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Political Decentralization and Health Service Delivery Outcomes During Shocks

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ABSTRACT
Political decentralization (PD), domestic government health spending (DGHS), financial autonomy, and accountability are considered as key elements to improving health outcomes in many countries during shocks (or pandemics). In highly decentralized systems, while PD may enhance responsiveness in health service delivery during shocks due to better information about local needs, critics highlight inefficiencies. The inefficiency is associated with the use of DGHS which is expected to increase as countries implement control measures, but spread thinly across several financially autonomous local administrations with weak state capacity and weak accountability mechanisms. Thus there is a debate about whether the information benefits (information advantage) of PD outweighs the cost (cost efficiency) during shocks and hence support better health outcomes. This study quantitatively assesses PD's benefits and costs during H1N1 and COVID-19, finding that the information advantage far outweigh its cost. PD helped reduce fatalities through better information access, despite higher spending. These findings are useful for policy decisions on decentralization for better health service delivery.

1.0 Introduction

Over the past decade, two major pandemics—H1N1 and COVID-19—have had profound social, fiscal, and economic impacts globally, with H1N1 causing up to 575,000 deaths and COVID-19 resulting in about 7 million fatalities. These crises have impacted human development outcomes especially those related to health and human capital. Countries responded with substantial increase in DGHS and state capacity to implement infection control measures. The spending was made in each country's political and administrative context, whether decentralized or centralized. The theory suggests that effective healthcare delivery in either of these contexts requires good information about local needs, adequate financing and the capacity to deliver outputs.

A key research gap exists in understanding how PD affected pandemic outcomes, particularly the variation in fatalities between decentralized and centralized systems. Most literature focuses on within-country responses, but this study examines whether countries with higher PD were more effective in controlling infections and reducing fatalities during H1N1 and COVID-19.

PD is believed to improve public service delivery by providing local governments with better information about community needs, leading many low- and middle-income countries to pursue decentralization reforms. However, critics argue that PD can introduce inefficiencies through coordination bottlenecks, fragmentation, low administrative capacity, and duplication of services. In healthcare delivery, these inefficiencies are linked to the use of DGHS, as resources may be spread thinly across multiple local administrations with weak governance. Efficient use of financial resources is thus crucial in evaluating the effectiveness of decentralized systems.

This study quantitatively assesses both the aggregate and disaggregated effects of PD—specifically, the benefits of improved information access and the costs of inefficiency—on H1N1 and COVID-19 fatalities. Two hypotheses are proposed: (1) PD positively impacts health outcomes during shocks via its information channel, and (2) countries with high PD are less efficient in using financial resources to control pandemic fatalities.
Ordinary least squares (OLS) regression with fixed effects is used to test these hypotheses, leveraging between-country variation in pre-pandemic PD levels. An interaction term between PD and DGHS is introduced to isolate the cost inefficiency channel. Robustness checks include converting PD to a discrete variable, sensitivity tests, and using maternal mortality as an alternative outcome measure. The analysis of two pandemics a decade apart adds further robustness. Endogeneity is minimized by treating the pandemics as exogenous shocks and controlling for time-invariant country factors.
The findings show that PD reduces H1N1 and COVID-19 fatalities, supporting the first hypothesis. However, more decentralized systems are less efficient in spending, supporting the second hypothesis. Overall, the information advantage of PD outweighs cost inefficiency, resulting in a net positive impact on reducing fatalities.
The rest of the paper is organized as follows: Section 2 presents the background and literature review of PD and DGHS; Section 3 details the empirical strategy; Section 4 describes the data and analysis; Section 5 presents results, Section 6 describes robustness checks; and Section 7 discusses the results and Section 8 concludes the study.

2.0 Background and literature review

We review the theoretical links between PD, DGHS, and health outcomes, as well as the epidemiological literature on H1N1 and COVID, focusing on their spread, risk factors, and containment measures. This literature informs our policy questions, particularly how PD's information advantage and DGHS influence control measures and health outcomes during shocks.

2.1 Political decentralization and service delivery

PD is derived from local autonomy and fiscal federalism, which assigns functions and fiscal instruments to different government levels (Musgrave, 1959; Oates, 1972). Fiscal federalism argues that central governments should handle macroeconomic stability and income redistribution due to constraints on lower levels of government (Oates, 1999). However, decentralized governments are better suited for service delivery within their jurisdictions, tailoring services to local needs and increasing economic welfare (Oates, 1999; Anosisye, 2017; World Bank, 2001; Angar, 2020).
Local political systems' effectiveness depends on elements like political accountability and discretion (World Bank, 2009). PD enhances service delivery through the information advantage of local governments, which can tailor services to homogenous groups and improve governance and accountability (Canare, 2020; Boadway and Shah, 2009; Kubal, 2006; Tanzi, 1996; Wallis and Oates, 1988; Faguet, 2009; Von Braun and Grote, 2002; Persson and Tabellini, 2000; Usui, 2007). Inter-jurisdictional competition further improves service delivery (Tiebout, 1956).
To measure PD, we use the Ladner et al. local autonomy index, which includes political discretion, financial autonomy, non-interference, policy scope, legal autonomy, organizational autonomy, and access (Ladner et al., 2016). Political discretion is crucial for effective service delivery, especially in health services, allowing local leaders to make decisions based on local conditions (Canare, 2020). During

emergencies like H1N1 and COVID, local measures, coordinated local decisions can complement national efforts in disease control and health service delivery.

2.2 Domestic government health spending and service delivery

A tenet of fiscal federalism is that local governments should efficiently raise and allocate resources based on local preferences (Oates, 1999). Efficient allocation and spending are crucial to match resources with needs and minimize waste. DGHS is considered the most sustainable and equitable form of healthcare financing (WHO, 2017). It ensures local governments can deliver on their service delivery mandates, especially during shocks like H1N1 or COVID (Hitiris and Posnett, 1992; Singh, 2014; Nikoloski and Amendah, 2017; Farag et al., 2013; IMF, 2021). Increasing DGHS is a common policy response to fund pandemic control measures and mitigate health and economic impacts.

However, PD can lead to inefficiencies in the use of DGHS due to administrative fragmentation, coordination challenges, and weak financial controls (Bahl, 1999; Faguet, 2004; Prud'homme, 1995). In contrast, centralized governments often produce public services more efficiently due to better resources, technology and economies of scale (Canare, 2020). Moreover, PD may increase inequality when localities have different development levels and capacities (Bahl, 1999; Prud'homme, 1995; Qiao, Martinez-Vasquez, and Xu, 2008). Improving health outcomes depends on both the size and composition of public spending. Inefficient use of resources on nonessential services can negatively impact health outcomes (Self and Grabowski, 2003; Çevik and Taşar, 2013). PD can also increase the risk of local elite capture and corruption (Faguet, 2009; Asante and Ayee, 2007; Boone, 2003; Prud'homme, 1995).

2.3.1 H1N1 Shock

In April 2009, the WHO declared a "public health emergency of international concern," marking the start of the first influenza pandemic of the 21st Century. Addressing the pandemic required a multi-phased approach involving health, social, fiscal, and economic measures. H1N1 influenza manifests with flu-like symptoms and can lead to severe respiratory complications (Batta et al., 2023). It spreads through respiratory droplets from infected individuals (CDC, 2022).

