Tamara Tomić
University of Zagreb
Faculty of Political Science
10000 Zagreb, Croatia
tamarattomic@gmail.com

JEL: H7, H75
Original scientific article
https://doi.org/10.51680/ev.38.2.10

Received: August 26, 2025
Revision received: October 10, 2025
Accepted for publishing: October 11, 2025

GOVERNANCE MODELS AND PANDEMIC OUTCOMES: ANALYSING THE IMPACT OF STRINGENCY, ECONOMIC STRENGTH AND HEALTH SYSTEM CAPACITY ON EXCESS MORTALITY

Abstract

Purpose: This paper explores the anti-epidemic policies of Italy, Germany, and Sweden in response to the COVID-19 pandemic in the period 2020–2022. The degree of decentralization, the stringency index, and the universal health coverage (UHC), expressed as the percentage of the gross domestic product (GDP), present distinguishing characteristics of the three crisis management models, making them essential for exploring their correlation with excess mortality.

Methodology: The mixed-method approach is used in this research. The study uses a qualitative cross-case design, incorporating countries with various combinations of key factors, allowing for the analysis of the causes of outcome variation. Given the temporal heterogeneity of independent variables, the quantitative analysis relies on the Mixed Data Sampling (MIDAS) regression model.

Results: The MIDAS regression analysis of excess mortality shows a statistically significant positive correlation with both average population age and healthcare expenditure, where the latter is contrary to expectations. GDP per capita and the proportion of women in total population are negatively correlated with excess mortality. In this sample, UHC and daily stringency indices are not statistically significant, indicating no detected association with excess mortality.

Conclusion: The presented analysis of Italy, Germany, and Sweden affirms that the demographics and the economic capacity, as opposed to the stringency index, shape excess mortality. The null effect for UHC and the surprising direction of the health-spending estimate suggest that the governance and productivity of resources matter more for pandemic performance than the magnitude of the budget.

Keywords: COVID-19, excess mortality, GDP, governance, mixed-methods

1. Introduction

The concept of crisis has become conventional, and the recurring emergence of economic, educational, and social crises has led some scholars to label the present era as the "century of crises" (Zamili, 2014). The COVID-19 pandemic is a health crisis, since the spread of SARS-CoV-2 produced cascading disruptions in public health, economic, and political contexts and affected the entire population. It caused a tragic loss of human life and a level of global economic insecurity not seen since the 2008 financial crisis (Song and Zhou, 2020; Brada et al., 2021). It reshaped nearly all spheres of life and posed an ultimate challenge for political leadership (Sahu, 2021). To prevent spread, countries introduced unprecedented measures, including quarantines to minimise social interactions, limits on travel, and school closures. Yet the literature indicates no consensus on an optimal strategy for managing such emergencies. Scholarship has shifted from discrete policy elements or isolated decisions toward complex processes and interactions among policy actors within institutional structures (Weible et al., 2020). Berman et al. (2023) highlight recent evidence that states' conduct during COVID-19 was conditioned by contextual factors that steered policy development. Given pronounced differences in approaches, implementation, and health outcomes, these authors argue that future analyses should focus on key causal drivers, including institutional rules, governance mechanisms, political context, and the structure of health systems, with emphasis on public health and crisis decision-making. In line with these considerations, Vampa (2021) notes that the pandemic sparked far reaching debates on the design of public policies capable of delivering coordinated and effective responses while recognizing territorial dynamics. However, the mechanisms linking territorial configurations to policy performance remain undertheorized and empirically underexamined. Evidence remains fragmented, since single country accounts dominate and multi-country analyses often treat territorial governance as background. This article addresses part of that gap by providing a structured cross-case comparison of Italy, Germany, and Sweden from 2020 to 2022 and by testing relationships between excess mortality, socioeconomic indices, and restrictive measures.

2. Literature review

The COVID-19 pandemic exposed weaknesses in governing institutions, inadequate crisis preparedness, and the absence of effective strategies. A shortage of timely and reliable information hindered evidence-based policymaking. Limited analytical capacity among political actors contributed to delayed responses and an inability to take prompt, effective decisions in emergencies (Howlett, 2009). Consequently, the role of political actors requires careful analysis, as they bear political responsibility for the implementation and outcomes of public health policies.

Many scholars argue that standardization within the health system enhances governance efficiency and they, therefore, advocate for a centralized approach that facilitates hierarchical decision-making structures (Elson, 2009; Zhong, 2010), a view further supported by Gilbert and Picard (1996), who concluded that centralization is optimal when the central government has full access to information related to costs. Similarly, centralization enables economies of scale and prevents the suboptimal use of scarce resources by local government stakeholders (Rubio, 2011). However, universal solutions often fall short of expectations. Political tensions and disputes among different governance levels frequently cause disruption within the centralized systems (Tselios, 2023). Scholars highlight that decentralized systems, by contrast, promote better knowledge acquisition and usage, particularly when being informed about local circumstances is crucial. Finally, some scholars advocate for a hybrid model, suggesting that a combination of centralized and decentralized systems may foster governance synergies (Maltsev, 2023).

During the COVID-19 pandemic, critical information was frequently replaced, shaping the distinctive responses of political actors who worked based on the information available at a given time. Responses to the COVID-19 pandemic varied among countries not only in terms of scope, intensity, and speed of reaction, but also exhibited considerable variations within countries. This research focuses on three EU member states: Italy, Germany, and Sweden.

