1. Introduction

The history of public housing supply in South Korea is not that long, when compared with that in North American and European countries. In 1989, the Korean government began supplying public housing, given the rapid economic growth and severe housing shortage (Jang and Kim 2013). The supply rate to total stock of households has steadily increased 2% in 1995 to 10% in 2015 (KRIHS 2013; MLIT 2016). During this period, there have been many types of public housing, while targeting on an extremely low-income group, at the first stage, and expanding into a middle-income group, at the latest stage (Ha 2008).

Like in western countries, however, major problems, such as poverty concentration and negative neighborhood effect, are driven by public housing policy in South Korea. A large scale and high-rise building with massive public housing units revealed residential segregation among different levels of income/social group, social stigma, and social exclusion by spatial segregation (Parkinson 1998). In particular, a public housing complex in South Korea has been often perceived as a case associated with NIMBY(Not In My Back Yard) syndrome (Kim 2018; Ahn and Kim 2018).

To address negative social impacts of public housing mentioned above, the Korea government adopted mixed tenure (so-called “social-mix”) housing policy as a social engineering agenda for social integration. More specifically, there should be a minimum share of the dwelling units for public housing in new, larger-scale residential (re)development projects by private sector. The basic presumption underlying the concept of social-mix is that a balanced socio-economic mix of residents (eg, private homeowners and public renters) might contribute to reducing the potential of negative social impacts of neighborhoods where low-income subpopulations are dominantly clustered (Mustard and Andersson 2005). Moreover, deconcentrating poverty in a certain area might lead to more positive social, psychological, residential, and environmental outcomes (Kleinhaus 2004; Sautkina, Bond, and Kearns et al. 2012; Livingston, Kearns, and Bailey et al. 2013).

Unlike the theoretical premise, however, the strong link between spatial integration and social integration is still elusive. Even though the supportive evidence on such relationship in reality is seldom provided or mixed at best (Bon, Sautkina, and Kearns et al. 2011), a concluding remark is that beneficial social, economic, and environmental impacts might be expected in a given spatial integration among residents with different tenures (Atkinson 2005; Bailey and Manzi 2008). This study analyzed the dynamic nature of public housings and mixed-tenure housings in South Korea, more highlighting the role of spatial configuration on the mechanism through which resident’s conflict as a specific social
outcome occurs. The rationale behind the attention to the conflict is that resolving conflict in mixed-tenure housings is one of urgent issues to be addressed in practice (Chaskin and Joseph 2010, 2011; Thurber, Bohmann, and Heflinger et al. 2018), and academic efforts to mitigate the level of conflict in residential areas might precede practical strategies for building community.

Given this background, this research fills the gaps of literature in four ways. First, much attention has been paid to the context of North America and European countries (Kleinheins 2004; Bond, Sautkina, and Kearns et al. 2011; Sautkina, Bond, and Kearns et al. 2012; Thurber, Bohmann, and Heflinger et al. 2018). However, this study tried to offer empirical evidence focusing on the context of Asian country rarely visited in the literature. Second, we controlled individual/household covariates (e.g., age, gender, household size, education, employment status, and the level of income) and compared the relative influence of other non-physical variables (e.g., management system and resident’s organization within mixed-tenure apartment complexes). Third, most of previous studies often dealt with small case-study or multi-site of mixed-tenure housings. Even though case studies offer depth of exploration based on qualitative approach, the limitation lies in the generalization of findings. However, this study employed a national-wide disaggregated secondary data with a representative sample of population in one country, allowing for the generalization of findings. Fourth, previous research is often limited by the spatial scale of analysis. For example, wards in UK cases and census tracts in US cases are generally considered as too large in scale to measure accurately neighborhood characteristics and its effect (Kearns and Parkinson 2001; Friedrichs, Galster, and Musterd et al. 2003; Kearns and Parkinson 2007; Ahn et al. 2018). However, we categorized spatial configuration of mixed-tenure housings into four types at the highly micro-level (e.g., apartment complex), addressing the degree of spatial integration.

Next section provides a review of the literature concerned with 1) resident’s conflict which is dependent variable in this study; 2) spatial configuration, management system, and resident’s organization which are key explanatory variables. We then present empirical framework for our research: data, hypotheses, variables, and analytic method, followed by results and conclusions with a discussion.