The CDC estimated that 150,000 to 575,000 people worldwide died from the H1N1 pandemic (Roos, 2012). About 87% of H1N1-related deaths occurred in people younger than 65, differing from typical seasonal influenza epidemics where 70% to 90% of deaths occur in people 65 and older (Shrestha et al., 2011; Wong et al., 2013; Hajjar and McIntosh, 2010). Wong et al. (2013) estimated fatality risks as 12 per 100 for ages 0-19, 18 per 100 for ages 20-64, and 11 per 100 for ages 65+.

2.3.2 COVID Shock

COVID, which occurred between 2020 and 2022, triggered the largest global economic crisis in over a century (World Development Report, 2022). By December 2024, COVID had caused 7 million deaths worldwide (WHO, 2024). Like H1N1, COVID spread through respiratory droplets from infected individuals (Liu et al., 2020). However, COVID can also be transmitted through aerosols, fecal-oral means, and ocular means. Symptoms vary widely, and asymptomatic cases pose a significant challenge in containing the virus.

Age increased the risk of severe COVID. People 65 and older and babies younger than six months were at higher risk. In the U.S., about 76% of COVID deaths by March 2024 were among those aged 65 and older. COVID required extensive control measures, including health education, social distancing, mask-wearing, rapid testing, and vaccination. These measures needed accurate data, preparedness, and coordination at all government levels. Increasing DGHS was crucial to finance these interventions.

2.3.3 Comparative analysis of symptoms, complications, and transmission patterns of H1N1 and COVID

According to Batta et al. (2023), both H1N1 and COVID share respiratory symptoms like fever, cough, and fatigue, but their manifestations and complications differ significantly. H1N1, characterized by its genetic diversity from avian, swine, and human influenza strains, has a sudden onset of symptoms, including fever, cough, sore throat, body aches, fatigue, and sometimes gastrointestinal issues. In contrast, COVID, caused by SARS-CoV-2, has a wider temporal spectrum of symptoms, with some individuals experiencing a gradual progression over several days. A distinctive feature of COVID is asymptomatic cases, where infected individuals show no symptoms but can still spread the virus, complicating containment efforts.

H1N1 complications mainly involve respiratory infections and can lead to acute respiratory distress syndrome (ARDS) (Batta et al., 2023). COVID, however, is linked to severe pneumonia, ARDS, vascular issues like blood clots and strokes, and multisystem inflammatory syndromes affecting both children and adults (Zadeh et al., 2023; CDC, 2023). Both viruses primarily spread through respiratory droplets, but COVID can also transmit via aerosols, has a longer incubation period, and shows less predictable seasonality. Public health strategies, including vaccination and preventive measures, are crucial for controlling their transmission. Understanding the modes of transmission and local conditions is essential for effective public health control measures.

2.4 Policy questions of interest to our study

Both viruses primarily spread through respiratory routes but differ in transmission dynamics. The spread of both diseases was influenced by local and social conditions such as mask-wearing, adherence to movement restrictions, social distancing, cultural norms, and willingness to vaccinate. Since optimal responses should consider these local conditions, there is no one-size-fits-all approach to containing the viruses. Local authorities should have the autonomy to allocate financial resources and implement control measures suited to their situation. PD is expected to help local governments understand infection drivers and respond effectively with appropriate interventions in financing, commodities, education, and infrastructure to reduce fatalities. However, in highly decentralized systems, low administrative capacity at the local level could lead to inefficient resource allocation and spending, and weak monitoring.

A key policy question therefore is whether politically decentralized countries were more efficient in using government spending and local capacity to control infections and reduce fatalities compared to centralized ones. While several studies (Huang et al., 2012; Cordova-Villalobos et al., 2017; Kucukkarapinar et al., 2022; Nuzzo and Ledesma, 2023) have examined responses to both pandemics, they primarily focus on within-country responses. There is a lack of cross-country studies on the variation in fatalities between decentralized and centralized systems. This paper contributes to addressing this gap by investigating the policy question for each shock using empirical data from a sample of ninety-nine countries affected by the two pandemics.

3.0 Empirical strategy

Our objective is to examine whether PD is linked to improved health outcomes, specifically H1N1 and COVID fatalities. PD's information advantage is thought to help reduce (positive effect) these fatalities, while its cost inefficiency is believed to have a negative effect. Therefore, we hypothesize that PD's information and cost inefficiency channels are associated with H1N1 and COVID fatalities as follows:

Hypothesis one: PD contributes positively to health outcomes during shocks because its information channel lets policy makers and local authorities make effective pandemic control decisions. Hence, the more politically decentralized a country is, the better it is able to control pandemic fatalities.
Hypothesis two: Countries with high PD are less efficient in the use of money in controlling pandemic fatalities. Hence, there is a smaller effect of health spending on pandemic fatalities.

3.1 Assumptions of Empirical Strategy

Before formulating our empirical strategy, we outline the assumptions that underpin it.

(i) We assume that the information and the efficiency channels are the only two competing hypotheses about how PD may affect resilience to shocks

The H1N1 fatalities (proxied by U5M) and COVID excess deaths resulting from the shocks will vary based on the level of PD in each country before the shock. We determine the impact of PD by examining the interaction between the pre-shock level of PD and a year dummy variable set to one for the shock year. Additionally, the cost inefficiency of PD is mainly driven by the increased use of DGHS to implement infection control and containment measures for H1N1 and COVID in various countries.

(ii) H1N1 and COVID are exogenous shocks to countries

Since the H1N1 and COVID shocks occurred rapidly and little was known about control measures, countries did not have time to prepare for them. Therefore, we consider these shocks as exogenous to the countries, which helps mitigate endogeneity concerns (Arizmendi et al., 2021). Additionally, we analyze two shocks that are over a decade apart in the same set of countries, adding an extra layer of robustness to our study results.

(iii) Mothers and people in general have not moved and the risk factors are the same.

We assume that mothers and the overall population have remained stable between more and less decentralized countries. Estimates show a decrease of nearly 2 million international migrants between mid-2019 and mid-2020 (UN DESA, 2020). For example, in 2020, permanent migration inflows to OECD countries fell by over 30 percent, marking a historical low since 2003 (OECD, 2021). Movement limitations were also evident during H1N1, with family migration to OECD countries dropping by more than 35 percent. We further assume that risk factors for U5M and COVID, such as infectious diseases, pre-term birth complications, and chronic conditions, are consistent across the study countries.

(iv) The number of sick people with a high risk of contracting H1N1 and COVID is not different among the countries and the sick people will not travel to countries with less H1N1 and COVID burden.

