The Effective Number of Political Parties as a Determinant of Public Health

Byung-Deuk Woo*

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This article empirically examines the relationship between the effective number of political parties in parliaments and public health by applying the selectorate theory. Based on the time-series cross-national data about 40 countries classified as democracies from 2000 to 2016, this article finds the higher effective number of political parties in parliaments tends to increase infant mortality rate per 1,000 live births and decrease life expectancy at birth. This relationship is statistically significant in both fixed effects (FE) regression models and lagged dependent variable (LDV) models. This article not only contributes the literature on the determinants of public health, but also highlights the needs to investigate the influence of other political institutions on health outcomes.

Keywords: The Effective Number of Political Parties, Public Health, the Selectorate Theory, Infant Mortality Rate, Life Expectancy.

Abstract

* Ph.D. Candidate in the Political Science Department at the University of Iowa. He has published journal articles in Korean Journal of Security Affairs and Korean Journal of Defense Analysis.
I. Introduction

Considering that good public health is indispensable for the prosperity of human beings and the preservation of humanity, examining the determinants of public health is always worthwhile. Good public health status is an important factor to overcome poverty, to improve national capabilities including long-term economic growth, and to protect public against financial crisis rooted in ill-health (World Health Organization 2001; 2016). Over the last decades, the global average of public health has been improved dramatically.

Based on the data from World Bank, the global average of infant mortality rate per 1,000 live births decreases from 53.2 in 2000 to 28.9 in 2018 and the life expectancy at birth in years increases from 67.5 to 72.6. However, some countries still suffer from lower levels of public health compared to the world average, while others enjoy the improved public health. For instance, the infant mortality rate and life expectancy of Switzerland are 4 and 84. On the contrary, those of the Central African Republic are 85 and 53 respectively. Even among industrialized countries and among democratic countries, there are non-negligible variations in the level of public health (Sheiham 2009; De Vogli et al., 2005; Navarro et al., 2003).

What determines the national level of public health? To answer this question, scholars have investigated series of economic and political variables such as GDP per capita or political stability. However, very few scientific studies have examined the relationship between party system and public health in democratic countries, even though some studies give some clues for this association (Bueno de Mesquita et al., 2000; Persson and Tabellini, 1999; Chhibber and Nooruddin, 2004). This scarcity of scientific studies about the influence of party system on public health is unexpected because, as a core of democracy, not only political party itself but also party system has been studied as a key factor affecting various social and political outcomes such as voting behaviors (Downs 1957; Norris, 2004; Dalton, 2008), the perception of government corruption (Davis et al., 2004; Schleiter and Voznaya, 2014), political stability (Powell, 1982), and government distortion (Kim et al., 2010).

This article aims to find out whether the party system is associated with the national level of public health, which has been a relatively marginalized topic. To measure the party system, this article relies on the effective number of political parties in parliaments developed by Laakso and Taagepera (1979) and extended by Golosov (2010). This article investigates the mechanism of how the effective number of political parties explain variations in health outcomes for the public. Applying the selectorate theory from Bueno de Mesquita et al., (2000), this article argues that a large effective number of political parties in parliaments lowers the level of public health because the relatively small size of the winning coalition with the large effective number of parties motivates political parties to provide private goods rather than public goods. On the contrary, the larger winning coalition with a small effective number of political parties leads incumbents to foster public goods.

This research focuses on 40 countries classified as democracies by Polity IV project (Marshall et al., 2009) from 2000 to 2016. By conducting a time-series cross-national analysis with “xtreg” command in STATA, this article finds empirical supports for the negative relationship between the effective number of political parties in parliaments and public health measured by life expectancy at birth and infant mortality rate per 1,000 live births, This sta-
II. Previous Literature on Determinants of Public Health

A wide array of economic and political factors has been considered determinants of public health. This section reviews previous literature on important economic and political determinants of public health.

1. Key Economic Factors

Economic development is one of the essential economic factors to improve public health. Almost all empirical studies argue that economically developed countries enjoy good public health (Navarro et al., 2006; Swift 2011; Navia and Zweifel 2003; McGuire 2013). Representatively, Navarro et al. (2006) conduct an empirical analysis with data about OECD countries over five decades and show that GDP per capita significantly increases the life expectancy. Relying on data ranging from 1820-2001 to 1921-2001 about 13 OECD countries, Swift (2011) adds empirical supports for the positive influence of GDP per capita on the life expectancy. In addition, Navia and Zweifel (2003) find that higher GDP per capita substantially decreases infant mortality rate among democratic countries.

Government health expenditure has also been studied widely. Previous empirical studies provide conflicting results about the impact of government health expenditure on public health. Some scholars argue that government health expenditure tends to promote public health (Berger and Messer 2002; Leu 1986; Lichtenberg 2002), while others find public health-care spending is...
not correlated with public health (Barlow and Vissandjee 1999; Kim and Moody 1992; Nolte and McKee 2004). More recently, the impact of government health expenditure is investigated compared to other factors of public health. For example, Behera and Dash (2020) demonstrate that government health expenditure has relatively less influence on public health compared to GDP per capita. 

In addition to the above two economic factors, urbanization and income inequality have been examined as determinants of public health. Urbanization can improve public health because urban dwellers tend to enjoy a higher level of education, advanced medical care, and socio-economic infrastructure, which can lead to better public health (Kabir 2008). Even though some empirical studies find no correlation between urbanization and public health (Eckert and Kohler 2014; Rogers and Wofford 1989), Kalediene and Petrauskiene (2000) find the positive association between urbanization and life expectancy by comparing 55 administrative regions of Lithuania. Singh and Siahpush (2014) also show that people residing in urban areas have outlived rural dwellers by 3.1 years. 

