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# Are mixed neighborhoods more socially cohesive? Evidence from Nanjing, China

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## ABSTRACT

Mixed housing is a widely accepted strategy to promote cohesive communities. However, there remains an enormous amount of heterogeneity in who are mixed, and through what mechanisms. Drawing on a bespoke household survey conducted in Nanjing, China, this paper responds to this gap by measuring how multiple sources of neighborhood mix are associated with different, theoretically-derived dimensions of neighborhood cohesion. The results underscore the multiplicity of the construct of “mix” in everyday life-worlds. We identify varied relationships between neighborhood mix and neighborhood cohesion. Mixing defined in terms of housing tenure and educational backgrounds is linked to greater behavioral cohesion, highlighting the importance of contact spaces and localized knowledge sharing. Contrastingly, income mix lends support to the homophily principle, emphasizing invisible boundaries strengthened by competition over group resources. Mixing of *hukou* status appears to undermine cognitive cohesion, underscoring the distinctive role played by the *hukou* regime for governing diversity in China.

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Mixed neighborhood; heterogeneity; diversity; neighborhood cohesion; China

## Introduction

Policymakers and scholars commonly advocate for mixed housing as a means to address problems of social exclusion and residential segregation. In the US, for instance, diversification projects like Chicago’s Moving to Opportunity program assist residents in high-poverty public housing to relocate to more affluent neighborhoods (Katz et al., 2001). In the UK, policymakers expect tenure mix to contribute to “sustainable” and ‘inclusive’ communities (Department of Communities and Local Government, 2007, p. 11). In China, Beijing, Guangzhou and Nanjing have declared urban redevelopment plans stipulating minimum shares of affordable housing in all new large-scale commodity housing development, with the aims of improving the quality of life of low-income citizens, and promoting sustainable community development (Nanjing Municipal Government, 2017).

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Researchers have long been interested in the effects of mixed housing in neighborhoods, examining how mixing might affect individual-level outcomes including crime, mental health, employment and economic mobility (Katz et al., 2001; Leventhal & Brooks-Gunn, 2003). Existing research has also explored “collective” outcomes, like social networks, community participation and attachment (Kleinhans, 2004; Sautkina et al., 2012; Thurber et al., 2018). Growing attention has been paid to social cohesion – as a general measurement of ‘connectedness and solidarity among groups in society’ (Manca, 2014). Scholars have assessed different mixed housing projects, seeking to understand whether mixing improves inter-group communication, promotes active citizenship, and leads to social cohesion (see Kleinhans, 2004 for an overview).

Although extensive evidence for these relationships have been collected, conclusions about social outcomes remain “ambiguous” (Kleinhans, 2004), ‘fragmented’ (Graham et al., 2009, p. 139), and ‘inconsistent’ (Andersson et al., 2007, p. 641). While the growing use of quasi-experiments helps address lingering issues of causal inference, such methods favor internal validity over generalizability. They are especially insufficient in the face of enormous heterogeneity in the form mixing takes on the ground, in terms of who is being mixed with whom, and through what mechanisms (Bond et al., 2011; Kleinhans, 2004). Neighborhood diversification can take many forms: through the mixing of household types and tenures; occupations and income levels; ethnicities and birthplaces; and languages and cultural backgrounds. Researchers’ understanding of how such variation is associated with different outcomes remains underexplored (Andersson et al., 2007). Context is also likely to be important, requiring systematic assessment of the background specificities between cases before any generalization or ‘lesson drawing’ could take place (Sautkina et al., 2012). This is particularly urgent when contextual differences are likely to be large, as they can be expected to be far from the North American and Western European contexts in which neighborhood mixing has largely been conceptualized, and where most empirical investigations have been undertaken.

This paper starts addressing these gaps. Using primary data collected for 32 neighborhoods in the eastern Chinese city of Nanjing, we investigate the relationships between neighborhood mix and a range of social outcomes that together describe social cohesion, including neighborly interactions, community participation, and neighborhood attachment. We consider several dimensions of mixing: *hukou*, tenure, income, occupation, and education. We analyze this original dataset using multilevel regression methods, which allow us to consider the characteristics of individual survey respondents, as well as the structuring forces of neighborhood features, including mixed housing.

In adopting this approach, the paper aims to make several contributions. First, though many of the individual measures of neighborhood mixing and social outcomes we leverage here have been used in existing studies, few studies consider multiple. Our approach therefore permits a new level of comparison across measures, improving reliability while exploring variation. Second, we address the theoretical question of “how mixing works” by determining which indicator of neighborhood mix matters for which aspect of cohesion. Third, we examine these issues in the Chinese context, where most prior studies have been narrowly oriented on heterogeneity in *hukou* status. While Chinese social segregation and spatial inequality has attracted growing political and academic attention (S. He & Qian, 2017), there remains a dearth of systematic

research on the micro-scale manifestations of neighborhood diversity. Can Western experiences of neighborhood mix be generalized to China? This study aims to provide a first answer.

We find a highly varied set of associations between specific forms of mixing and neighborhood cohesion, which suggests that prior studies oversimplify the relationship of interest. We find empirical support both for the pro-diversity proposition and the anti-diversity/homophily position, with the first proposition supported by evidence on tenure and educational mix, and the second by evidence on income and *hukou* mix. The Nanjing case shows both similarities and contrasts to Western counterparts. As with Western studies by Andersson et al. (2007) and Graham et al. (2009), results support skepticism about a positive role for income diversity. We also highlight the crucial role played by the *hukou* regimes for governing diversity, which confirms the importance of macro-institutional regimes.

## Literature review

### *Social cohesion and mixed neighborhoods*

Social cohesion describes the interaction between individuals and collective life; cohesion is the “glue” that binds individuals together, and permits the pursuit of collective goals (Putnam, 2000). How individuals are mixed within collectives thus becomes an important factor in discussions about cohesion (Van Kempen & Bolt, 2009).

