Health Expenditure Decentralization and Health Outcomes: The Importance of Governance

Nakatani, Ryota and Zhang, Qianqian and Garcia Valdes, Isaura

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ABSTRACT: Does health expenditure decentralization improve a nation's health? Should countries care about the governance quality when they decentralize healthcare spending to local governments? We answer these questions using cross-country data comprising 50 countries from 1996 to 2018. We find that health spending decentralization worsens health outcomes, which are offset by better governance of government. We calibrate the maximum feasible degree of health expenditure decentralization to have positive effects on health outcomes for a given percentile distribution of governance quality. Countries should be mindful of this negative consequence of health spending decentralization and should ensure that the quality of their governance exceeds a certain threshold to offset this negative externality. We also find that vertical fiscal imbalance is negatively associated with health outcomes, underscoring the role of revenue decentralization in improving the fiscal discipline of local governments by avoiding moral hazard caused by soft budget constraints and the common pool problem.

JEL Classification Numbers: D73; H75; I18; R50

Keywords: Spending Decentralization; Health Outcomes; Governance; Infant Mortality; Life Expectancy

INTRODUCTION

How does governance affect health outcomes when many countries provide public health services at the local level? According to the IMF's Fiscal Decentralization Dataset of Vintage 2020, approximately half of public health services have been decentralized on average across 75 countries from 1972 to 2019. During the COVID-19 pandemic, local governments' role in providing healthcare services has become more visible and important amid more attention to governance and corruption issues (Rieger and Wang 2022). Although health expenditure decentralization could potentially improve national health outcomes through better public healthcare services based on local medical needs, it is necessary to study whether this holds empirically, whether this depends on the quality of governance, and how fiscal decentralization and governance interact. Indeed, Tselios (2023) finds that more decentralized countries delayed the start of containment measures for the COVID pandemic. This casts doubt on the efficacy of public health policy under fiscal decentralization.

We focus on the effects of health expenditure decentralization and governance on health outcomes for three reasons. First, the extant literature has studied the association between health outcomes and fiscal decentralization or governance, making it easy for us to design our empirical methodology and add our contributions clearly. Second, in the midst of the COVID pandemic all over the world, citizens are now paying more attention to governments' quality of governance when they deliver healthcare services in decentralized fiscal systems. Third, health is a very essential, human capital-

building area of public services, which countries often do not cut even when undergoing fiscal consolidation. In fact, Espasa et al (2017) found that fiscal decentralization brings welfare gains the most significantly in health service provision.

Fiscal (or expenditure) decentralization and governance interact, and this interaction shapes health outcomes (Figure 1). Fiscal decentralization can improve health outcomes via better preference matching (Oates 1972), yardstick competition[i] (Besley and Case 1995; Bordignon et al 2004), minimizing monopolistic power of the Leviathan government (Brennan and Buchanan 1977; Edwards and Keen 1996), or organizational innovation and local initiatives (López-Casasnovas 2007), which is indicated by the left blue arrow in Figure 1. There are also negative aspects of expenditure decentralization, such as the common pool problem[ii] (Berry 2008), flypaper effect[iii] (Fisher 1982), fiscal crises and indiscipline (Nakatani 2023a), and a lack of economies of scale[iv]. Therefore, the literature survey by Dwicaksono and Fox (2018) found mixed results regarding the effects of decentralization on health outcomes. Moreover, better governance of government operations enhances health outcomes (Ciccone et al 2014), as indicated by the right blue arrow in Figure 1. Fiscal decentralization could also enhance governance (Altunbas and Thornton 2012), improve perceptions of accountability (Escobar-Lemmon and Ross 2014), and foster public-sector efficiency (Christl et al 2020), as shown by the positive case of the upper blue arrow in Figure 1. Using survey data on European individuals, Diaz-Serrano and Rodríguez-Pose (2015) found that the effects of fiscal decentralization on the perception of the state of the health system are unambiguously positive.

Governance, which is taken from the Worldwide Governance Indicators, is defined as the perception of the quality of government by citizens with regard to broad areas such as accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Theoretically, the relationship between fiscal decentralization and corruption is not clear. For example, there is theoretical literature that shows lobbying activities by interest groups could be more powerful at the local level (Bardhan and Mookherjee 2000; Bordignon et al 2008), which can be indicated by the negative case of the upper blue arrow in Figure 1. In contrast, the empirical literature has found the opposite results. Azfar et al (2000, 2001, 2006) found that there is less perceived corruption at the local government level than at the central level because community leaders are more concerned about local corruption and elections than national ones, and corrupt local government officials face a higher probability of being prosecuted. Since the quality of governance can be affected by spending decentralization (Treisman 2000), we include both decentralization and governance as separate variables influencing health outcomes in our study.

Governance plays a catalytic role in enhancing the positive effects of health expenditure decentralization and mitigating its negative effects (Nakatani et al 2022). On the one hand, health expenditure decentralization triggers fair competition among local governments if countries have better governance, and citizens can move to areas where local governments provide better medical services (Tiebout 1956). On the other hand, it is crucial to have a good governance and accountability framework to avoid

inefficient populist policies by corrupt local government officials. For instance, a strong accountability framework avoids corruption in procurement of medical equipment or hiring health workers.

The existing literature focuses on OECD countries (Jiménez-Rubio 2011a) or on a single country to analyze the effects of fiscal decentralization (Asfaw et al 2007; Costa-Font and Pons-Novell 2007; Cantarero and Pascual 2008; Jiménez-Rubio 2011b; Soto et al 2012; Cavalieri and Ferrante 2016; Jiménez-Rubio and García-Gómez 2017; Di Novi et al 2019). Most of these studies find that fiscal decentralization to local governments plays a positive role in improving health outcomes in advanced or emerging economies, although the effects depend on regional socioeconomic or political conditions. However, Antón et al (2014) and Lago-Peñas et al (2022) find negative effects of fiscal decentralization on health outcomes.

Our contributions are fourfold. First, we have a wide coverage of data, including non-OECD and low-income countries, while most of the literature analyzed only OECD or emerging countries. Inclusion of a broader country range enables us to control for different governance quality of governments. Thus, the second contribution is to decipher how these institutional arrangements regarding governance and control of corruption affect the efficacy of spending decentralization. Third, we address a reverse causality concern between health outcomes and public health services, employing a panel instrumental variable (IV) Tobit model with an exogenous instrument. Fourth,

Tobit models also improve the accuracy of measuring impacts on health outcomes, which are truncated data with limits.

The main message of our research is that expenditure decentralization, if not coupled with revenue decentralization, can be detrimental to health. Good governance is able to counteract the negative effects of spending decentralization and to further improve the positive effects of revenue decentralization.

EMPIRICAL METHOD

We construct an annual country panel dataset from 1996 to 2018 that includes variables from three data sources (see Annex Table 1 for detailed definition of each variable used and the relevant data source). The governance variable is taken from the Worldwide Governance Indicators 2020. We use the aggregate governance variable taking the average of six indicators—government effectiveness, control of corruption, regulatory quality, voice and accountability, rule of law, and political stability (Langbein and Knack 2010). We use the health spending decentralization variables from the IMF's Fiscal Decentralization Dataset 2020.[v] We study the effects of health expenditure decentralization to local governments, which are defined as municipal and village governments. We also examine the effects of vertical fiscal imbalance at the local governments to study the common pool problem, as we will discuss in greater detail later. We include health, macroeconomic, and demographic variables (infant mortality rate, life expectancy, etc.) from the World Development Indicators 2020.

