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The effect of sanitary restrictions on businesses in the city of Bejaia: Factorial analysis and logistic regression (ordered multinomial logit)

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***Abstract*---**The objective of this research is to evaluate the commercial activity in the city of Bejaia before, during and after the lifting of the sanitary restrictions following the spread of COVID-19. First, the data for this study were collected through a field study that was conducted on the shops in the city of Bejaia, in order to identify the degree of impact of this pandemic on the region, and to collect all useful information that will serve as a solution to our problem. Then, we proceeded to analyse the collected data through a multiple correspondence factorial analysis, which allowed us to classify the companies as essential and non-essential. Finally, logistic modelling was used to discern the effect of health restrictions on businesses in the city. Non-essential businesses suffered significant losses in the different periods (during and after the restrictions were lifted).

***Keywords*---**Bejaia, commercial activities, health restrictions; CFM, ordered multinomial logit.
JEL code: C25, C81, L66, L67, L68

Resume---L'objectif de cette recherche est d'évaluer l'activité commerciale dans la ville de Bejaia avant, pendant et après la levée

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des restrictions sanitaires suite à la propagation du COVID-19. Dans un premier temps, les données de cette étude ont été collectées à travers une étude de terrain qui a été menée dans les commerces de la ville de Bejaia, afin d'identifier le degré d'impact de cette pandémie sur la région, et de recueillir toutes les informations utiles qui serviront de base une solution à notre problème. Ensuite, nous avons procédé à l'analyse des données collectées à travers une analyse factorielle des correspondances multiples, qui nous a permis de classer les entreprises comme essentielles et non essentielles. Enfin, une modélisation logistique a été utilisée pour discerner l'effet des restrictions sanitaires sur les entreprises de la ville. Les commerces non essentiels ont subi des pertes importantes au cours des différentes périodes (pendant et après la levée des restrictions).

Mots clés: Bejaia, activités commerciales, restrictions sanitaires, ACM, Logit multinomial ordonné.
Code JEL: C25, C81, L66, L67, L68.

تأثير القيود الصحية على الأعمال التجارية في مدينة بجاية: التحليل العاملي والانحدار اللوجستي

ملخص:

الهدف من هذا البحث هو تقييم النشاط التجاري بمدينة بجاية قبل وأثناء وبعد رفع القيود الصحية بعد انتشار فيروس كورونا. في البداية، تم جمع بيانات هذه الدراسة من خلال دراسة ميدانية أجريت على مؤسسات تجارية بمدينة بجاية، من أجل التعرف على درجة تأثير هذه الجائحة على المنطقة، وجمع كل المعلومات المفيدة التي من شأنها أن تخدم كأساس لحل مشكلتنا. بعد ذلك، قمنا بتحليل البيانات التي تم جمعها من خلال تحليل عوامل المراسلات المتعددة، مما سمح لنا بتصنيف الأعمال على أنها أساسية وغير أساسية. وأخيرًا، تم استخدام النمذجة اللوجستية لمعرفة تأثير القيود الصحية على الشركات في المدينة. عانت الشركات غير الأساسية من خسائر كبيرة في فترات مختلفة (أثناء وبعد رفع القيود).

الكلمات المفتاحية: بجاية، الأنشطة التجارية، والقيود الصحية، والانحدار اللوجستي.

Introduction

SARS-COV-2 or more commonly known as Covid-19 was first identified in Wuhan, a city in Hubei Province, China, in November 2019. [1] This virus has a frequent RNA which makes it susceptible to mutation. It is transmitted by direct contact with an infected person or via droplets. As soon as the virus is contracted, the patient can infect up to 3 other people. The virus's rapid contamination system has made it possible for it to spread outside China, particularly via contaminated travellers, thus creating a large-scale pandemic[2]. Immediately, health systems around the world were overwhelmed with patients.

In response to the influx of infected people and the increase in death rates, the governments of several of the countries in question have taken measures to protect their populations and limit the spread of the disease, such as total or partial confinement, the introduction of curfews and social distancing. However, these are not without consequences.

[1] https://www.lemonde.fr/les-decodeurs/article/2020/05/12/coronavirus-de-la-chauve-souris-au-deconfinement-la-chronologie-de-la-pandemie_6039448_4355770.html
[2] https://www.who.int/fr/news/item/27-04-2020-who-timeline---covid-19, consulté le 19/06/2021

The impact was felt at all levels : social, medical, environmental and economic. Socially, the confinement and closure of leisure facilities and establishments for fear of infection has created a climate of tension and anxiety among people. Environmentally, the public health restrictions have led to a decrease in CO2 emissions by almost 9%[3], as well as in climate and noise pollution. On the other hand, the increase in the number of surgical gloves, gel bottles and especially masks is a real threat to the environment, which takes more than 400 years to decompose. [4]

The magnitude of the crisis lies in the strong globalisation of economies, which leads to a rapid spread of shocks. In fact, the countermeasures have more or less preserved public health, but they have had serious consequences on the macroeconomic level, with a recession equivalent to -7.5% in 2020[5], followed by a drastic imbalance in supply and demand. As a result, business functions and consumer behaviour are deregulated, and unemployment has risen by 6.5%[6]. Indeed, the crisis has led to a sharp decline in international trade, (Kaufman and Leigh, 2020), caused by disruptions in highly dispersed global supply chains, in addition to a dramatic change in consumer behaviour. Indeed, the confinements advocated in several countries have brought many retail outlets to a halt as unimportant. Consumers have focused on essential consumption, namely food and medical products.

