Oxford Covid-19 Government Response Tracker Analysis and AI modelling

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1 Abstract

The COVID-19 pandemic has posed unprecedented challenges to governments worldwide, necessitating swift and effective policy responses to mitigate its spread and impact. In this study, we leverage the rich dataset provided by the Oxford Covid-19 Government Response Tracker (OxCGRT) to develop a comprehensive model for analyzing and recommending COVID-19 policies across more than 150 national jurisdictions.

Our approach involves utilizing advanced machine learning and statistical techniques to analyze the multitude of policy interventions implemented by governments in response to the pandemic, along with corresponding COVID-19 outcomes. The OxCGRT dataset provides detailed information on various policy domains, including containment and closure measures, economic support, and health system policies.

Through rigorous data analysis and modeling, we aim to identify key factors and interactions that contribute to the effectiveness of COVID-19 policies in different contexts. By understanding the nuanced relationships between policy interventions and outcomes, our model seeks to provide actionable insights for policymakers and public health officials to optimize their strategies in combating the pandemic.

Furthermore, our project emphasizes the importance of data-driven decision-making in navigating complex public health crises. By harnessing the wealth of information available through the OxCGRT dataset, we strive to empower policymakers with evidence-based recommendations tailored to their specific socio-economic and epidemiological contexts.

Ultimately, our work aims to contribute to the global effort in fighting any future pandemics by providing a robust framework for policy analysis and decision support. We envision that our model will serve as a valuable tool for governments and stakeholders in formulating more effective and targeted interventions, ultimately saving lives and mitigating the societal impact of the pandemic.

2 Introduction

2.1 Background

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has emerged as one of the most significant global health crises in recent history. Since its emergence in late 2019, the virus has spread rapidly across the globe, leading to millions of infections and fatalities. In response to the unprecedented threat posed by the pan-

demic, governments worldwide have implemented a range of policy interventions aimed at mitigating the spread of the virus, protecting public health, and supporting economic resilience.

2.2 Policy Responses to COVID-19

The diverse nature of policy responses to COVID-19 reflects the complex interplay between public health imperatives, socio-economic considerations, and political dynamics. Governments have adopted a variety of containment and mitigation measures, including lockdowns, travel restrictions, mask mandates, and social distancing guidelines. Additionally, economic support measures, such as stimulus packages and income support programs, have been implemented to alleviate the socio-economic impact of the pandemic on individuals and businesses.

2.3 The importance of Data in Policy making

Informed decision-making is critical in navigating the multifaceted challenges posed by the COVID-19 pandemic. Data-driven approaches provide governments and policymakers with valuable insights into the effectiveness of different policy interventions and their impact on public health outcomes. The availability of comprehensive datasets, such as the Oxford Covid-19 Government Response Tracker (OxCGRT), offers a unique opportunity to analyze and evaluate the effectiveness of COVID-19 policies across diverse geographical and socio-economic contexts.

2.4 Outcome of the Study

The primary objective of this study is to develop a data-driven model for analyzing and recommending COVID-19 policies based on the extensive dataset provided by the OxCGRT. By leveraging advanced machine learning and statistical techniques, we aim to identify key factors influencing the effectiveness of COVID-19 policies and their impact on mitigating the spread of the virus and reducing associated morbidity and mortality. Additionally, we seek to provide actionable insights and evidence-based recommendations to policymakers and public health officials to optimize their response strategies. By doing so we hope to create a model that can be useful and helpful for handling pandemics should they arise in the future.

2.5 Significance of the Study

The findings of this study have significant implications for policymakers, public health officials, and other stakeholders involved in the response to the COVID-19 pandemic. By providing evidence-based recommendations and insights into the effectiveness of

COVID-19 policies, our study aims to inform decision-making processes and contribute to the development of more targeted and impactful interventions. Ultimately, our research seeks to advance the collective effort in combating the pandemic and mitigating its adverse effects on society.

3 Objectives

The main objectives of this project are as follows:

- To study the existing modeling techniques that detect/predict COVID-19 parameters using policies.
- To identify how our project differs from existing studies and evaluate its significance in the present day.
- To analyze government policies implemented from raw data and make the dataset suitable for AI analysis.
- To design and implement machine learning modelings that learn about these policies from our prepared dataset.
- We aim to conduct time series analysis on Covid-19 cases and build a clustering model for government policies worldwide.
- To evaluate these models.
- To outline any future scope of work.

4 Problem Statement

The COVID-19 pandemic presents unprecedented challenges to governments and policymakers worldwide, requiring swift and effective interventions to mitigate its spread and impact on public health and socioeconomic well-being. However, determining the most appropriate and effective policy responses amidst the evolving nature of the pandemic remains a complex and multifaceted challenge. With the plethora of policy interventions implemented by governments globally, there is collective motion towards their comprehensive understanding, effectiveness and impact on mitigating the spread of the virus and reducing associated morbidity, mortality, and socioeconomic disruption. Following up on this motion, we utilise OxCGRT dataset, which has also been cited by Our World in Data, to understand the effect of policy measures on the spread of the virus and also, analyse policy decisions taken by different governments.

5 Dataset Description

The dataset used was obtained from github repo at https://github.com/OxCGRT/covid-policy-dataset/tree/main.
For our project, we are using the compact version out of the 27 csv files in the repo, which has about 202760 entries with 56 columns.

5.1 Overview

Size: The dataset contains 202760 rows that have been collected by the oxford tracker based on the policies implemented by the government in national jurisdiction.
Type: The dataset is tabular, organized in rows and columns.

5.2 Columns and their significance

As the number of columns are large and would take up a lot of space if individually explained, we have opted to create a table with all the columns with a concise description of each along with their data type.

Table 1: Oxford OxCGRT dataset.