We use two dependent variables for health outcomes: infant mortality rate (IMR) per thousand live births and life expectancy (LE) at birth. We include several variables that represent access to healthcare, education, income, and so forth that affect infant mortality and life expectancy (Subramanian et al 2018; Papavlassopulos and Keppler 2011). Control variables include hospital beds (HB) and the number of physicians (Phy) per 1000 people to control for medical supply capacity,[vi] health expenditures (HE) as a proxy for medical demand, domestic private health expenditure (PHE) to control for the share of private health services, and tertiary school enrollment (TSE) as a proxy for medical knowledge. The last control variable is motivated by the findings of several papers that documented the fact that education has a significant direct effect on infant mortality rate and health outcomes (Clark and Snawder 2020; Shen and Williamson 2001; Young and Garcia 1996). We also include income per capita (GDP) because as income rises, people will choose relatively more health care expenditure (Fedeli 2015). Note that income per capita is also directly correlated with infant mortality (Anyamele et al 2017). Furthermore, we also include demographic variables—e.g., shares of population ages 0-14 ($P14$) and 65 and above ($P65$)—since changes in the age structure of the population have substantial impacts on changes in mortality rates (Land and McMillen 1980). We also control for demographic factors because population aging increases chronic degenerative diseases, which could shorten life expectancy, and health care expenditure (Shakoor et al 2021). We also include income inequality (Inq) as an explanatory variable in our estimation because Kyriacou et al (2017) found that income inequality, the degree of fiscal decentralization, and the quality of government

are simultaneously determined, all of which could influence the preference of the government regarding how to conduct public health policy. Finally, we include a dummy variable for countries that have states (SD) to control for different hierarchical structures of government operations. The summary statistics for each variable are shown in Table 1. As indicated by Table 1, an institutional variable such as governance moves slowly in each country, while there is a cross-sectional variation across countries. Therefore, to utilize the information on institutional variation across countries, we do not include country-fixed effects when conducting panel regression analysis.

Figure 2 shows the relationship between the mean health expenditure decentralization and the mean infant mortality rate for each country over the sample period. The fitted line demonstrates a slight negative relationship, indicating that health expenditure decentralization is likely to be associated with a lower infant mortality rate. Similarly, Figure 3 depicts the relationship between health expenditure decentralization and life expectancy, which shows a slight positive correlation. Both figures indicate that health expenditure decentralization might be associated with better health outcomes, but the slope of fitted lines are very close to horizontal, so we cannot conclude until we investigate the relationships econometrically.

In contrast, the relationships between governance quality and health outcomes are unambiguous. Figure 4 and Figure 5 show that better governance quality is associated with better health outcomes: lower infant mortality rate and longer life expectancy, respectively.

Note that the degree of health expenditure decentralization ranges between 0 and close to 1, indicating a large dispersion across countries. For instance, countries with a zero degree of health expenditure decentralization mean that all health expenditure is controlled by the central government. This is often the case for low-income countries that lack the capacity of public health policy at the local government level (e.g., Afghanistan, Myanmar, and Kiribati in Figure 3). In contrast, in countries with highly decentralized healthcare systems such as Sweden, local authorities and municipalities are responsible for managing healthcare resources that are mostly financed by revenues from local taxes. Such a decentralized healthcare system is managed by decision-makers at municipal councils backed by strong local democracy.

We employ the panel Tobit model, taking a lag of health expenditure decentralization and governance variables, to address the reverse causality and truncated dependent variables. The reverse causality arises if the government changes public health policy in response to health outcomes. For instance, higher infant mortality rates in rural areas may induce governments to authorize more public health services—such as immunization—through local clinical centers. To address this, we conduct IV estimation as a robustness check, using land area as the instrument. This is because countries with larger land areas tend to have more decentralized fiscal systems, which satisfies the validity of the instrument. On the other hand, health outcomes cannot change the size of the land area, which secures the exogeneity of the instrument. Since our

dependent variables cannot take negative values, we use the Tobit method to allow unequal sampling probability. Our model is given by

$$Health_{i,t} = \alpha_1 + \beta_1 \cdot FD_{i,t-1} + \gamma_1 \cdot Gov_{i,t-1} + \delta_1 \cdot HB_{i,t} + \delta_2 \cdot Phy_{i,t} + \delta_3 \cdot HE_{i,t} + \delta_4 \cdot PHE_{i,t} + \delta_5 \cdot TSE_{i,t} + \delta_6 \cdot GDP_{i,t} + \delta_7 \cdot P14_{i,t} + \delta_8 \cdot P65_{i,t} + \delta_9 \cdot Inq_{i,t} + \delta_{10} \cdot SD_{i,t} + \mu_t + \varepsilon_{i,t},$$

$$where\ Health_{i,t} = LE_{i,t}\ or\ \ 1/IMR_{i,t},$$

$$and\ FD_{i,t} = HED_{i,t}\ or\ VFI_{i,t}.$$

where the subscripts i and t represent the country and time period, respectively; $Health_{i,t}$ is the health outcome (life expectancy $LE_{i,j}$ or inverse of infant mortality rate $1/IMR_{i,t}$); $FD_{i,t}^{j}$ is fiscal decentralization variable that can be either health expenditure decentralization to local governments ($HED_{i,t}$) or vertical fiscal imbalance at local governments ($VFI_{i,t}$); $Gov_{i,t}$ is governance variable; control variables mentioned above are included with their respective coefficients δ_{1-10}; μ_t represents the time fixed effects; and $\varepsilon_{i,t}$ is the error term. The observed $Health_{i,t}$ in a Tobit model is defined by

$$Health_{i,t} = \begin{cases} y^* \ if\ |y^* > \tau \\ \tau \ if\ |y^* \leq \tau \end{cases} and \begin{cases} \theta \ if\ |y^* \geq \theta \\ y^* \ if\ |y^* < \theta \end{cases},$$

$$where\ Health_{i,t} = LE_{i,t}\ or\ \ 1/IMR_{i,t}.$$

where τ and θ are the censoring points and y^* is a latent variable. For example, both life expectancy and infant mortality rates cannot take negative values, so we set $\tau = 0$. Note that lower infant mortality rates mean good health outcomes, while higher values

of life expectancy are better health outcomes. Thus, we take the inverse of infant mortality rates as dependent variables so that higher values of the dependent variable always indicate better health outcomes (Piacenza and Turati 2014).

As the second Tobit specification, the cross-term of health expenditure decentralization and governance is added to the original model. This is motivated by the fact that the relationship among health outcomes, fiscal decentralization, and governance might be nonlinear, as they interact with each other (Figure 1).

$$Health_{i,t} = \alpha_2 + \beta_2 \cdot HED_{i,t-1} + \gamma_2 \cdot Gov_{i,t-1} + \theta \cdot HED_{i,t-1} \times Gov_{i,t-1} + \delta_{11} \cdot HB_{i,t} + \delta_{12} \cdot Phy_{i,t} + \delta_{13} \cdot HE_{i,t} + \delta_{14} \cdot PHE_{i,t} + \delta_{15} \cdot TSE_{i,t} + \delta_{16} \cdot GDP_{i,t} + \delta_{17} \cdot P14_{i,t} + \delta_{18} \cdot P65_{i,t} + \delta_{19} \cdot Inq_{i,t} + \delta_{20} \cdot SD_{i,t} + \mu_t + \varepsilon_{i,t},$$

$$where\ Health_{i,t} = LE_{i,t}\ or\ 1/IMR_{i,t}.$$

RESULTS

In the baseline results of the Tobit estimation shown in Table 2, we find that health expenditure decentralization by itself shortens life expectancy and increases infant mortality rates. Governance, on the other hand, increases life expectancy and reduces infant mortality rates. These results are demonstrated by the statistically significant coefficients in Table 2. Our finding on the negative effects of fiscal decentralization on health outcomes is consistent with the recent empirical literature (Antón et al 2014; Lago-Peñas et al 2022). For example, Lago-Peñas et al (2022) find that centralized

fiscal systems are associated with better health outcomes during the COVID-19 pandemic. Kyriacou and Roca-Sagalés (2019) found that local decentralization of health spending undermines the quality of public services. Moreover, Kyriacou and Roca-Sagalés (2021) argue that decentralization of procurement facilitates rent-seeking by special interests (in the absence of a good accountability framework) and forgoes economies of scale. The positive governance effect on health outcomes is consistent with findings in the extant literature. For example, De Luca et al (2023) found that a better institutional environment can affect the quality and appropriateness of healthcare provided.

