

COVID 19, POVERTY AND INEQUALITY: IMPLICATION ON THE EGYPTIAN ECONOMY

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Abstract

The adverse impact of COVID-19 pandemic in the year 2020 can be felt globally as it has affected almost all the continents with the impact being felt the most in many first World nations. The impact on Africa is still mild when compared with other continents, but despite the slight impact, the effect of the pandemic has plunged so many countries backward with poor and vulnerable citizens at the receiving end. It is in light of the occurrence of the pandemic that this study examined the dynamism of COVID-19, poverty and inequality in Egypt taking into account the effect of the pandemic on some selected structural issues such as number of employed persons, price of gasoline and tourism. A vector error correction mechanism and other diagnostic test was employed to determine both the short run and long run effect of the pandemic on the number of poor people in Egypt and on the income inequality among the Egyptians. Findings revealed that on the short run, a 1% increase in the number of COVID-19 cases give rise to 28% increase in the number of poor people living in Egypt while on the other hand it gives rise to 90% increase in income inequality thereby widening the gap between the rich and the poor. In the long run, findings revealed that a 1% increase in the number of COVID-19 cases give rise to 2% increase in the number of poor people living in Egypt with inequality giving rise to 3% increase in income inequality. This has policy implication as the findings from the impulse response function and variance decomposition revealed a significant impact on the short run to shocks from COVID-19 and a mild impact on the long run. The study therefore recommends that efforts should be made by the government and private individuals to curb and eradicate the virus in order to reduce and stop the number of daily cases of the virus in the bid towards the achievement of sustainable development goals of zero poverty and leaving no one behind.

Keywords: COVID 19 Poverty Inequality Egypt Interaction

JEL classification: I30 I32 I14

Introduction

Globally, records have shown that infectious diseases leads to the death of approximately 50, 000 people daily, with more than 17 million lives being claimed by death on a yearly basis (Bukari et al. 2020). In recent time, one of the infectious diseases that has troubled the world and the world leaders is the COVID-19. The disease started in China in December, 2019 and by April 2020, more than 1.5 million people have been infected all over the world (Suryahadi et al. 2020; John Hopkins University, 2020). With the outbreak of COVID-19 pandemic globally, several measures, such as the use of face masks, washing of hands, shelter-in-place and social distancing, were put in place in the absence of vaccine (Nicola et al, 2020; Morsy et al., 2020)

In Africa, COVID-19 pandemic appeared later than in other parts of the world when the first confirmed case was found in Egypt, North of Africa on the 14th of February, 2020 and this triggered the spread of the disease to other parts of the continents (Morsy et al, 2020). Recently, records have shown that 54 out of 55 countries in Africa have at least one reported case of COVID-19 with the impact gradually having a devastating socio-economic crisis on the continent (OECD, 2020). Based on the increasing number of cases daily in most countries in Africa, it can be asserted, according to International Monetary Fund (2020), that there is the need for the continent to brace up for a shock of extraordinary harshness and complication that is anticipated to prompt the worst recession ever since the Great Depression.

In the bid to curb the outbreak of COVID-19 pandemic in Egypt, the government implemented several measures, which include travel bans on international commercial passenger flights, curfew during night time, and restrictions on gathering, school and religious institutions closure (Breisinger et al, 2020). These measures and the partial lockdown of the Egyptian economy has been identified to be modest by international standard as it was able to strike a balance between public health and economic consideration as the economy was able to cope under the slower pace of economic activity (Mohammed and Mohammed, 2020). Aside the partial lockdown, the Central Bank of Egypt on 29th March 2020 gave out instructions to all banks in the country on the application of temporary limit on daily withdrawals and deposit. This is done with the knowledge that economic shocks affected the impoverished the most, thereby creating a place for inequality. The temporary limit was also put in place based on the foresight that the country's two main sources of income to the economy which are tourism and remittances from citizens working abroad

are most likely to be affected by the pandemic in relation to what happened during the global recession. The impact of the pandemic in the country was moderated to assist the poor and vulnerable. This is done by making available subsidised provisions for hundreds of thousands of struggling families across the capital. The country's workforce informally employed and vulnerable whose livelihood were destroyed during the pandemic were also put into consideration (Kurancid, 2020).

Based on recent forecast by the International Monetary Fund World Economic Outlook (2020), Egypt has been projected to be the only country in the Middle East and North Africa region to have witnessed positive economic growth in 2020 which was estimated at 1.95% with expectation on all other economies contracting. Egypt has also been identified as a budding economy among emerging economies as the country moves towards the completion of several reforms launched in 2016 (Mirette et al, 2020). Recent estimates revealed that Egypt economic growth has been growing over 5% in the last two years with the tourism sector recorded to have the highest revenues in 2018-19 which is a sign of stability increase for the country (Breisinger et al, 2020) However, with the outbreak of the COVID-19 pandemic, assessments from Egyptian Centre for Economic Studies revealed that the impact of COVID-19 on the country would likely be felt until around June 2021 because of lower domestic consumption, reduced remittances, declining travel and tourism and outflow of capital projected to be nearly 16 million (IMF, 2020). More so, the COVID 19 pandemic is also expected to interrupt the stability progress recorded based on the IFPRI's Social Accounting Matrix (SAM) multiplier model for Egypt as GDP is expected to fall between 0.7% and 0.8% (EGP 36-41 billion or \$ 2.3-\$2.6 billion) while household incomes are likely to fall particularly among the poor (Breisinger et al., 2020; Thurlow, 2020).

