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S14.2 Identifying and Reporting on Issues in Innovation System

**Identifying Web Visibility Issues on Political Innovation System:
A Case Study of South Korea's National Assembly Members**

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Abstract

This study examines whether the network characteristics represented on the Internet drive or reflect other events and occurrences in the offline environment. More specifically, the purpose of this study is to investigate the relationship between the web visibility network of Korea's National Assembly members and the amount of financial donations they receive from the public. In addition, the relationships between their socio-demographic networks (e.g., their party affiliation, committee affiliation, constituency, career/experience, gender, and age) are examined. The results show a positive direction, indicating that politicians who occupy a central position in the web visibility network are more likely to receive financial donations than those occupying a peripheral position. Also, those pairs of politicians with higher co-occurrence web visibility were more likely to have similar amounts of financial donations. That is, two politicians having a strong online relationship are likely to have similar amounts of financial donations and similar political power structures both online and offline. In addition, the web visibility network was significantly related to all of the socio-demographic networks ($p < .05$), except for the gender network ($p > .05$), and the financial network was significantly related to all of the attribute networks ($p < .05$). These results suggest that the politicians' online network was closely related to their offline political power and attribute networks, and that the structure of the political hierarchy is likely to be transferred to the online environment. This study contributes to the webometrics literature by considering the webometrics research goal of providing a proxy for the offline environment and examining the relationship between the online and offline environments.

Keywords: webometrics, web visibility, political finance, network analysis, Korean politician

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Introduction

The widespread use of the Internet has led to the emergence of heavily networked societies worldwide, and socio-political activities have tended to depend mainly on mediated social infrastructure based on advanced information and communication technology (ICT). Network society is a term describing the aspects of modern societies as an interrelated social structure that is derived from the digitalized communication relationships between social components, such as individual, groups, and organizations (Castells, 2009; Van Dijk, 1999). In network society, communication networks can be regarded as fundamental sources of political power making (Castells, 2009).

Thelwall (2009) notes that 'webometrics' is broadly defined as the study of web-based content (e.g., texts, images, audio-visual objects, hyperlinks etc.) with primarily quantitative indicators for social science research goals and using visualization techniques that derive from information science and social network analysis. In other words, webometrics studies are interdisciplinary in nature. Horgan (2008) emphasizes that webometrics has become an active research domain in examining social behavior online and further tracing the practices and trends of offline communication patterns.

While webometrics becomes methodologically sophisticated and provides social scientists to rich descriptive data sets about the use of Internet in society, what currently lacks is a theoretical explanation of the findings that enables generalizations and hypotheses that can be developed and tested in empirical research. Webometrics scholars especially in social and political information sciences (e.g., Ackland, Gibson, Lusoli, & Ward, 2010; Bruns, 2007, June; Caldas, David, & Ormanidhi, 2005; Holmberg & Thelwall, 2009; Lee & Park, 2010; Park, 2010;

Park & Kluver, 2009; Park & Thelwall, 2008; Park & Jankowski, 2008; Schmidt, 2007; Soon & Kluver, 2007) have mainly analyzed hyperlink data using social network measures and visualizations, their studies are descriptive and topological. In response to these trends, Borgatti and colleagues (2009) state that one major goal of theory-driven network analysis in the social sciences, in contrast to the natural and engineering sciences, is relating an individual node's positional difference (e.g., centrality) in certain networks to the node's outcomes (e.g., economic success) or behavior patterns (e.g., communication homogeneity).

A number of analytically well-grounded webometrics studies exist. However, the majority of them are more or less replications of the previous methods and their findings rarely provide for the advancement of social science theories of the impact of digital media deployment on society.

This study examines whether the network characteristics represented on the Internet drive or reflect other events and occurrences in offline world. More specifically, the purpose of this study is to investigate the relationship between the web visibility network of current Korean National Assembly Members and the volume of their political finance received from the public. Additionally, the relationships of the politicians' socio-demographic networks, such as party affiliation, committee affiliation, constituency, career-experience, gender, and age are examined.

Political Finance

Traditionally, the level of political finance has been regarded as a crucial indicator of political power. The amount of political donation may reflect the public support and can be used as the resource of political activities. Whenever any democracy nation raises political finance reform, the issue of political money power has been socially discussed.