In Italy, the primary decision-makers responsible for anti-epidemic measures were national political authorities. As the Italian Constitution does not offer distinct provisions for internal emergencies,

the government, invoking the legislative decree of the Civil Protection Code, declared a state of emergency on January 31, 2020 (Parolari, 2024). Italy's multi-level governance further obstructed policy implementation. Legislative and administrative authority is shared between central and regional governments. Within the healthcare system, the central government allocates healthcare funding by regions, while regional government is responsible for the organization of health services (Bosa et al., 2022). During the first wave of the pandemic, national measures were not differentiated. Namely, the same measures uniformly applied across all regions, regardless of infection rates. The lack of coordination between the national and regional government emphasized the issue of governmental emergency measures, highlighting the lack of institutional collaboration and sufficiently defined and targeted measures. This prompted the adoption of the Law Decree, which authorized regional governments to propose and implement urgent measures related to the COVID-19 pandemic, including stricter restrictions than those proposed by the national government. As a result, regional measure differentiation emerged, allowing local governments to tailor measures based on their contagion index (Nicola & Scaccia, 2021). Italy subsequently split their regions into zones and adopted a color-coded risk classification system: red zones indicated high-risk areas, orange zones medium-risk, and yellow zones low-risk, based on the infection rates, active case numbers, and hospital capacity (Pelagatti & Maranzano, 2021). The color-coded system remained in place until March 31, 2022, when Italy officially lifted the state of emergency (Parolari, 2024). The effectiveness of the pandemic response was hindered by the fact that, for example, the employee expenditure restrictions introduced in 2004 resulted in a decline in the professional capacities of healthcare personnel (Noto et al., 2020). Furthermore, the bailout programs implemented in 2007 in certain regions led to a reduction in hospital capacity, a freeze on staff recruitment, and the introduction of additional co-payments for pharmaceutical expenses (Bordignon & Turati, 2009; Piacenza & Turati, 2014). To combat the pandemic, the decree *Cura Italia*, adopted on March 17, 2020, allocated an additional €1,410 million to the national health requirement and extended tax credits for workplace sanitization and protective equipment (Italian Government, 2020). In comparative perspective, Italy's fiscal stimulus was relatively modest. During the same period, Germany set up 11% of GDP of additional spending and foregone revenues and 24% of contingent liabilities (IMF, 2021a).

Germany is a federal state composed of sixteen constituent states, where the responsibility for public healthcare is delegated to local health authorities. Local authorities had the autonomy to adapt national-level pandemic measures, including restrictions on public gatherings, suspension of mass events, closure of schools, restaurants, bars and shopping centers, as well as the imposition of quarantines and the temporary closure of domestic borders, to suit local needs. The only exception was the unilateral and centralized decision to close international borders (Hegele & Schnabel, 2021). In collaboration with the Robert Koch Institute and other research institutions, local authorities collected and analyzed available pandemic-related data, thereby contributing to Germany's overall pandemic management efforts (Brunn et al., 2022). However, by early 2021, it became apparent that the uniformity of the federal state strategy was inadequate. In response, the Infection Protection Act was amended in April 2021 to introduce the "emergency brake" measures, which empowered the federal government to enforce mandatory curfews and other restrictive measures (Hyde, 2021). The main mechanism Germany used against the COVID-19 pandemic was based on four core principles: prevention, detection, containment, and treatment (Wieler et al., 2021). In 2022, per capita health spending was €7,767 (adjusted for differences in purchasing power), the highest in the EU and among the highest in the WHO European Region (Blümel et al., 2024). Such substantial investment in healthcare provided a well-coordinated and stable healthcare system, together with professional and scientific institutions, which constituted an important foundation for Germany's management of the SARS-CoV-2 outbreak. Testing centers were rapidly set up, with high daily sample collection, and the country efficiently used its extensive intensive care unit capacity. Even though the COVID-19 pandemic brought about the deepest recession in Germany's post-war history, the economy regained stability by October 2020. This stabilization was supported not only by extensive aid programs at all levels of government and by a Keynesian-inspired fiscal strategy that accepted declining tax revenues while covering additional spending through public borrowing, but also by the crucial role of the Fed-

eral Ministry of Finance and the Federal Ministry of Economic Affairs, which relied on their prior experience in managing the 2008 global financial crisis (Auerbach, 2012; Färber, 2021).

During the COVID-19 pandemic, Sweden did not declare a state of emergency, as its constitution permits such a declaration only in times of war (Pierre, 2020). Instead, the Swedish response placed responsibility on citizens, relying heavily on voluntary social distancing and individual self-regulation. This approach was underpinned by Sweden's legal framework and cultural emphasis on safeguarding fundamental human rights and fostering civic accountability. Swedish core strategy for making new measures aimed at "flattening the curve" and was aligned with the objectives of Sweden's 2019 emergency pandemic plan: to reduce mortality, minimize population morbidity, and mitigate adverse effects on individuals and society. The Public Health Agency of Sweden (PHA) played a central role in shaping the national pandemic response strategy. The PHA issued voluntary guidelines, recommending proper hand hygiene, physical distancing, staying home when ill, and avoiding non-essential travel (ibid.). The majority of decisions in Sweden were made through a centralized approach, with 21 regions following national guidelines (Askim & Bergström, 2022). Although the government issued guidelines, each region bore responsibility for the performance of the healthcare system, and its coordination was facilitated by the Swedish Association of Local Authorities and Regions (ibid.; Pierre, 2020). By the end of 2020, regions began adapting measures according to the virus spread rate (Pierre, 2020). The Swedish model faced widespread criticism, particularly for delays in issuing recommendations and the perceived *laissez-faire* approach by authorities. In response, a temporary Pandemic Law was passed in January 2021, which enabled the authorities to take more assertive action toward suppressing the spread of the virus, including limitations on the size of public and social gatherings, temporary closures of hospitality and other business activities, and reinforced guidelines on physical distancing and remote work (Winblad et al., 2022). The Swedish government introduced a comprehensive package of financial relief measures in anticipation of the economic downturn expected from the containment policies. According to IMF (2021b), the authorities' extensive support program was both well-timed and well-suited to the circumstances. The Swedish Parliament approved twelve budget amendments directed at citizens, businesses, and vulnerable groups in the first year of the pandemic (Government Offices of Sweden, 2020a). These measures included combined tax cuts of approximately €0.76 billion in 2021, €0.94 billion in 2022, and €1.51 billion in 2023 (Government Offices of Sweden, 2020b). The National Institute of Economic Research estimated that the measures implemented in 2020 in response to the pandemic outbreak amounted to approximately €17.27 billion (National Institute of Economic Research, 2020). Furthermore, to ease the financial burden on companies and safeguard employment, a furlough scheme was introduced, employers' social security contributions were reduced, and rental subsidies were provided for vulnerable sectors such as consumer durables, hotels, and restaurants (Government Offices of Sweden, 2020b).