Since expenditure decentralization is found to worsen health outcomes but governance improves the outcomes, countries need to offset the negative effects from decentralization through the governance effect. To understand the threshold at which governance can offset the negative externality from decentralization, we plot the maximum feasible degree of decentralization given the governance quality. The maximum feasible degree of decentralization (FD^{max}) for a given percentile level of governance quality ($Gov^{\%}$) is calculated as follows:

$$0 > \beta_1 \cdot FD^{max} + \gamma_1 \cdot Gov^{\%} \;\leftrightarrow\; FD^{max} < -\frac{\gamma_1 \cdot Gov^{\%}}{\beta_1}$$

where $\beta_1 < 0$ and $\gamma_1 > 0$ are estimated coefficients in the baseline estimation presented in Table 2. In Figure 6, we show the degree to which countries can decentralize health expenditure to local governments, taking into account their governance quality. On the horizontal axis, the percentile distribution of governance quality is shown. On the

vertical axis, we show the maximum degree of health expenditure decentralization that can be offset by governance quality to avoid total negative effects on health outcomes, using the estimated coefficients from the baseline estimation in Table 2. For example, if countries are located in the 20th percentile of governance level, the bold line in Figure 6 shows that they can decentralize healthcare spending to local governments only up to 21 percent of general government health expenditure so that they are able to avoid negative effects on life expectancy. Otherwise, the negative externality from decentralization on life expectancy exceeds the positive effects from governance. In contrast, if we use the estimated coefficients from the regression for infant mortality rate in the dotted line, countries in the 20-percentile distribution of governance quality can decentralize their health expenditure to local governments up to 22 percent of total expenditure of general government. The average maximum limit of the degree of decentralization for the bold line (based on the life expectancy criterion) and the dotted line (based on the infant mortality criterion) is 22 percent for countries with 20th percentile governance quality, as indicated by the gray average line for local decentralization. As you can see from the figure, if countries have higher governance arrangements, they can decentralize healthcare expenditure more to local governments. According to the dotted line of local decentralization limit based on infant mortality rate estimation, countries with 40th percentile of governance quality are allowed to fully decentralize health expenditure operations to local governments.

For a robustness check, we also present estimation results based on Ordinary Least Squares (OLS) estimation in Table 3. The results in the table show statistically

insignificant coefficients of health expenditure decentralization. This is likely because both dependent variables and independent variables of our regressions mostly take values between 0 and 1, so estimating the linear relationship via OLS does not seem to be an appropriate choice of regression method. In fact, the literature used Tobit estimation to estimate infant mortality rate (Mohammadpour et al 2020; Ainsworth et al 1998) and life expectancy (Zozaya et al 2005). This is because estimating a model with a truncated dependent variable using OLS method provides biased and inconsistent results in estimations (Guo et al 2017).

As an alternative robustness check for endogeneity, we used the size of land area as an instrument for the two stage least squares estimation method in Table 4. The IV estimation demonstrates the negative statistical significance of the coefficient of health expenditure decentralization for life expectancy and the positive statistical significance of the governance variable for both life expectancy and infant mortality rates, corroborating our baseline results.

Furthermore, to examine the triangular relationship among health outcomes, health expenditure decentralization, and governance, the results from the nonlinear Tobit estimation are presented in Table 5. The table shows that the coefficients on spending decentralization become positive, while the negative effects of decentralization are absorbed by the cross-term of decentralization and governance. This could imply that higher health expenditure decentralization improves health outcomes when governance is at a very low level, manifested in more efficiency in using government resources by

the governments than the central government with less informational friction. However, while performance continues to rise, it increases at a lesser scale when governance quality largely improves. This finding is consistent with the concavity of the maximum feasible health expenditure decentralization curves in Figure 6.

Similar to Figure 6, we calibrate the maximum feasible degree of health expenditure decentralization using estimated nonlinear coefficients from Table 5. Since the coefficient of health expenditure decentralization is statistically significant only for life expectancy in Table 5, we use the estimated coefficients in column (7) for this exercise. The following equation is used to calculate the feasible decentralization limit.

$$0 > \beta_2 \cdot FD^{max} + \gamma_2 \cdot Gov^{\%} + \theta \cdot FD^{max} \cdot Gov^{\%} \leftrightarrow FD^{max} < \frac{\theta}{\gamma_2} \Big/ \left(\frac{\gamma_2}{\beta_2} Gov^{\%} + 1\right) - \frac{\theta}{\gamma_2}$$

The results in Figure 7 show that the line of the maximum feasible degree of health expenditure decentralization is more concave than that calculated in Figure 6. This means that when we consider the nonlinear interaction effects between governance and decentralization, the feasible maximum degree of health expenditure decentralization becomes higher for lower levels of governance quality, while it becomes lower for higher governance quality. For instance, countries with 20th percentile governance quality can decentralize health expenditure to local governments up to 34 percent of total general government health expenditure. This limit is higher than that in Figure 6, where we did not consider nonlinear effects. The maximum limit of healthcare decentralization increases sharply toward 60 percent if countries have 30th percentile governance quality. This maximum limit for 30th percentile governance quality is now lower than that

in Figure 6. The marginal increase in the maximum decentralization limit decreases as governance quality increases. For example, countries with 70th percentile governance quality could decentralize health expenditure to local governments by 71 percent, while the maximum decentralization limit is 75 percent for the countries with the highest governance quality (i.e., 100th percentile) as the marginal incremental benefits of healthcare decentralization decelerate.

Control variables in the baseline results in Table 2 show that a greater number of physicians per capita is associated with better health outcomes. High per capita income countries (a catchall for other relevant factors, for which we cannot control directly) and better human capital development (measured by tertiary school enrollment) tend to have better health outcomes as well, which is consistent with Poças et al (2020). We also find that a higher share of private health expenditure (and, by implication, a lower share of public expenditure) is associated with worse health outcomes, underscoring the importance of public health services for improving national health outcomes for infants and elderly individuals. This might reflect the practice that health services that affect infant mortality rates the most (e.g., vaccinations) are often provided by the public sector in many countries instead of through the coverage of private health insurance. Negative and statistically significant coefficients on inequality (Gini coefficient) for infant mortality rate imply that higher income inequality of society is associated with higher infant mortality rates.

The negative effects of expenditure decentralization on health outcomes could be explained by the common pool problem and the attendant soft budget constraint. For example, if only health expenditure is decentralized but (tax) revenue is not decentralized to local governments, this could create a moral hazard for lower-level governments to overspend, as the shortage of financing could eventually be covered by intergovernmental transfers from the central government (Bordignon and Turati 2009). To test this hypothesis, we include vertical fiscal imbalance to capture such a moral hazard effect caused by the common revenue pool and the soft budget constraint for local governments in Table 6. Vertical fiscal imbalance is an important indicator implying soft subnational or local budget constraints (Rodden et al 2003; Kornai et al 2003; Aldasoro and Seiferling 2014) by capturing the misalignment in the local government's revenue and expenditure responsibilities. Vertical fiscal imbalance measures the extent to which local governments' expenditure requirements are not met by their revenue sources. The results from Table 6 show that greater vertical fiscal imbalance lowers life expectancy and increases the infant mortality rate, consistent with our moral hazard hypothesis. As the mandate on improving health outcomes is one of the critical public services that the government delivers, and much of the delivery is vested in the government at the local level, large vertical fiscal imbalance could make service quality low—through loose fiscal discipline caused by moral hazard above—or healthcare service delivery fall short, especially if the local governments need to rely largely on transfers or local borrowing. Lack of discipline in spending efficiently or not having proper commitment to tax for spending could create issues for quality of necessary health spending, brining adverse impact on the health outcome. Our results indicate that

health spending decentralization should be accompanied by corresponding revenue decentralization to improve the delivery of public healthcare services and health outcomes. Our finding is consistent with Boetti et al (2012), who found that more fiscally autonomous municipalities (i.e., lower vertical fiscal imbalance) exhibit less inefficient behavior, thus supporting the waves of reforms toward the devolution of taxing power to lower government tiers. Why revenue decentralization brings about improvements in health outcomes is also a relevant policy question. One possible answer is that, following a (tax) revenue decentralization reform, increased local fiscal autonomy is associated with electing more politicians with high administrative skills (Bordignon et al 2020), which leads to better fiscal and health performance.

