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Fighting COVID-19: Performance of Countries in the First Half of 2020

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Abstract

The new coronavirus COVID-19 started in Wuhan, China in November or December of 2019 and spread to the rest of the world in 2020 at varying speed. Some countries responded relatively well, and others responded relatively poorly. Therefore, it is necessary to measure the performance to learn from mistakes and prepare better for the next time, when or if this is over. This is the main objective of this paper. There are two health related and two economy related indicators used as performance indicators. These indicators are used both individually and as part of indexes that we propose in the paper. We also propose the use of cluster analysis for country groupings.

Keywords: *COVID-19, Disaster Diamonds, Disaster Index, Principal Components, Cluster Analysis*

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1 Introduction

The new coronavirus COVID-19 started in Wuhan, China in November or December of 2019 and spread to the rest of the world in 2020 at varying speed, according to health experts. Some countries responded relatively well, and some responded relatively poorly. It is necessary to measure the performance to learn from mistakes and prepare better for the next time, when or if this is over. This is what we intend to do in this paper.

There are two health related common indicators used by many researchers and policy makers. These are death per confirmed cases and deaths per 100 thousand population. Data are from the Johns Hopkins University COVID research Center (see also CDC, 2020; GHS, 2019; WHO, 2020a, 2020b). They are gathered from many different resources. The primary sources are health authorities or department of countries. Although there are guidelines for gathering such data, full uniformity cannot be guaranteed. We use data as if they are all from a single source and assume that they are fully comparable.

There are also two commonly used indicators related to the economy, specifically increase in unemployment and percentage decrease in real gross domestic product. These are obtained from the World Bank, Global Economic Monitor (GEM) database. The World Bank gets individual county data primarily from statistical offices of member countries. They convert GDP numbers and express them in terms of current US dollars or in 2010 US dollars, and seasonally adjust data. The rate of unemployment is treated in a similar way, with no need for dollar conversion.

The primary goal of the paper is to measure performance against a virus. At this point, there are two health related and two economy related indicators mentioned above. There may be additions or substitutions to these variables. These indicators are used both individually and as part of indexes that we propose later in the paper. We also propose the use of cluster analysis for country groupings in which five clusters and k-means are selected as options.

The approach used here is intentionally a rather mechanical one. We assume all these international data are accurate and comparable. These may be regarded as scores given by independent bodies. These scores are taken as given, and countries are grouped based on these scores. Here, comparisons are made at a given time like taking a picture. There is no argument made for the policies adopted. There are no discussions on historical developments leading to the present situation. Leaders of countries and other public authorities may have similar or opposite world views and/or philosophies. The first confirmed case related to the virus may be at different times in different countries. No adjustment related to timing was made for that. Sectoral composition of economic activity is different in different countries. Countries depending largely on services or tourism activities may be affected more adversely than others. No adjustments were made for sectoral composition. Countries with high population density areas such as highly dense urban centers, large nursing home population, or big prison population may have a tougher time to fight a respiratory virus. Countries may be at different stage of a cycle. For example, if an economy is in a recession in 2019, the drop in real GDP and increase in unemployment in 2020 may not be that big. Some countries may have earlier experiences with similar viruses, so they may be better prepared to fight this one. Some countries may already have better healthcare systems before the spread of the virus. In addition to the reaction of public authorities, peoples' reactions and behavior are also very important determinants of success against the virus. Adherence to hygiene rules like

washing hands, wearing masks, social distancing, and lockdowns may change the outcome significantly. Some countries may have historically lived closer to new norms established after the outbreak. It may be easier for those countries to follow these rules and they may have greater success. All of these are extremely important problems; and each deserves to be the topic of separate papers, but they are not the main topic of this paper. Hopefully, they will be studied in subsequent research papers.

There are excellent studies on various aspects of the new coronavirus (among others, Albu, Preda, Lupu, Dobrota, Calin, and Boghicevici, 2020; Barbier and Burgess, 2020; Bauer and Weber, 2020; Burger and Calitz, 2020; Dong, Gozgor, Lu, and Yan, 2020; Fezzi and Fanghell, 2020; Haas, Neely, and Emmons, 2020; Havrlant, Darandary, and Muhsen, 2020; Lemieux, Milligan, Schirle, and Skuterud, 2020; Milani, 2020; Mitha, 2020; Ozili, 2020; Song and Zhou, 2020; Zhang, 2020; Asian Development Bank, 2020; European Commission, 2020; European Central Bank, 2020; Federal Reserve Board of Governors, 2020; International Monetary Fund, 2020a, 2020b; OECD, 2020a, 2020b; United Nations, 2020; World Bank, 2020b).

This paper is different from others. It concentrates on country performances; uses cluster analysis for groupings, and standardization and principal components for index designs. The paper also uses both health and economic indicators and provides novel summary performance measures such as Disaster Index and Disaster Diamonds.

The paper is organized as follows. The description of performance criteria, and the grouping of countries based on cluster analysis with individual indicators is presented in the second section. Section 3 is devoted to the construction of our Disaster Index and grouping of countries using cluster analysis and the Index. A convenient visualization of performance that we call Disaster Diagrams are introduced in this section, also. Some additional thoughts on the pandemic are given in Section 4. Summary of findings appear in the final section. The Appendix includes raw data, ranks and data sources.

2 Performance Indicators

A real test of “success” or “preparedness” is a response to a dire situation such as COVID-19 pandemic. Why are some countries “more successful” than others? This has something to do with policies taken before the appearance of a pandemic and/or during the pandemic. If a country has enough masks, protective gears, ventilators, tests, medicines or vaccinations before a pandemic or able to produce these in a very short period following a confirmed case, then that country is to be considered “more successful” in designing and implementing policies. On the other hand, if a country is not able to achieve those, then that country is not “very successful”. It should be noted that evaluation is difficult for an ongoing problem. It is better, and probably easier, to evaluate once the problem is over. Here, we just try to build a framework to measure “success” in case of a sudden shock to a system. Since the problem is not over, all our results here should be just preliminary and not conclusive. The idea was just to have a framework to study such an issue. Obviously, the suggested framework may be also expanded.

As of now, the information we have is that the first confirmed case related to novel coronavirus was in Wuhan, China in December, but most likely in November. Then it moved to Italy, and Western United States, sometime in January, although appearance of confirmed cases may be later. It makes sense to think that the virus was in most countries early 2020.

In addition to lives lost, losses in employment and real GDP are to be considered as criteria. In all these criteria, duration and amplitude are to be studied, if possible. A comparison with the end of 2019 is probably the most logical approach. For some variables, it may be better to make comparisons with an average of last 3 or 5 years, say average of 2017, 2018, and 2019 in case there are some outliers.

We should point out that all the comparisons given here are to be considered preliminary and will stay as preliminary until the world sees the end of the pandemic, which may be years from today. In any case, there is a value to do these comparisons to learn from experiences of others.

2.1 Lives Lost

Two common statistics used for international comparisons are number of deaths in relation to population and the number of deaths in relation to confirmed cases. Data are obtained from the Johns Hopkins University COVID Research Center and given in the [Appendix](#).

Cluster analysis with k-means and 5 clusters are used. Other choices gave similar results. It may be difficult to put 168 countries into 5 groups, but it is convenient choice for the future performance evaluation. The first cluster includes Singapore, Qatar, Maldives, Bahrain, and Iceland as top 5 leaders based on case fatality (deaths per confirmed cases) (Table 1, Figure 1, Appendix). The United States is in the third cluster. The fourth cluster includes Ireland, China, Netherlands, Egypt, Iran, France, Canada, Sweden, Belgium, United Kingdom, Mexico, and Italy. Yemen is the only country in the last cluster. If clustering is based on deaths per hundred thousand population, the following countries take the lead: Taiwan, Vietnam, Tanzania, Sri Lanka, Papua New Guinea. The fifth cluster includes Latin American, European countries and the United States (Colombia, Panama, Sweden, Italy, Mexico, United States, United Kingdom, Ecuador, Spain, Chile, Brazil, Andorra, Bolivia, Belgium, and Peru) (Table 2, Figure 2, Appendix) .

These results are interesting and rather troubling if one compares with the Global Health Security (2019) in which the United States was cited as the best prepared, but with a stark warning that no country is fully prepared for epidemics or pandemics and collectively, international preparedness is weak. The study also reports that the average score for all 195 countries was only 40.2 out of 100 (GHS, 2019, pp. 39). On the other hand, our calculations show that correlations with the Global Health Security Index and two health indicators that we use in our paper are positive. This leads to the conclusion that if the Index is correctly measured and calculated death rates given here are accurate, then European and North American countries, which have relatively high GHS Index scores, performed much worse than the rest.

COVID-19 is the most important health issue of 2020. Other health related issues do not go away because of that. On the contrary, they may have increased because of insufficient number of doctors and health care workers to treat patients with other illnesses. All services for most other patients are on halt or on a limited base. There are no dental treatments because of close contact required. Some of these illnesses may be very long term and may be related to mental health and health of the nervous system because of the lockdown. There may not be an easy way to quantify all these effects, but simpler calculations may also be useful. The death rate in 2020 in each country and the world may be compared with the death rate in 2019, and maybe compared with the average death rate of past 3 or 5 years. This comparison may be a guide for “total lives lost” due to this novel coronavirus. Data on population may take longer to obtain. Center for Disease Control (CDC) has data on excess death (https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm).

2.2 Real GDP Loss

Real GDP at present is to be compared with real GDP at the end of 2019, before the widespread appearance of the coronavirus. As alternatives, comparisons can be made with current GDP in US dollars, and in local currency. Directions of results probably will not change much.

What is the decrease in real GDP following the pandemic? Real GDP in 2020 may be compared with real GDP average of 2019, or fourth quarter of 2019. Here, the comparisons will be made with the fourth quarter of 2019. Data are obtained from the World Bank, Global Economic Monitor (GEM) database. All data are in 2010 US dollars, and seasonally adjusted. Since, only one or two quarters of data are available for 2020, seasonally adjusted data may be the appropriate one. Once the year is over and data for the year 2020 are available, a more reasonable comparisons can be made with real GDP in 2019.

Real GDP loss is calculated as the percentage in relation to the value in 2019Q4 of the sum of the difference between 2020Q1 and 2019Q4 and 2020Q2 and 2019Q4. Real GDP dropped in most of the countries in the first half of 2020 (Figure 3, Appendix). For example, China realized a very big drop in the first quarter of 2020, but the real GDP bounced back in the second quarter. The drop in Singapore was more significant in the second quarter of 2020. Germany, Italy, Spain, UK and the US all realized drops in GDP in the second quarter of 2020. Since some countries had the major lockdowns later, second quarter GDP may be a better indicator for them. It is better to have data for the entire year and have more reasonable comparisons.

Ranks based on real GDP loss during the first half of 2020 indicate that Ghana, Egypt, Taiwan, Vietnam, and Singapore make the top 5 in the group of 81 countries and take their place in the first cluster (Table 3). On the other hand, Italy, Tunisia, Argentina, United Kingdom, France, India, Philippines, Spain, and Peru appear in the fifth cluster.

2.3 Loss of Employment or Increase in unemployment

The rate of unemployment is another very significant indicator to see the effects of a pandemic. Data are also available from the World Bank, Global Economic Monitor (GEM) database for most countries. These data are available monthly, but for some major countries (for example, India) they are not available (Appendix). Here, comparisons with unemployment rate in December 2019 are made. The United States saw a surge in the rate of unemployment starting with the second quarter (Figure 5). In general, rate of unemployment data is released with some lag in all other countries. It will be a more reliable comparisons if we have data for all the months of 2020. In this group of 56, South Africa and Dominican Republic make up the first cluster. The six countries that make the fifth cluster are Canada, Peru, United States, Ecuador, Columbia and the Philippines (Table 4, Figure 6).

3 Summary Measures for Performance Indicators: Disaster Index and Disaster Diamonds

A single indicator to measure performance may not be enough. Several indicators may be used to form a single index. Such an effort requires two steps. The first one is the selection or determination of indicators. The second is the weights to be used for those selected indicators. There are two widely used health indicators: deaths per confirmed cases and deaths per hundred thousand population. Since, these are readily available on the web site of the Johns Hopkins University COVID Resource Center for all reporting countries, they will be included in the index.

Regarding economic activity, there are several indicators we have considered. One major restriction is that all statistics for different countries must be comparable. Individual countries may have much richer data, but that may not be very helpful if many countries are the major focus of the study such as this one. Therefore, data from international organizations may be the better choice. Another issue is to make the comparison as soon as possible, so that other countries may benefit from the experiences of others performing relatively better. That increases the need for monthly and/or quarterly data. The use of data with a frequency higher than annual brings another issue, which is the seasonality. Most international data, even individual economies and not just data from international organizations, are unadjusted. With unadjusted data, the first quarter GDP data for 2020 may not be directly comparable with data for the fourth quarter of 2019. They must be seasonally adjusted, but different countries may be using different seasonal adjustment procedures.

The World Bank, Global Economic Monitor (GEM) database use the same seasonal adjustment method for all the countries. That is the reason that GEM database is chosen. There may be issues with the database, but benefits overweight the problems. Quarterly real GDP (GDP with constant 2010 US dollars) and monthly unemployment rates are chosen from this database. The number of countries, including the World, with available data are 82 for real GDP and 57 for the rate of

unemployment. Since all four indicators will be used in the indexes, 56 countries with data on all four indicators available will be included in this analysis (Figure 7, Figure 8, Figure 9, Figure 10).

3.1 Index with Equal Weights (EWI)

The four indicators chosen are to be included in an index. Since the numbers have different units, standardizing makes them more comparable. The mean and standard deviation of indicators for 56 countries are then used to calculate standardized variables and the Index with equal weights (Table 5). Countries are ranked using this Index, as the first step. Percentiles based on the rank are also calculated. For example, Singapore leads the group of 56 countries, with an index score of negative 1.063, rank of 1, and percentile of 98.2.

3.2 Principal Components of Indicators

Principal components analysis for four indicators indicate that the first principal component explains 49% of the variance, and second principal component explain 25.6% of the variance (Table 6). First two components explain close to three quarters of total variance. Loadings indicate that the first principal component has a correlation of 0.64 with the deaths per hundred thousand population. The second principal component has the highest correlation with the increase in unemployment rate (0.83). The first principal component is to be used as the Index (Table 7).

3.3 Disaster Index

The Disaster Index (DI) is a weighted average of the Index with Equal Weights (EWI) and the first principal component (PC1) of the group of four indicators. The weights are the reciprocal of standard deviations of EWI and PC1.

$$DI=(EWI/0.6845216733+PC1/1.4129912355)/2$$

The Disaster Index has a lower dispersion (Figure 11, Figure 12, Figure 13, Figure 14, Table 8) . Ranks and clusters based on the Index and its components are quite similar (Table 9).

The primary goal of the paper is to group countries using performance indicators. It is not easy to give a place to individual countries, but grouping may be easier. To this end, cluster analysis is used. Although, several indicators may be used simultaneously in a cluster analysis, we prefer to use a derived index as the individual variable.

According to the Disaster Index, there are 6 countries in the first group (Table 11, Figure 14, Figure 15). Singapore, Taiwan, Belarus, South Korea, New Zealand and Japan appear on top in clusters. These 6 countries appear in the first cluster based on components of the index, also (Table 10, Table 11). The second group is the largest, with 20 countries. China is also in this group, but it is in the third group according to the index based on principal components.

All these must be recalculated once all data become available. Note that this is a cross-section analysis, at the time of the latest data available. Also, note that these groupings say nothing about the reasons or policies adopted. It just takes the photograph on a specific date. This information may be still useful for evaluation of industrial policies. Researchers, then must look at the reasons why one country is the first group and the other one in the fifth group. That requires a very careful study of different policies and actions taken by selected countries.

Preliminary calculations, as of October 2020, indicate that Asian countries fared better than European and American countries. Further studies and the pandemic to end are required for a more complete and reliable evaluation.

Overall Summary and performance indicators in the future will be cumulative (up to a date determined by data availability). This is not a one-time evaluation. It is like continuous evaluations where there may be other people carrying the baton, like relays.

3.4 Disaster Diamonds

A summary diagram, which looks like a diamond, may be easier for visualization and evaluation. The radar diagram in Microsoft's Excel may be a useful tool. We call the disaster diagrams because all four indicators that are on the diagram are related to death, job loss, or loss of activity (or income). Diagrams may focus on indicators or countries. Here, examples on both are provided.

All four indicators are standardized. Therefore, the range of numbers range from negative 4 to positive 4. A smaller number indicates a better performance; a larger number worse performance. The performance of 4 largest economies may be compared very easily with these diagrams (Figure 16). The United States did not do that well, especially in two indicators – deaths per hundred thousand population and increase in unemployment rate. These indicators are further away from the center, with values above 1.5 and close to 2, respectively. On the other hand, Japan did better than others in almost every category; it is closest to the center. China also did relatively better, except for the indicator death per confirmed cases. Germany was least successful in real GDP loss.

Diagrams for top performers and worse performers are instructive, especially if one notices the low figures for top performers, and very large numbers for bottom performers (Figure 17, Figure 18). Other comparisons may also be useful (Figure 19, Figure 20, Figure 21, Figure 22). It is possible to focus on indicators in disaster diagrams, also. In this case, diamonds show an indicator for selected countries (Figure 23, Figure 24).

4 Some Complementary Thoughts on the Pandemic

4.1 The Fallacy of “Lives Lost and Activity Loss Tradeoff”

Is the economy an alternative to health? The answer is “No”. The choice put in front of the general public, i.e. health or economy, is not the right one. Those are not competitive, but complementary. Public authorities should give guidance and financial support, and not just let the public find a solution for themselves. It is the duty of the authorities to provide both health and economy to the public during a pandemic. Under normal times, that may not be required, and people in general may not demand those, but during a pandemic, authorities should provide those. Here are some of the reasons. A pandemic moves faster if healthcare is not provided to every single one in a society, in this case in the world. If a government asks a company to close its doors because of a pandemic, and not because of a misbehavior of the company, is it fair for that company to bear the full burden of that closure? If the answer is no, which is what common sense tells us, then a government should cover some of the burden to alleviate the pain. The government will cover the cost now, preferably by direct payments to citizens, and then collect taxes when the economy bounces back. This should not even be an issue for advanced economies, but it may be difficult for developing or emerging economies.

Preliminary findings show that health and economy are not competitive (with a negative correlation). On the contrary, they are complementary as indicated by positive correlation coefficients. The correlation between deaths per hundred thousand population and real GDP loss is 0.42. On the other hand, the correlation with deaths per confirmed cases and real GDP loss is 0.25. This is lower, but also statistically significantly different from zero at the five percent level. The correlations between health indicators and the increase in unemployment rate are not statistically significantly different from zero, but estimated coefficients are not negative, that is suggesting no trade-off (Figure 25, Figure 26).

4.2 Pandemic and the Relevancy of Budget Deficit and Domestic Debt

The pandemic forced every government to take extra measures for the welfare of the general public. High rate of unemployment forced governments to increase its expenditures and exerted extra pressures on budgets. On the other hand, lower incomes reduced tax revenues for governments, leading to greater deficits. This situation is very common in recessions and downturns, and much amplified during a pandemic. Concepts like “the full employment budget deficit” were introduced for situations like these. Policy makers follow budget deficits closely, but adjustments must be made for the position of the economy in a cycle. It is important to see the level of full employment budget deficit.

