$$

The parameter λ reflects the strength of the interdependence between the residuals in the regression and u is the error term.

The Spatial Durbin Model (SDM): another way to express SEM models is to use a transformation that ensures that the error term of the relationship, in its reduced form, is spatially uncorrelated. This transformation, referred to as the Durbin Spatial Model (SDM),

thus proposes a rewriting of the model y=Xβ+(I-〖λW)〗^(-1) ε . Multiplying each of the terms by (I - Wλ), we then obtain a rewrite of the spatial autoregressive model of error terms equation:

$$(I - W\lambda)y=X\beta+(I-〖\lambda W)〗^{(-1)}+\varepsilon$$

We can then simplify the term on the left to obtain the final form to be estimated:

$$y=W\lambda y+X\beta-WX\beta\lambda+\varepsilon$$

Thus, the spatially autocorrelated error model (SEM) can be rewritten in a form introducing an autoregressive process in the dependent variable and in the independent variables (SLX). In this sense, the SDM model generalizes the spatial autoregressive model of the dependent variable (SAR), but places certain constraints on the parameters to be estimated. Again, this model can be estimated by the maximum likelihood method. (Dubé & Legros, 2014)

3.2.Data used

After defining the methodology followed, we will now proceed to the identification of the data used (kerkouch & BENSBAHOU, 2021). Table N°1 presents the definition of the different variables related to the coronavirus 2019 (COVID-19). Table N°2 presents the definition of the different variables related to the local finances of the 12 regions.

Table 1: Data on coronavirus (COVID-19)

Label	Formula	Year	Source
Hospitalization rate	$=\frac{\text{the number of hospitalizations in each region}}{\text{Number of residents of the regions}} * 1000 \text{ residents}$	2020	Ministry of Health
Mortality rate	$=\frac{\text{the number of deaths related to Covid}-19}{\text{Number of residents of the regions}} * 1000 \text{ residents}$	2020	

Source: Prepared by the author

Table 2: Local finance data for the 12 regions

Label	Definition	Year	Source
Total resource	includes resources managed by local authorities, resources managed by the State and transferred resources.	2020	Kingdom's General Treasury - Monthly Bulletin of Local Finance Statistics
Total expenditure	includes expenditures for personnel, other goods and services, interest on debt and capital expenditures.	2020	

Source: Prepared by the author

4. Discussion of the results

This section will be devoted to the discussion of the results. First, we will present the results of the mapping analysis of the variables. In the second part, we will present the results of the estimates of the impact of coronavirus 2019 (COVID-19) on the local finances of the 12 regions.

4.1.Result of the mapping analysis of the variables

4.1.1. Moran's I statistic

Table N°3 provides the results of the Moran's I statistic under the normality assumption (N) applied to the different variables of the model for the year 2020 at the level of 12 regions in Morocco.

Table 3: Moran 2020 Statistic I

Variable	I de Moran	$E_N(I)$	Standard deviation	$Var_N(I)$	P-value
Hospitalization rate	-0.44438996	-0.09090909	-2.222	0.02530629	0.02628
Mortality rate	0.10360002	-0.09090909	0.93497	0.04328008	0.3498
Total resource	0.43543077	-0.09090909	2.5985	0.04102722	0.009362
Total expenditure	0.15267362	-0.09090909	1.1764	0.04287062	0.2394