We assume that the high-risk populations for H1N1 and COVID are similar across the study countries. Children under 5 and elderly individuals were most susceptible to H1N1, with comparable percentages among these countries, which share similar demographic patterns. Cross-border movement restrictions for H1N1 and strict lockdowns for COVID further limited mobility

The Empirical Model

Considering the above assumptions, we posit that the U5M and COVID excess deaths induced by the shocks will vary according to the level of PD in each country prior to the pandemic year, all things being equal. We identify the impact of PD by examining the interaction between the pre-shock level of PD and a year dummy variable set to one for the shock year. Additionally, we create dummy variables for pre- and during-shock U5M and COVID excess deaths, respectively, and interact these dummies with PD pre-shock to investigate any changes in U5M and COVID excess deaths before and during the pandemics. We use overall mortality as a measure of deaths prior to COVID. For the H1N1 shock, we use data from 2008 and 2009 to capture the period before and during the shock, respectively. The WHO declared H1N1 a pandemic in April 2009, which ended in February 2010. For the COVID shock, we use data from 2019 and 2020 to capture the period before and during the shock, respectively. The WHO declared COVID a pandemic in January 2020[1].

Using the OLS with fixed effects method, we formulate the following regression specification for testing hypothesis one:

$$Y_{it} = \beta_0 + \beta_1 I(t = shock) + \beta_2\, I(t = shock) \times PD_{i,pre-shock} + \beta_3 X_{it} + \mu_i + \varepsilon_{it} \text{.......... (1)}$$

where Y_{it} is the outcome variable, U5M or COVID excess deaths at country i at time *t*. *I(.)* is an indicator function for the H1N1 or COVID period, which takes the value 1 for financial year 2009 for H1N1 and 0 otherwise, or 2020 for COVID and 0 otherwise. $PD_{i,pre-schock}$ is the PD index pre-shock, our measure of the level of political decentralization. X_{it} is a vector of time varying observed country features or control variables that include autonomy measures related to decentralization such as, organizational, financial, access, non-interference, and political scope. We also control for DGHS per capita, quality of leadership, GDP per capita, the percentage of population living in rural areas, access to sanitation, life expectancy and overall mortality, and country fixed effects. μ_i is an unobserved country fixed effect, which includes the level of the pre-pandemic PD, ε_{it} is random noise and *t* takes two values for financial years 2008 and 2009 for H1N1, and 2019 and 2020 for COVID.

The coefficient β_2 measures the change in fatalities attributable to PD before and during H1N1 or COVID. If hypothesis one holds, β_2 should be negative and significant for equation 1, which implies that at the aggregate level, PD contributes positively towards reducing H1N1 and COVID fatalities, respectively.

To test hypothesis two, we expand model 1 above by decomposing the aggregate effect of PD to account for the cost of the less efficient use of money in the empirical strategy. We do this by introducing an interaction term between PD and DGHS to determine the association between PD and U5M or COVID excess deaths by isolating the cost of inefficiency associated with PD, as suggested in the hypothesis. We formulate our empirical strategy in equation 2 below:

$$Y_{it} = \beta_0 + \beta_1 I(t = shock) + \beta_2\, I(t = shock) \times PD_{i,pre-shock} + \beta_5 I(t = shock) \times PD_{i,pre-shock} \times DGHS_{it} + \beta_6 DGHS_{it} \times PD_{i,pre-shock} + \beta_3 X_{it} + \mu_i + \varepsilon_{it} \text{.. (2)}$$

where β_5 is the coefficient of the PD and DGHS interaction term; and $\beta_5 I(t{=}shock) \times PD_{i,pre-shock} \times DGHS_{it} + \beta_6 DGHS_{it} \times PD_{i,pre\text{-}shock}$ is the interaction term of interest. All the other variables are the same as in equation 1 above. If hypothesis two is correct, β_5 will be positive and significant, implying that the cost of PD's less efficient use of money contributes to increasing H1N1 and COVID fatalities, respectively. The reverse is true if hypothesis two is incorrect.

4.0 Data and analysis of trends

In this section, we analyze data patterns and justify using U5M as a proxy for H1N1 fatalities and COVID excess deaths. We selected sample countries based on data availability and reliability, gathering data for the sample countries from the World Bank database. These data include DGHS per capita, GDP per capita, U5M, maternal mortality, rural population percentage, life expectancy, mortality rate, and infant mortality.

[1] https://www.who.int/europe/emergencies/situations/COVID.

PD, proxied by political discretion, and other local autonomy scores (organizational[2], financial[3], legal[4], and non-interference[5]) were calculated using guidance from the Ladner et al. (2016) index.

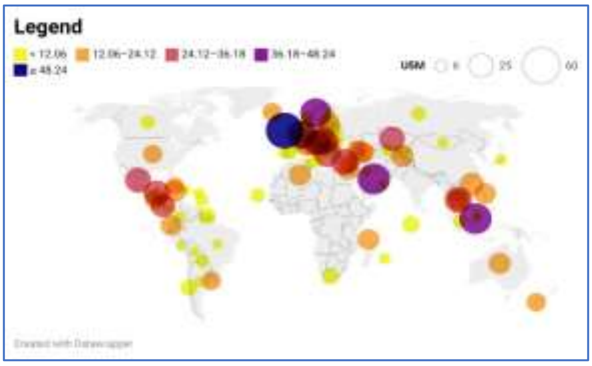
4.1 Calculation of Index

A PD score of 100 percent indicates high political decentralization, where local governments have significant authority over service delivery decisions. This includes decisions on schools, teacher employment, financial relief, health centers, building permits, zoning, public transport, housing, police services, and caring functions. A score of 0 percent represents low political decentralization, with no local authority. Other local autonomy variables also scored on a scale of 100 to 0 reflect varying levels of local decision-making autonomy.

Figures 1 and 2 show the intensity of PD and U5M, respectively, and Figures 3 and 4 show the intensity of PD and COVID excess deaths, respectively. There is an observable pattern of an inverse relationship between the intensity of PD and U5M as well as PD and COVID excess deaths in the raw data. These patterns will be tested using our empirical model.

Figure 1: PD intensity of sample countries

Figure 2: U5M intensity



Source: Author’s calculations

Figure 3: PD intensity of sample countries

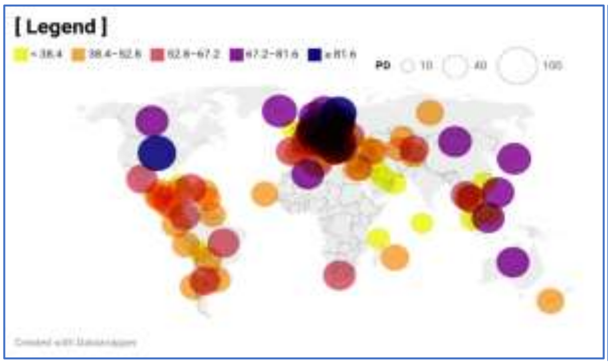
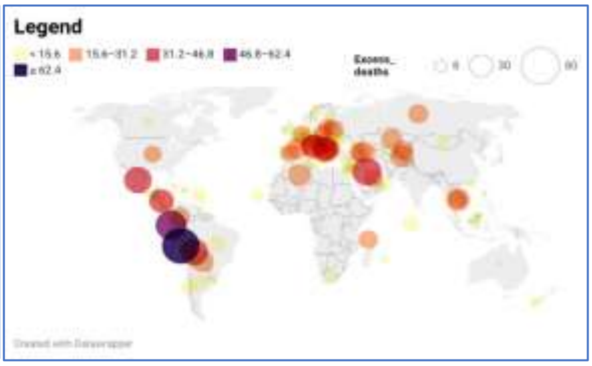


Figure 4: COVID excess deaths intensity



COVID excess deaths were sourced from Karlinsky and Kobak's 2021 World Mortality Dataset. Political decentralization is time invariant as a country's PD status typically remains stable in the short to medium term.