2. Literature review

2.1. The conflict in public housing and mixed-tenure housings

The definition of conflict varies across academic fields and research topics, but the general concept is explained by the circumstance where ideas, needs, values, or interests among multi-stakeholders are incompatible, inconsistent, and disharmonious (March and Simon 1958; Baron 1991). Narrowing down to housing sector, the conflict is prevailed among residents with heterogeneous nature of backgrounds and in residential areas with various environmental issues in socio-economic, physical, and psychological dimensions. In this vein, it is self-evident that people are less likely to encounter the conflict when they live in a neighborhood more homogeneous and environmentally better functioning.

The concern here is that both environmental function and quality are normally poor in public housing and individual/household backgrounds are fairly heterogeneous in mixed-tenure housings. More specifically, as summarized in Table 1, low levels of environmental function and quality is the major conflict issue in public housing complexes. On the other hand, as summarized in Table 2, the issues regarding the difference in terms of income, tenure, and household composition are reported as a dominant source of conflict among residents living in mixed-tenure housing complexes. Again, this information reflects the importance of heterogeneous individual/household backgrounds in explaining the prevalence of resident’s conflict in mixed-tenure housings.

Given those conflict issues among residents living in public housing or mixed-tenure apartment complexes in South Korea, extensive literature demonstrated the issues and challenges of public housing (Ha 2002; Jang and Kim 2013; Kim 2014), explored alternative

| Table 1. Summary of conflict issues among residents living in public housing units. |
|-----------------------------------|----------|----------|
| Items                             | Frequency| Percent  |
| Parking problems                  | 285      | 9.1      |
| Noise & loud singing              | 1847     | 58.7     |
| Children-related conflicts        | 32       | 1        |
| Vandalism                         | 109      | 3.4      |
| Invasion of privacy               | 250      | 8        |
| Use of public space & facility    | 46       | 1.5      |
| Alcohol drinking                  | 72       | 2.3      |
| Smoking                           | 258      | 8.2      |
| Pet-related conflicts             | 177      | 5.6      |
| Others                            | 68       | 2.2      |
| Sum                               | 3144     | 100      |

| Table 2. Summary of conflict issues in mixed tenure apartment complexes. |
|-----------------------------------|----------|----------|
| Issue of conflict                | Mean     | SLD      |
| Stress from economic gap between neighbors | 1.66     | 0.624    |
| Disrespect from residents living in private sale units | 1.61     | 0.647    |
| Conflicts from the use of parking space | 1.6     | 0.632    |
| Facility management issue        | 1.59     | 0.626    |
| Vandalism                         | 1.55     | 0.598    |
| Limited use of streets within private sale units | 1.54   | 0.6      |
| Children-related conflicts        | 1.54     | 0.596    |
| Limited use of playground and park within private sale units | 1.54   | 0.592    |

1 = Very unconcerned; 2 = Unconcerned; 3 = Concerned; 4 = Much concerned.
strategies for socially sustainable public housing developments (Ha 2008), and tested empirically the relationship between social mix policy and social outcomes, such as social conflict (Oh and Nam et al. 2016; Oh and Lee 2013; Lee 2012), residential satisfaction (Jun and Jeong 2018), and social capital (Yang et al. 2018).

More focusing on social conflict in mixed-tenure housings, various studies highlighted the disparities in rule enforcement as one of main sources of resident’s conflict as well as social stigma (Oh and Nam et al. 2016; Oh and Lee 2013; Keller 2011; McCormick, Joseph, and Chaskin et al. 2012). For example, even though both public rental housing and private sale housing are located in the same apartment complexes, the opinions from public housing residents are often ignored in the process of decision making due to either the lack of rule enforcement or the absence of organization as a representative of public housing residents. A reason behind this disparity is based on institutional context related to housing tenures in South Korea. More specifically, the composition of a representative of a lessor (ie, organization of private housing residents) is legally mandatory whereas the composition of a representative of a leaseholder (ie, organization of public housing residents) is optional (Lee 2012).

Another source of conflict in non-physical dimensions is the dichotomy (property) management system. The nuance between different management systems has been reported in Korean literature (Chun and Kang et al. 2009; Nam and Kim et al. 2014; Cha and Kim 2015), and stigmatic behavior of property managers was also often found in literature of U.S. (Thurber, Bohmann, and Heflinger et al. 2018). In general, there are three types of management system in mixed-tenure apartment complexes: “direct”, “outsourcing”, and “self” (Cha and Kim 2015), but in practice management system is commonly divided into two types: direct management by public housing authority and indirect management by private company subcontracted (Hong and Hong et al. 2014). While public housing authority under direct management system often considers public housing residents living in mixed-tenure apartment complexes as a sort of customer the authority should undertake, private company might be apt to pay careful attention to private housing residents and to neglect opinions (or requests) of public housing residents. This discriminatory manner normally stems from the fact that private housing residents private subcontracted property management to private company.

