COMPARATIVE PERFORMANCE ASSESSMENT OF HEALTH SYSTEMS IN THE UNITED KINGDOM, FRANCE, AND ITALY IN ADDRESSING THE HEALTH AND ECONOMIC CONSEQUENCES OF COVID-19.

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AGENDA:

1. Indicators

- 1.1 Pandemic Response Effectiveness
- 1.2 Addressing Health Consequences of the COVID-19
- 1.3 Addressing Health Consequences of the COVID-19

2. Data

- 2.1 Overview
- 2.2 Selection of Countries
- 2.3 Data Sources and Summary Statistics

3. Methods

WHO. The World Health Report 2000

“Health systems encompass all organizations, institutions, and resources, related to service provision, financing, and stewardship, which are devoted to producing health actions”

INDICATORS to assess health system performance

Pandemic Response Effectiveness

- Tests per Confirmed Case
- Fully Vaccinated Population per 100
- Government Response Stringency Index

Addressing Health Consequences of the COVID-19

- Excess Mortality
- Case Fatality Rate (CFR)
- ICU Occupancy per million

Addressing Economic Consequences of the COVID-19

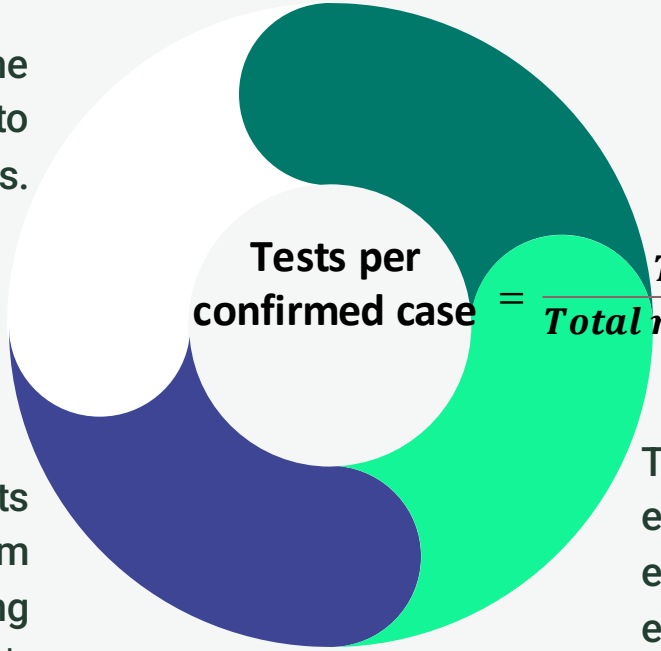
- GDP Growth Rate
- Unemployment Rate
- Consumer Confidence Index

1 INDICATORS

1.1 Pandemic Response Effectiveness

COVID-19 Testing Level

Crucial indicator of the healthcare system's ability to detect and monitor the virus.



Shows the number of tests conducted for each new confirmed case of COVID-19.

$$\text{Tests per confirmed case} = \frac{\text{Tests per confirmed case}}{\text{Total number of confirmed cases}}$$

A higher number suggests an effective health system in identifying and isolating cases*.

This indicator encompasses effectiveness, efficiency, equity, and captures both structural and process components of the healthcare system.

*Liang, L. L., Tseng, C. H., Ho, H. J., & Wu, C. Y. (2020). Covid-19 mortality is negatively associated with test number and government effectiveness.

Vaccination Coverage

Fully vaccinated population per 100

The total number of people who have received all the doses prescribed by the initial vaccination protocol per 100 people in the total population

