



# **The Influence of COVID-19 pandemic on Inflation**

## **An Empirical study on Egypt**

*By*

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## **The Influence of COVID-19 pandemic on Inflation An Empirical study on Egypt**

*Dr. Hebatallah Ahmed Soliman*

### **Abstract:**

The world is going through a difficult period since the outbreak of the COVID-19 Pandemic in early 2020. This unique health crisis has resulted in demand and supply-side shocks, affecting both the real and financial sectors of global economies. In order to jump-start economies, governments and central banks around the world implemented expansionary fiscal and monetary policies to stimulate the economy. At the same time, supply chains are disrupted, resulting in huge increases in inflation in several countries. So, using monthly data, the study evaluates the influence of the covid-19 pandemic on inflation in Egypt using the ordinary least squares model from January 2020 to December 2021.

The findings reveal that new confirmed cases of covid-19, food prices, imports, and the producer price index all increase inflation in Egypt, while inflation is unaffected by the money supply, crude oil price volatility, or shipping costs. On the contrary new death cases of COVID-19, the stringency index, and the purchasing managers index lead to decrease inflation. As a result, the study recommends that the government provide assistance to the companies engaged in the supply chain industry to tide over the difficulties. The government must establish good offers for investors, as well as loosen some investment regulations. and the government can lessen the tax burden by enacting tax holiday policies and providing financial assistance to the manufacturing sector in order to maintain production throughout the pandemic.

**Keywords:** Covid-19 pandemic, Inflation, Supply chains, Consumer price index, Producer price index, Egypt, OLS model.

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## **1- Introduction:**

The world is going through a difficult period since the outbreak of the COVID-19 Pandemic in early 2020. This new health crisis has caused demand- and supply-side shocks (Brianca et al., 2020), affecting both the real and financial sectors of economies around the world, and businesses have faced significant challenges. The unique coronavirus disease has caused unprecedented challenges for countries around the world, including pharmaceutical and food shortages, which might have a disastrous effect on global morbidity and death. Many countries have set limits on shipping or exporting all items as a result of the COVID19 outbreak.

when the economy falls into a deeper recession on the wings of both demand and supply shocks, it might lead to a stagflation phase, characterized by a higher price level and unemployment rates (Papanikolaou& Schmidt 2020). Disrupted supply chains and trade, as well as decreased production, consumption, and investment activities, are among the economic consequences of this pandemic (Mishra & Mishra, 2020). The global output and employment cutbacks caused by the pandemic's demand- and supply-side shocks are more severe than those seen during the early twentieth century's Great Depression (Borio, 2020). The demand-side shocks have resulted in the decrease in the ability of people to purchase goods and services essentially due to the lockdown, and quarantine measures implemented by the governments to contain the pandemic. The supply-side shocks have resulted in a decrease in nations' ability to produce goods and services, owing to the closure of production units, disruptions in global supply chains, restrictions on domestic and international labor movements. Along with these growing issues, the pandemic caused oil market disturbances primarily due to decreased demand in aviation and manufacturing, as well as limits on people's transportation. In order to encourages economies, governments and central

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banks around the world implemented expansionary fiscal and monetary policies in complement to each other in which fiscal measures targeted ensuring people's social security, restoring human health, creating job opportunities, and recovery of trade and business. (Mishra & Mishra, 2020)

Through the first half of 2021, coincided economic recovery, declining global infection rates, increase crude oil prices (from 18.8 \$ in April 2020 for a barrel to more than 70\$ Jun 2021 reach 88\$ Jan 2022), (investing.com/commodities/crude-oil-historical-data) supply-chains disruptions, with rising general price inflation. Espitia et al. (2020) forecast a decrease in worldwide food exports and an increase in food prices mainly for developing economies that rely greatly on food imports. The commodity price index had continued stable during the previous years but had seen fast increases during the Covid pandemic recording more than 160 point in Jun 2021 and 187 point in Dec. 2021 (in spite of the price decrease at the beginning of Covid due to a large decrease in demand, where record 83.9 point in April 2020) (data.imf.org/?sk=471DDDF8-D8A7-499A-81BA-5B332C01F8B9). This volatility of the commodity market would have posed price risks for the suppliers around the world, especially the Small and Medium-sized Enterprises (SMEs) because their trade volumes are usually not considerable enough for them to hedge price risks like large firms do (Li, 2021). According to Kalemli-Ozcan et al., (2020), SMEs' failure rate during the Covid pandemic was largely higher than other corporate, and this finding is empirical across sectors and countries. As a result, a drop in SMEs' supply would lead to a drop in global export.

At the same time, the supply-chains have seen a series of commodity and manufactured goods supply troubles due to weather fluctuations. The worst drought in 55 years in Taiwan lead to globally shortage of semiconductors (Taiwan produces 75% of the world's more complex

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semiconductors). (Fyfe, 2021) A general public health pandemic can have significant negative impacts on businesses and supply chains, through reduced efficiency and performance, which force challenges on their flexibility and sustainability (Ivanov& Dolgui, 2020). Increasing demand has coincided with supply-chains disruptions, which lead to drive prices higher. Furthermore, semiconductor shortages are seen continuing through 2022 and into 2023. Also container and dry bulk shipping costs have climbed, (reach more than 14000 \$, 4000 \$ in Sep 2021 Respectively). (Fyfe, 2021) Increasing supply-chains cost, lead to drive global price inflation. In recent months, shippers have faced a “perfect storm”, with a significant increase in commodity and merchandise goods demand. paired with, supply-side manpower and logistical infrastructure limitations. so, there is a deferral in responding to demand. some logistical problems will last another 12-18 months. (Fyfe, 2021)

According to BWCHINESE (2021), throughout the epidemic, several governments implemented various relief initiatives and adopted loose monetary policies to stimulate the economy, resulting in severe inflation in various countries. For example, the CPI in the United States increased by 5% year over year in May 2021, similar to the 5.3% level seen during the financial crisis in August 2008. The COVID-19 virus has a global impact due to its high propensity to spreading, and it has a significant impact on inflation in countries all over the world.

Therefore, this study aims to clarification how might the outbreak of COVID-19 pandemic affected the inflation in Egypt? As will be revealed from the review of related studies in the next section, there are only a few studies which address this particular issue. Thus, we have examined the possibility of the presence of inflation amid the pandemic using OLS model. The empirical outcomes of the study lend to support the COVID-19 confirmed cases, change in food prices, changes in producers price index, and imports as the significant

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factors of inflation amid the pandemic. The study contributes to the literature in two respects: first, it is a comprehensive study of inflation responses to the pandemic in Egypt; for our knowledge there is no study explain how pandemic effect on inflation on Egypt, and second, it identifies the macroeconomic variables which determine the inflation amid the pandemic. Using monthly data, for our knowledge there is scarcity in literature which explain the effect of pandemic on inflation with monthly data, as all study using annual or daily data.