Moreover, a high income inequality tends to lower the level of public health because only a small portion of the rich can enjoy welfare and health benefits provided by the public and private sector (Navarro 2020). The seminal research from Rodgers (1979) reveals the negative correlation between income inequality and life expectancy. Following studies with cross-national analyses have provided empirical evidences for this relationship (Waldmann 1992; De Vogli et al., 2005; Ram 2006).

2. Key Political Factors

Among political factors, democracy is unquestionably the main focus of the previous literature. There is a broad consensus about the positive association between democracy and public health (Moon and Dixon 1985; Dasgupta 1995; Przeworski et al., 2000; Zweifel and Navia 2000; Bueno de Mesquita et al., 2003; Lake and Baum 2001; Harding and Stasavage 2014; Avelino et al., 2005). At the same time, models developed from political economy studies provide strong evidences showing democracy tends to provide more public goods compared to non-democracy (Acemoglu and Robinson 2006; Boix 2003; Meltzer and Richard 1981).

Previous empirical studies have also unveiled the significant impact of democracy on indicators of public health, such as infant mortality (Ross 2006b) and life expectancy (Besley and Kudamatsu 2006).

Political Corruption defined as "the use of public office for private gains" (Bardhan 1997) and political instability meaning a high probability of government termination (Carmignani 2003) are considered political factors deteriorating public health, political corruption tends to increase the costs for people to gain public health services and reduce public health demands, which therefore worsens public health (Shleifer and Vishny 1993). Empirical studies support the negative impacts of political corruption on infant mortality and life expectancy (Azfar and Gurgur 2008; Gupta et al., 2000). Political instability which can be caused by international conflicts, terrorism, and civil war also can disturb governments’ efforts to deliver public goods. A seminal work from Levy and Sidel (2008) demonstrates how international conflicts can negatively affect people’s mental health, women’s and children’s mortality rate, and life expectancy. Ethnolinguistic Fragmentation also can explain variations in public health.
In highly fragmented societies, collective action to increase the quality of public health is less achievable. It is because dominant groups in heterogeneous countries are less willing to put effort on the provision of public goods benefiting other groups (Krist and Fritzell 2011; Powell-Jackson et al., 2011). Some empirical studies support this mechanism, Mackenbach and McKee (2013) demonstrate ethnic fractionalization is the main predictor of public health in European countries and Churchill et al. (2017) find ethnolinguistic fractionalization tends to deteriorate public health based on a cross-sectional analysis about 91 countries, On the contrary, Wimmer (2016) argues that the causal relationship between ethnolinguistic fractionalization and public health is at best spurious.

3. Other Factors

Even though not thoroughly examined by previous literature as key factors, higher voter turnout also can improve public health (Navarro et al., 2006). For sure, there are other social determinants correlated with public health aside from economic and political factors such as education, accessibility to public transportation, proper management in the workplace, smoking rate, and alcohol consumption (Marmot and Wilkinson 2005). Also, lifestyles in countries with different cultures are examined as possible determinants of public health (Hahn and Inhorn 2009).

III. The Effective Number of Political Parties and Public Health

In advancing this literature on the determinants of public health, this article is to add one more political factor of public health: the effective number of political parties in parliaments (ENPP).

As well as political parties themselves, party system has been placed at the center of modern democracy, and at the same time the creation and evolution of party systems have been widely studied (Bartolini 2007; Neto and Cox 1997; Mair 1997). However, even though party system is unquestionably one of the most important factors on policy outcomes including public health, the topic of the association between party system and the nationally aggregated level of public health has been marginalized and less been empirically tested because of the difficulties of systematically unveil the impacts of party system. This article fills this academic gap with the focus on the effective number of political parties.

With the pioneering position, this article devotes itself to the role of the number of parties in democratic countries to determine the level of public health because of the following reasons. Most importantly, the same number of political parties in democratic countries and non-democratic countries does not have the same meaning. During the waves of democratization, many non-democratic countries adopted democratic institutions such as political parties to increase their regime legitimacy (Mainwaring 1999). However, while political parties in democratic countries compete under the fair elections and introduce policies for their target voters (Aldrich 1995), political parties in non-democratic countries including both dictatorship and
authoritarian countries are used as tools to suppress opposition forces and to support the survival of dictators or ruling parties (Gandhi 2008). Moreover, non-democratic countries often create satellite parties which do not aim to transfer power, but to solidify the governing power (Hadenius and Teorell 2007). Therefore, empirically analyzing the influence of the effective number of parties on public health will reduce the credibility of results. Furthermore, the public health indicators about non-democratic countries are not reliable at best, which hinders me from empirically analyzing them. Official public health data from dictatorship and authoritarian countries are frequently be used to propagate the effectiveness of dictatorship or governments rather than the actual public health itself (Rechel and McKee 2007). Given that the reliability of data is indispensable to empirical analysis, this study focuses on democratic countries rather than runs the risk of data reliability problem.

1, Ways to Measure the Number of Political Parties

Since its first exposition from Laakso and Taagepera (1979), the effective number of political parties has been the most widely accepted way to measure party systems (Smith 1989). Influential scholars such as Lijphart (1999) advocate the usage of the effective number of political parties. The strength of the effective number of political parties from Laakso and Taagepera (1979) is to offer a simple and understandable way to calculate the number of parties. This measure is described as 1 divided by the sum of squared vote-shares or seat-shares in parliaments, It is generally presented as

\[
N = \frac{1}{\sum p_i^2}
\]

where N is the effective number of political parties and \( p_i \) denotes the share of votes or seats for each political party \( i \). Based on this formula, this index gives some weights to all political parties according to their sizes. It gives the largest weights to dominant political parties, but small or tiny political parties are hardly counted (Taagepera and Shugart 1989).