3. Methodology

This study uses an exploratory research design to deepen the understanding of key dimensions of governance structure, the strictness of containment measures, health system preparedness, and economic capacity, and to examine how these factors relate to policy effectiveness measured through excess mortality (Mueller, 2004). Existing research remains fragmented, since most analyses concentrate on individual countries, while cross-national studies rarely place territorial governance at the center of explanation. In response to this limitation, three cases were selected to reflect contrasting state organization and decentralization, providing a basis for comparing institutional responses to the COVID-19 pandemic. The cases of Italy, Germany, and Sweden were examined with the aim of capturing distinct approaches to policymaking, particularly in the implementation of anti-epidemic policies. Italy adopted a centralized approach, while Germany, as a federal state, followed a decentralized one. In contrast to the mandatory measures enforced by these two countries, Sweden pursued a more liberal approach, grounded in voluntary public compliance with government recommendations. Moreover, unlike Germany and Sweden, which actively involved scientists in shaping their pandemic response strategy, Italy largely depended on its political institutions. These cases collectively illustrate distinct models of crisis management, which become relevant when examining their rela-

tionship with excess mortality. Nevertheless, while Italy, Germany, and Sweden are heterogeneous examples of crisis management strategies, they do not capture the full complexity of all EU member states. Accordingly, any generalization should be made with caution given the small-N design and the article's limited scope. In this context, it is crucial to extract lessons related to factors identified in this study that may influence countries' crisis management and pandemic response, and to derive appropriate conclusions based on them.

This research uses qualitative and quantitative approaches, indicating a mixed-methods design. Saunders et al. (2003) note that the combination of quantitative and qualitative methods improves the generalization and validity of research findings. The use of both methods allows for an in-depth examination of the characteristics and specificities of the units of analysis, which are elements that are often overlooked in studies which are purely quantitative (Landman, 2002). This integration represents the core advantage of the mixed-methods approach. Namely, by leveraging the complementarity of qualitative and quantitative analyses, researchers enable a more nuanced and thorough understanding of the phenomenon (Johnson et al., 2007).

Italy, Germany and Sweden constitute the three units of analysis and the foundation of the qualitative framework, designed as a cross-case study. As Gerring (2008) argues, this selection strategy reflects the most diverse case selection, which is particularly suitable for this research as it aims at exploring the correlation between excess mortality and various economic, health, and political factors in countries characterized by distinct governance structures. The cases were chosen to capture a spectrum of variation in relevant variables, which in turn shaped differences in outcomes. Thereby, the method of selecting the most diverse cases is emphasized due to the representativeness of acquired results compared to other small-sample methods (ibid.). Cross-case analysis is employed in this research. This method is suitable as it investigates processes and outcomes in each case, identifies patterns and combinations of factors contributing to differences in outcomes, and explains how these are determined by local conditions (Miles & Huberman, 1994).

The analysis of quantitative data relies on the application of the MIDAS regression model. MIDAS regression is a statistical analysis that allows for modeling relationships between variables measured at different temporal frequencies (such as daily, weekly, and annual data), without requiring aggregation to a common, lower frequency. This approach enables the informational richness of high-frequency predictors and contributes to more precise modeling of dynamic effects over time (Ghysels et al., 2004; Ghysels et al., 2007). In this research, MIDAS regression was applied to examine the effects of daily public policy measures (e.g., stringency measures) and annual socioeconomic indicators (e.g., GDP and healthcare expenditures) on weekly excess mortality during the COVID-19 pandemic. The utilization of this methodology allows for the comprehensive use of information from a mixed-frequency dataset, minimizes information loss due to aggregation, and captures nuanced, time-lagged effects of policy interventions on health-related outcomes (Ghysels et al., 2007).

Secondary data analysis is employed through a systematic examination of existing documented sources. The approach integrates theoretical frameworks with established datasets to inform the design of effective anti epidemic policies. Publicly available data were drawn from the World Health Organization (WHO), the World Bank, Eurostat and the Organisation for Economic Co-operation and Development (OECD), supplemented by other relevant sources.

The list of variables tested in this research is presented in Table 1 below.

Table 1 List of research variables

	Concept	Operationalization	Data source
Dependent variable	Excess mortality	Difference between the number of reported fatalities and the expected number of fatalities	OECD
Independent variable	Restriction measures	Stringency index	Database: The Oxford Covid-19 Government Response Tracker (OxCGRT)
	GDP	GDP per capita	World Bank
	Healthcare expenditure	Total public and private expenditure	Eurostat
	Health coverage	UHC index	WHO
Control variables	Age and gender	Proportion of women in total population; Average age	OECD

Source: Author

In order to analyze the collected data, the following regression equation is specified:

$$Excess\ Mortality_t = \beta_0 + \sum_{k=0}^{K} * \beta_1 Stringency\ Index_{t-k} + \beta_2 GDPpc_t + \beta_3 Healthcare\ Expenditure_t + \beta_4 UHC_t + \beta_5 AgeY_t + \beta_6 AgeM_t + \beta_7 AgeE_t + \beta_8 FEM_t + \epsilon_t$$

In this formulation, the summation over *k* represents the distributed temporal structure of the daily stringency index, while *t* denotes the time period during which the variables were observed. All variables included in the analysis were log-scaled prior to estimation in order to standardize measurement scales and facilitate meaningful comparative analysis.