In the remainder of the study, section 3 reviews the extant literature. as the literature describes the ongoing COVID-19 pandemic as an exceptional public health crisis which has spread over the globe (Wang et al., 2020), and about 1/3rd of World's population has been subjected to lockdown (Hoof, 2020) to contain the rapid spread of the human-to-human infection. the global lockdown has generated demand- and supply side shocks, which causing global economic drops (Gormsen & Koijen, 2020). The pandemic-led economic slumps have impacted both real and financial sectors in COVID-19 affected countries (Maliszewska et al., 2020). unemployment and rising food prices could be linked to the covid-19 pandemic (Ahn& Norwood, 2020 ; Akter, 2020; Farias& Araujo, 2020; Agyei et al., 2021; Apergis& Nicholas, 2021; Rahmayani et al., 2021) the pandemic brings uncertainties and disruptions to international businesses and supply chains (Mahajan& Tomar, 2020; Sharma et al., 2020; Ivanov & Dolgui, 2020; Ho et al., 2021; Dunn& Leibovici, 2021; Amiti et al. 2021; santacreu& jesse, 2022 ), These global shocks have an impact on inflation (Szafranek, 2021; Alvarez et al., 2021).

The remainder of the paper is organized as: The theoretical framework in section 2, the influences of COVID-19 on Egyptian economy are highlighted in section 3, literatures and hypothesis in section 4, and the

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empirical model and estimation methodologies are presented in section 5. The empirical findings are discussed in section 6, then conclusion.

## 2- Conceptual framework

First of all, we begin with the definition of inflation, it is defined as a sustained rise in the general level of prices in an economy. Inflation has a significant impact on the function of money as a medium of exchange and a store of value. The consumer price index (CPI) is used in measuring inflation rates. CPI measures the average change in the prices of goods and services over time. (Chukwuemeka, 2018) In This paper we review two major viewpoint of inflation that exist, that is, The classical or Quantity theory of money, and the Keynesian theory. These theoretical viewpoints differ in their hypotheses about the causes and controls of inflation.

The classical theory propounded by Irving Fisher in 1956 postulates a direct and proportional relationship between money supply and the price level. That is, change in the supply of money causes a proportional change in the price level. If the amount of money overdoes the balance point of the current price level and the money supply is introduced into a market, the inflation rate will rise. Besides, there has been no important change in the production side, such as human resources, natural resources, technology, etc., implying that the number of goods supplied in a short period of time will not vary significantly. the supply of money is currently larger than the demand, then prices rise, so does the rate of inflation. (Mankiw, 2013).

The Keynesian hypothesis, which is essentially a demand-pull inflation theory. According to this hypothesis, inflation is produced by a mismatch between aggregate demand and aggregate supply. any fluctuation in the demand side of the economy, such as fiscal or monetary policy changes, expectations, and labour market changes, affects both prices and output in the short run (Dornbusch, et al., 1996). Inflation is thought to be a long-term

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phenomenon that occurs once full employment has been reached. A rise in aggregate demand is accompanied by a sustained rise in the price level beyond this point of equilibrium. In the short run, which is assumed to be associated with underemployment and underutilization of resources, an increase in investment and money supply leads to a proportionate increase in aggregate demand, output and employment. This process persists until full employment is attained. (Saungweme & Nicholas., 2021)

Today, the restraints introduced to limit the COVID-19 outbreak, have battered both the supply and demand sides. and this pandemic is still raging around the world and has a greater impact on society's resumption of work and production. Productivity is lower than previous years, which causing increase inflation level. The channels through which COVID-19 could influence prices are varied. Reduction in production as a result of limited labour supply (Fosso, 2021), changes in consumption pattern (Bracale & Vaccaro, 2020), increase price of raw material (Ejeromedoghene et al., 2020) and input cost dynamics resulting from exchange rate, inflation and crude oil price responses to the pandemic (Arouna et al., 2020) lockdowns under covid-19 lead to increased prices (Bitler et al., 2020), and expected increase in oil price lead to frequent increases in food prices (Arndt et al., 2020). As crude oil prices associated with food prices is a pass-through effect of cost of energy used in production (Baffes, 2007).

### **3- Literatures and Hypothesis:**

#### **3.1 Relation between covid-19 and increase prices**

Ahn & Norwood (2020) state that in the United States, unemployment, increasing food prices and sales decline, might be related to the COVID-19 pandemic. Akter (2020) makes similar observations in Europe. According to Farias & Araujo (2020), price fluctuations for products were substantial in COVID19-affected districts in Brazil. The study of Agyei et al., (2021) in sub-



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Saharan Africa (SSA), found that the COVID-19 pandemic led to increases in food prices. exchange rate, inflation and crude oil prices have negative effect on food prices. The study of (Apergis& Nicholas, 2021) in USA, found that inflation expectations and their volatility are positively affected by the Covid-19 pandemic. The study of (Rahmayani et al., 2021) analyze the effect of Covid-19 pandemic on inflation in Indonesia using Ordinary Least Squares (OLS). From the result, there is significant relation between inflation and the interest rate, stock market, exchange rate, and palm oil price. On the contrary, both raw oil, Brent oil price and pandemic, significantly negatively effect on inflation. and no effect of the money supply. while new cases of Covid-19 decrease inflation. The study of (Wahidah& Antriyandarti, 2021) aims to examine the impact of Coronavirus pandemic on inflation and food inflation in Indonesia, using OLS. The result indicate that the number of COVID-19 cases has a negative effect on both inflation and food inflation, while the number of recovered cases has a positive effect on both variables. The number of death is significant to the inflation rate. So, we hypothesize that: **H1: There is a significant relationship between COVID-19 and consumer price index in Egypt.**

### **3.2 Relation between supply chain disruption and increase prices:**

The Corona pandemic has affected global supply chains. From an economic and industry point of view, the pandemic brings uncertainties and disruptions to international businesses and supply chains (Sharma et al., 2020; Ivanov& Dolgui, 2020). The study of (Santacreu& Jesse, 2022) focus on industry PPI inflation on the period January 2021 to November 2021. the results show that supply chain disruptions during the pandemic recession have been unprecedented. The change in demand to durable goods consumption and the heavy dependence on foreign suppliers to produce these goods has created a mismatch between supply and demand resulting in price increases.