CONCLUSION

Fiscal decentralization is ubiquitous these days. Many public services, including healthcare, are provided at the local government level. Such decentralization has pros and cons—e.g., decentralization of health expenditure could meet local medical demand better, while a vaccination campaign would benefit from a centralized system. Thus, the previous literature found mixed results regarding the effects of decentralization on health outcomes (Dwicaksono and Fox 2018).

Motivated by the heightened role of control over corruption in public health service delivery in the decentralized fiscal system during the COVID pandemic, our research gauged the effect of expenditure decentralization on health outcomes, deciphering their

relationship with institutional quality of governance. Using a wide coverage of cross-country panel data, our Tobit approach improved the quantification of decentralization impacts on health outcomes.

Our results show that health expenditure decentralization by itself does not necessarily improve health outcomes and could even worsen them. The quality of governance, unsurprisingly, has consistently shown a significant positive relationship with health outcomes. This finding corroborates the recent findings and policy discussions in the literature. For instance, Fung and Owen (2020) find that audits by municipalities improve the performance of health systems. Low corruption leads to greater political participation[vii], as evidenced by Zheng et al (2017), and it will enable better preference matching at the local level. Abimbola et al. (2019) argue that the national government may cease to cover the deficit of subnational governments, imposing a sanction that compels subnational governments that are unable to contain health expenditure to generate additional resources by increasing local taxes and fees. In addition, a local health board (with community representatives) as part of decentralization reforms contributes to reducing corrupt practices. To enhance the accountability and transparency of local government operations, civic budgeting might be an option. Civic budgeting actively engages residents in developing projects and voting on submitted proposals, involving local communities in deciding how a defined portion of public resources should be allocated by means of a democratic debate (Szczepańska et al 2022).

We also find a nonlinear relationship among health outcomes, expenditure decentralization, and governance (Table 5). Our calculation based on nonlinear estimation in Figure 7 reveals that the maximum feasible limit of decentralization to local governments is below 75 percent of total health expenditure when countries have the highest governance quality. For countries with median (50-percentile) quality of governance, the maximum degree of healthcare decentralization is 66 percent. Our results in Figure 7 demonstrate that this decentralization limit curve is a concave function, so countries with low governance quality are bounded by a much lower decentralization limit (e.g., countries with 20th-percentile governance quality could only decentralize health expenditure up to 34 percent).

Furthermore, vertical fiscal imbalances are found to worsen health outcomes in Table 6, indicating that a large difference between local government expenditure and their own-source revenues (the “fiscal gap”) could disrupt the performance of health systems. In other words, spending decentralization should be accompanied by revenue decentralization to improve the fiscal discipline of governments so that local governments can avoid moral hazards caused by soft budget constraints and common pool problems.

Other than governance quality, we find that increasing the number of physicians could improve health outcomes. The public health service sector should continue to play a role in improving health outcomes, as should human capital development. Countries should strive to reduce corruption at the local level, improve the quality of health

infrastructure, and strengthen accountability through reporting of financial statements of public hospitals.

In sum, how much countries could decentralize health expenditure operations to local governments depends on governance quality, as we saw in Figures 6-7. Our study also shows that vertical fiscal imbalance should be reduced by raising the revenue share of local governments to help improve health outcomes. To benefit from health expenditure decentralization, countries should improve governance so that their institutional quality is strong enough.

Data Availability Statement

The data that support the findings of this study were derived from the website links provided in Annex Table 1.

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Table 1. Summary Statistics

Variable		Mean	Standard Deviation	Min	Max
Infant Mortality Rate (IMR)	Overall	5.705	4.753	1.700	43.700
	Between		7.558	1.992	43.700
	Within		1.423	1.700	15.372
Life Expectancy (LE)	Overall	77.447	4.415	63.777	83.602
	Between		4.726	63.777	82.449
	Within		1.247	73.537	80.960
Health Expenditure Decentralization (HED)	Overall	0.280	0.335	0.000	0.988
	Between		0.314	0.000	0.985
	Within		0.110	0.000	1.021
Governance (Gov)	Overall	0.839	0.764	-1.050	1.970
	Between		0.822	-0.886	1.858
	Within		0.101	0.284	1.360
Hospital Beds (HB)	Overall	5.341	2.124	0.570	11.450
	Between		2.170	0.833	11.136
	Within		0.571	3.320	7.670
Physicians (Phy)	Overall	3.236	0.829	0.140	6.631
	Between		0.876	0.259	4.892
	Within		0.381	2.063	6.628
Health Expenditure (HE)	Overall	7.822	1.894	2.602	11.895
	Between		2.016	2.803	11.148
	Within		0.668	5.086	10.630
Real GDP Per Capita (GDP)	Overall	0.031	0.023	0.001	0.110
	Between		0.024	0.001	0.104
	Within		0.002	0.020	0.053
Private Health Expenditure (PHE)	Overall	0.032	0.014	0.012	0.085
	Between		0.016	0.015	0.085
	Within		0.003	0.019	0.052
Tertiary School Enrollment (TSE)	Overall	63.850	17.708	9.815	136.603
	Between		20.144	15.459	120.966
	Within		7.398	15.139	100.958
Population Age 0-14 (P14)	Overall	17.129	3.504	13.217	34.774
	Between		4.779	13.313	32.437
	Within		0.679	13.185	20.950
Population Age>65 (P65)	Overall	15.544	3.401	3.736	22.752
	Between		4.236	3.736	21.176
	Within		1.044	12.948	18.908
Inequality (Inq)	Overall	32.120	4.614	23.200	48.500
	Between		4.614	24.886	44.725
	Within		1.413	26.105	36.954
Vertical Fiscal Imbalance (VFI)	Overall	0.450	0.221	0.028	0.869
	Between		0.218	0.033	0.851
	Within		0.083	0.087	0.703
State Dummy (SD)	Overall	0.159	0.366	0.000	1.000
	Between		0.364	0.000	1.000
	Within		0.083	0.000	0.992

Table 2. Baseline Estimation Results

	(1)	(2)
Dependent Variable	Life Expectancy (LE)	1/(Infant Mortality Rate <IMR>)
Lagged Health Expenditure Decentralization (HED)	-1.2427***	-0.0304***
	(0.3311)	(0.0098)
Lagged Governance (Gov)	1.5160***	0.0386***
	(0.2572)	(0.0075)
Hospital Beds (HB)	-0.6300***	-0.0108***
	(0.0630)	(0.0017)
Physicians (Phy)	0.2598*	0.0155***
	(0.1329)	(0.0041)
Health Expenditure (HE)	0.2962***	-0.0063***
	(0.0832)	(0.0019)
Real GDP Per Capita (GDP)	49.9611***	1.3377***
	(6.1473)	(0.1757)
Private Health Expenditure (PHE)	-33.6763***	-1.1441***
	(8.1815)	(0.2544)
Tertialy School Enrollment (TSE)	0.0157**	0.0014***
	(0.0068)	(0.0002)
Population Age 0-14 (P14)	-0.0112	-0.0014
	(0.0659)	(0.0014)
Population Age>65 (P65)	0.1197*	0.0007
	(0.0698)	(0.0017)
Inequality (Inq)	0.0174	-0.0039***
	(0.0260)	(0.0009)
State Dummy (SD)	0.3666	-0.0294***
	(0.2274)	(0.0070)
Constant	72.8358***	0.3035***
	(2.3499)	(0.0598)
Year Fixed Effects	Yes	Yes
F Statistic	91.24***	63.36***
Log Pseudolikelihood	-1080.4266	698.5357
Number of Observations	517	517