[2] the free organization of local political arenas and administration
[3] the financial resources available locally and the possibility to decide on their sources and uses (fiscal autonomy, financial self-reliance and borrowing autonomy)
[4] the legal status and protection of local governments (legal protection)
[5] the extent of liberty left by higher levels of government in their control (financial transfer system and administrative supervision)

4.2 Measure of H1N1 fatalities

While various metrics, such as infection cases, evaluate how well countries managed the H1N1 pandemic, this study uses the U5M rate before and during the pandemic as the benchmark. Empirical data indicates the pandemic's burden fell largely on children (Lemaitre and Carrat, 2010; Hajjar and McIntosh, 2010). Lemaitre and Carrat (2010) found that during seasonal epidemics, mortality is highest among the elderly. However, during pandemic influenza, mortality is highest among younger age groups, a signature feature of pandemics (Miller et al., 2009). Lemaitre and Carrat examined the age distribution of mortality during seasonal influenza epidemics in the US and France, comparing it with the 2009 H1N1 pandemic in the same countries, and noted higher mortality among children under 10 years. See Figures 7 and 8. This pattern is evident in the H1N1 pandemic data.

Figure 7. Relative Mortality for Seasonal Flu

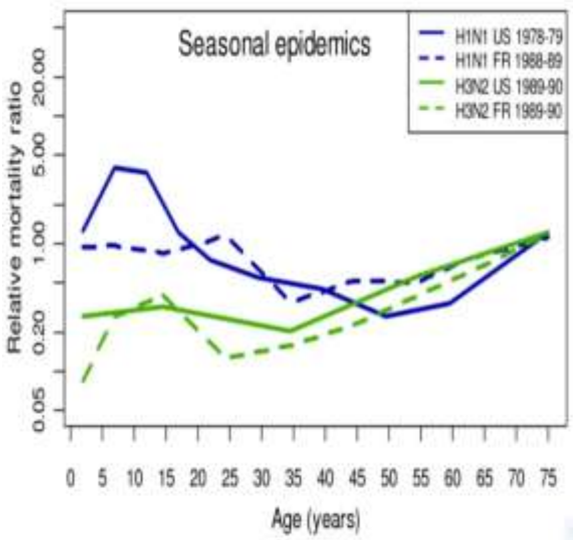
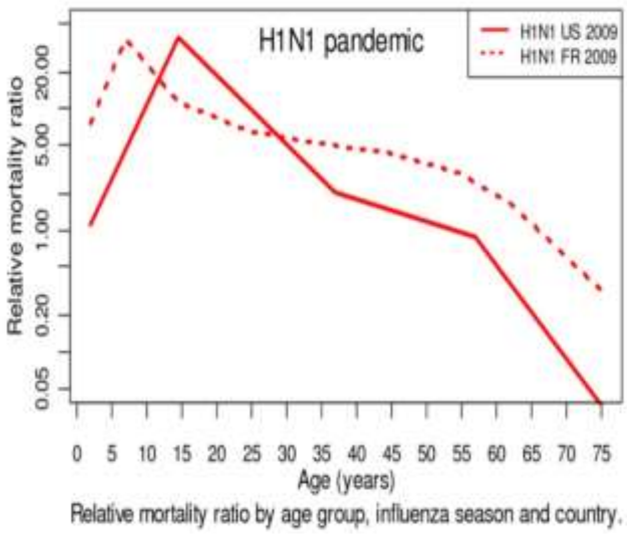


Figure 8. Relative Mortality for H1N1



Source: Lemaitre and Carrat, 2010.

Since the fatality rate of children was quite high[6,7] during H1N1, we use the U5M rate as a proxy for measuring the performance of countries in the study.

4.3 Measure of COVID fatalities

To estimate deaths from pandemics, scientists compare total deaths during the event to expected deaths based on previous years' data, determining excess deaths. Excess mortality, defined as the increase in all-cause mortality over historical trends, has been used to estimate death tolls from events like the Great Plague of London (Boka and Wainer, 2020), the 1875 influenza epidemic in London (Farr, 1885), and 20th and 21st-century influenza pandemics (Murray et al., 2006; Viboud et al., 2006), as well as seasonal influenza epidemics (Housworth and Langmuir, 1974). It was also used to measure fatalities from Hurricane Maria in Puerto Rico in 2016 (Milken Institute, 2018).

This study investigates whether countries with high political decentralization experienced fewer COVID excess deaths compared to those with low political decentralization. Karlinsky and Kobak (2021) developed the World Mortality Dataset, providing crucial information on COVID deaths across 103 countries. Although excess mortality does not exactly match COVID infection mortality, it is widely

[6] https://emedicine.medscape.com/article/1807048-overview#a6.
[7] https://www.cidrap.umn.edu/news-perspective/2009/12/making-sense-h1n1-pandemic-whats-going.

considered the most objective indicator of the COVID death toll in many countries (Beaney et al., 2020). Excess mortality has been used to estimate COVID's impact in various countries, both in academic literature (Kontis et al., 2020) and by major media outlets such as The Economist.[8]

5.0 Results

In this section, we test our hypotheses and analyze the effect estimates. We examine the aggregate and disaggregate effects of PD on U5M and COVID excess deaths using equations 1 and 2.

5.1 H1N1 shock

Table 3 reports our estimates of the association between U5M and PD. Column 1 presents the aggregate effects and column 2 presents the disaggregate effects of PD and the interaction of PD with DGHS.

In column 1, PD (β_2) has a statistically significant negative effect on U5M, i.e., higher PD leads to lower U5M per 1,000 live births. In particular, a 10-point increase in the PD index is associated with 0.11 fewer deaths among under 5 children per 1,000 live births. This is equivalent to 1.54 percent decrease in U5M at the mean U5M of 14 per 1,000 live births (Annex 1 -Table 1). The negative estimate of the PD coefficient speaks in favor of hypothesis one, or that countries with more decentralized political systems may have benefitted from the information advantage in their H1N1 control measures which may have helped reduce fatalities. We note that this estimate measures the aggregate effect of different PD channels on H1N1 and hence, may underestimate the actual effect of the informational channel if the DGHS effect is positive as hypothesized in hypothesis two.

The results in column 2 confirm the presence of cost inefficiency in politically more decentralized countries as when PD is interacted with DGHS per capita it has a statistically significant positive coefficient (β_5) of 0.007. This implies that the effect of a $10 increase in DGHS on U5M will be more by 0.7 deaths for a country with a 10-point larger PD index. In other words, politically more decentralized countries appear to be less cost efficient in appropriating additional spending on healthcare. From a different perspective, our results suggest that an increase in donor funding or budgetary spending for health programs implemented at district instead of provincial level of service delivery may be less cost efficient. After isolating the cost efficiency channel of PD, we obtain a six-fold increase in the PD coefficient (β_2), which suggests a much larger effect of the PD informational channel on U5M than obtained above when the aggregate PD effect was considered.