Beginning of Table			
ID	Description	Measurement	Data type and coding(if provided)
CountryName	Name of the Country	-	Object
CountryCode	ISO Country Code	-	Object
RegionName	Name of the region within the country	-	Float64
RegionCode	Code for the region	-	Float64
Jurisdiction	Level of jurisdiction (national or sub-national).	-	Object
Date	Date of the record in YYYYMMDD.	-	Int64

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
C1M_School Closing	Record closings of schools and universities	Ordinal scale	0 - no measures 1 - recommend closing or all schools open with alterations resulting in significant differences compared to non-Covid-19 operations 2 - require closing (only some levels or categories, eg just high school, or just public schools) 3 - require closing all levels Blank - no data
C1M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
C2M_Workplace closing	Record closings of workplaces	Ordinal Scale	0 - no measures 1 - recommend closing (or recommend work from home) or all businesses open with alterations resulting in significant differences compared to non-Covid-19 operation 2 - require closing (or work from home) for some sectors or categories of workers 3 - require closing (or work from home) for all-but-essential workplaces (eg grocery stores, doctors) Blank - no data
C2M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
C3M_Cancel public events	Record cancelling public events	Ordinal Scale	0 - no measures 1 - recommend cancelling 2 - require cancelling Blank - no data
C3M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
C4M_Restrictions on gatherings	Record the cut-off size for limits on gatherings	Ordinal scale	0 - no restrictions 1 - restrictions on very large gatherings (the limit is above 1000 people) 2 - restrictions on gatherings between 101-1000 people 3 - restrictions on gatherings between 11-100 people 4 - restrictions on gatherings of 10 people or less Blank - no data
C4M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
C5M_Close public transport	Record closing of public transport	Ordinal Scale	0 - no measures 1 - recommend closing (or significantly reduce volume/route/means of transport available) 2 - require closing (or prohibit most citizens from using it) Blank - no data
C5M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
C6M_Stay at home requirements	Record orders to ”shelter-in-place” and otherwise confine to the home	Ordinal Scale	0 - no measures 1 - recommend not leaving house 2 - require not leaving house with exceptions for daily exercise, grocery shopping, and ’essential’ trips 3 - require not leaving house with minimal exceptions (eg allowed to leave once a week, or only one person can leave at a time, etc) Blank - no data
C6M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
C7M_Restriction on internal movement	Record restrictions on internal movement between cities/regions	Ordinal scale	0 - no measures 1 - recommend not to travel between regions/cities 2 - internal movement restrictions in place Blank - no data
C7M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
C8EV_International travel records	Record restrictions on international travel Note: this records policy for foreign travellers, not citizens	Ordinal scale	0 - no restrictions 1 - screening arrivals 2 - quarantine arrivals from some or all regions 3 - ban arrivals from some regions 4 - ban on all regions or total border closure Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
E1M_Income support	Record if the government is providing direct cash payments to people who lose their jobs or cannot work. Note: only includes payments to firms if explicitly linked to payroll/salaries	Ordinal scale	0 - no income support 1 - government is replacing less than 50% of lost salary (or if a flat sum, it is less than 50% median salary) 2 - government is replacing 50% or more of lost salary (or if a flat sum, it is greater than 50% median salary) Blank - no data
E1_Flag		Binary flag for sectoral scope	0 - formal sector workers only or informal sector workers only 1 - all workers
E2_Debt/contract relief	Record if the government is freezing financial obligations for households (eg stopping loan repayments, preventing services like water from stopping, or banning evictions)	Ordinal scale	0 - no debt/contract relief 1 - narrow relief, specific to one kind of contract 2 - broad debt/contract relief
E3_Fiscal measures	Announced economic stimulus spending	USD	Record monetary value in USD of fiscal stimuli, includes any spending or tax cuts NOT included in E4, H4 or H5 0 - no new spending that day Blank - no data
E4_International support	Announced offers of Covid-19 related aid spending to other countries	USD	Record monetary value in USD 0 - no new spending that day Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
H1_Public information campaigns	Record presence of public info campaigns	Ordinal scale	0 - no Covid-19 public information campaign 1 - public officials urging caution about Covid-19 2- coordinated public information campaign (eg across traditional and social media) Blank - no data
H1_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
H2_Testing policy	Record government policy on who has access to testing	Binary flag for geographic scope	0 - no testing policy 1 - only those who both (a) have symptoms AND (b) meet specific criteria (eg key workers, admitted to hospital, came into contact with a known case, returned from overseas) 2 - testing of anyone showing Covid-19 symptoms 3 - open public testing (eg "drive through" testing available to asymptomatic people) Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
H3_Contact tracing	Record government policy on contact tracing after a positive diagnosis	Ordinal scale	0 - no contact tracing 1 - limited contact tracing; not done for all cases 2 - comprehensive contact tracing; done for all identified cases H4_Emergency investment in healthcare Announced short term spending on healthcare system, eg hospitals, masks, etc Note: only record amount additional to previously announced spending USD Record monetary value in USD 0 - no new spending that day Blank - no data
H5_Investment in vaccines	Announced public spending on Covid-19 vaccine development Note: only record amount additional to previously announced spending	USD	Record monetary value in USD 0 - no new spending that day Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
H6M_Facial Covering	Record policies on the use of facial coverings outside the home	Ordinal scale	0 - No policy 1 - Recommended 2 - Required in some specified shared/public spaces outside the home with other people present, or some situations when social distancing not possible 3 - Required in all shared/public spaces outside the home with other people present or all situations when social distancing not possible 4 - Required outside the home at all times regardless of location or presence of other people
H6M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
H7_Vaccination policy	Record policies for vaccine delivery for different groups	Ordinal scale	0 - No availability 1 - Availability for ONE of following: key workers/ clinically vulnerable groups (non elderly) / elderly groups 2 - Availability for TWO of following: key workers/ clinically vulnerable groups (non elderly) / elderly groups 3 - Availability for ALL of following: key workers/ clinically vulnerable groups (non elderly) / elderly groups 4 - Availability for all three plus partial additional availability (select broad groups/ages) 5 - Universal availability
H7_Flag		Binary flag for cost	0 - At cost to individual (or funded by NGO, insurance, or partially government funded) 1- No or minimal cost to individual (government funded or subsidised) Blank - no data

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
H8M_Protection of elderly people	Record policies for protecting elderly people (as defined locally) in Long Term Care Facilities and/or the community and home setting	Ordinal scale	0 - no measures 1 - Recommended isolation, hygiene, and visitor restriction measures in LTCFs and/or elderly people to stay at home 2 - Narrow restrictions for isolation, hygiene in LTCFs, some limitations on external visitors and/or restrictions protecting elderly people at home 3 - Extensive restrictions for isolation and hygiene in LTCFs, all non-essential external visitors prohibited, and/or all elderly people required to stay at home and not leave the home with minimal exceptions, and receive no external visitors Blank - no data
H8M_Flag		Binary flag for geographic scope	0 - targeted 1- general Blank - no data
V1_Vaccine prioritisation (summary)	Reports the existence of a prioritised plan for vaccine rollout	Ordinal scale	Blank – no data 0 - no plan 1 – a prioritised plan is in place 2 – universal/general eligibility; no prioritisation between groups