Problem Statement

The outbreak of COVID 19 pandemic in recent time has made scholars and researchers to address various impact of the pandemic on the social and economic activities of regions and countries. Studies have documented several ways in which the pandemic has triggered poverty and inequality effect (Furceri et al., 2020; Brown and Ravallion, 2020; Lakner et al., 2020; Palomino et al., 2020 and Patel et al., 2020) with evidence showing a significant impact of poverty felt before and during the pandemic. Estimated growth projections from June 2020 Global Economic Prospect report showed that 71 million people will be pushed into extreme poverty in 2020 with the baseline

scenario and 100 million under the scenario at the downside (World Bank, 2020). The implication of the estimate is that the global extreme poverty is likely to increase from 8.23% in 2019 to 8.6% in 2020. This stands as the first extreme poverty since 1998, overruling the progress experienced ever since 2017 (World Bank, 2020).

Specifically, it has been projected that COVID 19 might generate 176 million additional poor people at \$3.20 and 177 million additional poor at \$5.50 (Mahler et al., 2020). Regions expected to have at least 10 million more people living on less than \$5.50 per day are the Latin America & Caribbean, East Asia & Pacific and the Middle East & North Africa (World Bank, 2020). This stands as a major concern for a country like Egypt that has been rated as a rising star in North Africa, as estimates from the World Bank revealed that 60% of the Egyptian population are poor and vulnerable. This is based on the official poverty rates estimated by the national poverty levels to be 32.5% and the existence of sharp inequality across regions with poverty levels in Egypt poorest villages rated as high as 81.7%. (World Bank, 2020). Evidence also revealed a rising inequality triggered by the effect of COVID 19 with the gap between the rich and the poor getting widened day by day (Fathalla, 2020).

One of the major consequences of COVID 19 pandemic has been documented in relation to the achievement of UN Sustainable Development Goal (SDGs) towards ending poverty by 2030 (Buheji, et al., 2020; Sumner et al., 2020). This was supported by World Bank projections which suggested that COVID 19 will push into extreme poverty 50 million people (Mahler, et al., 2020; Bukari, et al., 2020). A study by Sumner (2020) showed a dismal poverty relapse scenario which has been estimated to make 420 to 580 million people poorer in 2020 due to COVID 19 pandemic impact. Given these fact and figures and based on the objective of leaving no one behind which is within the policy framework of SDGs gives the implication that there is the need to understand and report through deeper knowledge of the drives that cause people to plunge into and persist in poverty. Based on the stated SDGs objective, inequality has been documented in the literature as a potential long-term consequence of the current coronavirus pandemic (Maffioli, 2020). Inequality can reduce the poverty intensity of growth (Olinto, et al., 2014) which implies that there will be less impact on the poor and other marginalized groups if eventually there will be economic recovery after the pandemic as this can leave them worse off, thus experiencing inequality than

before. Therefore, there is the need to address the issue of inequality as eventual economic recovery might have less impact on poverty brought on by COVID 19 (FAO, 2020).

Hence, this study addresses the dynamic interaction of COVID 19, poverty and inequality in Egypt during and after the pandemic in addition to estimating the nature and degree of economic outcome linked to structural issues originating from the supply and demand side shock. This is adopted based on the interplay of one of the three context-specific factors which can be used to measure the impact of COVID 19 on any economy (Valensisi, 2020). This has been identified in the literature to deserve particular attention in many developing countries as it was argued to have greater significance than health emergency itself. (Baldwin and Weder di Mauro, 2020; Aung, et al., 2020; UNECA, 2020; UNCTAD, 2020).

Methodology

Data Sources and Measurement

In the bid to examine the dynamic interaction between COVID 19, poverty and inequality in Egypt, a vector error correction mechanism was employed with daily time series data from when the first case was discovered in Egypt on the 14th February to September 10th, 2020. Data were sourced on each of the variables used from different data bank. COVID 19 data were sourced from STATISTA data bank on number of daily cases starting from when the first case was first discovered to the 10th of September, 2020 and this was what prompted the choice of time frame for other variables. Data on Poverty were sourced from the POVCALNET (2020) data bank proxied by the number of population in millions classified to be poor. Data on Inequality were sourced from the World Bank Population review (2020) and this was proxied by Gini Index which measures the degree to which the distribution of income among persons or households within an economy differs from a perfectly equal distribution. Structural issues as suggested by Valensisi (2020) as a means of measuring the impact of COVID 19 were used as control variables. For this study, the structural issues adopted were commodity price as proxied by gasoline price in Egypt, labour force participation as proxied by number of employed persons in Egypt, value chain as proxied by one of the most important revenue generating sector which is tourism. Data used for the structural issues were sourced from Trading Economics Forecast for Egypt based on 2020-2022 outlook. Tourism is proxied by the number of tourists that travel to a country other than the country in which they have their normal residence. Labour force is measured by the number of employed

persons in the country who is economically active. Gasoline price is measured by the price of crude oil, the rate of refining the crude oil, the selling, supply costs, taxes and of course, profits all along the way from production to the final consumption.