Neighborhoods represent crucial sources of social cohesion, where many efforts to tackle social exclusion and segregation take place. Proponents of mixed housing developments argue neighborhood diversification can create a balanced mix of inhabitants spanning multiple social and economic backgrounds (Musterd & Andersson, 2005). Allport (1954) “contact hypothesis” suggests that, by providing opportunities for meeting and cooperating with others, neighborhood diversification makes room for positive socialization through the cultivation of inter-group ‘bridging ties’, participation, tolerance and territorial belonging (Cole & Goodchild, 2000; Putnam, 2000). Neighborhoods signal their cohesion by manifesting specific behaviors including neighborly interaction, and community participation; as well as cognitive manifestations like neighborhood attachment (Forrest & Kearns, 2001; Moody & White, 2003). Others argue that homophily, rather than diversity, regulates social cohesion (Mcpherson et al., 2001). In this view, people prefer being surrounded by those who resemble them and this homogeneity binds people together. In this view, social cohesion in heterogeneous neighborhoods is more fragile, due to one’s natural ‘aversion to heterogeneity’ and sense of threat (Alesina & Ferrara, 2000; Van Der Meer & Tolsma, 2014).

This debate remains unresolved, in part because researchers have operationalized neighborhood heterogeneity in different ways. In the remainder of the review, we synthesize findings across the full range of neighborhood-level measures of heterogeneity. By doing so, we aim to clarify the relationship of interest, and motivate the present study by considering their operation in China.

### **Sources of neighborhood mix**

Previous research identifies varied sources of neighborhood heterogeneity, especially ethnicity, tenure, income, occupation, and educational attainment.<sup>1</sup> Heterogeneity in ethnicity or place of origin is among one of the most widely explored indicators of neighborhood mix. Some consider ethnic and racial diversity to be a major reason for declines in social participation and generalized trust in the US (Putnam, 2007; Sampson et al., 1997), while others suggest socio-economic determinants like community deprivation and residential stability offer more explanatory power (Laurence, 2011; Twigg et al., 2010).

Heterogeneity in housing tenure – created through the integration of social and privately-owned housing – has also been the focus of neighborhood research. Studies in different contexts come to very different conclusions, with tenure diversity linked both positively and negatively to cohesion (Arthurson, 2012; Bolt et al., 2010; Kearns & Mason, 2007).

Economic heterogeneity measures the spatial mixing of income groups – a process not always occurring naturally, with housing prices acting as a strong force for segregation (F. Wu, 2005). Income and occupational heterogeneity are widely used indicators of economic heterogeneity. Limited evidence exists to support the idea that mixed-income or mixed-occupation development generates higher levels of behavioral cohesion, particular in areas relating to neighborly interactions (Chaskin & Joseph, 2011; Coffé & Geys, 2006; Curley, 2009). Regarding attitudinal cohesion, existing evidence remains mixed: Völker et al. (2006) observe a negative relationship between income heterogeneity and perceived cohesion in Dutch neighborhoods, a result that fits cross-country studies like Keefer and Knack (2005). Nevertheless, using data on neighborhoods in southeast Pennsylvania, Mennis et al. (2013) show that neighborly trust and attachment are higher in mixed-income, though not in occupationally-mixed neighborhoods.

Neighborhoods can also be classified according to their mix of more- and less-educated individuals. Focusing on education as opposed to income may yield less-biased estimates, since individuals may be more reluctant to disclose financial information. Neighborhood-level studies in the US and in Hong Kong suggest that educational inequality is negatively linked to perceived social cohesion (Cabrera & Najarian, 2013; Cheung & Leung, 2011).

With a few exceptions (for instance, Andersson et al., 2007; Boterman et al., 2020; Van Gent et al., 2019), existing studies measure heterogeneity along a single axis of differentiation. A single source of diversity is consequently privileged to the exclusion of others. A potentially pernicious effect of this methodological narrowness is that community problems can get linked to minority groups (e.g. ethnic minorities, tenants or low-income groups). Mennis et al. (2013), basing their study on a survey of respondents in neighborhoods in southeast Pennsylvania, is the only known research in which multiple measures of heterogeneity appear simultaneously in multivariate models predicting neighborhood cohesion and collective efficiency. In contrast with a range of existing work, they find that neighborhood diversity in terms of educational attainment and income are positively associated with neighborhood cooperation, neighborhood sentiment and neighborly trust. By exposing the multidimensional nature of social mix, this research suggests that different forms of heterogeneity may display variegated relationships to neighborhood cohesion. It further demonstrates the

necessity of an explicit and theoretically-derived operational framework of neighborhood mix measurement. Mennis et al. (2013) is the closest to the present paper in motivation.

### **Neighborhood mix research in China**

Most research in China concludes that neighborhood cohesion is negatively associated with heterogeneity, whether defined in terms of income (Gu & Zhou, 2015), occupation (Cai & He, 2014; X. He & Liu, 2016), and educational attainment (Cai & Zhang, 2017). Since ethnicity plays a distinctive role in China, scholars commonly turn to the Chinese household registration system (*hukou*) – a record of one's birthplace (and when criteria for a change of *hukou* location are met, the workplace) (Chan & Li, 1999). *Hukou* is a primary division in Chinese social structure and classifies residents into two groups based on their places of origin: residents who have local *hukou*, and migrants whose *hukou* is non-local.<sup>2</sup> Each group has differentiated access to state-sponsored benefits, such as social housing and public funding (Fan, 2002; Zhu, 2016). Similar to other indicators, heterogeneity in *hukou* status has been linked to reduced social relationships, tolerance, and collective decision-making (Zhang & Liu, 2015), though the effects of migrant presence may be non-monotonic (Wang et al., 2017).