Government debt will increase with higher deficits. Governments will issue bonds to cover increased deficit. In the United States, most of the buyers are the citizens. Government is borrowing money from its own citizens. This may not create a large problem because governments most likely will get those back with higher taxes in the future. What is needed is funds to ease the pain of the general public, now. Tomorrow may be too late for the problem.

The deficit and debt will be taken care of later. Now, it is the time to save the patient. Extra weight of the patient is not the most important problem at hand, but the life of the patient is. Take care of the urgent problem, now; and take care of the less urgent problem later. This simple logic should govern the minds and hearts of policy makers. Otherwise, the world be in more trouble. But subsequent downstream problems must be anticipated and prepared for.

4.3 Pandemic and Possible Future Outcomes

What is expected to happen in the “post-globalization” or “New World”?

There are probably two clear extremes and maybe many possibilities in between these two extremes. The first possibility, but maybe not the most likely, is a world with greater cooperation and coordination among countries. The second possibility, and maybe a more likely outcome, is moving towards a complete isolationist approach leading to countries aiming self-sufficiency.

In any case, most important requirement is a very close and complex international cooperation and coordination in every conceivable field for the good of the world population. Whether this will be realized or not mostly depends on the existence of leaders with vision. Without a sound leadership, the world population may have a very long struggle ahead of them.

It is clear for any economist that in a pandemic if there is only one agent who is standing, that agent is expected to help the others. That is the only way out of a depression or recession. During this pandemic of 2020, the world sees a drop in consumer expenditures because of lack of income and rising unemployment, poverty and uncertainty. Most business are closed because of mandatory lockdowns, lack of demand and greater uncertainty. Since, all countries are affected by the pandemic, there is lack of demand from foreign countries. In terms of Keynesian categories, $GDP=C + I + G + X - M$, C- private consumption, I – private investment, G- government expenditures (current and investment), X-exports of goods and services, M-imports of goods and services, C, I and (X-M) are all lower since the beginning of the pandemic. In order to bring GDP back to its previous level, government expenditures (G) should increase. This increase is expected by the general public. It is also expected that this should be in the form of an income like universal basic income for the general public, not a loan with a low interest.

Unfortunately, not all countries can respond to that expectation because they were already in a vulnerable position even before the pandemic. Even more troubling is, some countries fail to see this need of necessary expansion of government expenditures. Until this is realized, the general public will continue to suffer. There are also longer-term effects that international organizations are concerned. If schools are closed for a long period of time, the proportion of well-educated people may decrease which will have significant adverse effects on growth prospects of all the countries. This lack of schooling will also perpetuate poverty and inequality.

None of these issues stated here can be solved by the private sector or shrewd entrepreneurs in broken systems or markets with frictions. These problems can only be solved with capable leaders, sound public policies and a very solid foundation of national and international cooperation and coordination. Rulers and public authorities are expected to deliver these to be considered as “true leaders”.

Monetary authorities all over the world have been acting swiftly and surely during this crisis. Unfortunately, monetary policy cannot be effective without a firm and determined fiscal policy and incomes policy during a period of uncertainty and insufficient aggregate demand. It is up to governments to start these policies to fight a virus. Unfortunately, security issue is just seen as a military issue. It is necessary to see the security issue as the protection of the general public, whether an assault comes from a visible enemy or an invisible virus. The world population seem to have a long way to go.

5 Conclusions

In our first paper on the topic, we suggested four indicators to study the performance against a deadly virus. This number may be increased in a later study. We also introduced summary measures of these indicators such as Disaster Diagrams and Disaster Indexes. Using the Index, countries are grouped based on cluster analysis. Since the problem is not completely over, any conclusion drawn from any study is premature. Our preliminary findings show that high income Asian countries performed relatively better than low income Asian countries, European and American countries. Reasons for this geographical divide is very interesting and must be studied. We leave this for a future study. We also intend to update these groupings on a regular basis, maybe with some revisions on methods and with more analysis of reasons for our findings. Furthermore, similar methods may be applied to regions of a country.

Methods used in the paper help us to determine the relative performance of countries. If a country is doing relatively better, then there may be some lessons to learn for other countries. That was the primary goal of the paper, possibly finding role models. Unfortunately, in absolute terms, the rulers and other public authorities in power of the world were not very successful, with more than a million deaths in the world in less than a year despite enormous medical and technological achievements over the years and altruistic and heroic efforts of our courageous doctors, healthcare workers, first responders and other essential workers. The cluster analysis results given in the paper are like using a curve in a college course with grades of an average below 50 out of 100, yet another even more serious critical stage of the pandemic is evolving, especially in the U.S. and Europe, as we get deeper into winter.

The virus is a reminder that national security really means the protection of citizens, whether it is from a visible military force or from an invisible enemy such as a virus, a disease or a cyber-attack. In this century, peoples from all nations observed that more emphasis was given to the visible enemy; and with national and international cooperation and coordination some positive steps were taken with some success. A similar approach must be taken for all the enemies, not just visible, but also invisible ones such as viruses, bacteria, and cyber-attacks.

6 References

Albu, Lucian Liviu, Ciprian Ion Preda, Radu Lupu, Carmen Elena Dobrota, George Marian Calin, and Claudia M. Boghicevici (2020). “Estimates of Dynamics of the COVID-19 Pandemic and Its Impact on the Economy”, *Romanian Journal of Economic Forecasting*, Vol. 23, Issue: 2, pp. 5-17.

Asian Development Bank (2020). *Asian Development Outlook 2020, Update, Wellness in Worrying Times*. September 2020.

<https://www.adb.org/sites/default/files/publication/635666/ado2020-update.pdf>

Barbier, Edward B., and Joanne C. Burgess (2020). “Sustainability and development after COVID-19”, *World Development*, Vol. 135, Article No: 105082. November 2020.

Bauer, Anja and Enzo Weber (2020). “COVID -19: how much unemployment was caused by the shutdown in Germany?”, *Applied Economics Letters*, July 2020, DOI: 10.1080/13504851.2020.1789544.

Burger, Philippe, and Estian Calitz (2020). “Covid-19, Economic Growth and South African Fiscal Policy”, *South African Journal of Economics*, October 2020. DOI: 10.1111/saje.12270.

Centers for Disease Control and Prevention (CDC) (2020). *Coronavirus (COVID-19)*. <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

Dong, Dayong, Giray Gozgor, Zhou Lu, Cheng Yan (2020). “Personal consumption in the United States during the COVID-19 crisis”, *Applied Economics*, October 2020. DOI: 10.1080/00036846.2020.1828808.

European Commission (2020). *Coronavirus Response*. https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response_en

European Central Bank (2020). *Coronavirus*. <https://www.ecb.europa.eu/home/search/html/coronavirus.en.html>

Federal Reserve Board of Governors (2020). *Coronavirus Disease 2019 (COVID-19)*. <https://www.federalreserve.gov/covid-19.htm>

Fezzi, Carlo and Valeria Fanghell (2020). “Real-Time Estimation of the Short -Run Impact of COVID-19 on Economic Activity Using Electricity Market Data”, *Environmental & Resource Economics*, Vol. 76, Issue 4, Special Issue: SI, pp. 885-900 August 2020.

Global Health Security (GHS) (2019). *Global Health Security Index, Building Collective Action and Accountability*. October 2019. <https://www.ghsindex.org/wp-content/uploads/2020/04/2019-Global-Health-Security-Index.pdf>

Haas, Jacob, Christopher J., Neely, and William R. Emmons (2020). “Responses of International Central Banks to the COVID-19 Crisis”, *Federal Reserve Bank of St Louis Review*, Vol. 102, Issue: 4, pp. 339-384.

Havrlant, David, Abdulelah Darandary, and Abdelrahman Muhsen (2020). “Early estimates of the impact of the COVID-19 pandemic on GDP: a case study of Saudi Arabia”, *Applied Economics*, October 2020. DOI: 10.1080/00036846.2020.1828809.

IHS Markit (2020). *Eviews 11*.

International Monetary Fund (2020a). *The IMF and COVID-19 (Coronavirus)*. <https://www.imf.org/en/Topics/imf-and-covid19>

International Monetary Fund (2020b). *World Economic Outlook, October 2020: A Long and Difficult Ascent*. <https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020>

Johns Hopkins University & Medicine, Coronavirus Resource Center (2020). <https://coronavirus.jhu.edu/data/mortality>. Access date: September 28, 2020.

Lemieux, Thomas, Kevin Milligan, Tammy Schirle, and Mikal Skuterud (2020). “Initial Impacts of the COVID-19 Pandemic on the Canadian Labour Market”, *Canadian Public Policy-Analyse de Politiques*, Vol. 46, Special Issue, pp. 555-565. DOI: 10.3138/cpp.2020-049 Supplement: 1.

Microsoft (2020). Microsoft Excel.

Milani, Fabio (2020). “COVID-19 outbreak, social response, and early economic effects:

a global VAR analysis of cross-country interdependencies”, *Journal of Population Economics*, Vol. 34 Issue: 1 pp. 223-252 Early Access Date: August 2020. Publication date: January 2021.

Mitha, Sam (2020). “UK COVID-19 Diary: Policy and Impacts”, *National Tax Journal*, Vol. 73, Issue: 3, pp. 847-878, September 2020. DOI: 10.17310/ ntj.2020.3.10.

OECD (2020a). *Tackling Coronavirus (COVID-19) Contributing to a Global Effort*.
<http://www.oecd.org/coronavirus/en/>

OECD (2020b). *Country Policy Tracker*. <https://www.oecd.org/coronavirus/country-policy-tracker/>

Ozili, Peterson K. (2020). ” COVID-19 pandemic and economic crisis: the Nigerian experience and structural causes”, *Journal of Economic and Administrative Sciences*, October ,2020. DOI: 10.1108/JEAS-05-2020-0074.

Song, Ligang and Yixiao Zhou (2020). “The COVID-19 Pandemic and Its Impact on the Global Economy: What Does It Take to Turn Crisis into Opportunity?”, *China & World Economy*, Vol. 28, Issue: 4, pp. 1-25. July 2020. .DOI: 1.0.1111/cwe.12349

Stata (2019). *Stata, Statistics/Data Analysis, Version 15.1*, StataCorp, College Station, Texas.

United Nations (2020). *COVID-19 Response*. <https://www.un.org/en/coronavirus>

World Bank (2020a). *Global Economic Monitor*.
<https://datacatalog.worldbank.org/dataset/global-economic-monitor>. Access date: October 14, 2020.

World Bank (2020b). *COVID-19 (Coronavirus) Response*.
<https://www.worldbank.org/en/topic/health/coronavirus>. Access Date: November 14, 2020.

World Health Organization (WHO) (2020a). Coronavirus Disease (COVID-19) Dashboard. https://covid19.who.int/?gclid=Cj0KCQiA7qP9BRCLARIsABDaZzidi5dlwDVONA1svnUEK3BkATS9OdJ03iRt8XyOSfefQSjW9yuG-msaAkKfEALw_wcB.

World Health Organization (WHO) (2020b). Coronavirus disease (COVID-19) *Weekly Epidemiological Update and Weekly Operational Update*. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>

Zhang, Jun (2020). “Five Basic Insights into the Economic Impact of the COVID-19 Outbreak”, *Frontiers of Economics in China*, Vol. 15, Issue: 2, pp. 167-178. June 2020. DOI: 10.3868/s060-011-020-0008-8.

Table 1 Clusters Based on Case Fatality

Cluster 1

Singapore	Qatar	Maldives	Bahrain	Iceland	Sri Lanka	United Arab Emirates
	Slovakia	Jordan	Botswana	Georgia	Kuwait	Rwanda Cote d'IvoireGuinea
Gabon	Israel	Ghana	Nepal	Mozambique	West Bank and Gaza	Tajikistan Uzbekistan
	Venezuela	Oman	Czechia	Uganda	Lebanon	Cabo VerdeMalta Belarus
	Namibia	Djibouti	Costa Rica	Malaysia		

Cluster 2

Central African Republic	Cyprus	Belize	Papua New Guinea	Tunisia	New Zealand	Taiwan
	Saudi Arabia	Madagascar	Bangladesh	Comoros	Azerbaijan	Jamaica
Luxembourg	Montenegro	Libya	Kazakhstan	India	Ethiopia	Trinidad and Tobago
	Sao Tome and Principe		Equatorial Guinea	Thailand		Guinea-BissauCroatia
Korea	Benin	Philippines	Russia	Morocco	Congo (Brazzaville)	Kenya South Sudan
	Austria		Dominican Republic	Japan	NigeriaArmenia	Norway Burma
	Ukraine	Eswatini	Cameroon	Estonia	Brunei	Senegal Paraguay Lithuania Pakistan
	Panama		Suriname	Mauritania	Latvia	Greece Argentina Cuba Serbia
	Lesotho		Zambia	Kyrgyzstan	Bahamas	Uruguay Denmark South
Africa	Moldova		Turkey			Congo (Kinshasa)

Cluster 3

Iraq	Haiti	Togo	Portugal	Guyana	Mauritius	Somalia	Chile	Slovenia
	Poland	Burkina Faso	Albania		Andorra	United States	El Salvador	
Zimbabwe	Nicaragua	Brazil	World	Bosnia and Herzegovina			Antigua and Barbuda	
	Honduras		Gambia	Malawi	Colombia	Hungary	Australia	Sierra
Leone	Vietnam		Germany	Algeria	Finland	Guatemala	Angola	Barbados
	Indonesia		Kosovo	Romania		Bulgaria	Switzerland	Peru Tanzania
	North Macedonia		Mali	Spain	Syria			

Cluster 4

Ireland	China	Netherlands	Egypt	Iran	France	San Marino	Niger	Bolivia	Canada
Liberia	Sudan	Sweden	Chad	Ecuador		Belgium	United Kingdom	Mexico	
Italy									

Cluster 5

Yemen									
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Table 2 Clusters Based on Deaths per Hundred Thousand Population

Cluster 1

Taiwan	Vietnam	Tanzania	Sri Lanka	Papua New Guinea	Thailand	Uganda
	Mozambique	Rwanda	Burkina Faso	Niger	Congo (Kinshasa)	China
	Burma	Malaysia	Jordan	South Sudan	Singapore	Cote d'Ivoire
	Guinea	Chad	Nigeria	Angola	Togo	Somalia
	Georgia		Korea, South	Mauritius	Slovakia	Mali
						Brunei
						Botswana
Madagascar	Sierra Leone	Malawi	Ghana	Cuba	Ethiopia	Syria
African Republic		Kenya	Uruguay	Uzbekistan	Zimbabwe	Tunisia
	Cameroon	Lesotho	Congo (Brazzaville)	Liberia	Cyprus	Latvia
Senegal	Sudan	Haiti	Yemen	Venezuela	Guinea-Bissau	Nicaragua
	Iceland	Jamaica	Pakistan	Antigua and Barbuda	Bangladesh	Barbados
Australia	Greece	Mauritania	Indonesia	Afghanistan	Algeria	Gabon

Cluster 2

United Arab Emirates	Gambia	Estonia	Namibia	Philippines	Lebanon	Trinidad and
Tobago	Norway	Czechia	Morocco	Azerbaijan	Egypt	Finland
Bank and Gaza	Belize	Equatorial Guinea	Djibouti	Poland	Malta	West Croatia
	Maldives	India	Slovenia	Sao Tome and Principe	Libya	Hungary
	Qatar	Belarus	Austria	Ukraine	Kazakhstan	Guyana
Cabo Verde	Serbia					Eswatini
						Turkey

Cluster 3

Denmark	Bulgaria	Paraguay	Germany	El Salvador	World	Albania
Arabia	Russia	Kuwait	Bahrain	Israel	Costa Rica	Kyrgyzstan
	Guatemala	Portugal	Dominican Republic	Luxembourg	Suriname	Oman

Cluster 4

Bahamas	Iraq	Honduras	Romania	Switzerland	Bosnia and Herzegovina
Canada	Montenegro	Kosovo	South Africa	Iran	Armenia
	Argentina	Moldova	Ireland	Netherlands	France
					North Macedonia

Cluster 5

Colombia	Panama	Sweden	Italy	Mexico	United States	United
Kingdom	Ecuador	Spain	Chile	Brazil	Andorra	Bolivia
San Marino						Belgium
						Peru

Table 3 Clusters Based on Real GDP Loss

Cluster 1									
Ghana	Egypt	Taiwan	Vietnam	Singapore	Jordan	Belarus	Korea	Lithuania	
	Nigeria	Finland	Australia	Indonesia	Chile	Bosnia and Herzegovina			
Cluster 2									
Sweden	Norway	Kazakhstan	Serbia	Saudi Arabia	Japan	Russia	Bulgaria		
Poland	Luxembourg	Estonia	Denmark	Bahrain	Paraguay	Ireland	Albania		
	China	Switzerland	Turkey	United States	Netherlands	Latvia	Israel	Uruguay	
	Guatemala	Ukraine	Costa Rica	New Zealand	Romania	Georgia			
Cluster 3									
World	Germany	Ecuador	Brazil	Thailand	Czechia	Croatia	Hungary		
Greece	Canada	Cyprus	Slovakia	Austria	South Africa				
Cluster 4									
Belgium	Colombia	North Macedonia	Slovenia	Mexico	Bolivia				
Iceland	El Salvador	Malta	Malaysia	Portugal	Honduras	Morocco			
Botswana									
Cluster 5									
Italy	Tunisia	Argentina	United Kingdom	France	India	Philippines	Spain	Peru	
World Bank GEM Data not available									
Tanzania	Sri Lanka	Papua New Guinea	Uganda	Mozambique	Rwanda				
Burkina Faso	Niger	Congo (Kinshasa)	Benin	Burma	South Sudan	Cote d'Ivoire	Guinea		
Chad	Angola	Togo	Somalia	Mali	Brunei	Mauritius	Tajikistan	Comoros	
Madagascar	Sierra Leone	Malawi	Cuba	Ethiopia	Syria	Central	African		
Republic	Kenya	Uzbekistan	Zimbabwe	Nepal	Cameroon	Lesotho	Congo		
(Brazzaville)	Liberia	Zambia	Senegal	Sudan	Haiti	Yemen	Venezuela	Guinea-	
Bissau	Nicaragua	Barbados	Gabon	Jamaica	Pakistan	Antigua and Barbuda			
	Bangladesh	Mauritania	Afghanistan	Algeria	United Arab Emirates	Gambia			
	Namibia	Lebanon	Trinidad and Tobago	Azerbaijan	West Bank and Gaza				
	Belize	Equatorial Guinea	Djibouti	Maldives	Sao Tome and Principe				
	Libya	Qatar	Guyana	Eswatini	Cabo Verde	Kuwait	Kyrgyzstan	Suriname	
	Oman	Dominican Republic	Bahamas	Iraq	Montenegro	Kosovo	Iran	Armenia	
	Moldova	Panama	Andorra	San Marino					

Table 4 Clusters Based on Increase in the Rate of Unemployment

Cluster 1

South Africa Dominican Republic

Cluster 2

Portugal France New Zealand Belgium Italy North Macedonia Romania
 China Iceland Taiwan Belarus Ireland United Kingdom Singapore Korea
 Japan Czechia Turkey Israel

Cluster 3

Cyprus Switzerland Poland Germany Norway Brazil Finland Denmark
 Luxembourg Russia Malta Hungary Egypt World Uruguay Spain Latvia
 Slovenia Australia Sweden Greece Slovakia Estonia