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Sectors that rely more deeply on foreign inputs from countries that faced disruptions, faced larger increases in PPI inflation. Gu et al., (2020) find that the manufacturing industry has been negatively affected by COVID-19 pandemic due to the absence of raw materials. Study of (Ho et al., 2021) find, the pandemic causes new consumption demand and the popularity on China's mobile payment boosts this consumption behaviours, the increase in freight transportation may be the result of stockpiling behaviour. Ha. et al., (2021) analyze the driving forces of global inflation focusing on the 2020 global recession. Dunn& Leibovici (2021) discuss to which level supply chains disruptions reason the recent increase in inflation, concentrating on the semiconductors. The study of (Mahajan& Tomar, 2020) looks at the disruption in food supply chains due to COVID-19 induced economic shutdown in India. Amiti et al., (2021) measure the effects of increasing import prices on U.S. producer prices. the study of (santacreu& jesse, 2022) documented three significant features of the data on supply chains disruptions. First, since Jan. 2021, challenges have been worse, as seen by an increase in unfilled orders, and longer delivery times. Second, delivery times and backlogs closely match PPI inflation, with 90% correlation from January 2020 to November 2021. Third, interruptions in supply chains and their impact on PPI inflation have varied across industries. In the automobile and technology equipment industries, backlogs have expanded dramatically. This was followed by a significant spike in PPI inflation. However, bottlenecks in the pharmaceutical business remained generally stable, as seen by a consistent increase in PPI inflation during the same time period. According to this background, we hypothesize the following **H2: There is a significant relationship between supply chain disruption and consumer price index in Egypt.** according to Egyptian case, the exchange rate has been edited in 2016, and as Egypt is an importing country, that means imported commodities will lead to increase inflation, as exchange rate increase inflation in 2017 to

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29.5%. (imported inflation). According to this background, we hypothesize the following **H3: The imports will lead to increase inflation in Egypt.**

### **3.3 The relation between global shocks and increase prices:**

Oil shocks influence all economies that import this commodity in a similar way (Choi et al., 2018) and swiftly spread to consumer prices, as inflation is significantly influenced by fluctuating energy costs. (Szafranek, 2021). substantially exogenous events (such as global weather anomalies or outbreaks of disease) may amplify price co-movements, particularly in developing nations where food inflation is a major component of the consumer basket (Blagrave, 2020). structural changes such as increased reliance on commodity imports or greater economic integration may amplify commonality in inflation rates. Improving trade links, expanding global value chains, or boosting the importance of multinational enterprises on local markets may accelerate the transmission of shocks between economies, and result in the increasing sensitivity of domestic inflation to universal shocks (Auer et al., 2017).

There are many Empirical studies, studied the effect of global shocks on inflation. While the work by Forster and Tillmann (2014) underlines the importance of country-specific factors on inflation, other studies document that the common (global) component accounts for more than 35% of inflation variation. Neely and Rapach (2011) Therefore, it is widely argued that inflation measured at the national level is driven by worldwide developments to a significant level. Zhao, et al, (2016) noted that in China oil price shocks (both external supply and demand shocks) have resulted in inflation fluctuations. Nguyen et al., (2017) have underlined the positive role of both global shocks (in particular shocks to output) and domestic demand pressures in inflation dynamics in Sub-Saharan Africa in the recent decade. The positive inflation effect of global shocks (e.g., supply shocks, global demand shocks,

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domestic demand shocks) and oil specific demand shocks have been highlighted by authors such as (Kamber & Wong, 2020; Alvarez et al., 2021) and Szafranek (2021) indicate that price co-movements are time-varying and still most discernible for advanced, tightly integrated economies, strengthen for emerging countries but remain weak for least developed economies. and the Large variations in oil prices affect markedly inflation synchronization. According to this background, we hypothesize the following: **H4: Global shocks (Increase food prices and oil prices) lead to increase inflation in Egypt.**

From the previous presentation of the studies, we observe that the studies focused on a sample of developed countries such as the study Akter (2020) Europe countries, USA Ahn & Norwood (2020), (santacreu & jesse, 2022), and developing countries such as the study of (Mahajan & Tomar, 2020) in India, (Ho et al., 2021) in china, (Rahmayani et al., 2021; Wahidah & Antriyandarti, 2021) in Indonesia, and (Agyei et al., 2021) in sub-Saharan Africa. to our knowledge there is no study in Egypt. Therefore, the current study attempts to estimate the impact of covid-19 pandemic on inflation in Egypt to identify the most important challenges facing the Egyptian economy and then try to correct them during the monthly time period Jan 2020- Dec. 2021, by applying the Ordinary Least Squares model. Thus, the current study is different from the rest of the studies, in terms of the variables used, the time period, and the country.

#### **4- Covid-19 and the Egyptian economy**

Egypt's economy was doing well prior to the global covid-19 pandemic, real GDP growth was 5.5% in 2019 comparing with 3.5% in 2020 (World Bank indicators, 2020). The government's lockdown measures in 18 Mar, 2020, which were implemented in accordance with the World Health Organization's (WHO) recommendations to combat the spread of the

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coronavirus, may have had a significant impact on the economy. as these restrictions slowed growth in 2020. Figure (1) reveals that Real GDP growth recorded a preliminary figure of 7.7% in 2021 Q2. compared with 2.9 % in Q1. That means economic activity continues to gather pace and rebound from the sustained negative impact of COVID-19, as recorded 0.7% in 2020 Q3, -1.7% in 2020 Q2, as the investment situation has shrunk under the epidemic situation. From 2020 Q3, the pickup in growth was principally due to the substantial positive contribution stemming from consumption as well as the sustained subsiding unfavorable contribution of gross domestic investments. In the time of pandemic, people are likely to store a large amount of food and other daily necessities to protect their lives for a period of time fear of shortages as the pandemic continues to spread around the world. so the consumption increases at this time, which lead to increase the prices level. as figure (2), the inflation rate increase according to the CPI data, reach 5.9% in April 2020, after this time CPI volatile but take increase trend to reach accelerated to 7.3% in Jan. of 2022 from 5.9% in Dec.2021, and above market expectations of 6.7%. (CBE, II / 2021).

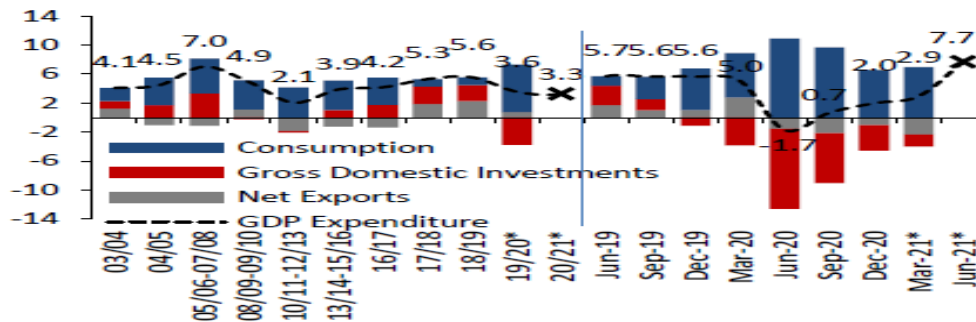
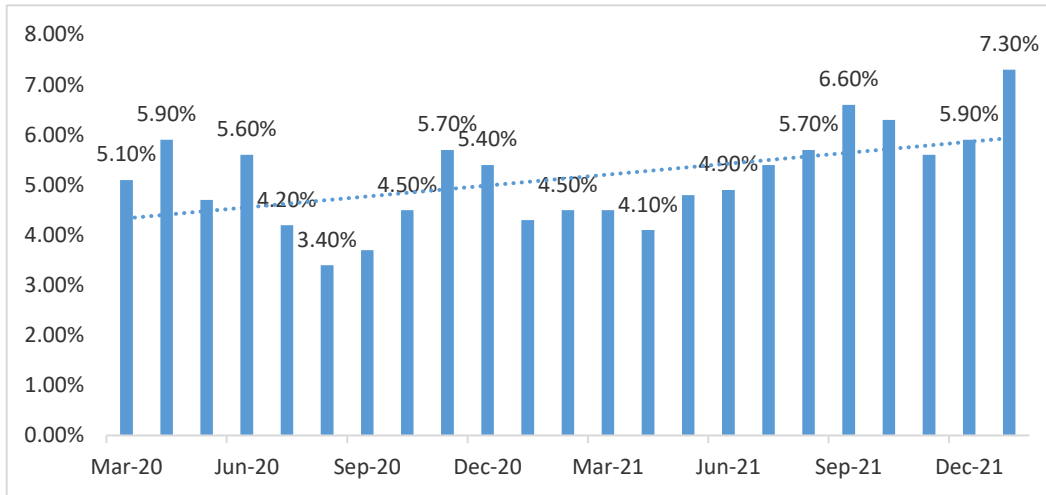