Algeria was not spared from COVID-19 either. The first case was declared on 25 February 2020[7], for a country characterized by a rather fragile economy following the drop in oil prices, 50.9 USD/barrel in February 2020[8], in addition to the delicate political situation with the popular revolt "el hirak", which generated several consequences such as the election of a new government. The Algerian economy was already in turmoil, both economically and socially, before the spread of the virus. This delicate situation led the government to introduce public health measures, as elsewhere. These measures had a direct impact on commercial activity at national level.

The scope of this investigation lies in the analysis of the effect of these health restrictions on the commercial activity of the city of Bejaia. Since the confinement of the wilaya of Bejaia, traders have felt its effect following the closure of businesses for a period of three months. The restrictive measures have caused unlikely financial losses, and a feeling of anxiety among traders has led some to hold demonstrations in front of the headquarters of the wilaya[9], which has led us to direct our analysis to the problem of the impact of health restrictions on the shops in the city of Bejaia.

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[3] https://www.construction21.org/france/articles/h/covid-19-les-consequences-environnementales-du-confinement.html#:~:text=L'un%20des%20premiers%20effets,et%20le%2030%20avril%202020).

[4] https://www.construction21.org/france/articles/h/covid-19-les-consequences-environnementales-du-confinement.html

[5] https://www.latribune.fr/economie/international/apres-une-recession-desastreuse-l-economie-mondiale-devrait-accelerer-de-4-2-en-2021-863659.html

[6] https://donnees.banquemondiale.org/indicator/SL.UEM.TOTL.ZS

[7] « RAPPORT DE SITUATION SUR L'EPIDEMIE DU COVID-19 EN ALGERIE », (02 novembre 2020)

[8] Groupe de la banque mondiale, « note de conjoncture : traverser la pandémie de COVID-19, engager les réformes structurelles. », 2020, *page 11.*

[9] https://www.algerie-eco.com/2020/05/31/confinement-les-commercants-reclament-la-reprise-de-lactivite/

In order to support our approach and to arrive at results that will help us solve our problem, we have outlined some rudimentary questions:

- ✓ How has the coronavirus modified the law of supply and demand ?
- ✓ Has the coronavirus encouraged online sales ?

Not all businesses were affected in the same way. The essential types of businesses managed to maintain their activity during the different periods of the restrictions (before, during and after). Moreover (Chikhi, 2020) ; states that, during the introduction of the confinement, the pharmaceutical and food type businesses recorded a spectacular increase in their sales. Consumer behaviour has been changed and health conditions have led to the expansion of e-commerce. (Bhatti, et al, 2020) confirm the spectacular growth of e-commerce across the world due to restrictive measures.

This study was conducted in the form of a field survey. The latter allowed us to build a database on the commercial activity of the city of Bejaia. The results of the survey will therefore serve as an answer to our problem and confirm or refute the hypothesis of our research work.

Firstly, we will describe the working methodology by presenting the questionnaire and the city where the field investigation took place. Secondly, we will outline the study sample through a unidimensional exploratory analysis of the related variables. Thirdly, we will proceed with a multidimensional exploratory analysis of the variables used in the questionnaire, via a multiple correspondence factorial analysis (MCA). Finally, we will carry out logistic regressions on the sample in order to detect the effect of public health restrictions on the commercial activity of the city.

1. Presentation Of The Analysis Sample

Our field of investigation focused on the shops in the city of Bejaia. But before proceeding to the presentation of the survey in question, we must first discover the city of Bejaia.

Locally called "vgayeth", Bejaia is a coastal city on the Mediterranean coast, which is located in the north-east of Algeria, about 250 km from the capital. It is considered one of the oldest cities in the country.

The city covers an area of 120.22km2 and has more than 190,766 inhabitants (2018) [10], a population that continues to grow, thus increasing mobility. Bejaia is also one of the most dynamic cities in Algeria with a developed industrial pole and an oil port among the most important in the country, in addition to having two university campuses with more than 47,495 students. This has largely contributed to the development of the city's commercial activity with several shopping avenues such as "Lekhemisse" which includes several clothing, cosmetic and other shops. The "Quartier Sghir" near the 3 university residences: Pépinière, 17 October 1961 and 1000lits, offering an opportunity to several traders, especially in the fields of fast food and office supplies.

[10] http://www.dsp-bejaia.dz/index.php/population, consulté le 19/06/2021.

In fact, according to the 2013 data, provided by the Directorate of Commerce of the wilaya of Bejaia, there are 59,785 merchants regularly registered in the trade register, 205 crafts, 194 17 retail businesses, 1969 service businesses and 1007 imports exports. [11]

This city has unfortunately not been spared by the pandemic, on 17/03/2020[12] the first case of Covid was detected, since then the virus has spread to reach more than 135,000 cases and 3615 deaths[13]. Commercial activity was one of the most affected, with the closure of non-essential businesses during the implementation of health restrictions. Subsequently, we will focus in this section on the presentation of the survey.

1.1. The shops targeted by our survey

We have selected a non-exhaustive sample, which is composed of the most representative shops in the city of Bejaia.

1.1.1. Food

Commercial activity based on the marketing of goods intended for consumption. It can be carried out in shops or on the Internet. The food sector includes general foodstuffs, supermarkets, etc., with surface areas of less than 120m², between 120 and 400m², and more than 400m² respectively.

1.1.2. Pharmacy

It is a trade specialising in the sale of medicines, hygiene products (hydroalcoholic gel, disinfectant wipes, etc.), medical instruments (thermometers, compresses, blood pressure monitors, glucometers, etc.), baby and maternity products (bottles, baby teats, baby milk, etc.), and derma-cosmetics.

