What determines instability of public health allocations, governance, economy or disaster?

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1 Abstract

Public health allocations are sensitive and important factors that determine quality of health services provided to people in many countries around the world. However, few studies have systematically analyzed the factors to affect stability of public health allocations over time. This paper empirically explores the determinants for instability of public health allocations which is conceptualized as punctuation (an increase with more than 35% is positive punctuation or a decrease with more than 25% is negative punctuation). To this end, we collect and statistically examine panel data for 191 countries from 1995 to 2014, posing a hypothesis that disasters characterize instability of public health allocations. The results show that countries with weak governance tend to have a high probability of punctuation in public health allocations compared to those with strong governance. Least developed countries have a high probability of facing negative punctuation compared to developed countries. On the contrary to our initial expectations, these results imply that occurrences of disasters are not the main determinants for punctuation. Rather, governance and economic development shall be of utmost importance. In particular, improving governance for countries with low economic development shall be prioritized to stabilize public health allocations for the betterment of human life.

2 Introduction

Governments allocate its budget among different sectors such as health, security and education to promote the well-being of the citizens in societies. The governmental budgetary allocations mostly evolve through small scale adjustments because policy makers cannot make large scale reforms due to time and information constraints (Lindblom, 1959, Wildavsky, 1964, Davis et al., 1966). However, sometimes, emergence of new information can make policy makers depart from status quo, leading to instability in governmental allocations i.e., punctuated equilibrium theory (Baumgartner and Jones, 2005). Public health allocations are considered to be one of the most important governmental allocations because it affects quality of health services and welfare of the citizens. The emergence of new information (i.e., disasters) leads to instability in public health allocations which is claimed to have a negative effect on the growth of these allocations in the long run (Breunig, 2012). Therefore, it is important to understand the influential factors on instability of public health allocations.

A group of scholars uses time series data to analyze instability of governmental allocations among different sectors utilizing punctuated equilibrium theory (PET) as a theoretical framework. Breunig (2006) examines whether budgets in Denmark, Germany, the United Kingdom and the United States face instability (i.e., punctuation) and investigates the variation in budget punctuation over time. They find that political and institutional constraints have various effects on punctuation among different countries over time. Ryu (2009) explores what factors cause budget stability and punctuation in the United States. They conclude that institutional frictions and oversupply of information increase punctuation occurrences. These studies have shown that political constraints and institutional frictions influence punctuation occurrences in governmental allocations for different sectors.

Other researchers have examined the determinants of public health allocations in different countries utilizing panel data. Behera et al. (2018) explore relationships

between public health allocations and fiscal space (i.e., tax revenue, non-tax revenue, fiscal transfer and borrowings) in 21 states of Indian economy from 1980 to 2014. They identify that governmental borrowings have a negative impact on public health allocations in the long run. Bettin et al. (2020) study how immigrants affect public health allocations across Italian regions from 2003 to 2016, revealing that an increase in immigrants leads to a decrease in public health allocations. In short, these studies find that governmental borrowings (immigrants) have a negative (positive) impact on public health allocations.

Previous studies have used PET as a framework to understand instability in governmental allocations among different sectors and examine the factors that influence public health allocations at the national level. However, little is known about the factors that influence stability of public health allocations at the international or cross-country level using PET framework. Therefore, this paper explores instability of public health allocations using panel data for 191 countries from 1995 to 2014. We hypothesize that occurrences of natural and health disasters characterize instability in public health allocations. A novelty of this research lies in analyzing effects of external factors (i.e., natural and health disasters) along with internal factors (i.e., governance and economic factors) on instability of public health allocations in a single analytical framework.

2 Methods and materials

This research collects data for 191 countries from 1995 to 2014 utilizing Historical Public Debt, The Global Health Observatory, Emergency Events Database (EM-DAT), World Development Indicators and Worldwide Governance Indicators to examine the factors to affect instability of public health allocations (International Monetary Fund, 2016, World Health Organization, 2016, Guha-Sapir et al., 2017, World Bank, 2018, Kaufmann and Kraay, 2019). We follow World Economic Situation and Prospects to categorize our data into three categories i.e., developed, developing and least developed countries (UNCTAD, 2018).