2.2. Spatial configuration of mixed tenure and its outcomes

As an alternative housing policy tool to solve the issue of residential segregation and social exclusiveness, mixed tenures strategy is conceptually based on the presumption that people with heterogenous demographic characteristics can share the sense of homogeneity as a neighbor when their housing units are in spatial propinquity. For example, putting an emphasis on the importance of spatial configuration, proponents of mixed-tenure housing policy often argues that spatial integration can lead to social integration because spatial proximity allows people to have various opportunities for social contact, activity, and interaction in shared public spaces, such as community gardens, yards, and schools (Sautkina, Bond, and Kearns et al. 2012).

On the other hand, raising the question about social mix policy and social engineering agendas, some studies maintained that, under the conditions of real or perceived homogeneity, the influence of spatial proximity on social interaction is effective (Michelson 1976). In this vein, homogeneity may be more important than propinquity (Gans 1967; Michelson 1976). Moreover, interesting literature cautioned different spatial scales of propinquity (e.g., street, block, or neighborhood) in operationalizing mixed tenures, mentioning that a too fine-grained social mix might be able to increase the potential for conflict among residents rather than the expected social integration (Arthurson 2010).

Along with spatial scales, the typology of spatial configuration also matters in investigating the connection between spatial integration and social integration (Bailey and Haworth et al. 2006; Kearns et al. 2013). Normally, previous studies provide three types of spatial configuration: “(fully) integrated or pepper-potted”, “segmented”, and “segregated” (see more explanations and diagrams in Kearns et al. 2013, 398). In the context of U.K., one qualitative study with 37 respondents as a resident in total 7 neighborhoods found that people living in “integrated” or “segmented” configurations were more likely to engage in social interactions than those in “segregated” configurations. Meanwhile, several negative social outcomes of spatial integration were found in the context of South Korea (Bae and Chun et al. 2006; Song 2008; Oh and Lee 2013). For example, public housing residents living in “integrated” or “segmented” configurations feel much discrimination, social stigma, and stress than those in ‘segregated’ configurations (Song 2008). Consistently, among three types of mixture, the conflict of residents is more prevalent in “integrated” but less prevalent in “segmented” configurations (Bae and Chun et al. 2006). Interestingly, a study showed that the influence of spatial configuration on the level of stress varies across different tenures: while homeowners or private rental housing residents are more exposed to stress in “integrated” or “segmented” configurations, public housing residents are more exposed to stress in “segregated” configurations (Kim 2011).
On the other hand, positive social outcomes of spatial integration were also found even though the number is very limited: the level of social exclusiveness on public housing residents in “integrated” configurations is lower than that in “segregated” or “segmented” configurations (Chun and Kang et al. 2009). One quantitative paper, which identified the factors affecting residential satisfaction among public housing residents living in mixed-tenure housing complexes, expands the types of spatial configuration into four types of mix: “complex”, “block”, “line”, and “random” (Jun and Jeong 2018). Given these categories, the authors reported that there is statistically significant difference (based on t-test) in social conflicts among residents living in different types of mixture: the level of severity of conflict is the lowest in “random” mix with the highest level of spatial integration. They also concluded that spatial integration does not necessarily increase the level of residential satisfaction but “random” mixture is more likely to produce the expected outcome (i.e., high levels of residential satisfaction) when compared to other mixed types (Figure 1).

In sum, several studies reported mixed findings on the relationship between spatial configuration and various types of social outcomes. As concluded in many review papers, planned social-mix strategies have not inherently, necessarily, and significantly led to positive social outcomes. However, this conclusion might be also premature since there are many research design issues: different datasets, measurements of spatial (e.g., as a input) and social integration (e.g., as an output), study areas/contexts, and approaches (e.g., qualitative and quantitative). Given the discussions mentioned above, we found some gaps of literature which dealt with a link between social engineering supported by mixed-tenure housing policy and conflict of public housing residents. First, previous studies rarely illuminated the complicated pathways by which the conflict of residents specially targeted on mixed-tenure housing occurs, failing to provide a more holistic view. Second, literature in Korean contexts elaborates the issues of conflict on the basis of management in theoretical perspectives, rather than investigates and quantifies the role of multiple factors in the occurrence for resident’s conflict. Third, most studies offered findings from the limited cases or comparative approach, not allowing for the generalization of findings. Fourth, little is known about the association between specific types of spatial configuration and conflict of public housing residents. Overcoming such gaps in the literature, this study seeks to gain empirical evidence on the potential connection between spatial integration and social integration, employing a national-wide disaggregated secondary data with a more comprehensive conceptual framework displayed in Figure 2.