Previously, many studies have supported that political finance could influence the election and the public supports (Ansolabehere & Gerber, 1994; Glantz, Abramowitz, & Burkart, 1976; Goidel & Gross, 1994; Grier, 1989; Erikson & Palfrey, 2000; Kenny & McBurnett, 1992; Green and Krasno, 1988, 1990; Jacobson, 1978, 1990). Representatively, Jacobson's (1978, 1990), Grier (1989), Green and Krasno (1988, 1990) find a positive relationship between challenger campaign spending and the shares of votes that they have. There is also a positive association between incumbents' political finance and their vote shares, even though sometimes it is not obvious. Recently, Coate (2004), Stratmann and Aparicio-Castillo (2006) suggest that voters' evaluation of candidates' quality are impacted by the sources of candidate's political finance.

On the contrary, other studies have argued that political money, specifically campaign spending, has little effect on vote shares at the global level (Levitt, 1994; Palda & Palda, 1998). Moreover, Prat (2002) suggests that the informational benefit of political finance is overestimated by the politicians' needs to raise political funds from the public.

Likewise, there is no any agreement regarding the relationships between political finance and election. However, a consensus seems to be reached regarding the importance of political finance and its implication to reflect political power. For this reason, this study considers that political finance is a crucial indicator of political power.

In this study, political finance data of individual politicians is transformed into relational data on the basis of dyadic differences of its volume between politicians. In short, the gap of political money between politicians can reflect their implicit power relationship. If there is a large financial gap between two politicians, their relationship can be identified as inequality of political power. Conversely, if their financial gap is zero, it means that the one's political power is equal to the other's power.

Web Visibility

This study regards the web visibility of politicians as an indicator of measuring their online political power. The web visibility has been usually regarded as 1) the number of external online links to an individual web site has (Thomas & Willett, 2000); and 2) the salience of particular people, objects, and issues on the web (Kretschmer & Aguillo, 2004; Drèze & Zufryden, 2004; Vaughan & Shaw, 2003, 2005). In this study, the web visibility can be defined as presence or appearance of actors or issues being discussed by the public (or Internet users) on the web.

Tracking web visibility is powerful way to get an insight into public reactions to actors or issues. Kerbel and Bloom (2005) analyze the web mentions in the Blog for America (BfA), which is the official campaign weblog of Howard Dean for the 2004 presidential election in the United States. 45% of the posts mentioning a presidential candidate were about George Bush, followed by John Kerry (12%). Although BfA was for Democratic Party's campaigning, the public's web mentions revealed the political power of the 2004 presidential election winner. Also, Lim and Park (2010) find a significant association between the amount of political blog postings that mention political candidates and the number of votes received by political candidates in the 2009 Korean National Assembly by-election. Likewise, the web visibility can be a new methodology for systematically measuring online political power structure in the digital age (Hindman, 2008).

Recently, Lee, Kim, Ahn, and Jeong (2010) suggest an expansion of the web visibility measure to identify the hidden relationship between two people on the web. The co-occurrence of two people's names on a webpage may indicate that they are related to each other. The more webpages mentioning the paired people, the more strong their relationship is. The co-occurrence

web visibility between the pairs of politicians can represent their hidden online political relationship based on the public attention. It is also able to make a social network structure. Thus, this study employs the co-occurrence web visibility measure to identify the online power structure among Korean politicians.

Political Role of the Internet

With regard to the impact of the Internet on politics, two theoretical perspectives have been argued; normalization and equalization (or innovation) hypotheses. Margolis and Resnick (2000) indicate a 'normalization of cyberspace', which posits real-world features of politics are transferred to the Internet. Advocators of the normalization hypothesis have asserted that online communication is affected by typical offline patterns in the form of reinforcement (Margolis & Resnick, 2000; Schweitzer, 2008) and have argued that traditional factors dramatically influence online activities (Foot & Schneider, 2006; Margolis & Resnick, 2000; Graber, 2001). That is, online politics function as a mirror of offline politics reflecting existing political structure.

However, the normalization perspective is contested by the innovation hypothesis. Bentivegna (2002) suggests that the Internet leads to a fundamental change in politics. Kluver (2007) indicates that new internet platforms, such as blogs, have created new opportunities for political expression within the tightly controlled media atmosphere. Di Gennaro and Dutton (2006) argue that the Internet has the power to facilitate political participation of new challengers by lowering the cost of involvement, and creating new mechanisms for organizing groups and opening up new channels of information that bypass traditional media gatekeepers. In short, these studies imply that the Internet can play a role as an alternative media transforming politics through diffusing information and mobilizing people.

