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Exploring the Susceptibility of Gentrification in Taipei City, Taiwan

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1 ABSTRACT

Gentrification is a dynamic process due to historically disinvested neighbourhoods experience susceptible class displacement in spatially concentrated areas. The attraction of the physical environment might encourage change of social class in local areas, and such replacement might push the original residents and others who might also suceptible outward to the marginal area or even further areas. The susceptible class includes elder, poorly educated, lower income, and people of colour, while the middle- and upper-class residents who are relatively younger, highly educated, and higher income may be able to stay. Taipei city is the captial and a municipality located in northern Taiwan. The population of Taipei city is around 2.5 million in 2022, and is part of Taipei–Keelung metropolitan area which is the 40th most-populous urban area in the world. The investment in transit and urban renewal projects have stimulated gentrification in Taipei city in the past, present and will do so in the future. Therefore, this study attempts to explore the susceptibility of gentrification for different neighbourhoods at two approaches in Taipei city. The first level is to identify various stages (including early, mid- current, late) of gentrification based upon small sets of indicators based upon real estate value and demographic changes. During the first phase, the temporal and spatial patterns of gentrifictaion will be analysed. The second phase will then apply principle component analysis (PCA) to explore social-economic indicators related to gentrification in various stages of genetrification. The outcome of the principle component analysis can help monitor changing conditions among various stages of gentrification and come up with an appropriate public response to the negative impacts of gentrification.

Keywords: Metropolitan Planning, Taipei city, Principle component analysis, Susceptibility, Gentrification

2 INTRODUCTION

The term gentrification first used in 1964 is indicating that the working class has been successively displaced by the middle class (Glass, 1964). Since then, there are interesting studies attempting to respond to key issues of gentrification in the past fifty years, such as the definition (Hofmeister, 1993; Smith and Williams, 1986), the types, the driving forces, and the impacts (Zuk et al., 2015; Engels, 1994; Bourne, 1993). The classic type of gentrification is proposed by Ruth Glass (1964), and many other types have been identified including new-build gentrification, 'studentification', and rural gentrification (Davidson and Lees, 2010; Lees et al., 2008; Davidson and Lees, 2005; Phillips, 2004). No matter the type, it is quite common to find gentrification in places which have been undergoing the depreciation or deterioration of the built environment and anticipating potential profit return from such land (Smith, 1979). Due to the attraction of the physical environment it might encourage the change of social class in local areas. Such replacement might push the original residents and others who might also be susceptible outward to the marginal area or even further areas of the city. As a result, upgrading the built environment will directly increase land rent and further lead to other indirect impacts, such as the increment of real estate price, the replacement of social classes, the change of industrial activities, and the change of individuals' living behaviours and others (Elliott-Cooper et al., 2020; Ghaffari et al., 2018; Zuk et al., 2018; Ding et al., 2016; Freeman et al., 2016).

Residential displacement is a well-known impact resulting from gentrification, including moving out by choice or through eviction (voluntary or involuntary). Although, the empirical findings of the displacement caused by gentrification is inconclusive and no consistent evidence shows which susceptible households are more likely to move. Some studies find evidence showing the shift of economic status, racial composition, population composition in gentrifying neighbourhoods (McKinnish et al., 2010; Crowder and South, 2005). Conversely, some studies find only few variations between gentrifying and nongentrifying neighbourhoods (Ellen and O'Regan, 2011; Freeman, 2005). Still, there is a filtering process in gentrified areas due to the physical renovation of deteriorated housing and built environment (Lees et al., 2008). A combination of 'push' and 'pull' factors compose the key agents in the filtering process of in-movers and out-movers. In-movers are people often described as those with higher income, higher education attainment levels (Hamnett, 1991), while out-movers are susceptible groups such as the elderly, low-income earners, renters, those with low educational attainment levels, and/or persons and households of colour (Ding et al., 2016).