The dependent variable in this research is excess mortality and the data were collected from the OECD. Excess mortality is calculated by comparing the number of reported fatalities to the expected number of fatalities, which is derived from the average number of deaths recorded over the five-year period from 2015 to 2019 (OECD, 2023). The independent variables in this research include restriction measures, GDP per capita, healthcare expenditure, and health coverage. Restriction measures are operationalized through the stringency index, which encompasses parameters such as school and workplace closures, cancellation of public events, limitations on mass gatherings, public transport suspension, stay-at-home requirements, and restrictions on national and international travel (Mathieu et al., 2020). These data are obtained from the OxCGRT, a comprehensive database tracking governmental policy related to implementing restrictive measures (Hale et al., 2021). The total economic activity within national economy is represented by GDP per capita, defined as the gross domestic product generated by local producers, increased by product and service taxes minus subsidies excluded from market prices, divided by the average population size (World Bank, 2025a). Healthcare expenditure comprises total public and private spending on the healthcare system, including government schemes, social health insurance schemes, compulsory private insurance schemes, voluntary health insurance schemes, non-profit institutions financing schemes, enterprise financing schemes, household out-of-pocket payment, and rest of the world financing schemes (Eurostat, 2025). The UHC index is calculated as the geometric mean of fourteen tracer indicators categorized into four domains: reproductive, maternal, newborn, and child health; infectious diseases; non-communicable diseases; and service capacity and access. The first domain includes indicators such as family planning, antenatal care, vaccinations, and paediatric care. The second domain covers treatment parameters for tuberculosis, HIV, malaria, and basic sanitation. The third domain assesses tobacco use and the prevalence of hypertension and diabetes. The final domain evaluates access to hospitals, health workforce availability, and health security (World Bank, 2025b). Demographic variables, including the proportion of women in the total population and average age, are incorporated as control variables to account for population characteristics across the countries included in the study.

The aforementioned variables are analyzed to test the following theory-driven hypotheses, which link governance, economic capacity, and health-system efficiency to expected outcomes.

Hypothesis 1 (H1): A higher stringency index is connected to lower levels of excess mortality.

Building on the Italian case, where initially uniform and weakly coordinated national rules were replaced by delegated authority for stricter, locally tailored restrictions based on contagion indices, effective policy response is contingent on decisive and targeted measures. Accordingly, H1 posits that a higher stringency index is associated with lower excess mortality.

Hypothesis 2 (H2): Greater GDP per capita is negatively correlated with excess mortality.

Evidence from Germany's 11%-of-GDP package, contrasted with Italy's modest stimulus, shows how economic strength enables expansive interventions that bolster health care. This suggests that a greater ability to finance additional spending through public borrowing directly supports the health system and thus lowers excess mortality.

Hypothesis 3 (H3): Increased healthcare expenditure results in reduced excess mortality.

Drawing on Germany's high per capita spending, which enabled strong institutions and swift testing, H3 posits that increased healthcare expenditure, by strengthening structural and operational capacity, reduces excess mortality.

Hypothesis 4 (H4): Wider UHC contributes to lower excess mortality rates.

Consistent with governance-efficiency logic, UHC enables uniform service provision that improves coordination and access and lowers excess mortality.

Following the WHO's assessment that SARS-CoV-2 posed a significant threat to global public health, a Public Health Emergency of International Concern (PHEIC) was declared on January 30, 2020. The WHO declared a global pandemic on March 11, 2020. Three years later, on May 5, 2023, the WHO determined that COVID-19 no longer constituted a PHEIC. This study focuses on the period from 2020 to 2022, a period marked by widespread implementation of restrictive policy measures aimed at controlling the pandemic (WHO, 2025).

While MIDAS regression analysis offers a methodologically innovative approach to the analysis of data with differing time frequencies, this research is subject to several limitations such as the modest sample size (specifically, the limited number of countries observed), which may impact the statistical reliability and the generalizability of the findings. Additionally, the potential presence of multicollinearity among predictors could compromise the stability and interpretability of the regression estimates. The limited within-country variability of key variables further reduces the likelihood of detecting significant correlations. Moreover, although the stringency index is widely used, it has inherent measurement limitations, stemming from its operational definitions and the manner of data collection. Lastly, the research may be affected by omitted variable bias, as unobserved factors not included in the model could influence the dependent variable.

4. Results

Table 2 shows the results of the conducted quantitative analysis. These estimates should be read as indicative patterns within a small, purposive sample and timeframe (2020–2022) and are not generalizable beyond the studied cases. The table includes the regression coefficients for each variable, along with the standard error, t-statistic, p-value, and the variance inflation factor (VIF). The VIF measures the extent to which the variance of a regression coefficient is inflated due to multicollinearity. A VIF value of 1 indicates no correlation between the observed variable and the others in the model, while higher values suggest increasing levels of multicollinearity. According to commonly accepted interpretation guidelines, a VIF value above 4 may warrant further examination, whereas values exceeding 10 are typically considered indicative of severe multicollinearity (Marquardt, 1970; Cohen et al., 2013). Among the analyzed variables, a strong correlation was identified between GDP per capita and UHC, indicating significant multicollinearity. The high degree of multicollinearity for LGDPPC (15.24) and LUHC (11.44) means that coefficient magnitudes for these covariates should be interpreted with caution. This can be attributed to the fact that they were measured on an annual basis, and the number of observations is relatively small, which further highlights one of the limitations of the research. This finding underscores the need for caution in interpreting individual coefficient estimates, as multicollinearity can inflate standard errors, obscure the independent contribution of predictors, and in some cases alter the direction of estimated effects. The small-N design of this study further amplifies these issues and limits the generalizability of the findings, which should therefore be regarded as indicative patterns rather than definitive causal relationships.

Table 2 Analysis results

Variable	Coefficient	Std. Error	t-Statistic	p-value	VIF
Intercept (β_0)	-0.13	1.75	-0.07	0.94	-
LFEMPC	-0.2029	0.0185	-10.97	<0.001*	7.84
LMEANAGE	0.253	0.030	8.43	<0.001*	6.82
LGDPPC	-0.100	0.00457	-21.88	<0.001*	15.24
LHEXP	0.101	0.00478	21.13	<0.001*	3.17
LUHC	0.4664	0.668	0.70	0.49	11.44
Series: LSTR(-0) Lags: 4					
Lag 0	-0.081			0.61	
Lag 1	0.093			0.59	
Lag 2	0.084			0.58	
Lag 3	-0.108			0.61	

Source: Author

The MIDAS regression results indicate that the lagged effects of the stringency index are small and fluctuate in sign. None of these effects are statistically significant, as evidenced by the Almon lag polynomial results ($p > 0.58$). The distributed time effects of the daily stringency index do not show significance, suggesting that short-term changes in the stringency index have no measurable impact on excess mortality. Given the absence of statistically significant evidence that recent variations in the stringency index influenced excess mortality in the examined model, the H1 is not confirmed. Within the context of the present sample, this suggests that short-term changes in policy stringency do not demonstrate a measurable association with excess mortality. However, this null result may partly reflect the limitations of the composite stringency index, which aggregates heterogeneous measures, as well as the modest number of cases examined.