However, the Laakso and Taagepera’s index is definitely not the flawless measure of party systems. It tends to generate extremely high scores for very concentrated party systems and the index, therefore, does not intuitively represent realities (Golosov 2010; Dunleavy and Boucek 2003). Golosov (2010) introduces a new measure presented below to overcome the problems of the Laakso and Taagepera’s index,

\[
N = \sum_{i=1}^{\pi_l} \frac{1}{1 + (p_i/p_l)^2 - p_i}
\]

where \( p_l \) indicates the share of votes or seats for the largest party and other nota-

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1 Other exemplary criteria to classify party systems, such as the competitive opposition (Dahl 1969), the level of institutionalization (Mainwaring 1999), the degree of citizen involvement (LaPalombara and Weiner 1980), and the compactness (Alvarez and Nagler 2004), have been also developed.

2 Lijphart (1999, 69) says ‘The problem of how to count parties of different sizes is solved by using the effective number measure’.
tions are the same in the Laakso and Taagepera’s index. By conducting a cross-national analysis about countries in East-Central Europe and the former Soviet Union, Golosov (2010) demonstrates his new measure performs better than the Laakso and Taagepera’s index.

Even though there are other ways to classify party system, recent empirical studies still rely on the effective number of political parties as an equivalent measure of party systems to evaluate or to control the influence of party system on various social and political outcomes (Jung 2020; Aspinall and Hicken 2020; Milazzo et al., 2018; Bischoff and Christiansen 2017; Van De Wardt and Van Witte-loostuijn 2019).

2. From the Effective Number of Political Parties to Public Health

How does the effective number of political parties in parliaments affect public health? This article argues that a high number of political parties decrease public health in democratic countries based on the selectorate theory from Bueno de Mesquita et al. (2000). This article relies on the selectorate theory to hypothesize the link between the effective number of political parties and public health rather than on other theories including the veto player theory, the theory of clientelism, the coalition theory, and the theories of electoral politics. Before discussing the selectorate theory, I briefly review the four alternative theories and the relative strengths of the selectorate theory.

First, the veto player theory emphasizes the role of institutional veto power on policy changes (Tsebelis 1999, 2002). The core argument of this theory is that the shape of legislative policies is determined largely by veto players and the status quo does not change under the absence of veto players. Even though it provides an theoretical tool to study policy outcomes, the veto player theory cannot be easily applied to cross-national empirical studies because of the three types of problems: problem of identification, problem of preference measurement, and problem of equivalence (Ganghof 2003). Simply speaking, scholars must identify which political actors are veto players in every country, they need to exactly measure the preference of the veto players, and they have to make an assumption that the relevant veto players are similar in all aspects even after the identification problem is solved. Even though solving the three types of problems is prerequisite to conduct empirical analysis, it is daunting because of the heterogeneity among the potential veto players across countries (Ganghof 2003, 2011).

Second, the theory of political clientelism is to illustrates the distribution or redistribution of selective benefits to certain individuals or specific groups in exchange for political support (Stokes 2007; Güney-Ayata 1994; Hopkin 2006).

With the focus on the dyadic reciprocity, interaction, and transactions between the patron and client, the theory of political clientelism has been applied to explain series of phenomena such as the economic development and modernization (Stokes et al., 2013; Kitschelt and Wilkinson 2007; Hicken 2011) and mobilization of voters (Wantchekon 2003; Lindberg and Morrison 2008).

However, even though the varying degree of the access to public services is sometimes examined with the lens of political clientelism (Robinson and Verdier 2013; Rosas et al., 2014), the theory of political clientelism does not provide a theoretical background that can be used to link the effective number of political parties and public health. Besides, the theory of political clientelism, as is veto player theory, is not free from the identification and measurement
problems.

Next, the coalition theory seminalley elaborated by Riker (1962) originally aims to explain formation of coalitions among political parties under the assumption of perfect information (Debus 2014). With this main focus, previous studies about the coalition theory deal with structural constraints affecting coalition bargaining (Weingast and Wittman 2006), the determinants of coalition size and coalition payoffs (Browne and Franklin 1973; Golder 2006), the influence of public good benefits on coalition (Burger and Kolstad 2009), or development of the theory itself (Weale 1984; Aldrich et al., 2014; Budge and Laver 1986). Although one analyzes the implementation of intersectoral health-related action in Quebec based on coalition theory (O’Neill et al., 1997), the dynamic nature of coalition, the strict assumption of coalition theory, and the difficulties to operationalize coalition formations in numerous countries over decades are the severe obstacles for scholars to take advantage of coalition theory. In addition, the coalition theory does not fundamentally examine the influence of party systems on public health,

Last but not least, the theories of electoral politics about political parties generally examine the interaction between voter preference and issue or ideological position of political parties (Downs 1957; Iversen 1994; Huckfeldt and Sprague 1992). One of the classical examples is the Downsian spatial theory of elections which can be summarized in a few axioms. Downsian theory assumes that the policy preferences of voters are clearly perceived, voters will vote for a candidate or party closest to their own position, and parties tend to adopt the positions enlarging the electoral supports (Iversen 1994). The theories of electoral politics derived from the axioms have been continuously elaborated by scholars (Lacy and Paolino 1998; Persson and Tabellini 1999; Sapiro and Conover 1997) and applied to study the variations in policy outcomes and in party strategies in case studies and comparative studies (Bowler 1990; Bardhan and Mookherjee 2010). However, there are some limitations to employ the theory of electoral politics for empirical analysis covering numerous countries because of the multidimensionality in voter preferences (De Sio and Weber 2014) and the measurement problems of party position across countries (Ray 2007).

Compared to the four alternative theories, the selectorate theory has the relative strengths to articulate the association between the effective number of political parties and public health both theoretically and empirically. Theoretically, unlike other theories explained above, it provides a parsimonious explanation about the political parties’ motivations of providing public and private goods without a strict assumption about political parties and voters (Hill 2012; Gallagher and Hanson 2014). Empirically, the simplicity of the selectorate theory compared to others about the key concepts, such as selectorate and winning coalition, provides an opportunity to conduct a cross-national empirical analysis on the relationship between party system and the level of public health by lowering the bar of identification and measurement problems. Thus, this article theorizes the link with the selectorate theory.

