Epidemiological Shocks and Their Effects on Algerian Import Dynamics: An econometric Analytical Study (1990–2020)

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Abstract:

This paper aims to study the impact of Epidemiological Shocks on Algerian imports in the period (1990-2020), because it **constitutes** as a serious global threat and a new "fascism" suffered by the global economy in general and Algeria in a particular case, also we tried to explain the impact rela-tionship that links the epidemic shocks with imports through economic variables, to show their impact on the import function.

And the study concluded that the Epidemiological shocks led to the disruption of supply chains and the decline on the imports demand, and this show the weakness of the Algerian's Economic structure in front of the Epidemiological shocks, but there were a government decision decided by the state that affected the imports to avoid the spread of infection inside the border's country.

By the way and according to the Algerian Economic structure, we can say that leaders should think about a wise solution or a good alternative plan that prevents shock damages and protects Economy from all the possible crises in the future.

Key words: Epidemiological shocks, Imports, Supply chains, covid-19.

JEL classification codes : H, F10, F23, L14.

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1. Introduction:

The landscape of international trade has been marked by a series of crises and transformations, shaping the global map into an economic curve with scars across various sectors. All nations, interconnected through the flows of exports and imports, have felt the impact of these changes. These commercial activities serve as a vital indicator, reflecting a country's capacity to develop value chains, enhance competitiveness, and boost productivity in the global market.

It seems that history repeats itself, and despite the diminishing impact of infectious diseases on human lives, the emergence of the COVID-19 pandemic has posed a significant threat. It not only jeopardizes human lives but also profoundly affects the economies of nations, proving to be an extraordinary and unprecedented international catastrophe.

Algeria's economy, heavily reliant on the fuel sector and importing essential consumer goods due to an inability to meet local demands, faces vulnerabilities. The fragility of the Algerian economy, coupled with its dependence on the external world, makes it susceptible to epidemiological shocks, notably the impact of the COVID-19 pandemic. These shocks have unveiled numerous patterns, suggesting that the consequences of epidemiological shocks are not coincidental. Instead, they reveal a direct relationship between past circumstances and those reoccurring, leaving the Algerian economy in its most precarious state, struggling to recover from the successive shocks. Understanding the implications of these shocks on imports is a complex matter, given the interconnected nature of economic variables through a web of cause-and-effect relationships. Therefore, this article aims to address the following question: How have epidemiological shocks impacted imports in Algeria, and is it conceivable that adversity could transform into an opportunity? The interdependence of imports with foreign trade, making them susceptible to various shocks, complicates the task of building a robust economic foundation. The globalization of the free movement of goods, services, ideas, and human resources has given rise to swift and widespread crises, traversing borders and regions. It is expected that epidemiological shocks will leave a lasting impact on Algeria's imports.

The resolution to the aforementioned problem is approached through two axes. The first delves into essential conceptual foundations, while the second axis involves a standardized study todescribe imports and the variables influencing them through a least squares model. The process begins with the description of the dependent and independent variables, followed by standard tests. Subsequently, the model is estimated to discern whether epidemiological shocks have indeed influenced imports in Algeria from 1990 to 2020. The results are then analyzed from both statistical and economic perspectives, leading to a comprehensive discussion of findings, hypotheses, recommendations, and an attempt to draw meaningful conclusions.

2. Axis One: Theoretical Foundation - Basic Concepts -

Imports serve as the backbone of international trade, and the movement of goods and services has become a crucial indicator for understanding the economic balance of nations. If the value of imports surpasses that of exports in a country, it signals a negative trade balance.

2.1. Imports:

Defining imports as a commercial term involves several interpretations, all converging on the notion that imports represent the aggregate of goods and services produced externally, brought into a country for domestic consumption. An increase in imports may lead to a reduction in demand for local goods and services, as it constitutes a part of the country's domestic consumption or investments from foreign producers subsequently purchased from them[2].

3. Axis Two: Epidemic Shocks -

Past experiences with epidemic shocks have demonstrated varied effects from one country to another. Examining the methodologies employed by past generations to overcome these shocks proves invaluable, especially in the current exceptional circumstances brought about by the COVID-19 pandemic. The pandemic has instilled panic on an international scale, indirectly impacting the global economy through challenging decisions imposed by nations.

Epidemiological shocks, both historical and contemporary, are regarded as catastrophic crises due to their toll on human lives and the economic structure of states, particularly imports directly linked to foreign trade and its cross-border movements. A shock is defined as an unexpected and emergent situation, creating a crisis that is challenging to resolve. An epidemiological shock, in this context, represents a health crisis, where the Centers for Disease Control and Prevention (CDC)[3] describe it as a severe situation marked by an unexpected increase in the number of disease cases in a specific geographic area.

Yellow fever, smallpox, measles, and polio serve as prime examples of epidemics constituting epidemiological shocks. It's crucial to note that the disease does not necessarily have to be contagious; West Nile fever and the rapid increase in obesity rates are also considered epidemics. Epidemics can indicate a disease or other health-related behavior at rates that significantly exceed the expected incidence in a community or region[4].

[2] Said Abdel Aziz Othman, Introduction to General Economics, Alam Al-KitabPublishing and Distribution, Algeria, 2004 AD, p. 45, Omar Sakhri, MacroeconomicAnalysis, Office of UniversityPress, Algeria, 2005 AD, p. 132, Khaled Muhammad Al-Sawai, International Trade - Theory and Its Applications, 1st edition, Alam Modern Book for Publishing and Distribution, Jordan, 2009, 25.

[3] CDC, Centers for Disease Control and Prevention, Principles of Epidemiology in Public Health Practice, Third Edition An Introduction to AppliedEpidemiology and Biostatistics, at https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.htm. l

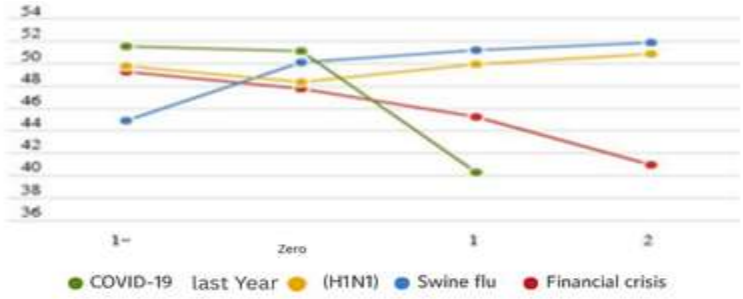
[4]W.IanLipkin, John Snow Professor, Columbia, Global Health , Epidemic, Endemic, Pandemic: What are the Differences? MAILMAN SCHOOL OF HEALTH, Updated12:50pm Fri May 6.

The COVID-19 pandemic, caused by the SARS-CoV-2[5] virus, has emerged as a formidable global crisis, impacting economies worldwide. It has particularly affected supply and demand dynamics, leading to severe consequences for the imports of numerous countries, especially those heavily reliant on nations significantly impacted by the pandemic. The first case was reported on December 1, 2019, and the virus, believed to have originated in animals, mutated to become a threat to humans. The virus belongs to a large family causing various diseases[6].