Gentrification is a dynamic process due to historically disinvested neighbourhoods experience with susceptible class displacement in spatially concentrated areas (Smith, 1998). Both qualitative and quantitative methods are applied to unfold gentrification over time and analyse the phenomenon of gentrification (Brown-Saracino, 2010; Davidson and Lees, 2005). A number of efforts incorporate available data including income, race, educational attainment, housing values, rent, and others to categorise the pattern and/or status of gentrification. Chapple (2009) applies a geographic information system to mapping susceptibility to gentrification based on the indicators of affordable housing programmes. Owens (2012) utilised cluster analysis to explore transitions among urban neighbourhood changes. Bates (2013) applied indicators to separate various stages of gentrification and then to measure the risk of gentrification. Ding et al. (2016) compared residential mobility among various kinds of gentrification categories based on intensity.

To sum up, gentrification has changed the living environment, the character, the population composition of urban neighbourhoods in cities worldwide. Taipei City, the capital city in Taiwan, has been undergoing significant public and private investments, the steep rise of housing price has further changed both in demographic and economic status of residents. The status and the features of displacement caused by gentrification is Taipei City is relatively little researched. The purpose of this study is to understand susceptibility of gentrification better and to come up with appropriate practices to address gentrification for Taipei City. The approach to exploring the socio-economic features of susceptible areas to gentrification has two phases. At the beginning, a relatively small set of indicators including the housing market conditions and demographic change are applied to identify various stages of gentrification in the study area, and the results will be represented as potential targets for emerging at-risk neighbourhoods. The study then applies principle component analysis (PCA) to explore key components among various stages of gentrification. The results of PCA could help to understand the socio-economic features of a particular area towards appropriate strategies to solve the disproportionately impact on present or susceptible residents.

3 RESEARCH DESIGN

3.1 Research Model

Based on past definitions of gentrification, the definition applied in the study is the change of housing market and demographic change. There are two parst of analysis in the study, including the stage of gentrification and the susceptibility of gentrification. In the first phase, a relatively small set of indicators including the housing market conditions and the demographic changes are applied. In the second phase, principle component analysis is used to explore the susceptibility of gentrification.
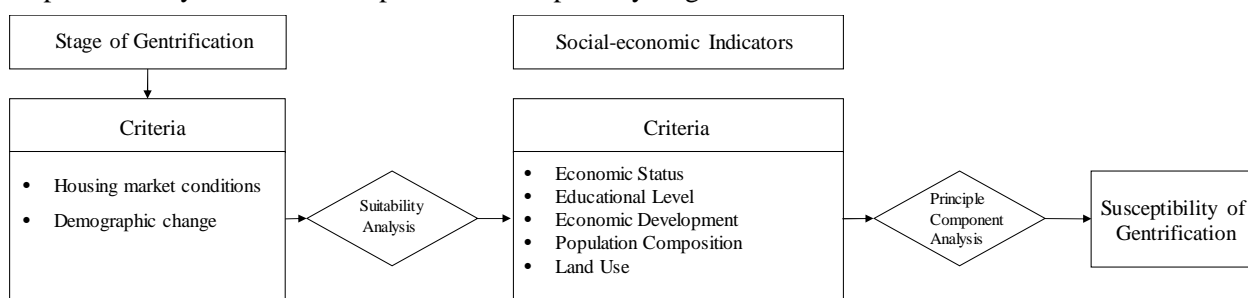

Fig. 1:Conceptual model.

3.2 Study area – Taipei City

Taipei city is the capital and a special municipality located in northern Taiwan. The population of Taipei city is around 2.5 million in 2022, and is part of Taipei–Keelung metropolitan area which together are the 40th most-populous urban area in the world. The study examines the stages and the key component of gentrification in Taipei City from 2012-2019. Like many cities worldwide, gentrification has accelerated its pace in Taipei City. Taipei City has several characteristics which contribute to the rapid gentrification over decades. With the vivid downtown and several major public investments (e.g., Taipei MRT system), Taipei City has a strong and stable economic development and attractiveness for the working class. In addition, large amounts of public investments are attributed to up-grading utilities and facilities in Taipei city which has further stimulated public and private urban renewal projects. As a whole, the investment in transit and urban renewal projects has stimulated gentrification in Taipei city in the past, present and will do so in the

future. Therefore, this study attempts to explore the susceptibility of gentrification for different neighbourhoods in Taipei city, Taiwan.