According to the selectorate theory from Bueno de Mesquita et al. (2000), the population in a country can be divided into three nested groups: citizen, selectorate, and winning coalition. Following the definitions from Bueno de Mesquita et al. (2000, 63), Citizen is defined as the largest subgroup of population and it includes every person enfranchised and disenfranchised such as children, The selectorate is the subset of citizenry with an institutionally legitimate right to choose their political leadership and the winning coalition is the subgroup of selectorate which incumbents rely on to hold
their offices. In other words, the winning coalition is defined in the selectorate theory as the minimum size of voters which politicians must please to win office.3

(Figure 1) Euler diagram of the Selectorate Theory

![Euler diagram of the Selectorate Theory](image)

Source: Bueno de Mesquita et al. (2000)

Incumbents try to secure a winning coalition by "Distributing things of value" which is divided into private and public goods (Bueno de Mesquita et al. 2000, 64). Private goods are purposefully delivered to the core members of the winning coalition by incumbents in order to buy their political loyalty, while public goods benefit all populations.

In reality, incumbents do not allocate their limited resources such as time and budget to provide only private or only public goods, but they provide a different combination of the two goods. With the purpose to win office, incumbents try to find the optimal combination to efficiently invest their resources. Bueno de Mesquita et al. (2000) argue that the size of the winning coalition is the main factor to determine the motivation of incumbents to focus on public goods provision rather than private goods by stating,

*The larger the winning coalition in a country, the thinner must be spread the private goods available to purchase political loyalty. The more slices of pie that must be cut, the less each mouth gets. For a fixed quantity of resources devoted to private goods, then, it becomes harder to buy loyalty with those goods as the size of the winning coalition increases. As the winning coalition increases in size, incumbents have more incentive to pour resources into public policy pursuits rather than private goods. If the institutionally mandated size of the winning coalition is large enough, then there is no incentive at all for incumbents to provide private goods (Bueno de Mesquita et al. 2000, 66).*

 Echoing Bueno de Mesquita, a larger winning coalition necessarily means that incumbents need to appeal to more supporters, which makes the fixed amount of private goods be spread widely. The supporters less satisfied with highly dispersed private goods are more likely to defect to other political parties. In terms of incumbents, the benefits of providing private goods decrease with the increased size of the winning coalition. In turn, a larger winning coalition leads incumbents to focus on providing public goods instead of private goods.

3 See also Bueno de Mesquita et al. (2001) and Bueno de Mesquita et al. (2002)
The effective number of political parties is closely related to the size of the winning coalition. The size of the winning coalition is larger under the two-party system rather than under the multiparty system. Some studies provide supports for this claim. Through formal models, Persson and Tabellini (1999) in their seminal work show that political parties under the two-party system need to get a majority (50 plus 1) to win an election, but political parties under the multiparty system are only required to get a much smaller portion of votes.\(^4\)

The increased possibility to win office with less percentage of votes (i.e., with a small winning coalition) gives less motivation for political parties to provide public goods because it is much easier to buy the winning coalitions' political loyalty under this circumstance with the fixed amount of private goods. On the other hand, political parties which need to secure majority votes under the two-party system have more incentives to provide public goods rather than private goods, because the winning coalition is larger and, in turn, voters can be easily dissatisfied with the disseminated private goods.

In the same vein, Cox (1997) demonstrates that policy positions tend to deviate from the median voters if political parties face more than one competitor and Chhibber and Nooruddin (2004) argue that political parties under multiparty system tend to please specific groups of voters instead of public itself.\(^5\) In addition, Chhibber and Nooruddin (2004), with data about Indian states, show that people live in multiparty states tend to perceive there are substantial problems with the access to electricity and drinking water.

Based on the selectorate theory from Bueno de Mesquita et al. (2000) and other works giving clues for the association between the effective number of political parties and public health, this article argues that the size of the winning coalition decreases when the effective number of political parties in parliaments increases and the motivations to provide public goods compared to private goods decrease. Hence, a country with a higher effective number of political parties tends to exhibit a lower level of public health. I test the below falsifiable hypothesis with time-series cross-national data.

**Hypothesis:** A higher effective number of political parties in parliaments decrease the level of public health, given all other things being equal (ceteris paribus).

I should note that the concept of the selectorate has been applied to the study of authoritarian countries such as post-Stalin communism and Soviet regimes to understand the dynamics between the leader and the Party bureaucracy (Gallagher and Hanson 2015; Sakwa and Crouch 1978; Hauslohner 1980). After the applicability of the selectorate theory was increased to cover democratic countries by Bueno de Mesquita et al. (2000), scholars recently employed the selectorate theory to unveil the influence of the varying size of

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\(^4\) For sure, not every political party under the two-party systems needs majority votes to win office. However, it is obvious that the required votes to win office are smaller in multiparty systems where more competitors exist.

\(^5\) Other studies have also emphasized the role of party competitions in determining incumbents' incentives to provide public goods (Min 2015; Lake and Baum 2001; Stasavage 2005; Harding 2015).
winning coalition on social and political outcomes in democratic countries: public goods provision in India and Tanzania (Chhibber and Nooruddin 2004; De Mesquita and Smith 2015), party leaders’ survival in Austria (Ennser-Jedenastik and Müller 2015), party activities and procedural reforms in Germany (Schindler and Höhne 2020), etc.

Given that the above studies focus on individual democratic countries and the potential of the selectorate theory to explain variations in democratic countries, the empirical generalizability and extensibility of the selectorate theory to democratic countries is still at the center of academic inquiry. Thus, this article makes contributions both to the literature of the determinants of public health by applying the selectorate theory to party system and to the literature of the selectorate theory itself by conducting time-series cross-national analysis on democratic countries.