The repercussions of the pandemic shock on global economies are evident, with China serving as a notable example[7]. In February, both the manufacturing and services sectors experienced a sharp decline, surpassing the levels observed at the beginning of the global financial crisis. The

services sector, in particular, faced a more significant downturn due to the substantial impact of social distancing measures. China's manufacturing sector saw reduced global demand for essential materials, such as building materials and primary commodities, akin to the severity witnessed during the global financial crisis. This decline, coupled with unprecedented efforts to contain the disease, is unparalleled in comparison to previous epidemics or events like the aftermath of the September 11 attacks.

The impact is visually depicted in Figure (1-01), illustrating the significant shock on China's manufacturing sector.



Source: Gita Gopinath, International Monetary Fund, 2020[8]

The figure illustrates a direct impact on China's manufacturing sector due to the COVID-19 shock, with the green color indicating a significant decline within one month of the outbreak. China, being the epicenter of the epidemic, is particularly affected. The figure suggests that the epidemic's impact on the global economic crisis,

[5] This phrase differsfrom the one chosen by the Arabization Coordination Office of the Arab League Educational, Scientific and Cultural Organization in a recentlypublisheddictionary of terms for the Coronavirus disease, whichis: "Coronavirus associatedwithsevere acute respiratory syndrome type 2." See: Dictionary of COVID-19 Terms (English-French-Arabic) (Rabat: Arab League Educational, Cultural and Scientific Organization, Bureau of Coordination of Arabization, 2020), pp, 16,52, accessed on 6/8/2020, at: https://bit,ly/2XFn7Fd

[6] Johns Hopkins Medicine, Whatiscoronavirus? Health Condition and Diseases, accessed on February, 24,2022, at https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus.

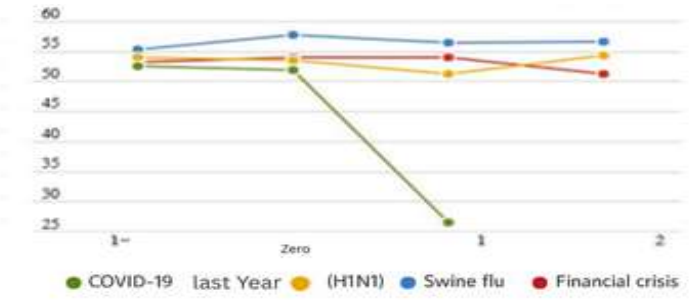
[7] Gérald, Anny, (2020). The early impact of the Covid-19 pandemic on the global and Turkish economy. Turkish journal of medical sciences p: 520.

[8] Gita Gobinat, Limiting the economicrepercussions of the Corona virus by establishing large targetedpolicies, 03/10/2020 SA: 18:14 Available at: https://www.imf.org/ar/News/Articles/2020/03/09/ blog030920-limiting-the-economic-fallout-of-the-coronavirus-with-large-targeted-policies.

depicted in red, may be more profound compared to the previous year, represented by the yellow color. In contrast, the swine flu, represented by the blue color, led to a notable expansion of over 50% in the manufacturing sector.

It was more affected by the global economic crisis, which is represented by the red color in the figure above, compared to last year, which is represented by the yellow color. As for the epidemiological shock represented by the swine flu, which is represented by the blue color, the sector witnessed an expansion of more than 50% in the manufacturing sector.

Figure No. (1-02) the impact of the Corona epidemic shock on the services sector in China



The information sourced from Gita Gopinath at the International Monetary Fund in 2020[9] highlights the impact of the COVID-19 pandemic on China's services sector. The figure indicates a sharp vertical fall in the green color, surpassing the effects of other shocks, including the global financial crisis depicted in red. The global shock from the swine flu is attributed to a decline in supply and demand worldwide due to reduced commercial activity resulting from measures to contain the epidemic. This recent epidemic has surpassed the impact of previous outbreaks like the plague, Ebola, SARS, and cholera.

In the context of Algeria, the economy's exposure to the outside world, particularly in consumer goods, emphasizes the vulnerability of the Algerian economy. With imports predominantly comprising consumer goods and exports heavily dependent on the hydrocarbons sector, the Algerian economy exhibits a dependence on a single sector, indicating fragility. The epidemiological shocks experienced by Algeria underscore the weaknesses of a rentier economy, serving as a warning of the seriousness of the situation within the country's economic structure.

[9] Gita Gopinath, Limiting the economicrepercussions of the Corona virus by developingsignificanttargetedpolicies, previouslymentionedreference.

its effects	the epidemic shock	The year
Lack of consumer spending and worsening economic impact on foreign trade. -Sharp decline in economic activity -Disruptions in supplies -Fear and panic -Absenteeism -Disruptions at the border level -Investment postponement -Transportation disruptions -Significant loss of human life -Border preparations and significant financial losses	Cholera[10]	1996
	plague[11] - SARS[12] - bird flu[13]	2003
	bird flu	2004
	Meningitis	2008
	swine flu[14]	2009
	swine flu	2010
	Ebola[15]	2014
	Ebola-mad cow disease[16]	2015
	Cholera[17]	2018
	Meningitis[18]	2019
	corona[19]	2020

Source: The table was prepared based on various official websites.

From the table above, we observe that the global health shocks, particularly those witnessed in Algeria, are predominantly pandemic shocks associated with infectious animal viruses. This association poses a challenge in understanding their bacterial composition and accelerates their spread. We have mentioned only some of these pandemics, focusing on the latest pandemic shock, the COVID-19 pandemic. The similarity of pandemics as health shocks is acknowledged, but there is a difference in timing. The temporal periods of pandemics vary due to the developments that have occurred globally in various fields. The factor of concern and panic remains constant over time, and its impact continues to be a puzzle for international decision-makers. Regardless of our attempts to analyze and interpret this puzzle, there will be no standardized answer because the human mind is the orchestrator. In this section, we aim to elucidate the implications of the COVID-19 pandemic shock on

[10] Gita Gopinath, Limiting the economicrepercussions of the Corona virus by developingsignificanttargetedpolicies, previouslymentionedreference.

[11] France 24, Cholera claims a second victim and the epidemic expands to new areas, Algeria, 08/25/2018, SA: 13.02, available at: https://www.france24.com/ar/20180825

[12] Maghreb Voices, Four deadlyepidemicsstruck Algeria, thisistheir story, August 31, 2018, SA: 14.55, available at: https://www.maghrebvoices.com/2018/08/31

[13] World HealthOrganization, Nomenclature of COVID-19 and the virus that causes it, 05/02/2022, availableat: https://www.who.int/ar/emergencies/diseases/novel-coronavirus-2019/technical-guidanece

[14] World HealthOrganization, previouslymentionedreference

MAYO CLINIC, SwineFluEpidemic, 02-05-2022, 16:07H, available on: https://www.;ayoclinic.org/ar/diseases-conditions/swine-flu/symptoms-causes/syc-20378103

[15] World HealthOrganization, op. cit.

[16] CDC, Bovine SpongiformEncephalopathy (BSE), or Mad CowDisease, The Previousreference

[17] France 24, previousreference

[18] Algerian News Agency, 126 cases of meningitisrecorded in three states, 10/11/2019, 08.51, availableat: https://www.aps.dz/ar/sante-science-technologie/77695-126

[19] France 24, Algeria announces the registration of the first confirmed case of infection with the Corona virus, 02/25/2020, 20:59, previousreference

imports in Algeria, presenting facts and figures during specific time periods, always leaving open parentheses within the economic structure in Algeria.

