

Housing inequality in relation to housing tenure: Evidence from Ho Chi Minh City

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ABSTRACT

Unfair distribution of social resources, including valuable assets such as housing, leads to inequality and threatens the sustainable development of countries. This phenomenon is a hot issue, attracting the attention of many researchers worldwide. Ho Chi Minh City is considered one of the economic-financial centers of Vietnam, with a high average annual GDP growth rate, rapid urbanization, and the flow of migrant workers to live and work has increased rapidly in recent years. Although many achievements are based on outstanding developments, Ho Chi Minh city has faced many difficulties in housing policy due to the limited urban land fund, colossal population, and housing prices many times higher than the residents' income. It is shown that there are difficulties in access to affordable housing in Ho Chi Minh City, especially for the population's low- and middle-income segments. This creates inequality and considerable pressure on housing development policy in urban areas. The article uses OLS regression to analyze issues related to housing inequality in Ho Chi Minh City in the relation to living space and homeownership, then gives some implications for housing policy toward improving the quality of living standards in terms of residential conditions. Research data is taken from a survey of 700 households in Ho Chi Minh City conducted by the author in 2020. The results show that household income, working time, age, education, household size, and a household with small business activity at home affect the household living space area. In addition, these factors have different impacts on families with housing tenure. The author believes that in the future, the government should focus on improving education, providing stable jobs, and planning suitable housing places to ensure equitable distribution of social resources, including housing.

Key words: Housing Inequality, Housing policy, Ho Chi Minh City

INTRODUCTION

Ho Chi Minh City is one of the economic-financial centers of Vietnam, with a high average annual GDP growth rate, rapid urbanization, and the flow of migrant workers to live and work has increased rapidly in recent years. According to the report of the People's Committee of Ho Chi Minh City, the population in the city as of April, 2019, is up to nearly 9 million people (but in fact, nearly 13 million people are living, studying, and working), increasing 1.8 million people compared to 2009; the average growth rate of 2.28%; household size is 3.51 people/household, of which 66.4% of households have 2-4 people. Every year, the city attracts approximately 200,000 thousand immigrants. The rapid population growth has caused many difficulties and obstacles to social security policies, especially the development of urban housing to solve the urgent housing requirements.

According to the preliminary results of the 2019 Population and Housing Census¹, the country's average housing area per capita in 2019 was 23.5m²/person.

The housing area per capita in urban areas is higher than in rural areas, respectively 24.9m²/person and 22.7m²/person. Compared with the figures in 2009, the housing area per capita increased by 6.8m²/person. Although the living conditions have gradually improved, some households still live in houses with limited space. About 690,000 families in urban areas (equivalent to about 3.2 million people) live in housing conditions with an average area of fewer than 6 square meters/per person. Housing price in Vietnam has constantly been increasing in recent years also contributing to limiting people's ability to access houses, especially in big cities. According to a survey from Navigos in 2019-2020, housing prices in Ho Chi Minh City were many times higher than the residents' income. Specifically, with the average income of graduates (the lowest level in the survey group is 72 million VND/year), house prices were 28 times higher than their income, and with long-term experience participants (120 million VND/yea the figure was 17 times higher. On average, it takes workers in Ho Chi Minh City about 20 to 30 years to buy

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an apartment in the middle - low segment, while in other developed countries, it only takes 7 to 10 years. The above analysis shows difficulties in access to affordable housing in Ho Chi Minh City, especially for the population's low- and middle-income segments. This creates inequality as well as considerable pressure on housing development policy in urban areas. In general, studies are interested in analyzing housing inequality in terms of housing expenditure, living space, or housing quality among different groups of people or living areas in different societies (Ahmad (2012)², Bian & Lu (2014)³, Liu & Meng (2019)⁴). Moreover, several studies are interested in analyzing housing inequality regarding residential property ownership and income (Filandri and Olagnaro (2014)⁵, Ben-Shahar et al. (2018)⁶, Chen et al. (2017)⁷, Kathrin Kolb et al. (2012)⁸). The article uses the Housing Survey conducted by the author in Ho Chi Minh City in the year 2020 to examine which factors affect housing quality and answers the question if there is housing inequality or differences in access to housing quality standards in terms of ownership, thereby providing several policy implications for housing development associated with improving the quality of life and sustainable development of urban space.