3. Method

3.1. Data, hypotheses, and variables

The main data source of this study is the Korea Housing Survey for Public Housing Residents (KHSPHR). As a subset of Korea Housing Survey, this survey was organized by the Korea Ministry of Land, Infrastructure and Transport (KMLIT) in 2011. Targeting on residents living in public housing national-wide, the questionnaire contains lots of information about residential status and issues in tandem with basic demo-socio-economic characteristics at the individual/household level. Especially, this survey asked whether or not residents living in a various type of public housing including mixed-tenure apartment complexes come into conflict with their neighbors. In this sense, this survey provides us with the best secondary data suitable to test research hypotheses mentioned below.

![Figure 1. Typology of spatial configuration in a mixed tenure apartment complex.](image-url)
H1> The probability of the occurrence for residents’ conflict might decrease as the level of spatial proximity between a public rental – and private sale unit is high.

H2> The probability of the occurrence for residents’ conflict might decrease as physical performance of residential environments (eg, housing and complex) increase.

H3> The direct management system might be more beneficial to decrease the probability of the occurrence for residents’ conflict than the indirect (outsourcing) – or self management system.

H4> If there is no representative of a leaseholder as an official meeting group in a mixed tenure apartment complex, the probability of the occurrence for conflict might be high.

The empirical model for testing several research hypotheses was mainly framed by five factors: individual/household backgrounds, physical layout, resident’s organization, management of apartment complex, physical environment performance of housing unit and apartment complex. The definition and measurement of specific variables related to factors potentially influencing the occurrence of resident’s conflicts is informed in Table 3. As a control variable, individual and household backgrounds include demo-socio-economic variables, such as age, gender, income, education level, occupation status, and length of residence. Those variables partially reflect the heterogenous nature of

Table 3. Definition and measurement of variables.

| Name of variable | Definition/Measurement | Source |
|------------------|------------------------|--------|
| Dependent variable | The presence of conflict | If there is a conflict among the residents = 1 |
| Individual & household characteristics | Age | Year | KHSPhr |
| | Gender | Male = 1 | KHSPhr |
| | Household size | Total number of members | KHSPhr |
| | Marital status | Married = 1 | KHSPhr |
| | HH income | Monthly average income (10,000 Won) | KHSPhr |
| | Length of residence | If a resident lives during 10 years or more = 1 | KHSPhr |
| | Education | Under high school | KHSPhr |
| | | High school graduate | KHSPhr |
| | | Bachlor degree or more (Ref.) | KHSPhr |
| | Occupation | Full time regular job | KHSPhr |
| | | Self employment (Ref.) | KHSPhr |
| | | Temporary job or others | KHSPhr |
| | Resident’s organization | If there is no representative of leaseholders = 1 | KHSPhr |
| Non-physical dimension | Management system | If there is direct management = 1 | KHSPhr |
| Physical dimension | Spatial configuration | A = Mono type: public rental only (Ref.) | KHSPhr |
| | (Level of spatial proximity) | B = Segregated | KHSPhr |
| | | C = Building-mix | KHSPhr |
| | | D = Line-mix | KHSPhr |
| | | E = Random-mix | KHSPhr |
| | | 1 = Very dissatisfied; 2 = Dissatisfied; 3 = Satisfied; 4 = Very satisfied | KHSPhr |
| Physical performance of housing and complex | Protection of privacy; Relationship with neighbors; Security maintenance (robbery, assault); Cleanliness in public (common use) space; Disaster prevention & Safety maintenance; Access to education service (school, private institute); Noise exposure (motor horn); Electric installation (wiring, lamp/light); Water & drainage system (rust, water pressure); Condition of faucet, sink, and toilet; Interior material (floor, wall); Window and doors system; A mold stain by dew condensation | KHSPhr |
residents living in a mixed tenure complex not directly observed in survey questionnaires.