4. The second axis: Analytical and measurement study.

4.1. Analytical Study:

In this phase, we impart a practical dimension to the study by employing econometrics, a branch of economics focused on measuring and analyzing economic phenomena. It utilizes economic theory, mathematics, and statistical methods to analyze and test economic theories.

The objective of this study is to estimate a standard model. In selecting study variables, we primarily rely on economic theory and prior research. The model aims to represent determinants influencing Algerian imports from 1990 to 2020.

After identifying key economic variables affecting the dependent variable (imports) through theoretical exploration, we formulate and estimate the standard model for the studied phenomenon or problem (imports). In establishing a model illustrating the impact of economic variables (such as Gross Domestic Product, standard prices of consumer goods, economic exposure) on imports, the first step involves determining the variables based on economic theory and available information about the independent and dependent variables.

4.2. Descriptive Study of the Dependent Variable:

The dependent variable, symbolized as (M), is the focus of interpretation. Through this study, we ascertain that the dependent variable is the volume of imports (M). Import value indices represent the current value of imports (CIF) converted to US dollars, expressed as a percentage of the average base period (2000 estimates). UNCTAD import value indices are reported for most countries. For selected countries without UNCTAD data, import value indices are derived from import volume indices (item 73) and related unit import value indices (item 75) found in the International Financial Statistics of the International Monetary Fund[20].

Table (2-01): Evolution of the volume of imports during the period (1990-2020)

Unit: billion dollars

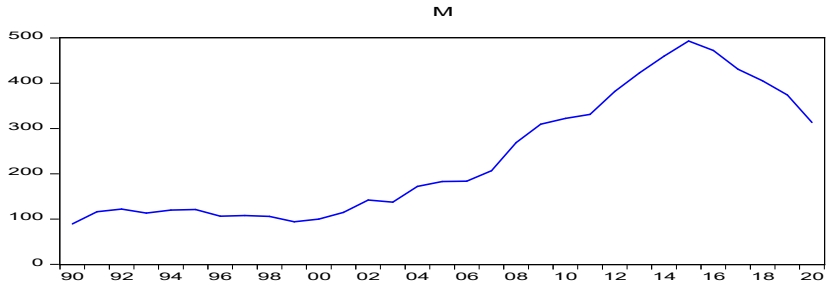
Imports (M)	The Year	Imports (M)	The Year
183.60	2006	89.32	1990
206.80	2007	116.10	1991
268.90	2008	122.10	1992
309.40	2009	113.10	1993
322.20	2010	119.90	1994
331.10	2011	121.00	1995
381.70	2012	106.20	1996
422.70	2013	107.83	1997

[20] The official website of the World Bank, 05-17-2022, SA: 10:48. https://data.albankaldawli.org/indicator/

459.70	2014	105.80	1998
493.30	2015	94.00	1999
472.40	2016	100.00	2000
430.85	2017	114.70	2001
405.39	2018	142.00	2002
373.96	2019	137.30	2003
313.50	2020	172.00	2004
		183.00	2005

Source: Prepared by students based on the official website of the World Bank

Figure (2-01): Development of the volume of imports in Algeria during the period (1990-2020)



Source: The figure was prepared based on statistical processing using the Eviews10 software, relying on the data from the table above.

From Table (01), it is evident that imports have decreased, starting at $472.40 billion in 2016 and steadily declining to $373.96 billion in 2019. In 2020, due to the global shutdown caused by the shock of the coronavirus, Algerian imports further decreased to $313.50 billion.

4.3. Descriptive Study of Explanatory Variables:

The independent variable, usually denoted by (ß), represents the causal values in the phenomenon. Through this study, we conclude that the independent variables are:

- **ß1**: Gross Domestic Product (GDP).
- **ß2**: Standard prices of consumer goods (CPI).
- **ß3**: Economicexposure (EEX).
- **ß4**: The visual variable (DV).

Independent variables play an important role in explaining the phenomenon, and the following table will show their development during the study period.

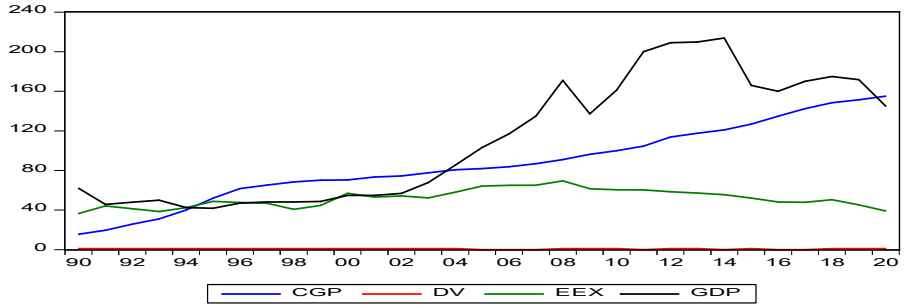
Table No. (2-02) represents the development of the explanatory variables for the period (1990-2020)

DV	EEX	CPI	GDP	The year
0	36.5	15.52	62.05	1990
0	44.21	19.54	45.72	1991
0	41.29	25.72	48	1992
0	38.43	31.01	49.95	1993

0	42.42	40.01	42.54	1994
0	48.74	51.93	41.76	1995
1	47.59	61.63	46.94	1996
0	46.87	65.16	48.18	1997
0	40.69	68.39	48.19	1998
0	44.59	70.2	48.64	1999
0	56.95	70.44	54.79	2000
0	53.11	73.41	54.74	2001
0	54.21	74.46	56.76	2002
1	52.37	77.63	67.86	2003
1	57.98	80.71	85.33	2004
0	64.3	81.83	103.2	2005
0	65	83.72	117.03	2006
0	65.04	86.8	134.98	2007
1	69.46	91.01	171	2008
1	61.56	96.24	137.21	2009
1	60.5	100	161.21	2010
0	60.36	104.52	200.01	2011
0	58.47	113.82	209.06	2012
0	57.21	117.52	209.75	2013
1	55.49	126.74	213.81	2014
1	52.04	126.74	165.98	2015
0	48.19	134.84	160.03	2016
0	47.77	142.38	170.1	2017
1	50.38	148.46	174.91	2018
1	45.27	151.36	171.77	2019
1	39.13	155.02	145.01	2020

Source: The figure was prepared based on World Bank data

Figure No. (2-02) represents the development of the explanatory variables for the period (1990-2020)



Source: The figure was prepared based on statistical processing using Eviews10.

