The Relation between the Public Health and Economic Impact of COVID-19 Across Asian Countries

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ABSTRACT

Discussing how GDP is affected by the public health condition during covid-19 is the main aim of the article. The current draft includes 20 different Asian countries. The report shows that: even in a few cases, the impact of COVID-19 on the economy was hard to prove through investigation. But most of the time, the death toll has a negative influence on the GDP growth rate, whereas confirm case has a positive influence on the GDP growth rate. The depth of influence depended on other factors, such as the development of a medical system. Lastly, future prospect between public health and covid-19 is also given.

Keywords: public health, GDP growth rate, COVID-19, economic impact

1.INTRODUCTION

According to the World Bank [1], the COVID-19 pandemic has spread with alarming speed, millions and bringing economic activity to a near-standstill is affected as countries imposed tight restrictions on movement to halt the spread of the virus. As the health and human toll grows, the economic damage is already evident and represents the largest economic shock the world has experienced in decades. This work is to investigate the relation between how hard countries were hit by COVID-19—based on confirmed cases and deaths as a percentage of the population—and what GDP decline their economies suffered.

There are already various of papers about Europe and North America, whereas the data and articles are particularly not enough for Asia- the continent that holds most of the global population. Meanwhile, it is regarded as the opportunity for us to shoulder our responsibility as Chinese students. Therefore, this paper focuses mainly on Asian countries.

To facilitate research and avoid regional impact, 20 countries are purposefully selected from different regions of Asia. Then, gross domestic product is used (GDP) growth rate across quarters as the dependent variable which is important in measuring economic situation. Additionally, quarterly confirmed cases and death rates caused by Covid-19 were chosen in the work as independent variables to represent the public health situation during the epidemic.

2.LITERATURE REVIEW

Many scholars have different views on the impact of the epidemic on the economic development. On the one hand, some of them figured that the health risk is not necessarily correlated with the economic risk to the global economy [2]. Similarly, many authors stated that there is no relation between COVID-19 cases and economic damage, rather that it was a lockdown and distancing rules plus consumer reactions that caused GDP declines [3].

On the other hand, most authors demonstrated that COVID-19 has a significant effect on the finance that no country would be left unharmed [2] which is very consistent with the view of our paper. COVID-19 dissemination and restrictive measures have led to a reduction in consumer activities. Meanwhile, the

additional global crisis has led to a great drop in the countries' exports [4]. The decline in aggregate demand, together with the original risk shocks also caused a sharp drop in equity markets [5]. In the subsequent papers, the authors illustrated that India's unemployment and poverty rates have soared because of COVID-19 since the economic collapse was caused [6].

Moreover, some studies have some interesting predictions, saying that there will be a strong recovery in the economy and finance in 2021 [1]. Additional data over the subsequent year to test those conclusions is used in our paper.

3.DATA

Firstly, the GDP growth rate was chosen as the indicator representing the change of financial condition from the first quarter of 2020 to the first quarter of 2021. For public health, this work uses confirmed cases rates (cases per 100,000 people) and the death toll (individuals per 1,000,000 people) in the same period to reflect the condition of public health. Then purposefully selected 20

countries from different regions of Asia, such as China in East Asia and Saudi Arabia from West Asia, which aim is to facilitate research and avoid regional bias. Besides, during the process of collecting data, it is necessary to drop some of the choices due to the fact of the data was missing.

According to the data as shown in table 1, it can be found that there were negative GDP growth rates for most of the West Asian countries to a larger extent than countries in other districts during 2020, in which the most noticeable is Armenia, which had over 35% decline in GDP. Similarly, it was detected that those countries in West Asia had the highest confirmation rate and death rate during the period, such as Israel with over 1900 confirmed cases per hundred thousand people and Armenia with over 215 deaths per million people. Statistically, the mean of the GDP growth rates of the countries from 2020 quarter one to 2021 quarter one is -6.03%, while the mean confirmation rate of the countries during this period is 519.83 per hundred thousand people and the mean of death rate is 45.07 per million people.

Table 1: Compounded GDP growth rate (%), average confirmed cases rate (per hundred thousand people) average death rate (per million people)

Country	Compounded GDP growth rate	Average Confirmed cases rate (per 100,000 population)	Average death rate (per 1,000,000 population [7]
China	3.78%	1.43	0.70
Korea	0.99%	40.21	6.75
Japan	-0.02%	74.85	14.45
Mongolia [8]	-13.81%	53.88	0.51
Georgia	-18.79%	1446.15	193.85
Israel	-2.83%	1956.91	145.93
India	9.51%	179.33	24.37
Sri Lanka [9]	8.80%	84.04	5.15
Philippines [10]	-20.99%	138.67	24.62
Maldives	-14.18%	897.85	63.00
Bahrain	-4.75%	1749.64	63.00
Saudi Arabia	-3.83%	224.97	37.61
Turkey	6.79%	783.79	75.47
Qatar	-4.10%	1290.41	20.36

Amenia	-35.59%	1178.88	215.01
Singapore	-3.98%	60.65	1.05
Thailand [11]	-6.16%	8.30	0.27
Malaysia	-6.43%	215.84	7.91
Vietnam[12]	-2.87%	0.53	0.07
Brunei	-12.15%	10.17	1.42
Total average	-6.03%	519.83	45.07

4.ANALYSIS

Firstly, this work set the quarterly confirmed cases and the death toll of each country as independent variables and the quarterly GDP growth rate of each country as the dependent variable to do the regression, what the work wanted to do is to find the linear relationship between them. However, it was discovered that except for the obvious relationship between the data in the first quarter of 2021 (see Table2), the R-squares of other quarters' data are not statistically significant, which means there seemed to be no strong linear relationship between the independent variables and the dependent variable in these quarters.