Source: Prepared by the author

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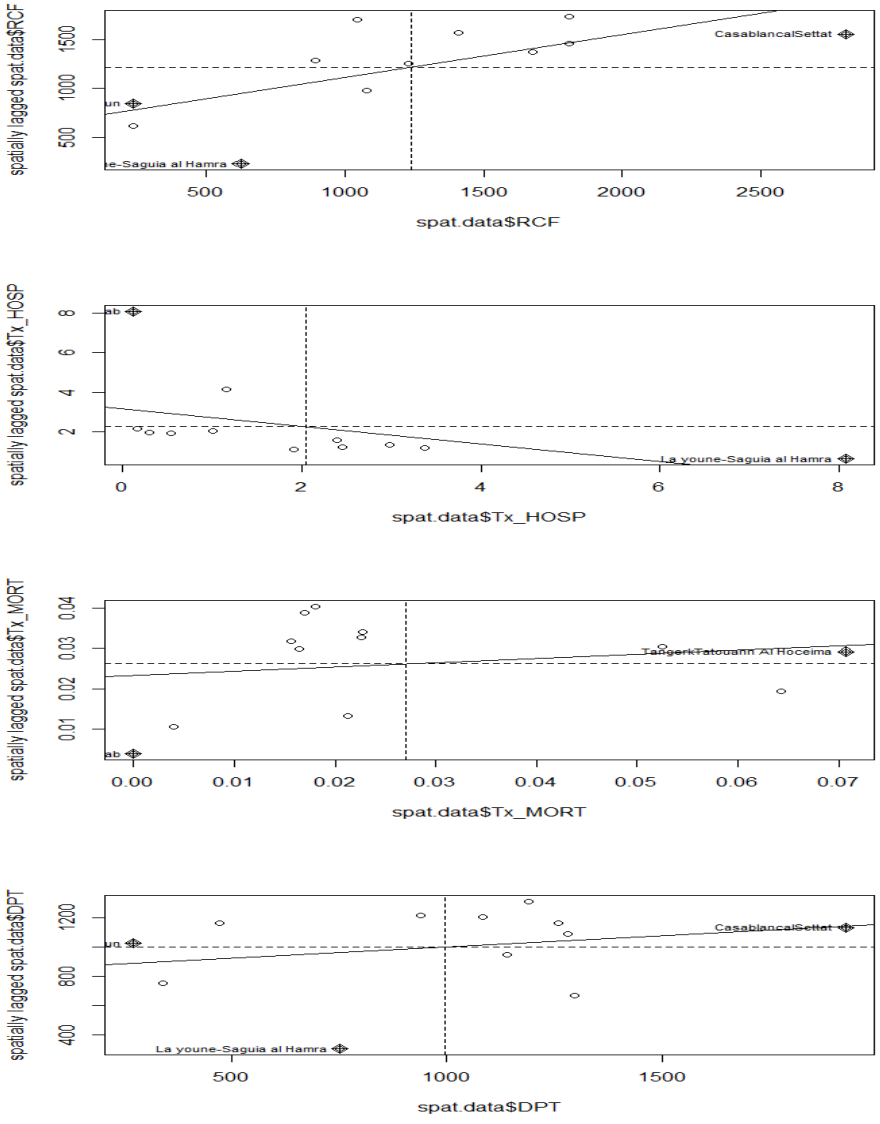
Thus, according to Table 3, it would appear that the model variables are positively and spatially auto-correlated over the entire period except for the variable "hospitalization rate by region" which is negatively and spatially auto-correlated over the 2020 period. Indeed, the Moran I-statistics are all significantly positive for the entire period for the variables "hospitalization rate by region" and "total resource by region. The Moran's I statistics for the variables "mortality rate by region and total expenditure by region are not statistically significant.

Figure 1: Moran diagram of variables



Source: Prepared by the author

4.1.2. LISA Statistics

Table 4: LISA statistics of the variables

Region	Hospitalization rate	Mortality rate	Total resource	Total expenditure
Tangier-Tetouan-Al Hoceima	NS	NS	NS	NS
Oriental	NS	NS	NS	NS
Fez-Meknes	NS	NS	NS	NS
Rabat-Salé-Kénitra	NS	NS	H-H	NS
Béni Mellal-Khénifra	NS	NS	L-H	NS
Casablanca-Settat	NS	NS	NS	NS
Marrakech-Safi	NS	NS	NS	NS
Drâa-Tafilalet	NS	NS	NS	NS
Souss-Massa	NS	NS	NS	NS
Guelmim-Oued Noun	NS	NS	NS	NS
Laâyoune-Saguia al Hamra	NS	NS	L-L	L-L
Dakhla-Oued ed Dahab	L-H	NS	NS	NS

Source: Prepared by the author

Visualization of the overall spatial association pattern (Figure 2: Cluster map of variables) provides the following comments:

- At the level of the variable "hospitalization rate" the region of Laâyoune-Saguia al Hamra has a fairly high value of hospitalization rate per region surrounded by the neighboring regions (Dakhla-Oued ed Dahab and Guelmim-Oued Noun) with a low value of hospitalization rate.