IV. Analysis

1. Variables and Data

To assess whether the effective number of political parties in parliaments or legislatures does have the expected impact on public health, I rely on time-series cross-national data about 40 countries categorized as democracies by Polity IV project from 2000 to 2016.6 Therefore, the unit of analysis is country-year.

The 40 countries in this study varies both in their level of economic development and that of medical development. Among the countries in this study, 18 countries such as Brazil, Mexico, and Poland are classified as economically developing countries and 22 developed countries including Republic of Korea and New Zealand as developed countries.7 By including those countries with the varying level of economic development, this study

6 Only democratic countries are included because the function of political parties should be different in non-democratic countries and the theory linking the effective number of political parties in parliaments and public health cannot work in authoritarian regimes and dictatorships where political parties exist in their name only or just one political party exists. In Polity IV project, democracy is defined as a regime type with free and fair elections, competitiveness of political participation, openness of political institutions, etc. See details in Marshall et al. (2002). Polity IV project categorized regime types into autocracies (−10 to −6), anocracies (−5 to 5), and democracies (6 to 10). Thus, only countries assigned polity score higher than 6 are included.

7 This categorization is from International Monetary Fund (IMF). 18 developing countries are Brazil, India, Indonesia, Bulgaria, Romania, Mexico, Costa Rica, Hungary, Columbia, Croatia, Poland, Chile, Latvia (before 2014), Estonia (before 2014), Slovenia (before 2009), Czech Republic (before 2009), Slovenia (before 2009), and Slovakia (before 2009).
also secures the significant variations in medical development that follows the economic development. Figure 2 presents the Overall Health System Achievement Index (World Health Organization 2000) created by World Health Organization (WHO) in 2000 to evaluate countries’ health system achievement and medical development.\textsuperscript{8} Although there are substantial variations in public health performances even among economically developed countries (Sheiham 2009; Navarro et al. 2003), the unprecedentedly large data coverage and span compared to the previous comparative and case studies enable me to examine the association between the effective number of parties and public health outcomes thoroughly.

1) Dependent Variable: Infant Mortality and Life Expectancy

This article employs two useful indicators to measure public health. First is infant mortality. Infant mortality is exceptionally useful to evaluate public health because it is sensitive to series of factors such as water and air quality, sanitation, prenatal and antenatal health care, disease, caloric intake, and public infrastructure (Sen 1999; Lipton and Ravallion 1995; Victora et al. 2003; Ross 2006a; Navarro et al. 2006). Second, Life expectancy at birth is also used to measure public health. It has been widely used not only as an indicator of public health but also as a proxy for human capital and environmental health because high life expectancy is considered the outcome of good governance, efficient public goods provision, and economic development (Baum and Lake 2003; Lin et al. 2012). Data on infant mortality and life expectancy are from World Bank.

2) Independent Variable: The Effective Number of Political Parties in Parliaments (ENPP)

This article employs Gallagher’s dataset (Gallagher 2017) which provides in-

\textsuperscript{8} The Overall Health System Achievement Index, widely used as a proxy for medical development of countries in 2000, is composed of five components including health and responsiveness inequalities, responsiveness, financial contribution, and the level of health (see World Health Organization 2000). This index has not been built after 2000 because of intensive data collection process.
formation about the effective number of political parties in parliaments for 139 countries from 1946 to 2016, Gallagher calculates the numbers using the formula invented by Laakso and Taagepera (1979). Moreover, the number of effective political parties in parliaments calculated from Golosov (2010) is also employed. I use the Quality of Government dataset (Teorell et al., 2018) to get the number of parties calculated based on the Golosov’s way. In addition, the minimum winning coalition in democratic countries can be determined both by the effective number of parties and the voter turnout simultaneously rather than independently. Therefore, I conduct an additional robustness checks with another independent variable: minimum winning coalition which is calculated through the below formula,

\[
\text{Effective Number of Parties in Parliaments} = \frac{100\%}{\text{voter turnout (%)}}
\]

When the effective number of parties increases and voter turnout decreases, the minimum winning coalition will be decreased. For instance, if voter turnout is 100% when there are two effective number of parties, the minimum winning coalition is theoretically just above 50%. However, if the voter turnout decreases to 80%, the corresponding minimum winning coalition will be reduced to 40% (50% multiplied by 80%). Given that the smaller minimum winning coalition provides motivations for political parties to focus on private goods, I expect that one unit increase in minimum winning coalition decreases infant mortality and increases life expectancy.

3) Control Variables
To appropriately estimate the influence of the effective number of political parties on infant mortality and life expectancy without omitted variable bias, this article controls for key economic and political variables examined as determinants of public health by the previous literature: GDP per capita, government health expenditure, urbanization, income inequality, democracy, political corruption, political stability, and ethnolinguistic fractionalization. Furthermore, voter turnout and education are also included as control variables. In addition to those previously studied determinants of public health, I include additional political factors as control variables to isolate the influence of the effective number of political parties. First is party linkage. If constituents cast their votes based on clientelistic party linkage in which political party rewards its voters by providing goods or cash rather than by suggesting good public or national policies, the motivations for political parties to put efforts on improving public health may decrease. Thus, it is hard to test the relationship between the effective number of political parties and public health without controlling characteristics of party linkage in countries. Second is legislative party cohesion. Party cohesion defined as the extent to which party members act together for their parties’ goals varies across countries (Ozbudun 1970). In some countries such as Brazil, incumbents tend to behave more independently from their political parties (Wojcik 2019). This variance in party cohesion may prevent me from evaluating the independent influence of the effective number of political parties on public health. Hence control party cohesion.