Figure (1): Percentage real GDP Growth at market prices

Source: Central Bank of Egypt, Monetary policy report, II / 2021.

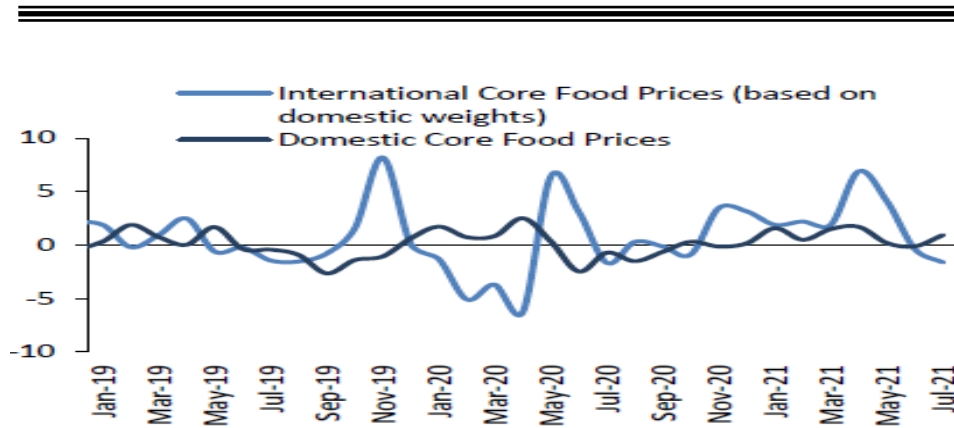


**Figure (2): Consumer Price Index during Mar 2020- Jan 2022**

Source: <https://tradingeconomics.com/egypt/inflation-cpi>

Assuming the level of uncertainty regarding the pandemic and its influence on economic activity remains low. From figure (3). In Q4 2021 and 2022, we observe international food price estimates relevant to Egypt's consumption basket are likely to continue to rise, which lead to increase the prices level, which is illustrated by Figure No (4). Furthermore, Brent crude oil prices continue to represent upside risks to inflation expectations, as they are influenced by global supply constraints, OPEC+'s curtailed output, and other factors. in addition to higher global demand. so Egypt's Fuel Automatic Pricing Committee decided to increase fuel prices by L.E. 0.25 per liter in 4, Feb. 2022, in line with the increase in international oil prices. (CBE, II / 2021)

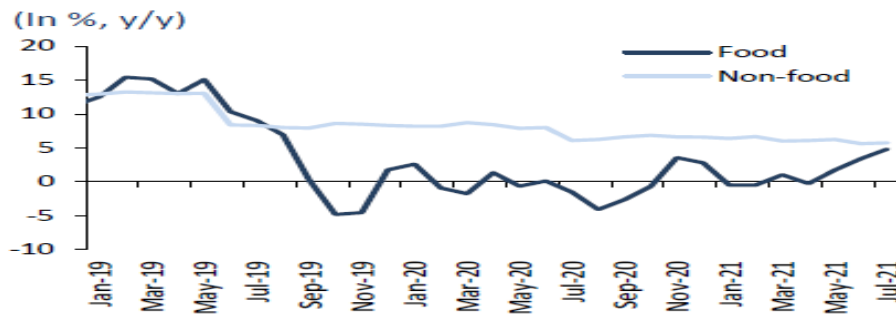
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**Figure (3): Annual food and non-food inflation**

**Source:** Central Bank of Egypt, Monetary policy report, II / 2021.

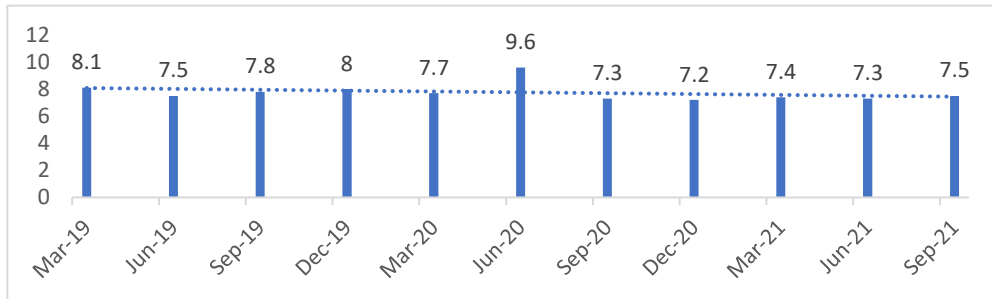
From figure (4) With the exception of July 2021, both monthly Egypt core food inflation and monthly international core food inflation have been trending in the same direction in terms of positive and negative rates since December 2020. International core food prices fell for the second consecutive month in July 2021, after rising since November 2020, aided by lower prices for grains, beef, dairy, while Egypt core food inflation take increase trend. (CBE, II / 2021).



**Figure (4): International vs. Egypt core food prices (in %, monthly)**

**Source:** Central Bank of Egypt, Monetary policy report, II / 2021.

Regarding the labor market, the pandemic has negative effect, as the unemployment rate reached 9.6% in 2020 Q2, while from Q3 2020, stabilized at 7.3%, While increase to 7.5% in the third quarter of 2021, attributed to the influx of new graduates during the months of August and September into the labor market, as figure (5).