Notes: Robust standard errors are in parentheses. * p<0.1, ** p<0.05, ***p<0.01

Table 3. Ordinary Least Squares Estimation Results

	(3)	(4)
Dependent Variable	Life Expectancy (LE)	1/(Infant Mortality Rate <IMR>)
Lagged Health Expenditure Decentralization (HED)	-0.1097	0.0146
	(0.4111)	(0.0141)
Lagged Governance (Gov)	0.6860	0.0520*
	(0.5280)	(0.0265)
Hospital Beds (HB)	-0.0601	0.0016
	(0.0926)	(0.0062)
Physicians (Phy)	0.3085***	0.0082
	(0.0767)	(0.0071)
Health Expenditure (HE)	-0.0168	0.0017
	(0.0777)	(0.0038)
Real GDP Per Capita (GDP)	47.7056**	1.0448
	(19.5879)	(0.7499)
Private Health Expenditure (PHE)	6.8280	-0.3671
	(10.2411)	(0.5697)
Tertialy School Enrollment (TSE)	-0.0019	-0.0002
	(0.0067)	(0.0004)
Population Age 0-14 (P14)	0.1187	0.0065
	(0.0961)	(0.0066)
Population Age>65 (P65)	0.0443	0.0073
	(0.0731)	(0.0053)
Inequality (Inq)	-0.0355	0.0008
	(0.0243)	(0.0018)
State Dummy (SD)	1.3120***	-0.0221
	(0.3156)	(0.0135)
Constant	70.5875***	-0.1709
	(2.8700)	(0.1862)
Year Fixed Effects	Yes	Yes
R-Squared: Within	0.8991	0.7257
R-Squared: Between	0.5788	0.6116
R-Squared: Overall	0.6206	0.5729
Number of Observations	517	517

Notes: Robust standard errors are in parentheses. * p<0.1, ** p<0.05, ***p<0.01

Table 4. Two Stage Least Squares Estimation Results

	(5)	(6)
Dependent Variable	Life Expectancy (LE)	1/(Infant Mortality Rate <IMR>)
Health Expenditure Decentralization (HED)	-3.3208**	0.0219
	(1.3697)	(0.0309)
Governance (Gov)	0.9821**	0.0498***
	(0.4139)	(0.0104)
Hospital Beds (HB)	-0.7174***	-0.0089***
	(0.0690)	(0.0017)
Physicians (Phy)	0.2137	0.0145***
	(0.1304)	(0.0040)
Health Expenditure (HE)	0.2113**	-0.0028
	(0.1017)	(0.0026)
Real GDP Per Capita (GDP)	62.6793***	1.0869***
	(9.9808)	(0.2607)
Private Health Expenditure (PHE)	-34.6143***	-1.0805***
	(8.1616)	(0.2499)
Tertialy School Enrollment (TSE)	0.0234**	0.0013***
	(0.0092)	(0.0002)
Population Age 0-14 (P14)	-0.0438	-0.0020
	(0.0675)	(0.0014)
Population Age>65 (P65)	0.1788**	-0.0004
	(0.0869)	(0.0019)
Inequality (Inq)	-0.0104	-0.0027***
	(0.0374)	(0.0009)
State Dummy (SD)	-0.0148	-0.0210**
	(0.3562)	(0.0084)
Constant	0.9324***	0.9324***
	(0.2356)	(0.2356)
Year Fixed Effects	Yes	Yes
Wald Chi-Squared Test	2743.96***	1815.13***
Number of Observations	542	542

Notes: Robust standard errors are in parentheses. * p<0.1, ** p<0.05, ***p<0.01

Table 5. Nonlinear Estimation Results

	(7)	(8)
Dependent Variable	Life Expectancy (LE)	1/(Infant Mortality Rate <IMR>)
Lagged Health Expenditure Decentralization (HED)	0.7173*	0.0068
	(0.3734)	(0.0112)
Lagged Governance (Gov)	2.6901***	0.0609***
	(0.2870)	(0.0087)
Lagged HED Multiplied by Lagged Gov	-2.2914***	-0.0435***
	(0.2698)	(0.0102)
Hospital Beds (HB)	-0.6762***	-0.0116***
	(0.0609)	(0.0016)
Physicians (Phy)	0.3517***	0.0172***
	(0.1306)	(0.0041)
Health Expenditure (HE)	0.3512***	-0.0052***
	(0.0729)	(0.0020)
Real GDP Per Capita (GDP)	38.6247***	1.1224***
	(5.8564)	(0.1803)
Private Health Expenditure (PHE)	-37.7661***	-1.2217***
	(8.0540)	(0.2559)
Tertialy School Enrollment (TSE)	0.0204***	0.0015***
	(0.0068)	(0.0002)
Population Age 0-14 (P14)	0.0045	-0.0011
	(0.0588)	(0.0014)
Population Age>65 (P65)	0.1153*	0.0007
	(0.0620)	(0.0017)
Inequality (Inq)	0.0302	-0.0037***
	(0.0263)	(0.0009)
State Dummy (SD)	0.1405	-0.0337***
	(0.2212)	(0.0073)
Constant	70.2473***	0.0038***
	(2.3140)	(0.0002)
Year Fixed Effects	Yes	Yes
F Statistic	102.98***	57.38***
Log Pseudolikelihood	-1053.6388	707.6370
Number of Observations	517	517

Notes: Robust standard errors are in parentheses. * p<0.1, ** p<0.05, ***p<0.01

Table 6. Estimation Results for Vertical Fiscal Imbalance

	(9)	(10)
Dependent Variable	Life Expectancy (LE)	1/(Infant Mortality Rate <IMR>)
Lagged Vertical Fiscal Imbalance (VFI)	-3.2476***	-0.1013***
	(0.4665)	(0.0194)
Lagged Governance (Gov)	3.2756***	0.0504***
	(0.3122)	(0.0086)
Hospital Beds (HB)	-0.4174***	-0.0051**
	(0.1087)	(0.0023)
Physicians (Phy)	0.3149*	0.0187***
	(0.1616)	(0.0044)
Health Expenditure (HE)	0.2689***	-0.0051**
	(0.0682)	(0.0023)
Real GDP Per Capita (GDP)	14.5997**	0.7403***
	(6.9709)	(0.2374)
Private Health Expenditure (PHE)	-14.0609*	-1.6553***
	(7.9230)	(0.2257)
Tertialy School Enrollment (TSE)	0.0618***	0.0017***
	(0.0117)	(0.0003)
Population Age 0-14 (P14)	0.1353**	0.0040***
	(0.0541)	(0.0013)
Population Age>65 (P65)	-0.0008	0.0049**
	(0.0772)	(0.0022)
Inequality (Inq)	0.0210	-0.0025***
	(0.0203)	(0.0007)
State Dummy (SD)	0.8068***	-0.0263***
	(0.2266)	(0.0065)
Constant	65.4338***	0.0628
	(2.8211)	(0.0793)
Year Fixed Effects	Yes	Yes
F Statistic	142.51***	82.96***
Log Pseudolikelihood	-627.5011	505.3090
Number of Observations	324	324

Notes: Robust standard errors are in parentheses. * p<0.1, ** p<0.05, ***p<0.01

Figure 1. Triangular Relationship among Fiscal Decentralization, Governance, and Health Outcomes