Cluster 4

Bulgaria Morocco Croatia Argentina Austria Chile Lithuania Tunisia

Cluster 5

CanadaPeru United States Ecuador Colombia Philippines

World Bank GEM Data not available

Ghana Vietnam Jordan NigeriaIndonesia Bosnia and Herzegovina Kazakhstan Serbia
 Saudi Arabia Bahrain Paraguay Albania Netherlands Guatemala
 Ukraine Costa Rica Georgia Thailand Mexico Bolivia El Salvador
 Malaysia Honduras Botswana India Tanzania Sri Lanka Papua New
 GuineaUganda Mozambique Rwanda Burkina Faso Niger Congo (Kinshasa)
 Benin Burma South Sudan Cote d'Ivoire GuineaChad AngolaTogo Somalia Mali
 Brunei Mauritius Tajikistan Comoros Madagascar Sierra Leone
 Malawi Cuba Ethiopia Syria Central African Republic Kenya
 Uzbekistan Zimbabwe Nepal Cameroon Lesotho Congo (Brazzaville) Liberia
 Zambia Senegal Sudan Haiti Yemen Venezuela Guinea-Bissau
 Nicaragua Barbados Gabon Jamaica Pakistan Antigua and Barbuda
 Bangladesh Mauritania Afghanistan AlgeriaUnited Arab Emirates Gambia
 Namibia Lebanon Trinidad and Tobago Azerbaijan West Bank and Gaza
 Belize Equatorial Guinea Djibouti Maldives Sao Tome and Principe
 Libya Qatar Guyana Eswatini Cabo Verde KuwaitKyrgyzstan Suriname
 Oman Bahamas Iraq Montenegro Kosovo Iran Armenia Moldova
 Panama Andorra San Marin

Table 5 Standardized Variables, Index with Equal Weights, Rank and Percentiles of the Index

	COUNTRY	Death per Confirmed Cases (Standardized)	Deaths per Hundred Thousand Population (Standardized)	Real GDP Loss (Standardized)	Increase in Unemployment Rate (Standardized)	Equal Weights Index	Rank According to Equal Weights Index	Percentiles of Equal Weights Index
1	Argentina	-0.403	0.500	1.422	0.464	0.496	45	19.6
2	Australia	0.027	-0.715	-0.996	0.045	-0.410	17	69.6
3	Austria	-0.551	-0.506	0.372	0.499	-0.047	36	35.7
4	Belarus	-0.897	-0.518	-1.330	-0.636	-0.845	3	94.6
5	Belgium	2.414	2.525	0.655	-0.836	1.189	52	7.1
6	Brazil	-0.070	1.759	0.019	-0.212	0.374	43	23.2
7	Bulgaria	0.333	-0.415	-0.706	0.332	-0.114	34	39.3
8	Canada	1.230	0.122	0.184	1.548	0.771	48	14.3
9	Chile	-0.170	1.748	-0.973	0.692	0.324	42	25.0
10	China	0.883	-0.836	-0.568	-0.655	-0.294	26	53.6
11	Colombia	-0.010	1.119	0.676	2.683	1.117	51	8.9
12	Croatia	-0.629	-0.595	0.126	0.424	-0.169	30	46.4
13	Cyprus	-0.788	-0.778	0.194	-0.360	-0.433	13	76.8
14	Czechia	-0.947	-0.635	0.110	-0.496	-0.492	10	82.1
15	Denmark	-0.312	-0.417	-0.640	-0.202	-0.393	23	58.9
16	Ecuador	2.232	1.700	-0.063	2.537	1.602	55	1.8
17	Egypt	1.084	-0.619	-1.599	-0.085	-0.305	25	55.4
18	Estonia	-0.484	-0.662	-0.644	0.185	-0.401	19	66.1
19	Finland	0.178	-0.609	-1.049	-0.205	-0.421	15	73.2
20	France	1.093	0.978	1.553	-1.068	0.639	46	17.9
21	Germany	0.067	-0.409	-0.104	-0.308	-0.189	29	48.2
22	Greece	-0.416	-0.714	0.161	0.105	-0.216	27	51.8
23	Hungary	0.001	-0.561	0.147	-0.123	-0.134	32	42.9
24	Iceland	-1.180	-0.740	0.844	-0.652	-0.432	14	75.0
25	Ireland	0.872	0.585	-0.620	-0.632	0.051	38	32.1
26	Israel	-1.074	-0.223	-0.395	-0.394	-0.521	9	83.9
27	Italy	3.597	1.441	1.345	-0.787	1.399	54	3.6
28	Japan	-0.539	-0.802	-0.769	-0.523	-0.658	6	89.3
29	Korea, South	-0.622	-0.819	-1.266	-0.530	-0.809	4	92.9
30	Latvia	-0.419	-0.777	-0.412	0.003	-0.401	20	64.3
31	Lithuania	-0.463	-0.726	-1.188	0.696	-0.420	16	71.4
32	Luxembourg	-0.704	-0.061	-0.650	-0.192	-0.402	18	67.9
33	Malta	-0.898	-0.602	0.864	-0.132	-0.192	28	50.0
34	Morocco	-0.591	-0.631	1.189	0.403	0.093	39	30.4
35	New Zealand	-0.764	-0.830	-0.296	-0.872	-0.690	5	91.1
36	North Macedonia	0.411	0.490	0.681	-0.734	0.212	41	26.8

37	Norway	-0.502	-0.653	-0.860	-0.292	-0.576	8	85.7
38	Peru	0.370	3.020	3.077	1.671	2.035	56	0.0
39	Philippines	-0.598	-0.658	1.700	3.490	0.983	49	12.5
40	Poland	-0.146	-0.603	-0.676	-0.326	-0.438	12	78.6
41	Portugal	-0.211	-0.119	1.013	-1.146	-0.116	33	41.1
42	Romania	0.299	0.081	-0.273	-0.666	-0.140	31	44.6
43	Russia	-0.592	-0.311	-0.751	-0.160	-0.454	11	80.4
44	Singapore	-1.324	-0.831	-1.533	-0.564	-1.063	1	98.2
45	Slovakia	-1.126	-0.818	0.345	0.141	-0.365	24	57.1
46	Slovenia	-0.148	-0.577	0.687	0.015	-0.006	37	33.9
47	South Africa	-0.304	0.246	0.437	-2.798	-0.605	7	87.5
48	Spain	0.509	1.733	1.940	-0.019	1.041	50	10.7
49	Sweden	1.405	1.382	-0.932	0.071	0.481	44	21.4
50	Switzerland	0.348	0.087	-0.477	-0.349	-0.098	35	37.5
51	Taiwan	-0.760	-0.848	-1.595	-0.649	-0.963	2	96.4
52	Tunisia	-0.780	-0.786	1.375	0.791	0.150	40	28.6
53	Turkey	-0.267	-0.477	-0.442	-0.394	-0.395	21	62.5
54	United Kingdom	2.796	1.595	1.496	-0.598	1.322	53	5.4
55	United States	-0.116	1.566	-0.420	1.855	0.721	47	16.1
56	Uruguay	-0.344	-0.797	-0.383	-0.053	-0.394	22	60.7

Table 6 Principal Components Analysis

Principal Components Analysis

Date: 10/20/20 Time: 12:56

Sample: 1 56

Included observations: 56

Computed using: Ordinary correlations

Extracting 4 of 4 possible components

Eigenvalues: (Sum = 4, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	1.960892	0.936265	0.4902	1.960892	0.4902
2	1.024627	0.318480	0.2562	2.985518	0.7464
3	0.706146	0.397810	0.1765	3.691664	0.9229
4	0.308336	---	0.0771	4.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4
S_CASE_FATALITY	0.544693	-0.460624	0.352348	0.605794
S_DEATHS_100KPOP	0.637678	-0.141565	0.115690	-0.748292
S_REALGDPLOSS	0.482901	0.271890	-0.798032	0.236700
S_INCREASEINUNEMPLOYMENTRATE	0.251956	0.832983	0.474986	0.130560

Ordinary correlations:

	S_CASE_FATALITY	S_DEATHS_100KPOP	S_REALGDPLOSS	S_INCREASEINUNEMPLOYMENTRATE
S_CASE_FATALITY	1.000000			
S_DEATHS_100KPOP	0.636921	1.000000		
S_REALGDPLOSS	0.233111	0.444583	1.000000	
S_INCREASEINUNEMPLOYMENTRATE	0.018538	0.202906	0.212501	1.000000

Table 7 Principal Components, Ranks and Percentiles for the first Principal Component

	COUNTRY	First Principal Component (PC1)	Second Principal Component (PC2)	Third Principal Component (PC3)	Fourth Principal Component (PC4)	Rank of the First Principal Component (PC1)	Percentile of the first principal component
1	Argentina	0.911	0.896	-1.008	-0.223	43	23.2
2	Australia	-0.919	-0.146	0.749	0.324	16	71.4
3	Austria	-0.320	0.850	-0.315	0.199	32	42.9
4	Belarus	-1.636	-0.408	0.387	-0.558	3	94.6
5	Belgium	3.058	-2.006	0.225	-0.384	53	5.4
6	Brazil	1.049	-0.392	0.064	-1.395	45	19.6
7	Bulgaria	-0.344	-0.010	0.798	0.392	31	44.6
8	Canada	1.238	0.762	1.045	0.908	48	14.3
9	Chile	0.733	0.144	1.259	-1.565	42	25.0
10	China	-0.496	-0.997	0.360	0.949	28	50.0
11	Colombia	1.726	2.285	0.869	-0.336	50	10.7
12	Croatia	-0.560	0.768	-0.192	0.151	26	53.6
13	Cyprus	-0.931	0.228	-0.699	0.104	14	75.0
14	Czechia	-1.001	0.144	-0.737	-0.139	10	82.1
15	Denmark	-0.803	-0.141	0.259	-0.055	21	62.5
16	Ecuador	2.935	0.835	2.259	0.400	52	7.1
17	Egypt	-0.603	-0.926	1.560	0.737	24	57.1
18	Estonia	-0.959	0.299	0.358	0.074	11	80.4
19	Finland	-0.857	-0.456	0.739	0.291	20	64.3
20	France	1.715	-1.119	-1.259	0.160	49	12.5
21	Germany	-0.355	-0.260	-0.088	0.284	30	46.4
22	Greece	-0.583	0.428	-0.311	0.337	25	55.4
23	Hungary	-0.320	0.017	-0.242	0.443	33	41.1
24	Iceland	-0.879	0.338	-1.498	-0.047	19	66.1
25	Ireland	0.393	-1.190	0.574	-0.140	40	28.6
26	Israel	-1.026	0.092	-0.278	-0.635	9	83.9
27	Italy	3.359	-2.170	-0.013	1.328	55	1.8
28	Japan	-1.320	-0.285	0.083	0.024	5	91.1
29	Korea, South	-1.620	-0.387	0.448	-0.134	4	92.9
30	Latvia	-0.930	0.195	0.094	0.233	15	73.2
31	Lithuania	-1.123	0.578	1.041	0.073	8	85.7
32	Luxembourg	-0.792	-0.004	0.174	-0.564	22	60.7
33	Malta	-0.494	0.629	-1.149	0.094	29	48.2
34	Morocco	-0.049	1.029	-1.048	0.452	38	32.1
35	New Zealand	-1.320	-0.340	-0.548	-0.026	6	89.3
36	North Macedonia	0.687	-0.691	-0.697	-0.052	41	26.8
37	Norway	-1.189	-0.155	0.298	-0.057	7	87.5

38	Peru	4.071	1.645	-1.193	-1.099	56	0.0
39	Philippines	0.963	3.772	0.015	0.997	44	21.4
40	Poland	-0.880	-0.306	0.266	0.162	18	67.9
41	Portugal	0.010	-0.570	-1.454	0.052	39	30.4
42	Romania	-0.086	-0.786	0.016	-0.031	35	37.5
43	Russia	-0.932	-0.021	0.281	-0.328	13	76.8
44	Singapore	-2.152	-0.161	0.396	-0.622	1	98.2
45	Slovakia	-0.941	0.853	-0.706	0.030	12	78.6
46	Slovenia	-0.114	0.352	-0.666	0.511	34	39.3
47	South Africa	-0.508	-2.126	-1.772	-0.636	27	51.8
48	Spain	2.335	0.032	-1.188	-0.537	51	8.9
49	Sweden	1.225	-1.046	1.446	-0.398	47	16.1
50	Switzerland	-0.074	-0.598	0.351	-0.013	36	35.7
51	Taiwan	-1.906	-0.509	0.604	-0.291	2	96.4
52	Tunisia	-0.063	1.517	-1.097	0.549	37	33.9
53	Turkey	-0.769	-0.260	0.017	0.040	23	58.9
54	United Kingdom	3.139	-1.620	-0.311	0.783	54	3.6
55	United States	1.211	1.274	1.369	-1.109	46	17.9
56	Uruguay	-0.902	0.124	0.068	0.293	17	69.6

Table 8 Summary Statistics for the Disaster Index, Equal Weights Index, and the First Principal Component

Sample: 1 56			
	EWI	PC1	DI
Mean	0.0000	-0.0000	0.0000
Median	-0.1903	-0.4950	-0.3180
Maximum	2.0346	4.0710	2.9257
Minimum	-1.0628	-2.1524	-1.5374
Std. Dev.	0.6845	1.4130	0.9948
Skewness	1.0622	1.1489	1.0965
Kurtosis	3.4991	3.6563	3.5506
Jarque-Bera	11.1119	13.3249	11.9294
Probability	0.0039	0.0013	0.0026

Table 9 Disaster Index, Index with Equal Weights, First Principal Component and Their Ranks and Clusters

Order	Country	Index with Equal Weights (EWI)	First Principal Component (PC1)	Disaster Index (DI)	Index with Equal Weights (EWI) (Rank)	First Principal Component (PC1) (Rank)	Disaster Index (DI) (Rank)	Index with Equal Weights (Cluster)	First Principal Component (Cluster)	Disaster Index (Cluster)
1	Argentina	0.496	0.911	0.6847	45	43	44	4	4	4
2	Australia	-0.410	-0.919	-0.6244	17	16	16	2	2	2
3	Austria	-0.047	-0.320	-0.1473	36	32	33	3	3	3
4	Belarus	-0.845	-1.636	-1.1960	3	3	3	1	1	1
5	Belgium	1.189	3.058	1.9508	52	53	52	5	5	5
6	Brazil	0.374	1.049	0.6442	43	45	43	4	4	4
7	Bulgaria	-0.114	-0.344	-0.2052	34	31	32	3	3	3
8	Canada	0.771	1.238	1.0011	48	48	47	4	4	4
9	Chile	0.324	0.733	0.4964	42	42	42	4	4	4
10	China	-0.294	-0.496	-0.3906	26	28	26	2	3	2
11	Colombia	1.117	1.726	1.4267	51	50	50	5	4	5
12	Croatia	-0.169	-0.560	-0.3212	30	26	28	3	3	3
13	Cyprus	-0.433	-0.931	-0.6458	13	14	12	2	2	2
14	Czechia	-0.492	-1.001	-0.7135	10	10	9	2	2	2
15	Denmark	-0.393	-0.803	-0.5712	23	21	23	2	2	2
16	Ecuador	1.602	2.935	2.2086	55	52	54	5	5	5
17	Egypt	-0.305	-0.603	-0.4361	25	24	25	2	2	2
18	Estonia	-0.401	-0.959	-0.6325	19	11	13	2	2	2
19	Finland	-0.421	-0.857	-0.6110	15	20	19	2	2	2
20	France	0.639	1.715	1.0737	46	49	49	4	4	4
21	Germany	-0.189	-0.355	-0.2634	29	30	30	3	3	3
22	Greece	-0.216	-0.583	-0.3642	27	25	27	2	2	3
23	Hungary	-0.134	-0.320	-0.2110	32	33	31	3	3	3
24	Iceland	-0.432	-0.879	-0.6268	14	19	15	2	2	2
25	Ireland	0.051	0.393	0.1767	38	40	40	3	3	3
26	Israel	-0.521	-1.026	-0.7440	9	9	8	2	2	2
27	Italy	1.399	3.359	2.2103	54	55	55	5	5	5
28	Japan	-0.658	-1.320	-0.9479	6	5	6	1	1	1
29	Korea, South	-0.809	-1.620	-1.1645	4	4	4	1	1	1
30	Latvia	-0.401	-0.930	-0.6223	20	15	17	2	2	2
31	Lithuania	-0.420	-1.123	-0.7045	16	8	10	2	2	2
32	Luxembourg	-0.402	-0.792	-0.5735	18	22	22	2	2	2
33	Malta	-0.192	-0.494	-0.3149	28	29	29	3	3	3
34	Morocco	0.093	-0.049	0.0503	39	38	38	3	3	3
35	New Zealand	-0.690	-1.320	-0.9712	5	6	5	1	1	1

36	North Macedonia	0.212	0.687	0.3980	41	41	41	4	4	4
37	Norway	-0.576	-1.189	-0.8418	8	7	7	2	2	2
38	Peru	2.035	4.071	2.9267	56	56	56	5	5	5
39	Philippines	0.983	0.963	1.0590	49	44	48	5	4	4
40	Poland	-0.438	-0.880	-0.6311	12	18	14	2	2	2
41	Portugal	-0.116	0.010	-0.0809	33	39	36	3	3	3
42	Romania	-0.140	-0.086	-0.1327	31	35	34	3	3	3
43	Russia	-0.454	-0.932	-0.6611	11	13	11	2	2	2
44	Singapore	-1.063	-2.152	-1.5380	1	1	1	1	1	1
45	Slovakia	-0.365	-0.941	-0.5994	24	12	21	2	2	2
46	Slovenia	-0.006	-0.114	-0.0447	37	34	37	3	3	3
47	South Africa	-0.605	-0.508	-0.6214	7	27	18	2	3	2
48	Spain	1.041	2.335	1.5865	50	51	51	5	5	5
49	Sweden	0.481	1.225	0.7849	44	47	45	4	4	4
50	Switzerland	-0.098	-0.074	-0.0978	35	36	35	3	3	3
51	Taiwan	-0.963	-1.906	-1.3779	2	2	2	1	1	1
52	Tunisia	0.150	-0.063	0.0876	40	37	39	3	3	3
53	Turkey	-0.395	-0.769	-0.5608	21	23	24	2	2	2
54	United Kingdom	1.322	3.139	2.0765	53	54	53	5	5	5
55	United States	0.721	1.211	0.9551	47	46	46	4	4	4
56	Uruguay	-0.394	-0.902	-0.6072	22	17	20	2	2	2

Table 10 Cluster Analysis for Disaster Index and Its Components (Countries are Ordered According to Ranks of Disaster Index)