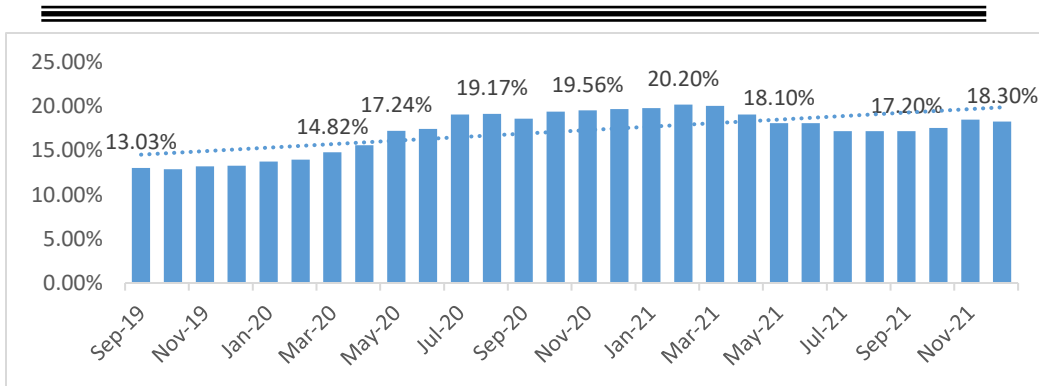


**Figure (5): Unemployment rate % labor force**

**Source:** <https://tradingeconomics.com/egypt/unemployment-rate>

Regarding the monetary policy, During FY 2020/21, M2 growth picked-up post the COVID-19 outbreak, to record an average of 19.2%, compared to an average of 12.6% before COVID-19 between 2019 and 2020 Q1, as figure (6). However, the growth in M2 was noninflationary, evident by the low inflation recorded during FY 2020/21, as it did not cause a proportional increase in GDP during FY 2020/21. While Broad money growth started to slow down from march 2021, due to lower contribution of fiscal deficit financing sources within M2 as well as credit to the private sector. (CBE, II / 2021)





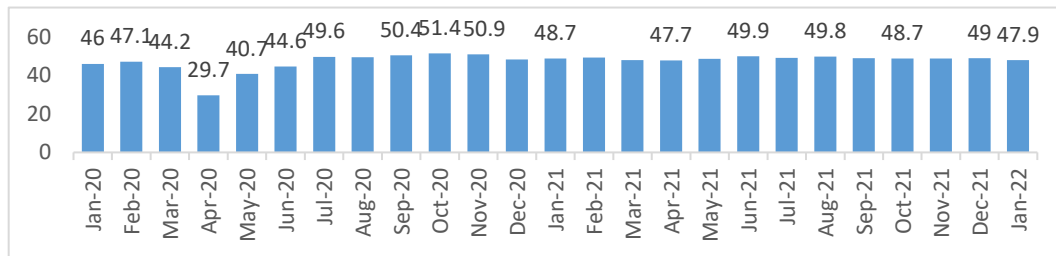
**Figure (6): Money Supply (M2%)**

Source: <https://www.investing.com/economic-calendar/egypt-money-supply-1297>.

Since the outbreak of the pandemic, supply chains disruptions have become a significant concern for the global economy. Factory closures in China in early 2020, as well as lockdowns in several other nations, labor shortages, strong demand for tradable commodities, logistics network disruptions, and capacity limits, have resulted in significant increases in shipping costs and delivery times. The Purchasing Managers Index (PMI) business surveys captures the extent of supply chain delays in an economy; It gives useful data on inflation patterns. The rapid reduction in the delivery times index can be attributed to rising demand, widespread supply restrictions, or a combination of the two. Suppliers usually have more pricing power at these times, resulting in a price increase. Furthermore, supply chain delays can restrict the availability of intermediate items, slowing production and output growth when combined with manpower shortages. ([weforum.org/agenda/2021/11/longer-delivery-times-supplychain-disruptions/](https://www.weforum.org/agenda/2021/11/longer-delivery-times-supplychain-disruptions/)).

Due to COVID-19 disruptions. Egypt Purchasing Managers Index (PMI) dropped to 29.7 in April 2020 from 44.8 in the prior month. while started to increase from Sep 2020 when excess 50 points, but return to

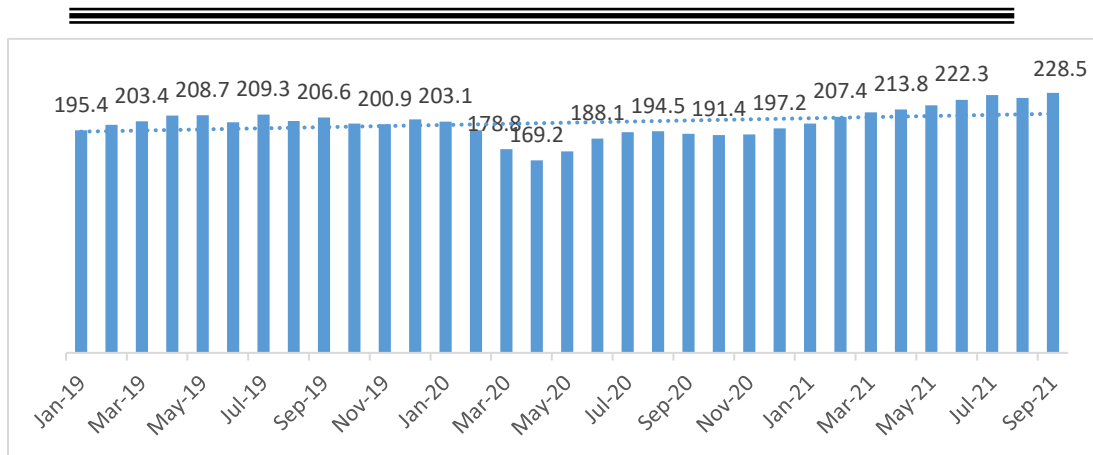
continued to hover in contractionary, below the 50-point benchmark from Dec. 2020 to Jan. 2022 as figure (7). The Egyptian non-oil private sector faced a widening of the supply chain crisis, led to a solid contraction in output, and potentially limit the economic recovery; as a lack of inputs and increase shipping costs, and a sharp rise in purchase prices, with metals, plastics, packaging and building materials all cited as up in price, resulting in the sharpest increases in both input costs and output prices over the same time. (IHS Market, 2021).



**Figure (7): Egypt Purchasing Managers Index**

**Source:** ministry of planning and economic development, Egypt,  
<https://mped.gov.eg/DynamicPage?id=91&lang=en>

The COVID-19 pandemic led to fluctuations in domestic producer prices, due to lockdown in march 2020, as record 169.2 point in April 2020, and after that increased to 228.5 point in Sep 2021, means increased by 35% as figure (8).



**Figure (8): Producer Price Index (Jan 2016=100)**

**Source :**producer price index,2021, 2020 central agency for public mobilization& statistics, Egypt.

### **5- Data and Methodology:**

We study the effect of Covid-19 on Egypt inflation, through the monthly data from Jan 2020 to Dec 2021. according to recommendation of (Pham& Sala, 2020) to use monthly data, they explain the use of monthly data on CPI inflation is advantageous for a twofold reason. First, it allows focusing on a recent period, with enough degrees of freedom for estimation. Second, because the volatility spillovers must be studied within a short time-frame after the shock attacks the economy, it will provide a more reliable short-run analysis. Table 1 depicts the list of the variables and source of data.