1.1.3. Catering

A business that provides meals, usually served to be consumed on the premises or to be taken away. The catering trade includes Pizzeria, Fast-Food, Cafeteria, Tea rooms, Café restaurant, Pastry shop, ... etc.).

1.1.4. Cosmetics

The cosmetics trade generally includes hygiene products (soap, toothpaste, shower gel, shampoos, etc.), care products (hair care, facial care, sun care products, etc.) and so-called "ornamental" products (make-up, perfume, etc.)

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[11] https://dcwbejaia.dz/index.php/component/content/category/13-statistiques consulté le 18/06/2021

[12] https://www.algerie-eco.com/2020/03/17/coronavirus-premier-cas-confirme-a-bejaia/, consulté le 19/06/2021

[13] https://www.google.com/search?q=colbien+de+cas+total+de+covid+a+bejaia&oq=colbien+de+cas+total++de+covid+a+bejaia&aqs=chrome..69i57j33i10i160.8786j0j7&sourceid=chrome&ie=UTF-8, consulté le 19/06/2021

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1.1.4. Clothing

This business specialises in the sale of all articles of clothing (jumpers, trousers, dresses, shoes, underwear, suits, etc.) and clothing accessories (belts, ties, etc.) intended for men, women and children and for all age categories, displayed in a shop with an average surface area of between 50 and 120 m².

1.1.5. Hairdressing salon

This is a trade offering services related to aesthetics and hair care and treatment, it also includes manicure and pedicure, skin care, depilation and beauty care. This business includes hair salons for men, women and children. The minimum size of a hair salon is 40m².

1.1.7 Electronics

Business activity for the sale of all electronic devices that are powered by electricity. This category includes household appliances, computer and telecommunication equipment, electrical and electronic tools and high-tech products (smart phone, computer, smart TV, etc.).

1.1.8. Travel agency

A commercial enterprise that offers its clients opportunities and services related to national and international travel; transport tickets, hotel reservations, car rentals and package holidays. This business acts as a mediator between consumers and the various providers of this service.

1.1.9. Bookshop and office supplies

This business is intended for the marketing of office supplies, which consist of paper and other supplies (paper, notebooks, cardboard folders, pens, etc.), administrative supplies (diary, calendar, signature pad, etc.), sometimes computer supplies (USB keys, cartridges, photocopiers, etc.) and furniture (desks, executive chairs, etc.).

1.2. The conduct of the field survey

We allocated a questionnaire to our field investigation as a material support for data collection. We designed it through scales allowing us to evaluate the different variables related to the effect of the pandemic on the commercial activity. The questionnaire was designed for the purpose of seeking observations and/or measures that are scientifically admissible for analytical and econometric treatments.

The survey was conducted, therefore, on the basis of a questionnaire, divided into five parts. The first part reports the profile of the commercial activity and its workforce. The second part deals with the evolution of the commercial activity during three periods: before, during and after the health restrictions. The third

part deals with the financial aspect of the impact of the sanitary restrictions on the interviewed businesses. The fourth part is mainly related to the difficulties encountered by the businesses during the pandemic. The last part deals with the use of e-commerce as an alternative to the reduction in activity during the pandemic for certain businesses.

Our survey took place during the month of June 2021 by distributing questionnaires to 170 targeted businesses in the city of Bejaia. Moreover, the table below represents a description of the questionnaires distributed and returned. We note that the rate of valid questionnaires from our survey is appreciated at 100%.

Table 1. Presentations of questionnaires assigned to shops

Items	Number
Questionnaires distributed	170
Questionnaires returned	0
Valid questionnaires	170
Invalid questionnaires	0
Rate of validated questionnaires	100%

Source: personal realization

The following table shows the composition of our sample, in terms of the number of people in the different types of shops.

Table 2. Composition of the study sample

Type of trade Number	Nombres
Clothing	29
Food	25
Restaurants	22
Booksellers and office supplies	20
Cosmetics	19
Hairdresser	17
Electronics	17
Pharmacy	12
Travel agency	9
Total	170

Source: own realization

2. Multidimensional Exploratory Analysis

First, we coded the survey responses. Then we undertook an exploratory approach to the variables.

2.1 Statistical description of the data collected

We will proceed with the statistical description of the responses collected.
The variable "Types of trade" represents the distribution of our population according to the different types. Consequently, the shops are considered according to the degree of their importance, in terms of satisfaction needs. We note, therefore, two types of shops: essential shops (food and pharmacy) with a total of 37 shops questioned, representing 21.8% of the sample, and non-essential shops (restaurants, cosmetics, clothing, hairdressing salons, electronics, travel agencies, bookshops) with a total of 133 shops questioned, representing a percentage of 78.2%.

The most dominant shops in the city are clothing and food shops. Subsequently, in our sample we took into consideration the representativeness of the study population. To this end, we questioned, respectively, 29 and 25 shops.

On the other hand, the number of pharmaceutical shops and travel agencies is limited. The former is a very controlled activity with quotas per area, and the latter is a very poorly developed activity due to the Algerian tourist situation, which is not very active. Consequently, we interviewed 12 pharmacies and 9 travel agencies. (See table n°03 and graph n°01).

Table 3. Types of trade

		Effectifs	Pourcentage
Valide	alimentation	25	14,7
	pharmacie	12	7,1
	restauration	22	12,9
	cosmetique	19	11,2
	habillement	29	17,1
	salondecoiffure	17	10,0
	electronique	17	10,0
	agencedevoyage	9	5,3
	librairie	20	11,8
	Total	170	100,0

Source: Compiled by the authors.