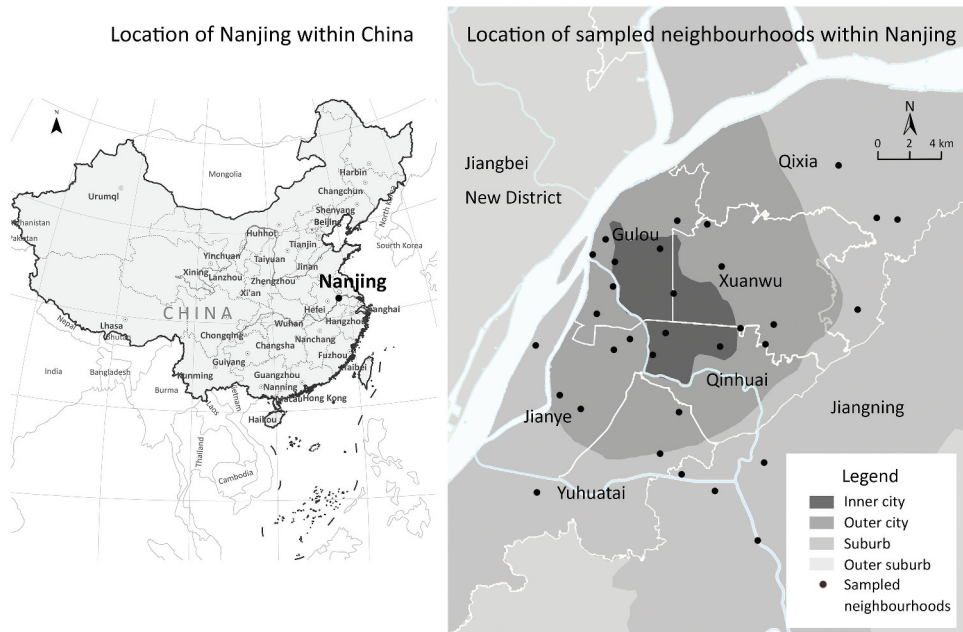
However, our understanding of mixed neighborhoods in China remains underdeveloped. Evidence is derived mostly from qualitative, direct observations of mixed housing development (e.g. Gu & Zhou, 2015), which insufficiently detail research designs, lack salient socio-economic control variables, and suffer from shortcomings around measurement. Idiosyncratic measurement choices also limit comparability to American and European studies, where heterogeneity gets operationalized using indices of fractionalization, dissimilarity, or entropy (Alesina et al., 2003; Graham et al., 2009; Mennis et al., 2013).

Motivated by these gaps, the present study investigates whether mixed neighborhoods in China are more socially cohesive. Using original data from the city of Nanjing, we explore this question while accounting for other socio-economic factors at both the individual and the neighborhood levels, capturing different, theoretically-derived aspects of social cohesion, and considering not only *hukou* diversity, but also heterogeneity in tenure, income, occupation and education – as widely explored by scholars in other country contexts.

## **Data and methods**

### **Data collection**

The underlying data come from a survey conducted in 2017 and 2018 in Nanjing, China (Figure 1). Nanjing is one of largest cities in the East China region, with 7.09 million household registered population and 3.21 million migrants, organized in over 3,500 *xiaoqus* (neighborhoods) – the basic unit of analysis of this research (Nanjing Statistical Bureau, 2020). The city includes a wide spectrum of neighborhoods: deprived communities with low-income populations; blighted urban villages; regenerated social



**Figure 1.** Locations of sampled neighborhoods in Nanjing, China.

housing; and modernized high-rise flats and villas populated by middle- and upper-class residents. This breadth makes Nanjing an apt site from which to study neighborliness (e.g. Wang et al., 2016).

Within Nanjing, 32 sampled neighborhoods were selected in the five central urban districts plus part of Jiangning and Qixia in the suburbs that have experienced massive social housing developments in recent decades. The sample was constructed using a multi-stage cluster sampling strategy. Using information drawn from the Chinese General Society Survey and other studies (e.g. Yu & Tang, 2018), in the first stage, urban neighborhoods were stratified into four “targeting groups”: (1) traditional urban neighborhoods (including lane- or courtyard-based housing, and other types of housing built before the 1998 housing reform); (2) privatized work-units (built during the postwar era by work-units, privatized during the 1990s); (3) newly-built commodity housing estate (*shangpinfang*, built after the housing reform, private ownership); and (4) affordable housing (social housing provided or subsidized by the government, such as shared ownership properties, public rental units, low-rent housing and resettlement housing). The purpose of this stratification process was to ensure coverage of a wide range of neighborhoods.

In the second stage, 6–10 neighborhoods were selected from each targeting group, according to their geographical locations and the total number of neighborhoods in each group. For each neighborhood, we applied a modified proportion to size sampling method. With a sampling rate of 1%, the number of surveys conducted in each target neighborhood ranges from 5 to 80, roughly proportional to the total number of households in that neighborhood. To maximize validity, in each neighborhood we interviewed at least 20 residents, each representing their household. Following Li et al. (2012),

respondents were approached using a hybrid method: either sampled randomly by apartment using interval sampling based on the residential distribution of households within the property, or approached in neighborhood public spaces using a quota sampling method. This yielded 918 valid observations<sup>3</sup>. During the survey, some respondents showed rich knowledge and experience of community issues, in which case they were encouraged to talk more on each question, and the survey evolved into informal interviews.

### **Measurement of key variables**

We build three distinct measures of neighborhood cohesion: *neighborly ties*, *community participation*, and *neighborhood attachment*. The first two variables measure behavioral dimensions of cohesion, while the latter captures the cognitive dimension (Lorenzen, 2007). To construct these indicators, we rely on specific survey questions. For neighborly ties, we used a question asking respondents for the number of neighbors they would say hello or nod heads to, when meeting in the neighborhood (defined as weak ties, Henning & Lieberg, 1996). By creating a real-life scenario of saying hello, we collected retrospective data as a proxy for behavioral data. For those who provided “vague” answers, such as ‘I know everyone in the neighborhood and say hello to them [when I] see them’ (Interview with residents in Neighborhood ZD, 10 December 2017), we followed-up with a question asking the total number of residents in their neighborhood. To capture community participation, we used a question asking if a respondent has participated in any neighborhood activities in 2016/17, including but not exclusive to civic groups (such as the Residents’ Committee and Homeowners’ Association), interest groups, cultural and sports activities, volunteer posts, and neighborhood online chat groups. To operationalize neighborhood attachment, we use respondents’ level of agreement with the statement ‘I feel attached to this neighborhood’, measured on a 5-point Likert scale, ranging from ‘strongly agree’ (5 points) to ‘strongly disagree’ (1 point).