Through the table and the above chart, we observe the evolution of economic variables, noting that they have a statistical relationship and significance on the dependent variable, imports. We also noticed the presence of a visual variable, which is the epidemic shocks that occurred in a specific time period, the period when these

epidemics appeared. As mentioned earlier, we introduced the visual variable as an explanatory variable. Through the studied model, we assign a value of (1) for the years affected by epidemic shocks and a value of (0) for the years that were not affected, as shown in the table above, where:

- In 1996, cholera reappeared in Algeria without any recorded deaths, after claiming many lives in previous years during the French colonial period, coinciding with the typhoid and smallpox epidemics.
- In 2003, after independence, the plague appeared, affecting the western Algerian provinces: El Oued, Ain Temouchent, Mascara, Tlemcen, and Oran, which recorded one death.
- In 2004, the H5N8 bird flu virus appeared for the first time, spreading in China, Indonesia, South Korea, Hong Kong, Japan, and Thailand, causing the death of thousands of birds in several farms in the country[21].
- In the years 2008-2009-2010, various epidemics emerged worldwide, such as the H1N1 pandemic in 2009, the swine flu pandemic, and the spread of meningitis virus in West Africa. This caused concern in many countries, especially Algeria, due to its strategic location with several African countries affected by various epidemics.
- In the years 2014-2015, another deadly epidemic appeared in some African countries, starting in Guinea in March 2014. The epidemic then spread to neighboring countries. On August 8, 2014, the World Health Organization (WHO) declared the pandemic a public health emergency requiring international attention[22].
- In 2018, cholera reappeared in Algeria, with the Ministry of Health announcing an outbreak located at the water source in Sidi El Kebir in the municipality of Ahmer El Ain in Tipaza (70 km west of the Algerian capital).

In the years 2019-2020, another virus outbreak, the coronavirus pandemic, emerged, reshaping the world map and causing countries to experience panic and fear. This pandemic, with significant death tolls, resulted in catastrophic shocks to the economic structure of advanced countries, especially major industrial nations. It affected international trade due to restrictions on the movement of people through border closures. In Algeria, this virus deepened existing scars in the Algerian economy, highlighting the weakness and fragility of its economic structure. This was compounded by some strict decisions made by the Algerian government regarding imports and international trade in general.

4.3.1. Gross Domestic Product (GDP):

Gross Domestic Product at purchaser prices is the total value added by all resident producers in the economy, plus any taxes on products, and minus any subsidies not included in the value of the products. It is calculated by subtracting the value of manufactured asset depreciation or making any deductions due to depletion and deterioration of natural resources. The data are expressed in the current value of The US dollar.

[21] -France 24, 09/02/2021, available on the site: https://amp.France24.com/ar/

[22] Roy-Macaulay, Clarence, Ebola Crisis,2014, Triggers Health Emergency, Drug Discov.Dov, Highlands Ranch, Colorado, United States, Associated Press, updated: 10-09-2017. At: https://www.dddmag.com/news/2014/07/ebola-crisis-triggers-health-emergency

When comparing imports with Gross Domestic Product, theoretical evidence and many standard studies have shown a correlation between imports and Gross Domestic Product[23].

Researchers Nasiruddin Ahmed and Dilip Dutta[24] found that Gross Domestic Product is the main determinant of demand for imports in India. The volume of imports is influenced by changes in Gross Domestic Product. Despite the debated direction of the relationship between the two variables, most studies have confirmed the importance of imports in forming Gross Domestic Product. According to economic theory, the Gross Domestic Product of any country influences imports, with the degree of response varying from one country to another. This can be illustrated through the following table and graphical representation.

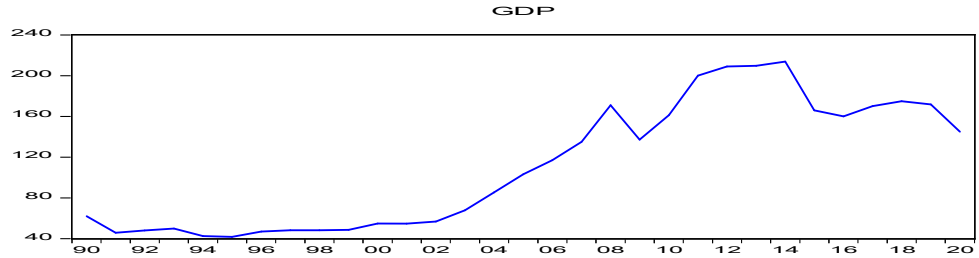
Table (2-03): Statistics of gross domestic product development during the period (1990 to 2020)

Unit: billion dollars

Gross Domestic Product" (GDP)	The Year	Gross Domestic Product" (GDP)	The year
117.03	2006	62.05	1990
134.98	2007	45.72	1991
171.00	2008	48.00	1992
137.21	2009	49.95	1993
161.21	2010	42.54	1994
200.01	2011	41.76	1995
209.06	2012	46.94	1996
209.75	2013	48.18	1997
213.81	2014	48.19	1998
165.98	2015	48.64	1999
160.03	2016	54.79	2000
170.10	2017	54.74	2001
174.91	2018	56.76	2002
171.77	2019	67.86	2003
145.01	2020	85.33	2004
		103.20	2005

Source: The table was prepared based on data from the official website of the World Bank 2022

Figure (2-03): GDP development in the period (1990-2020)



Source: The figure was prepared based on the statistical processing of Eviews 10

[23] Official website of the World Bank, 03-25-2022, SA: 22:48. https://data.albankaldawli.org/indicator/

[24] Dilip Dutta and NasiruddinAhmed, (2006), An Aggregate Import DemandFunction for India: AcointegrationAnalysis, School of Economics and Political Science, University of Sydney, pp1-12.

Through the table and figure above, in the period 1990-2002, the national economy was characterized by economic reforms and the implementation of the International Monetary Fund program, in addition to external debt restructuring. Consequently, Gross Domestic Product (GDP) experienced various fluctuations during this period. In 1995, GDP dropped to $41.76 billion. Then, the global financial crisis had a clear impact on GDP due to the collapse of oil prices in the world markets. In 2009, GDP reached $137.21 billion. From 2010 to 2014, there was an increase in GDP values due to rising oil prices. However, GDP witnessed a significant decline in 2020, amounting to $145.01 billion, reflecting the country's situation amid the repercussions of the COVID-19 pandemic. Studies have shown that to maintain the living standards of the population, GDP growth should not be less than 6%, given the continuous population growth, to cover their increasing needs and address social deficits. The country faced an unprecedented crisis, unaccustomed to the banking system, namely a liquidity crisis that led banks to collapse by billions of dollars within a few months of 2020.

4.3.2. Standard Prices for Consumer Goods Index:

The Consumer Price Index reflects changes in the cost for an average consumer to obtain a basket of goods and services that may remain constant or change over specific periods, typically annually. It is generally calculated using a formula such as Laspeyres[25].

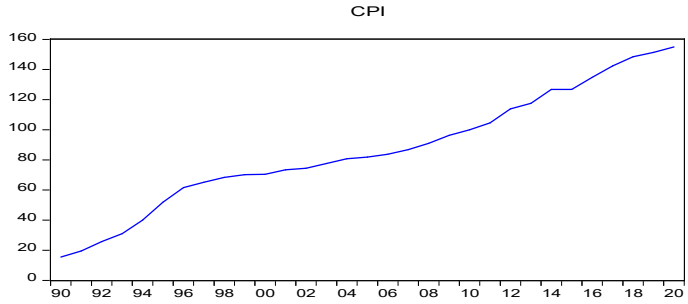
Table (2-04): Development of Standard Prices for Consumer Goods in the period (1990-2020) (2010=100)

Prices of consumer goods	The year	Prices of consumer goods	The year
83.72	2006	15.52	1990
86.80	2007	19.54	1991
91.01	2008	25.72	1992
96.24	2009	31.01	1993
100.00	2010	40.01	1994
104.52	2011	51.93	1995
113.82	2012	61.63	1996
117.52	2013	65.16	1997
120.95	2014	68.39	1998
126.74	2015	70.20	1999
134.84	2016	70.44	2000
142.38	2017	73.41	2001
148.46	2018	74.46	2002
151.36	2019	77.63	2003
155.02	2020	80.71	2004
		81.83	2005

Source: The table was prepared based on data from the official website of the World Bank 2022

[25] Official website of the World Bank, 03-25-2022, SA: 22:48. https://data.albankaldawli.org/indicator

Figure No. (2-04): The evolution of standard prices for consumer goods based on the data in the table above in the period (1990-2020).