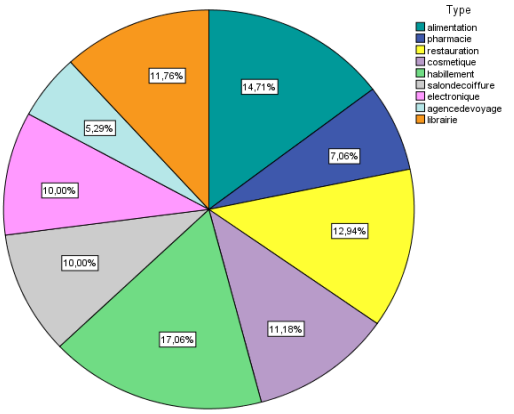

Figure 1. Pie chart
Source: Compiled by the authors.

2.2. Multiple Correspondence Factor Analysis (MCA)

Multiple Correspondence Factor Analysis is a method of factor analysis, which allows the analysis of several qualitative variables at the same time, and the study of the contiguity between them. Our analysis concerns 23 variables from a sample of 170 shops. This means, the resulting database synthesis is not easy to arrange. Subsequently, the AFCM allows us to reduce the dimensions, thus facilitating the reading of the results.

2.2.1. Eigenvalues

In order to verify the robustness of the analysis carried out, Table 4 provides information on the significance of the results. Indeed, we note that the AFCM explains the initial data base at a rate of 61.9%, which is largely considered satisfactory. The measure of internal suitability, Cronbach's alpha, is equal to 0.843. This is sufficient as it is greater than 0.7.

Table 4 Eigenvalues and ine

Dimension	Alpha de Cronbach	Variance expliquée	
		Total (valeur propre)	Inertie
1	,918	7,938	,378
2	,843	5,071	,241
Total		13,009	,619
Moyenne	,889[a]	6,504	,310

a. La valeur Alpha de Cronbach moyenne est basée sur la valeur propre moyenne.

Source: Compiled by the authors.

2.2.3. Joint modality point diagram

The joint modality point diagram allows us to measure the response trend of each variable. In our case, we note the division of the variables into three groups. This hierarchy is explained by the existence of a link characterising the variables in question. We note a group that responded to the question of alternative means of financing, by "bank loan", "weakly" for the question of E-commerce, and that have a significant number of staff between "3 to 5. This link applies to all the other parts of the graph which we will detail in the double diagram. We also notice that the variable "strongly" is far from the other answers. This can be explained by the fact that some respondents answered the question in an inconsistent way.

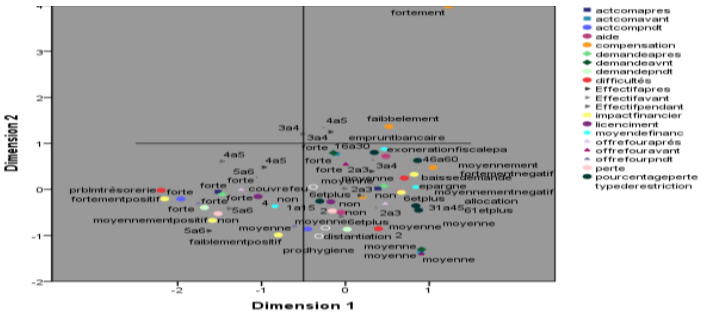

Figure 2. Joint diagram of modality points
Source: Compiled by the authors.

2.2.4. Discriminatory measures

The discriminant measures allow us to highlight the relevant variables in our analysis. In fact, we notice that the majority of the variables are close to each other in terms of gravity and that they are practically all correlated. The closest variables are those that have a strong causality between them, as is the case for commercial activity before restrictions and demand before restrictions. Indeed, before the restrictions, demand and activity were stable.

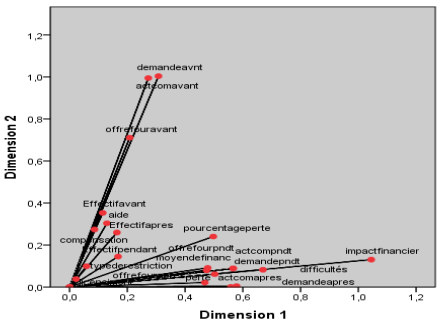

Figure 3. Measures of discrimination
Source: Compiled by the authors.

2.2.5. The double diagram

The double diagram allows us to extract the types of shops that responded in the same way, and that have characteristics in common.
Firstly, we note the absence of the "food" type as this was not impacted by the pandemic. This was the only sector that showed continuity in its exercise during the period of restriction. In fact, it is an elementary activity. Secondly, we note that the variables are divided into three main parts, as we mentioned earlier in the attached diagram of modality points.

We find, essentially, on the upper part of the diagram, on the right, the clothing, cosmetics and restaurant businesses. The latter responded in the same way, as they are characterised by the same effect of the public health restrictions, in terms of demand, and the activity that was strong before and then marked a decline, with staff numbers of 4 to 5 employees for clothing, and between 3 and 4

for cosmetics, who resorted to redundancy during the containment. The losses in these businesses are significant. The clothing sector is between 16% and 30%, and the restaurant sector is between 46% and 60%. Most of the restaurants interviewed admitted to having thrown away several out-of-date products, and the use of e-commerce was only able to compensate moderately for the losses recorded. The drop in supply can be explained by the closure of borders and the disruption of supply chains.

We have also noticed that three shops are far from the average response. These businesses actually responded differently to the majority. One of the owners of the hairdresser's salon announced that during the lockdown she continued her activity by going to the homes of her clients. The two restaurants, on the other hand, were the ones that worked in the dark and made deliveries.