3.3 Indicators for gentrification susceptibility

The operational definition applied in this study is the change of the housing market, vulnerability to displacement, and demographic change. When gentrification occurs it might create a disconnection between potential value and current value. Once the areas become desirable they would further appeal to developers and/or higher-income households, and there will be a steep rise in housing market. Therefore, both household income and university degree are applied as the indicators of vulnerability to displacement. The categorisation of low, moderate, or high is based on how an individual "Li" compares to the citywide average.

There are three main categories to capture the stage of gentrification: early, mid and later. In the early stage three types are distinguished in 2019 which are at-risk or have early signs of gentrification. Type 1 is close to high-value and high-appreciation, but housing values and appreciation rates remain low or moderate, there is no sign of demographic change. and for both appreciation rates in household income and university degrees stay low. Type 2 is experiencing a high-appreciation rate but housing values remain low or moderate and there is no sign of demographic change. In type 3 housing values remain low or moderate, but it has experienced high-appreciation rate and ia close to high-value and high-appreciation. The mid stage indicates that units are undergoing significant impacts from gentrification. Although mid units remain low and housing values moderate, they are experiencing high-appreciation rates in the housing market and significant change in demographic and there is moderate and high appreciation rate in household income and university degree. Two types of units are regarded as later category. In 2012 housing value in type 1 was low and moderate but then became high-value in 2019. In addition, it is experiencing moderate and high appreciation in household income and university degree. Housing value in type 2 was low and moderate in 2012 but became high in 2019, and both household income and university degree are moderate and high in 2019.

Public and private investments would displace local existing businesses and change the neighbourhood features (de Oliver, 2016), and further shift social networks and culture context (Betancur, 2011). In addition, the improvement of the neighbourhood results in rising home values and rents, and such an increment might force residents to move out (Anguelovski, 2016; Fullilove, 2004). Although there is little agreement on the negative impacts on gentrification, the improvement of a neighborhood might accompany racial displacement (Pattillo, 2007), income shift (Ellen and O'Regan, 2011), or socioeconomic upgrading (Ding et al., 2016). Existing residents who are often older, poorly educated, with low-income, and/or person of coloured households are displaceds by those who are relative young, highly educated, middle- and upper-class, and/or person of white households (Marcuse, 1985). A number of efforts applied indicators to identify gentrification neighbourhoods or risk of gentrification tracts. In this study, the four main sources referred to are Rigolon & Németh (2019), Chapple et al., (2017), Bates (2013), and Freeman (2005).

Freeman (2005) applied national sample and census tracts to measure residential mobility and displacement among gentrifying and nongentrifying neighbourhoods but with potential. Five indicators were used including housing prices, educational attainment level, poverty rate, colour of household, and household income. Bates (2013) categorised gentrifying neighbourhoods based on housing market condition, vulnerability to gentrification and demographic change, and used dozens of indicators (including demographic change, median home value, educational attainment level, communities of colour, median household income) to explore socio-economic features among various stages of gentrification. Chapple et al. (2017) defined four criteria, and if any tracts which meet three out of four will be considered as gentrifying neighbourhoods. The four criteria includes high percentages of low-income households, people without a college degree, renters, and people of colour. Multiple indicators such as housing price, white residents, median rents, college-educated people, and income are applied to analyse gentrified neighbourhood features. Rigolon & Németh (2019) gathered total population amount, people with bachelor's degree, coloured people, household income, rent, home value, and housing units.

In total, based on past literature review and data limitation in Taiwan, the period is 2012-2019, because of the disclosure of information on actual price registration of real estate transactions has been implemented in 2012. The indicators applied to measure gentrification susceptibility include economic status, educational level, population composition, and land use.