Some might argue that the size of the winning coalition depends on electoral systems such as proportional representation (PR) or single-member simple plurality (SMP) rather than the effective number of political parties in parliaments. To handle this concern and to isolate the influence of the effective number of parties on public health, I include electoral system as
an additional control variable. Moreover, given that some scholars argue parliamentary systems are more efficient to provide public goods than presidential systems (Bobik 2018; Persson and Tabellini 2005), I control government system as a categorical variable. Lastly, given the fact that the maternal ages and diseases including chronic diseases negatively impacts on infant mortality and life expectancy respectively (Van Den Bos 1995; Feeney 1980), mean age at childbearing and risk of premature death from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases is controlled.

Table 1 illustrates the descriptive statistics of all variables used in this article with data sources, information about variable names in the dataset, brief descriptions, and coding rules for categorical variables. Each observation corresponds to a country-year from 2000 to 2016. All independent and control variables are lagged by 1 year because political and economic changes do not translate into the infant mortality and life expectancy in a year.

2. Modeling Strategy

Model choice in this article is based on the characteristic of the dependent variables—infant mortality and life expectancy—and time-series cross-national data. Both infant mortality and life expectancy are continuous variables, It makes an Ordinary Least Square (OLS) a possible option for a modeling strategy. However, simple OLS regression is problematic when it is used with time-series cross-national data. Time-series cross-national data usually violates the independent and identically distributed (I.I.D.) assumption, because the same countries are observed over decades and errors are highly correlated (Allison 2009). Also, the variance is not constant across country-year observations. In other words, heterogeneity exists across countries and between years (Pang 2010). The violation of I.I.D. and homogeneity assumption lead to inefficient estimations of coefficients and wrong
To overcome the problems described above and to handle time-series cross-national data properly, this article estimates fixed effects regression models by using "*xtreg, fe*" command in STATA with cluster standard errors. First, by using "*xtset*" command, I declare countries as panels and years as time. Then, the fixed effects for countries are introduced by adding "fe" option to "*xtreg*" command, when fixed effects regression models are estimated. This "fe" option allows to control unobserved time-invariant country-specific variables such as cultures or geographical locations which can cause omitted variable bias and violate LJD assumption (Allison 2009; Allison 2014). I also include year dummy variables to parcel out the influence of time on public health. For instance, the development of medical technology or the improvement in scientific knowledge about healthcare over time is controlled by the year dummy variables. The fixed effects regression model used in this article is

\[
y_{it} = \beta_0 + \beta_1 x_{k,i,t-1} + \delta_t + \alpha_i + u_{it}
\]

where i, t, and k denote countries, years, and set of predictor variables respectively. \(Y_{it}\) is infant mortality or life expectancy, \(\beta_0\) is an intercept, \(\beta_1\) is a coefficient of \(x_{k,i,t-1}\) indexing lagged predictor variables, and \(\delta_t\) is a coefficient of \(T_t\) representing year dummies. Error terms are composed of a time constant unobserved heterogeneity (\(\alpha_i\)) varying across countries and an idiosyncratic error (\(u_{it}\)).

Considering the fact that a robustness check is dispensable to make a valid causal inference (Lu and White 2014), I alternatively estimate lagged dependent variable (LDV) models. As a useful tool to investigate causal effects, LDV models as well as fixed effects models have been used to deal with persistent dependent variables and to overcome omitted variable bias (Angrist and Pischke 2009). In LDV models in this article, country and year fixed effects are not modeled because estimations from models both with fixed effects and a lagged dependent variable will be inconsistent (Nerlove 1967; Nickell 1981) and the error term will correlate with a lagged dependent variable (Angrist and Pischke 2009). The LDV model is based on the below equation in which \(\theta\) is a coefficient of a lagged dependent variable (\(Y_{it-1}\)) and other notations follow the notations in the Equation (1).

\[
y_{it} = \beta_0 + \beta_1 x_{k,i,t-1} + \theta Y_{i,t-1} + u_{it}
\]

See Dougherty (2007), Angrist and Pischke (2009), or Wooldridge (2016) to get more detailed information about basic assumptions of OLS and about how the violations of the assumptions make estimates inefficient and biased. In my case, the number of panels is 40 and the number of times is 17. More explanation about "*xtreg*" command can be found in Torres-Reyna (2007), Frain (2008), or STATA manuals in https://www.stata.com/manuals13/xxtreg.pdf (accessed 12 June 2020).

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12. This notation follows Wooldridge (2016)'s notation in Chapter 14.

13. Angrist and Pischke (2009) emphasize that LDV models and fixed effects models are distinct model specifications. In addition, they argue that checking robustness by using both models is recommended by saying "So what’s an applied guy to do? One answer, as always, is to check the robustness of your findings using alternative identifying assumptions."
3. Results

Table 2 presents empirical results from fixed effects (FE) regression models (Model 1, 2, 5, and 6) and lagged dependent variable (LDV) models (Model 3, 4, 7, and 8) with two dependent variables and with two measures of the effective number of political parties in parliaments. FE models are estimated based on the equation (1) and LDV models are estimated through the equation (2). Country and year fixed effects are not included in LDV models as mentioned previously.

I conduct Hausman tests with the null hypothesis that there is no correlation between the error term and independent variables in the time-series cross-national data after estimating the four FE models (Model 1, 2, 5, and 6) and the corresponding random effects (RE) models in which country random-effects are used instead of country fixed-effects. The p-values of the Hausman tests are less than 0.001, which leads me to reject the null hypothesis of Hausman tests. In other words, FE models are preferred than RE models. Moreover, I test whether there are multicollinearity problems in the models through variance inflation factor (VIF) test. The coefficients of VIF are less than 4 in all eight models in Table 2, which indicates that