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
V2_Vaccine Availability (summary)	Reports whether any categories of people are receiving vaccines	Ordinal scale	Blank – no data 0 – no categories are receiving vaccines 1 – vaccines are available to some categories 2 – vaccines are available to anyone over the age of 16 yrs 3 – vaccines are available to anyone over the age of 16 yrs PLUS one or both of 5-15 yrs and 0-4 yrs
V2B_Vaccine age eligibility/availability age floor(General population summary)	Reports lowest age range of general population being vaccinated	Numerical	Blank – no data 0 – no categories are receiving vaccines numerical range – Lowest age range for 'General' category
V2C_Vaccine age eligibility/availability age floor(At-risk population summary)	Reports lowest age range of at risk population being vaccinated	Numerical	Blank – no data 0 – no categories are receiving vaccines numerical range – Lowest age range from either 'General' or 'At-risk' categories

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
V2D_Medically/ clinically vulnerable (Non-elderly)	Reports the number of categories selected from thematic group: V2_At risk age ranges below 60 (one or more selected counts as 1 x category) V2_Clinically vulnerable/chronic illness/significant underlying health condition (excluding elderly and disabled) V2_Disabled people V2_Pregnant people V2_People living with a vulnerable/shielding person or other priority group	Ordinal	Blank – no data 0 – no categories are receiving vaccines 1 – 1 or 2 categories in group selected 2 – 3 or more categories selected or all from V2_General 16-19 years up to V2_General 80+ years present
V2E_Education	Reports the number of categories selected from thematic group: V2_Educators V2_Primary and secondary school students V2_Tertiary education students	Ordinal	Blank – no data 0 – no categories are receiving vaccines 1 – 1 category in group selected 2 - 2 or more categories selected or all from V2_General 16-19 years up to V2_General 80+ years present

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
V2F_Frontline workers (non healthcare)	Reports the number of categories selected from thematic group: V2_Police/first responders V2_Airport/Border/Airline staff V2_Factory workers V2_Frontline retail workers V2_Military V2_Other high contact professions/groups (taxi drivers, security guards) V2_Frontline/essential workers (when subcategories not specified) (triggers an automatic 2)	Ordinal	Blank – no data 0 – no categories are receiving vaccines 1 – 1 or 2 categories in group selected 2 - 3 or more categories selected or all from V2_General 16-19 years up to V2_General 80+ years present
V2G_Frontline workers (healthcare)	Reports the number of categories selected from thematic group: V2_Staff working in an elderly care home V2_Healthcare workers/carers (excluding care home staff)	Ordinal	Blank – no data 0 – no categories are receiving vaccines 1 – 1 category in group selected 2 - 2 categories selected or all from V2_General 16-19 years up to V2_General 80+ years present

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
V3_Vaccine Financial Support (summary)	Reports the overall approach taken to vaccine funding – whether paid by the individual or the government	Ordinal scale	Blank - no data 0 – no availability 1 – full cost to the individual for all categories identified in V2 2 – full cost to the individual for some categories identified in V2, some subsidy for other categories 3- partial funding by the government for all of the categories identified in V2 4 – partial funding by the government for some categories identified in V2, full funding for other categories 5 – all categories fully funded by the government
V4_Mandatory Vaccination (summary)	Reports the existence of a requirement to be vaccinated	Binary	Blank - no data 0 – no requirement to be vaccinated 1 – requirement to be vaccinated is in place for one or more groups
ConfirmedCases	The cumulative number of reported covid-19 cases since the beginning of the pandemic	Number	Number of covid-19 cases
ConfirmedDeaths	The cumulative number of deaths attributed to covid-19 since the beginning of the pandemic	Number	Number of covid-19 deaths

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
Majority Vaccinated	Record a binary indicator of majority (non-)vaccinated.	Binary indicator	NV - the majority of the population is unvaccinated (used in jurisdictions where we do not have regular vaccination rate data) V - the majority of the population is vaccinated (used in jurisdictions where we do not have regular vaccination rate data) Blank - no data
Population Vaccinated	The percentage of fully vaccinated population in the jurisdiction, or, depending on data availability, a binary indicator of whether the majority of people are unvaccinated or vaccinated.	Percentage OR binary indicator	Number - the proportion of the population that is reported as vaccinated by that jurisdiction Under 50%* - the majority of the population is unvaccinated (used in jurisdictions where we do not have regular vaccination rate data) Over 50%* - the majority of the population is vaccinated (used in jurisdictions where we do not have regular vaccination rate data) Blank - no data
Stringency Index_Average	Weighted Average of C1, C2, C3, C4, C5, C6, C7, C8 and H1		
Government Response Index_Average	Weighted Average of C1, C2, C3, C4, C5, C6, C7, C8, E1, E2, H1, H2, H3, H6, H7, H8		

Continuation of Table 1			
ID	Description	Measurement	Data type and coding(if provided)
Containment Health Index_Average	Weighted Average of C1, C2, C3, C4, C5, C6, C7, C8, H1, H2, H3, H6, H7, H8		
Economic Support Index	Weighted Average of E1 and E2		
End of Table			

6 Analysis & Data Representation

Our project revolves around an extensive exploration of COVID-19 policy data sourced from the Oxford COVID-19 Government Response Tracker (OxCGRT). The primary objective of this endeavor is to comprehensively understand the dataset's intricacies, unveil underlying patterns, discern evolving trends, and illuminate significant relationships within the data. Through meticulous visualization and analysis, we aim to equip stakeholders with actionable insights to drive informed decision-making amidst the pandemic's complexities. The code for our comprehensive Exploratory Data Analysis (EDA) can be accessed here.

6.1 Key Steps in Exploratory Data Analysis (EDA)

Our EDA process unfolds through several key stages:

1. Initial Data Inspection and Cleansing: We commenced our journey by inspecting the dataset's columns to gauge their relevance and significance. Recognizing redundancies, we dropped the `RegionName`, `RegionCode`, and `CountryName` columns, opting to retain only the `CountryCode` for national-level analysis. Subsequently, we converted the date column into a datetime format for seamless manipulation. Identifying and handling missing values, we diligently curated the dataset to ensure its integrity and quality.

2. Feature Engineering and Reduction: Leveraging categorical encoding, we transformed object data types into categorical types, facilitating effective visualization and analysis. We pruned redundant columns, such as `Jurisdiction`, which harbored a single unique value, streamlining our dataset for focused analysis.

3. Uni-Variate Analysis and Visualization: Through uni-variate analysis, we delved into individual columns, unraveling their distributions and characteristics. Employing histograms, bar charts, and other visual aids, we meticulously scrutinized each feature's nuances, ultimately reducing our dataset to a concise yet insightful set of 40 essential columns.

4. Exploring Correlations: Our analysis culminated in the examination of correlations between different policy measures and outcomes. Utilizing correlation matrices, we unearthed significant relationships, such as the robust correlation between vaccination prioritization and availability. These insights serve as invaluable inputs for regression models and predictive analytics, informing strategic decision-making in public health policy.

