

Unequal Votes in Democracy: Malapportionment in the National Assembly Elections of Korea¹

SANGHACK LEE² *Kookmin University*

SUNG-KYU LEE³ *Andong National University*

This paper evaluates the extent of malapportionment in the National Assembly elections of Korea. The paper finds that the population-based political Gini coefficient is greater than the electorate-based one. The population-based coefficient of variation of the apportionment index is also found to be greater than the electorate-based one. These facts suggest that the apportionment of the Korean electoral districts is more seriously distorted than was previously evaluated (Lee 2011; Lee & Lee 2013). Considering the probable link from malapportionment to distortion in generational representation, the paper finds that youth and younger adults are generally underrepresented, and older adults are overrepresented, which may presage inter-generational conflicts over expenditures on social welfare.

INTRODUCTION

We have no choice but to adhere to the Constitutional Court's decision to narrow population deviation to 'two to one'. Population distribution needs to be checked first, but 'Gerrymandering' may also raise its ugly head during the apportionment process. Even so, I think we should maintain the two to one ratio. (Assemblyman Shim Jae-cheol, March 13, 2015, Interview with *News 1*).

The electoral districts of South Korea (hereinafter "Korea") are marked by considerable discrepancy in population size and number of voters between municipal and provincial districts and from one district to another. These deviations were even greater in the 18th and 19th general elections. As a result, a lack of 'vote equality' emerged as a serious social problem; thus, voters filed a constitutional complaint with the Constitutional Court. On October 30, 2014, the Constitutional Court held that the current legal provisions governing the electoral apportionment were flawed due to a "constitutional inconsistency" in a vote of six to three. The Constitutional Court ruled that the maximum number of voters in an electoral district should not exceed twice the minimum number of voters and that the current electoral districts had been

¹ This work was originally published in *Journal of Parliamentary Research* 10 (2): 5-23 in Korean and translated into English in this journal.

² Sanghack Lee (slee@kookmin.ac.kr) is a professor of economics at Kookmin University. His research interests are in the areas of political economy, international trade policy and applied microeconomics. He has published articles in academic journals such as *Journal of International Economics*, *Journal of World Trade*, *Public Choice*, *European Journal of Political Economy*, *Economic Inquiry*, *Quarterly Review of Economics and Finance*, *International Economic Journal*, *Journal of Economics and Business*, *Applied Economics Letters*, *Review of Law and Economics*, and *Asian Journal of Law and Economics*.

³ Sung-Kyu Lee (skl62@hanmail.net) is a professor at the Department of International Trade at Andong National University in Korea. He has been a chief editor of *Review of Institution and Economics* published by Korea Institution and Economics Association and also a chief editor of *Korean Journal of Public Choice Economics* issued by Korea Center for Public Choice Study. His main research field is public choice, international trade policy, and institutional economics. He is the co-author of *Theory of International Trade* (in Korean), author of *International Trade and Strategic Trade Policy* (in English), *Political Economy of Tax Policy and International Taxation* (in English), and *Essays on Probabilistic Voting, Policy and Campaigning* (in English).

constitutional only until the end of 2015. Consequently, electoral districts must be redrawn prior to the 20th general election, which will be held in 2016.

In representative democracy, representatives elected in general elections form a representative body to make key national policy decisions. Therefore, an electoral system is the very basis of representative democracy. An electoral system comprises four major components: district magnitude, electoral formula, ballot structure, and electoral apportionment. Of these, apportionment has the greatest potential to distort the election results. An unfair apportionment impedes fair competition and undermines political equality, the fundamental value of a liberal democracy. The controversy surrounding apportionment is as old as the concept of democracy itself. It is a well-known fact that the term “gerrymandering,” which refers to an arbitrary apportionment favoring one political party, is named after Gov. Elbridge Gerry of Massachusetts, USA, whose administration enacted a law in 1812 to redraw the state election district in a manner that allowed his political party to remain in power.

Korea’s current state of apportionment must be evaluated to understand the implications of the Constitutional Court decision. Lee (2011) noted that the share of seats relative to the electorate’s is generally lower in municipal districts and higher in provincial districts. This implies that electoral districts are apportioned such that the share of seats in rural districts is increased and that of urban districts is decreased.

The inter-district differences in the electorate size (the total number of voters of an electoral district) can be measured by the distribution of the apportionment index. The apportionment index of an electoral district is obtained by dividing the share of eligible voters in a district by its share of seats. The mean value of the apportionment index is 1. In a small electoral district system, an apportionment index greater than 1 indicates the presence of more voters than the national average in that district, i.e. it indicates that the district’s voters are underrepresented, and conversely, the voters in a district with an apportionment index of less than 1 are overrepresented. Furthermore, the extent of distortion in the apportionment, i.e. the extent of malapportionment, may be measured by the “political Gini coefficient,” which measures inequality in the political input distribution by the Gini coefficient, a measure of income or asset inequality. Let the total number of voters in an electoral district be n . Each voter is then assumed to possess $1/n$ -th share of political input and the political Gini coefficient is estimated for all the voters in the nation. The closer the coefficient is to 1, the greater the extent of the malapportionment. Lee and Lee (2013) tracked the trend of malapportionment for the 16th~19th general elections by measuring the political Gini coefficient. They showed that, after a decrease from 0.3014 in the 16th general election to 0.2338 in the 17th general election, the coefficient increased to 0.238 in the 18th general election and then rose again to 0.2431 in the 19th general election, thus demonstrating a deteriorating trend after the 17th general election.

