Does social capital enhance the involvement of residents in public transport? : a multilevel analysis of rural area in Japan

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Abstract

Public transport in Japan is, in principle, provided by ordinary private companies on a self-paying basis. However, declining population as well as increased motorization in rural area has worsened the operation of public transport throughout the last decades. As a result, many unprofitable services in rural area has faced operating difficulties due to business deficits.

On the other hand, many examples are found that the community organization such as a non-profit or voluntary organization has directly involved in the operation of public transport to maintain their services. As some research have indicated, the source of their activity is consisted from social capital(SC), that is reciprocity, social networks or participation and trust between people.

This research explores quantitative analysis on the relationship between SC and the involvement of residents in public transport. In specific, multilevel regression analysis are conducted on the basis of questionnaire survey for 347 samples along the Fukaya line in Ajigasawa, Aomori prefecture.

According to the result of analysis, it was found that the higher the number of individuals with high cognitive SC and the higher the structural SC at the community level, the higher the degree of civic engagement in public transport management affairs. However, the need to focus on extending the residence period rather than fostering community pride in order to nurture community-level SC was also identified. Therefore, as a policy agenda for the promotion of civic engagement in public transport, this research pointed out efforts to increase exchanges between communities and increase face-to-face interactions between acquaintances should be conducted with the focus on the retired senior persons.

Keywords: Social Capital, Civic engagement, Public transport, Hierarchical linear model
1. Introduction

Public transport in Japan is, in principle, provided by ordinary private companies on a self-paying basis. However, declining population as well as increased motorization in rural areas have aggravated the already worsening operation of public transport through the last few decades (Ministry of Land, Infrastructure, Transport and Tourism, 2017). While the central government and municipalities have supported the public transport operators, their subsidies are not sufficient to improve services due to the drop in taxpayers. As a result, many unprofitable services are facing operation difficulties.

In this context, some interesting examples have shown how local community organizations such as non-profit organizations or voluntary entities manage the operation of public transport by collaborating with a variety of stakeholders (Kato et al., 2009, Takahashi, 2011). The participation of such groups attracts a great deal of attention in that the civic and political engagement by residents as well as the improvement of service according to the characteristics of the community could be progressed (Currie and Stanley, 2008). However, there are many cases where this activity is hindered due to difficulty in bringing about a participation awareness among the stakeholders and creation of consensus in the residents.

Gray et al. (2006) point out that social capital (SC) advances solidarity in regions or communities and confers access to mutual support, contacts, resources, skills, influence and reassurance. SC has been defined as connections and relationships along with social networks, together with norms, values, reciprocity, trust, and informal sanctions that arise from them, binding individuals for mutual benefit (Putnam, 1993, 1995, 2000; Woolcock, 1998; Mohan and Mohan, 2002). Thus, it can be seen that SC facilitates a participation awareness among residents and plays an important role in better operation of residential participatory public transport. So far, however, there has been little empirical research into the relationship between SC and civic engagement awareness of public transport.

Therefore, this paper explores quantitative analysis on the relationship between SC and civic engagement awareness of public transport management. The remainder of the paper consists of three parts: Section 2 outlines the theoretical
relationship between SC and public transport management and indicates briefly reviews of previous research. Section 3 uses multilevel analysis on the basis of a questionnaire survey conducted for 1,303 people from 8 communities of the Fukaya line, the Konan Bus of Ajigasawa town and the Aomori prefecture of Japan. Section 4 describes the analysis results and discusses policy implication of operational continuity of the rural bus service. Section 5 discusses conclusions and limitations of this paper.