Table 3: Estimates of the impact of PD pre-shock on U5M

Dependent Variable	**1**	**2**
	Under 5 Mortality	**Under 5 Mortality**
Political Decentralization (PD), (β_2)	-.011***	-.06***
	(0.002)	-0.009
Political decentralization x Domestic gov't health spending x time, (β_5)		.007***
		(0.001)
Domestic gov't health spending	-1.554	-2.998
	(.937)	(3.859)

[8] https://www.economist.com/graphic-detail/coronavirus-excess-deaths-tracker.

Controls	YES	YES
R-squared	0.999	0.999
Number of countries	99	99
Observations	198	198

Notes: Time period is 2008 and 2009. Models estimated by OLS with standard errors (in parentheses under coefficients) robust to arbitrary heteroskedasticity. PD is measured in year 2008 using Ladner, et al., Index. In addition to PD in 2008 and the year 2009 dummy, controls are 10 variables corresponding to other forms of local autonomy that could potentially have an impact on the U5M, maternal mortality or influence political decentralization. The controls include financial autonomy, administrative autonomy, organizational autonomy, political scope, non-interference, legal autonomy, access, life expectancy, per cent of population in rural areas, and GDP per capita. Under 5 mortality rate is measured per 1,000 births. All models also include a constant and a full set of country dummies. * Significant at 10%; ** significant at 5%; *** significant at 1%.

5.2 COVID shock

Table 4 presents our estimates of the relationship between COVID excess deaths and PD. Column 1 presents the results for hypothesis one, using equation 1 (aggregate effect), and column 2 presents the results for hypothesis two using equation 2 (or disaggregated effect).

In column 1, PD (β_2) has a statistically significant negative effect on COVID excess deaths, i.e., higher PD leads to lower COVID excess deaths per 100,000 people. A 10-point increase in the PD index is associated with 0.73 fewer COVID excess deaths per 100,00 people. This is approximately 8.76 percent decrease in COVID excess deaths per 100,000 people at the mean COVID excess deaths of 12 per 100,000 people ((Annex 1 -Table 2). Like the H1N1 results, the estimate of the coefficient supports hypothesis one, or that countries with more decentralized political systems may have benefitted from the information advantage in their COVID control measures which may have helped reduce fatalities. Again, we note that this estimate measures the aggregate effect of the different PD channels on COVID excess deaths and, hence, may underestimate the actual effect of the informational channel if the DGHS effect is positive as hypothesized in hypothesis two.

The results in column 2 confirm the presence of cost inefficiency in politically more decentralized countries as when PD is interacted with DGHS per capita it has a statistically significant positive coefficient (β_5) of 0.051. This implies that the effect of a $10 increase in DGHS on COVID excess deaths will be 5.1 more deaths for a country with a 10-point larger PD index. In other words, politically more decentralized countries appear to be less efficient in appropriating additional spending on healthcare. After having isolated the cost efficiency channel of PD, we obtain a seven-fold increase in the PD coefficient (β_2), which suggests a much larger effect of the PD informational channel on COVID excess deaths than obtained above when the aggregate PD effect was considered.

Table 4: Estimates of the impact of PD pre-shock on excess COVID deaths

Dependent Variable	**1**	**2**
	COVID Excess deaths	**COVID Excess deaths**
Political decentralization (β_2)	-.073**	-.49**
	(0.032)	(0.202)

Political decentralization (x) Domestic gov't health spending (x) time (β_5)		.051*
		(0.029)
Domestic gov't health spending	7.334	23.621
	(13.091)	(47.112)
Controls	YES	YES
R-squared	0.516	0.54
Number of countries	99	99
Observations	194	194

Notes: Time period is 2019 and 2020. Models estimated by OLS with standard errors (in parentheses under coefficients) robust to arbitrary heteroskedasticity. PD is measured in year 2019 using Ladner, et al., Index. In addition to PD in 2019 and the year 2020 dummy, controls are 10 variables corresponding to other forms of local autonomy that could potentially have an impact on the COVID or influence political decentralization. The controls include financial autonomy, administrative autonomy, organizational autonomy, political scope, non-interference, legal autonomy, access, life expectancy, per cent of population in rural areas, and GDP per capita. The estimation sample for COVID fatalities is under excess deaths per 1,000 births. All models also include a constant and a full set of country dummies. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Combining the U5M and COVID excess death results, we observe a consistent pattern. PD positively impacts reducing H1N1 and COVID fatalities during shocks at the aggregate level. At the disaggregate level, despite inefficiencies in DGHS use, isolating cost inefficiency shows PD's positive impact increases six- to sevenfold.

6.0 Robustness

We performed two robustness checks: first, by using maternal mortality instead of U5M as the dependent variable for H1N1 health outcomes; and second, by modifying the methodology to use a discrete variable for PD instead of a continuous one.

6.1 Health outcome check: Maternal mortality test

To test the robustness of our results, we analyzed the association between PD and maternal mortality during the H1N1 shock using the same specifications as in Table 3. Maternal mortality was used because it is affected by similar health conditions as U5M. Pfitscher et al. (2016) confirmed that H1N1 influenza cases had worse outcomes, with a Maternal Near Miss MD ratio < 1 (0.9:1) compared to 12:1 in other causes, and a mortality index > 50 per cent compared to 7.4 per cent in other severe maternal morbidity causes.

The results in Table 5 (Column 1) show that PD (β_2) has a statistically significant negative effect on maternal mortality; higher PD leads to lower maternal mortality per 100,000 live births. A 10-point increase in the PD index is associated with 1.1 fewer maternal mortality 100,000 live births, equivalent to 3.14 per cent decrease in maternal mortalities at the mean of 35 per 100,000 live births. his supports hypothesis one, suggesting that politically decentralized systems may benefit from an information advantage in maternal mortality control measures. This estimate measures the aggregate effect of different PD channels and may underestimate the actual effect if the DGHS effect is positive as hypothesized in Hypothesis 2.

Table 5 (Column 2) confirms cost inefficiency in politically decentralized countries. When PD is interacted with DGHS per capita, it has a statistically significant positive coefficient (β_5) of 0.009. This means a $10 increase in DGHS leads to 0.9 more maternal deaths for countries with a 10-point higher PD index. Politically decentralized countries are less efficient in healthcare spending. After isolating the cost efficiency channel, the PD coefficient (β_2), increases nine-fold, indicating a larger effect of the PD informational channel on COVID excess deaths than previously considered.