Malapportionment can lead to distortions in policy and policymaking. Representatives strive to serve their constituencies through legislative activities. For example, if the industrial structure of an electoral district comprises 10% primary industry, 20% secondary industry, and 70% tertiary industry, the assemblyman representing that district will then likely assign 10%, 20%, and 70% weight to the primary, secondary, and tertiary industries, respectively. If voting equality is assured across the country, the total weight assigned to the three sectors by the assemblyman is identical to the nationwide industrial structure, because no distortion in the legislative activity occurs. Likewise, if the same industrial structure is applicable to all electoral districts, their political inputs will reflect the entire industrial structure regardless of an inequality in the distribution of political inputs, i.e. electoral malapportionment. In contrast, if the voters from a district with higher weight of the service (tertiary) industry are overrepresented, the interests of the service industry will be overrepresented as well.

The apportionment process is of vital importance in realizing democratic values. Despite its importance, no in-depth discussions have yet been devoted to the issue of apportionment.

Further, with the key stakeholders of apportionment positioned at center stage of the debate, no fundamental discussions have taken place, and only informal discussions and temporary measures have occurred. Although the Constitutional Court narrowed the ‘population deviation tolerance ratio’ in each electoral district to three to one (previously four to one), and revised it again to reflect two to one in consideration of the socioeconomic environment, the apportionment process must eventually focus on ensuring voting equality. In this respect, discussions regarding the procedure followed in the apportionment debate and cycle must occur prior to the electoral apportionment for the 20th general election and thereafter. The key point in this discussion must focus on ensuring compliance with the fairness principle of “one person, one vote.” Politicians pursuing private interests will arrange electoral apportionment to favor either themselves or their party. It is thus of crucial importance to establish a strategy to prevent this from occurring by entrusting apportionment to a neutral body.

Lee (2011) and Lee and Lee (2013) measured the extent of distortion in electoral apportionment based on the size of the electorate. However, the current Public Official Election Act stipulates that the apportionment of electoral districts must be based on the population size. Therefore, complementing the empirical analysis of Lee (2011) and Lee and Lee (2013), this study measures the extent of distortion in electoral apportionment based on population size using the political Gini coefficient and the coefficient of variation in the apportionment index. Furthermore, this work analyzes the potential for distortion of electoral apportionment to induce a “distortion of generational representativeness”: more specifically, this work examines the representativeness of each generation by dividing the population into groups comprising youth, younger adults, and older adults. Lastly, this work will briefly mention the effectiveness of objective criteria, such as the political Gini coefficient and the coefficient of variation of the apportionment index, in evaluating the electoral apportionment in the future.

The remainder of this paper is organized as follows: Section 2 presents and briefly discusses previous studies on electoral apportionment; section 3 evaluates Korea’s current electoral apportionment based on population size using the 19th general election as a case study; section 4 discusses the process by which an apportionment distortion entails a policy distortion; and the final section presents conclusions.

LITERATURE REVIEW

Representative democracy is a political system in which elected representatives form a representative body that makes key national policy decisions. Therefore, an electoral system is essential for representative democracy (Kim & Kim 2003). An electoral system comprises four major components: district magnitude, electoral formula, ballot structure, and apportionment.⁴ Of these, apportionment is viewed as having the highest potential to “distort” election results (Kim & Kim 2003), given that an election outcome can be distorted in favor or to the detriment of a certain candidate or party. That is, an unfair apportionment impedes fair competition, distorting the election outcome and thus undermining political equality, the fundamental value of liberal democracy (Kim & Kim 2003).

The apportionment of electoral districts has been an issue throughout the history of democracy. The term “Gerrymandering,” which refers to arbitrary apportionment, is named after Gov. Elbridge Gerry of Massachusetts, USA, whose administration enacted a law in 1812 to redraw the state election district to ensure that his political party, the Republican Party,

⁴ Ordeshook and Shvetsova (1994) presented four components of the electoral system: district, candidacy, ballot, and converting formula, and evaluated “district” as the component with the greatest effect on the fairness of an electoral system (as cited in Lee 2011; Shim & Kim 2001).

remained in power by manipulating the boundaries of the original district. At that time, the Republican Party had obtained fewer votes than the Democratic Party, but they secured more seats through gerrymandering. The Boston Gazette, a then local newspaper, posted the map with the newly drawn districts and coined the term gerrymandering, comparing the shape of Gerry's district to that of a salamander. From then on, Gerrymandering has been used as the name for the arbitrary apportionment of electoral districts and the form of the word changes according to the name of the politician involved in the manipulation: for example, we find the terms Tullymandering in Ireland, Playmandering in Australia, and Hatomandering in Japan.⁵ On a related note, the apportionment maneuver in which supporters are gathered to favor a certain candidate or party is termed "packing," and this maneuver in reverse, in which opponents are dispersed, is termed "cracking" (The Economist June 6, 2011).

Korean studies on electoral apportionment can be categorized into three types. The first research trend concerns the political effects of electoral apportionment. Many studies have investigated whether a certain apportionment favored a certain party (Kim 1991; Kim *et al.* 1991; Kim & Kim 2000; Lee 1996; Shim & Kim 2001). These studies have concluded that the apportionment practices in Korea are flawed due to considerable distortions, and vote equality is seriously violated. Shim and Kim (2001) studied electoral apportionment practices across all general elections, not only regarding the concept of "one voter, one vote" but also that of "interparty fairness". Then, they concluded that unfairness between parties practically disappeared.