The key explanatory variable regarding spatial configuration is the types of physical layout between a public rental- and private sale unit. Based on the level of spatial proximity, physical layout of mixed-tenure apartment complexes can be specified by 5 types as displayed in Figure 1. More specifically, type (A) refers to a mono type for public rental units only. In a following empirical model, this variable is defined as a reference group to compare the statistic results with other types of spatial configuration in mixed-tenure housings. For example, in type (B), both public rental – and private sale unit are located in the same apartment complex but segregated by a clear division such as a road, wall or fence. While different tenure units are segmented by individual buildings in type (C), those are located in the same buildings but segregated by a vertical structure line (e.g., elevator cores) in type (D). Type (E) denotes the case that different tenure units are randomly assigned and integrated in the same building. Given the defined typology of 5 spatial configurations of mixed-tenure apartment complex, we can easily presume that the mix levels between different tenures increase from type (A) to type (E) since the level of spatial proximity is high in type (E) which is “pepper-potted” (Kearns et al. 2013).

Another key explanatory variable in the physical dimension is environmental performance of housing unit and apartment complex. In a survey questionnaire, there are 13 subcategories describing the condition of residential environments directly related to housing unit and apartment complex. The answer was measured by a 4 likert scale: 1 = Very dissatisfied; 2 = Dissatisfied; 3 = Satisfied; 4 = Very satisfied. Employing factor analysis, such items were compressed into two component values, and finally included in a binary logistic model.

Two dummy variables in aspect of non-physical dimension are resident’s organization and management system. If there is a representative of leaseholders in a mixed-tenure apartment complex, the variable of resident’s organization was code by ‘1’. Also, if there is a direct management system by public housing authority, the variable was coded by ‘1’. Lastly, the as dependent variable

### 3.2. Analytic method

To test the proposed hypothesis mentioned before, this paper employs binary logit analysis and factor analysis. Binary logit analysis is more suitable for dependent variable measured by the binary code than the commonly used OLS (ordinary least squared) regression analysis since the basic assumptions for a standard regression model are not met in a case of binary dependent variable (Goldberger 1964). Moreover, it is a more reasonable methodological approach that the incidence of neighborhood problem is made by several thresholds which divide one continuous linear trend into multiple stages or non-linear segments (Galster, Quercia, and Cortes et al. 2000; Kearns and Mason 2007). Given this nature of neighborhood effect, the specific function of binary logistic model is as follows:

\[
\ln \left( \frac{p}{1 - p} \right) = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5
\]

\( p = \text{Probability of conflict of residents} \)
\( x_1 = \text{Characteristics of individual and household (covariates)} \)
\( x_2 = \text{Spatial configurations of mixed-tenure housing units (categorical variables)} \)
\( x_3 = \text{Presence of resident’s organization (dummy variable)} \)
\( x_4 = \text{Direct management system (dummy variable)} \)
\( x_5 = \text{Physical performance of residential environment: complex and housing} \)
\( \text{(continuous variable factor-loaded)} \)

Prior to the application of binary logistic regression model, we ran factor analysis model to variabilize physical performance of residential environment: housing unit and apartment complex. In general, factor analysis is often considered as a tool for data reduction: large numbers of observed variables reproduce a smaller number of underlying (i.e., “latent”) variables (Russell 2002). Table 4 displays two latent variables derived from 13 observed variables that describe the condition of residential environments in original survey questionnaires.

| Item of question                                              | Factor1 | Factor2 | Eigen_value | Cronbach’s alpha |
|---------------------------------------------------------------|---------|---------|-------------|------------------|
| Protection of privacy                                         | 0.758   | 0.154   | 4.724       | 0.812            |
| Relationship with neighbors                                   | 0.757   | 0.12    |             |                  |
| Security maintenance (robbery, assault)                       | 0.721   | 0.153   |             |                  |
| Cleanliness in public (common use) space                      | 0.693   | 0.162   |             |                  |
| Disaster prevention & Safety maintenance                      | 0.687   | 0.177   |             |                  |
| Access to education service (school, institute)                | 0.611   | 0.095   |             |                  |
| Noise exposure (motor horn)                                   | 0.586   | 0.101   |             |                  |
| Electric installation (wiring, lamp/light)                     | 0.148   | 0.77    | 2.098       | 0.828            |
| Water & drainage system (rust, water pressure)                 | 0.102   | 0.763   |             |                  |
| Faucet, sink, and toilet condition                            | 0.147   | 0.755   |             |                  |
| Interior material (floor, wall)                               | 0.183   | 0.742   |             |                  |
| Window and doors system                                       | 0.191   | 0.733   |             |                  |
| A mold stain by dew condensation                              | 0.105   | 0.615   |             |                  |
4. Results

4.1. Statistic summary of variables

The descriptive statistics of variables employed in an empirical model are summarized in Table 5. Total number of observations is 45,742 residents living in national-wide public housing apartment complexes in South Korea. Among those, residents who responded that there is he conflict in public housing apartment complexes are relatively small (7% of total samples).