Model Specification

The study made use of the vector error correction model which has been identified as a restricted vector auto regression mainly designed for use with non-stationary series known to be cointegrated. The usefulness of VECM is embedded in its cointegration relations built into the specification such that in the long run, it restricts the behaviour of the endogenous variables to converge to their cointegrating relationship giving space for short run adjustment dynamics. The cointegration term can be known as the error correction term based on the deviation from long run equilibrium which will be corrected gradually through a series of partial short run adjustments. In estimating the vector error correction models and cointegration, the following steps are required to be followed: test for order of integration, the cointegration tests and the error correction estimation.

Test of Order of Integration

The test of order of integration, which is also known as the unit root test, estimates the individual series under consideration. The test of order of integration was developed to follow several procedures which includes Augmented Dickey Fuller (ADF) test with reference to Dickey and Fuller (1979, 1981) and the Phillip-Perron (PP) with reference to Phillip (1987) and Phillips and Perron (1988). The main function of ADF test is to reject the null hypothesis of unit root (non-stationary series) in the bid to accept the alternative hypothesis of stationarity.

The tests are thus conducted based on with and without a deterministic trend (t) for individual series. The main equation of ADF test can be estimated using the following regression below:

$$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \sum_{i=1}^n \beta \Delta y_t + \varepsilon_t \dots \dots \dots (1)$$

$$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \sum_{n=1}^n \beta_1 \Delta y_i + \gamma_t + \varepsilon_t \dots \dots \dots (2)$$

Where

y represents times series, t represents a linear time trend, Δ represent the first difference operator, β_0 represent a constant, n stands as the optimum number of lags in the dependent variable and ϵ_t represents the random error term which is the difference between equation (1) and (2) with equation (1) including a drift while equation (2) includes both drift and linear time trend PP . The result of the difference between equations (1) and (2) is written below:

$$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \epsilon_t \dots \dots \dots (3)$$

Cointegration Test

Testing the presence of cointegration between series which are of the same order of integration is the next procedure and this done by forming a cointegration equation. Cointegration allow that if in the long run, two or more series move closely together notwithstanding the series are trended, the difference between them will remain constant. It is assumed that the series has a long run equilibrium relationship due to the stationarity between them (Hall and Henry, 1989). If the series are not cointegrating, then it suggests that the variables have no long run relationship which implies that the variables are randomly broadening from one another (Dickey et al, 1991). For this study, the Johansen (1991), Johansen and Juselius (1990) maximum likelihood test procedure was employed. This can be expressed if Y_t is a vector of n stochastic variable with the existence of a p -lag vector auto regression with Gaussian errors. Therefore, the Johansen’s methodology can take a point in the vector auto regression based on the order p which is given by the equation below:

$$Y_t = \pi + \Delta_i Y_{t-1} + \dots \Delta_p Y_{t-p} + \epsilon_t \dots \dots \dots (4)$$

Where Y_t represents $nx1$ vector of variables that are integrated of order and can be denoted by equation (1), ϵ_t represent $nx1$ vector of innovations. Thus, the VAR equation can be expressed as;

$$\Delta Y_t = \pi + \delta Y_{t-1} \sum_{i=1}^{p-1} \tau_i \Delta Y_{t-1} + \epsilon_t \dots \dots \dots (5)$$

Where;

$$\Gamma = \sum_{i=1}^p M_{i-1} \quad \text{and} \quad \tau_i = - \sum_{j=i+1}^p M_j \dots \dots \dots (6)$$

To examine the number of cointegration vectors, two statistical tests were recommended by Johansen and Juselius (1990) and Johansen (1988, 1989). Firstly, the study tests the null hypothesis that the number of distinct cointegration vector is less than or equal to q which stand against the general unrestricted alternatives $q=r$. The test was estimated using the equation stated below:

$$\lambda trace(r) = -\Pi \sum_{i=r+1} \ln[1 - \hat{\lambda}_t] \dots \dots \dots (7)$$

Where Π stands as the number of usable observations and the λ s stands as the estimated Eigen value from matrix.

Secondly, the study tests the maximum Eigen value test (λmax) which is calculated based on the formular below:

$$\lambda max(r, r + 1) = -\Pi \ln(1 - \lambda r + 1) \dots \dots \dots (8)$$

The main concern of the test of Null hypothesis is to show that there is r of cointegrating vectors as against the alternative that $r+1$ cointegrating vector.

The Vector Error Correction Model (VECM)

The appropriate estimation technique that can be used if a set of variables are discovered to have one or more cointegrating vectors is the Vector Error Correction Model (VECM). This technique is applied to determine the reaction of a set of independent variables to the shock from the dependent variable. The VECM adjust to both short run changes in variable given the deviations from equilibrium. In estimating VECM, the lag length criteria suggests the lag to be chosen. The general form of VECM model is specified below:

$$\Delta Y_t = \alpha_1 + \alpha_2 EC_{t-1} + \alpha_3 \Delta Y_{t-1} + \alpha_4 \Delta X_{t-1} + \varepsilon_t \dots \dots \dots (9)$$

The coefficient of the error term (EC_{t-1}) which is used to measure the speed of adjustment is an important parameter in the estimation of the VECM dynamic model. Therefore, for this study, a positive sign is expected for COVID 19, poverty, inequality, and number of employed persons, gasoline price and tourism. In the bid to establish the joint effect of variables using the VECM technique, all the variables are taken as endogenous(ΔY) and exogenous (ΔX) so as to establish

the long and short run interaction among them. The VECM is applied based on one co-integrating equations and using the Econometric Views (E-VIEWS) environment, the study estimated the OLS of six equations which is ordered by individual variable. Through the individual coefficient of the differentiated terms, the short run effect was captured which implies that the impact of the variables were captured such that the coefficients of the VECM variables is embedded with the information on whether the past values of variables have effect on the current values of the variables used for the study. In measuring the tendency of each variable returning to equilibrium, the size and statistical significance of the coefficient of the error correction term was employed. By implication, the significant coefficient explains that the past equilibrium errors played a role in determining the current outcomes which captures the impact on the long run.