6.2 Key Findings and Insights

1. Data Consistency and Completeness: The uniform count across all features underscores the dataset's consistency and completeness, assuring its reliability for robust analysis.

2. Policy Measures and Variability: Mean values across policy measures exhibit substantial variability, reflecting diverse approaches to policy implementation. Notably, fiscal measures and international support manifest extreme variability, underscoring the heterogeneity of responses across regions.

3. Impact of Policy Interventions: Analysis of percentiles and medians unveils the prevalence and distribution of policy measures, shedding light on their collective impact. Notably, the 75th percentile underscores the widespread adoption of stringent policies across various domains.

4. Extreme Outliers and Disparities: The presence of extreme outliers in fiscal measures underscores the heterogeneous nature of financial responses to the crisis. Furthermore, disparities in vaccination rates highlight the urgent need for equitable vaccine distribution and access.

Upon analyzing the correlation matrix, several noteworthy observations have emerged:

1. Vaccine Prioritization and Availability: A robust linear relationship, evidenced by a high correlation coefficient of 0.94 between V1_Vaccine Prioritization (summary) and V2A_Vaccine Availability (summary), underscores their significant interconnection. This finding holds profound implications for regression models aiming to forecast confirmed cases or vaccine adoption rates. However, it's imperative to exercise caution regarding multicollinearity and explore the possibility

of amalgamating these features into a comprehensive metric that encapsulates the intricacies of vaccination strategies.

2. Workplace Closures and Government Response Index: The substantial correlation coefficient of 0.75 between C2M_Workplace closures and GovernmentResponseIndex_Average underscores the pivotal role of workplace closures in shaping governmental responses to the pandemic. This insight is instrumental in categorizing countries into distinct clusters based on the efficacy and nature of their response strategies. By dissecting these clusters, we can discern which policy combinations, such as stringent lockdowns versus targeted interventions, yield favorable health outcomes and facilitate economic recovery. This nuanced understanding enhances our comprehension of policy effectiveness and aids in devising tailored response strategies.

Note: For a clear view, please zoom into the graphs.

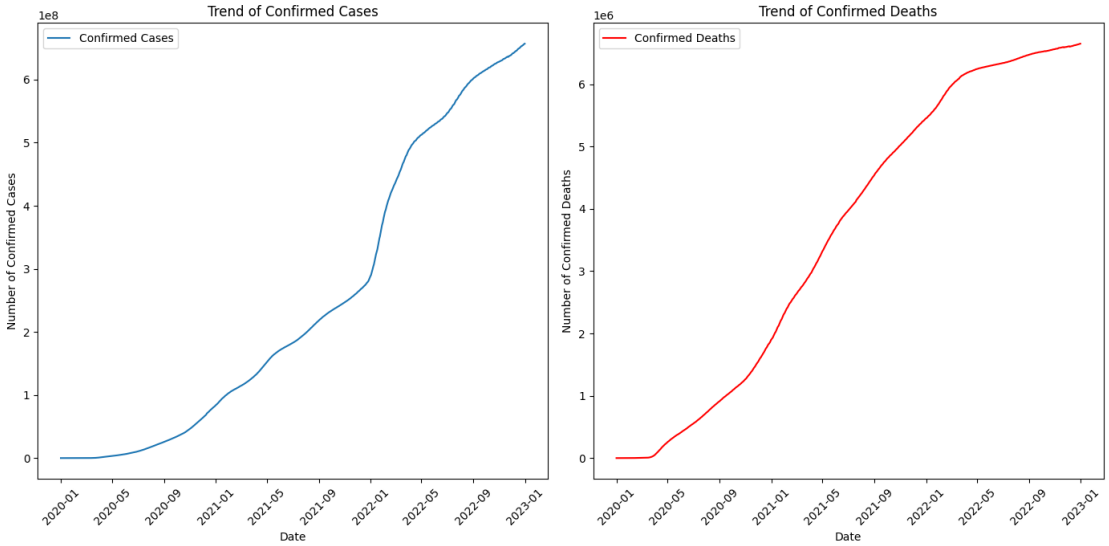

Figure 1: Confirmed Cases and Deaths Trend

The graph(**figure 1**) depicting confirmed cases displays a sharp incline, while the graph for confirmed deaths exhibits a gentler slope, alluding to a potential decline in fatality rate or advancements in case treatment and management or underreporting of cases in the early stages of the pandemic. This visual representation is especially well suited for analyzing the correlation between the trend of confirmed cases and confirmed deaths—an essential factor in evaluating the gravity and mortality rate of the pandemic in the course of time.

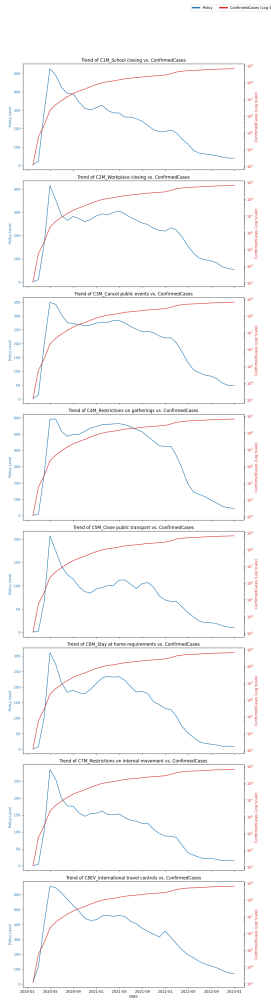

Figure 2: Containment Policies and Confirmed Cases

Containment policies(**figure 2**) often exhibit a lag effect, meaning that their impact on confirmed cases may not be immediately evident but rather become visible after a certain period of time following their implementation. This highlights the time needed for these policies to influence population behavior and ultimately affect case numbers. Moreover, it may also indicate that these measures were taken in response to the spread of the virus and not proactively. This graph is particularly useful in comprehending the timeline of how containment policies impact case numbers, a crucial factor in predictive modeling.

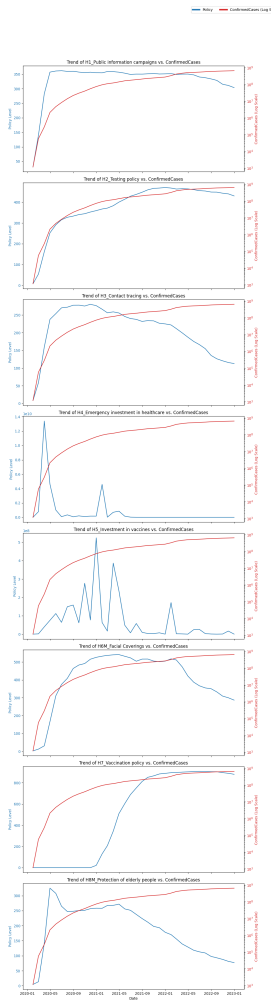

Figure 3: Health System Response vs. Confirmed Cases

The success of health system policies(**figure 3**) on confirmed cases varies depending on the state of healthcare infrastructure and public compliance with health guidelines. These policies were ramped up as soon as the cases increased, a direct response to rising demand for healthcare services. This makes them a valuable tool for assessing the relationship between policies and the number of confirmed cases, ultimately revealing the efficiency and capability of healthcare responses.