**Table 1: Variables and Definition**

Symbol	Definition	source
<b>dependent variable</b>		
CPI	The consumer price index (CPI) is a measure of change in the general level of prices of goods and services purchased by households over time. (%)	<a href="https://www.investing.com/economic-calendar/egypt-cpi-1198">https://www.investing.com/economic-calendar/egypt-cpi-1198</a>
<b>Independent variables</b>		
<b>COVID-19 pandemic outbreak</b>		
NC	New confirmed COVID-19 cases per million people.	<a href="http://www.ourworldindata.org">www.ourworldindata.org</a>
ND	New-deaths COVID-19 cases per million people.	
SI	Stringency-index, it archives information on social distancing rules, it a merged measure based on 9 reply indicators counting school closures, workplace closures, and travel bans. It scaled to a value from 0 to 100 (100 = strictest).	
<b>Global shocks</b>		
OIL	monthly crude oil prices measured as spot West Texas Intermediate (WTI) prices,\$.	<a href="https://www.investing.com/commodities/crude-oil">https://www.investing.com/commodities/crude-oil</a>
FP	Food Price Index, 2016 = 100, includes Cereal, Vegetable Oils, Meat, Seafood, Sugar, and Other Food (Apple (non-citrus fruit), Bananas, Chana (legumes), Fishmeal, Groundnuts, Milk (dairy), Tomato (veg)) Price Indices	<a href="https://data.imf.org/?sk=471DDDF8-D8A7-499A-81BA-5B332C01F8B9">https://data.imf.org/?sk=471DDDF8-D8A7-499A-81BA-5B332C01F8B9</a>
<b>Supply chains disruptions</b>		
PMI	The Purchasing Managers Index (PMI) is a measure of the manufacturing sector's economic health. The PMI's goal is to give purchasing managers with information regarding current business circumstances. The manufacturing PMI survey is based on questionnaire responses that cover the following economic variables: output, new orders, new export orders, backlogs of work, output prices, input prices, suppliers' delivery times, finished goods stocks, quantity of purchases, stocks of	<a href="https://mped.gov.eg/DynamicPage?id=91&amp;lang=en">https://mped.gov.eg/DynamicPage?id=91&amp;lang=en</a>

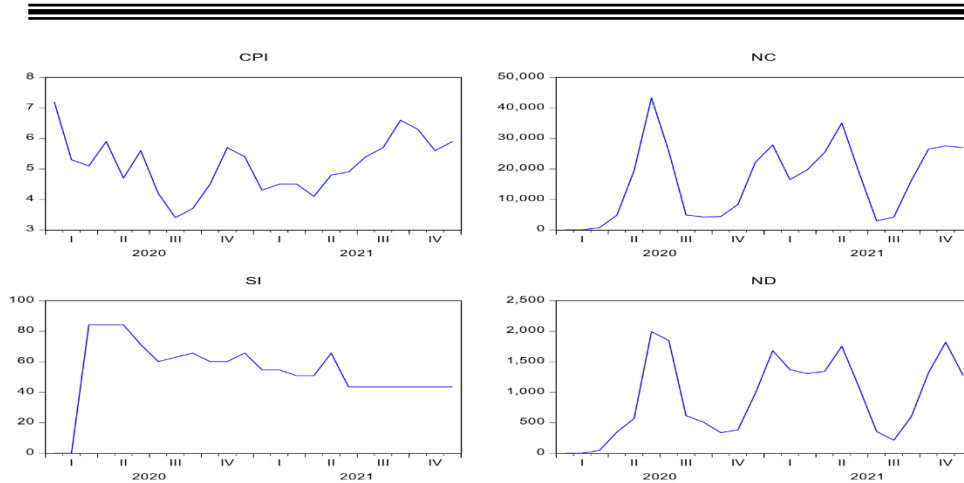
	purchases, employment, and future output. The PMI for manufacturing is a scale of 0 to 100. When compared to the previous month, a PMI above 50 implies expansion, a PMI below 50 suggests contraction, and a PMI of 50 shows no change.	
PPI	Price producer index, It is the basic prices paid to local producers of goods and services, at the production place.	CAMPS, monthly price producer index, <a href="https://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5107&amp;Year=23461">https://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5107&amp;Year=23461</a>
SC	Shipping costs: The RWI/ISL Container Throughput Index (2008=100) is based on the fact that international trade is predominantly handled by ships and containers, making port container throughput a key indication of global trade. Currently, the database includes 82 foreign ports that account for more than 60% of global container throughput.	<a href="https://www.isl.org/en/containerindex">https://www.isl.org/en/containerindex</a>
<b>Monetary policy and trade</b>		
MS	Money supply (M2%) the growth rate of the broad money, aims to capture the degree of monetary expansion. Excess money supply can cause inflation. M2 represents total liquidity. It contains currency in circulation + time deposits + foreign currency denominated current deposits.	<a href="https://www.investing.com/economic-calendar/egypt-money-supply-1297">https://www.investing.com/economic-calendar/egypt-money-supply-1297</a>
IMP	Total monthly value of Egyptian imports in million \$	CAMPS, monthly bulletin of foreign trade data, <a href="https://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5107&amp;Year=23614">https://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5107&amp;Year=23614</a>

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Figure (9) represents the CPI and stringency index, new death, new cases confirmed with covid-19. we observed the downwards in CPI in March 2020, when the government impose stringency procedures, and we observe CPI volatile with Covid-19 confirmed and deaths cases; through pandemic time people are likely to store a large amount of daily necessities fear of shortages as the pandemic continues to spread, so the consumption increases at this time and that lead to increase prices, because the increase demand and decrease supply due to lockdown procedures.

Egypt recorded its first case of COVID-19 on 14 February 2020. the government, implemented lockdown decision in 18 March 2020, to limit the spread of the virus. restrictions on mobility include a prohibition on international and cross-border travel, social isolation, lockdowns, and the closure of schools and places of worship. The implementation of these stringent measures obstructed the way of life of citizens and also reduced economic activities as decrease GDP growth to -1.7% in June 2020 from 5.6% in Dec 2019. increase unemployment rate to 9.6% in June 2020 from 8% in Dec 2019, decrease purchase managers index to 29.7 in April 2020 from 47 in Feb 2020, increase price producer index 188.1 point in Jun 2020 from 169 point in April 2020.