In contrast, MIDAS regression reveals that four variables have a statistically significant correlation with excess mortality ($p < 0.01$). The log-scaled value of the proportion of women in the total population is significantly and negatively correlated with excess mortality. Specifically, a 1% increase in the proportion of women in the total population is associated with a 0.2029% decrease in excess mortality. The log-scaled value of excess mortality also exhibits a statistically significant, strong positive correlation with the log-scaled average age of the observed country's population. An increase of 1% in the average age corresponds to a 0.253% rise in excess mortality. Interestingly, the log-scaled value of healthcare expenditure is also statistically significantly and positively correlated with excess mortality, which is unexpected as it contradicts previous findings. Namely, a 1% increase in healthcare expenditure is associated with a 0.1% increase in excess mortality. This finding contradicts H3 set in this research, which is therefore not confirmed. In addition, this relationship may reflect endogeneity or reverse causality, that countries experiencing higher mortality subsequently increase health-related spending, as well as inefficiencies in the allocation of resources, or diminishing marginal returns to expenditure beyond a certain threshold (Hensher et al., 2024). Furthermore, the log-scaled value of excess mortality is statistically significantly and negatively correlated with the log-scaled value of GDP per capita. The results indicate that a 1% decrease in GDP per capita leads to a 0.1% increase in excess mortality, thereby confirming H2.

The UHC index does not exhibit a statistically significant correlation with excess mortality in this sample. The absence of a statistically significant correlation between the UHC index and excess mortality leads to the rejection of H4. Given both its strong collinearity with GDP per capita and the relatively static nature of the index as an annual composite measure, this null result should not be taken as evidence of an absence of relationship, but rather as a reflection of measurement limitations and the constraints of the present research design.

5. Discussion

Lohsar (2024) analyzed 107 countries over the same timeframe as this study, and found a statistically significant negative correlation between the stringency index and excess mortality in 2021, with no association in 2020 or 2022, likely reflecting low early immunity and widespread vaccination by 2022. Similarly, Galmiche et al. (2024) reported an inverse correlation across thirteen Western European countries during the first thirty months. In contrast, the MIDAS regression analysis conducted in this research did not result in a statistically significant correlation between the stringency index and excess mortality. Because this finding differs from prevailing scholarship, it should be interpreted in light of methodological limitations and the pandemic context. The OxCGRT aggregates diverse restrictions, so the heterogeneous effectiveness of measures may be obscured and less effective measures can dilute the estimated impact of pivotal measures (Brauner et al., 2021). In addition, unmeasured factors such as compliance, variant transmissibility and hospital occupancy may shape the relationship between stringency and outcomes.

Using a global sample of more than 140 countries that includes the three countries examined in this study, Aizenman et al. (2022) find that a lower GDP per capita is associated with higher excess mortality. Pizzato et al. (2024) examine 29 European countries from 2020 to 2023 and likewise report a statistically significant negative correlation between GDP per capita and excess mortality. The results obtained in this research align with those findings, confirming a statistically significant negative correlation between GDP per capita and excess mortality for the three observed countries.

Several studies support H3 that greater healthcare expenditure reduces excess mortality. Kapitsinis (2021) analyzed 79 countries worldwide and found a statistically significant negative correlation between healthcare expenditure and excess mortality. Barrera-Algarín et al. (2020) reported the same pattern for 30 European countries. Extending this literature, Moolla and Hiilamo (2023) assessed 43 countries (high income and upper middle income economies, as classified by the World Bank), evaluating health system performance across financing, provision and public health; their sample comprised OECD members and key partner economies and again yielded a significant negative association. By contrast, this study's estimates for the three countries indicate a statistically significant positive correlation between log-scaled healthcare expenditure and excess mortality, contradicting the prevailing findings in the literature. This unexpected result may reflect several factors. First, high healthcare spending does not necessarily imply efficient allocation; administrative complexity can impede effective deployment. In particular, COVID-19 highlighted the importance of prevention and primary care, whereas budgets concentrated in costly hospital care indicate suboptimal use of funds. Second, regional disparities in access and broader social inequalities can attenuate the effect of high spending. Third, reverse causality is plausible: countries facing severe waves may reactively raise spending, so expenditures track higher mortality. Finally, beyond certain thresholds, additional spending delivers diminishing returns (Hensher et al., 2024).

In this research, health coverage entered as an independent variable and the analysis did not yield statistically significant results. By contrast, Wang et al. (2022) found a statistically significant negative correlation between health coverage and excess mortality across 74 countries. A likely explanation for these differing results is measurement: the UHC index is an annual, slow-moving composite, calculated as the geometric mean of fourteen tracers in four domains, which does not fully align with wave-driven mortality and has limited sensitivity to qualitative dimensions such as timely access to care, health workforce availability and distribution, and operational surge capacity, all closely linked to excess mortality (Yanful et al., 2023).

6. Conclusion

In early 2020, the WHO declared the COVID-19 pandemic, and governments' insufficient preparedness resulted in severe consequences for the global economy, national health systems, and societal functioning. This research examines the pandemic responses of Italy, Germany, and Sweden from 2020 to 2022, and emphasizes distinct crisis management strategies. Italy adopted a highly centralized model. Germany, consistent with its federal structure, delegated authority to regional governments. Sweden pursued a more liberal approach, emphasizing recommendations and voluntary compliance rather than strict enforcement.