Table 5: Estimates of the impact of PD pre-shock on Maternal Mortality

Dependent Variable	1 Maternal Mortality	2 Maternal Mortality
Political Decentralization (I(.)*PD)	-.011**	-.094***
	(0.005)	(0.034)
Domestic gov't health spending per capita	-4.413	-0.175
	(3.339)	(9.165)
Political decentralization x Domestic gov't health spending x time		.009*
Domestic gov't health spending	-4.413 (3.339)	(0.005) -.175 (9.165)
Controls		YES
R-squared		0.999
Number of countries		99
Observations		198

Notes: Time period is 2008 and 2009. Models estimated by OLS with standard errors (in parentheses under coefficients) robust to arbitrary heteroskedasticity. PD is measured in year 2008 using the Ladner, et al., Index. In addition to PD in 2008 and the year 2009 dummy, controls are 10 variables corresponding to other forms of local autonomy that could potentially have an impact on the U5M, maternal mortality, or influence political decentralization. The controls include financial autonomy, administrative autonomy, organizational autonomy, political scope, non-interference, legal autonomy, access, life expectancy, per cent of population in rural areas, and GDP per capita. The estimation sample for the under 5 mortality rate is under-5 mortality per 1,000 births. . All models also include a constant and a full set of country dummies. *Significant at 10%; **significant at 5%; and ***significant at 1%.

6.2 Methodological check: Threshold checks on H1N1 and COVID excess deaths

If PD is associated with reducing U5M and COVID fatalities during the H1N1 and COVID shocks, we expect significant reductions in fatalities among countries with at least a 50% PD score. These countries, having an average or higher PD level, would benefit more from the information channel compared to those with lower PD scores. Additionally, the cost inefficiency from the interaction of PD and DGHS is expected to be significant in these countries. We tested this by analyzing U5M and COVID excess deaths, measuring both aggregate and disaggregate effects of PD among countries with at least 50% decentralization. For the aggregate effect, we modified equation 1 for U5M and COVID excess deaths as follows:

$$Y_{it} = \beta_0 + \beta_1 I(t = shock) + \beta_2\, I(t = shock) \times \overline{PD}_{i,pre-shock} + \beta_3 X_{it} + \mu_i + \varepsilon_{it} \text{.........(3)}$$

where, Y_{it} represents U5M or COVID excess deaths, $\overline{PD}_i$ is a dummy (1) and a discrete variable for all countries with at least 50 percent PD. All other countries are represented by 0. Apart from these modifications, all the other variables are the same as those explained in the empirical strategy section under equation 1.

To test the disaggregate effect of PD, we modified equation 2 as follows:

$$Y_{it} = \beta_0 + \beta_1 I(t = shock) + \beta_2\, I(t = shock) \times \overline{PD}_{i,pre-shock} + \beta_5 I(t = shock) \times \overline{PD}_{i,pre-shock} \times DGHS_{it} + \beta_6 DGHS_{it} \times \overline{PD}_{i,pre-shock} + \beta_3 X_{it} + \mu_i + \varepsilon_{it} \quad \ldots\ldots(4)$$

Y_{it} represents U5M or COVID excess deaths, and $\overline{PD}$ is a dummy (1) and a discrete variable for all countries with at least 50 percent PD. All other countries were represented by 0. Apart from these modifications, all the other variables are the same as the ones explained in the empirical strategy section under equation 2.

The results of equations 3 and 4 in Table 6 show that PD has a negative and significant effect on U5M, supporting hypothesis one that PD reduces fatalities in countries with at least 50% PD. The coefficient of PD is much larger, providing strong evidence. For COVID, PD is negative but not significant, suggesting the positive effect of DGHS cost inefficiency may have been overestimated.

Table 6: Estimates of the impact of PD pre-shock on countries with at least 50 per cent political decentralization

Dependent Variable	**U5M**		**COVID Excess Deaths**	
	Aggregate Effect	Disaggregate Effect	Aggregate Effect	Disaggregate Effect
Political Decentralization (I(.)*PD)	-.636***	-.86***	-2.693	-4.921*
	(0.221)	(0.32)	(1.916)	(2.806)
Political decentralization x Domestic gov't health spending x time		.002*		.002*
		(0.001)		(0.001)
Domestic gov't health spending	-0.001	-0.001	.023***	.017***
	(0.001)	(0.001)	(0.008)	(0.006)
Controls	YES	YES	YES	YES
R-squared	0.998	0.998	0.492	0.505
Number of countries	99	99	99	99
Observations	198	198	198	198

Notes: Time period is 2008 and 2009. Models estimated by OLS with standard errors (in parentheses under coefficients) robust to arbitrary heteroskedasticity. PD measured in year 2008 using Ladner, et al., Index. In addition to PD in 2008 and the year 2009 dummy, controls are 10 variables corresponding to other forms of local autonomy that could potentially have an impact on the U5M, maternal mortality, or influence political decentralization. The controls include financial autonomy, administrative autonomy, organizational autonomy, political scope, non-interference, legal autonomy, access, life expectancy, per cent of population in rural areas and GDP per capita. The estimation sample for under 5 mortality rate is under 5 mortality per 1,000 births. All models also include a constant and a full set of country dummies. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Regarding hypothesis two, after isolating the efficiency channel of PD, the estimates show a negative and significant association between PD, U5M, and COVID excess deaths. The coefficients are large due to the rescaling of the PD variable. Unlike previous results, DGHS shows a positive and significant association with COVID, possibly due to omitted variables or the crude measure of PD. The analysis indicates that the degree of PD matters for health outcomes, and a continuous PD variable is a better measure. The results support hypothesis two, showing that higher PD is associated with less efficient use of spending in controlling U5M and COVID excess deaths.

7.0 Discussion of results

The positive impact of PD on service delivery aligns with Angar (2020), who found that introducing county administrations in Kenya in 2015 led to a 0.064 percentage point increase in piped water in the Southern border. The 2013 county government reforms granted local officials authority over resource allocation to enhance service delivery. Regarding cost efficiency, our study aligns with Musgrove (1996) and Filmer and Prichett (1999), who found no significant association between public health spending and child mortality. However, when DGHS is interacted with PD, we find a significant positive association with U5M and COVID excess deaths. Our study addresses the interaction of DGHS and PD on health outcomes, which previous studies did not.

Our results indicate that while increasing DGHS may be less cost-efficient in a more politically decentralized system, the overall benefits are greater because the information advantage of PD positively contributes to improving health outcomes. However, this may not be the case in every situation, as some countries may have better capacity to absorb and utilize additional funding than others. For instance, Filmer and Pritchett (1999) suggest that the impact of public spending depends on the extent to which it can create effective public services. In some countries, a dollar spent in the public health sector will result in facilities and services that effectively improve health status, while in others, it may lead to expensive but ineffective services. Therefore, even within a more politically decentralized system, local administrations with weak state capacity are more likely to experience inefficient service or low service provision during shocks.

8.0 Conclusions

We aimed to determine if politically decentralized countries use their information advantage to manage shocks and reduce fatalities. Using anecdotal, empirical evidence, and theoretical foundations, we examined the effects of PD's information and cost efficiency channels on pandemic fatalities. We tested two hypotheses using data from the two recent pandemics.