The second trend of apportionment-related studies concerns the political environment, procedure, and institution of the apportionment committee (Kang 2002; Kim & Kim 2003; Park 1997). These studies investigated and evaluated the composition and activities of all apportionment committees and presented foreign cases, thus establishing norms for the committees' activities. Kim (2009) proposed a comprehensive alternative system encompassing the proportional representation ratio and election system, assembly size, and seat succession. Choi (2013) analyzed problems related to the apportionment criteria and presented normative solutions. Seo (2015) presented strategies for improving the apportionment process after raising three core issues in the wake of the Constitutional Court decision of October 2014: (1) discrepancy in urban and rural representations, (2) adjustment and addition/reduction in the number of seats, and (3) modus operandi and authorities of the apportionment committee. In the same vein, Eum (2014) discussed the overall aspects of reference, entity, and cycle of the apportionment committee and proposed guidelines for its legislative discretion. Finally, Kim (2015) delivered a comprehensive evaluation of the general election reform debate raised in the wake of the 2014 decision of the Constitutional Court and proposed the expansion of districts as an alternative.

The third research trend concerns the empirical measurement and indexation of malapportionment. Lee (2011) used the concept of the Gini coefficient to measure apportionment inequality in the 18th general election by the political Gini coefficient. Lee and Lee (2013) measured the coefficient of variation of the apportionment index alongside the political Gini coefficient, and showed that both measures consistently increased in the 18th and 19th general elections. This implies an increase in the extent of malapportionment in the 18th and 19th general elections.

The core of apportionment evaluation involves the evaluation of 'vote equality'. Ample research and resultant findings exist in the field of vote equality in general elections. Kim *et al.* (1991) defined the ratio of electorate per seat relative to the average electorate size as the "non-

⁵ In Ireland, the term "Tullymandering" was named after James Tully, the then-minister for local government, who arbitrarily segmented Dublin and the surrounding constituencies in 1973. In 1954, the then-Japanese Prime Minister Ichiro Hatoyama arbitrarily split constituencies to create the Self-Defense Force, and brought shame on his name, as it was then used to coin the term "Hatomandering."

equivalence index.” In an electoral district with a non-equivalence index exceeding 1, voters are underrepresented because they outnumber the national average. On the contrary, in an electoral district with a non-equivalence index smaller than 1, voters are overrepresented because they are outnumbered by the national average. Furthermore, Kim *et al.* (1991) evaluated vote equality based on the distribution of the non-equivalence index. Shim and Kim (2001) extended the time-series of in Kim *et al.* (1991) and evaluated the changing trend of vote equality leading up to the 16th general election.

MALAPPORTIONMENT IN KOREA

The number of seats in the local constituencies in the 19th general election revealed considerably uneven distribution with significant discrepancies between municipalities and provinces, as was the distribution of the per-person and per-voter share of political input. Both the population and electorate-based inequality increased in the 18th and 19th general elections. This repeated increase in the inequality is apparently the origin of the Constitutional complaint and the Court decision.

Table 1. Population, electorate and seats of each region in the 19th general election

Region	Population (Share [A], %)	Electorate (Share [B], %)	Seats (Share [C], %)	[A/C]	[B/C]
Seoul Capital Area (Seoul, Gyeonggi, Incheon)	25,083,924 (49.33)	19,825,005 (49.34)	112 (45.53)	1.0835	1.0837
North-Central Region (Gangwon, Chungnam, Chungbuk, Daejeon, Sejong)	6,731,039 (13.24)	5,289,327 (13.16)	34 (13.82)	0.9580	0.9522
South-Eastern Region (Busan, Daegu, Ulsan, Gyeongbuk, Gyeongnam)	13,202,634 (25.96)	10,515,709 (26.17)	67 (27.24)	0.9530	0.9607
South-Western Region (Gwangju, Jeonnam, Jeonbuk, Jeju)	5,831,109 (11.47)	4,551,582 (11.33)	33 (13.41)	0.8553	0.8449
National total	50,848,706 (100.0)	40,181,623 (100.0)	246 (100.0)	–	–

Table 1 provides an overview of the population and electorate sizes, along with their respective shares and the consequent share of seats in the 17 municipalities and provinces across Korea, which are grouped into four broad regions, namely, Seoul Capital Area, North-Central Region, South-Eastern Region (Yeongnam), and South-Western Region (Honam). This data set could be used to calculate the political input share relative to the population share and electorate share, respectively. The Seoul Capital Area showed a lower share of political inputs (i.e., share of seats) relative to the population share and electorate share, and the remaining

three regions showed a higher share of political inputs relative to the population share and electorate share.