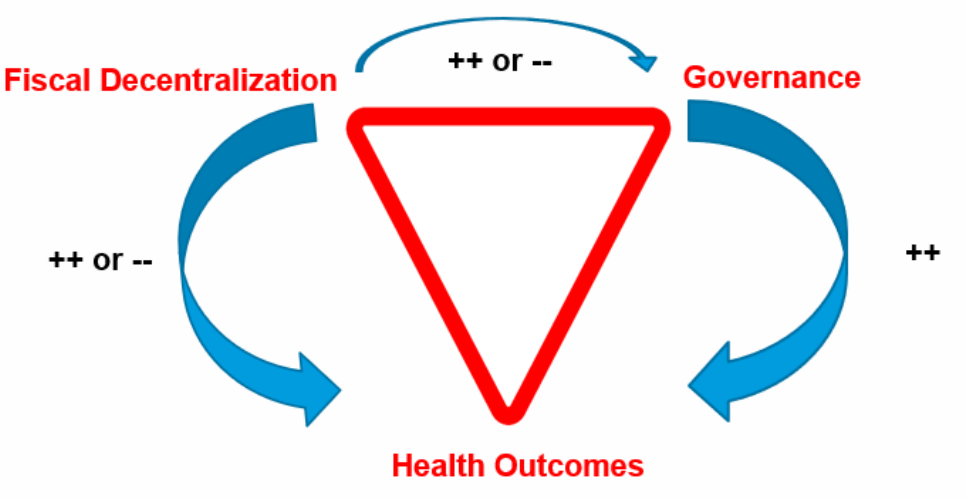


Figure 2. Health Expenditure Decentralization and Infant Mortality Rate

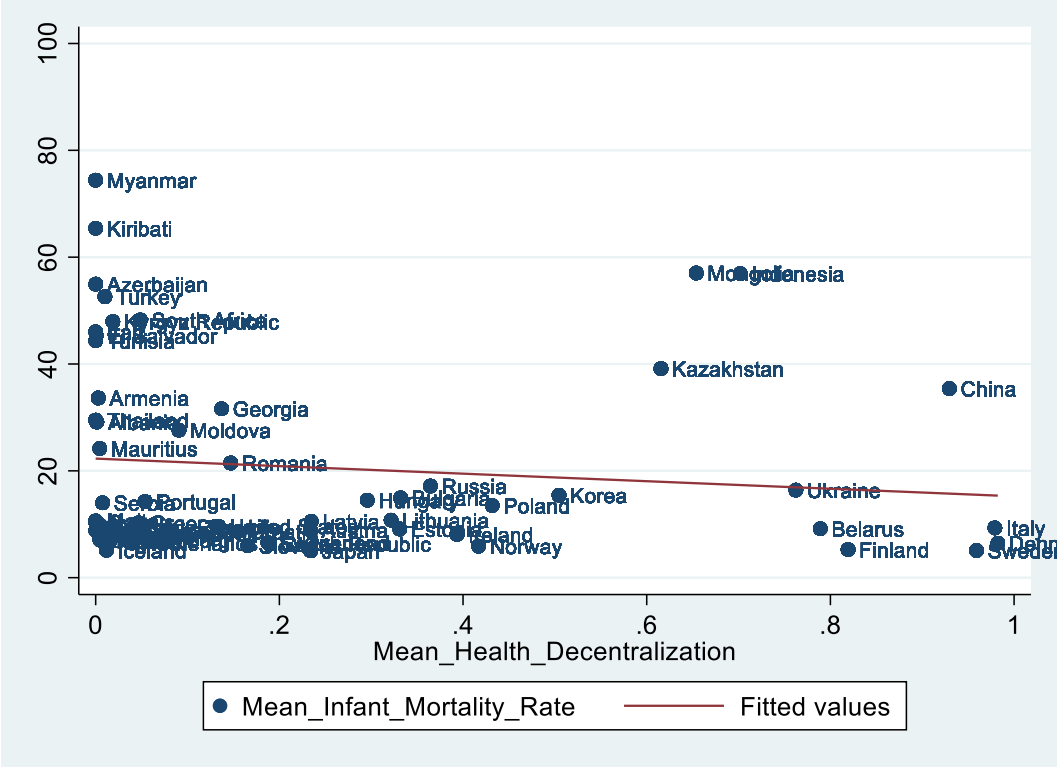


Figure 3. Health Expenditure Decentralization and Life Expectancy

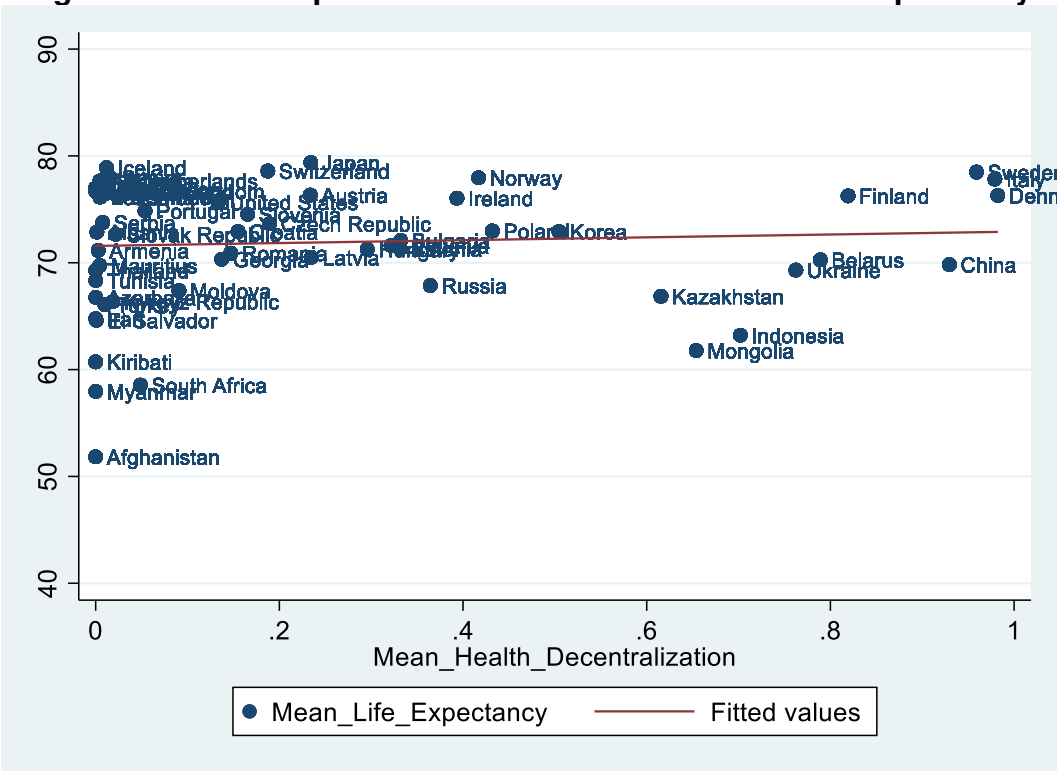