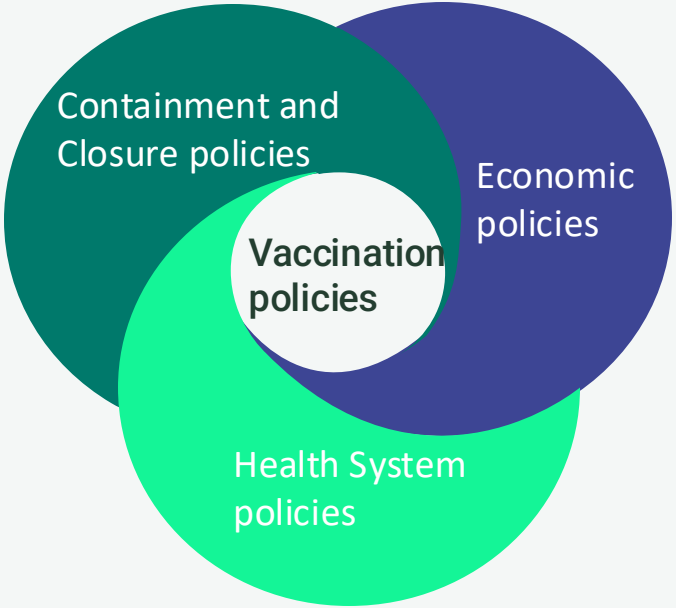
Provides a standardized measure of the population's complete vaccination coverage, which is essential for reducing the spread and severity of COVID-19 cases*

Encompasses safety, effectiveness, efficiency, timeliness, and equity of the healthcare system, and captures structural, process and outcome components.

* Moghadas, S. M., Vilches, T. N., Zhang et al.The impact of vaccination on COVID-19 outbreaks. (2021).

Government Response Stringency Index

Health systems performance can be greatly influenced by government policies



Vaccination policies prioritize population groups, secure vaccine supply, and promote vaccine uptake

Differences in vaccination policies and preferences across countries can impact the efficiency and effectiveness of vaccination efforts

Hale, T., Angrist, N., Goldszmidt, R. et al.
Oxford COVID-19 Government Response Tracker

1 INDICATORS

1.2 Addressing Health Consequences of the COVID-19

Excess Mortality

- **Estimates the additional deaths within a given time period, surpassing the limitations of relying solely on confirmed COVID-19 fatalities ***
- **Includes unreported or misdiagnosed cases**
- **Accounts for indirect deaths from societal and healthcare disruptions**

★ **Captures the domains of effectiveness and safety of healthcare systems, and the outcome and process components**

P-Scores for all ages

$$P-score = \frac{Reported\ Deaths - Projected\ Deaths}{Projected\ Deaths} * 100\%$$

Standardized metric allowing for cross-country comparisons of excess mortality

*Thomas Beaney et al., "Excess Mortality: The Gold Standard in Measuring the Impact of COVID-19, 2020

Case Fatality Rate (CFR)

$$CFR = \frac{Number\ of\ confirmed\ COVID-19\ deaths}{Number\ of\ COVID-19\ cases} * 100\%$$

+

- **Estimates the virus lethality**
- **Monitoring CFR over time provides insights into evolving health consequences***
- **Captures effectiveness, safety, and outcome components of healthcare systems**
- **readily calculated using available data on confirmed cases and deaths.**

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Can be influenced by factors like age distribution, healthcare quality, and case detection rates

* Robert Verity et al., "Estimates of the Severity of Coronavirus Disease 2019: A Model-Based Analysis

Intensive care unit (ICU) occupancy per million

- **Represents the number of COVID-19 patients in ICUs on a given day per million people**
- **Provides a snapshot of the current burden on the healthcare system, specifically intensive care units, relative to the population size**
- **Helps understand the capacity of the healthcare system to handle severe cases and meet the demand for critical care***

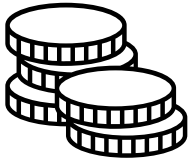
★ **Encompasses the domains of safety, effectiveness, efficiency and patient-centeredness, while capturing the structural and process components**

* World Health Organization. Indicators to Monitor Health-Care Capacity and Utilization for Decision-Making on COVID-19." 2022.