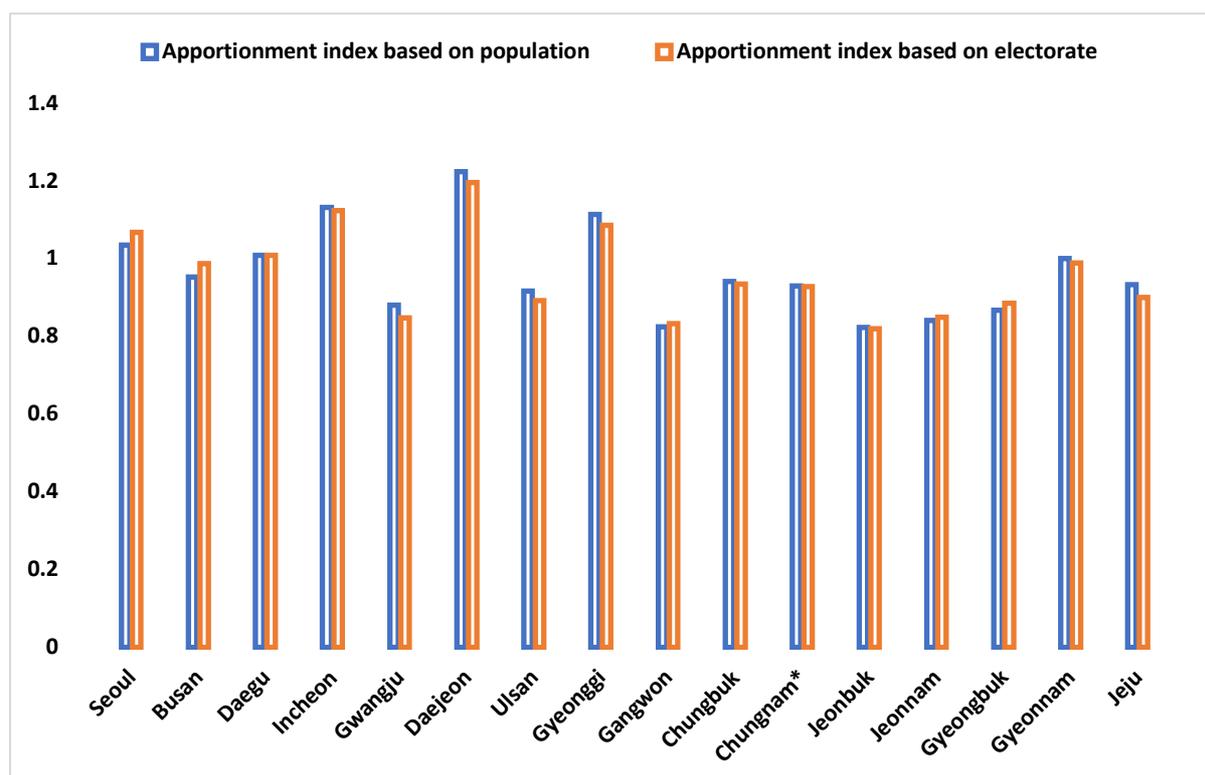
Table 2. Apportionment index by municipality and province in the 19th election (2012)

Municipality & Province	Population (Share [A], %)	No. of Voters (Share [B], %)	No. of Seats (Share [C], %)	Apportionment index based on population (A/C)	Apportionment index based on electorate (B/C)
Seoul	10,281,590 (20.22)	8,379,354 (20.85)	48 (19.51)	1.0364	1.0687
Busan	3,550,855 (6.98)	2,904,884 (7.23)	18 (7.32)	0.9536	0.9877
Daegu	2,509,200 (4.93)	1,978,971 (4.93)	12 (4.88)	1.0102	1.0102
Incheon	2,813,349 (5.53)	2,207,341 (5.49)	12 (4.88)	1.1332	1.1250
Gwangju	1,467,451 (2.89)	1,108,835 (2.76)	8 (3.25)	0.8811	0.8492
Daejeon	1,520,471 (2.99)	1,172,121 (2.92)	6 (2.44)	1.2254	1.1967
Ulsan	1,138,001 (2.24)	873,996 (2.18)	6 (2.44)	0.9180	0.8934
Gyeonggi	11,988,985 (23.58)	9,238,310 (22.99)	52 (21.14)	1.1154	1.0875
Gangwon	1,536,794 (3.02)	1,227,478 (3.05)	9 (3.66)	0.8251	0.8333
Chungbuk	1,558,125 (3.06)	1,222,879 (3.04)	8 (3.25)	0.9415	0.9354
Chungnam*	2,115,649 (4.16)	1,666,849 (4.15)	11 (4.47)	0.9306	0.9284
Jeonbuk	1,873,477 (3.68)	1,476,224 (3.67)	11 (4.47)	0.8233	0.8210
Jeonnam	1,911,473 (3.76)	1,525,053 (3.80)	11 (4.47)	0.8422	0.8501
Gyeongbuk	2,695,595 (5.30)	2,172,551 (5.41)	15 (6.10)	0.8689	0.8869
Gyeonnam	3,308,983 (6.51)	2,585,307 (6.50)	16 (6.43)	1.0015	0.9892
Jeju	578,708 (1.14)	441,470 (1.10)	3 (1.22)	0.9344	0.9016
Sum	50,848,706	40,181,623 (100)	246 (100)	–	–

Note: * Sejong is included in Chungnam.

The discrepancy in population size by region and electoral district can be measured by the apportionment index, which is obtained by dividing the number of the population in the corresponding region or district by the national average. Let the share of population in the electoral district j be v_j , and the share of seats be s_j . The apportionment index of the electoral district j is then defined as v_j/s_j .⁶ Let there be m electoral districts that elect one assemblyman each and let there be n_j population in the electoral district j : $j = 1, \dots, m$. Also, let the total population be $N = \sum_j n_j$. The apportionment index for the electoral district j is then given by the equation $[n_j/(N/m)] = n_j \cdot m/N$. The value of the mean apportionment index can then be obtained by $[\sum_j n_j \cdot m/N]/m = 1$. If a region or electoral district has an apportionment index exceeding 1, it is underrepresented, and if its apportionment index is smaller than 1, it is overrepresented.⁷ The value obtained by dividing the standard deviation of the apportionment index by the mean value is termed the “coefficient of variation” and shows the overall distribution of the electoral districts. As the mean of the apportionment index is 1, the standard deviation of the apportionment index is the coefficient of variation. Therefore, the coefficient of variation of the apportionment index displays the distribution of all electoral districts. In other words, a larger coefficient of variation of the apportionment index indicates a larger dispersion of electoral districts, and vice versa.