The paper's primary scientific contribution is to empirically test the relationship between governance models, economic capacity, health system characteristics, and COVID-19 excess mortality using the MIDAS regression model. The analysis suggests that the formal governance structure, whether Italy's centralized system, Germany's federal model, or Sweden's liberal approach, was not the primary determinant of excess mortality outcomes. This is evidenced by the lack of a statistically significant correlation between the stringency of anti-epidemic measures and excess mortality in the studied sample. Instead, the findings indicate that inherent national characteristics, particularly economic capacity (GDP per capita) and demographic profiles (average age), were the most significant factors shaping pandemic outcomes. Notably, the observed positive link between healthcare expenditure and excess mortality suggests that institutional governance and the efficient use of resources are more consequential for pandemic performance than expenditure levels per se.

Given the ongoing relevance of the COVID-19 pandemic, more time and research are needed to identify which strategies were truly effective. Current non-pharmaceutical interventions analyses do not yield a definitive ranking of specific measures, underscoring the need for further investigation. Priorities are to expand the sample to additional countries, examine decentralization as a core explanatory dimension, incorporate variables capturing qualitative aspects of health system performance (e.g., the Health Access and Quality Index), and test immunization coverage as an independent predictor of excess mortality.

References

1. Aizenman, J., Cukierman, A., Jinjarak, Y., Nair-Desai, S. & Xin, W. (2022). *A two COVID-19 years quartile comparison of official with excess mortality: Voice and accountability and the impact of vaccines.* National Bureau of Economic Research. https://doi.org/10.3386/w29778
2. Askim, J. & Bergström, T. (2022). Between lockdown and calm down: Comparing the COVID-19 responses of Norway and Sweden. *Local Government Studies, 48*(2), 291-311. https://doi.org/10.1080/03003930.2021.1964477
3. Auerbach, A. J. (2012). The Fall and Rise of Keynesian Fiscal Policy. *Asian Economic Policy Review, 7*(2), 157-175. https://doi.org/10.1111/j.1748-3131.2012.01228.x
4. Barrera-Algarín, E., Estepa-Maestre, F., Sarasola-Sánchez-Serrano, J. L. & Vallejo-Andrada, A. (2020). COVID-19, neoliberalism and health systems in 30 european countries: relationship to deceases. https://pubmed.ncbi.nlm.nih.gov/33111713/
5. Berman, P., Cameron, M. A., Gaurav, S., Gotsadze, G., Hasan, M. Z., Jenei, K., Keidar, S., Kornreich, Y., Lovato, C., Patrick, D. M., Sarker, M., Sosa-Villagarcia, P., Sriram, V. & Ruck, C. (2023). Improving the response to future pandemics requires an improved understanding of the role played by institutions, politics, organization, and governance. *PLOS Global Public Health, 3*(1), e0001501. https://doi.org/10.1371/journal.pgph.0001501
6. Blümel, M., Spranger, A., Achstetter, K., Hengel, P., Eriksen, A., Maresso, A. & Busse, R. (2024). Germany: Health System Summary, 2024. In *Germany: Health System Summary, 2024*.
7. Bordignon, M. & Turati, G. (2009). Bailing out expectations and public health expenditure. *Journal of Health Economics*, *28*(2), 305-321. https://doi.org/10.1016/j.jhealeco.2008.12.008
8. Bosa, I., Castelli, A., Castelli, M., Ciani, O., Compagni, A., Galizzi, M. M., Garofano, M., Ghislandi, S., Giannoni, M., Marini, G. & Vainieri, M. (2022). Response to COVID-19: Was Italy (un)prepared? *Health Economics, Policy and Law, 17*(1), 1-13. https://doi.org/10.1017/S1744133121000141
9. Brada, J. C., Gajewski, P. & Kutan, A. M. (2021). Economic resiliency and recovery, lessons from the financial crisis for the COVID-19 pandemic: A regional perspective from Central and Eastern Europe. *International Review of Financial Analysis, 74*, 101658. https://doi.org/10.1016/j.irfa.2021.101658

10. Brauner, J. M., Mindermann, S., Sharma, M., Johnston, D., Salvatier, J., Gavenčiak, T., Stephenson, A. B., Leech, G., Altman, G., Mikulik, V., Norman, A. J., Monrad, J. T., Besiroglu, T., Ge, H., Hartwick, M. A., Teh, Y. W., Chindelevitch, L., Gal, Y. & Kulveit, J. (2021). Inferring the effectiveness of government interventions against COVID-19. *Science, 371*(6531), eabd9338. https://doi.org/10.1126/science.abd9338

11. Brunn, M., Kratz, T., Padget, M., Clément, M. C. & Smyrl, M. (2022). Why are there so many hospital beds in Germany? *Health Services Management Research, 36*(1), 75-81. https://doi.org/10.1177/09514848221080691

12. Cohen, J., Cohen, P., West, S. G. & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge. https://doi.org/10.4324/9780203774441

13. Elson, S. (2009). Regionalization of health care from a political and structural perspective. *Healthcare Management Forum, 22*(1), 6-37. https://doi.org/10.1016/S0840-4704(10)60279-7

14. Eurostat (2025). *Health care expenditure (SHA 2011) (hlth_sha11).* https://ec.europa.eu/eurostat/cache/metadata/en/hlth_sha11_esms.htm

15. Färber, G. (2021). Germany's fight against Covid-19: The tension between central regulation and decentralised management. In Steytler, N. (2022). *Comparative Federalism and Covid-19*: Combating the pandemic (pp. 51-69). Taylor & Francis. https://doi.org/10.4324/9781003166771-5

16. Galmiche, S., Coustaury, C., Charniga, K., Grant, R., Cauchemez, S. & Fontanet, A. (2024). Patterns and drivers of excess mortality during the COVID-19 pandemic in 13 Western European countries. *BMC Global and Public Health, 2*(1), 78. https://doi.org/10.1186/s44263-024-00103-z

17. Gerring, J. (2008). Case selection for case-study analysis: Qualitative and quantitative techniques. In Box-Steffensmeier, J. M. et al. (Eds.) *The Oxford Handbook of Political Methodology* (pp. 645-684). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286546.003.0028

18. Ghysels, E., Santa-Clara, P. & Valkanov, R. (2004). The MIDAS touch: Mixed data sampling regression models.

19. Ghysels, E., Sinko, A. & Valkanov, R. (2007). MIDAS regressions: Further results and new directions. *Econometric Reviews*, *26*(1), 53-90. https://doi.org/10.1080/07474930600972467