Indicators		Description	Source
Economic Status	Housing Value	Median value of owner-occupied housing units	Dept. of Land Administration, M. O. I
	% People of low income [a]	Percentage of low income people	Dept. of Social Welfare, Taipei City Government
Educational Level	% Bachelor Degree or Higher	Percentage of people aged 15 or older with at least a bachelor's degree	Dept. of Household Registration, M. O. I
Population Composition	% 15-64 year-old people	Percentage of 15-64 year-old people	Dept. of Household Registration, M. O. I
	% over 65 year-old people	Percentage of people over 65 year-old	
Land Use	% Residential Use	Ratio between total amount of residential use and the area of 2nd statistic area	National Land Surveying and Mapping Center, M. O. I
	% Industrial Use	Ratio between total amount of industrial use and the area of 2nd statistic area	
	% Commercial Use	Ratio between total amount of commercial use and the area of 2nd statistic area	
	% Public Facilities [b]	Ratio between total amount of public facilities use and the area of 2nd statistic area	

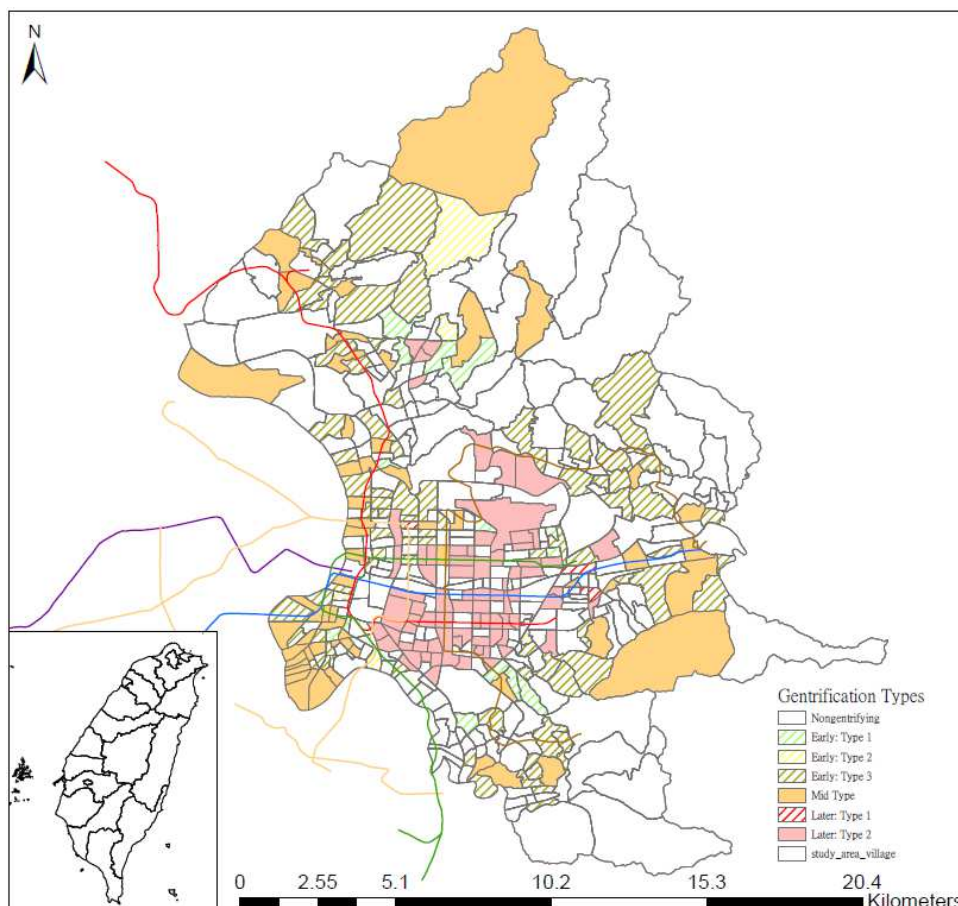Table 1: Indicators for exploring gentrification susceptibility

Fig. 2: Gentrification Types.

4 RESULTS

4.1 Gentrification types

The gentrification typology is applied to Taipei based upon the spatial unit of "li", and the map highlights the early, mid, and late stages of gentrification in housing market condition and demographic change. 102 li

belong to the early stage and are located in the outer areas of Taipei. 79 li belong to ther late stage, and are located in the inner city. 58 li belong to the mid stage, and are located in between thr early stage and late stage areas.

4.2 Susceptibility features

The nine attributes describing the physical environment were presented in Table 2 to Table 4. These are housing value, % people of low income, % bachelor degree or higher, % 15-64 year-old people, % over 65 year-old people, % residential use, % industrial use, % commercial use, and % public facilities.