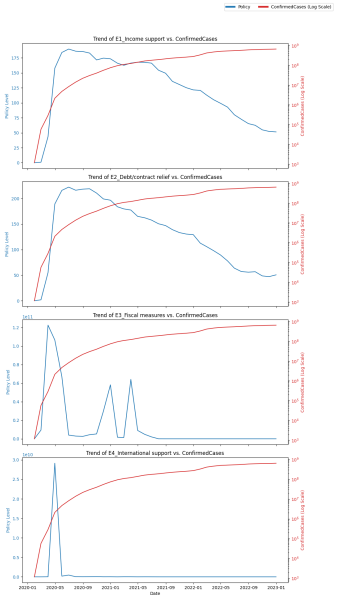

Figure 4: Economic Support vs. Confirmed Cases

The connection between economic support and confirmed cases may demonstrate an opposite association(**figure 4**), as it could assist individuals in following containment protocols. Timing and scale of this support seems reactive to the waves of the pandemic (from personal experience). This chart serves as an effective tool for analyzing the potential correlation between economic support measures and confirmed cases, potentially revealing the impact of financial assistance in containing the spread by enabling individuals to stay at home.

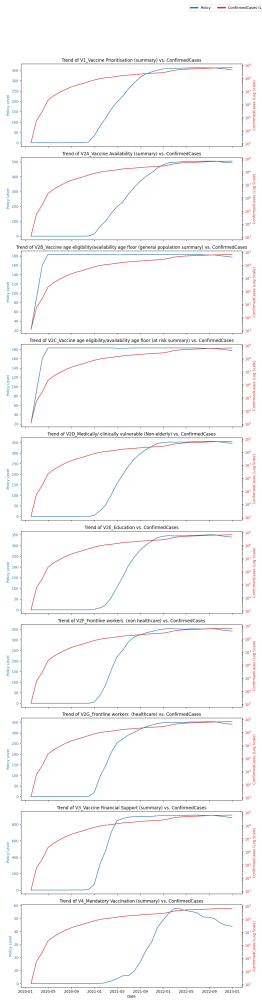

Figure 5: Vaccine Policy vs. Confirmed Cases

An observable trend could be the lag between vaccine policy implementation and its effect on case numbers(**figure 5**), which might be due to the time needed to achieve effective vaccination coverage. This plot is suitable for assessing the direct impact of vaccination policies on confirmed cases over time.

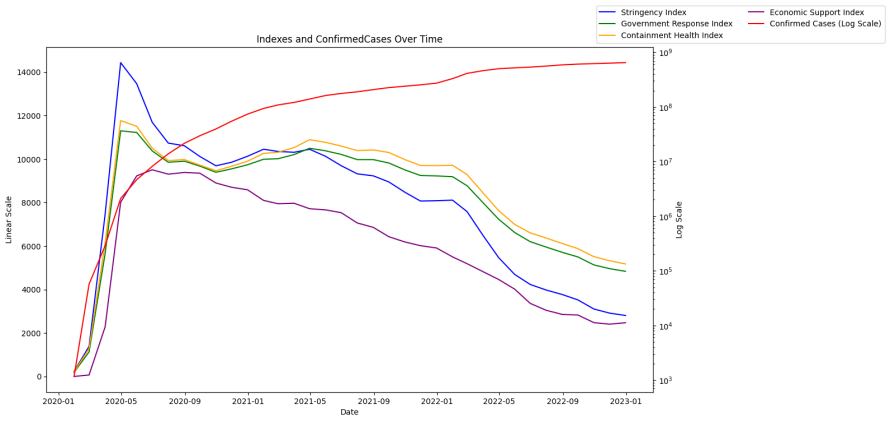

Figure 6: Indexes and Confirmed Cases Over Time

One could observe lag effects in which the implementation of policies may not have an immediate impact on case numbers(**figure 6**), as the virus has an incubation period and policies take time to be effective. This line graph is ideal for conducting a time series analysis to comprehensively grasp the effects of varying policy indexes on confirmed cases over time.
In general for confirmed cases we have observed lag effect because we believe policies affected the rate of change for Covid-19 cases in simpler terms reducing the spread of the virus