| (Table 2) Main Models: Regressions of Infant Mortality and Life Expectancy |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | Models 1 | Models 2 | Models 3 | Models 4 | Models 5 | Models 6 | Models 7 | Models 8 |
| | Dependent Variable | Infant Mortality (per 1,000 live births) | Dependent Variable | Infant Mortality (per 1,000 live births) | Dependent Variable | Infant Mortality (per 1,000 live births) | Dependent Variable | Infant Mortality (per 1,000 live births) | Dependent Variable | Infant Mortality (per 1,000 live births) | Dependent Variable | Infant Mortality (per 1,000 live births) |
| Independent Variable | | | | | | | | | | | | |
| Effective Number of Political Parties | 0.008*** (0.269) | 0.008** (0.272) | 0.008* (0.013) | 0.008* (0.013) | 0.008*** (0.870) | 0.008* (0.105) | 0.008*** (0.870) | 0.008* (0.105) |
| Log of Total Number of Observations | 676 | 676 | 676 | 676 | 676 | 676 | 676 | 676 |
| Proportional Representation | -2.281*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) | -2.259*** (0.013) |
| HDI (0.007) | HDI (0.002) | HDI (0.022) | HDI (0.010) | HDI (0.022) | HDI (0.010) | HDI (0.022) | HDI (0.010) |
| Lagged Dependent Variable | 0.881*** (0.013) | 0.885*** (0.013) | 0.914*** (0.013) | 0.918*** (0.013) | 0.914*** (0.013) | 0.918*** (0.013) | 0.914*** (0.013) | 0.918*** (0.013) |
| Total Number of Observations | 676 | 676 | 676 | 676 | 676 | 676 | 676 | 676 |
| Legislative Party Cohesion | 0.062 | 0.053 | 0.015 | 0.008 | 0.084 | 0.112 | -0.142* | -0.111 |
| Semi-Presidential System | -0.660*** (0.013) | -0.657*** (0.013) | -0.017 | -0.020 | 0.751* | 0.802* | 0.302* | 0.297* |
| Parliamentary System | -0.966*** (0.013) | -0.930*** (0.013) | -0.017 | -0.015 | 0.770* | 0.812* | 0.182 | 0.171 |
| Number of Countries | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| Political Corruption | 0.205 | 0.252 | 0.071* | 0.068* | -0.460 | -0.348 | 0.073 | 0.086 |
| (Golosov' Measure) (0.007) | (0.002) | (0.022) | (0.010) | (0.007) | (0.002) | (0.022) | (0.010) |
| Income Inequality | 0.004* | 0.004* | 0.000 | -0.001 | -0.028* | -0.025* | -0.009 | -0.008 |
| (0.047) | (0.050) | (0.008) | (0.009) | (0.158) | (0.156) | (0.061) | (0.060) |
| Number of Years | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Party Linkage | -0.003 | -0.016 | -0.006 | -0.006 | 0.031 | 0.030 | -0.190* | -0.196* |
| Education | -0.008 | -0.010 | 0.004 | 0.003 | 0.027 | 0.044 | -0.021 | -0.015 |
| Polity | -0.010 | -0.012 | 0.003 | 0.003 | 0.060 | 0.039 | 0.046 | 0.046 |
| Infant Mortality (years) | 52.726 | 52.726 | 52.726 | 52.726 | 52.726 | 52.726 | 52.726 | 52.726 |
| Note: *p<0.05, **p<0.01, ***p<0.001. | | | | | | | | | | | | |

14 See the difference between fixed effects regression models and random effects regression models in https://www.princeton.edu/~torates/Panel101.pdf (accessed 12 June 2020). Hausman tests in STATA is conducted through the following steps, First, I estimate Model 1 with the "xreg, fe" command and store the estimation by "estimate store m1_1" command. Second, I estimate the corresponding RE model with "xreg, re" command and store the estimation by "estimate store m1_2" command. Third, I conduct a Hausman test with "hausman m1_1,1;". The same steps are used to other FE models in Table 2. See also Sheytnotova (2019) and Park (2011) to get more information about Hausman test as a tool to choose an appropriate model between FE and RE models with a time-series cross-national data.
there are no multicollinearity problems among independent and control variables.\footnote{If multicollinearity exists, standard errors of coefficients are overestimated. As a result, some independent and control variables may be not statistically significant when they should be statistically significant. Even though there are no golden standards about the threshold of VIF to assure no multicollinearity problem, VIF less than 5 suggests there is no consequential collinearity. See Meta and Kopalé (2002), James et al. (2013), Akinyode et al. (2015), and Zaman et al. (2015) for more information about multicollinearity and VIF test.}

As expected, the effective number of political parties in parliaments is found to be a significant predictor of infant mortality and life expectancy at the level of $p<0.001$ across all models, regardless of whether Laakso and Taagepera’s or Golosov’s measures are used. The r-squared values are relatively high in LDV models compared to FE models, which means that a large portion of variations in infant mortality and life expectancy is explained by the lagged dependent variables. It is not surprising, considering that both dependent variables do not dramatically fluctuate between years.

About infant mortality based on Model 1 (FE model with Laakso and Taagepera’s measure), infant mortality rate per 1,000 births increases by 0.044 as the effective number of political parties increase by 1 across a year for a given country, while a wide array of control variables including country and year fixed effects is controlled. When Golosov’s measure is used, the coefficient of the effective number of parties in Model 2 decreases to 0.014, but it is still statistically significant at the level of $p<0.05$. In terms of Model 3 (LDV model with Laakso and Taagepera’s measure), the coefficient of the effective number of political parties is relatively small, 1 unit increase in the effective number of political parties increases infant mortality rate by 0.009 when all other control variables and the lagged dependent variable hold at constant.

Results from Model 4 with Golosov’s measure also provide empirical supports for this relationship.

Related to life expectancy, one more effective number of political parties decreases life expectancy by 0.130 in Model 5 (FE model with Laakso and Taagepera’s measure) and 0.050 in Model 7 (LDV model with Laakso and Taagepera’s measure), while other control variables hold at constant. In addition, the effective number of political parties measured by Golosov’s measure in Model 6 and Model 8 is estimated to have a statistically significant relationship with life expectancy at the level of $p<0.001$. These results provide empirical supports for the negative association between the effective number of political parties and public health.