2. Social Capital and Public Transport Management

2.1. Theoretical background

SC, as a concept, was proposed in the 1960s, but has come to be recognized only from the 1990s onward. Many theorists have been drawn to define the field, though they vary on specific points (for example, Bourdieu (1985, 1999), Coleman (1988, 1990), Uphoff (2000), Putnam (1993, 1995, 2000) and Burt (2001)). SC refers to the development of reciprocity (the process of exchanging goods/services in a social relationship), social networks or participation and trust between people (Putnum, 1993). While different networks or backgrounds create different types of SC, the two structural forms are practically related (Uphoff, 2000): Cognitive SC, deriving from mental process, refer to norms, values, attitudes and beliefs reinforced by trust, solidarity, reciprocity and generosity; Structural SC, stemming from patterns of social exchange and interaction, is strengthened by the degree of participation of social activities and interchange among individuals, whether formal or informal. SC can also be distinguished into ‘Bonding SC’ and ‘Bridging SC’, depending on relations among actors, the structure of relations among actors within a collectivity, and the types of linkages (Putnam, 2000, Adler and Kwon, 2002, Beugelsdijk and Sjak Smulders, 2003). The former consists of close and dense connections formed through homogeneous groups. It fosters trust and reciprocity within the group, but has a negative effect on the degree of sociability outside the closed community. The latter is formed between more heterogeneous groups and the connection is weaker, but renders closer ties with other communities.
This paper should not be confused with a set of research around the SC structure, which has also been related to an awareness of civic engagement. This paper seeks to estimate quantitatively the connection between the awareness of civic engagement of public transport management and the different types of SC, rather than the relationship of ‘liveable’ cities and public transport or traveling with others and social interaction (Currie and Stanley, 2008).

Civic engagement in public transport management occurs when a sense of neighbourhood develops between individuals, families and organizations and people become actively engaged in the community (Stanley et al., 2010). People may experience social connectivity and behave as active volunteers or leaders. Also, a sense of community pride might be fostered. Valenzuela et al., (2009) argues that investment in such a social network enables individuals to develop norms of trust, reciprocity, and social networks, necessary for successful engagement in collective activities (e.g. participation in local community organizations).

Moreover, an animated civic engagement is likely to have macro-level SC constitute on within communities, regions, or even cities. As Putnam’s early empirical study in Italy indicates, where macro-level SC exists, there is better community functioning and well-being (Putnam, 1995). Thus, SC allows individuals and the community to engage in managing of the operation of public transport management, rendering their activities to be more effective.

Figure 1 presents a structure of civic engagement in public transport management based on the literature reviewed (e.g. Kato, et.al.,2011). First, there are generally three processes in public transport management:

- **Planning** - Concerns strategies to operate public transport services such as fares, vehicles, routes, timetables etc. The transport operator conveys adequate skills or know-how of services for the community groups. Residents decide on detailed services based on the operator’s advice.

- **Operation** - Various actors are relevant to this category. For example, governments deliver some subsidiaries for the community when the operation is driven to limitations. The transport operator initiates the
Second, Kato et al., (2009) point out that civic engagement in public transport management consists of three kinds of activity: Operation, Promotion and Aid. Operation involves planning and management activities as a whole including fundraising, service marketing, adjusting between stakeholders in addition to formulating service strategies. Promotion refers to activities related to advertisement, sales promotion and event scheduling. Aid refers to financial support to maintain a better service, although there is criticism whether it may be considered part of civic engagement. Thus, civic engagement is mainly in these fields and this literature viewpoint shows the actual perspective of civic engagement more specifically than the three categories shown above.
To sum up, civic engagement in public transport management has three major aspects aimed at improving the participation awareness of residents and degree of accumulation of SC. The objective of this paper is to statistically investigate the relationship between the two. If this paper shows some evidence, it will be beneficial not only for academic researchers but also for policy makers, who are agonizing over reconstruction and revival of local public transport.

2.2. Previous research

While a great number of academic papers have been published about the relationship between SC and public transport, there are not many discussions from the standpoint of public transport management and civic engagement. The reason for this could be that social exclusion has been a key issue for transport planners and policy makers since the last decade. The U.K. Social Exclusion Unit (2003) has especially influenced a great number of people around the world.