These two perspectives are still controversial in current political communication studies. Both of them have received empirical supports from several case studies. However, prior studies of both sides usually have focused on the competitiveness of campaigning websites of individual politicians or political parties by investigating user traffic, accessibility, functionality, and innovativeness of their content and service features. Most of them rarely consider the overall political structure composed by individual political actors. This is a key motivation for this present study.

Research Objective

The purpose of this study is to investigate the structural relationship between the co-occurrence web visibility network of the 18th Korean National Assembly Members and the dyadic difference network of their political finance received from the public. It will provide a comparison between online and offline political structures in South Korea as well as a theoretical argument on the political role of Internet. If online and offline power structures among politicians are similar, the normalization perspective would be supported. That is, the Internet may reflect the traditional power structure among individual politicians. On the other hand, if the power structures are different, the equalization (innovation) perspective would be supported. The Internet may reform the offline hierarchical structure of individual politicians.

Methods: Data collection & Analysis

The subject of this research is Korea's 18th National Assembly members who were elected in April 2008. This study was conducted on January 30, 2010. At that point of time, the number of incumbent parliament members was 278. They all were considered for this present study.

Data collection

Co-occurrence Web visibility. It can be operationally defined as systematically counted numbers of webpages including two people's names simultaneously. The data were gathered from popular Korean search engines, Naver (<http://www.naver.com>) and Daum (<http://www.daum.net>). All data were automatically collected using e-research tools written in Visual C++. In order to retrieve pages that contain a pair of politicians, their names were used as a search query; for example, "politician A's name AND politician B's name". It is necessary to modify the query for collecting the most relevant pages in search engine results. The "name" query counts the pages that mention other celebrities whose names are same. Thus, some contextual word was added, such as "의원; National Assembly Member" to the query. Further, the search was restricted between 1st April 2008 (the date of their being elected) and 31st December 2009. The co-occurrence web visibility data of each pair of politicians were collected across various platforms, including blogs, images, news, and web sites.

Political finance. The data were collected from the annual report of Korean National Election Commission (2009). It provides the information of each politician's income and campaign expenditure in 2008 election. This study focused on the total amount of political donations from the public in each politician.

Vote. The amount of votes that each politician had in 2008 election were collected from the official site of Korean National Election Commission (<http://www.nec.go.kr:7070/abextern>).

Socio-political attributes. Additionally, this study considered the socio-political attributes of each politician, such as gender, age, party affiliation, consecutive incumbency, constituency, and committee membership. The data were gathered from the official site of Korean National Assembly (<http://www.assembly.go.kr>) and individual homepages of the politicians.

Analytic strategy

To identify the relationship between web visibility and political finance, two kinds of analytic strategy were employed. One is Pearson and Spearman correlations among the politicians' web centrality levels, financial amounts, and electoral vote numbers. The centrality of the co-occurrence web visibility can be defined as position in a network where nodes are politicians and ties are the number of pages that mention a pair of politicians. It was calculated using Bonacich's eigenvector measure (Bonacich, 1972; 1987) that is an appropriate centrality measure for the completely interconnected online network because the eigenvector centrality considers the strengths of the online links among nodes in the global structure (Newman, 2010).

The other is the quadratic assignment procedure (QAP) correlation between the co-occurrence web visibility network and political finance network made by the dyadic differences between the politicians. The QAP correlation analysis is useful for inter-network comparisons. From this analysis, the structural (network-based) relationships between online and offline political power structure can be identified.

QAP correlation analysis follows two-step procedure. In the first step, observed correlation coefficients for corresponding cells regarding two matrices are calculated. Then, in the second step, the rows and columns of one matrix are randomly permuted and the correlation between the matrices is recalculated. This process is repeated thousands of times. The resulting distribution of correlation coefficients is used to determine the probability whether the observed correlation is significant or not. Although the results of QAP analysis generate correlation coefficient values, the values may not represent a common significant level because the structure of social network data limits the possible number of correlations (Gibbons, 2004). QAP

correlation coefficient may be unreliable indicators of relation strength (Krackhardt, 1988). For this reason, the statistics of interest is the p-value (Gibbons, Butler, and Boss, 2004).

Additionally, the politicians' socio-demographic attributes were converted into actor-by-actor matrices in terms of their dyadic differences (age and consecutive incumbency) and affiliations (party, constituency, committee, and gender). These socio-political attribute networks were considered in the QAP correlation analysis using UCINET VI program (Borgatti, Everett, & Freeman, 2002).