Result and Discussion

Descriptive Statistics

In order to examine the dynamic interaction among COVID 19, Poverty and Inequality in Egypt, the study started with descriptive statistics and the correlation matrix of the variables used for the study. The descriptive statistics made available the facts surrounding the sample statistics such as the mean, median, maximum and minimum value and also revealed the measurement of the distribution of the sample such as the kurtosis, skewness and the Jarque-Bera statistic. The first case of COVID 19 from 14th February was observed after two hundred and ten days for this study. During this time, the maximum value for poverty, inequality, number of employed persons, price of gasoline and tourism was at 2%, 1%, 24%, -0.3% and 13% while the minimum value was at 2%, 0%, 24%, 0.3% and 13%. The data series displayed a high level of consistency as the mean and median values lies within the range of minimum and maximum value of the series. The standard deviation (SD) which measures the extent of the variation or degrees of dispersion of each series from its mean are generally very low, implying little deviations of the actual data from their mean. However, the standard deviation of COVID 19 was 41% indicating inconsistency when compared with other variable and by implication, it can be related to the daily increase of no of cases of infected persons. The result from the descriptive statistics also revealed 50% (3 of 6) negative and positive skewness of the series distribution which by implication show that the variables are skewed leftward and rightward. For a perfectly symmetrical distribution such as normal distribution, the coefficient of skewness which measures the degree of asymmetry or

departure from symmetry of a distribution is expected to be zero. From the result, almost all the variables have their coefficient of skewness approaching zero, suggesting that most of the series used for the study are normally distributed.

Similar to skewness is the kurtosis which provides information about the degree of peakedness of distributions and the result from the descriptive statistics showed that 83% (5 of 6) of the variables have platykurtic distribution (relatively flat-topped distribution) while the remaining have leptokurtic distribution series (relatively high peaked distribution). However, each of skewness and kurtosis statistics is not the end tool for testing the statistics on normality of a probability distribution of a series. One of the statistics used to test normality or the asymptotic property of a series is the Jarque-Bera statistic which is computed using the skewness and kurtosis coefficient of the series being examined. The essence of testing for normality or asymptotic property of a series is formed by the assumption of series normality distribution by other test statistics like χ , t and F among others which are popularly used in the estimation of econometric model. The result from the descriptive statistics revealed that the probability value of Jarque Bera statistics normally distribution assumption is accepted at 1% or 5% for all the series. The result of the descriptive statistics is presented in Table 1.

Table 1: Descriptive Statistics

	COVID	LPOV	INEQID	EMPP	GAS	TOU
Mean	40505.85	2.013565	1.002855	24115.41	-0.324172	12.57406
Median	21437.50	2.013568	1.006333	24115.41	-0.324169	12.57406
Maximum	100557.0	2.015941	1.018728	24115.69	-0.321561	12.57691
Minimum	1.000000	2.011181	0.000000	24115.12	-0.326793	12.57120
Std. Dev.	40534.37	0.001384	0.069632	0.166027	0.001521	0.001660
Skewness	0.363127	-0.003814	-14.32639	3.05E-08	-0.004193	2.18E-07
Kurtosis	1.374965	1.799966	206.8394	1.799945	1.799970	1.799945
Jarque-Bera	27.72162	12.60123	370750.4	12.60115	12.60125	12.60115
Probability	0.000001**	0.001835**	0.000000***	0.001835**	0.001835**	0.001835**
Sum	8506229.	422.8487	210.5996	5064235.	-68.07607	2640.552
Sum Sq. Dev.	3.43E+11	0.000400	1.013374	5.761089	0.000484	0.000576
Observations	210	210	210	210	210	210

*Note: ***, ** indicate 1% and 5% levels of significance. Figures in parenthesis are probability values*

Source: Author's Computation, 2020

Correlation Matrix

The next analysis conducted is to determine the possible degree of association among the variable. The study made use of the correlation matrix and results revealed the correlation coefficients and the degree of the relationship among the variables. The results showed that Poverty, Inequality, Number of employed persons, price of gasoline and tourism showed a positive association with COVID 19 pandemic which implies that the more the no of cases discovered, the more the variables are adversely affected. The result of the correlation matrix is presented in Table 2.