Gray et al., (2006), on the other hand, as one of the earlier research teams using the term SC, is noteworthy. They clarify the links between SC/social network and mobility, accessibility, and social exclusion, describing the increased car dependent society in the U.K. rural areas as lowering the average levels of SC and the social network. Currie and Stanley (2008) clearly examine theoretical relationships between SC and public transport. They consider three themes: public transport and mobility, public transport and liveable cities, and travelling with others as social interaction, which explain the mechanisms of close linkage on the basis of literature review and theoretical discussion.

Stanley et al., (2010) analyses a person’s travel patterns and their risk of social exclusion, considering the extent of bonding SC and bridging SC based on responses from 535 people interviewed from Metropolitan Melbourne. They statistically find that those who have the greatest risk of social exclusion, travelled less often and a lesser distance, owned fewer cars, and used public transport less, than those who are socially included. Good bridging SC appears to be related to increased trip-making and promotion of social inclusion. Kamruzzaman et al., (2014) empirically show the difference of SC by area: transit
oriented development area (TOD), non-transit oriented development area (non-TOD). Results indicate that individuals living in TOD have a significantly higher level of SC compared with residents of non-TOD.

In Japan, researchers in the infrastructure planning and management field have also become interested in SC and public transport. For example, Taniuchi et al., (2009a, 2009b) quantitatively show the relationship between SC and residents’ activities to introduce community transport. Yamashita (2011) finds the external effect of SC on community transport using Cramer’s correlation test. Utsunomiya (2016) shows how the activities of residents along the light rail transit line influenced on SC in the community.

As seen above, many researchers have tackled a variety of issues on SC, but there is little quantitative evidence of a relationship between civic engagement in public transport management and SC. Moreover, almost all previous research has treated SC as personal rather than as collective. Coleman (1990), Portes (1998), Putnam (2000) and Lin (2001) investigate that there is a distinction in the degree to which SC can be considered as either an individual or as a collective characteristic. According to their research, SC could be differentiated into two kinds of characteristics which have a hierarchical structure; this aspect will also be considered in the proposed analysis.

3. Methodology and case studies

3.1. Methodologies

The hierarchical linear model to be used in this paper is, for example, data having a hierarchical structure such as an individual belonging to a community, a student belonging to a school, a patient belonging to a hospital, and repeated measurement data of the same subjects (e.g. for the same individual, different time points of the blood pressure measurement data). This model is frequently used to verify the effect of second level factors on first level factors and it can be said that this is the most effective analysis method in analyses such as this. A lot of research has conducted around the fields of social psychology, public health, health economics (e.g. Kavana, et al., 2006, Kim and Kawachi, 2006, Ichida, et al.,
2009), but there is little outcome in transport research field.

For continuous explanatory variables, assume data with communities $j$ and continuous covariates as explanatory variables. For individuals in the community $j$, the regression analysis formula for individuals is shown as follows.

$y_{ij} = \alpha_j + \beta x_{ij} + \varepsilon_{ij}, \text{where } \varepsilon_{ij} \sim N(0, \sigma^2)$ \hspace{1cm} (1)

In the hierarchical linear model, regarding the community for which the level has been assumed, instead of using $j = 1, 2$ as the assumed level, we assume that the constant term $\alpha$ follows some distribution pattern (here, normal distribution in $\alpha_j \sim N(\mu_\alpha, \sigma_\alpha^2)$). That is, regarding the expression $\alpha$ in (1)

$\alpha_j = \mu_\alpha + \delta_j$ \hspace{1cm} (2)

is plotted in the model, and the regression analysis used with $\alpha$ as a dependent variable is added to the expression (1). If we summarize equations (1) and (2)

$y_{ij} = (\mu_\alpha + \delta_j) + \beta x_{ij} + \varepsilon_{ij}, \text{where } \delta_j \sim N(0, \sigma_\alpha^2), \varepsilon_{ij} \sim N(0, \sigma^2)$ \hspace{1cm} (3)

and a model in which two regression expressions are nested is expressed. The first term on the right side means that the intercept differs from group to group, and based on this the effect of the explanatory variable at the community level on the explanatory variable at the individual level, that is, the influence of community level SC on civic engagement can be calculated.