These data are utilized to explore the determinants for instability in public health allocations, which is defined as punctuation in public health allocations (hereafter, punctuation). Punctuated equilibrium theory (PET) is used as an analytical framework. Punctuation refers to the sudden and big fluctuations in the yearly percentage change of public health allocations where an increase with more than 35% is positive punctuation or a decrease with more than 25% is negative punctuation (Jordan, 2003, Breunig, 2006).

The dependent variable in our models is denoted by y_{it}, taking $y_{it} = 1$ when punctuation occurs for country i at time t and $y_{it} = 0$, otherwise, where index i is a country ID ($i = 1,\ldots,191$) and t is a year or time ID ($i = 1,\ldots,20$). $\text{Prob}(y_{it} = 1)$ represents the probability that country i faces punctuation, following a distribution function F evaluated at $x_{it}\beta$, where x_{it} represents a $1 \times K$ vector of independent variables for country i at time t, β refers to a $K \times 1$ vector of regression coefficients estimated via standard maximum likelihood method and K is the number of independent variables in the regression. The panel logit regression method assumes a logit distribution function as follows (Wooldridge, 2010, 2019):

$$\text{Prob}(y_{it} = 1|x_{it}) = \frac{\exp(x_{it}\beta)}{1 + \exp(x_{it}\beta)}$$

This model can be utilized to estimate countries' marginal probability of facing punctuation, positive and negative punctuations when an independent variable increases by one unit, holding other independent variables fixed at some level. The set of the independent variables x_{it} includes last year's punctuation, natural disaster, health disaster, economic development, governmental debt, the governance indicator, population

and GDP.

EM-DAT database reports a disaster when at least one of the following criteria is met: ten or more people reported killed, hundred or more people reported affected, a declaration of the state for emergency and a call for international assistance (Guha-Sapir et al., 2017). Natural and health disasters are divided into low, medium, high and very high number of deaths dummy variables i.e., less than 100, from 100 to 500, from 500 to 1000, more than 1000, respectively. This research also uses the ranking of the governance indicator defined by Worldwide Governance Indicators ranging from -2.5 to 2.5, with higher values corresponding to better governance (Kaufmann and Kraay, 2019).

3 Results

Table 1 shows the summary statistics of 39, 106 and 46 developed, developing and least developed countries, respectively, from 1995 to 2014. Punctuation occurs in around 4%, 10% and 20% of the observations for developed, developing and least developed countries, respectively. Around 40% of the observations for developed, developing and least developed countries face low number of deaths natural disaster. However, around 11%, 3% and 3% (20%, 3% and 3%) of the observations for developing countries (least developed countries) face medium, high and very high number of deaths natural disasters. Health disaster follows the same trend as natural disaster for developed, developing and least developed countries.

On an average, governmental debt is around 56%, 53% and 80% of GDP for developed, developing and least developed countries, respectively. The average populations (GDP) of developed, developing and least developed countries are around 25, 45 and 15 million (878, 141 and 9 billion dollars), respectively. Developed countries have a strong governance indicator with an average of around 1.2, whereas developing and least developed countries have a weak governance indicator with an average of around -0.2 and -0.7, respectively. These statistics show that least developed countries generally face more punctuation than developed and developing countries. It also indicates that there are differences between the three groups of countries in terms of natural disaster, health disaster and other economic factors.

To confirm these differences, we run a chi-square test with the null hypothesis that the frequencies of punctuation, positive and negative punctuations are the same among developed, developing and least developed countries. The null hypothesis is rejected at 1% significance level ($x^2 = 133.013$, $P < 0.01$; $x^2 = 54.17$, $P < 0.01$; and $x^2 = 73.6$, $P < 0.01$, respectively). We test the correlation between the governance indicator and the frequencies of punctuation, positive and negative punctuations, finding that there is negative and insignificant correlation between these variables. These results indicate that economic development is likely to have some effects on punctuation, positive and negative punctuations.

[Table 1 about here.]

To quantitatively characterize the marginal impact of economic factors, natural disaster, health disaster and the governance indicator variables on the probability of punctuation, panel logit regressions are applied. Table 2 presents the coefficients and the marginal effects. As mentioned earlier, we use the dummy variables of punctuation, positive and negative punctuations as dependent variables in models 1, 2 and 3, respectively. In all models, the independent variables are last year's punctuation, natural disaster, health disaster, economic development, governmental debt, the governance indicator, population and GDP.