Figure 4. Governance and Infant Mortality Rate

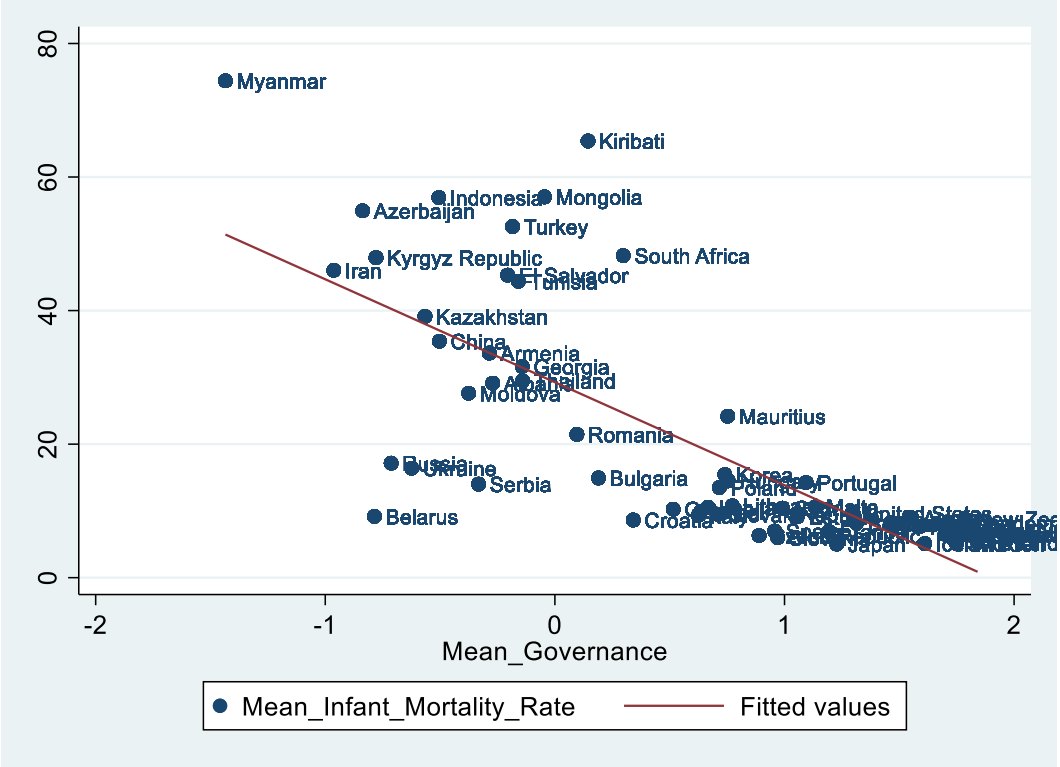


Figure 5. Governance and Life Expectancy

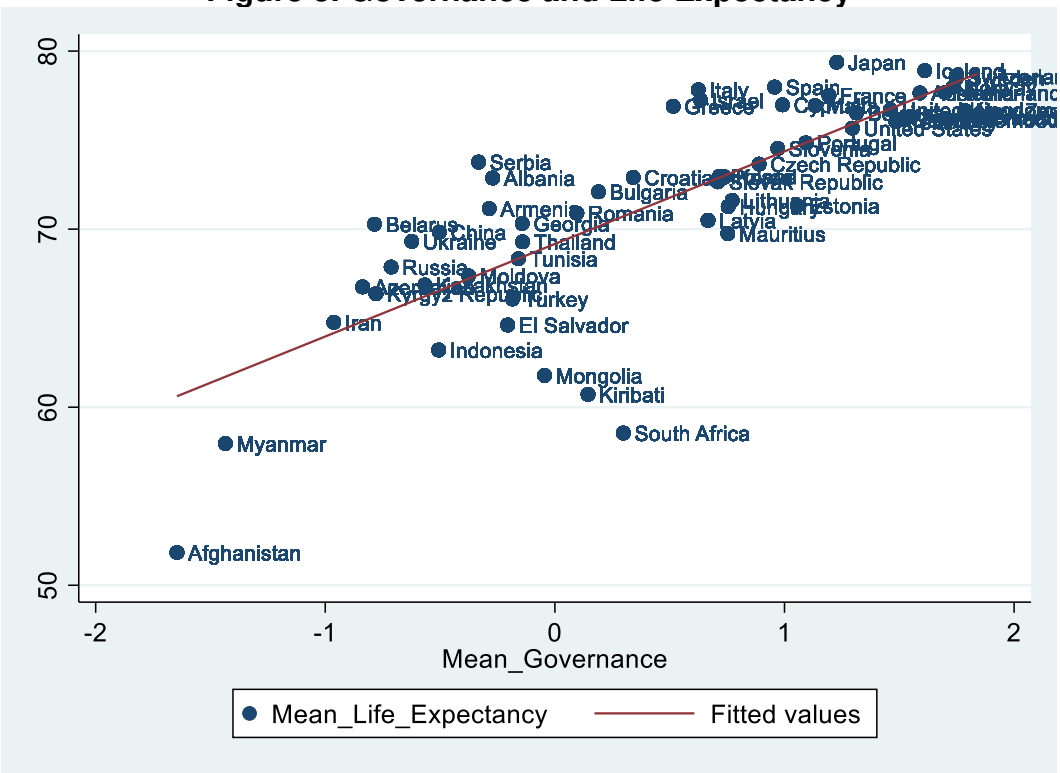


Figure 6. Limits of Health Expenditure Decentralization to Have Positive Effects on Health Outcomes