3.2 Case studies

3.2.1 Case study area

This paper focuses on 8 communities along the Konan Bus Fukaya line in Ajigasawa Town, located at the northernmost tip of the mainland of Japan in Aomori Prefecture (see Figure 2). Ajigasawa is a small town with a total area of 342.99 square kilometers and a population of 10,161 people (as of the end of March 2018). There are 8 bus routes in Ajigasawa Town, three of which depart from relatively large population core cities such as Hirosaki City and Goshogawara City. For the Fukaya line, operations over the 35 km line
Fig.2. Ajigasawa town and Fukaya line connecting the Ajigasawa Bus Terminal to the Kuromori Bus Stop started after calls from the district for service of this area located at the gorge of the Shirakami Mountains World Heritage Site.

The Fukaya line was operated with the cooperation of the residents as well as Ajigasawa Town and Konan Bus for about 25 years since the start of operations in August 1993, and there are two buses from the Kuromori bus stop early in the morning and one from the Ajigasawa bus stop in the daytime and the evening, with a total of two round trips. The total number of passengers in 2015 was 3,139 people, and most of the users are elderly people who do not have a license with few young users.

There are 8 communities on the Fukaya line making up the Fukaya district, including Honcho district, Hamacho district, Tominecho district, Akaishi district, Tatemae district, Minami-Kanazawa district, and Ubabukuro district. Among them, residents of Fukaya district purchase a book of coupon tickets every month for 2,000 yen (1,000 yen till January, 1999) in support of the bus service, and
once every three months, the interested parties exchange opinions related to bus operational affairs. In addition, the residents of Fukaya district have been participating in daily bus stop clean up and snow removal initiatives to demonstrate their appreciation for the service. All these are carried out by residents of Fukaya; residents of other communities are not involved.

The purpose of this study was to gather data about the all districts along the Fukuya line through questionnaire surveys of people 20-years-old or over living in the 8 communities. The investigation period was 15 days, from December 13 to December 27, 2016. For this paper, the reason for including the districts other than Fukaya district in the survey is to determine the difference in the degree of accumulation of SC for districts along the same route with long participation in the service’s operational affairs and those without. Samples were obtained through the stratified random sampling method, with 1,303 people selected for sampling from the resident register system in Ajigasawa Town.

The questionnaires were distributed to subjects by mail, and after they were filled, they were sent back to the investigator by mail. The number of surveys collected was 386 (response rate of 29.6%). For this investigation, screening was conducted by accepting only questionnaires for which full response for questions related to personal attributes, awareness of participation, SC, bus use per month, and questions concerning emotional attachment to the area the survey is covering were taken as samples with valid answers. As a result, the number of samples decreased to 347 (valid response rate: 26.6%). Table 1 outlines the answer results.

3.2.2 Data

*Dependent variables*

There are three forms of civic engagement in public transport management: administration, promotion, and aid. Among them, people are primarily involved in administration and promotion. The survey used in this study was based on 5-point Likert-type scale for the following two questions: "If bus service reduction or even abolition was to take place in the future, do you think you would still participate in meetings related to operations of the bus?", and "
Table 1. Answer results