In model 1, very high number of deaths natural disaster, economic development and the governance indicator (governmental debt) variables are statistically significant

at 1% (5%), respectively. Last year's punctuation, high number of deaths natural disaster, economic development, governmental debt and the governance indicator variables are statistically significant at 1% in model 2, respectively. In model 3, economic development and the governance indicator variables are statistically significant at 1%, respectively.

More specifically, occurrences of natural disaster with very high number of deaths decrease the probability of punctuation by 5.3% compared to other countries that do not face natural disaster in model 1. Developing countries (least developed countries) have a high probability of punctuation by 3.9% (9.3%) compared to developed countries. When the percentage of governmental debt increases by 10%, the probability of punctuation increases by 0.018%. An increase of one unit in the governance indicator declines the probability of punctuation by 3.8%.

In model 2, occurrences of last year's positive punctuation increase the probability of positive punctuation by 4.3%. Occurrences of natural disaster with high number of deaths decrease the probability of positive punctuation by 2.8% compared to other countries that do not face natural disaster. Developing countries (least developed countries) have a high probability of positive punctuation by 2.0% (4.6%) compared to developed countries. When the percentage of governmental debt increases by 10%, the probability of positive punctuation increases by 0.013%. An increase of one unit in the governance indicator declines the probability of positive punctuation by 1.8%. The magnitudes of governmental debt variables are economically insignificant in models 1 and 2.

In model 3, developing countries (least developed countries) have a high probability of negative punctuation by 2.1% (4.8%) compared to developed countries. An increase of one unit in the governance indicator declines the probability of negative punctuation by 2.2%. The results show that the governance indicator and natural disaster (low economic development) have a negative (positive) effect on the probability of punctuation in public health allocations. Our results suggest that enhancing governance for developing and least developed countries should be considered to be effective at increasing stability of public health allocations, being an urgent agenda for these countries.

[Table 2 about here.]

Overall, our findings indicate that economic development and the governance indicator increase stability of public health allocations. On the other hand, only few categories of natural disaster stabilize public health allocations. An important question here is why these factors influence stability in public health allocations. It is our conjecture that some politicians in developing and least developed countries have the idea that health sector is not a profitable or productive sector because it does not have a direct effect on GDP in the short run. Thus, they tend to sacrifice public health allocations for such profitable sectors.

The governance indicator includes several factors that might directly affect the budgetary process, such as voice and accountability, regulatory quality, political stability and absence of violence, rule of law, government effectiveness and control of corruption. This paper claims that these factors affect public health allocations as they capture whether the political system represents the public and the extent to which corruption is prevailing in countries. When the political system represents the public (i.e., corruption is low), then governments mostly care about health sector to be re-elected, leading to the continuous stability in public health allocations. However, in many cases, the government, especially with high degree of corruption, pays more attention to other sectors such as defense and infrastructure ones, than health sector. Thus, the attention and priority of policy makers might have been given to

such sectors, consequently ignoring and destabilizing public health allocations.

4 Conclusion

This paper has examined the factors that influence instability of public health allocations, posing a hypothesis that natural and health disasters characterize the determinants for stability in public health allocations. The statistical analysis shows that countries with weak governance tend to have a high probability of punctuation compared to those with strong governance. Least developed countries have a high probability of facing negative punctuation compared to developed countries. These results imply that occurrences of natural and health disasters are not the main determinants for punctuation, which is in sharp contrast with our initial expectations. Instead, governance and economic development are imperative elements to determine punctuation. In summary, the results suggest that improving governance for countries with low economic development is prioritized to increase stability of public health allocations.

Finally, we note some limitations of our study and directions for future research. This research clarifies the influential factors on stability of public health allocations because it is one of the crucial problems in many countries around the world. To generalize these findings in our research, future study should focus on missing factors of how regime change and punctuation are positively or negatively associated with one another. Such a study might reveal effects of regime change on stability in overall governmental allocations as well. These caveats notwithstanding, it is our belief that this study is an important step to understand the determinants for stability of public health allocations.