Descriptively, neighborhoods vary in their level of social cohesion. According to Figure 2, respondents from affordable neighborhoods reported the strongest neighborly ties, with more than half of respondents reporting more than 10 local contacts. Those in privatized work units tended to be more active, with nearly 75% participating in neighborhood activities. They also reported relatively high levels of neighborhood attachment, second only to respondents in commodity neighborhoods.

Key independent variables include five measures of neighborhood mix: *hukou* status, tenure, income, occupation and educational attainment. We follow best practices in the literature in measuring different forms of heterogeneity. For each sampled neighborhood, the mix measures are derived from the answers of all survey respondents from that neighborhood.

We characterize differences in *hukou* status and tenure by the extent to which respondents differ from their neighbors. Both are measured using a fractionalization index, which is commonly used to capture ethnic diversity (Alesina et al., 2003). To



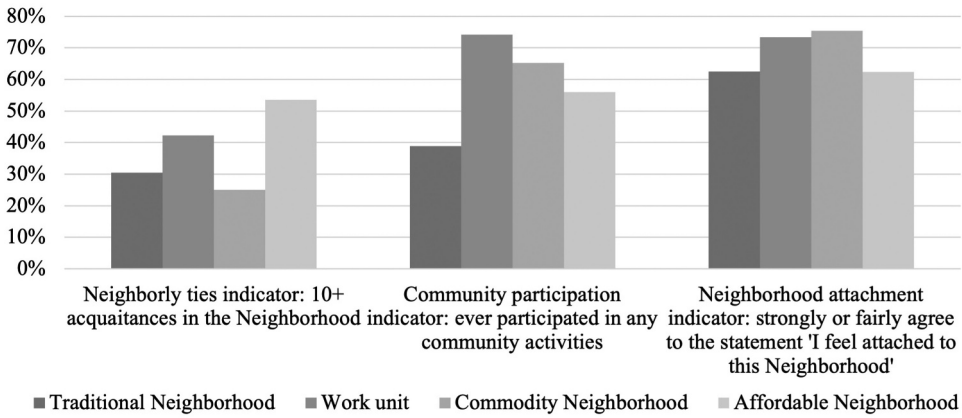


Figure 2. Distribution of neighborhood cohesion across different types of sampled neighborhoods.

adjust for the influence of group size on “sampling without replacement”, we correct for a finite population by multiplying the fractionalization index by  $\frac{j}{j-1}$ , as shown in Equation (1):

$$H_{hkj} = \frac{j}{j-1} \left( 1 - \sum_{i=1}^n p_{ij}^2 \right) \tag{1}$$

where  $p_i$  is the proportion of members with the status  $i$  for each of the  $n$  categories of the characteristics in neighborhood  $j$ . According to the survey, *hukou* location is coded as a binary variable, classifying respondents as either local or non-local. Meanwhile, *tenure heterogeneity* describes respondents’ variation across five categories identified in the national population census: public rental, private rental, public housing purchased, affordable housing purchased, and commodity housing purchased.

Given a continuous measure of income, we measure *income heterogeneity* using the coefficient of variation (CV):

$$H_{income\ j} = \frac{SD_{xj}}{\bar{x}j} \tag{2}$$

where  $SD_{xj}$  is the standard deviation of respondents’ reported income, and  $\bar{x}j$  is the average income of that neighborhood.

We rely on an entropy-based measure to describe *occupational heterogeneity*, tracking the diversity of occupation types across neighborhoods:

$$H_{occ\ j} = - \sum_{i=1}^n p_{ij} \ln(p_{ij}) \tag{3}$$

where  $p_{ij}$  is the proportion of members who are engaged in occupation  $i$  for each of the  $n$  categories in neighborhood  $j$ . Categories are defined according to the Chinese occupational classification system.

Finally, we measure *educational heterogeneity* by leveraging continuous data describing respondents’ years of schooling. We adopt Dawson (2011) index to estimate educational heterogeneity:

$$H_{edu\ j} = \frac{(x_{max\ j} - x_{min\ j})^2}{(n - 1)(X_{max\ j} - X_{min\ j}) \max(x_{ij} - x_{(i-1)j})} \quad (4)$$

where  $X_{max\ j}$  and  $X_{min\ j}$  represent the maximum and minimum possible school years, and  $x_{max\ j}$  and  $x_{min\ j}$  represent the observed maximum and minimum values. The maximum distance in education attainment between adjacent respondents in a neighborhood is given by  $\max(x_{ij} - x_{(i-1)j})$ .

Measures of different forms of heterogeneity are only weakly correlated, confirming that they capture distinct properties of neighborhoods.<sup>4</sup> Figure 3 describes (standardized) variation in these dimensions of local heterogeneity. Among sampled neighborhoods, traditional neighborhoods tend to be more *hukou*- and education-diverse, privatized work units rank the highest in tenure heterogeneity. Affordable neighborhoods host residents from the most diverse occupational backgrounds, and commodity housing estates report the highest income heterogeneity.

To account for competing determinants of cohesion, in the regression modeling to follow we include a range of control variables. Based on findings in prior studies (Forrest & Kearns, 2001; Wang et al., 2016, 2017; Yip, 2012) in regression estimates we include measures of individual characteristics including demographics (age, gender, *hukou* status and marital status); socio-economic factors (year of schooling and annual household income); and housing status (tenure and length of residence). Following extant research on China (Li et al., 2012; Wang et al., 2017; Yip, 2012) we include neighborhood-level controls, including evaluation of built environment, percentage of migrants, population density and neighborhood type.