LITERATURE REVIEW

The United Nations (1991) realizes that adequacy is determined by various social, economic, cultural, climatic, ecological, and other factors. The general guidelines provided by the UN-Habitat (2009) cover not only the physical and territorial dimensions but also cultural adequacy, accessibility for disadvantaged groups, and legal security of tenure. Independent of the definition, housing adequacy is closely associated with household housing consumption, which encompasses broader housing quality and quantity ranges from the physical condition to housing tenure and investment.

Inequality in housing, is always a hot issue, attracting the attention of many researchers. In general, studies are interested in analyzing housing inequality in terms of housing expenditure, living space, or housing quality among different groups of people in one society or in the others. Ahmad (2012) approached housing inequality based on housing expenditure. The author believed that income improvement strategies associated with the orientation of career decentralization would be one of the strategies to help reduce housing inequality. Bian & Lu (2014) analyzed housing inequality through the criterion of living space. The authors suggested that in areas with a high level of mar-

ketization, living standards would be higher. Therefore, market mechanisms were one of the factors that caused housing equality. Liu & Meng (2019) analyzed housing inequality based on housing quality and argued that household living in their private houses had better conditions than renters, dormitories, or sharing a room with others.

Several studies are interested in analyzing housing inequality regarding residential property ownership and income. Filandri and Olagnaro (2014) examined the difference in housing conditions of social classes in European countries, focusing mainly on two aspects: type of home ownership and residential property (Housing well-being). The authors concluded that variation in housing characteristics and city-to-city variation explain only a portion of housing inequality and that high homeownership rates reduce inequality in housing. However, housing inequality would grow with increasing income inequality. Ben-Shahar et al. (2018) estimated housing accessibility based on the adjusted consumption coefficient when studying house price trends and housing affordability of the low-income population in Vietnam. The authors found that low income led to housing problems. Increasing mortgage rates would widen the housing access gap and cause natural and income inequality trends. Chen et al. (2017) concluded that there was a gap existed between indigenous peoples and immigrants regarding housing conditions and ownership relationships. The increase in the share of homeownership significantly impacts the home distribution system and led to an imbalance in the structure of the home distribution system. Kathrin Kolb et al. (2012) measured housing inequality in 13 European countries concerning home ownership patterns. They concluded that immigration had a negative impact on the identity of the homeownership rate of people and there is no relationship between the homeownership rate and the house value.

The models applied when analyzing and researching housing inequality mainly include: OLS, Logit, Multinomial Logit models or statistical techniques, and data analysis. The factors affecting housing inequality differ for different housing markets in other countries. In countries with high divergence in housing inequality, it limits the access to housing goods for low- and middle-income people. This also requires empirical studies to analyze and verify the impact of housing inequality in developed cities like Ho Chi Minh City, from which suggestions and contributions are related to housing.

DATA AND METHOD

Data

The sample size: Each statistical analysis method requires a different sample size. Researchers often rely on empirical formulas to calculate sample size for statistical analysis methods. For the case where the population size can be determined, the sample size is determined by the formula:

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

In there:

n: Number of samples to be determined

N: Overall quantity

e: Allowable error. Selectable $e = \pm 0.01$ (1%), ± 0.05 (5%), ± 0.1 (10%).

The larger the sample size, the smaller the sampling error. Depending on the conditions of time and resources, the researcher can decide on the mistake we choose. However, a maximum error of 10% is allowed. If the author chooses the error of 1% and knows that the number of households (N) in Ho Chi Minh city is 2,500,000, the required sample size from the above formula is 100. This article chooses to survey about 700 households in Ho Chi Minh city. Therefore, the sample size is more significant than needed to achieve a 1% error.