For the early stage, PCA extracted three components that explained 63.2% of the variance and 0.608 of the KMO value (Table 2). The attributes % bachelor degree or higher, % 15-64 year-old people, % over 65 year-old people, % residential use, and % commercial use show a high positive correlation within Early_PC1 and explained 28.9% of the variance. For purposes of descriptive clarity, this combination of attributes that make up Early_PC1 was labelled "strong working population". The second principal component, Early_PC2, explained 21.7% of the variance with the attributed % industrial use and % commercial use; this combination of attributes was labelled "economic growth". The attributes % people of low income and % over 65 year-old people are highly positive within Early_PC3 and explained 12.6% of the variance; the combination of the attributes was renamed as "vulnerable population".

	Component		
	Early_PC1	Early_PC2	Early_PC3
Housing value	0.348	-0.337	-0.562
% People of low income	-0.357	0.372	0.583
% Bachelor Degree or Higher	0.714	-0.562	-0.050
% 15-64 year-old people	0.689	-0.370	0.343
% over 65 year-old people	0.554	-0.204	0.537
% Residential Use	0.712	0.440	0.005
% Industrial Use	0.276	0.671	-0.248
% Commercial Use	0.615	0.649	-0.014
% Public Facilities	0.315	0.383	-0.066
Eigenvalue	23599	1.957	1.131
Proportion (%)	28.883	21.742	12.565
Cumulative (%)	28.883	50.625	63.190
KMO	0.608		
Bartlett test	Test value: 569.763, degrees of freedom: 36		

Table 2: Component matrix of early stage.

For the mid stage, PCA extracted three components that explained 63.2% of the variance and 0.556 of the KMO value (Table 3). The first principal component Mid_PC1 shows high positive correlations with % bachelor degree or higher, % 15-64 year-old people, and % over 65 year-old people, explaining 28.8% of the variance; this combination of attributes was referred to as "strong working population". The attributes % residential use, % industrial use, and % commercial use show high positive correlation in Mid-PC2 and explained 19.5% of the variance; Mid_PC2 was renamed "economic growth". Mid_PC3 (working class and low income) explained 14.8% of the variance with the attributes % people of low income and % industrial use. Mid_PC3 was renamed "vulnerable population".

	Component		
	Mid_PC1	Mid_PC2	Mid_PC3
Housing value	0.323	0.494	-0.552
% People of low income	0.169	0.061	0.821
% Bachelor Degree or Higher	0.869	-0.088	-0.235
% 15-64 year-old people	0.938	0.042	0.111
% over 65 year-old people	0.843	0.079	0.112
% Residential Use	0.180	0.744	-0.090
% Industrial Use	-0.084	0.463	0.524
% Commercial Use	-0.081	0.754	0.025
% Public Facilities b	-0.027	0.448	0.128
Eigenvalue	2.595	1.758	1.331
Proportion (%)	28.833	19.532	14.785
Cumulative (%)	28.833	48.365	63.150
KMO	0.556		
Bartlett test	Test value: 595.465, degrees of freedom: 36		

Table 3: Component matrix of mid stage.

For the late stage, PCA extracted three components that explained 64.5% of the variance and 0.578 of the KMO value (Table 4). Late_PC1 (strong working population) explained 32% of the variance with the

attributes % bachelor degree or higher, % 15-64 year-old people, % over 65 year-old people, % residential use, and % commercial use. The second principal component Late_PC2 (economic growth) explains 18.1% of the variance with the attributes % people of low income, % industrial use, % commercial use, and % public facilities. Late_PC3 (better living environment) explained 14.3% of the variance with the attributes housing value and % public facilities.

| | Component | | |
	Late_PC1	Late_PC2	Late_PC3
Housing value	0.279	-0.307	0.534
% People of low income	0.170	0.476	-0.650
% Bachelor Degree or Higher	0.873	-0.332	0.098
% 15-64 year-old people	0.909	-0.017	-0.226
% over 65 year-old people	0.805	-0.288	-0.181
% Residential Use	0.646	0.368	0.195
% Industrial Use	0.140	0.584	-0.081
% Commercial Use	0.532	0.466	0.255
% Public Facilities	-0.042	0.587	0.523
Eigenvalue	2.877	1.633	1.291
Proportion (%)	31.969	18.144	14.347
Cumulative (%)	31.969	50.113	64.460
KMO	0.578		
Bartlett test	Test value: 932.164, degrees of freedom: 36		

Table 4: Component matrix of late stage.