Order	Country	Index with Equal Weights (EWI) (Rank)	First Principal Component (PC1) (Rank)	Disaster Index (DI) (Rank)	Index with Equal Weights (Cluster)	First Principal Component (Cluster)	Disaster Index (Cluster)	Difference in Ranks of EWI and DI	Difference in Ranks of PC1 and DI	Difference in Clusters of EWI and DI	Difference in Clusters of PC1 and DI
44	Singapore	1	1	1	1	1	1	0	0	0	0
51	Taiwan	2	2	2	1	1	1	0	0	0	0
4	Belarus	3	3	3	1	1	1	0	0	0	0
29	Korea, South	4	4	4	1	1	1	0	0	0	0
35	New Zealand	5	6	5	1	1	1	0	1	0	0
28	Japan	6	5	6	1	1	1	0	-1	0	0
37	Norway	8	7	7	2	2	2	1	0	0	0
26	Israel	9	9	8	2	2	2	1	1	0	0
14	Czechia	10	10	9	2	2	2	1	1	0	0
31	Lithuania	16	8	10	2	2	2	6	-2	0	0
43	Russia	11	13	11	2	2	2	0	2	0	0
13	Cyprus	13	14	12	2	2	2	1	2	0	0
18	Estonia	19	11	13	2	2	2	6	-2	0	0
40	Poland	12	18	14	2	2	2	-2	4	0	0
24	Iceland	14	19	15	2	2	2	-1	4	0	0
2	Australia	17	16	16	2	2	2	1	0	0	0
30	Latvia	20	15	17	2	2	2	3	-2	0	0
47	South Africa	7	27	18	2	3	2	-11	9	0	1
19	Finland	15	20	19	2	2	2	-4	1	0	0
56	Uruguay	22	17	20	2	2	2	2	-3	0	0
45	Slovakia	24	12	21	2	2	2	3	-9	0	0
32	Luxembourg	18	22	22	2	2	2	-4	0	0	0
15	Denmark	23	21	23	2	2	2	0	-2	0	0
53	Turkey	21	23	24	2	2	2	-3	-1	0	0
17	Egypt	25	24	25	2	2	2	0	-1	0	0
10	China	26	28	26	2	3	2	0	2	0	1
22	Greece	27	25	27	2	2	3	0	-2	-1	-1
12	Croatia	30	26	28	3	3	3	2	-2	0	0
33	Malta	28	29	29	3	3	3	-1	0	0	0
21	Germany	29	30	30	3	3	3	-1	0	0	0
23	Hungary	32	33	31	3	3	3	1	2	0	0
7	Bulgaria	34	31	32	3	3	3	2	-1	0	0

3	Austria	36	32	33	3	3	3	3	-1	0	0
42	Romania	31	35	34	3	3	3	-3	1	0	0
50	Switzerland	35	36	35	3	3	3	0	1	0	0
41	Portugal	33	39	36	3	3	3	-3	3	0	0
46	Slovenia	37	34	37	3	3	3	0	-3	0	0
34	Morocco	39	38	38	3	3	3	1	0	0	0
52	Tunisia	40	37	39	3	3	3	1	-2	0	0
25	Ireland	38	40	40	3	3	3	-2	0	0	0
36	North Macedonia	41	41	41	4	4	4	0	0	0	0
9	Chile	42	42	42	4	4	4	0	0	0	0
6	Brazil	43	45	43	4	4	4	0	2	0	0
1	Argentina	45	43	44	4	4	4	1	-1	0	0
49	Sweden	44	47	45	4	4	4	-1	2	0	0
55	United States	47	46	46	4	4	4	1	0	0	0
8	Canada	48	48	47	4	4	4	1	1	0	0
39	Philippines	49	44	48	5	4	4	1	-4	1	0
20	France	46	49	49	4	4	4	-3	0	0	0
11	Colombia	51	50	50	5	4	5	1	0	0	-1
48	Spain	50	51	51	5	5	5	-1	0	0	0
5	Belgium	52	53	52	5	5	5	0	1	0	0
54	United Kingdom	53	54	53	5	5	5	0	1	0	0
16	Ecuador	55	52	54	5	5	5	1	-2	0	0
27	Italy	54	55	55	5	5	5	-1	0	0	0
38	Peru	56	56	56	5	5	5	0	0	0	0

Table 11 Five Clusters Based on the Disaster Index of Fifty-Six Countries

Cluster 1 (6 Countries)

Singapore, Taiwan, Belarus, South Korea, New Zealand, Japan

Cluster 2 (20 Countries)

Norway, Israel, Czechia, Lithuania, Russia, Cyprus, Estonia, Poland, Iceland, Australia, Latvia, South Africa, Finland, Uruguay, Slovakia, Luxembourg, Denmark, Turkey, Egypt, China

Cluster 3 (14 Countries)

Greece, Croatia, Malta, Germany, Hungary, Bulgaria, Austria, Romania, Switzerland, Portugal, Slovenia, Morocco, Tunisia, Ireland

Cluster 4 (9 Countries)

North Macedonia, Chile, Brazil, Argentina, Sweden, United States, Canada, Philippines, France

Cluster 5 (7 Countries)

Colombia, Spain, Belgium, United Kingdom, Ecuador, Italy, Peru

Table 12 Correlation Coefficients: Case Fatality, Deaths per 100 Thousand Population, Real GDP Loss and the Increase in the Rate of Unemployment

Sample: 1 168

Included observations: 168

Cases	CASE_FATALITY DEATHS_100KP OP REALGDPLOSS		
	CORRELATION	t-STATISTIC	PROBABILITY
DEATHS_100KPOP	0.350536	4.822326	0.0000
		168	
REALGDPLOSS	0.248412	2.279383	0.0253
	0.426589	4.192193	0.0001
		81	81
INCREASEINUNEMPLOYMENT	0.037402	0.277575	0.7824
	0.198490	1.501924	0.1388
	0.212501	1.598053	0.1159
		57	57
			56

Figure 1 World Map - Clusters Based on Case Fatality

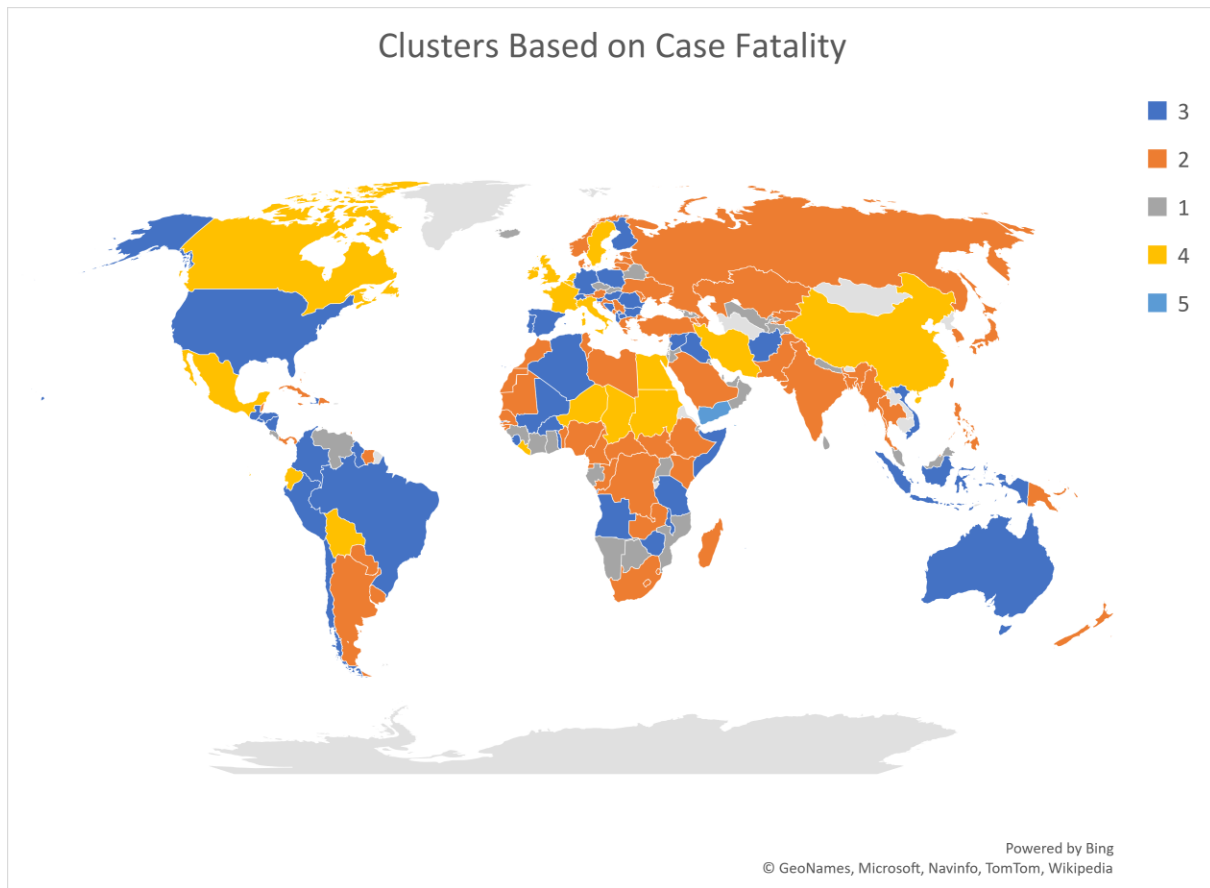


Figure 2 World Map - Clusters Based on Death per Hundred Thousand Population

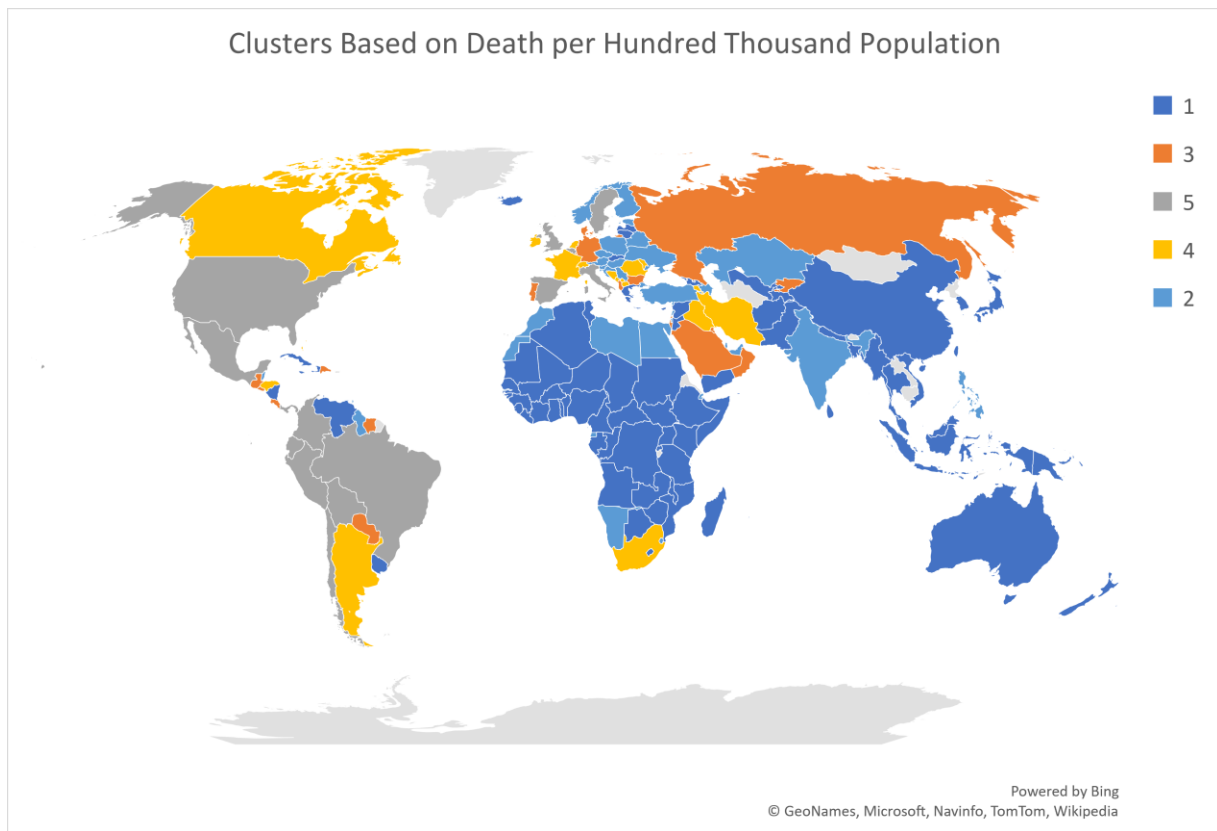


Figure 3 Real GDP (2010 Constant US Dollars)