On the right-hand side below the diagram, we observe that the shops mainly present are electronics, bookshops, office articles and hairdressers. They are characterised by an average demand before covid-19 that decreased after the restrictions were put in place. And they recorded significant losses of 31% to 45%, and over 61%. The latter did not resort to e-commerce, some of them received allowances for e-commerce.

The latter are characterised by an average supply, even before the pandemic. This state of affairs leads to the difficulty of imports from which the country suffers. This hindrance causes supply difficulties and limited stocks. We also remark the presence of some clothing shops in the lower right-hand part of the diagram. These are shops located in the less frequented districts such as Sidi Ahmed, the old town, etc.

As for the hairdressing salons, the post-recovery period is constantly marked by a negligible demand for services. The closure of the village halls is one of the main causes of the persistent low demand.

On the lower left-hand side, we observe the presence of pharmacies. These have not resorted to redundancies or alternative financing. Their activity was still strong but not at the same level as before Covid-19. This can be explained by the exclusive sale of medicines related to the treatment or prevention of the virus, i.e. vitamin C, zinc, doliprane, bibs, gels, etc.

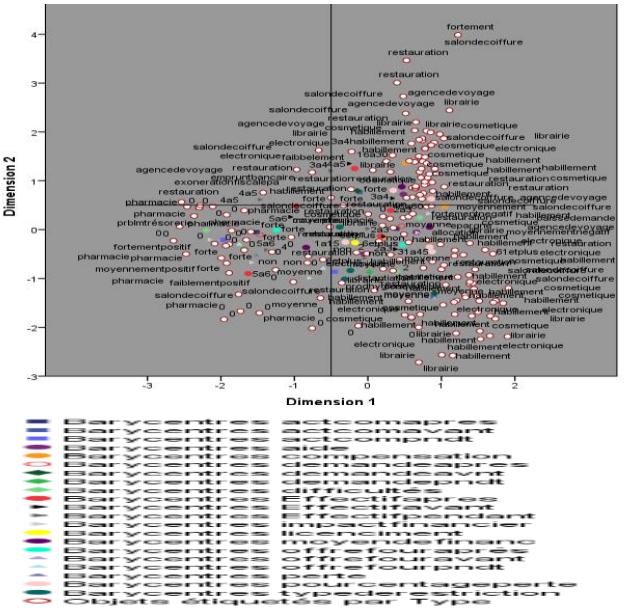

Figure 4: double chart
Source: Compiled by the authors.

3. Estimates And Discussion Of The Results Of The Ordered Multinomial Logit Models

In order to study the impact of sanitary restrictions on businesses in the city of Bejaia, we conducted an ordinal multinomial logit model analysis. The qualitative nature of the dependent variable imposed the use of logistic modelling. This choice was made because the "period" variable takes three forms.

$$\text{Period} = \begin{cases} 0 & \textit{Period before health restrictions} \\ 1 & \textit{Period during health restrictions} \\ 2 & \textit{Period after health restrictions} \end{cases}$$

We used four explanatory variables, namely : the business activity variable noted as "activity", the demand for products or services noted as "demand", the supply of suppliers noted as "supply" and the employee headcount variable noted as "headcount"

$$\text{Activity} = \begin{cases} 0 & \textit{Low} \\ 1 & \textit{Medium}, \\ 2 & \textit{High} \end{cases} \qquad \text{Demand} = \begin{cases} 0 & \textit{Low} \\ 1 & \textit{Medium} \\ 2 & \textit{High} \end{cases}$$

$$\text{Supply} = \begin{cases} 0 & \textit{Low} \\ 1 & \textit{Medium} \\ 2 & \textit{High} \end{cases}$$

$$\text{Workforce} = \begin{cases} 0 & 1\ to\ 2\ employees \\ 1 & 2\ to\ 3\ employees \\ 2 & 3\ to\ 4\ employees \\ 3 & 4\ to\ 5\ employees \\ 4 & 5\ to\ 6\ employees \\ 5 & 6\ and\ more\ employees \end{cases}$$

Hence the estimated equation below:

$$Period = \beta 0 + \beta 1\ activity + \beta 2\ demand + \beta 3\ supply + \beta 4\ workforce + \varepsilon i$$

3.1 Estimation of the ordered multinomial logit model [14]

Multi-variable discrete models, also called polytomous models, are a generalization of dichotomous dependent variable models. Polytomous variables are widely used in surveys to facilitate the processing of information through codes. In this type of model, the values taken by the dependent variable y_{ij} are hierarchical; they correspond to a class or category. The introduction of a latent variable in this type of model, as in the binary models, is essential for their estimation. Therefore:

$$Y_i^* = \beta_k x_i + \varepsilon_i$$

The variables taken by the discrete variable Y_i correspond to the intervals in which the only continuous (unobservable) latent variable Y_i^* is present:

$$\begin{cases} Y_i = 0 & si\ Y_i^* \le c_1 \\ Y_i = 1 & si\ c_1 < Y_i^* \le c_2 \\ Y_i = 2 & si\ c_2 < Y_i^* \le c_3 \\ & \vdots \\ & \vdots \\ & \vdots \\ Y_i = m & si\ \ c_m < Y_i^* \end{cases}$$

Where : $c_1 \cdots\cdots c_m$ sare bounds to be estimated, defining the ends of the intervals. The latent variable $Y_i^*$is, therefore, a linear combination of the explanatory variables x_i :

$$Y_i^* = x_i \beta + \varepsilon_i$$

Where $\varepsilon_i$admits a distribution function F where the probabilities associated with the realizations are :

If the probability P is associated with a symmetric density and a distribution function F, then we have:

$$Prob\left(Y = \frac{j}{x}, \beta, c\right) = F\left(c_{j+1} - x\beta\right) - F\left(c_j - x\beta\right)$$

Where: $j = 0,1,2, \cdots\cdots\cdots mc_0 = -\infty$, $c_{m+1} = +\infty$, $c_j \le c_{j+1}$

The bounds c_0 and $c_{(m+1)}$guarantee the condition of the sum of the probabilities, over all intervals, being equal to 1. We will have the distribution function F of the normal or logistic probability distribution.