Results

Network analysis

< Here in Figure 1 >

Co-occurrence web visibility. Regarding 278 National Assembly members, the co-occurrence web visibility network is presented in Figure 1. The total number of webpages is 54,971,900 ($M = 1,428$; $SD = 1,794$). The largest number of webpages including two politicians' names is 80,461 and the minimum number is zero. Each node represents politician; colors and shapes, different political parties; and size, eigenvector centrality value in each politician. Links are based on the co-occurrence of paired politician' names, so the thickness of links corresponds to the number of webpages including each paired politicians' names. The network structure shows a butterfly pattern. Two large groups indicate current ruling party members and opposite party members. From the eigenvector centrality measure, the maximum value of eigenvector centrality is 0.289, and the minimum value is zero.

< Here in Figure 2 >

Political finance. The network of political finance is presented in Figure 2 that is based on reversely transformed data from original dyadic difference network between each paired politicians. The maximum financial gap is 360,617,140 won and the minimum is 1,882 won. The average gap is 97,233,238 won ($SD = 76,022,684$). Node colors and shapes represent different political parties; and size, the amount of political finance in each politician. Links are based on the reversed financial gap between two politicians. In Figure 2, the network structure shows a snake shape indicating a strong relationship between two politicians who have equal amount of money.

Pearson & Spearman correlations

< Here in Table 1 >

< Here in Table 2 >

Table 1 and Table 2 show the results of Pearson and Spearman correlations. According to the results, the web centrality of politicians is significantly correlated to their volume of political finance ($r = .420, p < .01; rho = 513, p < .01$). While the financial volume is not significantly related to vote outcome ($r = .101, p > .05; rho = 090, p > .05$), the web centrality is significantly related to the number of votes that politicians received ($r = .184, p < .01; rho = 163, p < .05$). Although there is not any direct relationship between political finance and electoral outcome, indirect effect can be calculated using a path analysis.

< Here in Figure 3 >

Like Figure 3, a path analysis assumes the linear relationships among the three variables because political finance can be spent for political campaigning on the web. The results reveal that the indirect effect of political finance on election is .076. The effect size is small, but is significant.

QAP correlation analysis

< Here in Table 3 >

In Table 3, the QAP correlation results reveal that the politicians' web visibility network is significantly correlated to the political financial network ($r = -.158, p < .01$). The correlation between the two networks is negative, indicating that the more the web visibility between the politicians the less the gap of their financial amount.

Additionally, QAP analysis examined the associations of the socio-demographic networks with the web visibility network and the political financial network. Regarding the web visibility network, all socio-demographic networks, except gender network ($p > .05$), are significantly associated ($p < .05$). In terms of the financial network, all attribute networks are also significantly related ($p < .05$).

Discussion

This study systematically identifies the structural relationship between Korean politicians' online (web visibility) and offline (political finance) networks. In addition, the politicians' socio-political attribute networks were considered.

The results of linear correlation analysis among politicians' web centrality levels, financial amounts, and vote counts indicate a positive direction that politicians with a central position of the web visibility network have more political finance than those with a peripheral position. While online power (web centrality) is significantly related to the number of votes, offline power (political finance) is not. However, the indirect impact of political finance on election can be assumed from a path analysis of this study. That is, although the amount of political finance seems not to be directly affect electoral outcome, it can have an indirect influence on political election by supporting online campaign activities. Thus, the political finance is still regarded as a significant determinant of election in this study.

In terms of the structural relationships between online and offline networks of the politicians, the results of QAP analysis suggest a significant correlation. That is, the less the gap of their financial amount, the more the co-occurrence web visibility between a pair of politicians. If two politicians have a strong relationship with each other on the Internet, their financial differences might be small or equal. It means that political power structures between online and offline are similar to each other.

In addition, both web visibility and political finance networks are significantly related to most of socio-political attribute networks, such as age, party affiliation, consecutive incumbency, constituency, and committee membership. Exceptionally, gender network is significantly related to financial network, while it is not correlated with web visibility network.

Overall, these findings suggest that the politicians' online network is closely associated with their offline power network and attribute networks. In other words, the politicians' online network can be considered a reflection of their existing power structure and embedded socio-political characteristics. It is likely that the political hierarchy structure transfers to the online

world. From these findings, this study supports the normalization argument that the Internet is a replication of the real world rather than the equalization perspective that the Internet will reform the offline hierarchical structure of individual politicians.