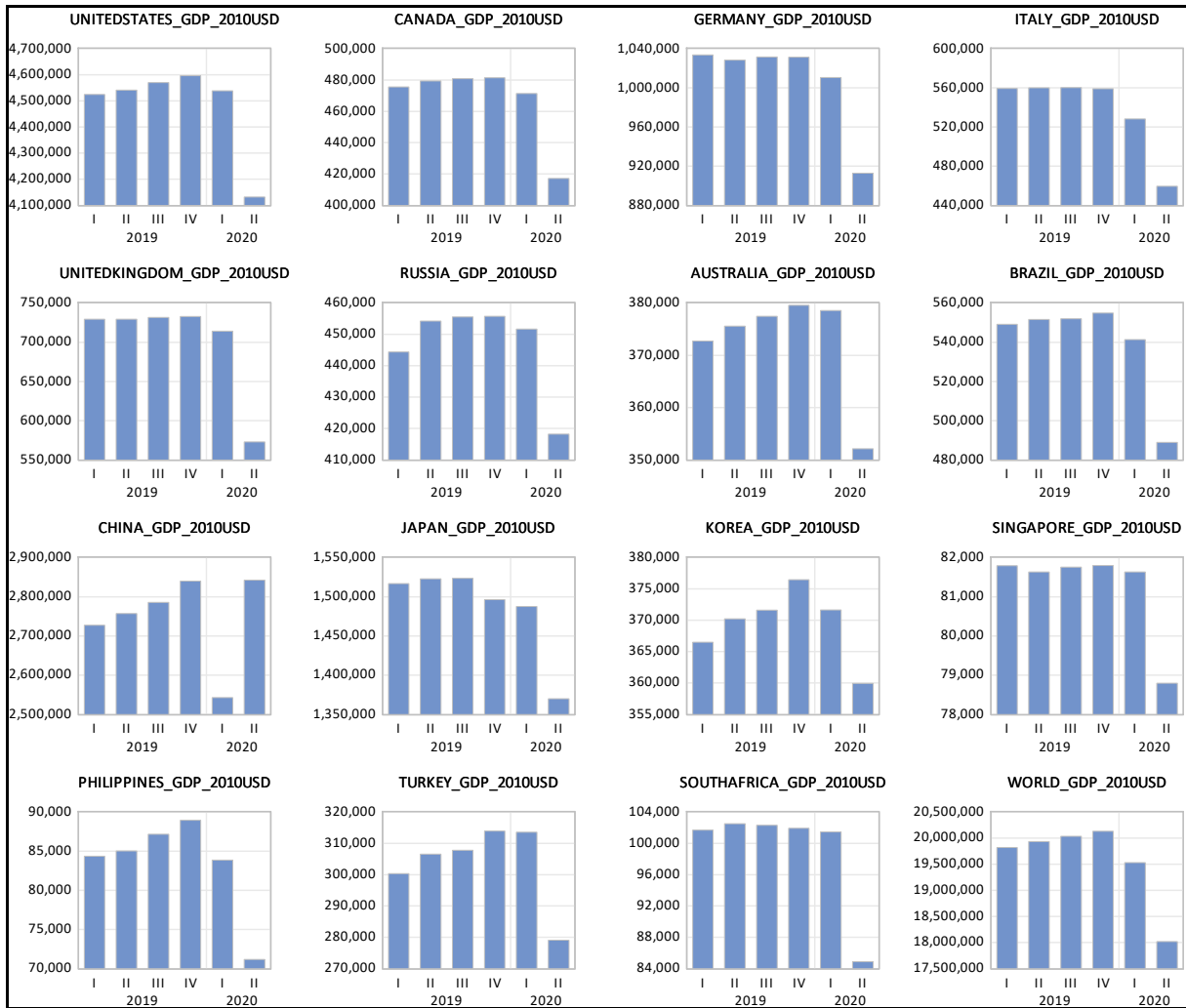


Figure 4 World Map - Clusters Based on Real GDP Loss

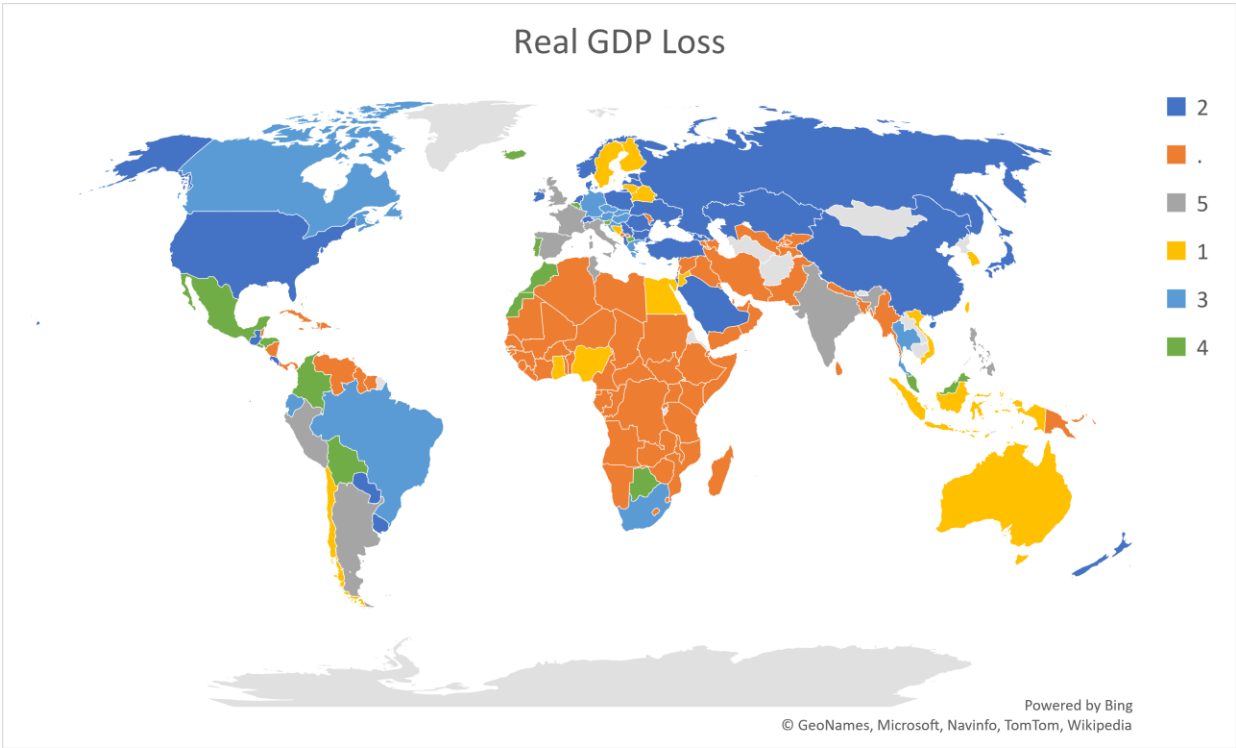


Figure 5 Unemployment Rate in 2019 M 01 – 2020 M 12

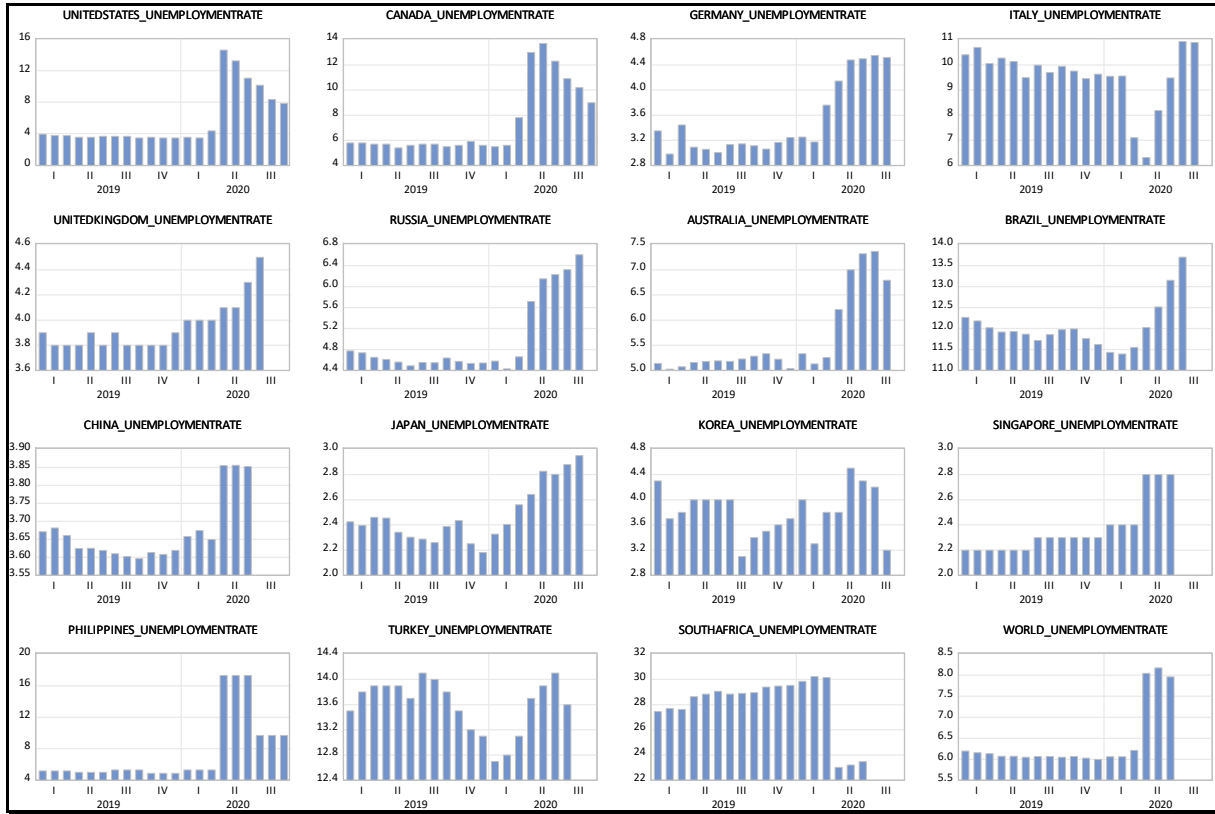


Figure 6 World Map - Clusters Based on the Increase in the Rate of Unemployment

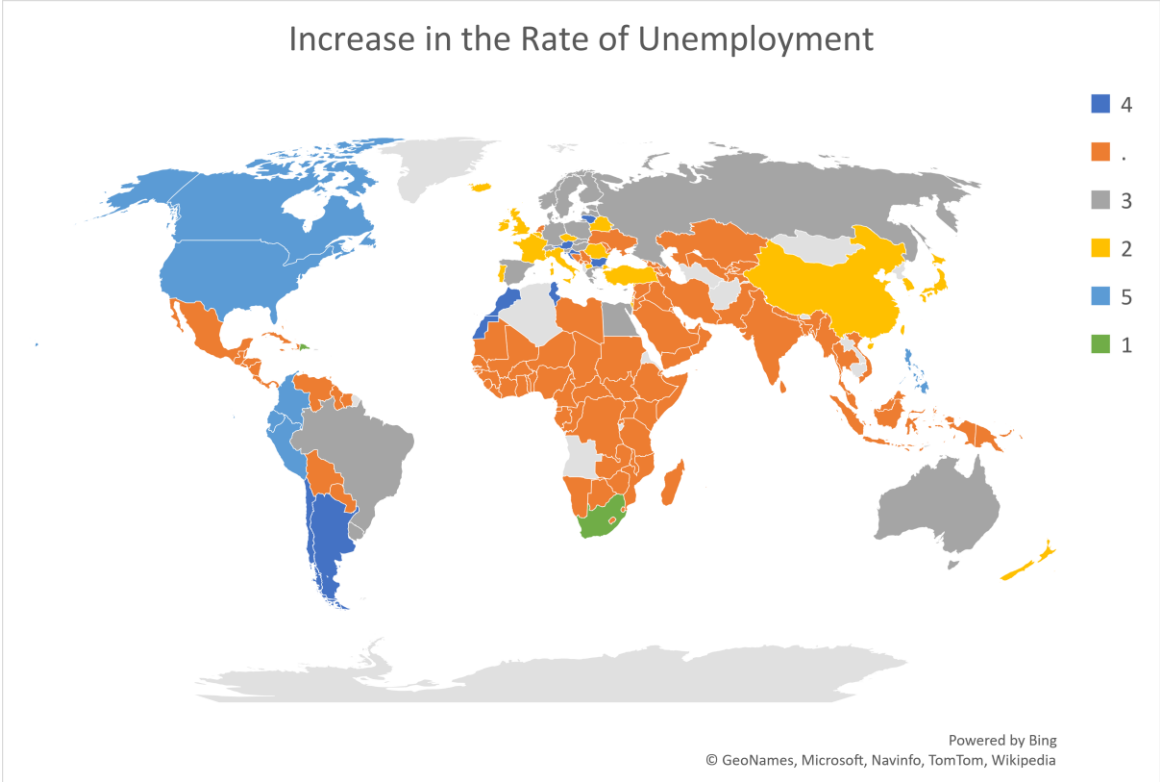


Figure 7 Case Fatality Rates (Death/Confirmed Cases) (%)

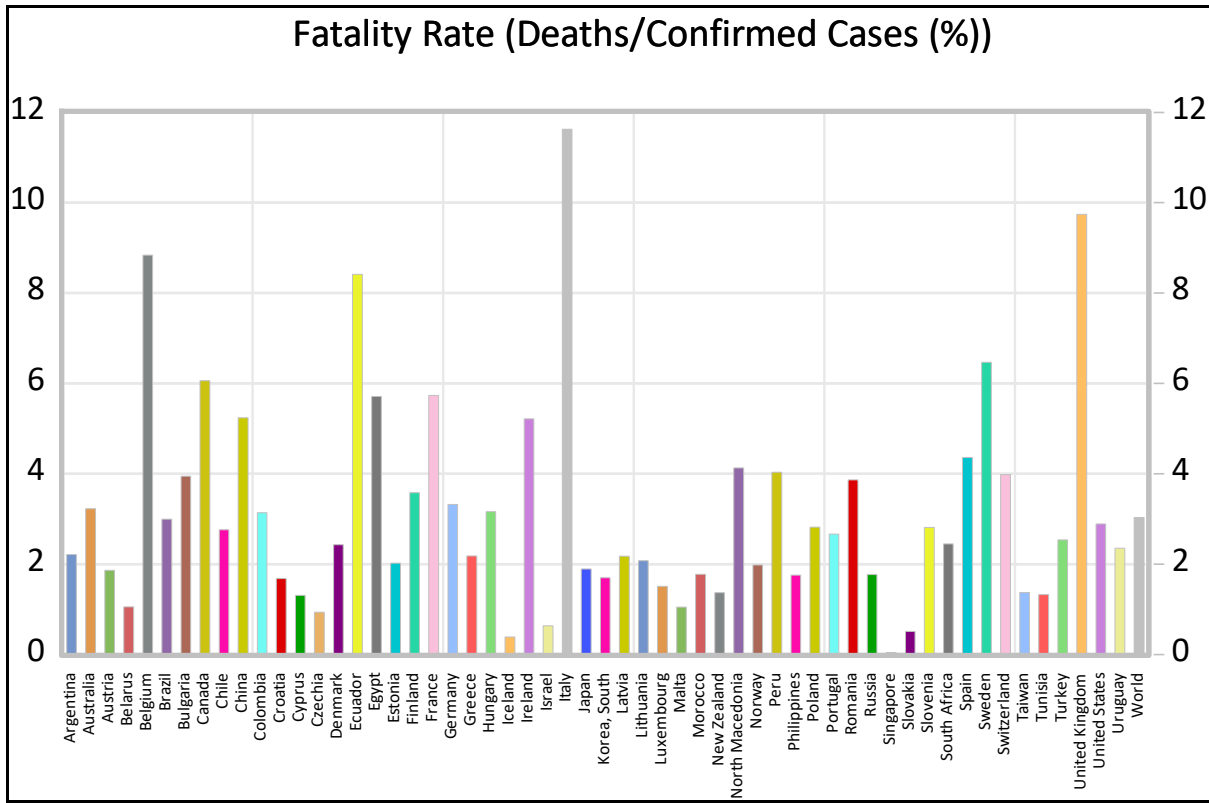


Figure 8 Deaths per Hundred Thousand Population

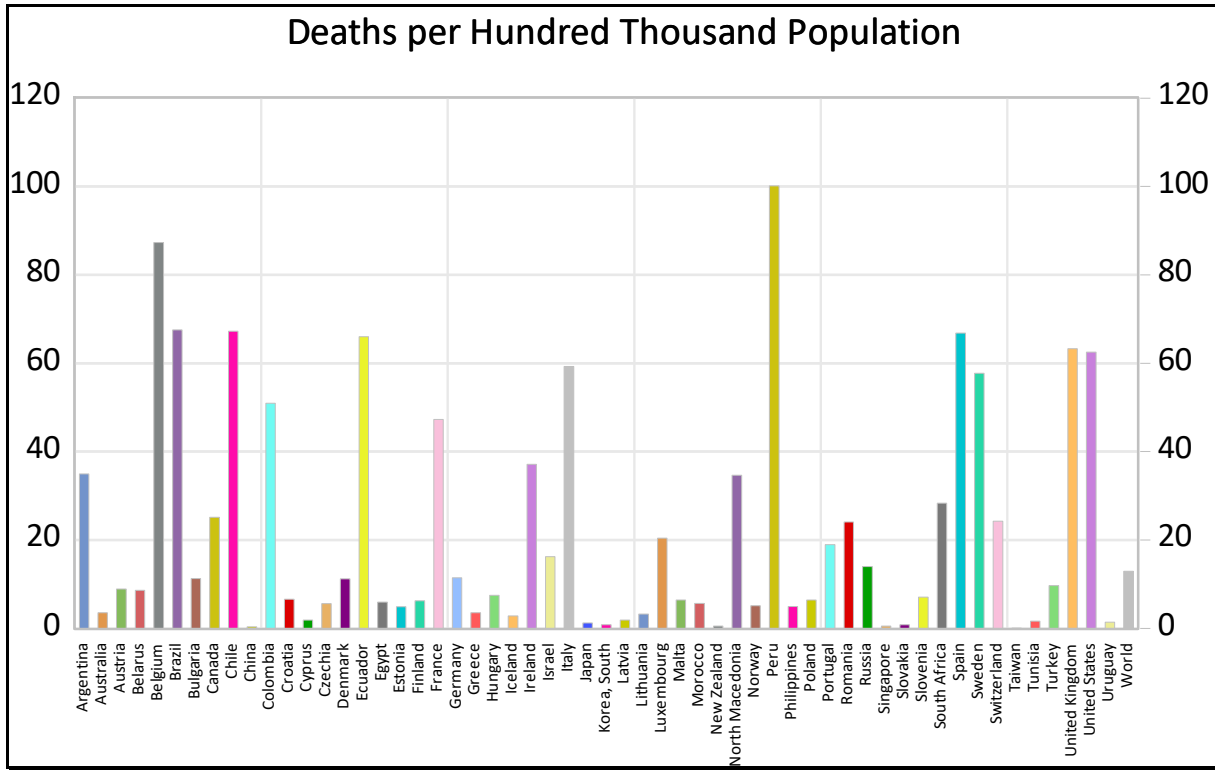


Figure 9 Percentage Decrease in Real GDP

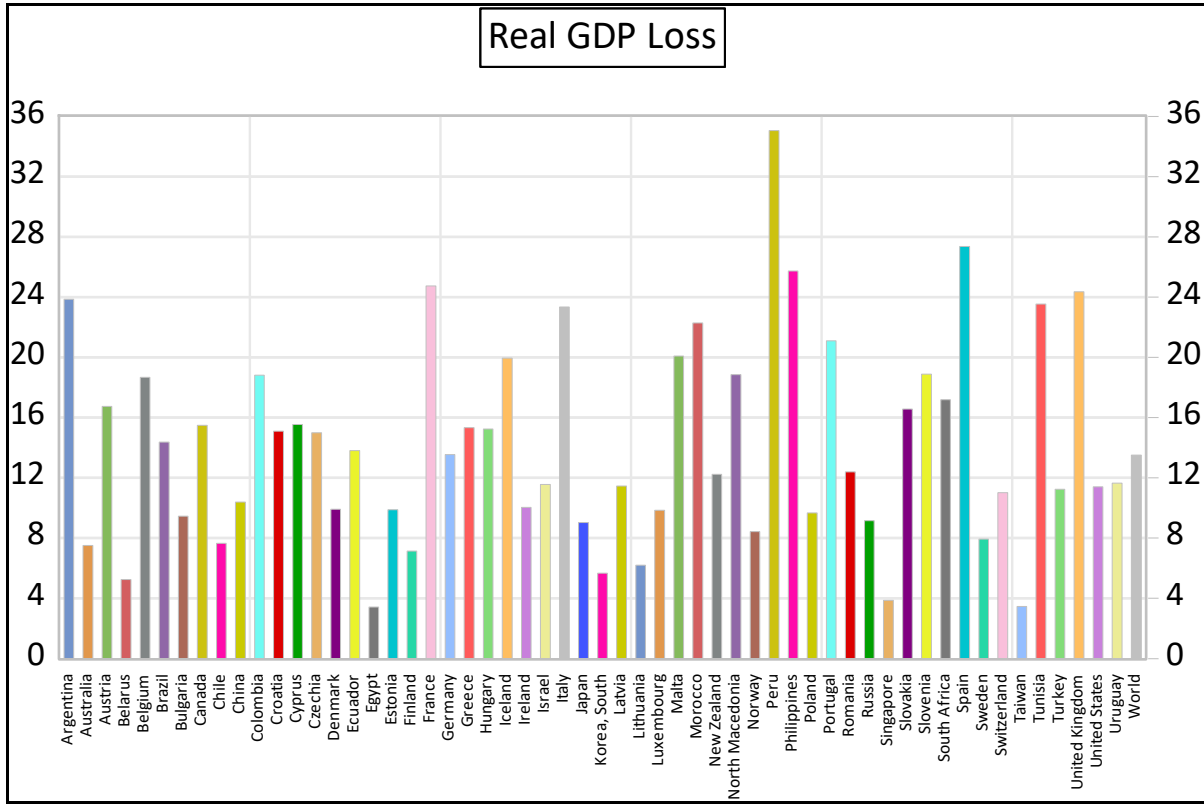


Figure 10 Increase in Unemployment Rate

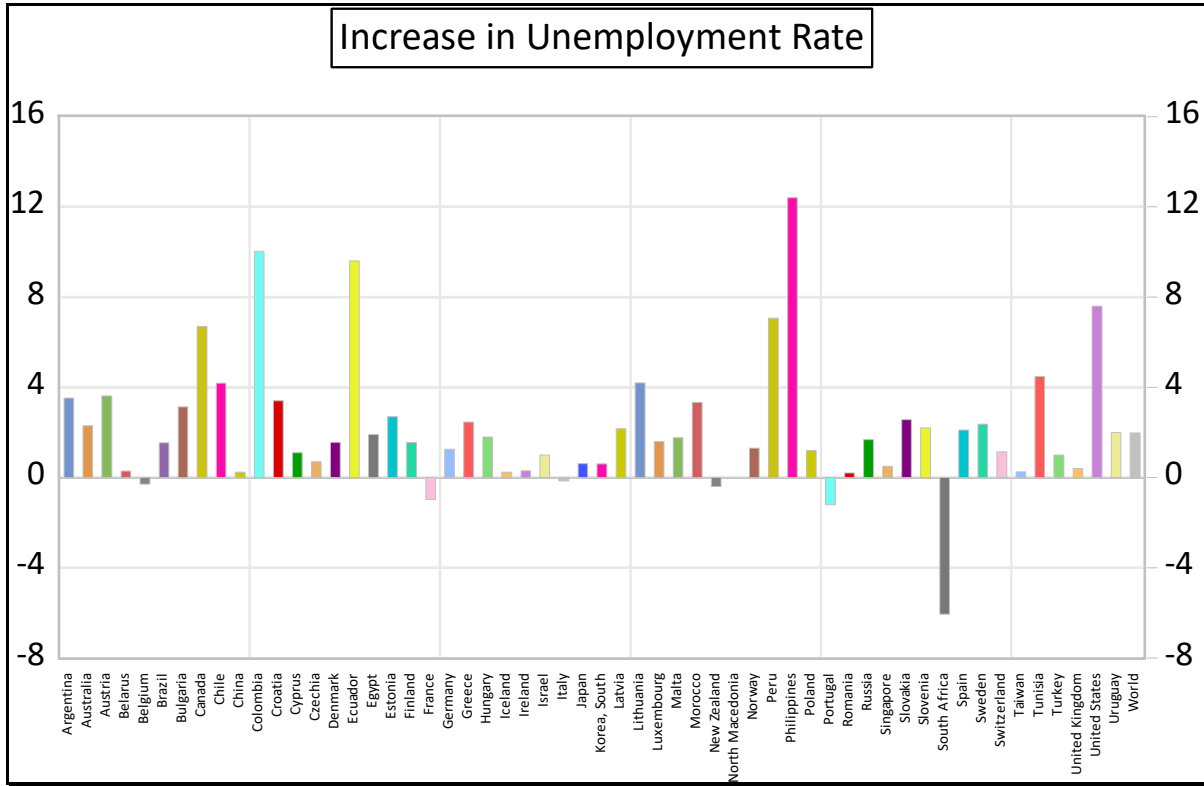


Figure 11 Disaster Index, Index with Equal Weights and the First Principal Component