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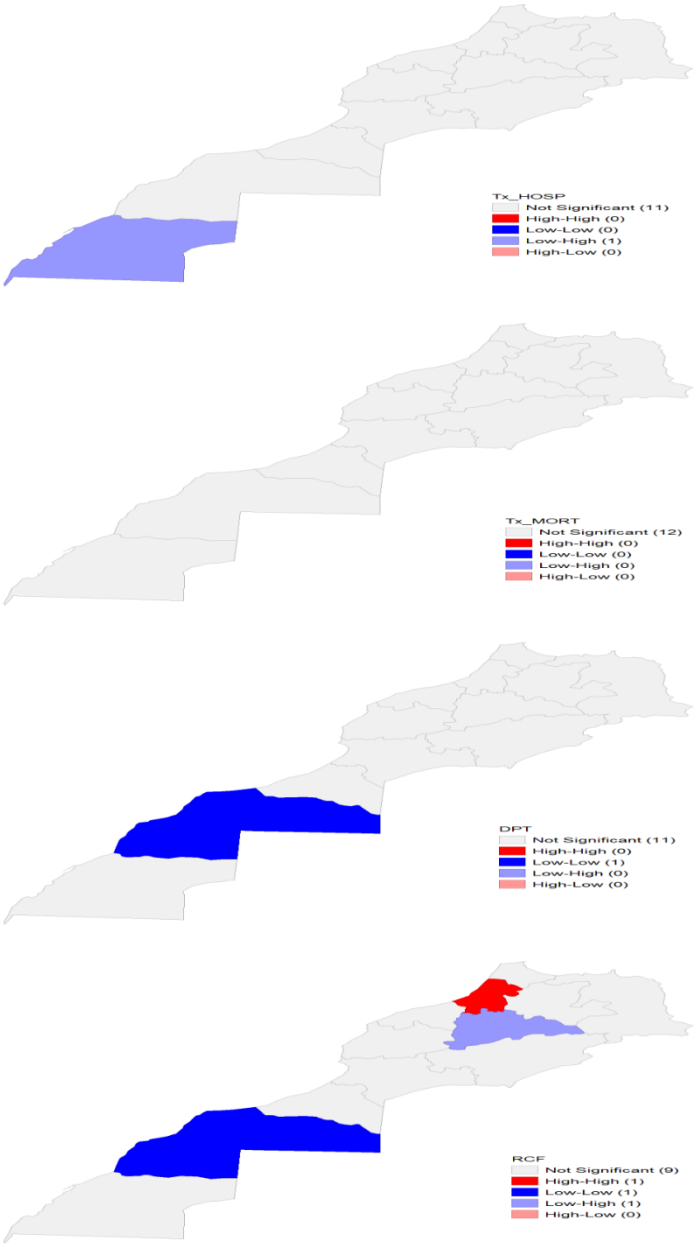
- For the variable "mortality rate", the Tangier-Tetouan-Al Hoceima region has a fairly high mortality rate per region surrounded by neighboring regions (Rabat-Salé-Kénitra, Fès-Meknès and Oriental) with a low mortality rate.

- At the level of the variables "Total Resource and Total Expenditure": the region of Casablanca-Settat has a fairly high value of the variables surrounded by the neighboring regions (Rabat-Salé-Kénitra, Béni Mellal-Khénifra and Marrakech-Safi) having a low value of the variables.

Figure 2: Cluster map of variables



Source: Prepared by the author

4.2.Results of the 2019 coronavirus (COVID-19) impact estimates on local finances for the 12 regions

4.2.1. Results of the non-spatial model

Table 5: Results of the non-spatial model estimates

	OLS
Hospitalization rate	0.0063601 (0.88407)
Mortality rate	4.35166 (0.36161)
Total resource	1.1464 (0.00015)
Constant	-0.961966 (0.41294)
Observation	12
R^2	0.886478
log likelihood	-0.395955
AIC	8.79191
I de Moran	-0.0497 (0.88950)
LMError	0.0422 (0.83731)
RLMError	3.2986 (0.06934)
LMLag	5.6045 (0.01791)
RLMLag	8.8609 (0.00291)

Source: Prepared by the author

Based on the results of the non-spatial model estimates, our regression is of good quality. The R2 tells us that about 88% of the variation in total resource by region is explained by variation in the different exogenous variables included in the model. The different coefficient estimates confirm our preliminary analyses as to the direction of variation of the endogenous variables with respect to the exogenous variables. Following the different tests carried out for our case, we obtained the following results:

- A 1% increase in hospitalization rate by region in the previous month results in a 0.0063601% increase in total resource by region.