5 DISCUSSION

The results show that vulnerable population, especially the combination of % people of low income and % over 65 year-old people and the combination of % people with low income and % industrial use, exist in both early and mid stage. Although % people of low income also exist in the late stage, but with % industrial use, % commercial use, and % public facilities, indicate that the strong demographic shift might change the amount of vulnerable population. In addition, the combination of housing value and % public facilities representing an improved living environment have increased housing value in the late stage. Economic growth exists in all stages indicating that strong economic activities might attract more highly educated population in such areas. To sum up, there are similarities and divergences among the three stages. Areas where are undergoing gentrification, it seems to have siginifcant features on labour force and economic development. In all three stages, "strong working population" and "economic growth" are the signifcant compositions. As for the divergence, there is vulnerable population before mid stage while it become less significant in the late stage of gentrification. For the positive effect, gentrification indeed revitalize neighborhoods and local businesses. However, numerous consequences include increase in rental leases, higher real estate prices, changes in industrial activities and commercial services, displacement of the already vulnerable residents to either a nearby marginal area or a location further out, and a cascade of disruptions in the lives of the displaced (Elliott-Cooper et al., 2020; Ghaffari et al., 2018; Zuk et al., 2018; Ding et al., 2016; Freeman et al., 2016).

In order to cope with the displacement of vulnerable residents, there have been many strategies studied previously. These include affordable housing production strategies, preservation strategies, tenant protections and suppoprt, and asset building and local economic development (Chapple et al., 2017). There are multiple ways such as impact fees from the private housing market (Kim, 2011) and housing trust funds (Calavita and Grimes, 1992) are fiscal ways to create affordable housing. Taxing and land use controls are possible ways such as property tax exemptions for particular owners and integrate inclusionary housing requirements into zoning regulations to incentivize affordable housing development (Hickey 2014). Lastly, cities can invest and build up city-owned affordable housing on public land (Hickey and Sturtevant, 2015b). Due to the fiscal limitation, the supply of affordable housing might not catch up the displacement of vulnerable residents. Therefore, rent control would be a fisible approach in the short-term. The rent control allows vulnerable residents to stay at the existing neighborhood for relative stable and secure of tenure (Ellen and O'Flaherty, 2013). However, some studies found out rent control might reduce the the quality and quantity of rental units for relative low return on rents (Freeman and Braconi, 2004; Keating et al. 1998). Tenant protections and support limits landlords of having 'just cause' to do the further eviction on tenants (Winstead, 2006). Last but not least, it is important to support local economic development to vulnerable

residents. This way, the accumulation of fortune might increase the capacity of affording housing and living standard in gentrifed areas (Lester, 2009; Page-Adams and Sherraden, 1997).

6 CONCLUSION

The driving forces of gentrification might include public-sector investment in transit, upgrading of utilities and facilities, urban renewal and others, and such investments are positive in revitalising neighbourhoods and local businesses. However, the upgrading built enviornmnet will directly increase land rent and further lead to other indiret impacts such as the replacement of social classes, the increment of real estate price, the change of industrial activities, and the change of individuals' living behaviours and so on. This study attempts to explore the susceptibility of gentrification for different neighbourhoods through two phases of analysis in Taipei city, Taiwan. The first phase is to identify various stages (including early, mid, and late) of gentrification ny means of small sets of indicatos based on real estate value changes and demographic changes. During the first phase, the temporal and spatial patterns of gentrifictaion are analysed. The second phase applies principle component analysis (PCA) to explore social-economic indicators related to gentrification in various stages of genetrification. Overall, the outcome of the principal component analysis can help monitor changing conditions among various stages of gentrification and come up with appropriate public response to the negative impacts of gentrification.

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