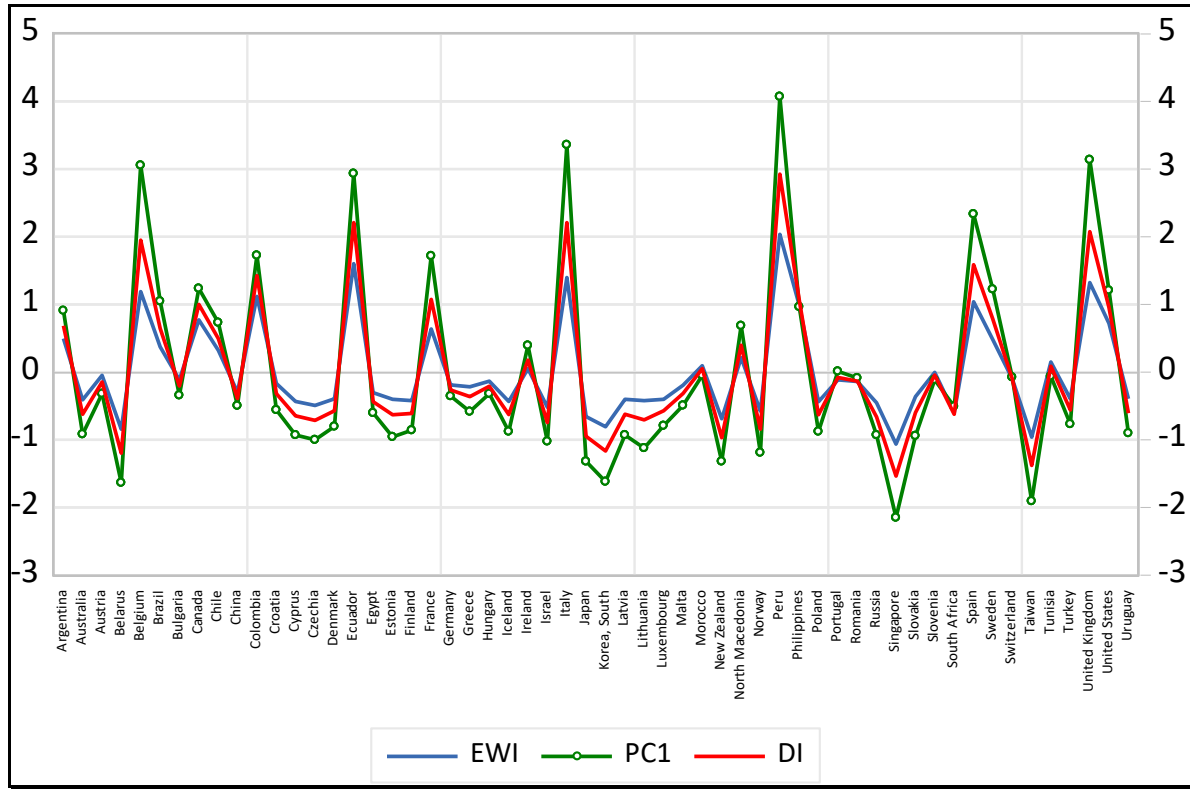


Figure 12 Distribution of the Disaster Index, Equal Weights Index, and the First Principal Component

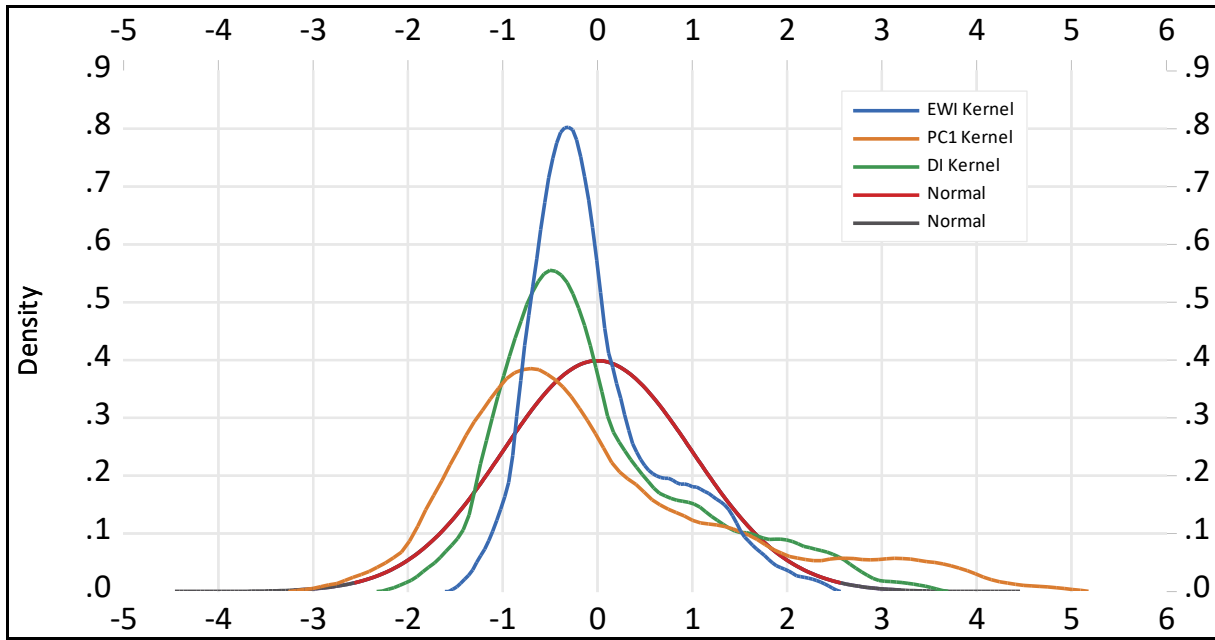


Figure 13 Disaster Index (DI), Equal Weights Index (EWI), and the First Principal Component (PC1)(Countries are Ordered According to Ranks in DI)

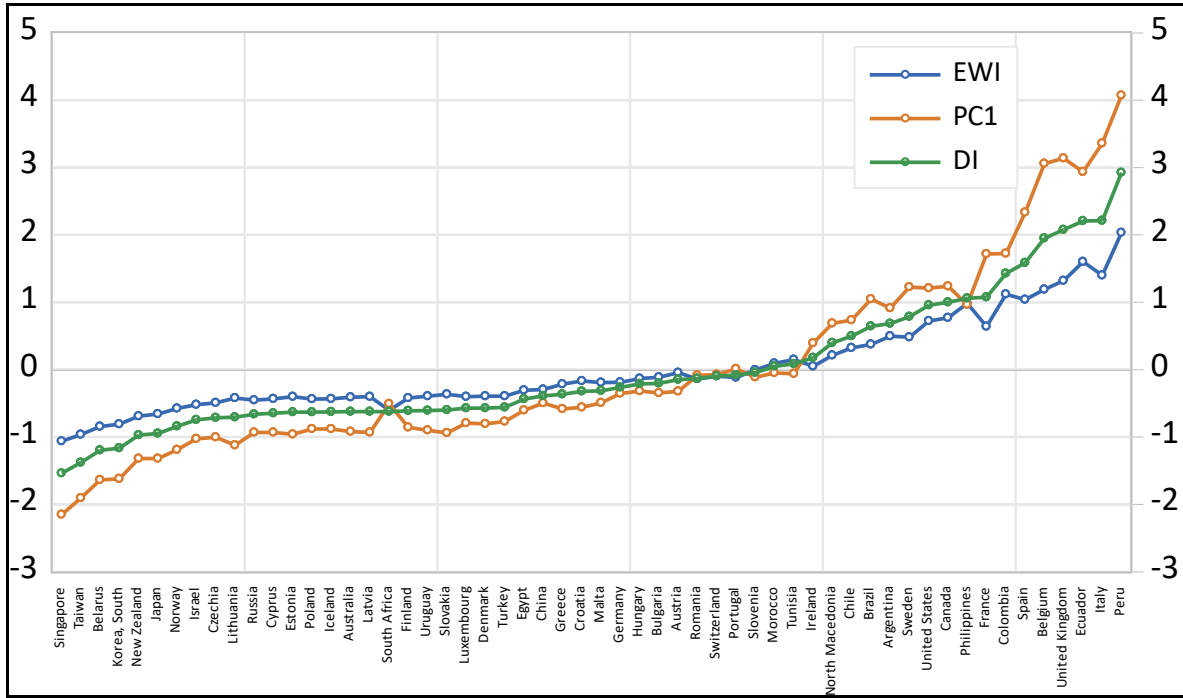


Figure 14 Disaster Index (Countries are Ordered by Rank)