<table>
<thead>
<tr>
<th>Investigation period</th>
<th>December 13-27, 2016 (15days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male: 161 (46.4%) Female: 186 (53.6%)</td>
</tr>
<tr>
<td>Age</td>
<td>20-29 years old: 8 (2.3%) 30-39 years old: 23 (6.6%) 40-49 years old: 38 (11.0%) 50-59 years old: 60 (17.3%) 60-64 years old: 30 (8.6%) over 65: 188 (54.2%)</td>
</tr>
<tr>
<td>Occupation</td>
<td>Pensioner: 172 (49.6%) Agriculture, Forestry and Fisheries: 29 (8.4%) Office worker or Public servant: 80 (23.1%) Student: 1 (0.3%) Others: 65 (18.7%)</td>
</tr>
<tr>
<td>Residence years</td>
<td>under 5 years: 24 (6.9%) 6-9 years: 9 (2.6%) over 10 years: 314 (90.5%)</td>
</tr>
<tr>
<td>Household structure</td>
<td>Living together with underage: 78 (22.4%) Living together with pensioner: 237 (68.4%) Others: 32 (9.2%)</td>
</tr>
<tr>
<td>Income</td>
<td>under 2 million yen: 237 (68.3%) 2-2.9 million yen: 67 (19.3%) 3-4.9 million yen: 27 (7.8%) 5-6.9 million yen: 10 (2.9%) over 7 million yen: 7 (2.0%)</td>
</tr>
<tr>
<td>Bus use per month</td>
<td>Over 25 times: 1 (0.3%) 15-24 times: 6 (1.7%) 5-14 times: 33 (9.5%) 1-5 times: 60 (17.3%) None: 246 (70.9%)</td>
</tr>
</tbody>
</table>

Assuming the service reduction or abolition have already been decided, would you participate in promotional initiatives related to the bus service? The average score of responses to these two questions was used as an indicator of residents' potential participation in management of the Fukaya line.
Individual-level independent variables

There are a variety of quantitative measurements for SC in various fields such as public health, medical care, psychology, sociology, but there are two main measurement methods. One is a measurement method with consideration for the structure of the network. The other focuses on making measurements by setting surrogate parameters for trust, norms, reciprocity and social networks constituting the SC. The former can evaluate the relationship between individuals within the community and the structure of the network between communities. However, it cannot clarify the relationship between SC and other environmental factors. The latter cannot grasp the structure of the SC in the community, but it is a useful method when analyzing the relationship with various events on which the SC has an influence. Given these facts, this paper adopts the latter method.

Uphoff (2000) identified two structural forms of SC, cognitive SC and structural SC, claiming that SC measurement should take place while distinguishing the two. Therefore, based on 5-point Likert-type scale for obtaining the answers for the following four questions about trust constituting the cognitive SC; reciprocity; solidarity and generosity, the average score of the responses was used as a surrogate index of cognitive SC.

- To what extent do you trust neighbors?
- To what extent do you trust strangers?
- How careful are you with the safety and health conditions of your neighborhood?
- To what extent do you cooperate with community volunteers?

On the other hand, regarding the structural SC measured from the degree of participation in social activities and the degree of human exchange,

- How often do you talk with people in your neighborhood?
- To what extent do you participate in the community meetings?
- To what extent do you participate in the community festivals and events?

A 5-point Likert-type scale was used to obtain answers to the above 3 questions, whose average score was used as a surrogate parameter.
Community-level independent variables

This paper analyzes the effect of the ‘multilevel’, i.e. individual level SC and community level SC, on residents’ awareness of participation using a hierarchical linear model. For both community level SC and individual level SC, measurement is performed while maintaining the distinction between the cognitive SC and the structural SC. Specifically, individual questionnaires were categorized into 8 communities according to the postal code entered in the questionnaire, and a value obtained by dividing the total score of individual answers by the number of people in the community was set as the SC index of community level.

4. Results

4.1. Social capital and civic engagement

Figure 3 shows civic awareness of participation in operation of public transport. 22.1% of respondents answered “I definitely want to participate every time” or ”I want to participate as possible”. Meanwhile, 42.9% of respondents replied that they "rarely want to participate" or "they would never participate", so the opposition to participation outweighed favorableness. As for promotion activities, 42.4% responded that they "rarely wanted to participate" or that "they would never participate", which surpassed the answers "I want to participate every time" or "I want to participate without necessity" by 18.1%, (see Figure 4)

Next, Figure 5 shows the overall response results for the four questions related to cognitive SC. First of all, 60.5% answered I "trust them very much," or I "trust them to a certain extent," to the question "How much do you trust the neighbors?" The number of people who replied that they “do not trust them much” (8.4%) or “do not trust them at all (2.3%)” were quite small compared with this.