According to the census data in Korea at the same time period, in average, demographic profiles of samples observed in this model were found to be fairly similar to those of the population, except for monthly household income (Korean Statistical Information Service 2011). For example, the average of household’s age of observed samples is slightly high (52.84 vs. 50.19), but the average of household size is slightly low (2.64 vs. 2.83). On the other hand, it was reported that there is the clear gap of monthly household income between observations and the population (167.02 vs. 223.33). Categorical variables of “education level” were found to be evenly distributed, whereas some of occupation status variables are over-sampled (i.e., “temporary job or others”) or under-sampled (“self-employed”).

Regarding key explanatory variables, the dominant type of spatial configuration was reported by “mono” type which refers to “public rental unit only”, but others have a very small portion of samples size ranging from 1% (“line-mix” type) to 6% (“random-mix” type). Lastly, it was recorded that residents living in apartment complexes with indirect management system or without a representative of a leaseholder as an organization of resident are in the majority.

4.2. Results of binary logistic regression model

Table 6 displays the results from the logit model. Briefly, the reported general model fit and explanatory power of model are 43.834 (chi-square value: ρ < 0.01), 0.189 (Cox&Snell) and 0.231 (Nagelkerke), respectively. Given the VIF test assessing potential bias due to multicollinearity, we reject the possibility of multicollinearity between explanatory variables because the VIF value of all variables is less than 3 (Judge and Hill et al. 1982). One issue here is that the proportion of the total variation explained by the model is relatively small. Low level of explanatory power, however, might reflect a common case where the large amount of variation in the data is not able to be simply explained by a small number of variables of major effect (Kearns and Mason 2007).

Overall, all control variables related to demo-socio-economic factors among the individual/household characteristics, except for “temporary job or others” in occupation, are significantly associated with the presence of resident’s conflict. More specifically, residents who are young, female, married, more educated, less affluent, or in larger size of household and short-length of residence (i.e., less than 10 years) are more likely to encounter the conflict with their neighbors than each counterpart group.

Among the variables within a physical dimension of a mixed-tenure apartment complex, not surprisingly, the influence of spatial configuration on the presence of resident’s conflict varies across the level of spatial integration. More specifically, two types of mixing (e.g., segregated and segmented) with lower levels of spatial integration are positively associated with the presence of resident’s conflict at the 1% significant level, whereas the other two types of mixing (e.g., “line-mix” and “random-mix”) with higher levels of spatial integration are negatively associated with the presence of spacing among the residents.

Table 5. Descriptive statistics of variables.