Although this study has tried to identify the structural relationships between online and offline political power, there are several limitations. This study considers the co-occurrence web visibility network based on the numbers of webpages including two people's names simultaneously as well as the dyadic difference network based on political financial gap between a pair of politicians. Although these networks can represent online and offline power structure, they cannot reflect the comprehensive social networks between politicians and the public. To better understand the political power structures, comprehensive social networks regarding political donors and supporters should be more considered in future research.

Another limitation is from a cross-sectional research design. Online and offline power structure is being changed over time, even though they seem to be fixed. In this study, web visibility network is significantly related to political financial network, but their future direction cannot be identified. For this reason, future research should provide a more detailed understanding of political power structures by considering the changes in their relationships over time.

Lastly, this study focuses on the quantitative aspects of online power relations. This approach does not indicate whether the web mentions of politicians are favorable or not. The quality of web content is also important to investigate a politician's online reputation and power. Thus, future research should consider the qualitative aspects of web mentions as well.

Conclusion

This study systemically examined the structural relationships between 1) online political network in terms of the co-occurrence web visibility between the pairs of politicians, 2) offline power network in terms of the dyadic difference of political finance between the pairs of politicians, and 3) socio-demographic attribute networks (e.g., party affiliation, constituency, gender, age, career-experience, committee affiliation). When considering the webometrics research goal of providing a proxy indicator to offline world and how they are related to each other, this study contributes as a theoretical piece in this webometrics literature.

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Table 1

Pearson correlation between political finance, web centrality, and votes

	1 (N=278)	2 (N=278)	3 (N=234)
1 Finance	1	0.420**	0.101
2 Web		1	0.184**
3 Vote			1

Note. ** $p < .01$

Table 2

Spearman correlation between political finance, web centrality, and votes

	1 (N=278)	2 (N=278)	3 (N=234)
1 Finance	1	0.513**	0.090
2 Web		1	0.163*
3 Vote			1

Note. * $p < .05$; ** $p < .01$

Table 3

QAP correlation between political finance, co-occurrence web visibility, and socio-political attribute networks

	1	2	3	4	5	6	7	8
1 Committee	1	0.004	-0.016	0.025	-0.021	-0.074**	0.045**	-0.037**
2 Constituency		1	0.097**	-0.007	-0.043**	-0.064**	0.105**	-0.119**
3 Party			1	0.027	-0.045*	-0.050*	0.242**	-0.094**
4 Gender				1	0.024	0.031	0.041	-0.224**
5 Age					1	0.179**	-0.051*	0.049*
6 Incumbent						1	-0.060**	0.098**
7 Web							1	-0.158**
8 Finance								1

Note. * $p < .05$; ** $p < .01$

Figure Captions

Figure 1. Co-occurrence web visibility network

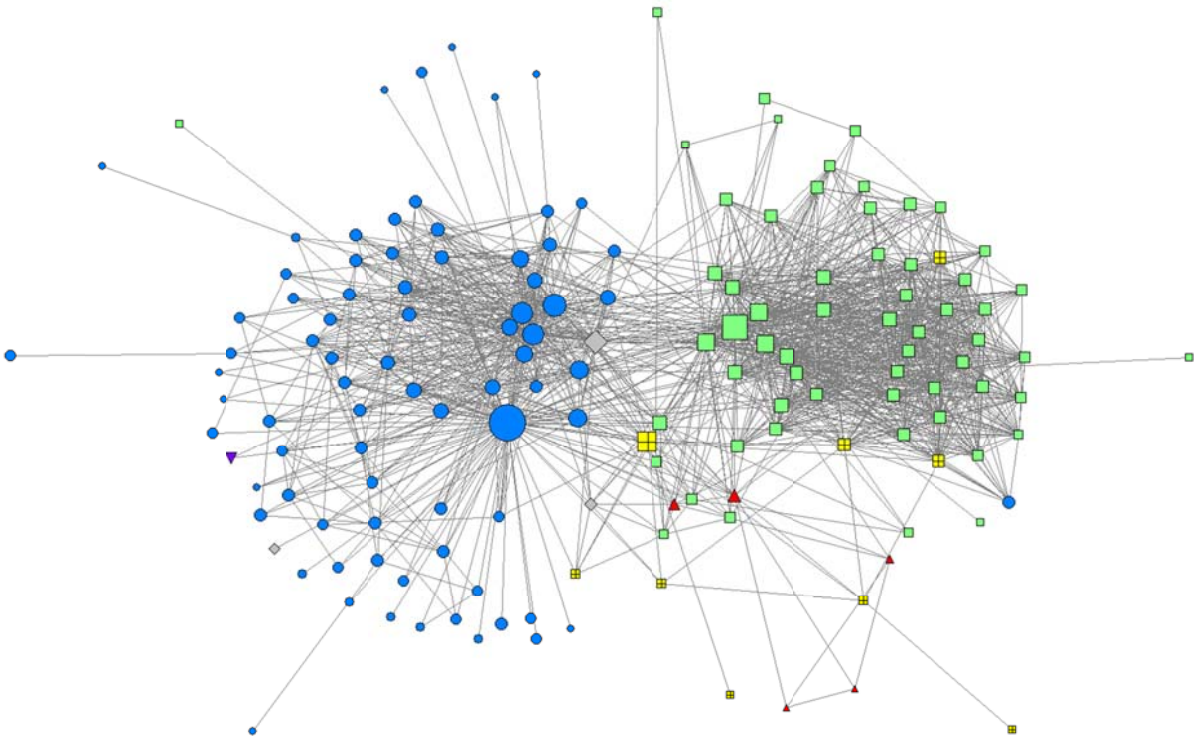
Note. 5,000 required for a line. Ruling party members are circle and other shapes are opposite party members. Node size depends on the eigenvector centrality value of each politician.