However, regarding the degree of trust for strangers, people who answered "do not trust them much (39.8%)" or "do not trust them at all (14.1%)" highly exceeded those who responded “trust them very much” (0.9%) and those who responded “trust them to a certain extent” (12.1%). Then, regarding the safety of the surroundings, the degree of concern for their health conditions, and the degree of cooperation with the volunteers in the communities, positive answers exceeded
negative responses, which demonstrates solidarity of the entire community and generosity.

The results of the answers to the three questions related to structural SC are shown in Figure 6. "To what extent do you participate in the community festivals..."
"How long have you been participating in the community meetings?" "How long have you been participating in the community meetings?" are questions regarding the level of participation in social activities, but for the former, 41.5% of the respondents replied that they are "definitely participating every time" and "participating as possible." However, 45.2% responded that they "are rarely participating" or "are never participating". Of the latter, 39.5% of the respondents answered that they are "definitely participating every time" and "participating as possible"; 45.8% replied that they "are rarely participating" or "are never participating". And as a whole this shows a relatively weak relationship with the outside world.

Finally, for questions regarding the degree of human exchange ("to what extent do you usually talk with the neighbors), the sum of "if we meet I talk to them"
Fig. 5. Response for structural SC

every time" or "If we meet, I talk to them to a certain extent" (62.1%) exceeds the total ratio of "I do not talk to them much even if I meet them" or "I do not talk to them at all"(17.9%).

What are the differences between the communities in terms of residents’ awareness, the cognitive SC, and the structural SC shown so far in each community? In this study, the SC index of community level was calculated using the procedure demonstrated in the previous section, and the community level index was measured. Regarding the residents’ awareness of participation, this paper divided each individual by community, and divided the total score by the number of people in the community and took that value as the value representing
residents’ awareness of participation at the community level.

In order to statistically measure the existence of differences at the community level regarding residents’ awareness of participation and SC, this paper conducted one-way ANOVA. Table 2 shows the finding that there was a difference between residents’ awareness of participation and structural SC between the communities at 1% significance level. Against this backdrop, based on the Games-Howell test, multiple comparison tests were conducted to find out which of the communities differed, and regarding resident awareness of participation, there was a 5% difference in significance level between Fukaya district and Hamacho district, between Fukaya district and Akaishi district (see Table 3).

In other words, there are differences between the Fukaya district and the Hamacho district and the community adjacent to the town center called Akaishi area, an area which has seen continued civic engagement for over 20 years. Regarding the structural SC, there is a 1% difference in the significance level among the three districts including the Tatemae district, Hamacho district, and Honcho district, and it is clear that the external network differs between the town and the suburbs became

4.2. Causal correlations between civic engagement awareness and social capital

The measurement results by the hierarchical linear model are shown in Table 4. In order to measure with a hierarchical linear model, this paper selected as explanatory variables at the individual level, gender (male = 1, female = 0), age, presence or absence of employment(employed = 1, not employed = 0), presence or absence of underage persons, presence or absence of pensioners, the logarithm of income, residence years, bus use per month, cognitive SC, and structural SC.