| Variables                             | N     | Mean  | SD   | Min  | Max  |
|---------------------------------------|-------|-------|------|------|------|
| The presence of conflict              | 45,742| 0.07  | 0.253| 0    | 1    |
| Gender (Male = 1)                     | 45,742| 0.66  | 0.474| 0    | 1    |
| Age                                   | 45,742| 52.84 | 16.353| 20   | 104  |
| Household size                        | 45,742| 2.64  | 1.304| 1    | 9    |
| Marital status (Married = 1)          | 45,742| 0.56  | 0.497| 0    | 1    |
| HH income                             | 45,742| 162.07| 121,314| 0 | 1500 |
| Length of residence (10 or more = 1)  | 45,742| 0.31  | 0.464| 0    | 1    |
| Education                             |       |       |      |      |      |
| Under high school                     | 45,742| 0.41  | 0.492| 0    | 1    |
| High school graduate                 | 45,742| 0.37  | 0.483| 0    | 1    |
| Bacholar degree or more              | 45,742| 0.22  | 0.414| 0    | 1    |
| Occupation                           |       |       |      |      |      |
| Full time regular job                | 45,742| 0.32  | 0.467| 0    | 1    |
| Self employment                      | 45,742| 0.11  | 0.295| 0    | 1    |
| Temporary job or others              | 45,742| 0.58  | 0.493| 0    | 1    |
| Representative of a leaseholder      | 45,742| 0.76  | 0.426| 0    | 1    |
| Management system (Directed by public authority = 1) | 45,742| 0.22  | 0.417| 0    | 1    |
| Spatial configuration                 |       |       |      |      |      |
| A = Public rental only               | 45,742| 0.86  | 0.347| 0    | 1    |
| B = Segregated                       | 45,742| 0.04  | 0.196| 0    | 1    |
| C = Building-mix                     | 45,742| 0.02  | 0.153| 0    | 1    |
| D = Line-mix                         | 45,742| 0.01  | 0.112| 0    | 1    |
| E = Random-mix                       | 45,742| 0.06  | 0.244| 0    | 1    |
| Factor1 (Physical performance of apartment complex) | 45,742| 2.978 | 0.3733| 1 | 4    |
| Factor2 (Physical performance of housing unit) | 45,742| 2.922 | 0.3965| 1 | 4    |
resident’s conflict. However, statistical significance was found only in the highest level of spatial integration (i.e., “random-mix”; p < 0.1%). We confirmed that “random-mix” contributes to decreasing the probability of occurrence for resident’s conflict. This finding from national-wide samples is fairly consistent with the finding from samples of SMA (Seoul Metropolitan Areas in South Korea) that there is the statistically significant gap in the frequency of conflict between different types of spatial configuration; and that the level of conflict in “random-mix” is the lowest among the other mixed types at the statistically significant level (Jun and Jeong 2018). However, it is contradictory to the finding from previous studies that a high level of spatial integration increases the conflict among the residents with heterogeneous nature of backgrounds mainly due to the issue of invasion of privacy (Bae and Chun et al. 2006).

Such mixed results imply that the degree of spatial integration matters in a highly micro-scale neighborhood (i.e., apartment complex). Even though both “line-mix” and “random-mix” can be considered as a type of spatial configuration with higher level of spatial integration, only “random-mix” has statistical significance with a fairly high magnitude influence. Considering that the majority of conflicts in mixed-tenure housing complexes are related to the issues from the difference in socioeconomic status of the residents such as income, tenure, and household composition, these results suggest that the positive role of spatial configuration in reducing the social conflicts among residents can be effective when the spatial configuration assures that the residents are unable to recognize their neighbors’ socioeconomic status. It seems that residents in a random-mix type housing complex may experience a lower level of social conflicts than the other types because their socioeconomic status is more difficult to be identified by others based on the locations of their housing units; and hence there is little chance of social stigma between residents of different socioeconomic backgrounds.

Along with the variable of spatial configuration, as expected, two factor-loaded variables regarding physical performance of residential environments (i.e., apartment complex and housing unit) are negatively associated with the presence of resident’s conflict at the 1% level. Probability of the occurrence for resident’s conflict decreases when people evaluated positively overall physical performance of residential environments. Those results are in a line with statistics summary of sources of conflict within public housing complexes as shown in Table 1.

Not surprisingly, we found statistically significant associations between two key explanatory variables (i.e., resident’s organization and management system) in non-physical dimensions and the presence of resident’s conflict (p < 0.1%). More specifically, the absence of a representative of public housing residents affects positively the presence of conflict, whereas direct management by public housing authority affects negatively.

These findings might support the argument by contact theorists. According to contact theory, people with heterogeneous backgrounds will be more likely to interact when different groups are under equal-status cooperation and the support from authority (Pettigrew 1998; Kleit 2005). Thus, it is a more reasonable interpretation on major findings from our empirical study that “random-mix” might allow residents for some of equal-status circumstances since they are randomly assigned. Also, the presence of resident’s organization (i.e., a representative of lease household) might provide some opportunities for sharing common goals and intergroup cooperation without any exclusive manner. Moreover, direct management system might be able to deliver the support from public housing authority to residents rarely found in indirect management systems.