Figure 1. Apportionment index by municipality and province in the 19th election (2012)



⁶ This apportionment index corresponds to the ‘non-equivalence index’ proposed by Kim *et al.* (1991).

⁷ Defining the apportionment index as the inverse number of [share of population/share of seats]—that is, the [share of seats/share of population], yields the inverted interpretation: an apportionment index larger than 1 indicates overrepresentation, and vice versa. This definition appeals to a more intuitive understanding. However, the inverse of such definition is used in this paper to make the mean value of the apportionment index to be 1, which facilitates calculation and interpretation of the coefficient of variation. That is, the standard deviation of the apportionment index equals the coefficient of variation.

The population-based apportionment index in the 19th general election was revealed as lower in the North-Central Region (0.9580), Yeongnam Region (0.9530), and Honam Region (0.8553), while it was higher in the Seoul Capital Area (1.0835).

Figure 1 shows the apportionment index of municipalities and provinces measured in terms of population (left bar) and electorate size (right bar), respectively. Slight differences are exhibited between the population-based and electorate-based apportionment index values. Lee and Lee (2013) noted that the population-based coefficient of variation of the apportionment index consistently increased in the 18th and 19th elections. This indicates that the extent of vote inequality in the electoral district distribution increased in the 18th and 19th elections as well.

Regarding the Constitutional Court decision on October 2014, most media are paying attention to the “2:1 deviation of the population.” However, even in electoral districts that fall within the 2:1 range, inequality exists across electoral districts. Therefore, the discrepancy between the sizes of electoral districts eventually leads to a question regarding equality in the influence of each voter.

The extent of the malapportionment can also be measured by the “political Gini coefficient”. Let there be one assemblyman and n_j population in the electoral district j . Each person in the district can then be regarded as possessing $1/n_j$ political input. According to this interpretation, each voter in an electoral district with a larger population size has a smaller political share. Conversely, each voter in an electoral district with a smaller population size has a larger political share. In the case of perfect equality in electoral apportionment, the political Gini coefficient is equal to 0, while perfect inequality in electoral apportionment is represented by a political Gini coefficient of 1. The closer to 1 the political Gini coefficient, the higher the extent of malapportionment.

According to the electorate-based calculations in Lee and Lee (2013), the political Gini coefficient decreased from 0.1721 in the 16th election to 0.1334 in the 17th election, but increased to 0.1358 in the 18th election and 0.1391 in the 19th election. This suggests that vote inequality across electoral districts was aggravated over time. In this paper, however, the political Gini coefficient is calculated based on the population, as stipulated in the Public Official Election Act. The population-based political Gini coefficient is calculated as 0.1827, 0.1389, 0.1424, and 0.1469 from 16th to 19th elections, respectively. That is, the population-based political Gini coefficient also consistently increased in the 18th and 19th elections, thus demonstrating a consistent increase in the extent of the vote inequality between the electoral districts.

Table 3. Political Gini coefficient and the coefficient of variation of the apportionment index based on population and electorate

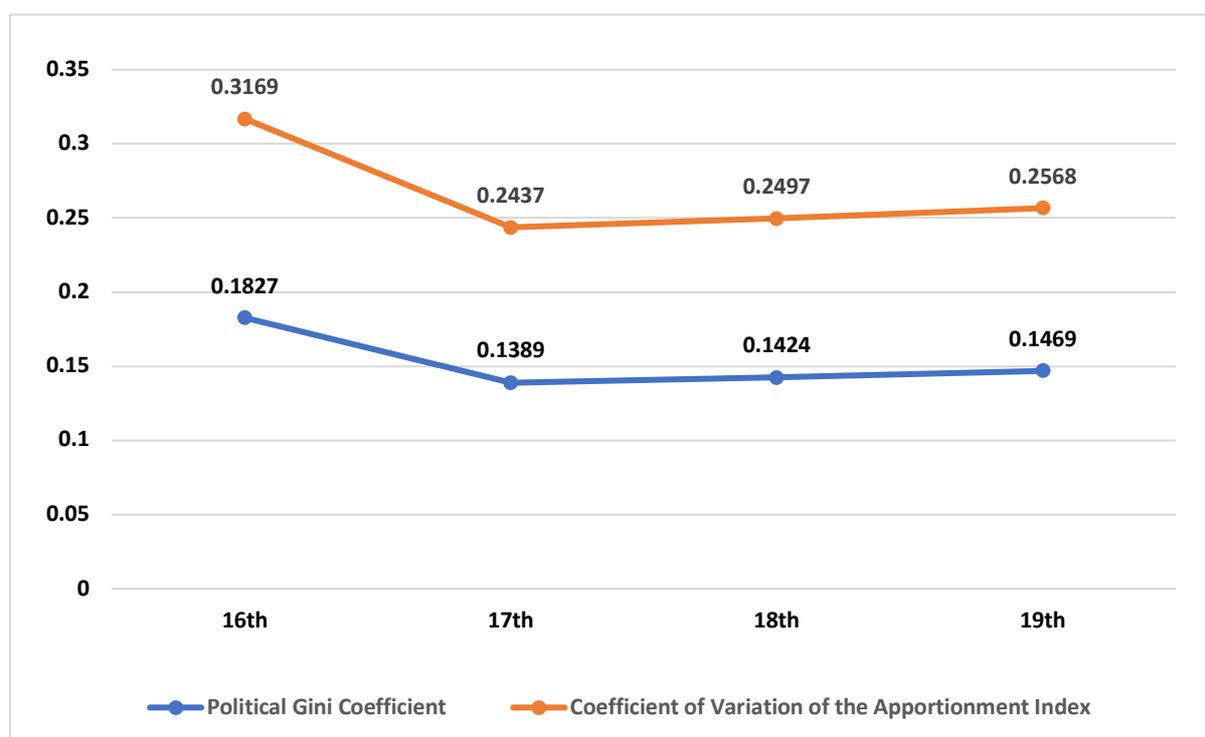
Index	Calculation basis	16th Assembly	17th Assembly	18th Assembly	19th Assembly
Political Gini coefficient	Population base	0.1827	0.1389	0.1424	0.1469
	Electorate base	0.1721	0.1334	0.1358	0.1391
Coefficient of variation of the apportionment index	Population base	0.3169	0.2437	0.2497	0.2568
	Electorate base	0.3014	0.2338	0.2380	0.2431