Source: The figure was prepared based on the statistical processing using Eviews10 program.

Through the graphical representation, we observe a significant increase in the consumer price index. This surge is attributed to the rise in prices of raw materials at the beginning of 2018, supported by supply and demand factors. Among these factors is the accelerated pace of global growth, leading to increased demand for most industrial raw materials and supply constraints affecting other goods. Since Algeria's economy is open to the world, with most of its imports being food products, it may be influenced by international price fluctuations. When the COVID-19 pandemic hit in 2019, the price basis for raw materials was disrupted, causing a substantial increase in prices in our country.

4.3.3. Economic Exposure Index:

Economic exposure represents the value of commodity trade. It is expressed as a percentage of total GDP, with the value of commodity exports and imports divided by the total GDP. All data are in current US dollars[26]. Through this table, we will try to illustrate the degree of economic exposure for Algeria in the period (1990-2020).

Table No. (2-05): Algerian economic exposure index for the period (1990-2020)

(Merchandise trade: % of GDP)[27]

Economic exposure index	The year	Economic exposure index	The year
65.00	2006	36.50	1990
65.04	2007	44.21	1991
69.46	2008	41.29	1992
61.56	2009	38.43	1993
60.50	2010	42.42	1994
60.36	2011	48.74	1995
58.47	2012	47.59	1996
57.21	2013	46.87	1997
55.49	2014	40.69	1998
52.04	2015	44.59	1999

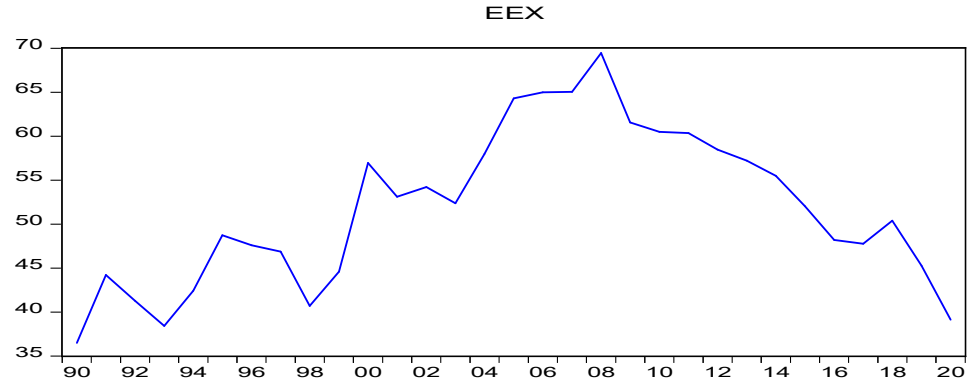
[26] The official website of the World Bank, 03-25-2022, SA: 22:48. https://data.albankaldawli.org/indicator

[27] World Bank data, samereferenceabove.

48.19	2016	56.95	2000
47.77	2017	53.11	2001
50.38	2018	54.21	2002
45.27	2019	52.37	2003
39.13	2020	57.98	2004
		64.30	2005

Source: Prepared by students based on the official website of the World Bank

Figure No. (2-05) Economic exposure index in Algeria for the period (1990-2020)



Source: The figure was prepared based on the statistical processing of Eviews 10

The economic exposure index, representing the trade of goods as a percentage of total GDP, fluctuated over time, particularly in the periods preceding the oil crisis (2010-2014). Despite yearly increases in imports, the bill showed relative stability during 2011-2015. However, a significant decline in commodity trade occurred in 2019-2020, decreasing by 13.56%. This decline is attributed to the impact of the COVID-19 pandemic, reflecting the country's economic vulnerability to external factors.

Analyzing the economic exposure degree in Algeria reveals its dependence on foreign markets for product distribution and acquiring goods and services. The higher the index, the deeper the economic reliance on external markets, making the local economy more sensitive to global variables like international prices, fiscal policies, trade policies, economic partnerships, and global political events.

4.3.4. Dummy Variables:

- **Qualitative Variable Integration:** Dummy variables are used to incorporate qualitative variables into the model, expressing a specific condition that might affect the dependent variable. Examples include economic development, sector (public or private), and gender. The dummy variable takes a value of 1 for one condition and 0 for the other, determining the statistical significance of its impact.
- **Correction of Exceptional Data:** Dummy variables are utilized to correct and neutralize the impact of exceptional events within time series data. This is essential to remove any distortion caused by these events and understand their influence on the studied phenomenon.

❖ **Seasonal Features:** Dummy variables are employed to account for seasonal features in the phenomenon. The binary values (1 or 0) are assigned based on whether a year was affected by international crises, providing a tool to measure their impact on the studied economic structure.

Econometrics, as a blend of economic theory and statistical/mathematical methods, evaluates and quantifies economic variables. Coined by economist Ragnar Frinsh in 1926, the term "econometrics" combines "econo" for economic relationships and "metrics" for measurement, reflecting its purpose of quantifying economic relationships. The field relies on statistics, economic theory, and mathematical modeling[28].

- **Econometrics involves three branches of science:** statistics, economic theory, and mathematical economics. Economic theory helps identify the problem under study, mathematical economics formulates theoretical relationships into measurable rates and mathematical symbols, and statistics estimates proposed formula parameters, tests hypotheses, and derives results for future value predictions.

- **Estimation and Testing of the Standard Model:**

❖ **Specification of the Model:**

Building on economic theories and previous models regarding import demand determinants and analyzing import realities during pandemics, the model is estimated. Utilizing Eviews10 and World Bank statistics for 1990-2020, the relationship between various explanatory variables and the dependent variable is expressed in the following model:

$$Y_i = \beta_0 + \beta_1 \text{GDP} + \beta_2 \text{CPI} + \beta_3 \text{EEX} + \beta_4 \text{DV} + \epsilon_i$$

Where:

- **ß0**: time (year)
- **ß1**: Gross Domestic Product
- **ß2**: Standard Prices for Consumer Goods
- **ß3**: Economic Exposure
- **ß4**: Dummy Variable

- and ß4, ß3, ß2, ß1, ß0are term Model Description: Table No. (2-06) Ramsey test

To determine the suitability of this functional form to the model, we applied the appropriate test, which is the Ramsey test, and the following table explains this in some detail:

[28] Damodar N Gujarati, Econométrie, Traduction de la 4eme édition Américaine par Bernard Bernier de Boecketlarcier, S, A, Paris, 2004, p 02.