| Table 6. Results of binary logistic regression model. |
|-----------------------------------------------------|
| Variables                                           | Coefficient | S. E.   | Wald  | Exp(B)  | VIF  |
| Age                                                | -0.012      | 0.002   | 39.274 | ***     | 0.999 | 1.981 |
| Male                                               | -0.114      | 0.059   | 1.706  | *        | 0.993 | 2.086 |
| Household size                                      | 0.049       | 0.021   | 5.294  | **       | 1.05  | 1.951 |
| Married                                             | 0.16        | 0.065   | 6.067  | **       | 1.174 | 2.712 |
| HH income                                           | -0.43       | 0.092   | 21.644 | ***      | 0.651 | 2.183 |
| Length of residence                                 | -0.409      | 0.051   | 64.9918| ***      | 0.664 | 1.156 |
| Education                                           | -0.313      | 0.072   | 19.003 | ***      | 0.731 | 1.995 |
| Occupation                                          | -0.201      | 0.052   | 14.72  | ***      | 0.818 | 2.436 |
| Resident’s organization (Non)                       | -0.216      | 0.068   | 10.024 | **       | 0.805 | 2.084 |
| Management (Direct)                                 | -0.029      | 0.073   | 0.151  |          | 0.972 | 1.393 |
| Spatial configuration                               | -0.388      | 0.05    | 59.335 | ***      | 0.678 | 1.023 |
| Factor1_Physical performance of complex             | 0.647       | 0.079   | 67.118 | ***      | 1.909 | 1.042 |
| Factor2_Physical performance of housing             | 0.322       | 0.113   | 8.204  | **       | 1.38  | 1.038 |
| Model fit                                           | -0.16       | 0.191   | 0.701  |          | 0.852 | 1.023 |
| Pseudo R_square                                    | 0.135       | 0.053   | 35.06  | ***      | 0.731 | 1.331 |

* = p < 0.05; ** = p < 0.01; *** = p < 0.001
5. Conclusion and discussions

As often seen in many western countries, the development of public housing in South Korea also made a large contribution toward improving the level of housing stability and housing welfare among the disadvantaged groups, such as low-income households and the disabled. There are also, however, negative social outcomes, led by the conventional development with large-scale complex and massive housing units, such as residential segregation, social stigma, and social exclusiveness. Among negative outcomes, a various types of conflict in public housing are blamed for obstructing community building and hence decreasing the level of overall residential satisfaction (Jun and Jeong 2018). Given this problematic situation, this study explored the mechanism through which resident’s conflict occurs and also quantified the impact of factors affecting the probability of occurrence for such conflict, using national-wide samples of residents living in public housing apartment complexes.

Major findings from binary logistic analysis imply that, in tandem with physical performance of residential environments (i.e., housing unit and apartment complex), spatial configuration, management system, and resident’s organization are critical factors in determining whether or not the conflict of resident occurs. Moreover, based on the value of Exp(B) of key variables, the relative importance between critical factors ranks as follows: “segregated” (0.909 = 1.909–1), “physical performance of complex” (0.743 = 1–0.257), “random-mix” (0.606 = 1–0.384), “building-mix” (0.380 = 1.380–1), “direct management” (0.322 = 1–0.678), “resident’s organization” (0.308 = 1.308–1), “physical performance of housing” (0.269 = 1–0.731).

These ranks inform us that, in terms of magnitude of impact, the priority of policy strategies for mitigating the conflict among residents living in a mixed-tenure apartment complex goes to the issues related to physical dimension rather than to non-physical dimension. More importantly, to decrease the conflict of residents, “segregated” configuration should be rejected in operationalizing a mixed-tenure neighborhood at the highly micro-level, whereas “random-mix” (i.e., perfect or complete meaning of “a pepper-potted”) should be recommended in tandem with the continuous improvement of physical performance of housing unit and apartment complex. In addition, given a better combination between the factors in non-physical dimension (i.e., the presence of direct management system and resident’s organization by a representative of a leaseholder), it is urgent to bind legal agreements on discriminative institutional context and local governance for social inclusiveness among the residents with the heterogenous nature of backgrounds.

In this study, we tried to identify the potential mechanism through which the conflict of residents living in a mixed-tenure complex occurs. We also found some supportive evidence on the positive role of spatial configuration highly integrated in resolving the conflict. However, the study has some limitations. First, as mentioned earlier, there was a clear gap in the economic characteristics of the households between the samples and those from the national census, which calls for a cautious imputation of the findings. Second, the results might not be consistent in other context. For example, we can’t be sure whether private housing residents in a mixed-tenure apartment complex also encounter such conflict and if they do, what the types of conflicts are, and whether the key explanatory variables in our analytic model can be applied to the conflict of private housing residents. It is expected that the future studies could contribute to a more comprehensive understanding of the relationship between social conflicts of residents and the spatial configuration of the dwelling units, where various socioeconomic groups live together.

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