Table 2: Correlation Matrix

Correlation						
Probability	COVID	LPOV	INEQID	EMPP	GAS	TOU
COVID	1.000000					

LPOV	0.948032	1.000000				
	0.0000***	-----				
INEQID	-0.143558	-0.167248	1.000000			
	0.0376**	0.0153**	-----			
EMPP	0.948308	0.999999	-0.167438	1.000000		
	0.0000***	0.0000***	0.0151**	-----		
GAS	0.948005	1.000000	-0.167230	0.999999	1.000000	
	0.0000***	0.0000***	0.0153**	0.0000***	-----	
TOU	0.948308	0.999999	-0.167436	1.000000	0.999999	1.000000
	0.0000***	0.0000***	0.0151**	0.0000***	0.0000***	-----

Note: ***, ** indicate 1% and 5% levels of significance. Figures in parenthesis are probability values

Source: Author's Computation, 2020

Stationarity Test

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are the test adopted to stationary test of COVID 19, poverty, inequality, number of employed persons, price of gasoline and tourism series. Through the application of equation 3, the ADF and PP unit root tests was carried out in sequential order such that estimation is done with and without intercept and /or deterministic trend. Akaike and Schwarz information criteria were used in the determination of Lag length of the augmenting term. The result showed that the variables are stationary at levels

and in first differences suggesting that the variable selected for the study are integrated of order I(0) and I(1). The result is presented in Table 3.

Table 3: Test of order of Integration

Variable	ADF	PP
COVID	-3.68 (0.03) **	-
POV	-10.8 (0.00)***	-30.0 (0.00)***
INEQ	-3.12 (0.08)*	-
EMPP	-17.6 (0.00)***	-56.6 (0.00)***
GAS	-13.9 (0.00)***	-3.31 (0.02)**
TOU	-19.1 (0.00)***	-56.6 (0.00)***

Note: ***, **, * indicate 1%, 5% and 10% levels of significance.

Figures in parenthesis are probability values

Source: Author's Computation, 2020

Cointegration Test

The Johansen cointegration test was conducted on COVID 19, poverty, inequality, number of employed persons, price of gasoline and tourism. The result revealed that both the Trace and Maximum Eigen value test suggest the acceptance of the Null hypothesis under the 5% level with positive relationship. This implies that there is the existence of a stable and long-term equilibrium relationship among the variables. Based on the presence of cointegration, the Vector Error Correction Mechanism (VECM) was conducted. The result of the cointegration test is present in Table 4.

Lag Length Criteria

The VAR lag length is used to select some model selection criteria. Generally, it is approach by fitting VAR models with orders $p= 0, 1, 2, \dots, p_{max}$ and then select the value of p which minimizes the model selection criteria (Lebari, 2018; Lutkepohl, 2005). The main issue about selection of Lag is that choosing too few lags might lead to systematic variation in the residuals and in another

scenario, too many lags has the end product of fewer degrees of freedom. This study made use of a fit at Lag 1 according to Schwarz information criteria. The result is presented in Table 5.

Table 4: Result of Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesize No of CE(s)	Eigen Value	Trace Statistics	Critical Value (0.05)	Prob**
None*	0.44	177.3	95.8	0.00
At Most 1	0.09	56.6	69.8	0.35
At Most 2	0.08	37.7	47.9	0.32
At Most 3	0.07	21.6	29.8	0.32
At Most 4	0.03	6.9	15.5	0.60
At Most 5	0.00	0.2	3.8	0.67

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Haug-Michelis (1999) p-values

Source: Author's Computation, 2020

Unrestricted Cointegration Rank Test (Maximum Eigen Value)

Hypothesize No of CE(s)	Eigen Value	Max-Eigen Statistics	Critical Value (0.05)	Prob**
None*	0.44	120.7	40.1	0.00
At Most 1	0.09	18.9	33.9	0.83
At Most 2	0.08	16.1	27.6	0.66
At Most 3	0.07	14.8	21.1	0.31
At Most 4	0.03	6.67	14.3	0.53
At Most 5	0.00	0.18	3.84	0.67

Max-eigenvalue test indicates 1 cointegrating eqn (s)

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Haug-Michelis (1999) p-values

Source: Author's Computation, 2020

Table 5: Lag Length Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-928.3241	NA	1.489681	8.912193	8.960169	8.931590
1	2926.982	2563.041*	1.54e-16*	-27.89456	-2770266*	-27.81698

Source: Author's Computation, 2020

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Normalized Cointegrating Coefficients

The result from the normalized cointegrating coefficient shows a negative relationship between the no of daily cases of COVID 19 and Poverty. This implies that a 1% decrease in the number of cases will lead to 2.09% decrease in poverty ceteris paribus. This finding supports the works of (Mahler, 2020; Breisinger, et al., 2020; Kurancid, 2020) that the more the no of cases of COVID 19, more Egyptians will be plunged into poverty on the long run. On the other hand, there exist a positive relationship between COVID 19 and inequality. By implication, a 1% increase in the no of COVID 19 cases will lead to 3.14% increase in inequality, ceteris paribus. This finding supports the estimates done by World Bank (2020) on the impact of COVID 19 on inequality (Maffioli, 2020; Fathalla, 2020) and how the pandemic has widen the gap between the rich and the poor.