**Figure (9): Descriptive statistics**

### 5.1 Methodology

We use Ordinary Least Squared (OLS) to show the effect of Covid-19 on inflation in Egypt. The baseline empirical model specification used in this paper draws upon the generic empirical specification proposed by Yolanda 2017. modified with a global pandemic variable as: (Rahmayani et al., 2021; Coulibaly, 2021)

$$CPI = f(Nd, Nc, Si, MS, Pmi, Imp, Oil, Fp, Ppi, Sc)$$

Then, write down as:

$$CPI = a_0 + a_1 \ln Nd + a_2 \ln Nc + a_3 \ln si + a_4 Ms + a_5 \ln Pmi + a_6 \ln Imp + a_7 \ln Oil + a_8 \ln Fp + a_9 \ln Ppi + a_{10} \ln SC \quad (1)$$

Then, equation (1) derived to econometric model with Ordinary Least Squared (OLS) method as:

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$$Cpi_t = a_0 + a_1 \ln Nd_t + a_2 \ln Nc_t + a_3 \ln Si_t + a_4 Ms_t + a_4 \ln Pmi_t + a_4 \ln imp_t + a_4 \ln Oil_t + a_4 \ln Fp_t + a_4 \ln Ppi_t + a_4 \ln SC_t + \varepsilon_t$$

Where  $CPI_t$ , is the consumer price index dependent variables.  $Nd$  New death cases of covid-19,  $Nc$  New confirmed cases of covid-19,  $Si$  Stringency index,  $Ms$  Money Supply,  $Pmi$  Purchasing managers index,  $Imp$  Imports of goods and services,  $Oil$  crude oil,  $Fp$  world food price,  $Ppi$  Price producer index,  $SC_t$  shipping cost,  $\varepsilon_t$  is the error term, Letter “L” indicate that all the variables are expressed in natural logarithm, all variables use with logarithm except CPI, MS because it was in percentage.

### 5.2 Unit root test results

To apply OLS model, first we test the stationarity of time series in level through employing unit root tests, as KPSS, Phillips-peron and ADF. The results in Table (2), shows that all of the series are stationary at level.

**Table (2): unit root tests results in level**

	KPSS	PP	ADF
CPI	0.17**	-3.14**	-3.10**
<i>lNd</i>	0.36***	-4.08*	-3.42**
<i>lNc</i>	0.40***	-9.45*	-2.80***
<i>Ms</i>	0.17**	-2.65***	-3.11**
<i>lpmi</i>	0.39***	-2.67***	-4.00*
<i>limp</i>	0.60**	-4.71*	-4.72*
<i>Loil</i>	0.59**	-4.10**	-3.87**
<i>lfp</i>	0.62**	-3.26***	-2.73
<i>lSi</i>	0.64**	-4.06*	-2.22**
<i>lppi</i>	0.61**	-4.32**	-9.25*
<i>lsc</i>	0.50**	-4.51*	-4.39**

\*, \*\*, \*\*\* mean significant at 1%, 5%, 10%



**Table 3: OLS Models**

Variablies	CPI			
	(1)	(2)	(3)	(4)
C	0.180 (0.148)	-0.205 (0.414)	-0.479* (0.128)	-0.492*** (0.261)
<i>lNd</i>	-0.013* (0.004)	-0.016* (0.005)	-0.017* (0.004)	-0.017* (0.005)
<i>lNc</i>	0.011* (0.003)	0.012* (0.004)	0.013* (0.003)	0.013* (0.004)
<i>Ms</i>	-0.220 (0.140)	-0.081 (0.197)		0.001 (0.175)
<i>lpmi</i>	-0.036*** (0.019)	-0.048*** (0.024)	-0.055* (0.013)	-0.057** (0.023)
<i>lImp</i>	0.045** (0.021)	0.043*** (0.021)	0.041** (0.019)	0.042*** (0.023)
<i>Loil</i>	0.004 (0.012)	-0.0007 (0.013)		0.0003 (0.013)
<i>lfp</i>	-0.053 (0.032)	0.079*** (0.041)	0.091** (0.033)	0.093** (0.041)
<i>lSi</i>	-0.028** (0.012)	-0.015 (0.018)		
<i>lppi</i>		0.096 (0.096)	0.152* (0.043)	0.152** (0.068)
<i>lsc</i>				0.0046 (0.034)
Goodness of Fit Measures				
R <sup>2</sup>	0.758	0.777	0.764	0.764
R <sup>2</sup> <sub>adj</sub>	0.609	0.609	0.669	0.587
RSS	0.0004	0.005	0.0003	0.005
σ	0.008	0.008	0.008	0.008
F	5.0906 [0.005]	4.636 [0.008]	8.090 [0.0005]	4.324 [0.010]

Diagnostic Tests				
	1.07	0.71	0.181	0.326
$F_{ar}$	[0.37]	[0.515]	[0.84]	[0.73]
	1.144	0.293	0.229	0.220
$\chi^2_{nor}$	[0.56]	[0.86]	[0.89]	[0.89]
	0.022	0.00007	0.270	0.288
$F_{arch}$	[0.88]	[0.999]	[0.609]	[0.598]
	0.302	0.859	0.599	0.788
$F_{het}$	[0.952]	[0.581]	[0.727]	[0.633]
	0.008	0.004	0.133	0.112
$F_{reset}$	[0.930]	[0.948]	[0.721]	[0.744]

\*, \*\*, \*\*\* significant at 1%, 5%, 10%, RSS Sum Squared resid,  $\sigma$  Standard deviation, F F-statistic. ( ) t-value, and the P-value between [ ].  $F_{ar}$  and  $F_{arch}$  represent the F test for serial correlation,  $F_{het}$  represent the F test for Heteroskedasticity,  $\chi^2_{nor}$  represent the normal distribution test, and  $F_{reset}$ -Ramsey test for model stability diagnostics.

Table 3 explained four models to analyze the factors that effect on inflation. The first model indicated that new confirmed cases, value of imports, had a positive significance to drive inflation. Which is consistent with (Ahn& Norwood, 2020; Agyei et al., 2021; Apergis& Nicholas, 2021; Rahmayani et al., 2021; Wahidah& Antriyandarti, 2021; Amiti et al., 2021) Where they explained that the Covid-19 pandemic has a negative impact on inflation by increasing prices. **From model (1)** 1-person increase in new confirmed case would increase inflation by 1.1%, then an 1% of import increase led to increase inflation by 4.5%. On the opposite, new death cases, purchasing managers index, stringency index have a negative significance to drive on inflation. which Agree with (santacreu& jesse, 2022). increase 1% of purchasing managers index decrease inflation by 3.6%. and increase a 1-

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person in new death cases would decrease inflation by 1.3%. increase stringency index by 1% would lead to decrease inflation by 2.8%. The others variables, money supply decrease inflation, but not statistical significant, which agree with ([Egypt central bank report 2021](#)). world food prices increase inflation, but not statistical significant effect on inflation. which agree with ([Szafranek, 2021](#)). The value of the R2 of the first model was 0,76. In the other word, all independent variables in the first model explained 76% of the dependent variable.

