



RELATIONSHIP BETWEEN COVID DEATHS AND SOME IMPORTANT ECONOMIC DEVELOPMENT INDICATORS USING TOBIT REGRESSION MODEL

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Abstract: This paper tries to enquire does there exist any relation between number of deaths, and some economic variables that is the level of economic development, health infrastructure, inequality of income , number of physicians, hospital beds per million population, age 65 and older population (as % of total) etc using Tobit regression approach. This result reflects that people of high developed nations are either care less about government's efforts to combat covid pandemic, or their immunity is less than the African or middle east Muslim nations or other less affected nations. Though this result may change with the changes of data, since covid death data is changing day by day and in this paper data used last three months back. This may be treated as the limitation of this study.

Keywords: Covid death, Tobit regression, Immunity

INTRODUCTION

The outbreak of pandemic COVID-19 all over the world has disturbed the political, social, economic, religious and financial structure of the whole world. The COVID-19 outbreak (also known as CORONA virus) was first triggered in December 2019 in Wuhan city of China. From the information known at this point, several facts are pertinent, it belongs to the same family of viruses that caused the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 and Middle East Respiratory Syndrome (MERS) outbreak in 2012. After that the COVID-19 continues to spread across the whole world. The World Health Organization (WHO) first declared COVID-19 a world health crisis in January 2020. Since then, the pandemic has affected the global economy beyond anything experienced in nearly a century.

According to WHO till now there is no vaccines nor specific antiviral treatments for COVID-19. Measurements involve the treatment of symptoms,

supportive care, isolation and experimental measures. WHO declared the COVID-19 outbreak a Public Health Emergency of International Concern (PHEIC) on 30th January, 2020 and a pandemic on 11th March, 2020. Local transmission of disease has occurred in most countries across all six WHO regions.

The impacts of the disease beyond mortality and morbidity has become apparent since the outbreak of the disease has occurred to the human life. Amidst the slowing down of the world economy with interruptions in production, the functioning of the supply chains has been disrupted. Transport being limited and even restricted among the countries has further slowed down the global economic activities. Global financial markets have also been responsive to the changes and the global stock indices have plunged. As the virus spreading globally, economic paralysis and unemployment follow in its wake. Amid the corona virus pandemic, several countries across the world resorted to lockdowns to flatten the curve of the infection. These lockdowns confining millions of citizens to their homes, shutting down business and break off almost all the economic activity. According to the International Monetary Fund (IMF), the global economy is expected to shrink by over 3 percent in 2020, the steepest slowdown since the Great Depression of the 1930s. This economic crisis triggered dire social consequence, affecting the lives and livelihoods of most of the global population.

OBJECTIVES OF THE STUDY

It is important to say few words about covid-19. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, experience mild to moderate respiratory illness and it affects all people irrespective of income, color, and power. Older people and those with underlying some common medical problems (age related) are more likely to attack

Now covid crises surpass the world war, great depression etc. in terms of income, employment, standard of living and apprehension among people all over the world. In spite of high level of literacy, sound health care infrastructure it stuck the developed nations heavily initially but now the developing world (like India , Brazil)are also not running neck to neck. This paper tries to enquire does there exist any relation between number of deaths, and some economic variables that is the level of economic development, health infrastructure, inequality of income etc? At present except few nations or islands all most all nations have experienced covid deaths which initially started from Wuhan province of China. After that it affected Italy, France, UK and other European nations, then covid deaths started in USA and finally it touches the developing nations like India , Brazil etc nations. Therefore it is clear that though there is some time lag but ultimately it affected all nations in the world. It is therefore pertinent to enquire

the relation among covid deaths and the level of development, health infrastructure, inequality of income etc.

HYPOTHESIS OF THE STUDY

- (1) Covid deaths and economic development are not related
- (2) Covid death and health infrastructure are not related
- (3) Covid death and inequality of income are not related.

DATA & METHODOLOGY OF THE STUDY

Logit and Probit model consists of binary or dichotomous value of the dependent variable (1 or 0). But in some cases the responses will not consist of only 0 or 1 but 0 and any other value (or range of values) which also depends on some desired or potential capacity of the buyers. Hence one part of the dependent variable is based on a discrete values and another part is continuous values. In other words, the distribution of the dependent variable is a combination of the continuous and discrete probability distribution.