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Table 1: Summary statistics

	Developed countries		Developing countries		Least developed countries		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Punctuation	0.04	0.20	0.10	0.30	0.20	0.40	0.11	0.31
Positive Punctuation	0.02	0.20	0.04	0.20	0.10	0.30	0.10	0.21
Negative Punctuation	0.01	0.12	0.10	0.22	0.11	0.31	0.10	0.23
Natural Disaster								
Low no. Deaths	0.44	0.50	0.40	0.50	0.41	0.50	0.40	0.50
Medium no. Deaths	0.10	0.30	0.11	0.32	0.20	0.40	0.13	0.33
High no. Deaths	0.01	0.10	0.03	0.20	0.03	0.20	0.02	0.20
Very high no. Deaths	0.02	0.12	0.03	0.20	0.03	0.20	0.03	0.20
Health Disaster								
Low no. Deaths	0.01	0.10	0.10	0.30	0.20	0.40	0.10	0.30
Medium no. Deaths	0.001	0.04	0.02	0.20	0.10	0.30	0.04	0.20
High no. Deaths	0	0	0.01	0.08	0.02	0.20	0.01	0.10
Very high no. Deaths	0	0	0.003	0.10	0.02	0.20	0.01	0.10
Governmental debt % GDP	0.56	0.50	0.53	0.44	0.80	0.57	0.60	0.48
Population	25.30	51.20	45.14	169.22	15.74	24.71	34.00	129.00
GDP	878.61	2201.41	141.63	535.04	9.20	18.30	263.00	1130.00
Governance indicator	1.20	0.51	-0.23	0.70	-0.74	0.60	-0.10	0.90
No. of countries	39		106		46		191	
Years (1995-2014)	20		20		20		20	
No. of observations	780		2120		920		3820	

Table 2: Panel logit models

Variables[1]	Model 1		Model 2		Model 3	
	Punctuation		Positive Punctuation		Negative Punctuation	
	Coefficient	Marginal effects	Coefficient	Marginal effects	Coefficient	Marginal effects
Last year's punctuation[2]	0.400*	0.023*	1.283***	0.043***	-0.635*	-0.021*
	(0.228)	(0.013)	(0.237)	(0.008)	(0.351)	(0.012)
Natural Disaster (no disaster is a base group)						
Low no. Deaths	0.036	0.002	0.188	0.007	-0.158	-0.006
	(0.188)	(0.012)	(0.229)	(0.008)	(0.256)	(0.009)
Medium no. Deaths	-0.369	-0.020	-0.118	-0.004	-0.642	-0.019
	(0.309)	(0.016)	(0.363)	(0.011)	(0.472)	(0.013)
High no. Deaths	-0.675	-0.033	-1.483	-0.028***	0.102	0.004
	(0.785)	(0.031)	(1.064)	(0.011)	(0.994)	(0.042)
Very high no. Deaths	-1.346*	-0.053***	-0.547	-0.015		
	(0.744)	(0.019)	(0.838)	(0.018)		
Economic Development (developed countries are a base group)						
Developing countries	1.288**	0.039***	1.294	0.021***	1.281*	0.021***
	(0.609)	(0.012)	(0.860)	(0.008)	(0.778)	(0.008)
Least developed countries	2.091***	0.093***	1.974**	0.046***	1.992**	0.048***
	(0.659)	(0.020)	(0.916)	(0.012)	(0.822)	(0.013)
Governmental debt % GDP	0.003**	1.8×10^{-4}**	0.004***	1.3×10^{-4}***	0.002	5.6×10^{-5}
	(0.001)	(7.6×10^{-5})	(0.001)	(4.1×10^{-5})	(0.001)	(4.5×10^{-5})
Governance indicator	-0.644***	-0.038***	-0.538***	-0.018***	-0.643***	-0.022***
	(0.200)	(0.012)	(0.197)	(0.007)	(0.225)	(0.008)
Wald x^2	120.41***		172.14***		63.63***	
Observations	3,260		3,260		3,160	
Number of ID	180		180		180	

[1] We control for health disaster, population and GDP in models 1, 2 and 3, however these variables are insignificant.

[2] In case of model 2 and 3, last year's punctuation refers to positive and negative punctuations, respectively.

Robust standard errors in parentheses

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$