Built environment is evaluated both subjectively – by respondents based on their levels of satisfaction with neighborhood environment, and objectively – by the researchers based on a set of criteria, such as public space, public facilities, green space and environment.<sup>5</sup> Summary statistics for all variables are presented in Table 1.

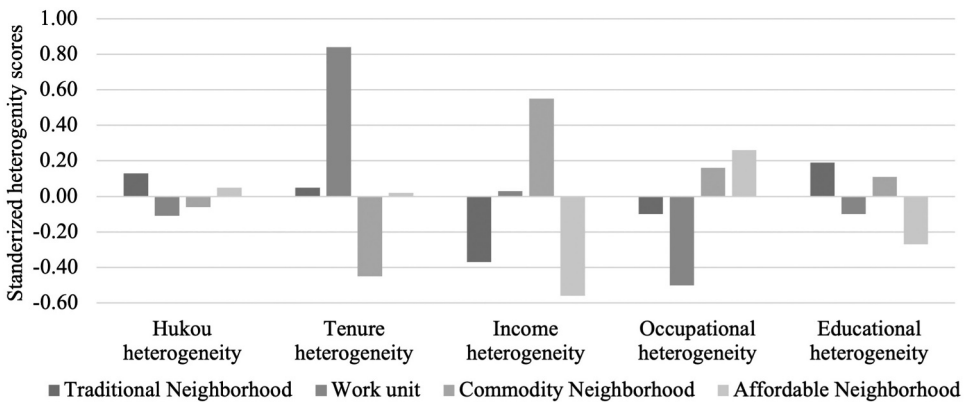


Figure 3. Standardized heterogeneity scores across different types of sampled neighborhoods.

**Table 1.** Summary statistics.

Variables	Mean or %	Standard Deviation	Min	Max	Frequencies (Binary variables only)	
					0	1
<i>Dependent variables</i>						
Neighborly ties	94.16	207.84	0	2000	-	-
Community participation	-	-	0	1	325	576
Neighborhood attachment	3.72	0.78	1	5	-	-
<i>Independent variables</i>						
Hukou heterogeneity	0.22	0.15	0	0.51	-	-
Tenure heterogeneity	0.36	0.21	0.07	0.95	-	-
Income heterogeneity	11.00	8.17	4.79	56.30	-	-
Occupational heterogeneity	2.56	0.30	1.86	3.07	-	-
Educational heterogeneity	0.04	0.02	0.02	0.10	-	-
<i>Control variables</i>						
Age	50.25	16.69	16	96	-	-
Gender (ref=male)	-	-	0	1	415	497
Local hukou (ref=non-local)	-	-	0	1	126	786
Urban hukou (ref=rural)	-	-	0	1	127	780
Ownership (ref=tenant)	-	-	0	1	208	697
Length of residence	11.52	10.21	0	75	-	-
Marital status (ref=single)	-	-	0	1	74	836
Year of schooling	12.96	3.82	6	19	-	-
Household annual income (ln)	2.50	0.77	0	5.30	-	-
Subjective evaluation of built environment	3.15	0.91	1	5	-	-
Objective evaluation of built environment	1.30	1.01	0	4	-	-
Population density (per 10,000 people per km <sup>2</sup> )	2.11	1.88	0.15	8	-	-
Percentage of migrants	0.22	0.22	0	0.77	-	-
<i>Neighborhood type (ref=traditional neighborhoods)</i>						
Privatized work units	0.19	-	-	-	-	-
Commodity neighborhoods	0.37	-	-	-	-	-
Affordable neighborhoods	0.22	-	-	-	-	-

**Analytical strategy**

We investigate the relationship between these sources of neighborhood mix and cohesion using multilevel regression. This permits simultaneous consideration of individual- and group-level factors. Models are specified reflecting the features of each dependent variable.

Respondents’ scaled neighborhood attachment indicate their cognitive bond to their community. Following prior work (e.g. Wang et al., 2017), these responses are treated as ratio measures, yielding the following regression equation:

Level 1 (individual level):

$$Y_{ij} = \alpha_{ij} + \beta_{ij}X'_{ij} + \varepsilon_{ij} \tag{5}$$

where  $Y_{ij}$  is self-reported cohesion measured for the  $i$ th resident in neighborhood  $j$ ;  $X'_{ij}$  is a vector of individual-level predictors, such as age, sex, and hukou status;  $\alpha_{ij}$  is the intercept for the  $j$ th neighborhood;  $\beta_{ij}$  is the regression coefficient associated with individual-level predictors; and  $\varepsilon_{ij}$  is a random error associated with the  $i$ th resident within the  $j$ th neighborhood. The neighborhood level is specified as:

Level 2 (neighborhood level):

$$\alpha_j = \gamma_0^\alpha + \gamma_1^\alpha W'_j + \eta_j^\alpha \tag{6}$$

$$\beta_j = \gamma_0^\beta + \gamma_1^\beta W'_j + \eta_j^\beta \quad (7)$$

where  $W'_j$  is the vector of neighborhood-level predictors, such as neighborhood type;  $\gamma_0^\alpha$  is the overall mean intercept adjusted for neighborhood-level predictors;  $\gamma_1^\alpha$  is the regression coefficient associated with neighborhood-level predictors relative to neighborhood-level intercept;  $\gamma_0^\beta$  is the overall mean intercept adjusted for neighborhood-level predictors;  $\gamma_1^\beta$  is the regression coefficient associated with neighborhood-level predictors relative to the neighborhood-level slope;  $\eta_j^\alpha$  and  $\eta_j^\beta$  are random errors.