20. Gilbert, G. & Picard, P. (1996). Incentives and optimal size of local jurisdictions. *European Economic Review, 40*(1), 19-41. https://doi.org/10.1016/0014-2921(94)00037-9

21. Government Offices of Sweden (2020a). *From the Budget Bill for 2021: Budget Statement.* https://www.government.se/4a73a0/contentassets/ddfaf5ce78494ce991e c231acf9c5b83/summary-budget-statement.pdf

22. Government Offices of Sweden (2020b). *Extra ändringsbudget med anledning av coronaviruset.* https://www.regeringen.se/pressmeddelanden/2020/03/extra-andringsbudget-med-anledning-av-coronaviruset/

23. Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas L. & Tatlow, H. (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nature Human Behaviour*, *5*(4), 529-538. https://doi.org/10.1038/s41562-021-01079-8

24. Hegele, Y. & Schnabel, J. (2021). Federalism and the management of the COVID-19 crisis: Centralisation, decentralisation and (non-) coordination. *West European Politics*, *44*(5-6), 1052-1076. https://doi.org/10.1080/01402382.2021.1873529

25. Hensher, M., Blizzard, L., Campbell, J., Canny, B., Zimitat, C. & Palmer, A. (2024). Diminishing marginal returns and sufficiency in health-care resource use: an exploratory analysis of outcomes, expenditure, and emissions. *The Lancet Planetary Health, 8*(10), e744-e753. https://doi.org/10.1016/S2542-5196(24)00207-9

26. Howlett, M. (2009). Policy analytical capacity and evidence-based policy-making: Lessons from Canada. *Canadian Public Administration*, *52*(2), 153-175. https://doi.org/10.1111/j.1754-7121.2009.00070_1.x

27. Hyde, R. (2021). Controversy surrounds Merkel's new lockdown powers. *Lancet (London, England), 397*(10285), 1610. https://doi.org/10.1016/S0140-6736(21)00992-2

28. IMF (2021a). *Database of fiscal policy responses to COVID-19.* https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19

29. IMF (2021b). *IMF Executive Board Concludes 2021 Article IV Consultation with Sweden.* https://www.elibrary.imf.org/view/journals/002/2021/061/article-A001-en.xml?ArticleTabs=fulltext

30. Italian Government (2020). *Decreto Legge 19 Maggio 2020, n.34 Misure urgenti in materia di salute, sostegno al lavoro e all'economia, nonché di politiche sociali connesse all'emergenza epidemiologica da COVID-19.* https://www.gazzettaufficiale.it/eli/id/2020/05/19/20G00052/sg

31. Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112-133. https://doi.org/10.1177/1558689806298224

32. Kapitsinis, N. (2021). The underlying factors of excess mortality in 2020: a cross-country analysis of pre-pandemic healthcare conditions and strategies to cope with Covid-19. *BMC Health Services Research, 21*, 1-19. https://doi.org/10.1186/s12913-021-07169-7

33. Landman, T. (2002). *Issues and methods in comparative politics: An introduction*. Routledge. https://doi.org/10.4324/9780203133828

34. Lohsar, I. (2024). *Assessing the Impact of Stringency Rates on Excess Mortality in Response to the Global COVID-19 Pandemic* [Master's thesis, Södertörn University]. DiVA Portal. https://urn.kb.se/resolve?urn=urn:nbn:se:sh:diva-56428

35. Maltsev, V. V. (2023). Decentralized response as a pandemic second-best: The case of Russia. *Southern Economic Journal, 90*(2), 291-316. https://doi.org/10.1002/soej.12653

36. Marquardt, D. W. (1970). Generalized inverses, ridge regression, biased linear estimation, and nonlinear estimation. *Technometrics*, *12*(3), 591-612. https://doi.org/10.2307/1267205

37. Mathieu, E., Ritchie, H., Rodés-Guirao, L., Appel, C., Giattino, C., Hasell, J., Macdonald, B., Dattani, S., Beltekian, D., Ortiz-Ospina, E. & Roser, M. (2020). *Coronavirus pandemic (COVID-19).* https://ourworldindata.org/coronavirus

38. Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed). Sage Publications.

39. Moolla, I. & Hiilamo, H. (2023). Health system characteristics and COVID-19 performance in high-income countries. *BMC Health Services Research, 23*(1), 244. https://doi.org/10.1186/s12913-023-09206-z

40. Mueller, C. W. (2004). Conceptualization, operationalization, and measurement. *The SAGE Encyclopedia of Social Science Research Methods,* 162-166.

41. National Institute for Economic Research (2020). *Swedish Economy Report December 2020.* https://www.konj.se/download/18.3891afad1764bc62ba85729c/1608215087376/KLDec2020.pdf

42. Nicola, F. & Scaccia, G. (2021). The Italian model to fight COVID-19: Regional cooperation, regulatory inflation, and the cost of one-size-fits-all lockdown measures. *Administrative Law Review, 73*(1), 1-46. https://doi.org/10.2139/ssrn.5001750

43. Noto, G., Belardi, P. & Vainieri, M. (2020). Unintended consequences of expenditure targets on resource allocation in health systems. *Health Policy*, *124*(4), 462-469. https://doi.org/10.1016/j.healthpol.2020.01.012

44. OECD (2023). *Methodological note – All-cause, excess and COVID-19 deaths.* http://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_MORTALITY

45. Parolari, S. (2024). *Italy country report WP3*. Zenodo. https://doi.org/10.5281/zenodo.12185703

46. Pelagatti, M. & Maranzano, P. (2021). Assessing the effectiveness of the Italian risk-zones policy during the second wave of COVID-19. *Health Policy, 125*(9), 1188-1199. https://doi.org/10.1016/j.healthpol.2021.07.011

47. Piacenza, M. & Turati, G. (2014). Does fiscal discipline towards subnational governments affect citizens' well-being? Evidence on health. *Health Economics*, *23*(2), 199-224. https://doi.org/10.1002/hec.2910

48. Pierre, J. (2020). Nudges against pandemics: Sweden's COVID-19 containment strategy in perspective. *Policy and Society, 39*(3), 478-493. https://doi.org/10.1080/14494035.2020.1783787