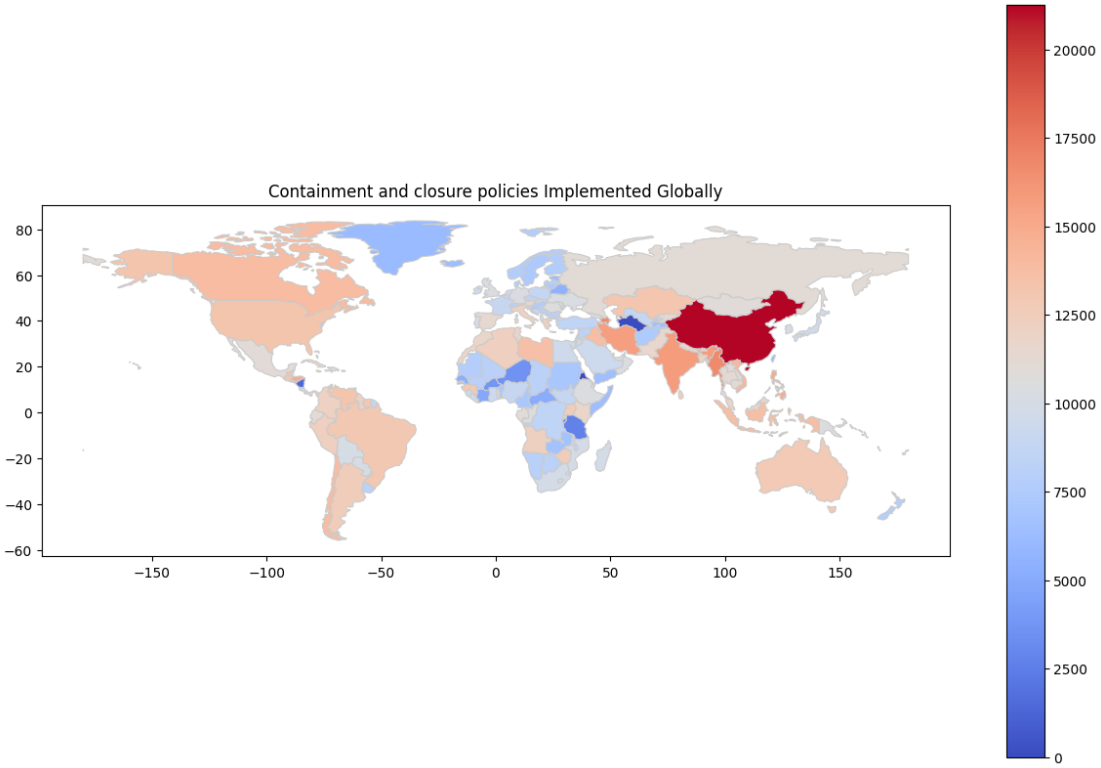

Figure 7: Containment and Closure Policies Map

This map(**figure 7**) plays a crucial role in monitoring the distribution and impact of containment measures, making it ideal for cross-country comparisons of lockdown effects. By looking at the global map, distinct variations can be seen in both the timing and strictness of lockdown measures, which could possibly account for the disparities in case numbers between different regions. Notably, the map highlights how containment and closure policies have spread across the world with varying levels of enforcement. It is interesting to note that countries with larger urban populations and higher confirmed case numbers tend to have more stringent containment and closure policies in place.

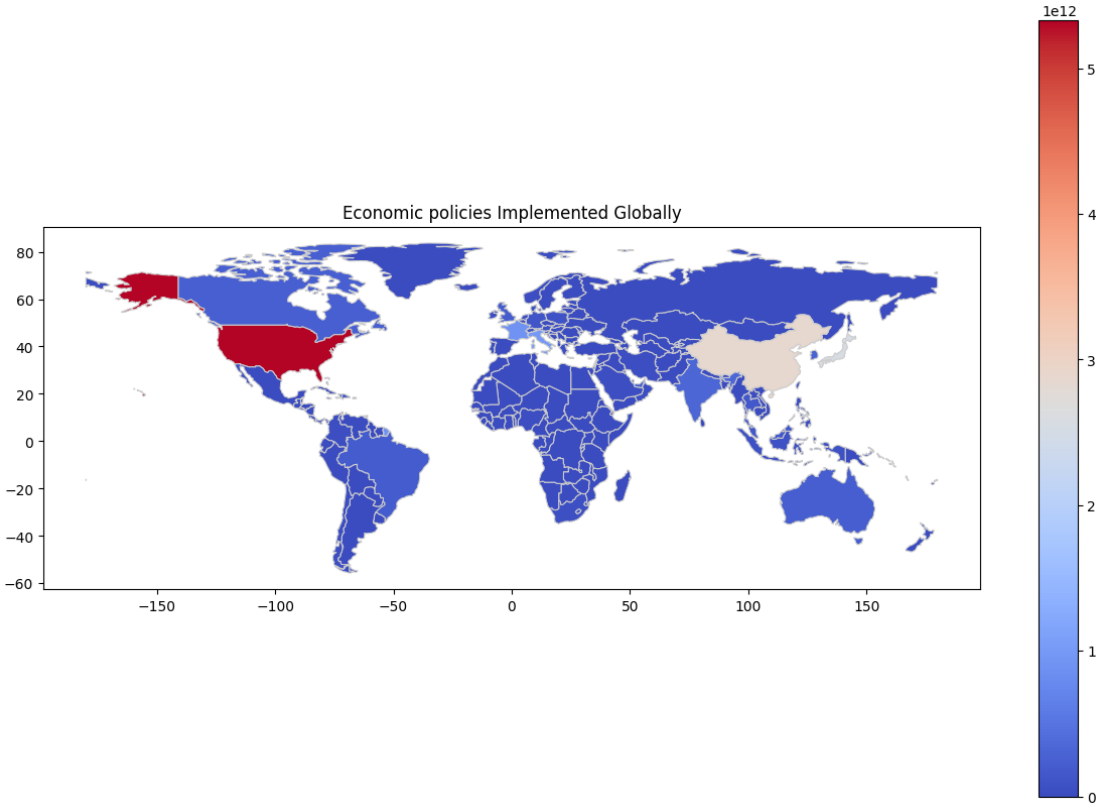

Figure 8: Economic Policies Map

The distribution of economic support measures among different countries may indicate the varying economic effects of the pandemic and governments' financial capabilities in providing aid(**figure 8**). By mapping out the economic support provided by various governments, we gain insight into how countries can be clustered based on their resilience in the face of economic challenges. This also gives us a closer look at the economic policies implemented by different nations in supporting their citizens, potentially revealing the correlation between these policies and the pandemic's impact on each region. Moreover, a noticeable concentration of economic measures in wealthier countries suggests their ability to afford more costly forms of economic aid.