Table 2. 2021 Q1 Regression Result

	GDP growth rate[13]	Confirmed cases/per 100000 persons [14]	Death Toll/per 1000000 persons [15]
	2021 Q1	2021 Q1	2021 Q1
China	0.04%	0.4320	0.0444
Korea	1.70%	82.5980	16.2083
Japan	-1.00%	188.5620	44.7665
Mongolia [8]	-16.34%	230.3180	2.2293
Georgia	-18.91%	1410.2600	328.2050
Israel	-2.00%	4783.6130	338.8272
India	4.05%	143.8120	10.3802
Sri Lanka [9]	3.45%	226.1000	16.6818
Philippines [10]	-15.70%	252.9850	37.5227
Maldives	34.35%	1902.0700	100.5361
Bahrain	12.54%	3132.2200	100.5361
Saudi Arabia	0.50%	78.7302	11.4335
Turkey	1.70%	1285.9026	129.0920

Qatar	-1.10%	1290.3571	16.4286
Amenia	-32.40%	1007.8490	219.8943
Singapore	-0.16%	85.2186	0.1753
Thailand [11]	-1.54%	31.8840	0.4740
Malaysia	-2.09%	732.3990	25.0393
Vietnam [12]	-7.93%	1.1403	0.0000
Brunei	4.37%	13.7213	0.0000

Therefore, using the accumulated data as dependent variables is another decision. For example, when studying the first quarter to the third quarter of 2020, the dependent variable is the compounded quarterly GDP growth rate during this period, and the independent variables are the confirmed cases and death toll of the same period. After doing that, it was obvious that there was no significant relation between the GDP growth rate and the severity of the pandemic for the first two or three quarters in 2020. After continuing studying data of 2020 Q1- Q4 and 2020 Q1 - 2021 Q1, this work obtained statistically significant results (see Table 3 and Table 4).

Table 3. 2020 Q1- 2020 Q4 Regression Result

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.639156277					
R Square	0.408520747					
Adjusted R Square	0.338934952					
Standard Error	0.107460038					
Observations	20					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	2	0.135586828	0.067793414	5.870749194	0.011520886	
Residual	17	0.196310216	0.01154766			
Total	19	0.331897044				
	Coefficients	Std Error	T Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.017326237	0.029858899	-0.580270471	0.569344603	-0.080323006	0.045670532
2021 Q1 confirmed cases	9.2128E-05	2.96003E-05	3.112399353	0.006333948	2.96768E-05	0.000154579

2021 Q1 death toll	-0.001133582	0.000346889	-3.267853927	0.004533927	-0.001865454	-0.000401711
SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.665964019					
R Square	0.443508075					
Adjusted R Square	0.339165839					
Standard Error	0.079064605					
Observations	20					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	3	0.079712579	0.02657086	4.25051343	0.021797169	
Residual	16	0.100019389	0.006251212			
Total	19	0.179731968				
	Coefficients	Std Error	T Stat	P-value	Lower 95%	Upper 95%
Intercept	0.017095253	0.027150915	0.62963817	0.537819353	-0.040462117	0.074652622
2020 Q1 confirmed cases	0.004284339	0.001834979	2.334815962	0.03290872	0.000394357	0.008174321
2020 Q3 confirmed cases	-8.26502E-05	3.20594E-05	-2.578035718	0.020222296	-0.000150613	-1.46874E-05
2020 Q1 death toll	-0.050771982	0.021782499	-2.330861208	0.033166661	-0.096948817	-0.004595147

Table 4. 2020 Q1~2021 Q1 Regression Result

	GDP growth rate [16]	Confirmed cases/per 100000 persons [17]	Death Toll/per 1000000 persons [18]
	2020 Q1~ 2021 Q1	2020 Q4	2020Q4
China	3.78%	0.4070	0.0308
Korea	0.99%	71.8760	9.4987
Japan	-2.01%	119.7620	15.1059
Mongolia [8]	-13.81%	28.7260	0.3185