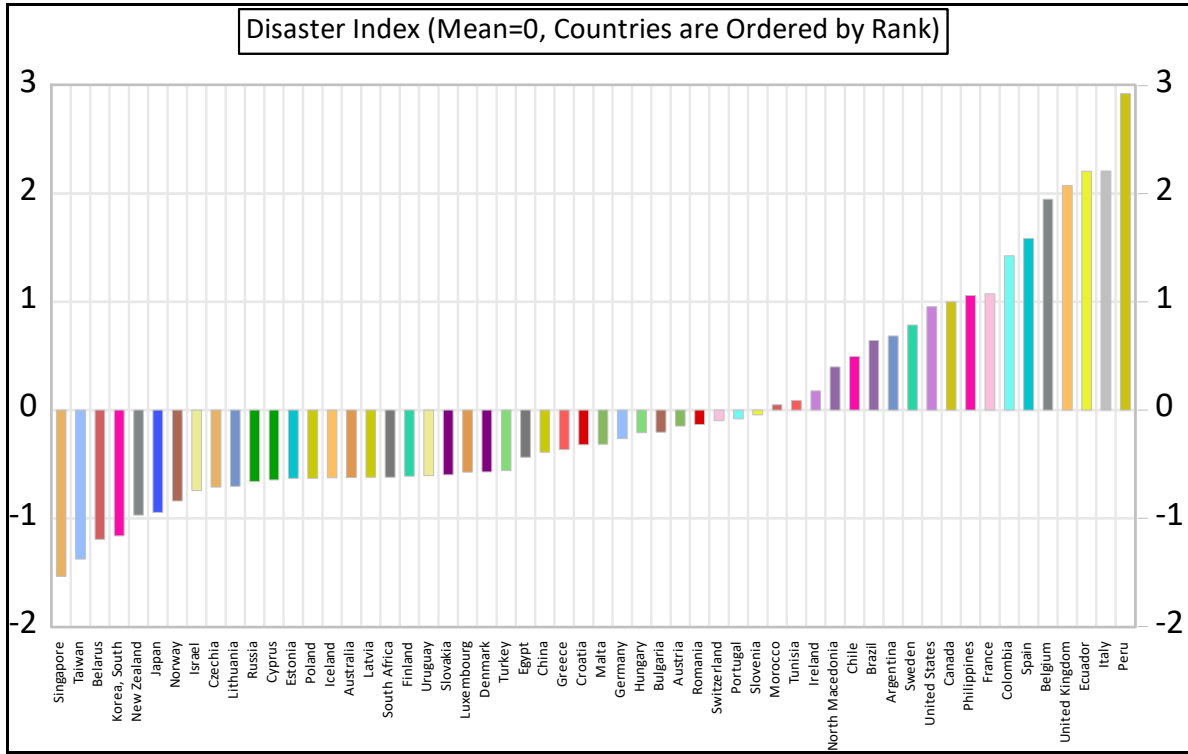


Figure 15 World Map - Clusters Based on the Disaster Index

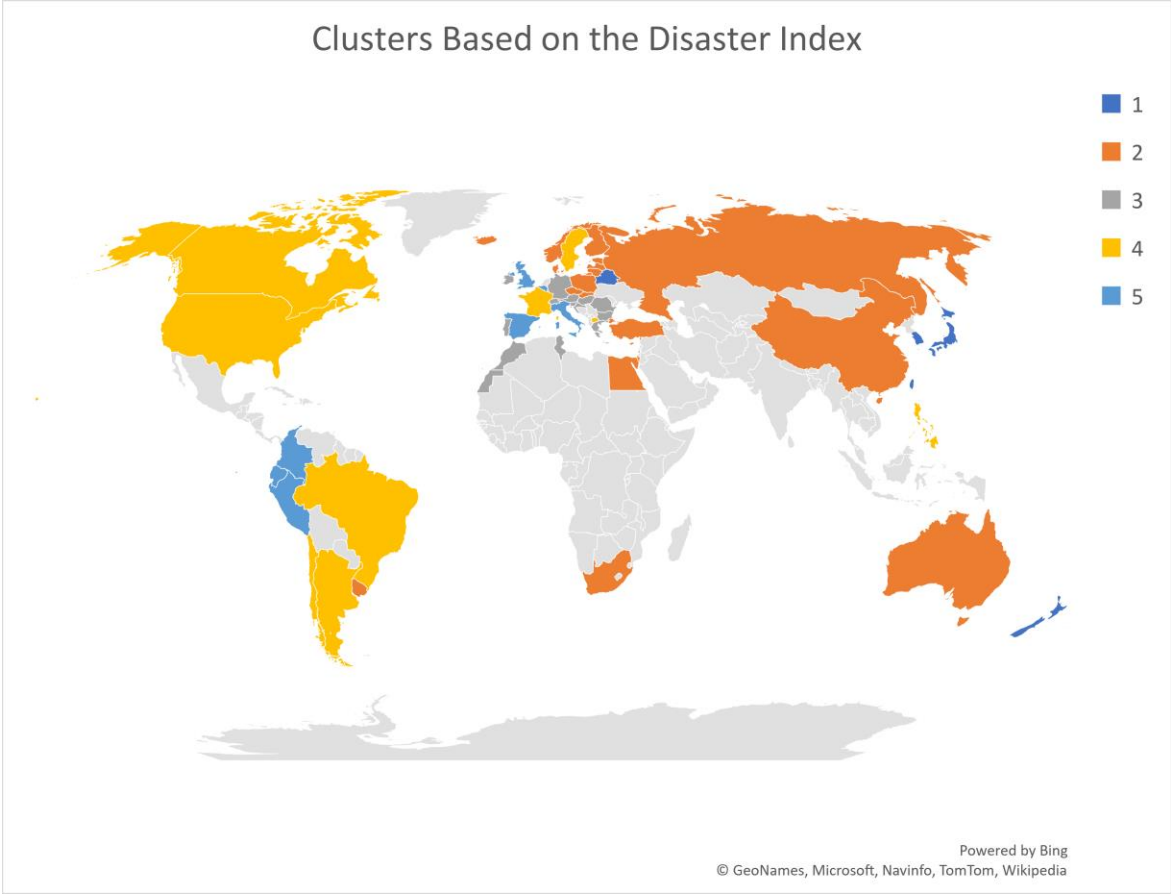


Figure 16 Disaster Diamonds – Four Biggest Economies

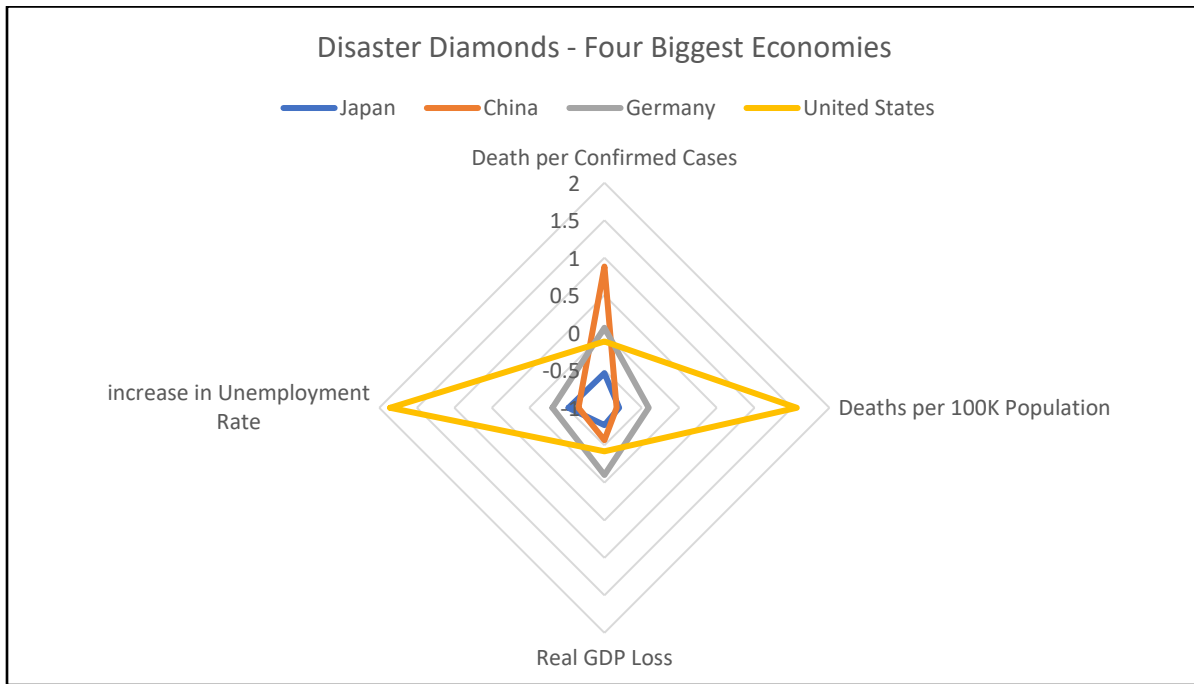


Figure 17 Disaster Diamonds – Top Four Performers

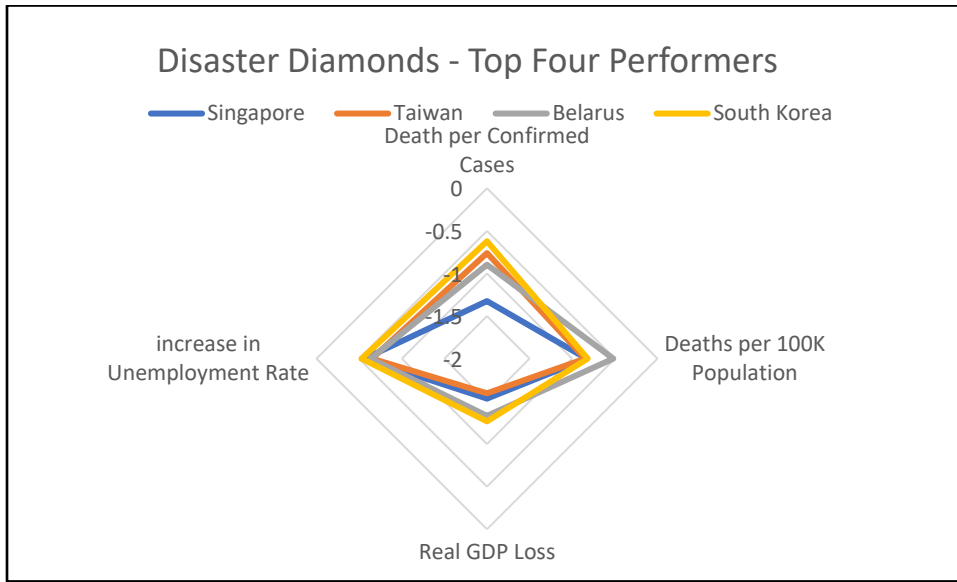


Figure 18 Disaster Diamonds – Bottom Four Performers

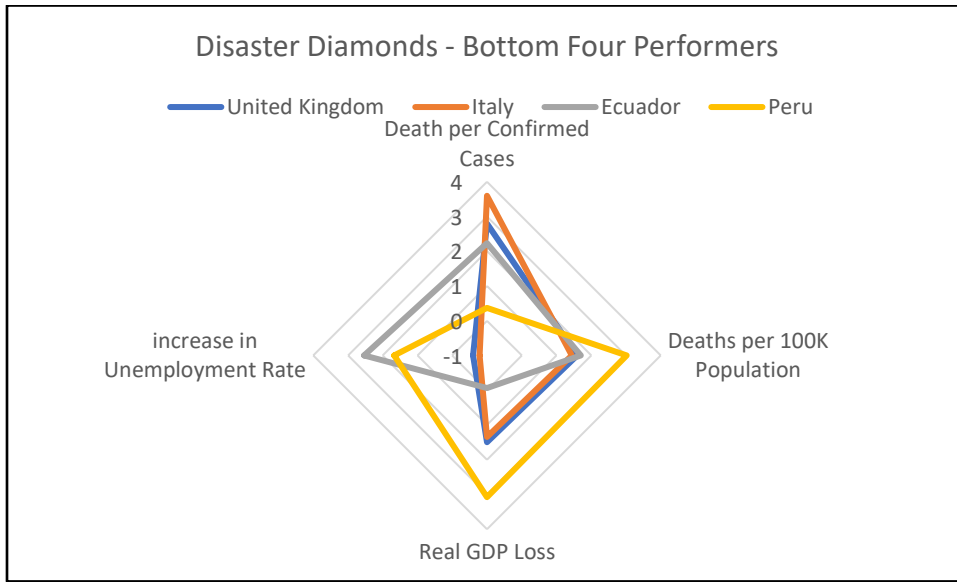


Figure 19 Disaster Diamonds – Singapore, China, United States, United Kingdom

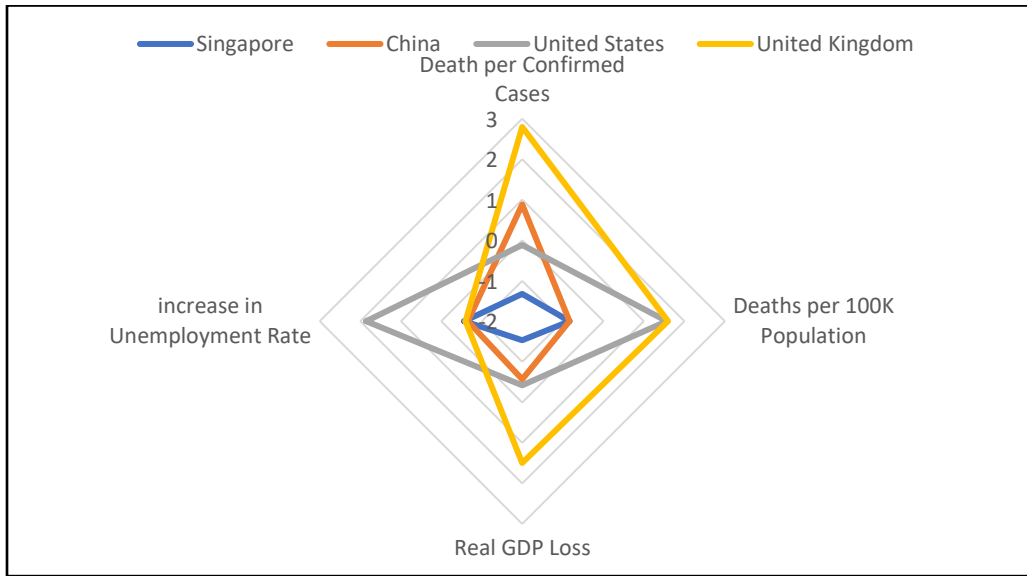


Figure 20 Disaster Diamonds – New Zealand, Russia, Philippines, Peru

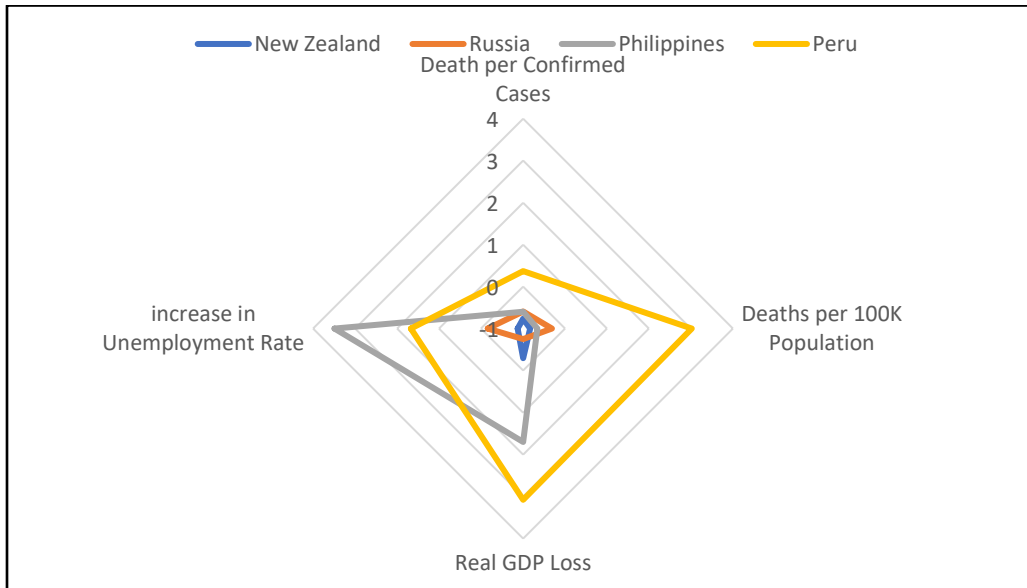


Figure 21 Disaster Diamonds – Germany, Switzerland, France, Italy

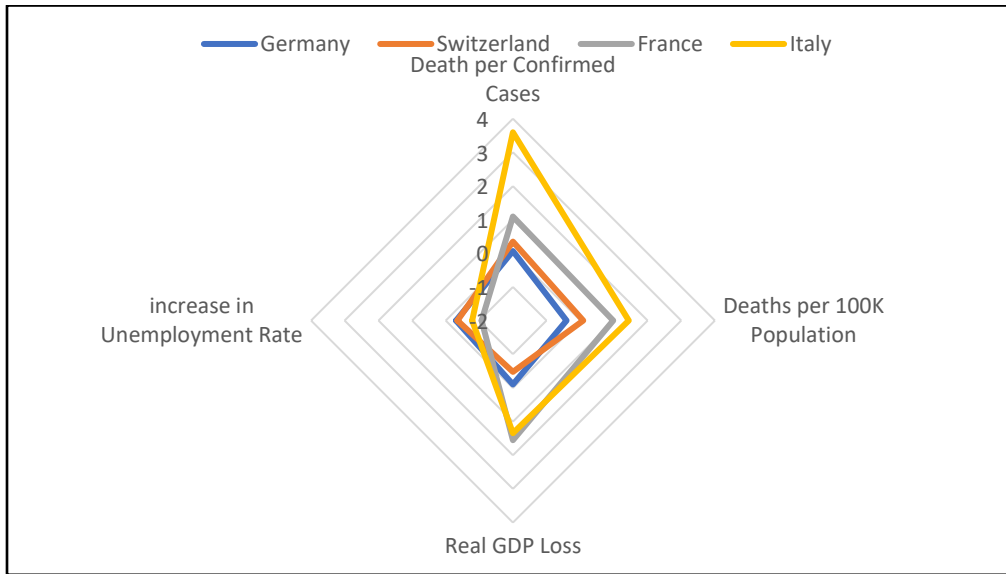


Figure 22 Top of Clusters 1 & 2 and Bottom of Clusters 4 & 5

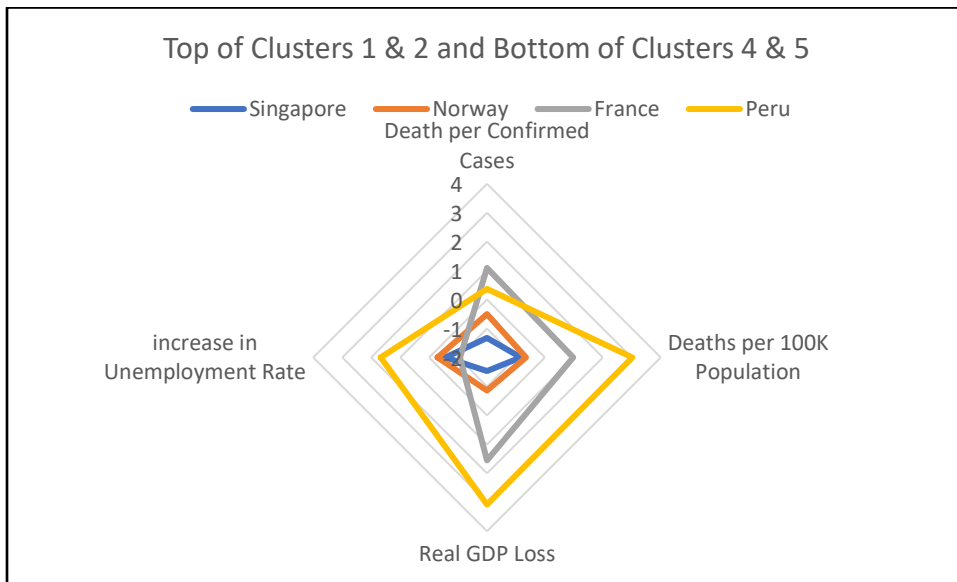


Figure 23 Disaster Diamonds – Death per Confirmed Cases, Deaths per 100 Thousand Population, Real GDP Loss, Increase in Unemployment Rate (Top 10 Countries)

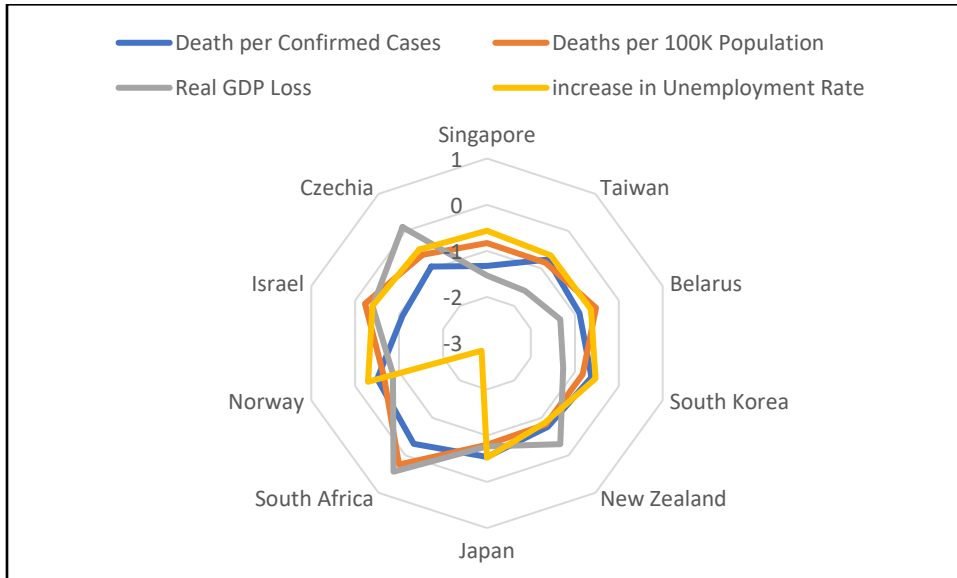


Figure 24 Disaster Diamonds – Death per Confirmed Cases, Deaths per 100 Thousand Population, Real GDP Loss, Increase in Unemployment Rate (Top 10 and Bottom 10 Countries)

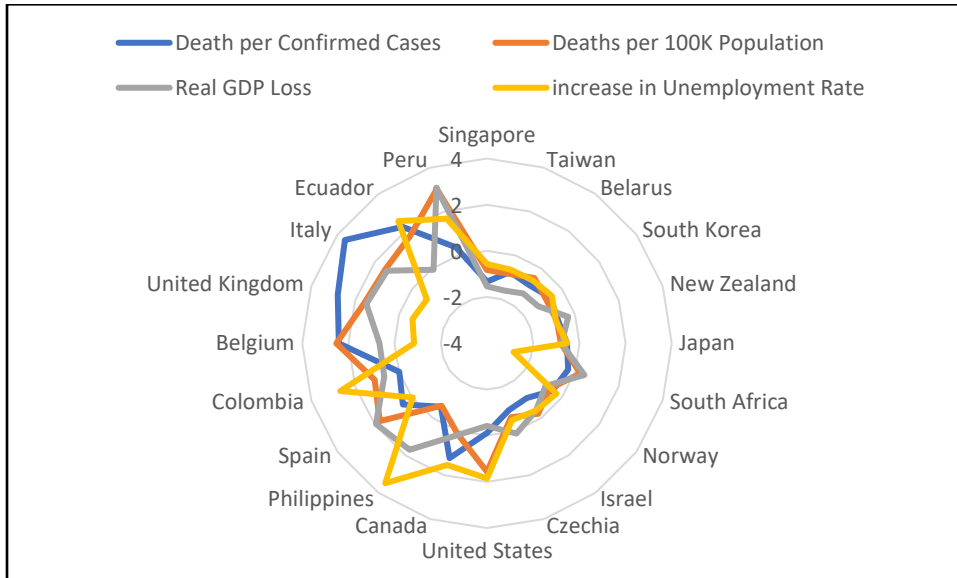


Figure 25 Case Fatality, Real GDP Loss and the Increase in Unemployment Rate Scatter Diagram and Estimated Regression Lines

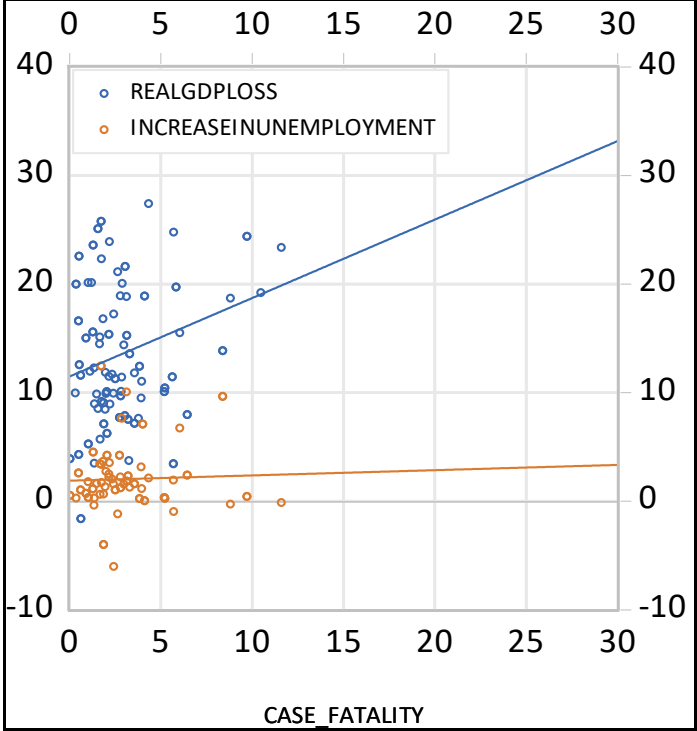
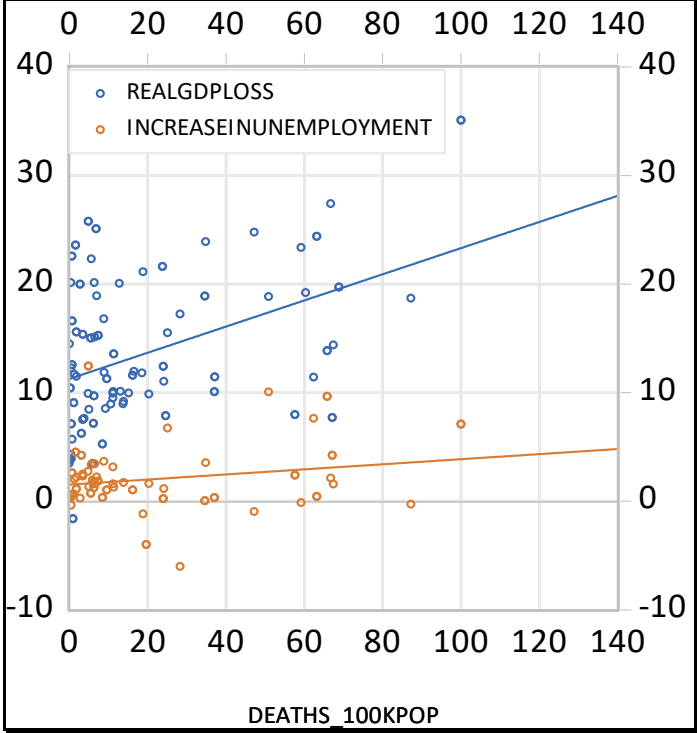


Figure 26 Deaths per 100 Thousand Population, Real GDP Loss and the Increase in Unemployment Rate Scatter Diagram and Estimated Regression Lines



7 Appendix

7.1 Appendix A1: Indicators and Country Ranks

Country	Case-Fatality (%)	Rank (out of 169)	Deaths per 100 Thousand Population	Rank (out of 169)	real GDP loss (%)	Rank (out of 82)	increase in Unemployment Rate	Rank (out of 58)
Afghanistan	3.71	138	3.91	78				
Albania	2.85	114	13.08	122	10.08	31		
Algeria	3.36	133	4.05	79				
Andorra	2.89	115	68.83	165				
Angola	3.66	136	0.56	24				
Antigua and Barbuda	3.06	123	3.12	71				
Argentina	2.21	90	34.93	149	23.86	76	3.52	48
Armenia	1.93	73	32.12	147				
Australia	3.22	129	3.49	74	7.50	12	2.29	40
Austria	1.86	69	8.90	108	16.75	58	3.62	49
Azerbaijan	1.47	47	5.88	90				
Bahamas	2.35	96	23.08	136				
Bahrain	0.35	4	15.23	126	9.94	28		
Bangladesh	1.43	45	3.18	72				
Barbados	3.68	137	2.44	66				
Belarus	1.05	31	8.57	107	5.24	7	0.29	13
Belgium	8.84	165	87.32	167	18.67	60	-0.30	6
Belize	1.32	38	6.27	94				
Benin	1.72	62	0.35	14				
Bolivia	5.86	158	68.95	166	19.67	65		
Bosnia and Herzegovina	3.06	122	24.67	141	7.84	15		
Botswana	0.55	10	0.71	30	22.53	73		
Brazil	3.00	120	67.51	164	14.37	49	1.53	27
Brunei	2.05	80	0.70	29				
Bulgaria	3.95	142	11.23	117	9.46	23	3.13	45
Burkina Faso	2.84	113	0.28	10				
Burma	1.98	75	0.37	15				
Cabo Verde	0.98	29	10.30	114				
Cameroon	2.02	78	1.66	51				
Canada	6.06	159	25.13	142	15.48	55	6.70	53
Central African Republic	1.29	36	1.33	45				
Chad	7.05	163	0.54	23				
Chile	2.76	110	67.23	163	7.66	14	4.19	50
China	5.24	151	0.34	13	10.39	32	0.23	10
Colombia	3.14	127	50.95	154	18.81	61	10.03	57
Comoros	1.46	46	0.84	36				

Congo (Brazzaville)	1.78	66	1.70	54				
Congo (Kinshasa)	2.56	102	0.32	12				
Costa Rica	1.15	34	16.56	128	11.93	42		
Cote d'Ivoire	0.61	14	0.48	19				
Croatia	1.68	60	6.58	99	15.09	52	3.40	47
Cuba	2.22	91	1.06	41				
Cyprus	1.31	37	1.85	56	15.55	56	1.10	22
Czechia	0.93	26	5.56	88	14.98	51	0.70	19
Denmark	2.43	98	11.18	116	9.91	27	1.56	29
Djibouti	1.13	33	6.36	96				
Dominican Republic	1.89	70	19.69	134			-4.04	2
Ecuador	8.41	164	65.98	161	13.82	48	9.60	56
Egypt	5.71	153	5.96	91	3.42	2	1.91	34
El Salvador	2.91	117	12.86	120	20.01	67		
Equatorial Guinea	1.65	57	6.34	95				
Estonia	2.02	79	4.85	82	9.88	26	2.70	44
Eswatini	1.99	77	9.51	112				
Ethiopia	1.60	54	1.07	42				
Finland	3.58	134	6.22	92	7.14	11	1.55	28
France	5.73	155	47.29	153	24.74	78	-0.98	4
Gabon	0.62	16	2.55	67				
Gambia	3.09	125	4.82	81				
Georgia	0.56	11	0.75	31	12.52	45		
Germany	3.32	132	11.41	119	13.53	47	1.25	25
Ghana	0.65	18	1.00	40	-1.64	1		
Greece	2.18	89	3.50	75	15.33	54	2.46	42
Guatemala	3.58	135	18.63	132	11.78	40		
Guinea	0.62	15	0.52	22				
Guinea-Bissau	1.68	59	2.08	63				
Guyana	2.72	107	9.50	111				
Haiti	2.60	104	2.04	61				
Honduras	3.07	124	23.86	138	21.58	71		
Hungary	3.16	128	7.47	104	15.23	53	1.80	33
Iceland	0.38	5	2.83	68	19.95	66	0.24	11
India	1.58	53	6.90	101	25.07	79		
Indonesia	3.80	139	3.85	77	7.59	13		
Iran	5.73	154	31.04	146				
Iraq	2.58	103	23.25	137				
Ireland	5.21	150	37.13	151	10.05	30	0.30	14
Israel	0.63	17	16.22	127	11.57	38	1.00	20
Italy	11.63	168	59.27	157	23.33	74	-0.15	7
Jamaica	1.50	48	3.00	69				
Japan	1.89	71	1.22	44	9.04	21	0.62	18