[14] ZIDAT.R, (2021), « Econométrie des variables qualitatives », polycopié de cours, université de Bejaia, p28-30.

$$F(t) = \frac{e^t}{1+e^t} \quad et \sum_{i=0}^{m} P_i = 1$$

We model the polytomous variable Yi= 0,1, 2 according to the member ship of the latent variable $yi*$ to three different categories :

$$Y_i = \begin{cases} 0 & si \quad Y_i^* < c_1 \\ 1 & si\ c_1 \leq Y_i^* < c_2 \\ 2 & si\ Y_i^* > c_2 \end{cases} \qquad \forall i = 1 \ldots \ldots . N.$$

The latent variableY_i^* ~ N (x_i β, σ^2), where the vector x_i includes the set of property features mentioned above. The vector x_i does not include a constant for a collinearity reason. We should therefore proceed to the estimation of the structural parameters of the model, namely: c_1, c_2, σ and the k coefficients of the vector β. Subsequently, we estimate k + 3 structural parameters.

The normal and logistic distribution functions define the Logit and Probit models respectively. And like the dichotomous models, the estimation of the coefficients β_k and the values of the thresholds C_j of the ordered multinomial models is done through algorithms of maximisation of a log-likelihood function defined by P_{ij}.

The sign of the estimated parameters informs us about the positive or negative impact that the explanatory variables could have on the variable Yij. The significance of the estimated parameters is assessed by the Z-statistic test and the overall significance of the model through the $LR = -2\,(Ln\,(LR) - Ln\,(Lu))$ statistic. The Pseudo-R^2 assesses the overall fit of the model:

$$R^2 = 1 - \frac{\log\,(L_u)}{\log\,(L_R)}$$

3.1.1. Statistical validation

We will proceed to the statistical validation of the model through the significance tests of the parameters, the global significance test and finally the global adjustment test.

Table 5 Estimation of a multinomial logit for the sample n=170

Dependent Variable: PERIODE
Method: ML - Ordered Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/21 Time: 23:00
Sample: 1 510
Included observations: 510
Number of ordered indicator values: 3
Convergence achieved after 4 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ACTIVITE	-0.419372	0.274561	-1.523787	0.1276
DEMANDE	0.072768	0.275995	0.263657	0.7920
EFFECTIF	0.039752	0.065926	0.602985	0.5465
OFFRE	-0.682804	0.211074	-3.234910	0.0012
Limit Points				
LIMIT_1:C(5)	-1.604372	0.149230	-10.75099	0.0000
LIMIT_2:C(6)	0.032099	0.126153	0.254446	0.7992

Pseudo R-squared	0.089415	Akaike info criterion	2.024289
Schwarz criterion	2.074105	Log likelihood	-510.1936
Hannan-Quinn criter.	2.043820	Restr. log likelihood	-560.2923
LR statistic	100.1973	Avg. log likelihood	-1.000380
Prob(LR statistic)	0.000000		

Source: Compiled by the authors.

i) Significance test of the coefficients

The "activity" variable has a probability of 0.12, which is slightly higher than the α risk at the 10% threshold. We can consider this variable as being weakly significant.

The coefficients of the two variables "demand" and "number of employees", with respective probabilities of 0.79 and 0.56, are well above the 10% threshold. They are therefore not significant. The parameter of the "supply" variable has a probability of 0.001, which is below the 10% threshold. Therefore, this variable is significant.

ii) Global significance test

The test of global significance is done through the "LR statistic". Otherwise it is the log-likelihood ratio. We first assume two hypotheses:

- H0: all coefficients are equal to zero, $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
- H1: at least one coefficient significantly different from 0

The log-likelihood must be compared to the value of the x2 table at the threshold of 0.90 at two degrees of freedom. This value is equal to 7.779 and is largely inferior to the LR-statistic value which is equal to 100.19, which leads us to reject the hypothesis H0 and accept the hypothesis H1.

iii) *Global fit test*

Concerning the global fit test, "pseudo R-squared" its value is R2 = 0.08% which means that this model explains only 8% of the information which is a very low value.

3.1.2 Discussion of results

Despite an accepted global significance test, we reject this model due to insignificant coefficients, and the model explains very little of the data. We can explain this by the fact that this sample includes all essential and non-essential shops, the former having felt no impact from the restrictions as they are considered to be basic necessities and therefore the government did not close them.

We have therefore attempted a model that mobilises all types of trade. This first attempt led to insignificant results. To this end, we will proceed, in a second stage, to the purification of the model by splitting the sample into two parts: essential and non-essential shops.

The first part includes a sample of n=37 businesses said to be essential, which includes both the food and pharmaceutical sectors. The second part includes a sample of n=133, grouping together all the businesses deemed non-essential

during the pandemic; the restaurant, cosmetics, clothing, hairdressing, electronics, travel agency and bookshop and office supplies sectors.

3.2. Logistic regression on the sample of essential shops

The table below shows the results of the estimation of the coefficients of each variable with their associated statistics.