49. Pizzato, M., Gerli, A. G., La Vecchia, C. & Alicandro, G. (2024). Impact of COVID-19 on total excess mortality and geographic disparities in Europe, 2020–2023: a spatio-temporal analysis. *The Lancet Regional Health–Europe*, *44*. https://doi.org/10.1016/j.lanepe.2024.100996

50. Rubio, D. J. (2011). The impact of decentralization of health services on health outcomes: evidence from Canada. *Applied Economics, 43*(26), 3907-3917. https://doi.org/10.1080/00036841003742579

51. Sahu, M. (2021). Public policy measures for COVID-19 crisis management: lessons from the UAE. *Fulbright Review of Economics and Policy, 1*(2), 246-265. https://doi.org/10.1108/FREP-09-2021-0054

52. Saunders, M., Lewis, P. & Thornhill, A. (2003). Research methods for business students. *Financial Times/ Prentice Hall*

53. Song, L. & Zhou, Y. (2020). The COVID-19 pandemic and its impact on the global economy: what does it take to turn crisis into opportunity?. *China & World Economy, 28*(4), 1-25. https://doi.org/10.1111/cwe.12349

54. Tselios, V. (2023). Does political decentralization affect income inequality? The role of governance quality. *Regional Studies, 57*(5), 829-843. https://doi.org/10.1080/00343404.2022.2101634

55. Vampa, D. (2021). COVID-19 and territorial policy dynamics in Western Europe: comparing France, Spain, Italy, Germany, and the United Kingdom. *Publius: The Journal of Federalism, 51*(4), 601-626. https://doi.org/10.1093/publius/pjab017

56. Wang, H., Paulson, K. R., Pease, S. A., Watson, S., Comfort, H., Zheng, P., Aravkin, A. Y., Bisignano, C., Barber, R. M., Alam, T., Fuller, J. E., May, E. A., Jones, D. P., Frisch, M. E., Abbafati, C., Adolph, C., Allorant, A., Amlag, J. O., Bang-Jensen, B., Bertolacci, G. J., Bloom, S. S., Carter, A., Castro, E., Chakrabarti, S., Chattopadhyay, J., Cogen, R. M., Collins, J. K., Cooperrider, K., Dai, X., Dangel, W. J., Daoud, F., Dapper, C., Deen, A., Duncan, B. B., Erickson, M., Ewald, S. B., Fedosseeva, T., Ferrari, A. J., Frostad, J. J., Fullman, N., Gallagher, J., Gamkrelidze, A., Guo, G., He, J., Helak, M., Henry, N. J., Hulland, E. N., Huntley, B. M., Kereselidze, M., Lazzar-Atwood, A., LeGrand, K. E., Lindstrom, A., Linebarger, E., Lotufo, P. A., Lozano, R., Magistro, B., Malta, D. C., Månsson, J., Mantilla Herrera, A. M., Marinho, F., Mirkuzie, A. H., Misganaw, A. T., Monasta, L., Naik, P., Nomura, S., O'Brien, E. G., O'Halloran, J. K., Olana, L. T., Ostroff, S. M., Penberthy, L., Reiner, R. C., Reinke, G., Ribeiro, A. L. P., Santomauro, D. F., Schmidt, M. I., Shaw, D. H., Sheena, B. S., Sholokhov, A., Skhvitaridze, N., Sorensen, R. J. D., Spurlock, E. E., Syailendrawati, R., Topor-Madry, R., Troeger, C. E., Walcott, R., Walker, A., Wiysonge, C. S., Worku, N. A., Zigler, B., Pigott, D. M., Naghavi, M., Mokdad, A. H., Lim, S. S., Hay, S. I., Gakidou, E. & Murray, C. J. L. (2022). Estimating excess mortality due to the COVID-19 pandemic: A systematic analysis of COVID-19-related mortality, 2020–21. *The Lancet*, *399*(10334), 1513-1536. https://doi.org/10.1016/S0140-6736(21)02796-3

57. Weible, C. M., Nohrstedt, D., Cairney, P., Carter, D. P., Crow, D. A., Durnová, A. P., Heikkila, T., Ingold, K., McConnell, A. & Stone, D. (2020). COVID-19 and the policy sciences: Initial reactions and perspectives. *Policy Sciences, 53*(2), 225-241. https://doi.org/10.1007/s11077-020-09381-4

58. WHO (2025). *Coronavirus disease 2019 (COVID-19) pandemic overview*. https://www.who.int/europe/emergencies/situations/covid-19

59. Wieler, L. H., Rexroth, U. & Gottschalk, R. (2021). *Emerging COVID-19 success story: Germany's push to maintain progress.* https://ourworldindata.org/covid-exemplar-germany

60. Winblad, U., Swenning, A. K. & Spangler, D. (2022). Soft law and individual responsibility: a review of the Swedish policy response to COVID-19. *Health Economics, Policy and Law*, *17*(1), 48-61. https://doi.org/10.1017/S1744133121000256

61. World Bank (2025a). *Data Bank World Development Indicators*. https://databank.worldbank.org/reports.aspx?source=2&type=metadata&series=NY.GDP.PCAP.CD

62. World Bank (2025b). *Metadata Glossary*. https://databank.worldbank.org/metadataglossary/world-development-indicators/series/SH.UHC.SRVS.CV.XD

63. Yanful, B., Kirubarajan, A., Bhatia, D., Mishra, S., Allin, S. & Di Ruggiero, E. (2023). Quality of care in the context of universal health coverage: a scoping review. *Health Research Policy and Systems*, *21*(1), 21. https://doi.org/10.1186/s12961-022-00957-5

64. Zamili, A. (2014). School crises and methods of dealing with them in the schools of the Sultanate of Oman. *Journal of Educational and Psychological Sciences*, *8*(64), 3-84.

65. Zhong, H. (2010). The impact of decentralization of health care administration on equity in health and health care in Canada. *International Journal of Health Care Finance and Economics, 10*(3), 219-237. https://doi.org/10.1007/s10754-010-9078-y