To solve the above problem James Tobin developed a model which is known as Tobit model in which the dependent variable takes some continuous and some discrete values. According to Tobin's model, the desired level of spending can be written as

$$Y_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \mu_i \quad (1)$$

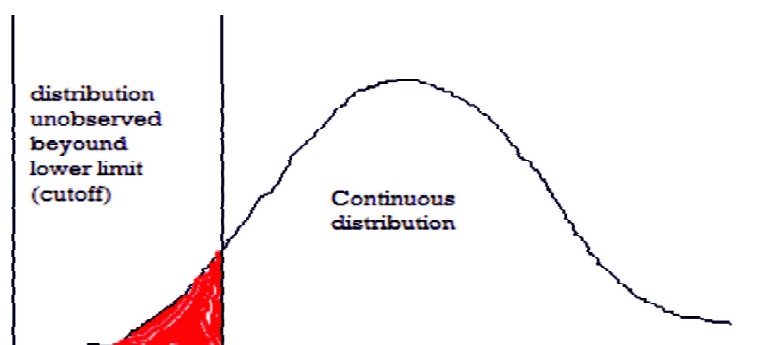
Where, Y_i^* is the amount that the respondent is willing to spend for a particular product and $X_{1i}, X_{2i}, \dots, X_{ki}$ are the socio economic variables that are influencing this desired spending, μ_i is the error term. Here the dependent variable that is is also known as latent or unobservable variable.

In reality, the respondents have some internal potentiality or capacity or thought or desire to sacrifice the amount of money for the product which he wants to purchase. If this capacity exceeds the price of the product that he is willing to purchase, he will buy or spends for that model. Hence his desired spending is equal to his actual spending that is ($Y_i^* = Y_i$). But if his desire to spend is less than the cutoff (that is the minimum price of his preferred product he will not proceed for this transaction. Hence his actual spending will be zero that is $Y_i = 0$. Mathematically we can write this expression as

$$Y_i^* = \beta_0 + \beta_1 X_i + \dots + \beta_k X_k + \mu_i, \quad \mu \sim N(0, \sigma^2) \quad (2)$$

$Y_i > 0$ and continuous if $Y_i^* > 0$ in that case $Y_i^* = Y_i$
and $Y_i = 0$, if $Y_i^* \leq 0$ that is we don't observe any outcome.

The distribution of desired spending looks like the fig below.



So we do not actually observe this variable for all the observations. We only observe it for those observations in which desired spending exceeds the cutoff marks. Since some of the observations (desired spending) are known and some of the observations are not known (denoted by 0 or spending zero amount), hence this type of sample is known as 'Censored sample'. Censored from below, similarly censored from above for a particular value is also possible) and regression by taking such sample is known as 'Censored regression model or Limited dependent variable regression model. Tobin solved this censored regression model by applying Maximum Likelihood estimation method (since application of OLS method does provide biased and inconsistent estimator). The data are collected from WHO and World Development report. Total sample size is 143. the variables are number of covid deaths per million, number of cases per million, rank of human development Index, government's health expenditure (which is converted into ranks), number of physicians per million, Hospital beds per million population, inequality of income, Age 65 and older etc. and lower cut off limit is taken 10 deaths per million population.

FINDINGS

Table 1: Summary statistics

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
Death million	143	61.07791	134.7256	0	833.764
Cases million	143	1266.829	1839.496	1.867	9648.827
HDI	143	.7040839	.1579036	.354	.953
Health exp	143	6.91958	2.682842	2.3	18.3
Physician	143	16.77972	15.27472	.2	62.6
Hospital beds	143	29.46853	24.49312	1	137
Inequality	143	24.1014	10.5852	8.9	56.4
Age 65 and older	143	4.358741	15.13872	0	150

FINDINGS

Total no of sample is 143. That is the data are collected from 143 nations. Mean, standard deviation minimum and maximum level of variables that is number of death and cases per million population, value of Human development index, health expenditure (as % of GDP), number of Physicians and hospital beds per million population, inequality of income, and finally percentage of population with age 65 and older (% of total population) are shown in the above table.