Jordan	0.53	9	0.43	17	4.27	6		
Kazakhstan	1.58	52	9.30	110	8.50	18		
Kenya	1.82	67	1.34	46				
Korea, South	1.70	61	0.78	32	5.68	8	0.60	17
Kosovo	3.85	140	26.45	144				
Kuwait	0.58	12	14.43	125				
Kyrgyzstan	2.31	95	16.83	129				
Latvia	2.18	88	1.87	57	11.45	37	2.16	38
Lebanon	0.96	28	4.96	85				
Lesotho	2.25	93	1.66	51				
Liberia	6.13	160	1.70	54				
Libya	1.57	51	7.47	104				
Lithuania	2.07	83	3.19	73	6.20	9	4.20	51
Luxembourg	1.51	49	20.40	135	9.84	25	1.59	30
Madagascar	1.41	44	0.87	37				
Malawi	3.10	126	0.99	39				
Malaysia	1.24	35	0.42	16	20.10	69		
Maldives	0.34	3	6.59	100				
Mali	4.22	147	0.68	28				
Malta	1.05	30	6.41	98	20.08	68	1.77	32
Mauritania	2.16	87	3.66	76				
Mauritius	2.72	108	0.79	33				
Mexico	10.50	167	60.42	158	19.18	64		
Moldova	2.53	100	36.07	150				
Montenegro	1.55	50	25.39	143				
Morocco	1.77	65	5.66	89	22.28	72	3.34	46
Mozambique	0.70	20	0.18	8				
Namibia	1.10	32	4.90	83				
Nepal	0.65	19	1.66	51				
Netherlands	5.65	152	37.23	152	11.40	36		
New Zealand	1.36	41	0.51	21	12.24	43	-0.40	5
Nicaragua	2.94	119	2.30	65				
Niger	5.78	157	0.31	11				
Nigeria	1.90	72	0.56	24	7.09	10		
North Macedonia	4.13	146	34.66	148	18.85	62	0.00	8
Norway	1.98	74	5.08	87	8.42	17	1.30	26
Oman	0.92	25	18.32	131				
Pakistan	2.08	84	3.04	70				
Panama	2.11	85	55.62	155				
Papua New Guinea	1.32	39	0.08	5				
Paraguay	2.06	82	11.24	118	10.05	29		
Peru	4.03	144	100.15	168	35.06	82	7.06	54
Philippines	1.75	63	4.95	84	25.74	80	12.40	58

Poland	2.82	112	6.38	97	9.66	24	1.20	24
Portugal	2.67	106	18.91	133	21.09	70	-1.21	3
Qatar	0.17	2	7.69	106				
Romania	3.87	141	24.07	139	12.39	44	0.20	9
Russia	1.77	64	13.94	124	9.16	22	1.69	31
Rwanda	0.60	13	0.24	9				
San Marino	5.78	156	124.32	169				
Sao Tome and Principe	1.65	56	7.11	103				
Saudi Arabia	1.40	43	13.81	123	8.93	20		
Senegal	2.06	81	1.93	59				
Serbia	2.24	92	10.68	115	8.90	19		
Sierra Leone	3.26	130	0.94	38				
Singapore	0.05	1	0.48	19	3.87	5	0.50	16
Slovakia	0.51	8	0.81	34	16.57	57	2.57	43
Slovenia	2.81	111	7.06	102	18.88	63	2.20	39
Somalia	2.76	109	0.66	27				
South Africa	2.45	99	28.34	145	17.19	59	-6.06	1
South Sudan	1.83	68	0.45	18				
Spain	4.36	148	66.84	162	27.36	81	2.10	37
Sri Lanka	0.39	6	0.06	4				
Sudan	6.14	161	2.00	60				
Suriname	2.11	86	17.71	130				
Sweden	6.47	162	57.74	156	7.93	16	2.36	41
Switzerland	3.98	143	24.24	140	11.01	33	1.13	23
Syria	4.66	149	1.11	43				
Taiwan*	1.37	42	0.03	1	3.45	3	0.25	12
Tajikistan	0.78	22	0.82	35				
Tanzania	4.13	145	0.04	2				
Thailand	1.67	58	0.08	5	14.44	50		
Togo	2.65	105	0.58	26				
Trinidad and Tobago	1.62	55	5.04	86				
Tunisia	1.33	40	1.65	50	23.54	75	4.48	52
Turkey	2.53	101	9.63	113	11.25	34	1.00	21
United States	2.89	116	62.50	159	11.40	35	7.60	55
Uganda	0.96	27	0.17	7				
Ukraine	1.99	76	8.94	109	11.83	41		
United Arab Emirates	0.45	7	4.27	80				
United Kingdom	9.74	166	63.26	160	24.36	77	0.40	15
Uruguay	2.35	97	1.36	47	11.65	39	2.00	36
Uzbekistan	0.82	23	1.37	48				
Venezuela	0.83	24	2.08	63				
Vietnam	3.27	131	0.04	2	3.70	4		
West Bank and Gaza	0.75	21	6.24	93				

Yemen	28.92	169	2.06	62				
Zambia	2.27	94	1.91	58				
Zimbabwe	2.91	118	1.57	49				
World	3.03	121	12.92	121	13.51	46	1.97	35

Sources: Data Columns “Case Fatality” and “Deaths per 100 Thousand Population”: Johns Hopkins University Coronavirus Resource Center and Center for Systems Science and Engineering (CSSE). <https://coronavirus.jhu.edu/data/mortality>. and <https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>. Access Date: September 28, 2020. Data Columns “Real GDP Loss” and “Increase in Unemployment Rate”: calculated by us using data from the World Bank, Global Economic Monitor Database. <https://datacatalog.worldbank.org/dataset/global-economic-monitor>. Excel files: GDP at market prices, constant 2010 US\$, millions, seasonally adjusted; Unemployment rate, seasonally adjusted. Access Date: October 14, 2020.

Note: Eviews 11 is used to get the ranks in a series.

7.2 Appendix A2: Indicators and Country Clusters

Country	Case-Fatality (%)	Clusters =5 obs.= 168	Deaths per 100 Thousand Population	Clusters =5 obs.= 168	real GDP loss (%)	Clusters =5 obs.= 81	increase in Unemployment Rate	Clusters =5 obs.=56
Afghanistan	3.71	3	3.91	1	.	.	.	.
Albania	2.85	3	13.08	3	10.08	2	.	.
Algeria	3.36	3	4.05	1	.	.	.	.
Andorra	2.89	3	68.83	5	.	.	.	.
Angola	3.66	3	0.56	1	.	.	.	.
Antigua and Barbuda	3.06	3	3.12	1	.	.	.	.
Argentina	2.21	2	34.93	4	23.86	5	3.52	4
Armenia	1.93	2	32.12	4	.	.	.	.
Australia	3.22	3	3.49	1	7.50	1	2.29	3
Austria	1.86	2	8.90	2	16.75	3	3.62	4
Azerbaijan	1.47	2	5.88	2	.	.	.	.
Bahamas	2.35	2	23.08	4	.	.	.	.
Bahrain	0.35	1	15.23	3	9.94	2	.	.
Bangladesh	1.43	2	3.18	1	.	.	.	.
Barbados	3.68	3	2.44	1	.	.	.	.
Belarus	1.05	1	8.57	2	5.24	1	0.29	2
Belgium	8.84	4	87.32	5	18.67	4	-0.30	2
Belize	1.32	2	6.27	2	.	.	.	.
Benin	1.72	2	0.35	1	.	.	.	.
Bolivia	5.86	4	68.95	5	19.67	4	.	.
Bosnia and Herzegovina	3.06	3	24.67	4	7.84	1	.	.
Botswana	0.55	1	0.71	1	22.53	4	.	.
Brazil	3.00	3	67.51	5	14.37	3	1.53	3
Brunei	2.05	2	0.70	1	.	.	.	.
Bulgaria	3.95	3	11.23	3	9.46	2	3.13	4
Burkina Faso	2.84	3	0.28	1	.	.	.	.
Burma	1.98	2	0.37	1	.	.	.	.
Cabo Verde	0.98	1	10.30	2	.	.	.	.
Cameroon	2.02	2	1.66	1	.	.	.	.
Canada	6.06	4	25.13	4	15.48	3	6.70	5
Central African Republic	1.29	2	1.33	1	.	.	.	.
Chad	7.05	4	0.54	1	.	.	.	.
Chile	2.76	3	67.23	5	7.66	1	4.19	4
China	5.24	4	0.34	1	10.39	2	0.23	2

Colombia	3.14	3	50.95	5	18.81	4	10.03	5
Comoros	1.46	2	0.84	1	.	.	.	.
Congo (Brazzaville)	1.78	2	1.70	1	.	.	.	.
Congo (Kinshasa)	2.56	2	0.32	1	.	.	.	.
Costa Rica	1.15	1	16.56	3	11.93	2	.	.
Cote d'Ivoire	0.61	1	0.48	1	.	.	.	.
Croatia	1.68	2	6.58	2	15.09	3	3.40	4
Cuba	2.22	2	1.06	1	.	.	.	.
Cyprus	1.31	2	1.85	1	15.55	3	1.10	3
Czechia	0.93	1	5.56	2	14.98	3	0.70	2
Denmark	2.43	2	11.18	3	9.91	2	1.56	3
Djibouti	1.13	1	6.36	2	.	.	.	.
Dominican Republic	1.89	2	19.69	3	.	.	-4.04	1
Ecuador	8.41	4	65.98	5	13.82	3	9.60	5
Egypt	5.71	4	5.96	2	3.42	1	1.91	3
El Salvador	2.91	3	12.86	3	20.01	4	.	.
Equatorial Guinea	1.65	2	6.34	2	.	.	.	.
Estonia	2.02	2	4.85	2	9.88	2	2.70	3
Eswatini	1.99	2	9.51	2	.	.	.	.
Ethiopia	1.60	2	1.07	1	.	.	.	.
Finland	3.58	3	6.22	2	7.14	1	1.55	3
France	5.73	4	47.29	4	24.74	5	-0.98	2
Gabon	0.62	1	2.55	1	.	.	.	.
Gambia	3.09	3	4.82	2	.	.	.	.
Georgia	0.56	1	0.75	1	12.52	2	.	.
Germany	3.32	3	11.41	3	13.53	3	1.25	3
Ghana	0.65	1	1.00	1	-1.64	1	.	.
Greece	2.18	2	3.50	1	15.33	3	2.46	3
Guatemala	3.58	3	18.63	3	11.78	2	.	.
Guinea	0.62	1	0.52	1	.	.	.	.
Guinea-Bissau	1.68	2	2.08	1	.	.	.	.
Guyana	2.72	3	9.50	2	.	.	.	.
Haiti	2.60	3	2.04	1	.	.	.	.
Honduras	3.07	3	23.86	4	21.58	4	.	.
Hungary	3.16	3	7.47	2	15.23	3	1.80	3
Iceland	0.38	1	2.83	1	19.95	4	0.24	2
India	1.58	2	6.90	2	25.07	5	.	.
Indonesia	3.80	3	3.85	1	7.59	1	.	.
Iran	5.73	4	31.04	4	.	.	.	.
Iraq	2.58	3	23.25	4	.	.	.	.
Ireland	5.21	4	37.13	4	10.05	2	0.30	2

Israel	0.63	1	16.22	3	11.57	2	1.00	2
Italy	11.63	4	59.27	5	23.33	5	-0.15	2
Jamaica	1.50	2	3.00	1	.	.	.	.
Japan	1.89	2	1.22	1	9.04	2	0.62	2
Jordan	0.53	1	0.43	1	4.27	1	.	.
Kazakhstan	1.58	2	9.30	2	8.50	2	.	.
Kenya	1.82	2	1.34	1	.	.	.	.
Korea, South	1.70	2	0.78	1	5.68	1	0.60	2
Kosovo	3.85	3	26.45	4	.	.	.	.
Kuwait	0.58	1	14.43	3	.	.	.	.
Kyrgyzstan	2.31	2	16.83	3	.	.	.	.
Latvia	2.18	2	1.87	1	11.45	2	2.16	3
Lebanon	0.96	1	4.96	2	.	.	.	.
Lesotho	2.25	2	1.66	1	.	.	.	.
Liberia	6.13	4	1.70	1	.	.	.	.
Libya	1.57	2	7.47	2	.	.	.	.
Lithuania	2.07	2	3.19	1	6.20	1	4.20	4
Luxembourg	1.51	2	20.40	3	9.84	2	1.59	3
Madagascar	1.41	2	0.87	1	.	.	.	.
Malawi	3.10	3	0.99	1	.	.	.	.
Malaysia	1.24	1	0.42	1	20.10	4	.	.
Maldives	0.34	1	6.59	2	.	.	.	.
Mali	4.22	3	0.68	1	.	.	.	.
Malta	1.05	1	6.41	2	20.08	4	1.77	3
Mauritania	2.16	2	3.66	1	.	.	.	.
Mauritius	2.72	3	0.79	1	.	.	.	.
Mexico	10.50	4	60.42	5	19.18	4	.	.
Moldova	2.53	2	36.07	4	.	.	.	.
Montenegro	1.55	2	25.39	4	.	.	.	.
Morocco	1.77	2	5.66	2	22.28	4	3.34	4
Mozambique	0.70	1	0.18	1	.	.	.	.
Namibia	1.10	1	4.90	2	.	.	.	.
Nepal	0.65	1	1.66	1	.	.	.	.
Netherlands	5.65	4	37.23	4	11.40	2	.	.
New Zealand	1.36	2	0.51	1	12.24	2	-0.40	2
Nicaragua	2.94	3	2.30	1	.	.	.	.
Niger	5.78	4	0.31	1	.	.	.	.
Nigeria	1.90	2	0.56	1	7.09	1	.	.
North Macedonia	4.13	3	34.66	4	18.85	4	0.00	2
Norway	1.98	2	5.08	2	8.42	2	1.30	3
Oman	0.92	1	18.32	3	.	.	.	.

Pakistan	2.08	2	3.04	1	.	.	.	.
Panama	2.11	2	55.62	5	.	.	.	.
Papua New Guinea	1.32	2	0.08	1	.	.	.	.
Paraguay	2.06	2	11.24	3	10.05	2	.	.
Peru	4.03	3	100.15	5	35.06	5	7.06	5
Philippines	1.75	2	4.95	2	25.74	5	12.40	5
Poland	2.82	3	6.38	2	9.66	2	1.20	3
Portugal	2.67	3	18.91	3	21.09	4	-1.21	2
Qatar	0.17	1	7.69	2	.	.	.	.
Romania	3.87	3	24.07	4	12.39	2	0.20	2
Russia	1.77	2	13.94	3	9.16	2	1.69	3
Rwanda	0.60	1	0.24	1	.	.	.	.
San Marino	5.78	4	124.32	5	.	.	.	.
Sao Tome and Principe	1.65	2	7.11	2	.	.	.	.
Saudi Arabia	1.40	2	13.81	3	8.93	2	.	.
Senegal	2.06	2	1.93	1	.	.	.	.
Serbia	2.24	2	10.68	2	8.90	2	.	.
Sierra Leone	3.26	3	0.94	1	.	.	.	.
Singapore	0.05	1	0.48	1	3.87	1	0.50	2
Slovakia	0.51	1	0.81	1	16.57	3	2.57	3
Slovenia	2.81	3	7.06	2	18.88	4	2.20	3
Somalia	2.76	3	0.66	1	.	.	.	.
South Africa	2.45	2	28.34	4	17.19	3	-6.06	1
South Sudan	1.83	2	0.45	1	.	.	.	.
Spain	4.36	3	66.84	5	27.36	5	2.10	3
Sri Lanka	0.39	1	0.06	1	.	.	.	.
Sudan	6.14	4	2.00	1	.	.	.	.
Suriname	2.11	2	17.71	3	.	.	.	.
Sweden	6.47	4	57.74	5	7.93	1	2.36	3
Switzerland	3.98	3	24.24	4	11.01	2	1.13	3
Syria	4.66	3	1.11	1	.	.	.	.
Taiwan*	1.37	2	0.03	1	3.45	1	0.25	2
Tajikistan	0.78	1	0.82	1	.	.	.	.
Tanzania	4.13	3	0.04	1	.	.	.	.
Thailand	1.67	2	0.08	1	14.44	3	.	.
Togo	2.65	3	0.58	1	.	.	.	.
Trinidad and Tobago	1.62	2	5.04	2	.	.	.	.
Tunisia	1.33	2	1.65	1	23.54	5	4.48	4
Turkey	2.53	2	9.63	2	11.25	2	1.00	2
United States	2.89	3	62.50	5	11.40	2	7.60	5

Uganda	0.96	1	0.17	1	.	.	.	.
Ukraine	1.99	2	8.94	2	11.83	2	.	.
United Arab Emirates	0.45	1	4.27	2	.	.	.	.
United Kingdom	9.74	4	63.26	5	24.36	5	0.40	2
Uruguay	2.35	2	1.36	1	11.65	2	2.00	3
Uzbekistan	0.82	1	1.37	1	.	.	.	.
Venezuela	0.83	1	2.08	1	.	.	.	.
Vietnam	3.27	3	0.04	1	3.70	1	.	.
West Bank and Gaza	0.75	1	6.24	2	.	.	.	.
Yemen	28.92	5	2.06	1	.	.	.	.
Zambia	2.27	2	1.91	1	.	.	.	.
Zimbabwe	2.91	3	1.57	1	.	.	.	.
World	3.03	3	12.92	3	13.51	3	1.97	3

Sources: Data Columns “Case Fatality” and “Deaths per 100 Thousand Population”: Johns Hopkins University Coronavirus Resource Center and Center for Systems Science and Engineering (CSSE). <https://coronavirus.jhu.edu/data/mortality>. and <https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>. Access Date: September 28, 2020. Data Columns “Real GDP Loss” and “Increase in Unemployment Rate”: calculated by us using data from the World Bank, Global Economic Monitor Database. <https://datacatalog.worldbank.org/dataset/global-economic-monitor>. Excel files: GDP at market prices, constant 2010 US\$, millions, seasonally adjusted; Unemployment rate, seasonally adjusted. Access Date: October 14, 2020.

Note: Statistical Software Stata is used to obtain clusters. The World is not used in cluster analysis. The cluster of the country with a closest figure to the World figure is used for the cluster for the World.