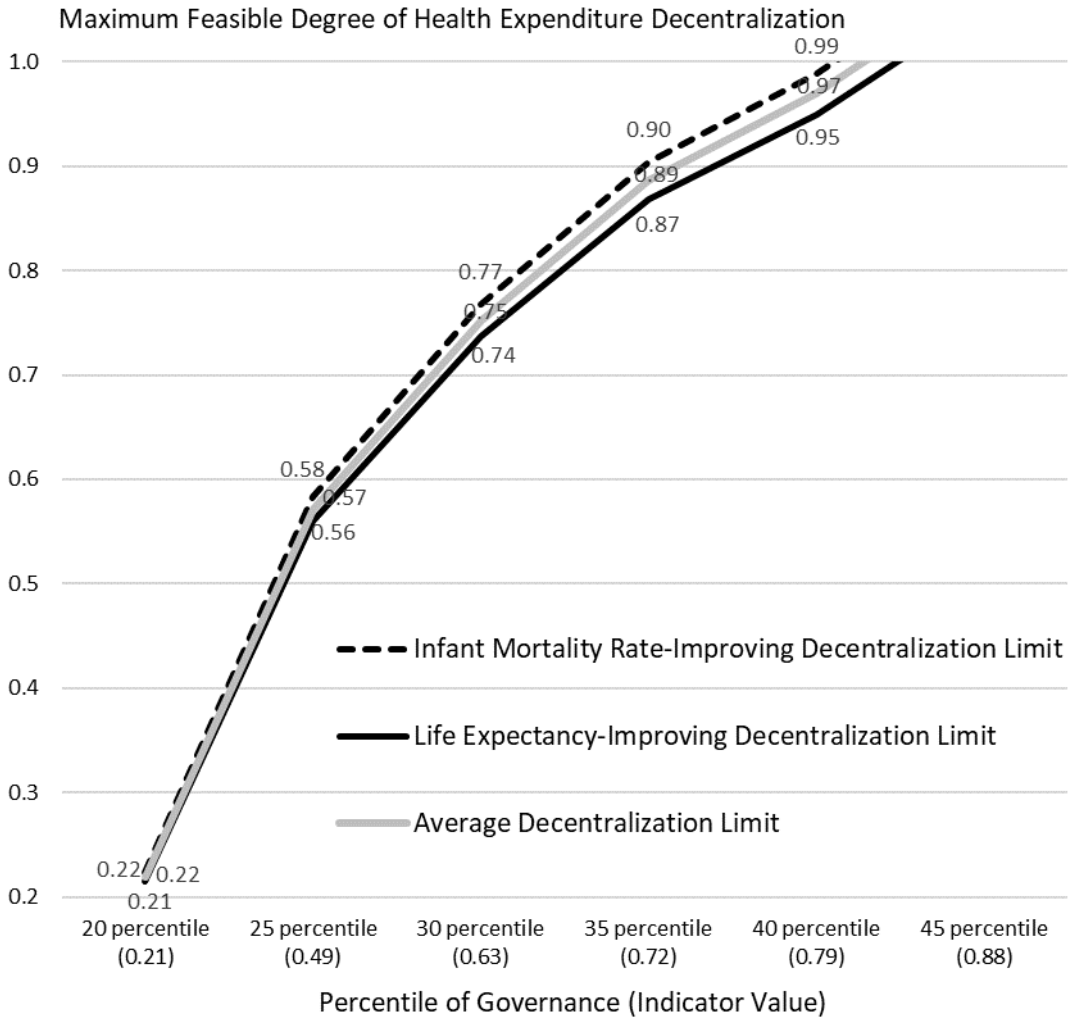
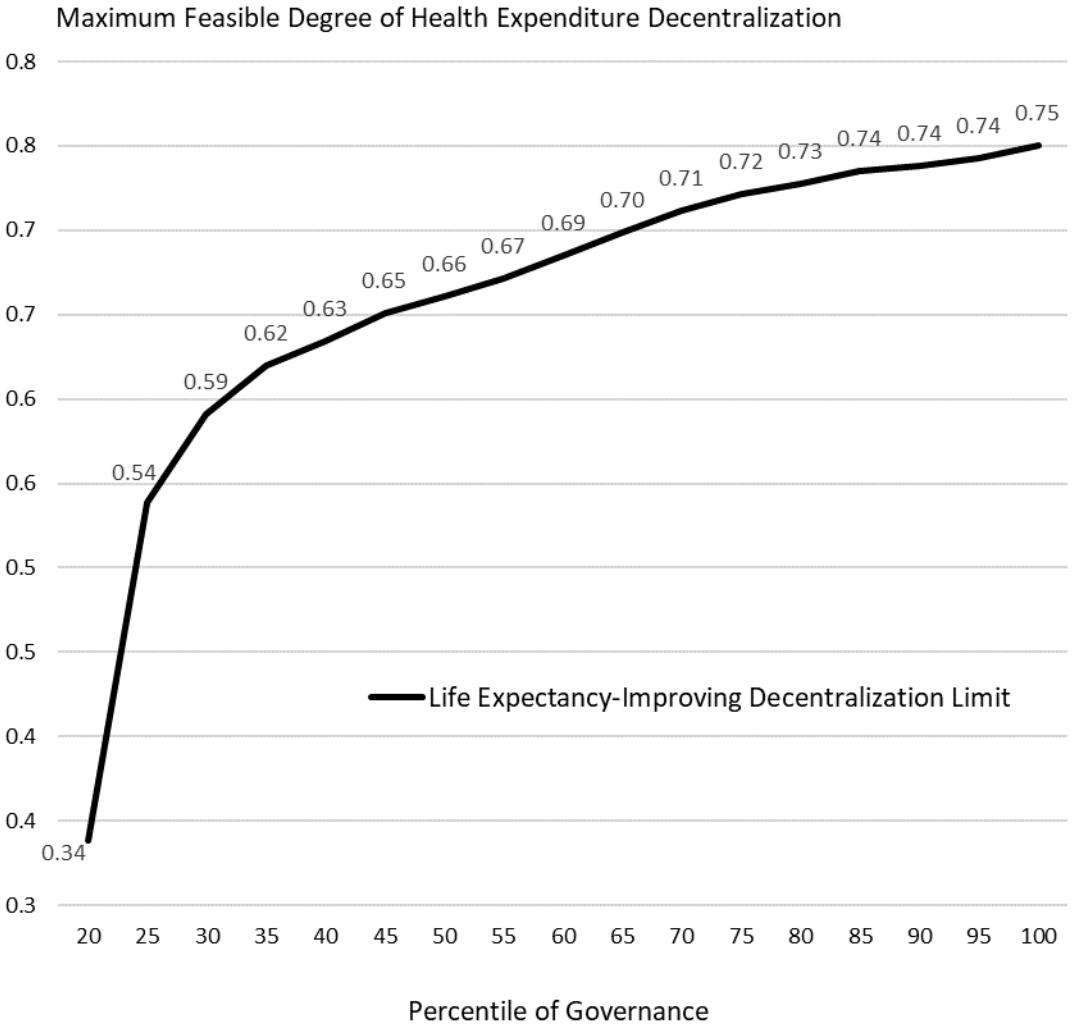


Figure 7. Limits of Health Expenditure Decentralization Incorporating Nonlinear Effects from Governance to Have Positive Effects on Life Expectancy



Annex I. Data Source and Description

Annex Table 1. Sources and Descriptions of Data

Variable	Source	Description
Health expenditure decentralization	Fiscal Decentralization Dataset https://data.imf.org/?sk=1C28EBFB-62B3-4B0C-AED3-048EEEBB684F	Share of health spending of local governments as a proportion of general government spending.
Governance	Worldwide Governance Indicators http://info.worldbank.org/governance/wgi/	The average of government effectiveness, control of corruption, regulatory quality, voice and accountability, rule of law, and political stability. The index ranges from -2.5 to 2.5 (worst and best possible outcome, respectively).
Life expectancy at birth, total (years)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	The number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
Infant mortality rate (per 1,000 live births)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	The number of infants dying before reaching one year of age in a given year.
Hospital beds (per 1,000 people)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centers. Beds for both acute and chronic care are included.
Physicians (per 1,000 people)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Physicians include generalist and specialist medical practitioners.
Current health expenditure (% of GDP)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Current health expenditures include healthcare goods and services consumed during each year. This indicator does not include capital health expenditures such as buildings, machinery, IT and stocks of vaccines for emergency or outbreaks.

Domestic private health expenditure per capita (% of current health expenditure)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Domestic private sources include funds from households, corporations and NPOs. Such expenditures can be either prepaid to voluntary health insurance or paid directly to healthcare providers.
Tertiary school enrollment (% gross)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	The ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown
GDP per capita	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Constant 2010 U.S. million dollars
Population ages 0-14 (% of total population)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Population between the ages 0 to 14 as a percentage of the total population. Population counts all residents regardless of legal status or citizenship.
Population ages 65 and above (% of total population)	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	Population ages 65 and above as a percentage of the total population. Population counts all residents regardless of legal status or citizenship.
Gini index	World Development Indicators https://databank.worldbank.org/source/world-development-indicators	The Gini index measures the extent to which the distribution of income or consumption among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
Vertical fiscal imbalance	Fiscal Decentralization Dataset https://data.imf.org/?sk=1C28EBFB-62B3-4B0C-AED3-048EEEBB684F	$1 - \frac{Own\ Revenue_{i,t}^{Local\ \ Government}}{Own\ Expenditure_{i,t}^{Local\ \ Government}}$
State dummy	Fiscal Decentralization Dataset https://data.imf.org/?sk=1C28EBFB-62B3-4B0C-AED3-048EEEBB684F	A dummy variable takes the value of 1 if countries have state governments, 0 if not.

[i] Yardstick competition refers to the situation in which taxpayers compare the performance of their local government with that of neighboring governments as a yardstick, enhancing competition among local governments to improve delivery of public goods and services.
[ii] When only government expenditure is decentralized but revenue is not, the common pool problem arises from not-fully internalized cost of local fiscal actions owing to the local government's tendency to overuse common revenue sources.
[iii] Flypaper effect occurs when an intergovernmental grant from central government increases local government spending more than the increase in local income.
[iv] Economies of scale are the situation in which an increase in size can lead to an improvement of productivity (Nakatani 2023b).
[v] Decentralization of healthcare system can be classified into political, administrative, or fiscal decentralization (Saltman and Bankauskaite 2006). In this paper, we study the effects of fiscal (notably, expenditure) decentralization on health outcomes because we do not have cross-country data on administrative or political decentralization of healthcare system.
[vi] Diaz-Serrano and Rodríguez-Pose (2012) found that fiscal decentralization has a positive and significant effect on the well-being of individuals when local governments have the capacity to deliver public goods and services to citizens.
[vii] Note that the interaction between political participation of citizens and local corruption could be more complex in practice. Kuenzi and lambright (2019) found that citizens in areas with greater local control over public expenditures perceive local officials to be more responsive, yet also more corrupt.