1 INDICATORS

1.2 Addressing Economic Consequences of the COVID-19

GDP growth rate



$$GDP\ Growth\ Rate = \left(\frac{Ending\ Value}{Beginning\ Value} - 1 \right) \times 100\%$$

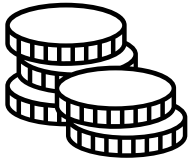
- **Provides an interpretable measure of economic growth**
- **Clearly shows whether the total economic output is accelerating or decelerating ***
- **Widely used and standardized measure, enabling easy comparison across countries**

Limitations:

- May not fully reflect the economic well-being of all individuals in a society
- Does not capture the specific sectoral impacts of the pandemic

*International Monetary Fund. Gross Domestic Product: An Economy's All.
**Deaton, A., & Schreyer, P. GDP, wellbeing, and health. 2022

Unemployment rate



Crucial indicator that directly captures the impact of the pandemic on the labor market

COVID-19 has led to widespread job losses due to lockdowns, reduced economic activity, and changes in consumer behavior

Health System

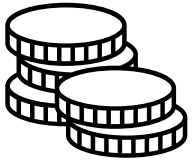
Loss of employer-sponsored health insurance, increasing the burden on public health systems

Financial stress and reduced access to healthcare can negatively impact mental and physical health outcomes *

Increased unemployment strain healthcare resources, as more people rely on public health services and emergency care

*Achdut, N., & Refaeli, T. Unemployment and psychological distress during the COVID-19 pandemic.2020

The consumer confidence index (CCI)



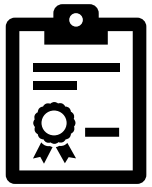
- **Measures the overall sentiment of consumers towards the economy and their personal financial situation in real-time**
- **Captures factors such as job security concerns, health risks, and uncertainty about the future during the pandemic ***
- **Considers not only financial aspects but also psychological and emotional dimensions**

- **Inflation rate**
- **CPI**

* Coibion, O., Gorodnichenko. The cost of the COVID-19 crisis: National Bureau of Economic Research. 20020

The adequacy of the chosen indicators was evaluated based on the criteria that Bojke et al. identified for an exemplary performance indicator to be considered for inclusion in a measure of health output (clarity, validity, measurability, consistency, attribution, and data availability).

After careful consideration, it was determined that all the selected indicators met these criteria satisfactorily.



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Data

1. Dataset Composition:

- Quarterly data from various sources (Table 1)
- Aggregated into a panel dataset
- 9 variables

2. Time Period:

- Q1 2020 – Q4 2022

3. Countries:

- France
- Italy
- the United Kingdom

Justification for Panel Data:

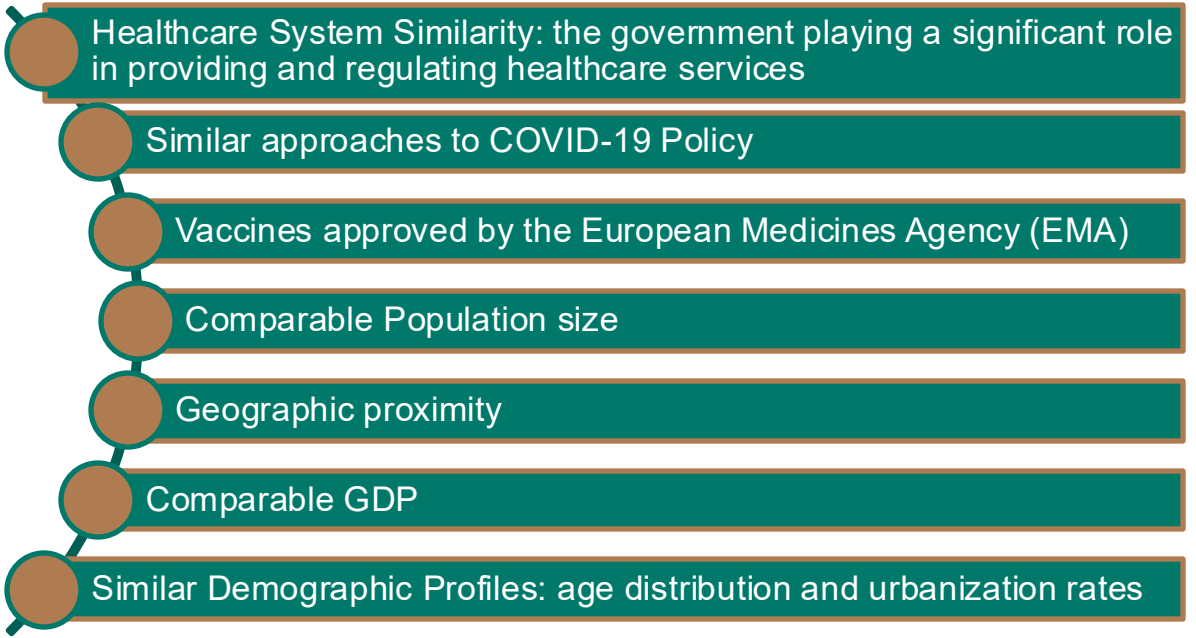
- Time-variant nature of variables
- Allows for analysis of changes over time and across countries