In addition to these, as an index of community pride, the question "How much emotional attachment and pride do you feel for the history and culture of the community?" was added to the questionnaire and the response results based on 5-point Likert-type scale were standardized so that average = 0, standard deviation and variance = 1, and this value was incorporated into the explanatory variable as an index of community pride. Cognitive SC and structural SC were
Table 2. Results of one-way ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of squares</th>
<th>Degree of freedom</th>
<th>Mean square</th>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between each groups</td>
<td>19.064</td>
<td></td>
<td>2.723</td>
<td>2.037</td>
<td></td>
</tr>
<tr>
<td>Within each group</td>
<td>305.061</td>
<td>346.000</td>
<td>0.900</td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>324.125</td>
<td>346.000</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cognitive SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between each groups</td>
<td>5.765</td>
<td>7.000</td>
<td>0.824</td>
<td>1.759</td>
<td>0.09</td>
</tr>
<tr>
<td>Within each group</td>
<td>158.697</td>
<td>339.000</td>
<td>0.468</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>164.462</td>
<td>346.000</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Structural SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between each groups</td>
<td>34.452</td>
<td>7.000</td>
<td>4.922</td>
<td>3.615</td>
<td>0.00</td>
</tr>
<tr>
<td>Within each group</td>
<td>461.593</td>
<td>339.000</td>
<td>1.362</td>
<td></td>
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<tr>
<td>Total</td>
<td>496.045</td>
<td>346.000</td>
<td></td>
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<td></td>
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Table 3. Results of multiple comparison tests

<table>
<thead>
<tr>
<th>Communities</th>
<th>I-J</th>
<th>Standard error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation awareness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fukaya vs. Hamacho</td>
<td>0.596</td>
<td>0.181</td>
<td>0.03</td>
</tr>
<tr>
<td>Fukaya vs. Akaishi</td>
<td>0.516</td>
<td>0.156</td>
<td>0.03</td>
</tr>
<tr>
<td>Structural SC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tatemae vs. Hamacho</td>
<td>1.290</td>
<td>0.289</td>
<td>0.00</td>
</tr>
<tr>
<td>Tatemae vs. Honcho</td>
<td>1.124</td>
<td>0.294</td>
<td>0.01</td>
</tr>
</tbody>
</table>

adopted as explanatory variables for the community level. For the SC of the individual level and the SC of the community level, in order to solve the problem of multiple collinearity, the former was centralized by the group average, the latter by the whole average.

Model 1 adds individual level SC, community level SC, and other environmental factors to explanatory variables and measures the relationship with the residents’ awareness of participation, which is an explained variable. The measurement result shows that the higher the cognitive SC of the individual level and the structural SC of the community level, the higher the residents’ awareness of participation. This has been demonstrated in numerous previous studies and is not surprising.

On the other hand, regarding the relationship with other environmental factors, it turned out that the employment situation influences the presence or absence of civic engagement, and the more workers are employed, the more they refrain from participating in the activities. In other words, communities where many individuals who have confidence and mutual compatibility with others are living throughout the community are more active in civic engagement; however this
Table 4. Results of multilevel analysis