More so, with regards to structural issues in Egypt, result on the three selected variables revealed a positive relationship between the number of COVID 19 cases and the number of employed persons, ceteris paribus. A 1% increase in the number of COVID 19 cases in Egypt will lead to 1.58% decrease in the number of persons employed as many people lost their jobs due to the lock down experienced during the pandemic. By implication, more people are likely to join the bracket of unemployed thereby increasing the unemployment rate in the country. The price of gasoline revealed a positive relationship between the no of COVID 19 cases, ceteris paribus. A 1% increase in the number of cases of COVID 19 is expected to lead to 1.73% decrease in the production of gasoline. This implies that the price of gasoline is likely to increase so as to meet up with the short

fall in production as most revenue generated will likely be diverted to reducing the number of infected persons. Also, consumer spending will be affected as gasoline stands as an essential commodity to the household, industry and the economy as a whole. The tourism sector which stands as a major revenue generating sector to Egyptian economy showed a positive relationship with the number of cases of COVID 19. A 1% increase in the number of cases will lead to 1.42% decrease in the number of tourists. By implication, there will be a drop in the revenue being generated from the sector. The findings on structural issues support the findings of Valensisi (2020). The result is presented in Table 6.

Table 6: Result on Normalized cointegrating coefficients (Long run VECM)

COVID	POV	INEQ	EMPP	GAS	TOU
1.00000	2.09	-3.14	-1.58	-1.73	-1.42
	(2,5)	(7.7)	(4.1)	(2.1)	(1.8)

Note: Standard Errors in Parenthesis.

Source: Author's Computation, 2020

VECM and Short run relationship

The result of the short run VECM revealed the error correction model used in the study. The ECM was developed by Engle and Granger in the bid to reconcile the short run behaviour of an economic variable with its long run behaviour (Gujarati, 2004). It is expected that the ECM be negative and must lie between 0 and 1. The negative sign implies a movement backward towards equilibrium. The ECM is also known to be the speed of adjustment factor which reveal how fast the system adjust or a shock in the economy is restored. In this study, the error correction coefficient revealed the speed at which Poverty, inequality and other control variables converges to equilibrium after an exogenous shock of COVID 19 pandemic. By implication, the error correction term is expected to be negatively signed to indicate a move towards long run equilibrium. The error correction term in this study revealed a negative sign, which implies that based on adjustment speed of 1069 and given the initial shock with a speed of adjustment of 11%, the error term converges. Taking the first difference of the lagged of dependent variable, the error correction estimate for poverty, inequality, number of employed persons, price of gasoline and tourism, that is, D(POV(-1)), D(INEQ(-1)), D(EMPP(-1)), D(GAS(-1)) and D(TOU(-1)) respectively as explanatory variables indicates that the model converges in the long run given any initial shock with a speed of adjustment of 3.7%, 65%, 19%, 1.7% and 3.1% respectively. The result is presented in Table 7.

Estimation of Ordinary Least Square

As a robustness check, the study made use of OLS specifically to test for the short run dynamics of the main three variables for this study which are COVID 19, Poverty and Inequality. The results of the OLS estimates was used to establish the behaviour of the variables in the absence of cointegration or error correction mechanism. Poverty showed a positive and significant relationship with the daily number of cases in Egypt while Inequality revealed a positive but not significant relationship with the daily number of cases of COVID 19. By implication of the statistical evidence, a 1% increase in the no of cases of COVID 19 gives rise to 28% increase in the number of poor people in Egypt, *ceteris paribus*. This findings supports the work of Nonvide (2020) and Vos, et al., (2020) On the other hand, a 1% increase in the no of cases of COVID 19 also give rise to 90% increase in inequality thereby widening the gap between the rich and the poor in the country. This supports the findings in the Vector error correction estimate, despite the magnitude of change are not the same, it reveals the same direction. The OLS result is presented in Table 8.

Impulse Response Function and Variance Decomposition

As part of the robustness check, the study examines the dynamic effects of the model response to shocks as well as the extent of the effect among the variables. Further analysis was employed using Impulse Response Function and Variance Decomposition based on VECM. The result was presented for 10 periods. The impulse response function was presented in a diagram showing the generalized impulses one SD innovations which draw more meaningful interpretations for the short run and long run responses to shocks. Therefore, based on the impulse estimations, it is assumed that the first variable to appear explains the other variables but not vice versa. COVID 19, poverty, inequality and price of gasoline indicates a negative short run correlation from the first to the eighth period and a positive long run correlation from the ninth to the tenth period while on the other hand, number of employed persons and tourism sector revealed a positive correlation in the first to eighth period and a negative correlation in the ninth to tenth period. In the broad sense, COVID 19 pandemic shock has a large effect on Poverty and Inequality in the short term but on the long run, mild effect will be experienced as the country move toward looking for immediate solution to curb the spread of the virus. The result is presented as Figure 1

Table 7: Short run VECM Result

Error Correction	D(COVID 19)
Coint Eq 1	-3.71 (5.6)
D(COVID(-1))	0.94 (0.07)
D(POV(-1))	3.67 (1.7)
D(INEQ(-1))	6557 (3.9)
D(EMPP(-1))	-1879 (1553)
D(GAS(-1))	-1.67 (1.8)
D(TOU(-1))	-2.95 (1.5)
C	6355 (1069)
R ²	0.97
Adjusted R ²	0.97
F-statistics	551.22

Note: Standard Errors in Parenthesis.