To measure community participation, we construct a binary outcome such that 0 represents nonparticipation and 1 represents participation at least once in any neighborhood activities in the year preceding the survey. This coarse categorization of an underlying continuous variable  $Y_{ij}^*$  can be modeled using the multilevel linear models defined above. We use a threshold model to link the unobserved continuous variable  $Y_{ij}^*$  with the observed binary responses  $Y_{ij}$ .

We measure neighborly ties using counts of respondents' neighborhood weak ties. As this variable is over-dispersed, we use the negative binomial estimator, with a gamma distribution for the exponentiated level-1 random intercept  $\varepsilon_{ij}$ . The level-1 model is as follows:

$$\ln(\mu_{ij}) = \alpha_{jjj} + \beta_{ij} X_{ij} + \varepsilon_{ij} \quad (8)$$

where  $\mu_{ij}$  is the expectation of  $Y_{ij}$ . On level-2, individual's relative propensity to know his/her neighbors is estimated by models similar to Equations (6) and (7).

Though our approach offers advantages, it imposes at least one important limitation. We cannot make strong statements about the directions of the causality between mix and cohesion. Behaviors and attitudes are plausibly influenced by compositional factors of the neighborhood in which individuals reside (Mennis et al., 2013), while they likely jointly self-select into neighborhoods that cater to their tastes (Knies et al., 2021; McPherson et al., 2001). However, unlike in Western housing markets, in China self-selection is limited in work units and some affordable housing estates, where housing is allocated by the local state. Selection is stronger in commodity housing estates, but it remains unclear how strong the resulting bias would be, and, more importantly, whether neighborhood cohesion is associated with other determinants of housing choices, such as affordability, job opportunities, and preferences for public goods (Q. Wu et al., 2018).

## Results

Table 2 summarizes our preferred models describing the relationship between neighborhood heterogeneity and social cohesion.<sup>6</sup> If mixed housing in Nanjing offers evidence in support for the contact hypothesis, we expect to observe a positive relationship between the various heterogeneity measures and neighborhood cohesion. If instead homophily rules, neighborhood cohesion outcomes should be negatively related to neighborhood diversity.

Model 1, Table 2 presents multilevel negative binomial regression estimates predicting neighborly ties. The results suggest a complex picture. Tenure and income heterogeneity are each significantly related to neighborly ties, in opposite directions. Respondents are

**Table 2.** Multilevel regression results predicting neighborhood cohesion in Nanjing.

	<i>Model 1</i> <i>Multilevel negative binomial</i> <i>model predicting</i> <i>neighborly ties</i> <i>Incidence rate ratios</i>	<i>Model 2</i> <i>Multilevel logit model</i> <i>predicting community</i> <i>participation</i> <i>Odds ratios</i>	<i>Model 3</i> <i>Multilevel linear model</i> <i>predicting neighborhood</i> <i>attachment</i> <i>Coefficient</i>
<i>Neighborhood mix measures</i>			
Hukou heterogeneity	0.89 (0.10)	0.73 (0.17)	-0.16** (0.05)
Tenure heterogeneity	1.36** (0.14)	0.87 (0.19)	-0.07 (0.05)
Income heterogeneity	0.84* (0.07)	0.59*** (0.12)	-0.02 (0.05)
Occupational heterogeneity	0.91 (0.07)	0.92 (0.16)	-0.05 (0.04)
Educational heterogeneity	1.10 (0.09)	1.42† (0.27)	0.03 (0.04)
<i>Individual characteristics</i>			
Age	1.01*** (0.00)	1.01 (0.01)	0.01* (0.00)
Female	1.08 (0.10)	1.31 (0.27)	0.09† (0.05)
Local hukou	1.35† (0.22)	2.18* (0.76)	0.00 (0.09)
Urban hukou	1.28 (0.22)	1.21 (0.42)	0.01 (0.10)
Homeowner	0.90 (0.13)	2.32** (0.71)	-0.08 (0.08)
Length of residence	1.04*** (0.01)	1.01 (0.02)	0.00 (0.00)
Married	1.42† (0.28)	1.59 (0.67)	-0.06 (0.11)
Years of schooling	0.95** (0.02)	1.05 (0.04)	0.01 (0.01)
Household income (ln)	1.02 (0.08)	0.77 (0.14)	0.01 (0.04)
<i>Neighborhood characteristics</i>			
Subjective evaluation	1.08 (0.06)	1.36* (0.18)	0.30*** (0.03)
Objective evaluation	1.01 (0.10)	1.52* (0.32)	0.19*** (0.05)
Population density	0.83*** (0.04)	0.85† (0.08)	-0.02 (0.02)
Percentage of migrants	0.76 (0.41)	0.97 (1.09)	1.03*** (0.26)
Neighborhood type (ref=traditional neighborhoods)			
Privatized work units	0.68† (0.14)	1.11 (0.51)	-0.09 (0.11)
Commodity housing	0.86 (0.20)	0.87 (0.43)	-0.16 (0.12)
Affordable housing	3.57*** (0.87)	0.54 (0.27)	-0.28* (0.12)
Constant	16.66*** (7.99)	0.06** (0.06)	2.07*** (0.26)
Observations (Neighborhoods)	887 (32)	824 (32)	903 (32)
Intra-neighborhood correlation	0.25	0.18	0.19
AIC (Akaike's Information Criteria)	5951.65	689.86	1279.30
BIC (Bayesian Information Criteria)	6015.71	793.97	1385.73
Deviance	5903.65	646.86	1231.30
PRE (%) (Proportional reduction of error)	36.33	28.06	31.06

Notes: \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05, † p < 0.1. Standard errors are in parentheses.

more likely to build and maintain weak ties when living with a greater mix of homeowners and tenants. This implies that cohabitation provides opportunities for making social contacts in mixed neighborhoods, confirming Arthurson (2012) observation in Australia.