The statistically significant relationship between the effective number of political parties in parliaments is robust to other model specifications with alternative combinations of series of control variables. For example, some might worry about the multicollinearity because the effective number of political parties in parliaments can be closely related to electoral system and government system, even though they do not necessarily determine the number of parties and VIFs are less than 4. When I exclude electoral system and government system from controls, the beta coefficients of the effective number of political parties in parliaments are only slightly changed from the results in Table 2 and they are statistically significant at the level of $p<0.05$ across FE and LDV models. Moreover, even after the interaction between government and electoral system is controlled, the effect number of political parties is consistently significant at the level of $p<0.05$. Also, the simple bivariate FE and LDV models support the association between the number of parties and the two dependent variables.

Turning to control variables, this article finds the relative importance of
GDP per capita and risk of premature death over other control variables. Among the control variables, GDP per capita and risk of premature death are consistently significant in all FE models and LDV models with the two dependent variables. This gives additional supports for the previous literature emphasizing the role of economic development on public health and the adverse impacts of diseases. In addition, the mean age at childbearing has statistically significant negative association with the infant mortality. This article also unveils that countries with proportional representation and mixed electoral systems tend to enjoy lower infant mortality rate and higher life expectancy compared to countries implementing a majoritarian electoral system. It shows that electoral systems as well as the effective number of political parties explain variations in public health.

Table 3 shows the empirical results from FE and LDV models which are based on equation (1) and (2) respectively. As the models in Table 2, the Hausman test gives supports for the FE models rather than LDV models and the coefficients of VIF tests are less than 4 confirming no multicollinearity problems. The r-squared values are higher in the LDV models than in the FE models. Throughout the eight models, the minimum winning coalition is statistically significant with the expected directions of impacts on the two dependent variables at the level of p<0.001.

To be specific, one percent in the minimum winning coalition (%) decreases infant mortality per 1,000 live births by 0.011 and 0.009 in the two FE models (Model 9 and 10) respectively. In Model 13 and 14, life expectancy increases by 0.031 and 0.024 when the minimum winning coalition (%) increases by 1. In the LDV models, the coefficients of the minimum winning coalition are slightly smaller than those in FE models but still statistically significant.
meaningful. Furthermore, the relationships between the dependent variables and the three control variables including GDP per capita, electoral system, and risk of premature death are also consistently significant. These results in Table 3 provide an additional empirical evidence to support the salient role of the effective number of political parties in parliaments to determine the level of public health. As the effective number of political parties is statistically significant in other model specifications, the alternative independent variables have significant impacts on infant mortality and life expectancy, even when I estimate models without controlling government systems and electoral systems or with the interaction term between them.

V. Conclusion

This article with a statistical analysis with time-series cross-national data about 40 countries classified as democracies from 2000 to 2016 uncovers the statistical relationship between the effective number of political parties in parliaments and public health based on the selectorate theory from Bueno de Mesquita et al. (2000). The findings support the claim that a higher effective number of political parties in parliaments tends to lead political parties to concentrate on the provision of private goods rather than public goods. Given that the influence of the effective number of political parties on public health conventionally has not been studied as much as that of socio-economic and political factors, this article contributes to the literature about public health by demonstrating the importance to examine the association between the effective number of parties and public health more closely. More broadly, the empirical results also highlight the need to investigate the influence of other political institutions on health outcomes. The empirical results from this article absolutely should be not considered as a definitive conclusion about the influence of party system on public health. Even though the empirical results are robust across alternative model specifications with different measures of the effective number of political parties in parliaments, a statistical approach has its innate limitation. A statistical approach does not provide thick descriptions of the mechanisms behind the statistical relationship (Collier 1991). Moreover, even though the empirical results from the statistical analysis with time-series cross-national data can support the generalizability of the findings based
on the conditional expectation function (Lijphart 1971), a statistical approach only tests hypotheses but not theories themselves (Seawright 2019).

Future studies can elaborate the empirical results in this article, by conducting a comparative analysis or a case study on the relationship between the effective number of political parties in parliaments and public health. To be specific, a comparative analysis on countries which have similar economic and political characteristics except party systems can reveal the causal mechanisms behind the link between the effective number of political parties and public health. Especially, comparative studies on the potential mediating factors, which cannot be easily examined by time-series cross-national empirical analysis because of data limitation, will be encouraging. For instance, whether individual representatives introduce more bills to advance public health or whether they are more responsive to the constituents’ opinions about public health when there are a smaller number of political parties in decision making institutions are valuable topics to be studied. Also, studies about the conditional relationships between the effective number of political parties and various economic and political factors are deserved to be proceeded. Collectively, the further analyses with different approaches based on the preliminary statistical analysis can make the empirical results of this article more promising.

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The Effective Number of Political Parties as a Determinant of Public Health


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본 연구는 의회에서의 유효정당 수 (the effective number of political parties in parliaments)와 공중보건의 관계를 선출인단 이론 (selecorate theory)를 통해 경험적으로 분석한다. 본 연구는 40개 민주주의 국가에 대한 2000년에서 2016년까지의 데이터에 기반하여 (time-series cross-national data), 유효정당 수의 증가가 출생아 1,000명 당 영아사망률을 증가시키고 출생 시 기대수명을 감소시키는 효과가 있다는 점을 발견하였다. 이러한 관계는 고정효과 회귀모형 (fixed effects regression models)과 내생시차변수 모형 (lagged dependent variable models)에서 유의미하다. 본 논문은 공중보건 결정 요인에 대한 체계적 연구에 기여함과 동시에 정치체제가 공중보건에 미치는 영향력에 대한 폭넓은 연구의 필요성을 역설한다.

주제어: 유효정당 수, 공중보건, 선출인단 이론, 영아사망률, 기대수명.