The results suggest that during the H1N1 and COVID shocks, politically decentralized countries may have implemented targeted interventions more effectively due to the information channel. However, these interventions might have incurred higher costs perhaps due to weak local capacity, diseconomies of scale from fragmented pandemic control approaches across multiple local governments, weak policy coordination and monitoring of interventions. While money alone cannot ensure good health, our findings show that when combined with political decentralization, the impact on reducing fatalities during shocks can be significant, albeit potentially inefficient due to increased resource expenditure. Nonetheless, after isolating the effects of the cost inefficiency channel, greater political decentralization still contributes positively to reducing fatalities.

References

1. Ahmad, J., Devarajan, S., Khemani, S., Shah, S., 2005. *Decentralization and Service Delivery*. (World Bank Policy Research Working Paper 3603). Washington, DC: World Bank.
2. Angar, J. M., 2020. *Political Decentralization and Public Service Delivery: A case study of the Southern border region of Kenya and the Northern border region of Tanzania*. KDI School of Public Policy and Management. Unpublished, pp.22.
3. Anosisye, M., 2017. Decentralization by Devolution: Perception of Councilors on Their Exercise of Fiscal Decision Making Authority in Local Government Authorities in Tanzania. *Journal of Political Sciences & Public Affairs*, 5(2), pp.1–5. https://doi.org/10.4172/2332-0761.1000242.
4. Arizmendi, C., Gates, K., Fredrickson, B. and Wright, A., 2021. Specifying exogeneity and bilinear effects in data-driven model searches. *Behavior Research Methods*, 53, pp.1276–1288. https://doi.org/10.3758/s13428-020-01469-2.
5. Asante, F. and Ayee, J., 2007. Decentralization and poverty reduction. In: E. Aryeetey, ed. *The Economy of Ghana: Analytical Perspectives on Stability, Growth, & Poverty*. Accra, Ghana: Woeli Publishing Services, pp.325–347.
6. Bahl, R., 1999. Fiscal decentralization as development policy. *Public Budgeting & Finance*, 19(2), pp.59–75. https://doi.org/10.1046/j.0275-1100.1999.01163.x.
7. Batta, I., Kaur, T., Agrawal, D. K., 2023. Distinguishing Swine Flu (H1N1) from COVID-19: Clinical, Virological, and Immunological Perspectives. Arch Microbiol Immunol. 2023;7(4):271-280. doi: 10.26502/ami.936500125. Epub 2023 Nov 3. PMID: 37994372; PMCID: PMC10664801.
8. Beaney, T., Clarke, J.M., Jain, V., Golestaneh, A.K., Lyons, G., Salman, D. and Majeed, A. 2020. Excess mortality: the gold standard in measuring the impact of COVID-19 worldwide? *Journal of the Royal Society of Medicine*, 113(9), pp.329–334. https://doi.org/10.1177/0141076820956802.
9. Boadway, R. and Shah, A., 2009. *Fiscal Federalism: Principles and Practices of Multiorder Governance*. New York: Cambridge University Press.
10. Boka, D. M. and Wainer H., 2020. How Can We Estimate the Death Toll from COVID-19? *Chance*, 33(3), pp.67–72.
11. Boone, C., 2003. Decentralization as Political Strategy in West Africa. *Comparative Political Studies*, 36, pp.355–380. https://doi.org/10.1177/0010414003251173.
12. Canare, T., 2020. Decentralization, Local Government Fiscal Independence, and Poverty: Evidence from Philippine Provinces. *Southeast Asian Journal of Economics*, 8(2), pp.77–108.
13. CDC (2022) How Flu Spreads. In: Centers for Disease Control and Prevention. Accessed 2 Oct (2023).
14. CDC., 2023. What you need to know about influenza (flu) from CDC. In: Centers for Disease Control and Prevention. https://www.cdc.gov/flu/index.htm. Accessed 2 Oct (2023)
15. Çevik, S., and Taşar, M. O., 2013. Public Spending on Health Care and Health Outcomes. A Cross-Country Comparison. *Journal of Business, Economics and Finance,* 2(4), pp.82–100.
16. Cordova-Villalobos, J, A., Macias, A, E., Hernandez-Avila, M., Dominguez-Cherit, G., Lopez-
17. Faguet, J., 2009. Governance from below in Bolivia: A theory of local government with two empirical tests. *Latin American Politics and Society*, 51, pp.29–68. https://doi.org/10.1111/j.1548-2456.2009.00063.x.
18. Farag, M., et al., 2013. Health expenditure, health outcomes and the role of good governance. Int *International Journal of Health Care Finance and Economics*, 13(1), p.33–52.

19. Farr, W., 1885. *Vital statistics: a memorial volume of selections from the reports and writings of William Farr*. London: The Sanitary Institute.
20. Filmer, D., and Prichett, L., 1999. The impact of public spending on health: does money matter? *Social Science & Medicine,* 49, pp.1309–1323.
21. Hajjar, S., and McIntoshb, K., 2013. The first influenza pandemic of the 21st century. *Annals of Saudi Medicine*, 30(1), pp.1–10. doi: 10.4103/0256-4947.59365.
22. Huang, J, H., Miao, Y, Y., Kuo, P, C., 2012., Pandemic influenza H1N1 vaccination intention: psychosocial determinants and implications from a national survey, Taiwan. Eur J Public Health. 2012 Dec;22(6):796-801. doi: 10.1093/eurpub/ckr167. Epub 2011 Nov 17. PMID: 22102631.
23. Hitiris, T. and Posnett, J., 1992. The determinants and effects of health expenditure in developed countries. *Journal of Health Economics,* 11(2), pp.173–81.
24. Housworth, J., Langmuir, A. D., 1974. Excess mortality from epidemic influenza. *American Journal of Epidemiology,* 100(1):40–8. doi: 10.1093/oxfordjournals.aje.a112007.
25. Karlinsky, A. and Kobak, D., 2021. Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset. *Elife,* 10, pp.e69336. doi: 10.7554/eLife.69336.
26. Kontis, V., Bennett, J. E., Rashid, T., Parks, R. M., Pearson-Stuttard, J., Guillot, M., Asaria, P., Zhou, B., Battaglini, M., Corsetti, G., McKee, M., Di Cesare, M., Mathers, C. D., and Ezzati, M., 2020. Magnitude, demographics and dynamics of the effect of the first wave of the COVID-19 pandemic on all-cause mortality in 21 industrialized countries. *Nature Medicine* (26), pp.1919–1928.
27. Kubal, M., 2006. Contradictions and constraints in Chile's health care and education decentralization. *Latin American Politics and Society*, 48, pp.105–135. https://doi.org/10.1353/lap.2006.0048.
28. Kucukkarapinar, M., Karadag, F., Budakoglu, I., Aslan, S., Ucar, O., Pence, A, Y., Timurcin, U., Tumkaya, S., Hocaoglu, C., Kiraz, I., 2022., The Relationship between COVID-19 Protection Behaviors and Pandemic-Related Knowledge, Perceptions, Worry Content, and Public Trust in a Turkish Sample. Vaccines (Basel). 2022 Nov 27;10(12):2027. doi: 10.3390/vaccines10122027. PMID: 36560437; PMCID: PMC9784616.
29. Ladner A., Keuffer, N., and Baldersheim, H., 2016. *Self-rule Index for Local Authorities (Release 1.0)*. Luxembourg: Publications Office of the European Union.
30. Lemaitre, M., and Carrat, F., 2010. Comparative age distribution of influenza morbidity and mortality during seasonal influenza epidemics and the 2009 H1N1 pandemic. *BMC Infectious Diseases*, 10, 162.
31. Liu, J., Liao, X., Qian, S., et al., 2020. Community transmission of severe acute respiratory syndrome coronavirus 2, Shenzhen, China. Emerg Infect Dis 2020 doi.org/10.3201/eid2606.200239
32. Miller, E., Andrews, N., Stellitano, L., Stowe, J., Winstone, A. M., Shneerson, J., and Verity, C., 2013. Risk of Narcolepsy in Children and Young People Receiving AS03 Adjuvanted Pandemic A/H1N1 2009 Influenza Vaccine: Retrospective Analysis. *BMJ* , 346, pp.f794.
33. Milken Institute School of Public Health., 2018. *Project report on ascertainments of the estimated excess mortality from hurricane Maria in Puerto Rico*. In collaboration with the University of Puerto Rico Graduate School of Public Health. Available from: https:// https://publichealth.gwu.edu/sites/g/files/zaxdzs4586/files/2023-06/acertainment-of-the-estimated-excess-mortality-from-hurricane-maria-in-puerto-rico.pdf.
34. Musgrave, R. M., 1959. *The Theory of Public Finance*. New York: McGraw-Hill Public Finance.
35. Musgrove, P., 1996. *Public and private roles in health: Theory and financing patterns*. (Health, Nutrition and Population Discussion Paper). Washington DC: World Bank.