Table 6. Estimation of the multinomial logit for the 37 shops

Dependent Variable: PERIODE
Method: ML - Ordered Logit (Newton-Raphson / Marquardt steps)
Date: 06/24/21 Time: 11:27
Sample: 1 111
Included observations: 111
Number of ordered indicator values: 3
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
OFFRE	-0.185727	0.433714	-0.428224	0.6685
DEMANDE	0.040919	0.541277	0.075597	0.9397
EFFECTIF	-0.000255	0.133886	-0.001907	0.9985
ACTIVITE	-0.209508	0.591025	-0.354483	0.7230
Limit Points				
LIMIT_1:C(5)	-1.273732	0.709591	-1.795022	0.0727
LIMIT_2:C(6)	0.125073	0.698668	0.179016	0.8579

Pseudo R-squared	0.005057	Akaike info criterion	2.294222
Schwarz criterion	2.440683	Log likelihood	-121.3293
Hannan-Quinn criter.	2.353637	Restr. log likelihood	-121.9460
LR statistic	1.233272	Avg. log likelihood	-1.093057
Prob(LR statistic)	0.872591		

Source: Compiled by the authors.

3.2.1 Statistical validation of the model

We shall first carry out the statistical validation of the coefficients, then perform the global significance test of the model and finally the global adjustment test.

i) Significance test of the coefficients

The coefficients of the explanatory variables "supply", "demand", "workforce", and "activity", with their respective probabilities of 0.66, 0.93, 0.99, 0.72 are not significant since the probabilities are higher than the critical value threshold of 0.10.

ii) Overall significance test

We test the following hypotheses :

- H0: all coefficients are equal to zero, $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
- H1: at least one coefficient significantly different from 0

The log-likelihood statistic is equal to 1.23 which is strictly lower than the value of the chi-square table which is equal to 7.779. Therefore, we accept the zero hypothesis (H0) which stipulates that all the coefficients are equal to zero and are therefore not significant.

iii) Global fit test

The overall goodness of fit test performed via the pseudo R-squared is R2 = 0.005 which means that this model explains only 0.5% of the information.

3.2.2 Discussion of results

This model, is an obsolete model as it does not meet any statistical validation characteristics. This is due to the nature of the sample which only includes shops of the essential type whose period does not really impact on their activity, which is essentially due to government decisions to leave these shops open during the restrictions in order to provide for the basic needs of the population.

3.3 Estimation of the model for the sample of non-essential shops

We will therefore estimate the second part of the sample, which consists of 133 non-essential shops.

Table. 7 Multinomial logit estimation for sample n=133

Dependent Variable: PERIODE
Method: ML - Ordered Logit (Newton-Raphson / Marquardt steps)
Date: 07/02/21 Time: 13:08
Sample: 1 396
Included observations: 396
Number of ordered indicator values: 3
Convergence achieved after 4 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ACTIVITE	-0.938219	0.294881	-3.181691	0.0015
DEMANDE	-0.528195	0.317269	-1.664815	0.0959
EFFECTIF	0.111600	0.083977	1.328934	0.1839
OFFRE	-0.267183	0.204226	-1.308276	0.1908
Limit Points				
LIMIT_1:C(5)	-1.842668	0.174983	-10.53058	0.0000
LIMIT_2:C(6)	0.041539	0.135748	0.306001	0.7596

Pseudo R-squared	0.172079	Akaike info criterion	1.849432
Schwarz criterion	1.909757	Log likelihood	-360.1876
Hannan-Quinn criter.	1.873331	Restr. log likelihood	-435.0505
LR statistic	149.7258	Avg. log likelihood	-0.909565
Prob(LR statistic)	0.000000		

Source: Compiled by the authors

3.3.1 Statistical validation

We will proceed with the statistical validation of the coefficients, the global significance test and finally the global adjustment test.

i) Significance test of the coefficients

First of all, we will test the significance of the coefficients. The two coefficients of the "activity" and "demand" variables with respective probabilities of 0.001 and 0.09 are significantly lower than the α risk at the 10% critical threshold.

The parameters of the "workforce" and "supply" variables with respective probabilities of 0.19 and 0.18 are weakly significant with probabilities slightly above the 10% critical threshold.

ii) Overall significance test

We test the hypotheses:

- H0: all coefficients are equal to zero, $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
- H1: at least one coefficient significantly different from 0

The log-likelihood is equal to 149.72. It is strictly greater than the chi-square value = 7.779. This allows us to reject the H0 hypothesis and accept the H1 hypothesis.

iii) Global adjustment test

The value of the pseudo R2 is equal to 0.17 which means that this model explains 17% of the information.

3.3.2 Discussion of results

The first two estimated models are rejected because of their statistical weakness. In contrast, the third model is sufficiently statistically acceptable at the 10% threshold. The equation of the model is therefore written in the following form :

$$Periode = -0.94activite - 0.53demande + 0.11effectifs - 0.27offre + e_i$$

From the estimation results, we see that the variables "supply", "activity" and "demand" are variables with negative signs. This is explained by the fact that these variables are of low intensity during the period after the lifting of the public health restrictions. In other words, in the city of Bejaia, the recovery of commercial activities is relatively slow because of limited demand. This can be explained by several factors, notably consumer behaviour. Indeed, after months of confinement and restriction, consumer behaviour tends to be modified. As (Kaci, 2020, p15) points out, a return to initial consumption, i.e. before the imposition of sanitary restrictions, is impossible in the short term, and even this return cannot take place if the economic uncertainty due to Covid persists. This scenario is contrary to that of (Chikhi, 2020, p6) who believes that after de-containment, and thanks to the stabilisation of prices, consumer behaviour towards traders will be rebalanced. Moreover, the supply of suppliers remains reduced after restrictions, due to the The "workforce" variable has a positive sign, as does the "supply chain disruption" variable, and the slowdown in production units.