Georgia	-18.79%	5661.7900	631.7950
Israel	-2.83%	2093.7800	206.4705
India	9.51%	295.5505	38.3151
Sri Lanka [9]	8.80%	178.7727	8.4545
Philippines [10]	-20.99%	150.3426	34.6290
Maldives	-14.18%	667.4190	64.5859
Bahrain	-4.75%	1323.8480	64.5859
Saudi Arabia	-3.83%	80.4252	40.8216
Turkey	6.79%	2238.4943	150.4750
Qatar	-4.10%	645.5000	11.0714
Amenia	-35.59%	3347.2803	562.2576
Singapore [19]	-3.98%	75.8068	0.3507
Thailand [11]	-6.16%	4.4520	0.0287
Malaysia	-6.43%	312.0520	10.2974
Vietnam [12]	-2.87%	0.3732	0.0000
Brunei	-12.15%	12.6023	0.0000
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.718245863		
R Square	0.51587712		
Adjusted R Square	0.458921487		
Standard Error	0.079991825		
Observations	20		
ANOVA			

	df	SS	MS	F	Significance F	
Regression	2	0.115912639	0.057956319	9.057525901	0.002099533	
Residual	17	0.108777766	0.006398692			
Total	19	0.224690404				
	Coefficients	Std Error	t- Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.044471529	0.021176025	-2.100088584	0.05095111	-0.089149037	0.000205979
2021 Q1 confirmed cases	0.000102138	4.14823E-05	2.462207157	0.024789185	1.4618E-05	0.000189658
2021 Q1 death toll	-0.001137553	0.000334809	-3.397618253	0.00342539	-0.001843938	-0.000431168

Since the work filtered out those regressions that are statistically significant in year 2020, we conclude the key variables that it was observed were the confirmed cases rate from 2020 Q1 to Q3 and the death toll in 2020 Q3. If the confirmed cases rate of 2020 Q3 is lower than that of 2020 Q1, it is beneficial for the GDP growth, while more death toll of 2020 Q1 tends to have a negative impact on GDP growth. This is because a stronger country will have a higher confirmed cases rate in 2020 Q1 than in 2020 Q3, and the death toll in 2020 Q1 is lower. For a country that may have more well-developed public health, which means that more cases have been tested and treated in time and the transmission of COVID-19 can be better controlled, the pandemic condition is relatively more transparent in this country. Thus, the epidemic will not affect the economic to a very large extent.

However, the situation completely changed when the data was researched from 2020 Q1 to 2021 Q1. The compounded GDP growth rates in these five quarters only rely on the confirmed cases rate and the death toll of the 2020 Q4. According to the regression results (see Table 4), the coefficient of 2020 Q4 confirmed cases rate is positive. In contrast, the coefficient of 2020 Q4 death toll is negative. That means, compounded GDP growth rate can be influenced actively by a higher confirmed cases rate, but more death toll will exert a negative effect. The dramatic change of independent variables between the two regressions is noticeable, so we studied the data of the first quarter of 2021 separately. It can be found that the 2021 Q1 compounded GDP growth rate is closely related to the confirmed cases rate and the death toll in that quarter. Similarly, the 2021 Q1 confirmed cases rate is still positively related to the compounded GDP growth rate of that quarter, and the 2021 Q1 death toll is also negatively related to the independent variables (see Table 5 and Table 6).

Table 5. Regression t-statistics

Dependent Variable	Independent Variables						
GDP growth rate	Confirmed cases/ per 100000 persons				Death toll/per 1000000 persons		
	2020 Q1	2020 Q3	2020 Q4	2021 Q1	2020 Q1	2020 Q4	2021 Q1
2020 Q1 ~2020 Q4	2.33	-2.58			-2.33		
2020 Q1~ 2021Q1			2.46			-3.4	
2020 Q1				3.11			-3.27

Table 6. Regression Equation & R-square

GDP growth rate(Y)	Regression Equation	R-square
2020 Q1~ 2020 Q4	$Y=0.0171 + 0.0042*cases\_2020 Q3 - 0.0508*deaths\_2020Q1$	0.44
2020 Q1~ 2021 Q1	$Y= -0.0445 + 0.0001*cases\_2020Q4 - 0.0011*deaths\_2020Q4$	0.52
2020 Q1	$Y= -0.017 + 0.0001*cases\_2021Q1 - 0.0011*deaths\_2021Q1$	0.41

5.CONCLUSION

In summary, the work did data regression and analysis from the first quarter of 2020 to the fourth quarter of 2020, the first quarter of 2020 to the first quarter of 2021, and the first quarter of 2021, which helped find that although the relation between COVID-19 and GDP growth rate is not obvious at the beginning, its impact on the economy has begun to emerge gradually. As more death toll existed within a country, which might lead to public panic, lockdowns and business shutdowns, which is not surprisingly, has a negative impact on GDP growth. From the first quarter of 2020 to the third quarter of 2020, the confirmed cases rate of COVID-19 dropped, and the GDP growth rate increased. Moreover, according to the data analysis, the death toll from the first quarter of 2020 to the first quarter of 2021 continued to decrease, which contributed to the increase of GDP growth rate during this period.

Most people believe that the increase in the confirmation cases rate of COVID-19 must have a negative impact on the GDP growth rate. However, based on a specific study, it can be seen that COVID-19 also has a positive impact on the GDP growth rate since the country's medical system for treating the virus is improved. It means that in a country with more developed public health, though more confirmed cases would be found by timely testing, the spread of coronavirus will be greatly reduced by prompt treatment, and the GDP compound growth rate is moving in the direction of being positively affected.

It is speculated that in the future, perhaps because of better health care, public health can be better protected, and the economic impact of COVID-19 will be smaller.

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