Research data was collected through interviews with housing-related issues of 700 households in Ho Chi Minh City in 2020, randomly selected based on the list of families. Households in the 2019 Population and Housing Census. Based on the list of selected households, the interviewer will contact the household for permission to interview. If the family refuses or is not at home after two approaches, the interviewer will interview the nearest neighbor instead. If the address is not found, the household will be replaced with another randomly selected family. The questionnaire is divided into two main parts: In the first part, the author collects information on households, such as household income, occupation, age, marriage, professional qualifications, the proportion of older people, percentage of young people. Children in families and areas of residence; The second part concerns housing-related content such as home ownership, housing expenditures and their components, and home loan interest (if any). The interviewee must be a household member and fully understand the information related to the questionnaire. Housekeepers, employees are not subjects of the interview.

Measurement

Housing tenure

According to OECD housing tenure refers to agreements under which households can own and use all or part of a housing unit. Common forms include personal ownership, full house rental, or partial rental of a residential unit. In Vietnam, if we divide housing tenure based on the right to dispose of property, there generally are two types. The first one is personal ownership, which is a form of ownership includes the right to use and dispose of assets. The second is a form of a rental ship, a type of ownership in which the tenant has only the right to use but not the right to dispose of the real estate. It can be seen that the decision to own a house is a personal decision of the nuclear family - even an adult individual. Therefore, delving into the aspect of home ownership in Vietnam, based on the division of property according to an individual perspective including only interviewers or their spouses, different forms of ownership can be divided in three types: (1) A house owned by an individual or by a couple (referred to as individual ownership); (2) Rented house; (3) The house is owned by another member of the household.

Housing inequality in relation to housing tenure

According to Aladangady (2017), housing inequality was often related to consumption and inequality in the distribution of housing assets. Housing always accounts for a large and stable proportion of household expenditure. Housing inequality is often associated with income inequality. However, they are also related to the living space or the costs people must pay for housing in different areas.

Ben-Shahar and Warszawski (2015)⁶ found that there are multiple ways to measure housing accessibility: home loan/income, expenditure/income (Brounen et al., 2006⁹; Haffner & Heylen, 2011¹⁰; Kim & Cho, 2010¹¹; Mayer and Engelhardt, 1996¹²; Norris & Shiels, 2007¹³); Quigley & Raphael, 2004¹⁴; Stone, 2006¹⁵). Several studies have observed affordability among populations stratified by socioeconomic and demographic characteristics such as income, poverty status, race, and ethnicity, focusing on analyzing housing inequality through income indicators. In the literature, the Gini coefficient is often used to estimate income inequality (Alderson & Nielsen, 2002¹⁶; Frank, 2009¹⁷; Jantti & Jenkins, 2010¹⁸; Leigh, 2007¹⁹).

In addition, the Gini coefficient for income has been extended and implemented to measure inequality

in other areas such as education and human capital (Foldvari & Van Leeuwen, 2011)²⁰, consumption of fossil resources (Papathanasopoulou & Jackson, 2009)²¹, ecological interests (Ruitenbeek, 1996)²², State of innovation activity and spillover of R&D (Audretsch & Feldman, 1996)²³, enterprise size by industry and locality (Jovanovic, 1982)²⁴. In the housing literature, the Gini coefficient approach has been applied by Buckley & Gurenko, 1997²⁵ to measure the impact of housing subsidies on the inequality of living space; by Landis et al., 2002²⁶ to measure inequality in housing value, housing costs, and monthly rent; and Henley, 2003²⁷ to study changes in housing distribution. Robinson et al., 1985²⁸ applied the Gini coefficient to measure inequality in housing expenditure. In addition, studies by Tilly, 2006²⁹ and Matlack & Vigdor, 2008³⁰ discuss the link between income inequality and housing affordability challenges. More recently, Dewilde (2011)³¹, Dewilde & Lancee (2012)³², and Norris & Winston (2012)³³ relate income inequality to home ownership and ownership inequality.