Table 2: Results of Tobit Regression

Tobit regression		Number of obs = 143				
		LR chi2(11) = 102.43				
		Prob > chi2 = 0.0000				
Log likelihood = -703.92285		Pseudo R2 = 0.0678				
<i>Death in million</i>	<i>Coefficient.</i>	<i>Std. Err.</i>	<i>t</i>	<i>P> t </i>	<i>[95% Conf. Interval]</i>	
Cases per million	.0427183	.0057555	7.42	0.000	.0313333	.0541032
HDI Base is nations with very high HDI						
2	-82.96958	27.0803	-3.06	0.003	-136.5371	-29.40208
3	-73.26334	32.58459	-2.25	0.026	-137.7189	-8.807796
4	-91.86777	31.3115	-2.93	0.004	-153.805	-29.93053
Health expenditure rank Base category: Nations with minimum Health expenditure						
2	-75.10398	29.60282	-2.54	0.012	-133.6613	-16.54667
3	-84.2922	37.10804	-2.27	0.025	-157.6956	-10.88882
Physician	-.2010252	.849532	-0.24	0.813	-1.881483	1.479433
Hospital beds	-.1383249	.5474383	-0.25	0.801	-1.221212	.9445621
Inequality of income rank base category: Nations with lowest range of inequality of income						
2	32.72151	26.60811	1.23	0.221	-19.91195	85.35497
3	38.2116	32.58902	1.17	0.243	-26.25271	102.6759
Age 65 and older	.1338625	.6288986	0.21	0.832	-1.110161	1.377886
_cons	89.12122	36.28897	2.46	0.015	17.33806	160.9044
/sigma	106.8658	7.079446		92.862	120.8697	

Obs. summary: 30 left-censored observations at Death per million ≤ 1 ,
113 uncensored observations
0 right-censored observations

FINDINGS

- (i) This model takes 1 as lower cut off mark that is at least one death per million populations. This shows 30 left censored observations. The total number of observations are 143. The log likelihood chi- square test shows the present model is an improvement over the null model.

- (ii) With respect to the human development indices the results show that the very low level of development nations covid death is lower than nations with very high level of development by approximately 92 units. More or less similar results are seen with the nations having medium development level and with high HDI levels with respect to very high HDI or developed nations. This may be the reflection of don't care attitude of the people or ultra liberalization effects or lack of immunity to combat with the covid 19 virus of the people of very high development.
- (iii) The estimated coefficient of the Health expenditure variable is negative. Here the base category: is nations with minimum Health expenditure (less than 3% of GDP). This implies nations with high or medium level of government spending on health (as % of GDP) death rate is lower than with low level of government spending on health as % of GDP.
- (iv) The number of physician coefficient is negative. This means with the increase of number of physicians per million population covid death declines. Though this coefficient is not statistically significant. Similar results obtained for hospital beds also.
- (v) Inequality coefficient is positive . This means with the increase of inequality of income covid death increases. This result is consistent with developing or less developed nations. Since there is huge inequality of income in developing nations like India, Brazil etc.
- (vi) People with age 65 and older is also positive. This means this covid death is prone to older people more since most of the time they suffer from co-diseases also.

SUMMARY AND CONCLUSION

One event that shattered that rhythm of human civilization is the covid pandemic. Reported in December last by Chinese govt. which was first seen in Wuhan province of China and spreaded all most all nations of the world. It is assumed that free movement of labour, capital, and tourists are primary responsible reason for this spread. Moreover global warming, el-nino, melting of ice and resulting misbalance in the ecosystem may be another reason for the spread of this highly contagious virus. Now covid crises surpass the world war, great depression etc. in terms of income, employment, standard of living and apprehension among people all over the world. In spite of high level of literacy, sound health care infrastructure it stuck the developed nations heavily initially but now the developing world (like India , Brazil)are also not running neck to neck. This paper tries to enquire does there exist any relation between number of deaths, and some economic variables that is the level of economic development, health infrastructure, inequality of income , number of physicians, hospital beds per million population,

age 65 and older population (as % of total) etc ? this paper found that nations with very high level of development covid death is much more than less developed nations in spite of having high expenditure on health, and low level of inequality of income. This results reflect that people of high developed nations are either care less about government's efforts to combat covid pandemic, or their immunity is less than the African or middle east Muslim nations or other less affected nations. Though this result may change with the changes of data, since covid death data is changing day by day and in this paper data used last three months back . this may be treated as the limitation of this study.

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