Meanwhile, respondents are more likely to build neighborly ties in neighborhoods with less income inequality. This might mean that disparities in income levels act as social boundaries across income groups, as demonstrated by the widespread complaints heard during fieldwork. For instance, one interviewee was very disappointed about the maintenance of his communal garden and attributed that to the “‘low *suzhi*’ (lacking quality)<sup>7</sup>” of “those *low-income* people [who] destroyed our communal gardens by growing vegetables there” (Interview with residents in Neighborhood YX, 11 April 2017). Although partly demonstrating different lifestyles and values, such a reaction appeared chiefly economic since the interviewee explicitly associated the “undesired” usage of communal garden with ‘*low income*’ neighbors.

Since heterogeneity indices have each been standardized, incidence rate ratios can be directly compared; the larger coefficient on tenure heterogeneity indicates that variation in this measure is more important than income heterogeneity in predicting neighborhood ties. Meanwhile, against an alpha of five or even ten percent, other measures of neighborhood heterogeneity do not emerge as significant predictors of neighborhood ties.

Model 2, Table 2 reports results from a multilevel logit regression predicting another indicator of behavioral cohesion: community participation. Among the various indicators of heterogeneity included in the model, only income and educational heterogeneity are related to community participation. We find a significant, negative relationship between income heterogeneity and behavioral cohesion. Participation in community social or political activities tends to be lower in neighborhoods with wider income gaps. This finding is consistent with observations from Chaskin and Joseph (2010), who argue that mixed-income developments in Chicago reinforce existing divisions among different income groups.

Meanwhile, the positive coefficient on educational heterogeneity, significant against an alpha of 10%, means that participation in neighborhood activities or community groups is linked with a wide mix of educational backgrounds.<sup>8</sup> This is supported by our observations in a choral group in Neighborhood CZ, the members of which range from primary school to university graduates. The considerable differences in educational and cultural backgrounds did not prevent interactions; one interviewee perceived it to enrich associational life by facilitating the exchange of practical information and resources, such as where to hire costumes and when to find best fruit deals (Interview with a resident in Neighborhood CZ, 17 April 2017).

Model 3, Table 2 reports predictors of neighborhood attachment, as an indication of cognitive forms of social cohesion. We find a negative and statistically significant relationship between levels of neighborhood attachment and *hukou* heterogeneity. Respondents are more likely to feel more attached to their neighborhoods when surrounded by those who share their *hukou* status. In practice, this is more likely to occur in migrant-dominant enclaves (i.e. those with non-local *hukou*), since there is also a positive correlation between attachment and migrant concentration. In *hukou* heterogeneous neighborhoods, however, ‘aversion to heterogeneity’ (Alesina & Ferrara, 2000, p. 225)

is evident. Some interviewees with local *hukou* reported preferring to make more prominent the invisible boundaries separating them from migrants. One interviewee made no effort to disguise his antipathy and hoped that “our children could sit in a class different from migrants children” (Interview with a resident in Neighborhood H, 23 November 2017). Other manifestations of neighborhood heterogeneity do not emerge as being significant predictors of neighborhood attachment.

Across these models, signs on estimates for individual and neighborhood characteristics included as controls are broadly in line with expectations drawn from prior studies. Model 1 indicates that older and married respondents, those with local *hukou*, and those who have spent longer in the neighborhood are more likely to have wider neighborhood social networks, as in He and Liu (2016). A better educated and denser population limit neighborly ties, which contrasts to Western observations (Glaeser, 2001) but echoes research conducted in China (Liu, Zhang et al., 2017). Consistent with previous studies of urban China (Liu, Wu et al., 2017; Wang et al., 2017), Model 2 shows that local *hukou*, home ownership, and a subjective evaluation of built environment are positively associated with community participation, and annual household income is negatively associated with participation. In Model 3, the built environment appears to shape neighborhood attachment. As in Wang et al. (2017), higher levels of neighborhood attachment are also found in neighborhoods with higher shares of migrants who rely heavily on local support networks.

## Conclusion and discussion

This paper aims to improve our understanding of the social effects of mixed housing, by exploring whether mixing contributes to neighborhood cohesion. Drawing on a novel survey of 918 residents in 32 neighborhoods in Nanjing, China, we explored multiple sources of neighborhood mix and their associations with different, theoretically-derived dimensions of neighborhood cohesion.

We yield both “yes” and ‘no’ answers to the question of whether mixed neighborhoods are more socially cohesive. Consistent with existing research in China (Gu & Zhou, 2015; Zhang & Liu, 2015), we find evidence relating to income and *hukou* mix that supports the homophily (‘no’) position and the ‘hunkering down’ thesis (Putnam, 2007). This also echoes skepticism about the effectiveness of mixing policies among Western scholars (Chaskin & Joseph, 2011; Graham et al., 2009; Manley et al., 2011). We detect negative relationships between income heterogeneity and behavioral cohesion, indicating that residents are less likely to make neighborhood contacts and engage in community activities in income heterogeneous communities. We also find that *hukou* heterogeneity is negatively associated with cognitive cohesion, suggesting that residents are less likely to establish an emotional attachment to their neighborhood when it is made up of a greater mixture of locals and migrants.

While these results are generally in line with previous research on ethnic fragmentation and birthplace mix (Alesina & Ferrara, 2000; McPherson et al., 2001; Mennis et al., 2013), the explanation is different. As demonstrated by the interviews, respondents articulated perceived threats relating to competition over material resources, such as communal spaces and school places. This perceived threat could plausibly overshadow more symbolic threat pertaining to group identities and behavioral expectations since China is largely

ethnically homogeneous. This perceived competition over resources widened the “invisible boundaries” between income or *hukou* groups, reducing social interactions, limiting community engagement and even spurring distrust and xenophobia.