- A 1% increase in mortality rate by region in the previous month results in a 4.35166% increase in total resource by region.

- A 1% increase in total expenditure by region in the previous month results in a 1.1464% increase in total resource by region.

4.2.2. Results of the spatial model

Table 6: Results of the spatial model estimations

	SAR	SDM	SEM
Hospitalization rate	0.102357 (6.724e-06)	0.045136 (0.2842293)	0.102357 (0.00001)***
Mortality rate	-3.021445 (0.1511)	-2.957581 (0.2005552)	-3.02145 (0.15113)
Total expenditure	0.971489 (2.2e-16)	1.021943 (< 2.2e-16)	0.971489 (0.00000)***
lag. Tx_HOSP		-0.072834 (0.1473110)	
lag. Tx_MORT		1.146334 (0.9098157)	
lag. LDPT		0.721659 (0.0572131)	
Constant	-4.367164 (3.052e-10)	-4.542769 (0.0005756)	-4.36716 (0.00000)***
ρ	0.65841	-0.036699	
λ			0.658413
Observation	12	12	12
R^2			0.971158
log likelihood	6.674162	9.811443	6.67416
AIC	-1.3483	-1.6229	-3.34832
LR test	14.14 (0.0001696)	0.0075075 (0.93095)	14.1402 (0.00017)***
LM test	0.010992 (0.9165)	0.23339 (0.62902)	

Source: Prepared by the author

The results of the total resource estimates by region showed the admission of spatial autocorrelation. Given that the value associated with the LR test in the SEM model is relatively

superior in comparison to that corresponding to the same test in the SAR and SDM models, and for the other indicators, we notice a salient superiority of the LR test value and the log-likelihood value (Log L) in the case of the SEM model. The estimation results (Table 6) show that there is a positive and significant effect of the variables "hospitalization rate by region and total expenditure by region" on the endogenous variable "total resource by region". The variables "total resource per region" and "total expenditure per region" are log-transformed before being introduced into the models that we will estimate.

From an economic point of view, the results presented in Table 6 show the decrease in financial resources and revenues of the local authorities in this delicate period characterized by the emergence of COVID-19. Due to the strict containment measures and challenges brought about by the COVID-19 epidemic, almost all regions of Morocco were affected. In this regard, local governments are on the front lines by increasing budget and financial resources for emergency measures, providing medical services to patients, purchasing supplies and equipment, and putting in place the human resources needed to contain COVID-19. Despite the efforts and measures taken, the severe consequences of the economic impact have affected public finances and caused imbalances in the different regions of Morocco.

These results also confirm the importance of the role of local authorities in local development as true partners in regional and local development, especially in the context of the COVID-19 pandemic. In this context, local authorities are responsible for the transport and burial process, which will ensure that the virus does not spread. And the local authorities also contribute to the maintenance of the health centers located on their territory.

5. Conclusion

This article discusses the impact of the COVID-19 pandemic on public finances in different regions of Morocco. In order to study this issue, we started discussing the role of regions in the fight against epidemics and national disasters. In this perspective, the management of the Moroccan region is based on advanced regionalization, i.e., the region has the right to exercise its attributions. Next, we have identified the failures and imbalances suffered by the Moroccan region, such as the predominance of the informal sector, the lack of health coverage, the failure of the health system, the lack of human and hospital resources, the imbalance of local finances and the decline in taxes. Finally, we have discussed some of the measures taken by the state to enable local governments to participate in the fight against the epidemic and its impact.

Regarding the methods and variables used, we measured two indicators that reflect the prevalence of COVID-19, namely the hospitalization rate and the mortality rate at the level of 12 regions in 2020. In addition, to explain the impact of the COVID-19 pandemic on public finances in different regions of Morocco, we used spatial econometrics to take into account geographic locations. As a result, local governments take the lead in increasing the budget and financial resources for emergency measures, providing medical services to patients, purchasing supplies and equipment, and putting in place the human resources needed to contain COVID-19.

Ultimately, in the suggestions in this article, we have highlighted the role of new information and communication technologies used in various regions to curb the spread of the coronavirus pandemic, as well as the key role of the state in implementing and managing fiscal reforms. Mobilize all that is unique to each region, ways to ensure the security of people's lives and the security of people's lives. In addition, implement digital transformation projects in the modernization of administrative management to simplify procedures, strengthen traceability and improve services to citizens and businesses.

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