Table No. (2-06) Ramsey test

Ramsey RESET Test
Equation: EQ04
Specification: M C GDP CGP EE DV
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.561333	25	0.5796
F-statistic	0.315095	(1, 25)	0.5796
Likelihood ratio	0.388276	1	0.5332

Source: The figure was prepared based on the statistical processing of Eviews 10

From the table we notice Prob = 0.5796

0.05<Prob We accept: H0: that is, the model fits the study data.

4.3.3: Estimation of the Model

We now estimate the model and study its validity through appropriate statistical and standard tests using the ordinary least squares method, which is considered one of the best methods for estimating linear models, due to its characteristics. After getting to know the general form of the overall model, we estimate the model as follows:

Table No. (2-07): Results of estimating the model of the impact of epidemic shocks on Algeria's imports for the period (1990-2020)

Dependent Variable: M
Method: Least Squares
Date: 05/29/22 Time: 09:30
Sample: 1990 2020
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	129.6769	59.85909	2.166369	0.0396
GDP	1.681517	0.284617	5.907991	0.0000
CGP	1.094210	0.442007	2.475550	0.0201
EEX	-3.393677	1.195875	-2.837820	0.0087
DV	-6.538187	20.63914	-0.316786	0.7539

R-squared	0.886179	Mean dependent var	232.8961
Adjusted R-squared	0.868668	S.D. dependent var	137.7641
S.E. of regression	49.92530	Akaike info criterion	10.80562
Sum squared resid	64805.93	Schwarz criterion	11.03691
Log likelihood	-162.4872	Hannan-Quinn criter.	10.88102
F-statistic	50.60733	Durbin-Watson stat	1.150005
Prob(F-statistic)	0.000000		

Source: The figure was prepared based on the statistical processing of Eviews 10

From the table we note that: Coefficient of determination R^2: represents the constant variable C

Number of views: N; Fisher's test calculated: F: Probability of error occurring

The form of the regression equation is as follows

M = 129.676852036+ 1.6815171199*GDP + 1.09420969062*CPI-3.39367736551*EEX – 6.53818716754*DV

❖ **Estimation of the Model**

Here we will study the model from a statistical and economic perspective as follows:

- First: Statistical evaluation:

By this we mean knowing the significance of the parameters and the explanatory power of the model, and through Table No. (..) we note:

▪ **Study of the significance of parameters:** There are two tests that are used in this regard:

- **Student T test:** This test is used to determine the significance of each parameter separately (partial significance of the model):
  - **H0**: ßi = 0
  - **H1**: ßi ≠ 0

- 0.5 > 0.0000 = GDP Prob Hence we accept H1, meaning that the variable (GDP) is statistically significant, meaning that there is a relationship between gross domestic product (GDP) and imports (M).
- 0.5 > 0.0201 = CGP Prob Hence we accept H1, meaning that the variable (CGP) is statistically significant, meaning that there is a relationship between the prices of consumer goods (CGP) and imports (M).
- 0.5 > 0.0087 = EE Prob Hence we accept H1, meaning that the variable (EE) is statistically significant, meaning that there is a relationship between economic exposure (EE) and imports (M).
- 0.5 < 0.7539 = DV Prob Hence, we reject H1, meaning that the variable (DV) is not statistically significant, meaning that epidemiological shocks have no impact on Algerian imports.

- **Fisher F test:** This test is used to determine the significance of the model as a whole (the overall significance of the model).
- Since the significance level of 0.000 = Prob for all explanatory variables is less than 0.05, this means that the model is significant as a whole, and this is what makes us reject the null hypothesis, which says that the model is not significant.

We accept the alternative hypothesis: which says that the model is statistically significant, that is, it can be relied upon in explaining the relationship between imports and the explanatory variables.

▪ **Study the explanatory power of the model:**

To judge that the model has explanatory power we use the criterion of the coefficient of determination R^2 or the corrected coefficient of determination R.

0.886179 = R^2 Strong relationship between variables.

88% of the R^2 of the dependent variable Y is explained by the explanatory variables, which are: GDP.CGP, EEX, and the rest is explained by other factors that were not included in the model, 12%.

- Second: Economic Evaluation:

Through the table and the previous results, the following insights can be gained:

❖ **Variables with Statistical Significance:**

- **Gross Domestic Product (GDP) (ß1):** The positive relationship aligns with economic theory, indicating that demand for imports is positively related to GDP. An increase in income leads to higher purchasing power and, consequently, increased overall demand.
- **Consumer Goods Prices (CGP) (ß2):** The positive relationship aligns with Keynesian theory, where a decrease in overall demand leads to lower production and prices.
- **Economic Exposure (EEX) (ß3):** The negative relationship is significant, reflecting the impact of economic exposure. A higher economic exposure index indicates dependence on oil, leading to increased imports due to a lack of production diversity.

❖ **Variables without Statistical Significance:**

- **Epidemiological Shocks (DV) (ß4):** The negative relationship is present but not statistically significant. This implies that epidemiological shocks may not significantly affect imports, with government decisions and unaccounted factors playing a role.

❖ **Economic Interpretation:**

- **Impact of Gross Domestic Product (GDP):** The rise in GDP signifies increased purchasing power, resulting in higher demand for imports.
- **Impact of Consumer Goods Prices (CGP):** Changes in overall demand and production affect consumer goods prices, possibly leading to lower prices due to decreased demand.
- **Impact of Economic Exposure (EEX):** The impact reflects the economic dependence on oil and its consequences on imports, highlighting the importance of production diversity.

❖ **Impact of the Shocks (DV):**

The negative impact, though not statistically significant, suggests that government decisions during crises may play a crucial role in directing imports.

In summary, the economic evaluation indicates that the derived relationships from the model align with theoretical expectations, emphasizing the influence of economic factors on the movement of imports in the Algerian economy.

❖ **Extension:**

These findings offer valuable insights into the dynamics of import behavior in the Algerian economy. The statistical significance of certain variables underscores their importance in shaping the import landscape, providing policymakers with crucial information for decision-making.

Additionally, the lack of statistical significance in the relationship with epidemiological shocks highlights the need for a more nuanced understanding. Government decisions and unaccounted factors during crises may significantly influence import patterns, emphasizing the importance of a comprehensive approach in economic modeling.

The economic interpretation reveals the sensitivity of imports to changes in GDP, consumer goods prices, and economic exposure. This information is vital for creating effective economic policies aimed at stabilizing the import sector and fostering economic resilience.

In conclusion, the combination of statistical analysis and economic interpretation enhances our understanding of import dynamics in the Algerian context, offering valuable insights for policymakers and economists alike.

4.3.4 Evaluation of Forecasting Power

This stage is considered very important in econometrics. After formulating, estimating, and testing the model comes the stage of evaluating its suitability to predict the values of the dependent variable. This stage includes several tests:

First: Breusch-Godfrey LM Test for autocorrelation between random errors

Table No. (2-08) LM test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.479028	Prob. F (2,24)	0.1050
Obs*R-squared	5.307668	Prob. Chi-Square(2)	0.0704

Source: The figure was prepared based on the statistical processing of Eviews 10

1050 =Prob

Since 0.05 < Probe, we accept H0 and reject H1, meaning there is no autocorrelation between random errors.