Regarding the “coefficient of variation” of the apportionment index, the electorate-based values are 0.3014, 0.2338, 0.2380, and 0.2431 from 16th to 19th elections, and the population-

based values are 0.3169, 0.2437, 0.2497, and 0.2568, respectively. Thus, the population-based political Gini coefficient and the coefficient of variation of the apportionment index all indicate that inter-district inequality was aggravated in the 18th and 19th elections.

A comparison of the population-based and electorate-based calculations reveals the following patterns. First, both calculation bases yield similar results. Second, the population-based political Gini coefficient and the coefficient of variation of the apportionment index are always greater than those based on the electorate. As such, it follows that the electorate-based analysis of Lee (2011) and Lee and Lee (2013) generally underestimates the extent of malapportionment (see Fig. 2).

Figure 2. Political Gini coefficient and the coefficient of variation of the apportionment index based on population (16th~19th general elections)



DISTORTION IN GENERATIONAL REPRESENTATION

This section investigates the distortion of political inputs caused by the electoral malapportionment from the perspective of demography. In this analysis, the potential for intergenerational conflict is latent in electoral apportionment. The possibility of policy distortion regarding the expansion of welfare expenditures will also be examined.

Table 4 presents the age composition of each municipality and province as of 2010. For the analysis, the raw data on age composition were retrieved from the portal run by Statistics Korea. In table 4, the population is classified into three age groups: youth (0~19 years); younger adults (20~54), and older adults (≥ 55). The younger adults are an economically active group. The age bracket of 55~59 was classified as older adults, considering the recent trend of early retirement, and that their interests coincide with those of older adults. As of 2010, the youth, younger adults, and older adults comprised 23.4%, 55.0%, and 21.6% out of the entire population, respectively.

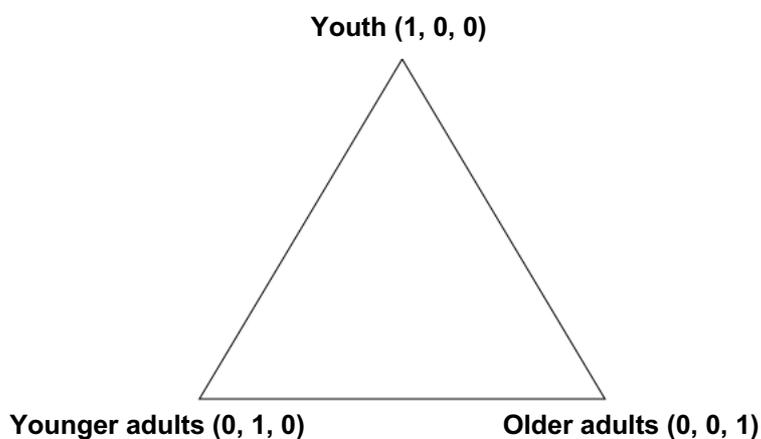
Table 4. Demographic composition by age for each municipality and province (as of 2010)

Age & District	0~19 No. (%)	20~54 No. (%)	≥ 55 No. (%)	Sum
Seoul	1,990,540 (20.67)	5,650,679 (58.67)	1,990,263 (20.66)	9,631,482
Busan	704,965 (20.78)	1,849,468 (54.51)	838,758 (24.72)	3,393,191
Daegu	574,156 (23.61)	1,344,617 (55.29)	513,001 (21.10)	2,431,774
Incheon	635,388 (24.14)	1,520,792 (57.78)	475,855 (18.08)	2,632,035
Gwangju	389,797 (26.59)	809,857 (55.24)	266,489 (18.18)	1,466,143
Daejeon	376,863 (25.29)	844,914 (56.70)	268,381 (18.01)	1,490,158
Ulsan	277,316 (25.88)	617,937 (57.66)	176,420 (16.46)	1,071,673
Gyeonggi	2,847,676 (25.43)	6,395,206 (57.12)	1,953,171 (17.45)	11,196,053
Gangwon	331,853 (22.67)	742,721 (50.74)	389,076 (26.58)	1,463,650
Chungbuk	357,095 (23.87)	778,781 (52.06)	360,108 (24.07)	1,495,984
Chungnam*	472,850 (23.64)	1,010,123 (50.49)	517,500 (25.87)	2,000,473
Jeonbuk	419,573 (23.76)	854,175 (48.37)	492,296 (27.88)	1,766,044
Jeonnam	391,127 (22.62)	773,652 (44.75)	563,970 (32.62)	1,728,749
Gyeongbuk	561,957 (21.82)	1,280,821 (49.73)	732,592 (28.45)	2,575,370
Gyeonnam	754,223 (24.18)	1,649,007 (52.86)	716,341 (22.96)	3,119,571
Jeju	140,008 (26.50)	269,026 (50.91)	119,377 (22.59)	528,411
Sum	11,225,387 (23.39)	26,391,776 (54.99)	10,373,598 (21.62)	47,990,761 (100)

Source: Korean Statistical Information Service (KOSIS), accessed on March 24, 2015.