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>Standard error</td>
</tr>
<tr>
<td><strong>Fixed effects</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Individual-level</strong></td>
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</tr>
<tr>
<td>Constant</td>
<td>2.618</td>
<td>0.341</td>
</tr>
<tr>
<td>Gender(Male=1 Female=0)</td>
<td>-0.119</td>
<td>0.096</td>
</tr>
<tr>
<td>Age</td>
<td>-0.468</td>
<td>0.630</td>
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<tr>
<td>Employed(Yes=1 No=0)</td>
<td>-0.247</td>
<td>0.101</td>
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<tr>
<td>Living with underage(Yes=1 No=0)</td>
<td>-0.056</td>
<td>0.190</td>
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<td>Living with pensioner(Yes=1 No=0)</td>
<td>-0.079</td>
<td>0.176</td>
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<tr>
<td>ln_income</td>
<td>-0.034</td>
<td>0.175</td>
</tr>
<tr>
<td>Residence years</td>
<td>-0.019</td>
<td>0.099</td>
</tr>
<tr>
<td>Bus use per month</td>
<td>0.117</td>
<td>0.088</td>
</tr>
<tr>
<td>Community pride</td>
<td>0.057</td>
<td>0.094</td>
</tr>
<tr>
<td>Cognitive SC</td>
<td>0.274</td>
<td>0.113</td>
</tr>
<tr>
<td>Structural SC</td>
<td>0.144</td>
<td>0.094</td>
</tr>
<tr>
<td><strong>Community-level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive SC</td>
<td>-1.399</td>
<td>1.565</td>
</tr>
<tr>
<td>Structural SC</td>
<td>1.604</td>
<td>0.783</td>
</tr>
<tr>
<td>Cognitive SC*Community pride</td>
<td>4.136</td>
<td>5.476</td>
</tr>
<tr>
<td>Structural SC*Community pride</td>
<td>-2.286</td>
<td>8.599</td>
</tr>
<tr>
<td>Cognitive SC*Residence years</td>
<td>9.835</td>
<td>15.687</td>
</tr>
<tr>
<td>Structural SC*Residence years</td>
<td>-6.119</td>
<td>3.213</td>
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<tr>
<td><strong>Random effects</strong></td>
<td></td>
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<td>Community-level res. of intercept</td>
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<td>0.212</td>
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<td>Z-Score</td>
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<td>Log-likelihood</td>
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<td>Nj</td>
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<tr>
<td>Ni</td>
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Note: *p < .10. **p < .05. ***p < .01.

depends on the presence or absence of each individual’s job. This may be the result of the structure unique to rural areas in Japan.

In this paper, in order to analyze which explanatory variable at the individual level affects the community level SC, four reciprocal factors including community pride and community level SC; and residence years and SC, which were cross-multiplied, were included in the model to create Model 2.

The results of the analysis revealed that the length of residence increases the community level-structural SC, but community pride does not have the effect of raising community level SC. This is quite different from the results of numerous previous studies and is a phenomenon peculiar to this area. Perhaps it could be
said that in these 8 communities in order to improve the structural SC of the entire region, participation in community-related events over a long period and increasing the number of face-to-face encounters between acquaintances etc. is more effective than the degree of community pride. If this holds true, as a policy agenda for the promotion of civic engagement in public transport, efforts to increase exchanges between communities and increase face-to-face interactions between acquaintances should focus on retired senior persons rather than job holders. It can be concluded that growing SC at the community level over a relatively long period is conducive to continuation of active civic engagement.

5. Conclusions

This study clarified the theoretical relationship of civic engagement and SC and quantitatively measured the residents’ awareness of participation in public transport management affairs based on the questionnaire of 8 communities along the Fukaya line, the Konan Bus of Ajigasawa Town and Aomori prefecture of Japan. Moreover, an analysis of relationship with SC at the individual level and community level was conducted using a hierarchical linear model.

There are three forms of civic engagement in public transport: administration, promotion, and aid. In this study, the areas of resident's most active participation, administration and promotion, were analyzed in terms of residents’ awareness of participation and the relationship with SC. Analysis revealed similar results to previous studies that indicated that the higher the number of individuals with high cognitive SC and the higher the structural SC at the community level, the higher the degree of civic engagement in public transport management affairs. However, the need to focus on extending the residence period rather than fostering community pride in order to nurture community-level SC was also identified. This is an observation that has not been obtained in previous studies and it is the result of the measurements conducted for this paper.

Furthermore, as a suggestion given to researchers specializing in this field, for quantitative measurements of civic engagement SC-related relationships, it is very difficult to obtain analysis results that apply to all regions and to this end, the
need to carry out detailed measurements separately by region and to grasp the results needs to be stressed.

Finally, the limitation of this study is that the research was conducted in a limited area; in order to analyze the effect on all regions it is necessary to expand the scope of the research subject. Also, although we demonstrated the influence of community level SC on individual level SC, we have not confirmed what the mechanism for these effects is. For the crossing effect term, various variables must also be created and analyzed again. Further studies are needed in order to tackle above limitations.

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