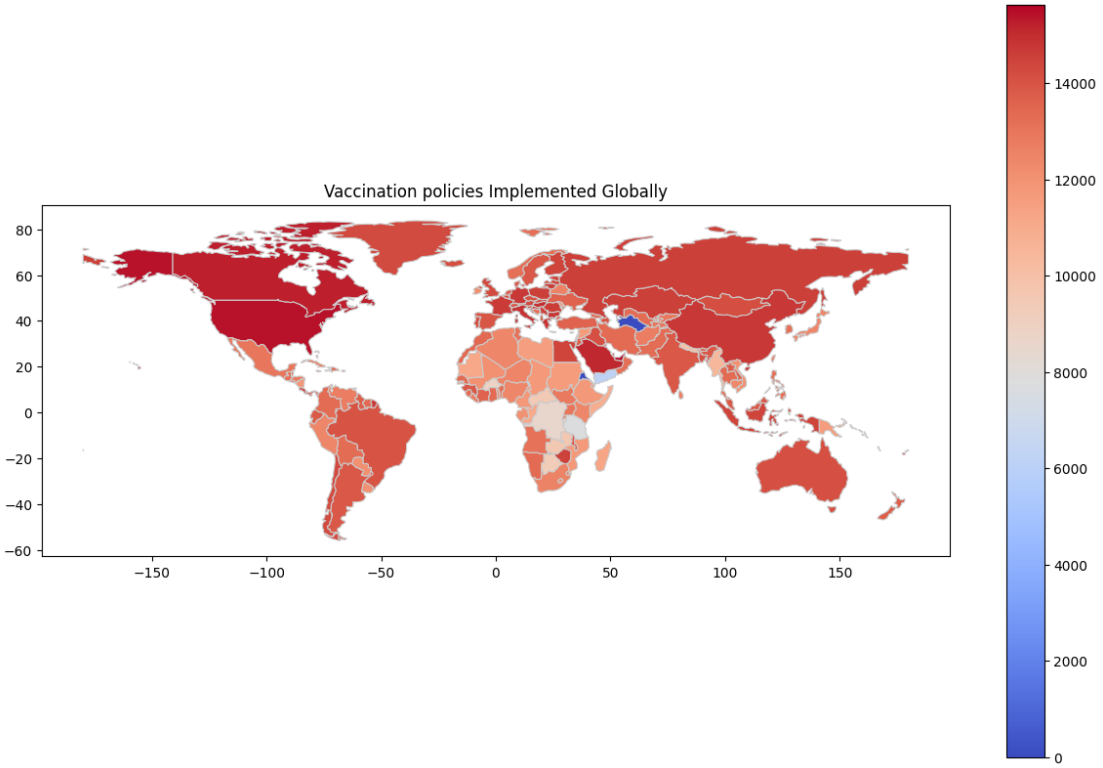

Figure 9: Health System Policies Map

It is plausible that there exists a clear link between nations that have well-developed health system policies and their ability to effectively cope with the consequences of the pandemic. Notably, countries with higher income tend to have more comprehensive health system policies in place(**figure 9**), which suggests a proactive approach to handling healthcare resources during this crisis. The map presented effectively displays the discrepancies in health policy reactions, serving as a valuable tool for grouping countries according to their readiness and response in terms of health systems.

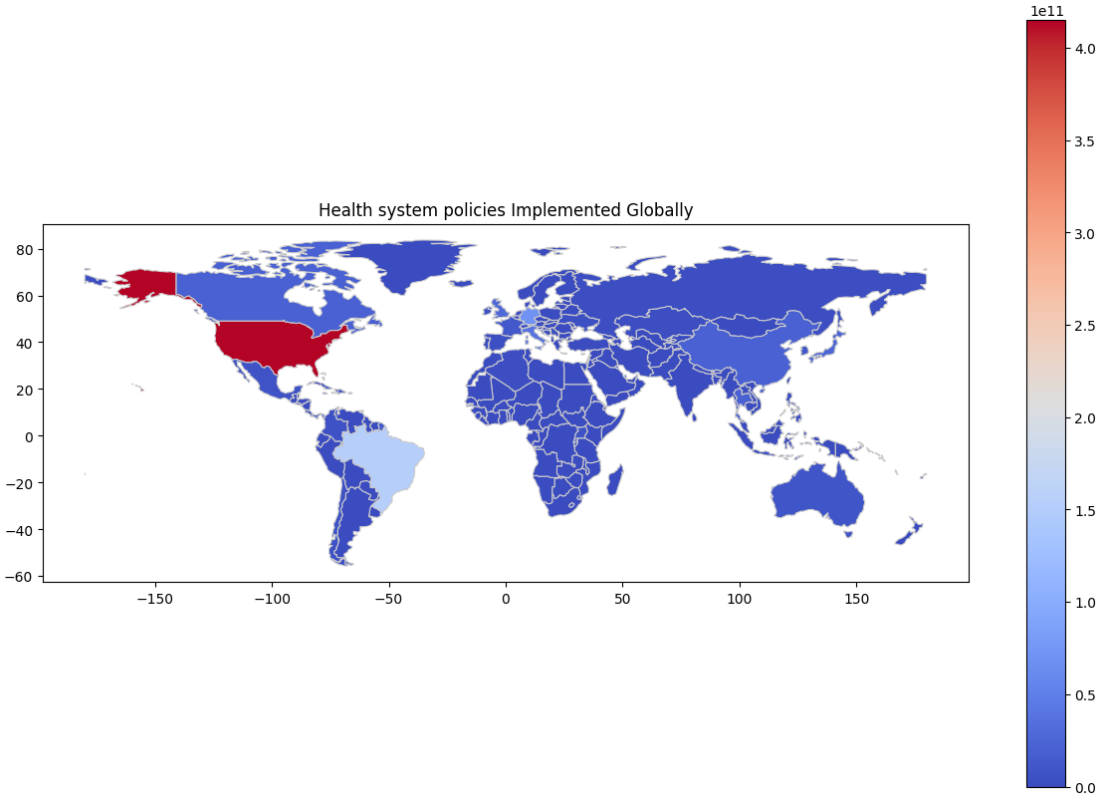

Figure 10: Vaccination Policies Map

It is probable that the graph(**figure 10**) depicts a concentration of more robust vaccination policies in specific regions, potentially linked to vaccine availability and healthcare systems. This visual representation is particularly useful for recognizing discrepancies in vaccine policy implementation worldwide, as this is crucial for comprehending the allocation of vaccine resources and order of priority.