36. Nikoloski, Z. and Amendah, D., 2017. Does a country's greater health care spending lead to better health to better health outcomes for its population for its population? – Evidence from African Health Accounts. Unpublished.
37. Nuzzo, J. B., and Ledesma, J, R., 2023., Why Did the Best Prepared Country in the World Fare So Poorly during COVID? Ledesma Journal of Economic Perspectives—Volume 37, Number 4—Fall 2023
38. Oates, E., 1972. *Fiscal Federalism*. New York: Harcourt Brace Jovanovich
39. Oates, E., 1999. An essay on Fiscal Federalism. *Journal of Economic Literature*, XXXVII, pp.1120–1149.
40. OECD. 2021. Key facts and figures (infographic). In: *International Migration Outlook 2021*. Paris: OECD Publishing. https://doi.org/10.1787/3e2ffd79-en.
41. Persson, T. and Tabellini, G., 2000. *Political Economics: Explaining Economic Policy*. Cambridge and London: Massachusetts Institute of Technology Press.
42. Pfitscher, L.C., et al. and Brazilian Network for Surveillance of Severe Maternal Morbidity Group, 2016. Severe maternal morbidity due to respiratory disease and impact of 2009 H1N1 influenza A pandemic in Brazil: results from a national multicenter cross-sectional study. *BMC Infectious Diseases,* 16, 220. https://doi.org/10.1186/s12879-016-1525-z.
43. Prud'homme, R., 1995. *On the Dangers of Decentralization*. (Policy Research Working Paper 1252). Washington, DC: World Bank.
44. Qiao, B., Martinez-Vasquez, J. and Xu, Y., 2008. Growth and Equity Trade-off in Decentralization Policy: China's Experience. *Journal of Development Economics*, 86, pp. 112–128. https://doi.org/10.1016/j.jdeveco.2007.05.002.
45. Roos, R., 2012. "CDC estimate of global H1N1 pandemic deaths: 284,000". CIDRAP. Archived from the original on 19 September 2020.
46. Shah, A., 1998. *Balance, accountability, and responsiveness: lessons about decentralization*. (World Bank Policy Working Paper, No. 2021). Washington, DC: World Bank.
47. Self, S., Grabowski, R., 2003. How effective is public health expenditure in improving overall health? A cross-country analysis. *Applied Economics*, 35, pp.835–845.
48. Tanzi, V., 1996. Fiscal Federalism and Decentralization: A Review of Some Efficiency and Macroeconomic Aspects. In: M. Bruno and Pleskovic, eds. *Annual World Bank Conference on Development Economics*. Washington: The World Bank, pp.295–316. https://doi.org/10.1596/0-8213-3280-5.
49. The Economist., 2019. The NHS falls out of love with the market – No hospital for old men. *The Economist*, January 12. Available from: https://www.economist.com/britain/2019/01/12/the-nhs-falls-out-of-love-with-the-market.
50. The Economist, 2020. Top of the covid class? Germany excels among its European peers. *The Economist*, 25 April. Available from: https://www.economist.com/europe/2020/04/25/germany-excels-among-its-european-peers.
51. The Economist, 2020. The American way How the world's most powerful country is handling covid-19. *The Economist*, 28 May. Available from: https://www.economist.com/leaders/2020/05/28/how-the-worlds-most-powerful-country-is-handling-covid-19.
52. Tiebout, C., 1956. A pure theory of local expenditures. *Journal of Political Economy*, 64, pp.416–424. https://doi.org/10.1086/257839.

53. United Nations Department of Economic and Social Affairs (UN DESA), 2020. *World Migration Report 2020.* Geneva: International Organization for Migration. https://worldmigrationreport.iom.int/wmr-2020-interactive/.
54. Usui, N., 2007. *Critical Issues of Fiscal Decentralization*. (Asian Development Bank Economics and Research Department Technical Note Series. No. 21). Manila, Philippines: Asian Development Bank.
55. Viboud, C., Alonso, W. J. and Simonsen, L., 2006. Influenza in Tropical Regions. *PLoS Medicine*, 3(4), pp.e89. https://doi.org/10.1371/journal.pmed.0030089.
56. Von Braun, J. and Grote, U., 2002. Does decentralization serve the poor? In: E. Ahmad and V. Tanzi, eds. *Managing fiscal decentralization*. London: Routledge, pp.68–96. https://doi.org/10.4324/9780203219997_chapter_4.
57. Wallis, J. and Oates, W., 1988. Decentralization in the public sector: an empirical study of state and local government. In: H. Rosen, ed. *Fiscal federalism: quantitative studies*. Chicago: University of Chicago Press, pp. 5–32.
58. Wong, J. Y., Kelly, H., Ip D. K., Wu, J. T., Leung, G. M. and Cowling, B.J., 2013. Case fatality risk of influenza A (H1N1pdm09): a systematic review. *Epidemiology*, 24(6), pp.830-41. doi: 10.1097/EDE.0b013e3182a67448.
59. World Bank, 2001. *World Development Report 2000/2001: Attacking Poverty*. New York: Oxford University Press. pp.1–33.
60. World Bank, 2022. *World Development Report, 2022: Finance for an Equitable Recovery*. Washington, DC: World Bank.
61. World Health Organization, 2023. *Sustainable financing for health*. [Online]. Geneva: World Health Organization. Available from: https://www.who.int/initiatives/sdg3-global-action-plan/accelerator-discussion-frames/sustainable-financing-for-health.
62. World Health Organization and Springer, 2003. *Human Resources for Health*. https://www.springermedicine.com/human-resources-for-health-1-2003/22471260.