The **Fourth model** reported that new confirmed cases, imports, food price, and price producer index also had positive significance to drive inflation. that Agree with ([Santacreu& Jesse, 2022](#)) It meant that, on average, a 1-person increase of new confirmed cases, imports, world food price, producer price index could rise inflation as 1.3%, 4.2%, 9.3%, and 15.2%. However, new death, purchasing managers index were of negative significance to drive inflation. On average, a 1-person increase in new death of covid-19 would decrease inflation by 1.7%. Then, a 1% increase in purchasing managers index would decrease inflation as 5.7%. The money supply, oil price. and shipping cost increase inflation but not statistically significant. The value of the R2 of the model was 76%. All independent variables in the model explained 76% of inflation.

From the **results of the models**. The New cases confirmed, imports, price producer index and world food prices index, all of this variables lead to increase inflation in Egypt, as the spread of COVID-19 and the actions taken in response to it (lock-down) lead to increase consumption in the time of pandemic, people are likely to hoard a large amount of food and other daily necessities to protect their lives for a period of time fear of shortages as the epidemic continues to spread around the world. so the consumption increases at this time, with problems of supply chains, which contributed to increased

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volatility in import, export, producer, and consumer prices in the months following the onset of the COVID-19 pandemic. where Egypt is imported country, as supply chains disruption, with increase shipping costs, with exchange rate edit in 2016, all of these factors increase the imports prices, which reflected in increase consumer price index.

**Regarding food prices**, according to Egypt central bank, we observe Both monthly domestic core food inflation and the monthly international core food inflation have been moving in tandem in terms of recording positive and negative rates. While Egypt core food inflation take increase trend from July 2020. **Regarding Crude Oil price**, shipping cost, all have positive effect but not significant statistically effect on inflation in Egypt, that agree with [Alvarez et al. \(2021\)](#) and [Szafranek \(2021\)](#) who indicate that price co-movements are time-varying and still most discernible for advanced economies but remain weak for least developed economies. **This confirms the validity of the fourth hypothesis H4: global shocks (Increase food prices) lead to increase inflation in Egypt.**

Since the outbreak of the pandemic, **supply chain disruptions** have become a significant concern for the global economy. Factory closures in China in early 2020, as well as lockdowns in several other nations, labour shortages, strong demand for tradable commodities, logistics network disruptions, and capacity limits, have resulted in significant increases in shipping costs and delivery times. Suppliers typically have more pricing power during these times, resulting in price increases, hence the producer price index leads to higher inflation. **This confirms the validity of the third hypothesis H3: The imports will lead to increase inflation in Egypt.** As a result, a 1% increase (improvement) in the purchasing managers index, means reduction in delivery time, which leads to a price reduction. **This confirms the validity of the second hypothesis H2: There is a significant**

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**relationship between supply chain disruption and consumer price index in Egypt.**

**Money supply** has no effect in inflation, which agree with Egypt central bank report 2021, which indicate that the growth in M2 was non-inflationary, evident by the low inflation noted during FY 2020/21, as it did not cause a relative increase in GDP during FY 2020/21. **Regarding Stringency index**, and new death with covid-19, both lead to decrease inflation, in the time of lockdowns, labor shortages, decrease demand, which decrease inflation. After recovery increase demand with supply chains disruptions, that lead to increase inflation. **This confirms the validity of the first hypothesis H1: There is a significant relationship between COVID-19 and consumer price index in Egypt.**

The explanatory power of all the model represented in  $R^2$  is about 75%, and the models as a whole is statistically significant according to the F statistic. Also, the models do not suffer from any statistical problem such as serial correlation, instability of variance, or failure to follow the normal distribution, and the description of the model is statistically right according to Ramsy test, as results are also confirmed by diagnostic tests.

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## **6- Conclusion:**

Inflation is a disease in a country's economy that has an effect on all economic activities. The study investigates in the effect of covid-19 pandemic on inflation in Egypt by using the ordinary least squares model during the period Jan 2020-Dec 2021 using monthly data. the study findings indicated that the variables analyzed have a major impact on the rate of inflation, the **results** indicate that:

- 1- Money supply, crude oil prices volatility and shipping costs have no effect on inflation.
- 2- New cases confirmed of covid-19, food prices, imports, and price producers index, all they have positive effect on inflation.
- 3- New death cases of covid-19, stringency index, and purchasing managers index, all they have negative effect on inflation.

**Recommendations:** The study suggests that the government must apply a policy to prevent and mitigate the economic decline and deep recession through:

- 1- The government has to make a trust and good offers for investor and cut some rigid of regulation for investing.
- 2- The government can release the taxation burden with tax holiday policy for manufacture sectors to keep productivity in pandemic period.
- 3- The government should provide the aid funds for lower- middle income people needed when many workers have retired in formal and informal sectors.
- 4- The government should provide the aid for the companies engaged in the supply chain industry to tide over the difficulties.

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## تأثير جائحة كوفيد-١٩ على التضخم: دراسة تجريبية على مصر

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### الملخص:

يمر العالم بفترة صعبة منذ تفشي وباء كوفيد-١٩ في أوائل عام ٢٠٢٠. وقد أدت هذه الأزمة الصحية الفريدة إلى صدمات في جانب العرض والطلب، مما أثر على كل من القطاعين الحقيقي والمالي للاقتصادات العالمية. ومن أجل تحفيز الاقتصادات؛ نفذت الحكومات والبنوك المركزية في جميع أنحاء العالم سياسات مالية ونقدية توسعية لتحفيز الاقتصاد. في الوقت نفسه، تعطلت سلاسل التوريد، مما أدى إلى زيادات هائلة في التضخم في العديد من البلدان. لذلك، باستخدام البيانات الشهرية، تقيم الدراسة تأثير جائحة كوفيد-١٩ على التضخم في مصر باستخدام نموذج المربعات الصغرى العادية خلال الفترة الزمنية من يناير ٢٠٢٠ إلى ديسمبر ٢٠٢١.

توصلت نتائج الدراسة إلى أن الحالات الجديدة المؤكدة لكوفيد-١٩، وأسعار المواد الغذائية، والواردات، ومؤشر أسعار المنتجين تؤدي إلى زيادة التضخم في مصر. بينما لا يتأثر التضخم بعرض النقود أو تقلب أسعار النفط الخام أو تكاليف الشحن. في حين تؤثر حالات الوفاة الجديدة لكوفيد-١٩، ومؤشر الصرامة والإغلاق، ومؤشر مديري المشتريات تأثيراً سلبياً على التضخم. نتيجة لذلك، توصي الدراسة بأن تقدم الحكومة المساعدة للشركات العاملة في صناعة سلسلة التوريد للتغلب على الصعوبات. ويجب على الحكومة تقديم عروض جيدة للمستثمرين، وكذلك تخفيف بعض لوائح الاستثمار. ويمكن للحكومة تخفيف العبء الضريبي من خلال سن سياسات الإعفاء الضريبي وتقديم المساعدة المالية لقطاع التصنيع من أجل الحفاظ على الإنتاج طوال فترة الوباء.

**الكلمات المفتاحية:** جائحة كوفيد-١٩، التضخم، سلاسل التوريد، مؤشر أسعار المستهلكين، مؤشر أسعار المنتجين، مصر، نموذج OLS.