As for the "workforce" variable, it has a positive sign. Indeed, when the restrictions were lifted, the businesses proceeded to re-hire staff. Moreover, we have observed, according to the survey data, that businesses had a higher workforce after the lifting of restrictions than during the period.

Conclusion

The disruption of supply chains, the imbalance of supply and demand, the oil shock, the drop in mobility and trade were hostile consequences on the world economy, following the sanitary restrictions imposed.

Algeria was not spared, as were other countries in the world. The crisis reminds us of the low resilience of our economic systems to shocks. Moreover, the unprecedented nature of the measures taken to contain this virus has only aggravated the economic situation. In this investigation, the purpose was to assess the commercial activity in the city of Bejaia before, during and after the lifting of the sanitary restrictions.

To this end, we interviewed 170 businesses in the city of Bejaia. The field study was carried out in order to determine the degree of impact that the pandemic had on the region and to collect all the useful information that would serve as a basis for our problem. The survey responses were processed, on the one hand, through a multiple correspondence factorial analysis. On the other hand, we estimated logistic regression models. The empirical analysis carried out in this manuscript is crowned by some rudimentary findings.

First of all, during the different periods studied, both the food and the pharmaceutical businesses flourished. However, the pharmaceutical sector did not benefit as much as the food sector during the Covid-19. The risk of contamination in this type of (pharmaceutical) trade is high, given the particularity of the consumers in this sector, and the shortage of certain medicines, and freezing due to Covid-19, explains this distortion compared to the food trade. This leads us to accept hypothesis 1: the essential shops managed to maintain their activities during the different periods of restrictions, as shown by the results for the pharmaceutical shops.

Subsequently, we found that the activity of non-essential shops deteriorated during the introduction of health restrictions. Indeed, these shops were forced to close, leading to a decrease in activity and demand. Our analysis in Logit model allowed us to deduce that even after the lifting of the sanitary restrictions, the rebound of the activity of these retail businesses was rather difficult. A constant confirmed by the AFCM, from these results, hence the assertion of hypothesis 2 "non-essential type shops, suffered significant losses during the different periods of containment."

Notwithstanding the significant expansion of e-commerce at the international level, the shops in the city of Bejaia remain reluctant to use this alternative. Indeed, 84.7% of the businesses questioned have not resorted to online sales. On the other hand, 8.2% of the businesses using this online practice were able to compensate for their losses in a small way. We therefore refute hypothesis 3, which states that health conditions have led to the expansion of e-commerce.

Bibliographic References

Bhatti, A et al. (2020), « *E-commerce trends during COVID-19 Pandemic* ». International Journal of Future Generation Communication and Networking, N° 2, vol. 13.

Chikhi, K. (2021), « *L'impact de la crise sanitaire du Covid-19 sur le comportement de consommation des Algériens* », Revue d'Etudes en Management et Finance d'Organisation, N°12, vol. 6.

Groupe de la banque mondiale, (02 novembre 2020), « *Rapport de situation sur l'epidemie du covid-19 en Algerie* », note de conjoncture : traverser la pandémie de COVID-19, engager les réformes structurelles.

Kaci, S. (2020), « *L'effet de la pandémie de covid-19 sur l'activité économique en Algérie* », les cahiers du cread, N°3, vol. 36.

Kaufman, M., & Leigh, D. (2020), **"***Déséquilibres de l'économie mondiale et crise de la COVID-19*", International Monetary Fund.

OCDE (2020), « *Le COVID-19 et le secteur du commerce de détail : Impact et mesures de politique publique* ». OCDE.

Organisation mondiale du commerce (2020), "*Le commerce des services dans le contexte de la crise liée à la covid-19*" pp 1- 6.

Soltani, M.Z. (2021), « *La pandémie Covid-19: Une récession de l'offre et de la demande.* », Revue Economie, Gestion et Société, N° 29, vol. 1.

Zidat.R, (2021), « *Econométrie des variables qualitatives* », polycopié de cours, université de Bejaia.

Websites

https://www.lemonde.fr/les-decodeurs/article/2020/05/12/coronavirus-de-la-chauve-souris-au-deconfinement-la-chronologie-de-la-pandemie_6039448_4355770.html

https://www.who.int/fr/news/item/27-04-2020-who-timeline---covid-19, consulté le 19/06/2021

https://www.construction21.org/france/articles/h/covid-19-les-consequences-environnementales-du-confinement.html#:~:text=L'un%20des%20premiers%20e fets, et%20le%2030%20avril%202020).

https://www.construction21.org/france/articles/h/covid-19-les-consequences environnementales-du-confinement.html.

https://www.latribune.fr/economie/international/apres-une-recession-desastreuse-l economie-mondiale-devrait-accelerer-de-4-2-en-2021-863659.html

https://donnees.banquemondiale.org/indicator/SL.UEM.TOTL.ZS

https://www.algerie-eco.com/2020/05/31/confinement-les-commercants-reclament-la-reprise-de-lactivite/

http://www.dsp-bejaia.dz/index.php/population, consulté le 19/06/2021.

https://dcwbejaia.dz/index.php/component/content/category/13-statistiques consulté le 18/06/2021

https://www.algerie-eco.com/2020/03/17/coronavirus-premier-cas-confirme-a-bejaia/, consulté le 19/06/2021

https://www.google.com/search?q=colbien+de+cas+total+de+covid+a+bejaia&oq=colbien+de+cas+total++de+covid+a+bejaia&aqs=chrome..69i57j33i10i160.8786j0j7&sourceid=chrome&ie=UTF-8, consulté le 19/06/2021.