Second: Testing the stability of the variance of random errors:

There are several tests to detect this problem, the most famous of which is the WHITE test

Table No. (2-09): Results of the WHITE test to detect the problem of non-constancy of contrast

Heteroscedasticity Test: White

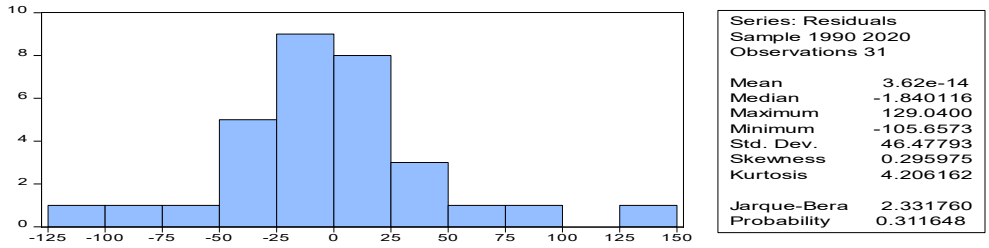
F-statistic	1.568682	Prob. F (13,17)	0.2123
Obs*R-squared	6.026901	Prob. Chi-Square(13)	0.1971
Scaled explained SS	6.796306	Prob. Chi-Square(13)	0.1471

Source: The figure was prepared based on the statistical processing of the Eviews10 program

We notice from the table that the probability of the F-statistic equals 1.568682 is greater than 0.05, so we accept H0, which says that there is no problem of heterogeneity of variance.

- Third: Error distribution test (Jarque Bera test):

Figure (2-06) Jarque Bera's error distribution test



Source: The figure was prepared based on the statistical processing of Eviews10 program.

Through the table, it is observed that the probability of Jarque-Bera equals 0.311648, which is greater than 0.05. Therefore, we accept the null hypothesis, indicating that the errors follow a normal distribution.

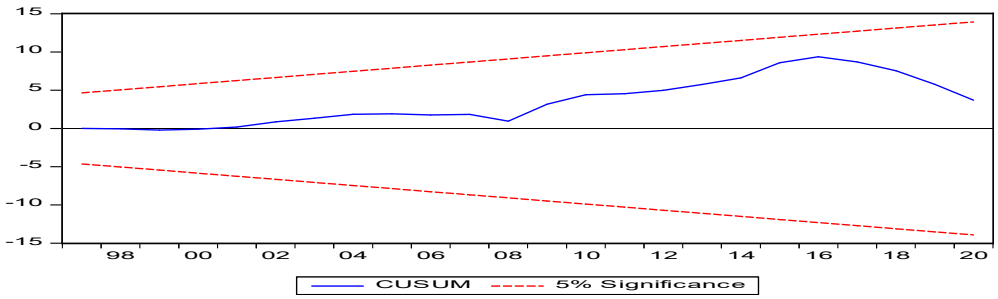
Fourth: Parameter Stability Test:

This is conducted through the CUSUM test, allowing us to assess the stability of parameters over time. The test involves two hypotheses:

- Null Hypothesis (H0): Parameters are within the confidence interval.

- Alternative Hypothesis (H1): Parameters are outside the confidence interval.

Figure No. (2-07) Cusum test results



4.3.5 Analysis and Interpretation of Results (Extended):

❖ **Impact of Economic Exposure:**

- The economic exposure coefficient, with its negative sign, underscores the intricate relationship between economic openness and import dynamics. While economic exposure reflects the significance of exports and imports to the Gross Domestic Product (GDP), the negative coefficient implies that heightened economic exposure leads to a decrease in imports. This phenomenon exposes Algeria's economic structure, heavily reliant on oil and gas, to external market shifts and emphasizes the necessity for diversification.

❖ **Insights from Pandemic Shocks:**

- The pandemic shock variable, while statistically non-significant, bears a negative sign, suggesting an inverse relationship with imports. The intricate nature of government decisions during pandemics, such as lockdowns

and precautionary measures, is reflected in the model. Although not statistically significant, it sheds light on the government's role in shaping import patterns during crisis situations.

❖ **Long-Term Economic Planning:**

- The comprehensive study accentuates the significance of long-term economic planning, especially in mitigating external shocks. The revealed vulnerability of the Algerian economy to global economic fluctuations, including the recent COVID-19 pandemic, emphasizes the imperative for strategic foresight, resilience-building, and economic diversification.

❖ **Government Decision-Making and Imports:**

- The model underscores the role of government decisions, particularly during economic and pandemic shocks, in shaping import trends. Decisions such as closures and precautions, while crucial for public health, have tangible effects on trade patterns. Understanding these dynamics is vital for policymakers to formulate effective strategies that balance health concerns with economic stability.

❖ **Recommendations for Economic Resilience:**

- The study recommends that the Algerian government prioritize economic diversification strategies to enhance resilience during crises. Developing alternative economic pathways and reducing dependence on a single revenue source, such as oil and gas, would contribute to a more robust and adaptable economic framework.

❖ **Global Economic Integration:**

- The study sheds light on the interconnectedness of Algeria's economy with global markets. As the country navigates challenges posed by external shocks, fostering global economic integration can open avenues for diversified trade partnerships, reducing vulnerability to singular shocks and enhancing economic sustainability.

❖ **Implications for Public Health Policies:**

- The findings hint at the intersection of economic and public health policies. During pandemics, policies impacting trade, such as closures and restrictions, have implications for economic stability. This underscores the need for coordinated efforts between health and economic authorities to strike a balance between safeguarding public health and maintaining economic resilience.

❖ **Lessons for Crisis Management:**

- The study serves as a lesson for crisis management, highlighting the importance of anticipating and preparing for unforeseen events. Establishing robust crisis management protocols, both economically and health-wise, is critical to navigating uncertainties and minimizing the impact of external shocks.

In summary, the integrated statistical, economic, and pandemic shock analysis provides a comprehensive understanding of Algeria's import dynamics. The insights derived from this study offer valuable guidance for

policymakers, urging a holistic approach to economic planning, diversification, and resilience-building in the face of global uncertainties.

6. Conclusion:

In conclusion, our study aimed to address the research problem concerning the impact of pandemic shocks on imports in Algeria during the period (1990-2020). We sought to explore how these shocks influenced imports and how crises can potentially transform into opportunities. Through a meticulous investigation, employing the methodologies and tools outlined in the introduction and applied in the empirical study, we diversified the conclusion to cover research findings, hypothesis testing, recommendations, and future research prospects.

6.1. Research Findings and Discussion:

The study yielded both theoretical and practical results, allowing us to either confirm or refute the hypotheses formulated in both the theoretical and empirical sections. Summarizing the results:

Discussion of the First Hypothesis:

There exists a statistically significant correlational relationship between the independent variables of the study and imports.

To verify the validity of this hypothesis, the students utilized the Ordinary Least Squares (OLS) method, relying on annual time series data. The partial significance of the model was tested using the coefficient of determination (R^2), indicating the explanatory power of the model. The following table provides a detailed overview:

The outcomes demonstrated a robust statistical significance, reinforcing the established connection between the independent variables and imports, as hypothesized.