Source: Author's Computation, 2020

Variance Decomposition

The impulse response function has revealed the effect of shock of a system on an internal variable while the variance decomposition was conducted to influence individual variable's update on the other variables showing the relative effect. The estimated result predicted high variance contribution of COVID 19 shocks in the first and second period for poverty, number of employed persons, price of gasoline and tourism with the variance contribution gradually slowing down from the third to the tenth period. This was not the case for inequality as the predicted variance contribution of COVID 19 shocks is expected to affect inequality from the first to the tenth period. The result is presented as Figure 2.

Table 8: Ordinary Least Square Results

Variables	OLS coefficients
POV	2785 (0.00)***
INEQ	8982 (0.49)
C	-5604 (0.00)***
R ²	0.899
Adjusted R ²	0.898
F-statistics	921.2167 (0.00)***

*Note: ***, ** indicate 1% and 5% levels of significance. Figures in parenthesis are probability values*

Source: Author's Computation, 2020

Response to Cholesky One S.D. (d.f. adjusted) Innovations

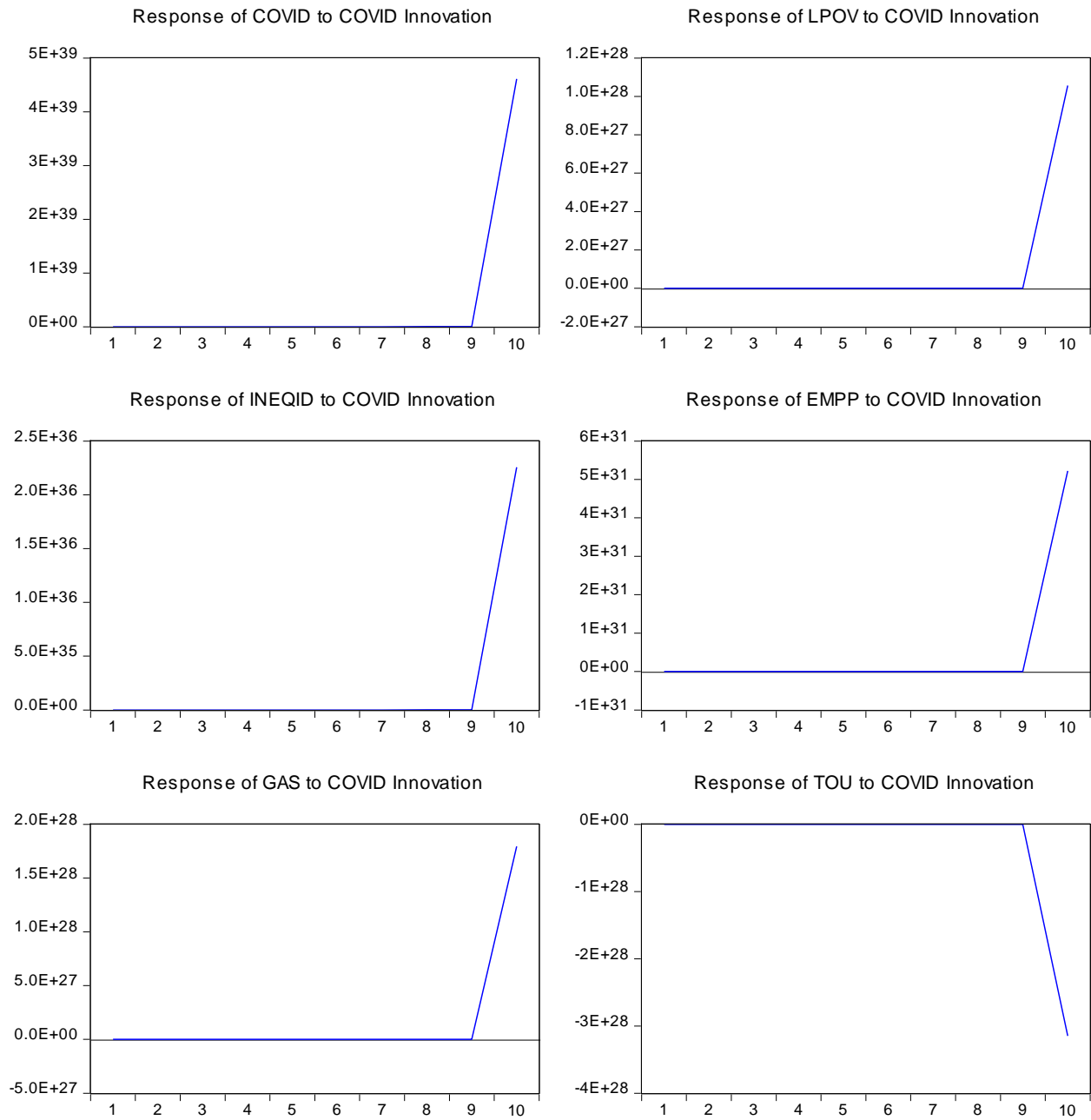


Figure 1: Impulse Response Function

Variance Decomposition using Cholesky (d.f. adjusted) Factors

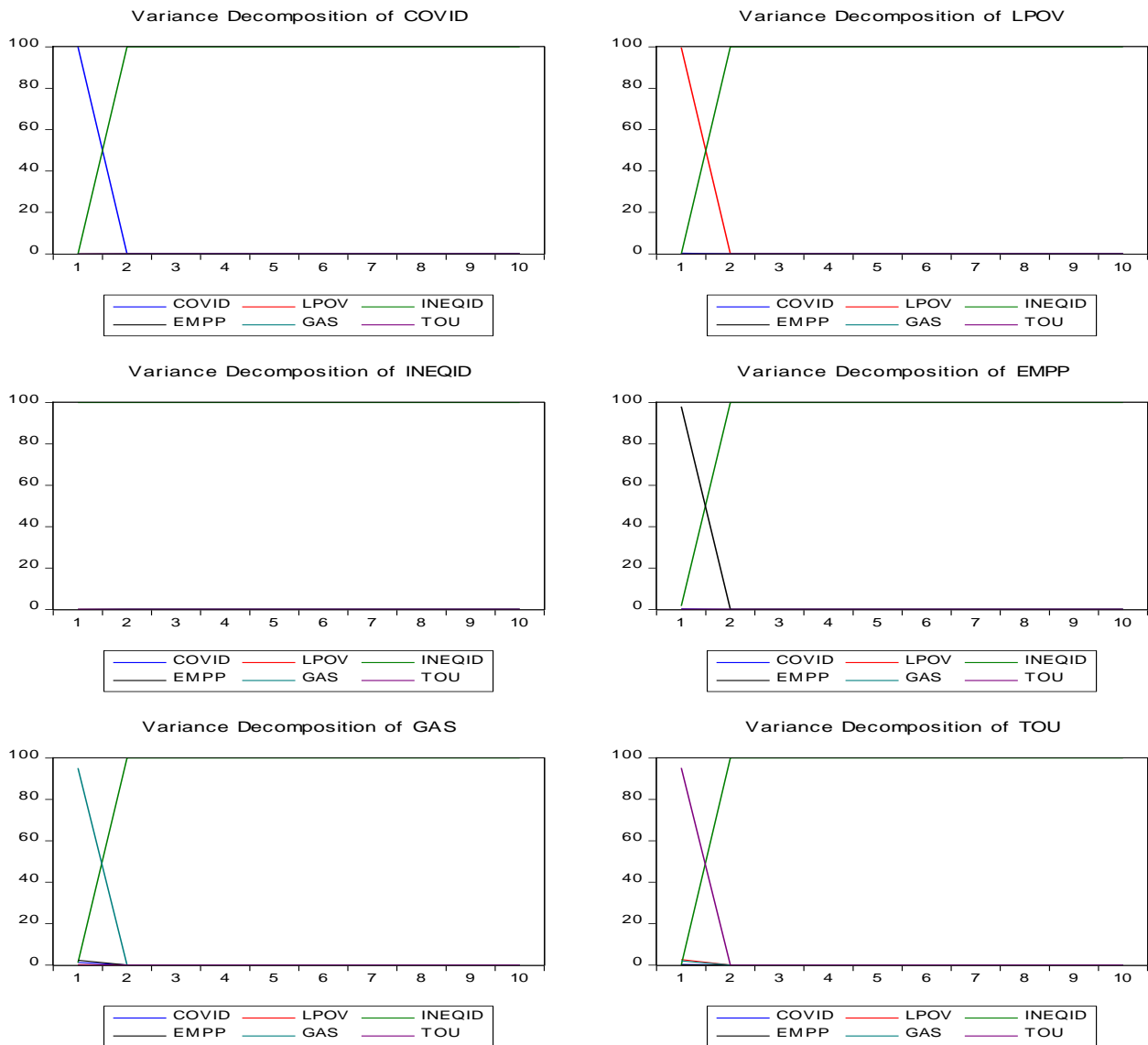


Figure 2: Variance Decomposition

Conclusion

The study examined the nexus between COVID 19, poverty and inequality in Egypt with the aim of determining the dynamic interaction among the variables. The study made use of structural issues such as number of employed persons, price of gasoline and tourism as identified in the literature. The study made use of vector error correction model in the bid to detect the long run relationships among the variables. As part of robustness check, the study made use of ordinary least square technique to assess the short run dynamics among the variables. The impulse response