Selection of Countries for Comparison

The UK

France

Italy



Data Sources

Table 1

Variable	Data Sources	Unit
Tests per confirmed case	Our World in Data	Number
Fully Vaccinated Population per 100	Our World in Data	Number
Government Response Stringency Index	Oxford COVID-19 Government Response Tracker	Scale ranging from 0 to 100, where 100 is the strictest response
Excess Mortality	Our World in Data,	Percentages (%)
Case Fatality Rate (CFR)	Our World in Data	Percentages (%)
ICU Occupancy per million	Our World in Data	Number
GDP Growth Rate	Organisation for Economic Cooperation and Development (OECD) Data	Percentages (%)
Unemployment Rate	OECD Data	Percentages (%)
Consumer Confidence Index	OECD Data	Scale with a baseline value of 100 (above 100 – optimistic outlook, below 100 -negative)

2

Data

The outcome of interest:

Health System Performance Index – a composite index that comprises an aggregated excess mortality variable and a GDP growth rate variable.

The Explanatory variables:

- Tests per confirmed case
- Fully Vaccinated Population per 100
- Case Fatality Rate (CFR)
- ICU Occupancy per million
- Unemployment Rate
- Consumer Confidence Index (CCI)

The Controlled variables:

- Government Response Stringency Index

2

Data Summary Statistics

Table 2

Variables	Mean	Standard Deviation
Tests per confirmed case	56.32143	72.70603
Fully Vaccinated Population per 100	60.9	27.89192
ICU occupancy per million	21.41859	22.3957
Case Fatality Rate (CFR), %	0.9836667	0.9668558
Unemployment Rate,%	6.991667	2.129168
Consumer Confidence Index (CCI)	98.99722	2.6143
Government Stringency Index	54.54389	19.40092

3 METHODS

1. The pooled OLS model:

$$HS_{i,t} = \beta_0 + \beta_1 * tests_{i,t} + \beta_2 * fulvac_{i,t} + \beta_3 * CFR_{i,t} + \beta_4 * ICU_{i,t} + \beta_5 * unempl_{rate_{i,t}} + \beta_6 * CCI_{i,t} + \beta_7 * govresp_{i,t} + \varepsilon_{i,t}$$

$i = 1,2,3$

$t = 1,\ldots,12$

the Breusch-Pagan Test - robust standard errors

2. Panel regression with fixed effect (FE)

$$HS_{i,t} = \alpha_{i,t} + \theta_t + \beta_1 * tests_{i,t} + \beta_2 * fulvac_{i,t} + \beta_3 * CFR_{i,t} + \beta_4 * \\ * ICU_{i,t} + \beta_5 * unempl_{rate_{i,t}} + \beta_6 * CCI_{i,t} + \beta_7 * govresp_{i,t} + \varepsilon_{i,t}$$

$i = 1,2,3$
$t = 1,\ldots,12$

$\alpha_{i,t}$ – *the country fixed effect*
θ_t – *the quarter fixed effect*

Hausman test

THANK YOU!