Table No. (2-09): Results of Partial Significance Testing for the Model's Coefficient of Determination (R^2):

R-squared	R-squared	**0.886179**	Mean dependent var	232.896
Adjusted R-squared	Adjusted R-squared	0.868668	S.D. dependent var	137.764
S.E. of regression	S.E. of regression	49.9253	Akaike info criterion	10.8056
Sum squared resid	Sum squared resid	64805.93	Schwarz criterion	11.0369
Log likelihood	Log likelihood	-162.4872	Hannan-Quinn criter.	10.881
F-statistic	F-statistic	50.60733	Durbin-Watson stat	1.15001
Prob(F-statistic)	Prob(F-statistic)	0.000000		

Source: The table was prepared based on the statistical processing of Eviews 10

Considering the previous table, it is evident that there is a strong statistically significant relationship between the independent variables of the study and imports. This relationship accounts for 88% of the variation in the dependent variable \(M \), explained by the explanatory variables represented by GDP, CGP, EEX, and DV.

The remaining 12%, unaccounted for by the model, is attributed to other factors. The statistical relationships between variables can be summarized as follows:

- There is a statistically significant relationship between imports and Gross Domestic Product (GDP), indicating that the level of GDP influences imports. According to the study model, an increase in GDP by one unit leads to an increase in \(M \) by 1.68 units. This suggests that an increase in the level of GDP enables the country to enhance its imports of goods and services, addressing the deficit in local production. Notably, GDP affected imports through supply and demand shocks that reduced import volumes due to pandemic-related disruptions, especially the COVID-19 shock.
- There is a statistically significant relationship between imports and Consumer Goods Prices (CGP). This implies that an increase in import prices compared to local alternatives leads to a decrease in demand for imports. According to the study model, an increase in CGP by one unit results in an increase in \(M \) by 1.09%. This aligns with the principles of supply and demand in partial economics, indicating that the unit price of a commodity or service may fluctuate until it stabilizes at an economic equilibrium or when the quantity demanded by consumers equals the quantity supplied. Therefore, the equilibrium level of imports is determined by the interaction of demand and supply in the imports market for goods and services, with consumer demand for imports influenced by both income and import prices.
- There is a statistically significant relationship between imports and Economic Exposure (represented by commodity trade). The negative sign of the variable suggests an inverse relationship. According to the study model, an increase in EEX by one unit leads to a decrease in \(M \) by -3.39%. This relationship can be explained by the country's dependence on oil revenues as a primary source of production and income. The Algerian economy relies on imports due to the lack of diversity in its production base. This explains the economic dependence and exposure to external factors, highlighting the inverse relationship. Economies most exposed to external factors are least reliant on oil in their total domestic production, suffering from the "resource curse" and struggling to diversify their local production.

6.2. Discussion of the Second Hypothesis:

There is a statistically significant inverse relationship between the explanatory variable representing pandemic shocks and imports. To confirm the validity of this hypothesis, researchers used the Ordinary Least Squares (OLS) method and observed that the explanatory variable has a negative sign. According to the study model, an increase in the Dependent Variable (DV) by one unit results in a decrease in \(M \) by -6.53%. This implies an inverse relationship between pandemic shocks and imports. The following table provides a detailed illustration of the impact of pandemic shocks on imports:

The outcomes indicate a statistically significant inverse relationship between pandemic shocks and imports, emphasizing the economic challenges posed by global health crises on external trade dynamics.

Table No. (2-09): Impact of Pandemic Shocks on Imports:

Dependent Variable: M
Method: Least Squares
Date: 05/29/22 Time: 09:30
Sample: 1990 2020
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	129.6769	59.85909	2.166369	0.0396
GDP	1.681517	0.284617	5.907991	0
CGP	1.09421	0.442007	2.47555	0.0201
EEX	-3.393677	1.195875	-2.83782	0.0087
DV	**-6.538187**	20.63914	-0.316786	0.7539

Source: The table was prepared based on the statistical processing of Eviews10 software.

6.3. Interpretation:

Considering the preceding table, it is evident that the variable DV is not statistically significant, but it exhibits an inverse relationship with the dependent variable \(M \). This implies that when pandemic shocks increase by 1%, imports decrease by -6.53%. This result aligns with economic logic, indicating that as pandemic shocks spread, governments implement closure measures and decisions that restrict commercial activities, leading to a reduction in imports.

This finding is consistent with a study by Dr. Ahmed El-Sayed Ali (2020), mentioned in previous research. The study revealed an inverse relationship between the volume of exports and imports in the Kingdom of Saudi Arabia and the novel coronavirus at a 5% significance level, using the Autoregressive Distributed Lag (ARDL) test. The students attribute this result to the fact that all pandemic shocks have affected all countries, especially oil-exporting nations that rely on energy outputs for their revenues. Algeria was not exempt when the shock of the coronavirus impacted its imports.

6.4. Discussion of the Third Hypothesis:

Other factors and governmental decisions affect imports. To confirm the validity of this hypothesis, students considered the decisions of the Algerian government, specifically the full statement of the periodic meeting of the Council of Ministers on Sunday, March 22, 2022. Through these decisions, it became apparent that imports were indeed affected by these government measures. This indicates an indirect influence in which other conditions intervene that did not appear in the model.

This result is consistent with a study by Konstantin A. Kholodlin and Malte Rieth (2020), mentioned earlier in previous research. The study concluded that pandemic shocks continue to have direct and indirect negative effects on affected countries, global production, and a significant decline in world trade, especially imports.

The researchers attribute this result to the fact that the impact of pandemic shocks is represented by other variables not included in the model. This is explained by the remaining 12% of the determination coefficient, which was clarified by the students through the complete statement of the Prime Minister, including the decision to close borders, restrict foreign trade movement, and impose strict measures. Thus, it can be concluded that all the proposed hypotheses served the study and have a logical economic explanation. The study model demonstrated strong explanatory power, making it a reliable foundation for future reliance.

6.5. Recommendations:

Based on the results obtained, we find it necessary to provide a set of recommendations that are relevant to the study's topic:

- Prioritize and invest in the healthcare sector, establishing equipped hospitals and projects to address future pandemic shocks. Build robust infrastructure to mitigate the risks of such shocks.
- Implement economic diversification policies and rely on local products to reduce the impact of sudden pandemic shocks and eliminate economic dependence.
- Focus on the agricultural sector, leveraging it to decrease imports and achieve self-sufficiency in food supplies.
- Support private entrepreneurs, especially those with sustainable development ideas, as they represent a valuable asset in current circumstances.
- Learn from the experiences of European countries in addressing pandemic shocks, particularly through joint projects that proved successful globally.
- Strengthen relationships with advanced countries in the fields of medicine and healthcare. Benefit from their expertise to enhance the skills of Algerian medical professionals in using modern medical equipment.
- Support researchers and epidemiologists, providing a conducive environment for their experiments and facilitating their work in genetics and virology.
- Reduce reliance on oil revenues and encourage non-hydrocarbon exports to build a resilient economy capable of withstanding various shocks.
- Consider integrating the Algerian economy into the global economy by amending restrictive laws hindering local investment and carefully regulating foreign investment to safeguard national resources.
- Utilize the country's natural resources to improve the income of the population, ensuring equitable distribution, and helping the economy withstand shocks.
- In conclusion, after discussing the results of the hypotheses, we will now explore the study's prospects, providing researchers with avenues for further investigation and expanding on what we have presented.

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