function and variance decomposition techniques was employed to explain the interaction of the shocks of COVID 19 pandemic with the explanatory variables. The study concluded that in the short run, a 1% increase in the number of COVID 19 cases give rise to 28% increase in the number of poor people living in Egypt while on the other hand it gives rise to 90% increase in income inequality thereby widening the gap between the rich and the poor. In the long run, findings revealed that a 1% increase in the number of COVID 19 cases give rise to 2% increase in the number of poor people living in Egypt with inequality giving rise to 3% increase in income inequality. This has policy implication as the findings from the impulse response function and variance decomposition revealed a large impact on the short run to shocks from COVID 19 and a mild impact on the long run. The study therefore recommends that efforts should be made by the government and private individuals to curb and eradicate the virus in order to reduce and stop the number of daily cases of the virus in the bid towards the achievement of sustainable development goals of zero poverty and leaving no one behind. The Egyptian government should put in place institutions that will work on the structural issues affected by the pandemic such as provision of employable ventures and investment that will accommodate people that have been driven to the unemployed bracket due to the occurrence of the pandemic. Also, specific sectors such as tourism should be revamped as soon as the pandemic effect has dropped down so as increase its revenue base. Finally, the commodity prices should be revisited and other economic activity that have been affected by the pandemic as the no of cases is expected to drop drastically in the long run.

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