Contrastingly, evidence relating to tenure and educational mix support the “yes” answer and the ‘contact’ hypothesis. Rather than ‘hunkering down’ (Putnam, 2007), socio-cultural forces appear to bind inhabitants together in mix-tenure or educationally diverse environments. We found that inhabitants of tenure-heterogeneous communities are more likely to establish neighborhood contacts; meanwhile, those from educationally mixed communities are more likely to get involved in neighborhood activities. These pro-diversity findings support the idea that mixed housing provides opportunities for neighborhood socialization and engagement (but not necessarily neighborhood attachment). These positive associations contrast with some findings in European and North American contexts, in which diversity is often treated as a form of inequality i.e. said to threaten cohesion (Cole & Goodchild, 2000; Costa & Kahn, 2003; Kleinhans, 2004).

One plausible explanation for the reported relationship between educational mix and social cohesion relates to the generation and exchange of localized knowledge from diverse educational backgrounds. Rather than a proxy for economic inequalities (Glaeser, 2001; Treiman, 1977) or signifier of social status (Cabrera & Najarian, 2013) as discussed widely in the European and North American contexts, we interpret disparate educational trajectories as a broad repertoire of life skills, experiences, and information, the exchange of which contribute to localized knowledge (Erickson, 1996). As demonstrated by the interviews with choral group members in Neighborhood CZ, respondents in educationally diverse groups reported broader exchanges of information, which often went beyond one’s own circles. The diversity-enabled knowledge (Breschi & Lissoni, 2001; Wixe, 2018) not only facilitates individual decision-making but also generates a feeling of connection that bridges educational differences. Moreover, knowledge-sharing is facilitated by everyday intermingling in associational and communal spaces (Wessendorf, 2013). This relies on the spatial proximity of inhabitants (Breschi & Lissoni, 2001), as what is more likely to happen in neighborhoods with a good mixture of tenure groups.

Of further note is our finding that not all heterogeneity measures are equally important, and their relative importance largely depends on the dimension of neighborhood cohesion to predict. Comparison across magnitudes estimated in this study indicates the negative impact of income mix is superseded by the positive influence of tenure mix in the prediction of neighborly ties, highlighting the importance of spatial proximity in facilitating social interactions. The comparison of magnitudes also reveals a relatively strong negative role for income heterogeneity in the prediction of community participation, compared to a weaker positive association for educational diversity. One way to interpret this is to suggest that the competition effect may outweigh the benefits of knowledge-sharing in local civic life. *Hukou* heterogeneity is the only form of mixing that matters for neighborhood attachment.

Results from this study have implications for wider debates on mixed housing and social cohesion. The complex nature of our findings confirms that both cohesion and heterogeneity are many-sided concepts; studies that do not account for this complexity risk misinterpreting the relationship of interest. For instance, neighborhoods in Nanjing can be both *hukou* heterogeneous and income-homogeneous (Figure 3). While *hukou*



heterogeneity points to relatively lower levels of neighborhood attachment, income homogeneity implies higher levels of participation and socialization. This complexity should be considered when planning housing development.

Further, macro-institutional regimes play crucial roles in managing neighborhood cohesion. In Nanjing, the *hukou* system regulates cohesion by excluding migrants from accessing certain services and social housing, acting as a force enabling segregation. This invisible boundary appears to matter most to cognitive cohesion. But, the concentration of migrants may also generate stronger neighborhood attachment. Here, people's *hukou* status has less to do with welfare provision but more to do with their hometown-based social networks. This observation fits with existing research that views these migrants as creating tight, new in-group communities (Wang et al., 2017; Zhu, 2016).

Finally, although the *hukou* system is exclusive to China, its interactions with neighborhood mix and cohesion might have wider implications. Building cohesive neighborhoods, as the Nanjing case demonstrates, calls for local attempts to redesign segregated communities. The present study suggests more attention needs to be paid to tenure and educational mix, as well as national strategies to address general problems associated with economic inequality and institutional exclusion, which would shape the wider neighborhood contexts and influence the long-term fate and fortune of neighborhoods.

## Notes

1. Readers seeking fuller reviews can turn to papers dedicated to this subject, including Bond et al. (2011), Van Der Meer and Tolsma (2014), and Tunstall and Lupton (2010).
2. Since the initiation of the New Urbanization Plan (2014), China's rural-urban dual system, which classifies citizens into agricultural and non-agricultural categories, is gradually replaced by a uniform household registration system. We, therefore, adopted the local/non-local division as the main classification of *hukou* status in this research.
3. We briefly compared key demographic characteristics of the survey and official statistics of Nanjing. The comparison shows the survey is slightly biased toward retired females and university graduates, reminding us to be cautious about the representativeness and generalizability of the survey. This drawback, however, does not significantly distract us from exploring the structural determinants of neighborhood cohesion because these groups over-represented to similar extents in all sampled neighborhoods and will not significantly bias any cross-neighborhood comparison.
4. No correlation coefficients between mix measures exceed 0.3.
5. Details regarding these criteria are available upon request.
6. For each dependent variable, we carried out intra-neighborhood correlation coefficient tests. The results showed that the clustering of respondents within neighborhoods accounted for at least 18.43% of the variations among self-report social cohesion, which necessitated the usage of multilevel models. We also found that the addition of neighborhood heterogeneity indicators improves model fit over a model restricted only to individual demographics and more tangible community characteristics. In each case, the addition of neighborhood heterogeneity measures causes a reduction in deviance, AIC and BIC, and a larger PRE percentage. We also explored the use of ordinal variables to capture neighborhood mix. In these models, following Wang et al. (2017) classification, *hukou* and tenure heterogeneity were classified into four groups by the share of local residents/homeowners: 0–20%, 21–50%, 51–75%, and 76–100%. Following Twigg et al. (2010), income and educational heterogeneity were divided

into four quartiles. However, these models fit the data less well than the models presented in section 4. Though for concision we do not present these models here, all are available upon request.

7. Although *suzhi* is widely used in discussions of educational levels, mental qualities and moral characters, we follow Kipnis (2006) and view it as a comprehensive reflection of one's socio-economic status in this research.
8. Though we would conventionally hold an alpha of 5%, given the relatively modest sample size in this study, we consider a somewhat wider threshold for statistical significance.

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