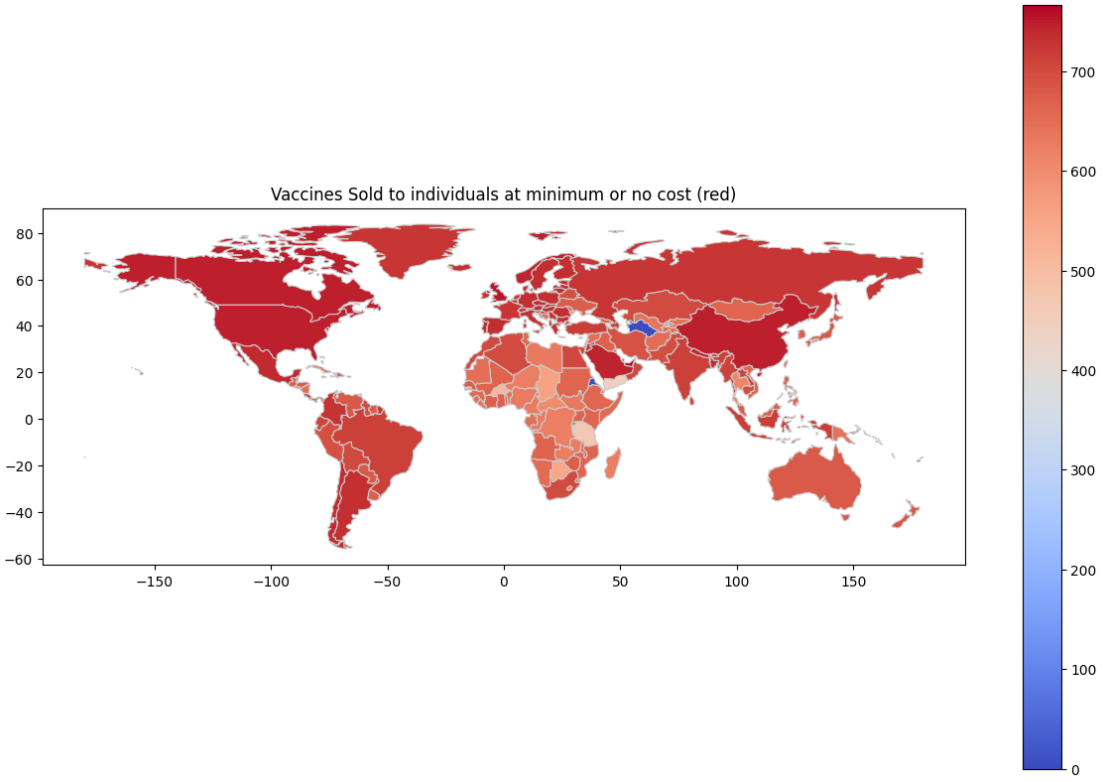

Figure 11: Policy Indices Map

This map(**figure 11**) serves as a swift tool to compare policy indices across the globe, allowing for the grouping of countries based on their overall pandemic response. The darker hues on the Stringency Index suggest a heightened level of containment measures, possibly indicating a more forceful approach. The Government Response Index's darker regions represent inclusive government actions beyond health protocols, such as fiscal and social policies. Likewise, darker shades on the Containment Health Index may highlight strong health responses, signaling improved healthcare capacity or a targeted healthcare strategy. The Economic Support Index indicates that in darker regions, economic interventions may have been given higher priority as a way to address the effects of the pandemic.

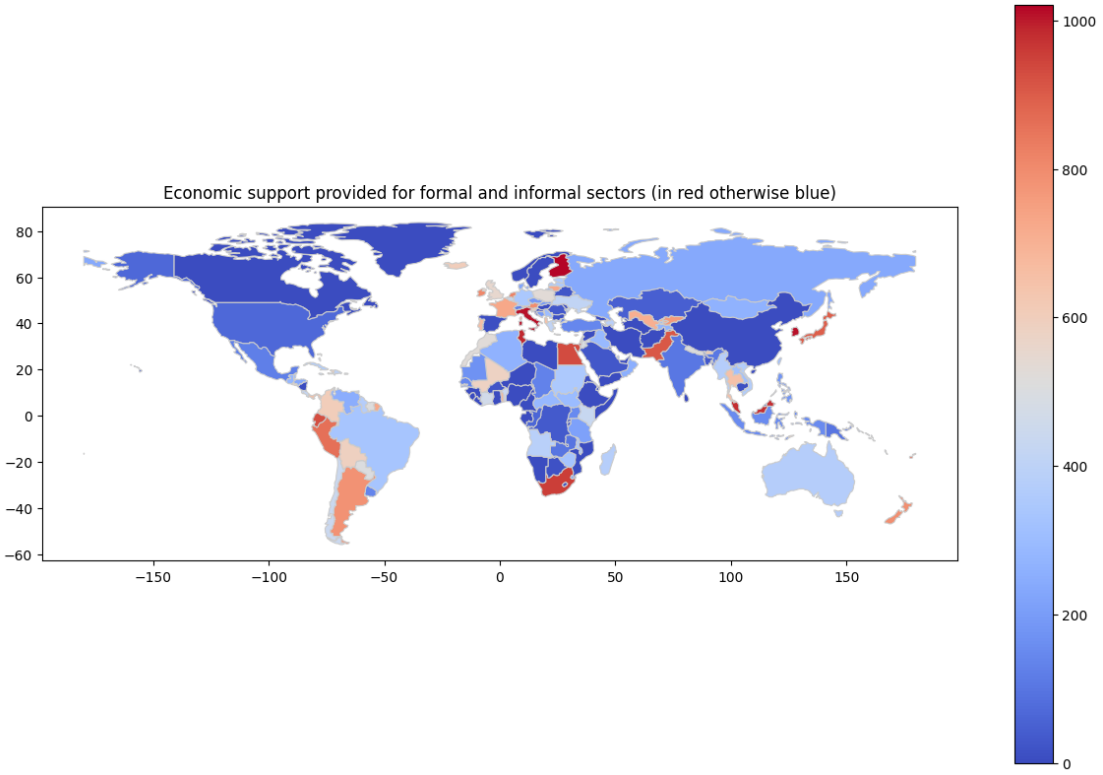

Figure 12: Economic Support Provided for Formal and Informal Sectors

The map's(**figure 12**) varying shades of red and blue reveal that economic support is not evenly distributed among countries. The deep red regions may suggest robust assistance for both formal and informal sectors, potentially resulting in a more reliable safety net for communities during pandemic-induced economic crises. This map effectively allows for a comparison of aid given to both formal and informal sectors, providing insight into the extent and inclusivity of economic relief efforts during this challenging time.

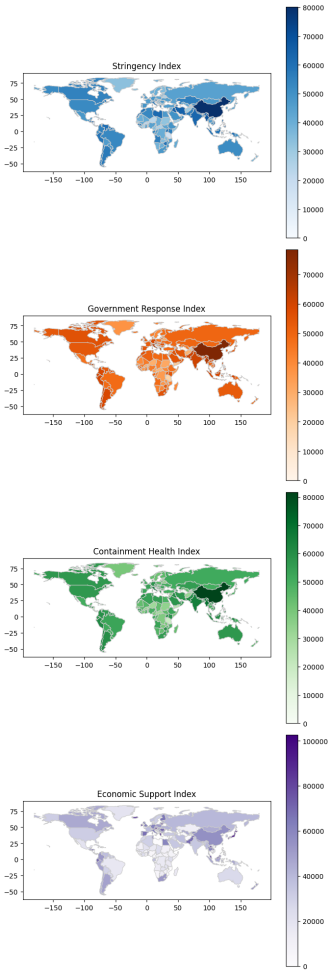

Figure 13: Vaccines Sold to Individuals at Minimum or No Cost

The striking prevalence of red hues on the map(**figure 13**) reflects the widespread implementation of policies aimed at providing vaccines to individuals at little or no cost in numerous countries. This serves as compelling evidence of a global paradigm shift towards increasing accessibility of vaccinations - a crucial element in the success of immunization efforts. With its ability to assess both the availability and affordability of vaccines across various regions, this map serves as a powerful tool in deciphering global vaccination tactics.

The diversity of approaches to addressing the pandemic is reflected in each map, offering valuable insights into how various regions have tackled everything from healthcare to economic interventions. These perspectives can not only aid in predicting future outcomes, but also facilitate international comparisons and the exchange of successful

tactics. The visual data, showcasing trends and distinct color intensities, can assist decision makers in evaluating the efficacy of different strategies and informing future action plans.