Figure 2. Political finance network

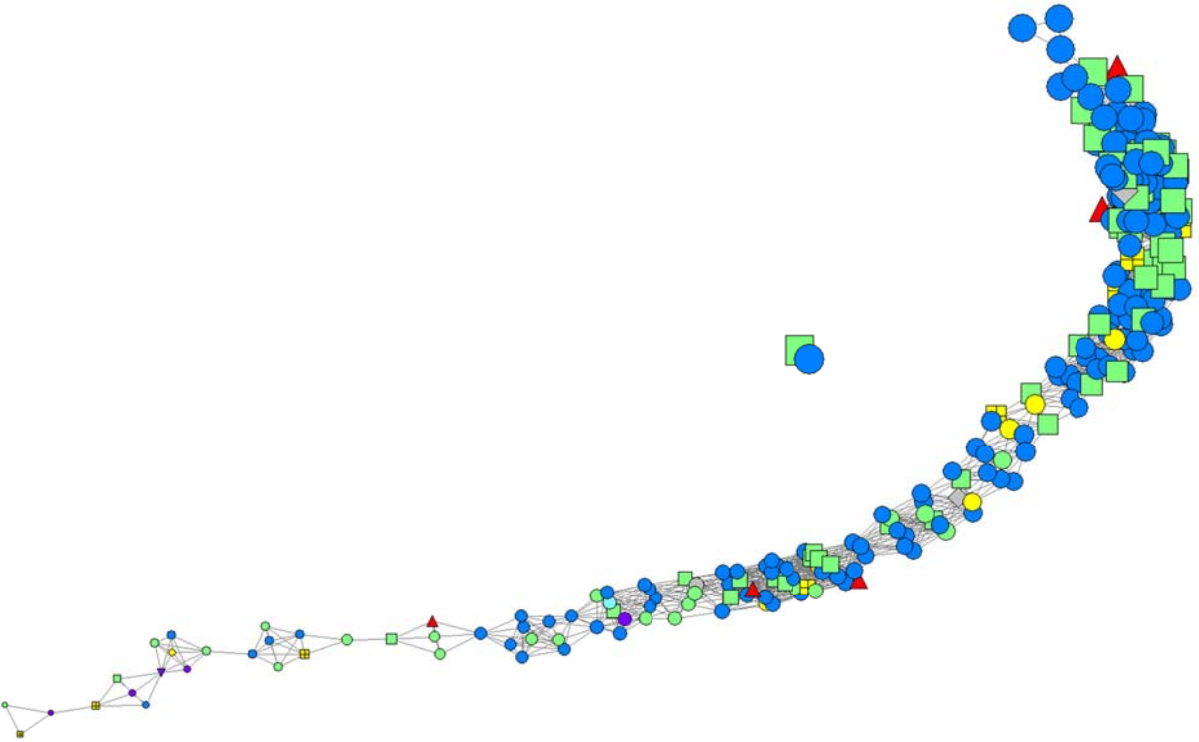
Note. 350 million won (Korean currency) required for a line. Ruling party members are circle and other shapes are opposite party members. Node size depends on the amount of each politician's political finance.

Figure 3. Path analysis of political finance, web centrality, and vote

Note. * $p < .05$; ** $p < .01$



1



2