Note: * Sejong is included in Chungnam.

Figure 3. Generation-specific simplex



Let us assume that the district representatives reflect the age structure of their districts in their legislative activities. The characteristics and interests of youth are expressed by $E_1 = (1, 0, 0)$, those of younger adults by $E_2 = (0, 1, 0)$, and those of older adults by $E_3 = (0, 0, 1)$. Let the proportions of youth, younger adults, and older adults in district j be denoted by α_{1j} , α_{2j} , and α_{3j} , respectively; the age structure of district j can then be expressed as a vector $(\alpha_{1j}, \alpha_{2j}, \alpha_{3j})$, whereby $\alpha_{1j} + \alpha_{2j} + \alpha_{3j} = 1$. As shown in Figure 3, the age structure of district j can be expressed by one point within the simplex. Let the proportions of youth, younger adults, and older adults of the entire population be denoted by α_1 , α_2 , and α_3 . The age structure of the country is then represented by $(\alpha_1, \alpha_2, \alpha_3)$, which is denoted by A . A is also a point within the simplex, as was the case with the age structure of district j .

If the representative of district j reflects its demographic structure accurately in his/her legislative activities, the political input P_j of district j is assumed to be given as follows:

$$\begin{aligned} P_j &= (\alpha_{1j}/m) \cdot E_1 + (\alpha_{2j}/m) \cdot E_2 + (\alpha_{3j}/m) \cdot E_3 \\ &= (1/m) \cdot (\alpha_{1j}, \alpha_{2j}, \alpha_{3j}) \end{aligned}$$

Next, let us assume that an actual policy is determined as the sum of these political inputs. Then, the actual policy P^* is given as the sum of P_j , as shown below:

$$P^* = \sum_j P_j$$

The distance $d(P^*, A)$ between the actual policy P^* and the actual demographic structure A can be interpreted as the policy distortion caused by the malapportionment.⁸ An absence of malapportionment would result in $d(P^*, A) = 0$ (i.e., $P^* = A$).

Now, in this paper, P^* is calculated using demographic statistics in 2010. Given that the demographic structure cannot be derived for each electoral district, that of the municipality and provincial levels is used to calculate the actual policy P^* . This yields $P^* = (0.233, 0.546, 0.220)$. And the actual demographic structure A is $(0.234, 0.550, 0.216)$.

Upon comparing the actual generation-specific demographic composition A and the actual generation-specific political input P^* , the following results are demonstrated. First, the youth (0~19) account for 23.4% of the entire population and 23.3% share of political inputs. This implies that the youth are slightly underrepresented. Second, the younger adults (20~54) account for 55.0% of the population and 54.6% share of political inputs. This also shows that the younger adults are slightly underrepresented. Finally, older adults (≥ 55) account for 21.6% of the population and 22.0% share of political inputs. This demonstrates that the older adults are slight overrepresented. However, these results alone are not a reliable basis upon which one can evaluate whether each age group is overrepresented or underrepresented. The reason is that data on demographic structure at the electoral district level are not available. The estimation is a rough approximation based on data on demographic structure of municipalities and provinces

⁸ The *JoongAng Ilbo* and the Korean Political Science Association have recently released the "Life Politics Index," which is a scaled measure of the degree to which local members of the district reflected the opinions of members of the local population in the issues closely related to our daily lives (*JoongAng Ilbo*, April 10, 2015). This index is a score on a scale from 0 and 100; the higher the index value, the more accurately local residents' opinions are reflected in the agenda. The Life Politics Index expresses the discrepancy between the opinions of residents and the legislative activities of their representatives as a distance in a line segment. However, this paper indicates a gap between the demographic structure and the legislative activities of assemblyman as a distance between two points on the simplex.

rather than in the district level. It is expected that the deviation will be greater if the actual data from the district-level demographic structure can be used in the calculation.

Nevertheless, it can be reasonably inferred that what is inherently present in the distorted structure of political inputs, resulting from malapportionment, is that the interests of older adults are overrepresented and those of youth and younger adults are underrepresented. This implies that a structural bias toward an increase in welfare expenditures for older adults is embedded in the electoral apportionment. In fact, this trend will likely be greater than the results of the calculations performed in this study, because the district representatives will have little incentives to reflect the interests of youth who have no voting power.

CONCLUSION

This paper measured the political Gini coefficient using the size of the population rather than the electorate. The population-based political Gini coefficient was found to have greater values than the electorate-based one. Further, the coefficient of variation of the apportionment index was also greater when calculated based on population size than on that of the electorate. This suggests that current electoral apportionment in Korea is more seriously distorted than the results conducted by Lee (2011) and Lee and Lee (2013). Finally, the extent of the distortion was revealed as aggravated in the 18th and 19th general elections, in accordance with the analysis by Lee and Lee (2013).

Future research must use objective criteria when determining or evaluating electoral apportionment. This paper will present two important points regarding the criteria for electoral apportionment. First, electorate size is considered more appropriate than population size as a criterion for electoral apportionment, and it seems necessary to examine a means of determining electoral apportionment in the future based on the electorate size, i.e., the number of eligible voters in the electoral district, because vote equality is inherently associated with the electorate rather than the population itself. Moreover, if population size is used as the basis of the calculation, its range could prompt a controversy, which can be precluded by instead using the electorate size as the basis. Second, particular attention must be given not only to the difference between the maximum and minimum electoral districts as a criterion for electoral apportionment, but also to the overall distribution of electoral districts, in alignment with Lee (2011) and Lee and Lee (2013). The future electoral apportionment must be carried out with the objective of avoiding exceeding the political Gini coefficient and the coefficient of variation of the apportionment index levels in the 17th election. More specifically, it implies that the electoral apportionment for the 20th election in 2016 must insure that the political Gini coefficient is maintained below 0.13 while the coefficient of variation of the apportionment index is below 0.23. These criteria may be used as an interim evaluation in the apportionment process.

By presenting various apportionment indices capable of objectively estimating the state of electoral apportionment, this study endeavored to propose the direction of future discussion related to electoral apportionment. In other words, the results of this study can be used to establish the criteria for specific cut-off values or tolerable ranges in the population-based or electorate-based political Gini coefficient or coefficient of variation of the apportionment index. As a minimum principle, when deciding future electoral apportionment, inter-district discrepancies must be minimized by verifying even distribution patterns using objective measures and index, such as the political Gini coefficient and the coefficient of variation of the apportionment index, and long-term targets for vote equality may also be established. It will also be necessary to ensure clear rationale and awareness regarding which elements are taken as criteria. For example, more considerations must be made to determine whether the

population or electorate size is more reliable as a basis for measuring electoral apportionment. Of course, the current criterion for electoral apportionment is naturally the population size. Strictly speaking, however, under the “one person, one vote” rule, one person means one electorate. As such, additional discussions are necessary to examine in greater detail whether the population or the electorate is more reliable as a relevant criterion.

This paper also analyzed the potential for the electoral apportionment to cause distortion in the representation of generational interests. The analysis demonstrated that youth and young adults are generally underrepresented, while older adults are overrepresented. This is an important factor that will likely significantly affect future generational conflict regarding the increasing burden of welfare expenditures.

This paper did not address the procedural aspects of electoral apportionment directly. However, the process by which the issue of electoral apportionment was raised can be considered an acute manifestation of various problems in Korean society. Electoral apportionment is a crucial process in the realization of democratic values. In this context, the entire procedure related to electoral apportionment must be addressed systematically with the utmost clarity. Prudent discussions must precede detailed planning for a long-term solution. Ultimately, electoral apportionment will be aimed at ensuring vote equality. In this respect, considerations regarding the procedure followed by the discussion pertaining to electoral apportionment, apportionment cycle, and other related factors must take place prior to the concrete electoral apportionment for the 20th general election and should continue thereafter. Although procedural matters, such as the neutrality of the apportionment committee and a detailed apportionment procedure, are not addressed in this paper, they are extremely important issues that require systematic review and discussion. We leave these for future study.

REFERENCES

- Choi, K. O. 2013. “Problems of electoral malapportionment and troubleshooting.” *Public Law Journal* 13 (4): 135–169.
- Eum, S. P. 2014. “Constitutional review of electoral apportionment: With focus of the reference/entity/cycle.” *Journal of Parliamentary Research* 9 (2): 211–245.
- JoongAng Daily. 2015. “Representatives going against their voters.” (issued on April 10, 2015)
- Kang, H. W. 2002. “The redistricting commissions in England and Korea: Political environment, operation, and reform directions.” *Korean Political Science Review* 36 (4): 343–363
- Kim, D. H. 2009. “A study on strategies to improve the general election system.” *World Constitutional Law Review* 15 (2): 67–86.
- Kim, D. J. and Kim, H. J. 2000. “Analysis of cumulative data on the 16th General Election Results.” *Korean Political Science Review* 34 (2): 105–127.
- Kim, H. J. and Kim, D. J. 2003. “A study on the reform of the National Assembly electoral apportionment: Focusing on equivalent representativeness of population and region.” *Daehan Political Science Review* 11 (2): 45–64.
- Kim, J. K. 2015. “Reform and improvement of the current national election system.” *Journal of Parliamentary Research* 10 (1): 65–91.
- Kim, J. L. 1991. “The extent of distortion effect in the Korean electoral system: Evaluation from a competition-based democratic political perspective.” *Kyegan Sasang* Winter.
- _____, Kim, H. J. and Kim, K. W. 1991. “Electoral system and the dominance of government party in Korean democracy.” *Korean Politics in the Challenging Global Order*. Korea Political Science Association.

- Korean Statistical Information Service (KOSIS). Accessed on March 24, 2015.
- Lee, K. Y. 1996. "Electoral reform project: Modification of electoral apportionment and the abolition of the proportional representation system." *Journal of Legislative Studies* 2 (2).
- Lee, S. H. 2011. "Electoral apportionment and political Gini coefficient." *Review of Institution and Economics* 5 (1): 103–118.
- _____ and Lee, S. K. 2013. "Electoral mal-apportionment and policy distortion in Korea." *Review of Institution and Economics* 7 (3): 157–183.
- Ordeshook, P. C. and Shvetsova, O. V. 1994. "Ethnic heterogeneity, district magnitude, and the number of parties." *American Journal of Political Science* 38 (1): 100–123. <https://doi.org/10.2307/2111337>
- Park, C. W. 1997. "Reform orientation of the National Assembly electoral district system and electoral apportionment process." *National Strategy* 3 (1).
- Seo, B. K. 2015. "Electoral apportionment." *National Assembly Library Expert Reports*. (issued on April 10, 2015)
- Shim, J. Y. and Kim, M. J. 2001. "Evaluation of the electoral apportionment processes in the past: With focus on the vote equality and fairness between political parties." *Korean Political Science Review* 35 (1): 125–148.
- The Economist. 2011. "Election boundaries: No more packing or cracking." (issued on June 16, 2011)