Method

The article regresses the equations by the OLS method, with the dependent variable is the housing area per capita. Accordingly, there will be one general equation and three separate equations for each group (living in their private house, living in their relatives' house, and renters).

$$Y = C_i^{n=0 \rightarrow 3} + \alpha_1 \ln Y_i + \alpha_3 D_i + \alpha_4 F_i + u_i \quad (2)$$

Where C_i housing area per capita or Y_i is the living area per capita; D_i are the characteristics of the main labour in the family, F_i are the characteristics of the household, $n = 0$ general regression equation for households in the observed sample; $n = 1$: regression for the family that owns the house in which they live; $n = 2$: regression for families living at home owned by another member and staying at a relative's house; $n = 3$ regression for the group of rental families.

DESCRIPTIVE ANALYSIS

Table 1 illustrates the summary of variables included in the model. The dependent variable is the Logarithmic value of living space per capita. The independent variables are the average income/month/person of households, characteristics of the main labor (working time, education, career, age, gender, marital status), the demography characteristics of households (rate of children, rate of older, household size, families with the business activity in the living space).

Table 2 presents the statistical results of continuous variables used in the model. Accordingly, the average housing area per person of the household is 26.17 square meters; the total average income/ per person/per month of the household is 5,422,000 VND; the average household size is 4.5 person/per household; the average rate of children is 6.65%; the average rate of older people is 10.18%; The average age of the main income member is 43.7 years old and the average working time is about 9.8 years.

Table 3 presents statistics of discrete variables applied in the model. According, the main employees with the profession as lecturers accounted for 25.19%, followed by unskilled laborers accounted for 23.08%; office workers accounted for 14.93%; people working in the fields of tourism, traffic and transportation accounted for 11.16%, students, pensioners, and unemployed accounted for 5.88%, and other occupations accounted for 8.6%. Regarding the main income level, high school accounted for the highest proportion at 28.66%, followed by the lower secondary school with 24.74%; university and graduate accounted for 20.66%; primary and lower primary school accounts for 15.08%; and college degree accounts for 10.86%. The percentage of households with business organizations or small businesses in nah2 accounted for 21.18%. Regarding the form of house ownership, the percentage of households owning houses is the highest, accounting for 56.73%; followed by living with other household members at 23% and staying with 20.27%.

Table 4 presents the statistical results of the living space according to the form of house ownership. Accordingly, households living in private houses have a living space per capita of about 29.7 square meters. This value for renters is 19.78 square meters, and staying with other members of the household is 22.88 square meters.

RESULTS AND DISCUSSIONS

Table 5 presents seven regression results of the OLS model, with the dependent variable being the average housing area/per person. The R square index is 0.249, and the Mean VIP = 1.53 in Table 6 shows that the model has no multicollinearity problem. The author used the Robust Standard Errors Model developed by White (1980) and proposed using the standard solid error method to overcome the variance of the error changes, causing the estimated coefficients to be distorted bias in the OLS model.

Regarding the regression according to the indicator of living space, the author regressed one ordinary equation for the entire sample and three separate equa-

Table 1: Summary of variables included in the model

Criteria	Description
Dependent variable	
Y	i : Logarithmic value of living space per capita
Independent variable	
income_per	Average income/month/person of households (VND)
time_emp	Working time of main income member (year)
age	Age of main income member (years)
gender	Main income member's gender (age)
career	Career of references member: - Unskill labour (rererence) - Staff - Working in the field of transport and tourism Manager - House keeper - Teacher
education	Education of references member: - Primary and lower elementary (reference) - Junior high school - High school - Intermediate college - University and graduate school
mar_status	Marital status of main earner (1 = Yes, 0 = No)
hh_size	Number of members in a family (person)
rate_child	Rate of children (under six years old) (%)
rate_older	Rate of orders (over 60 years old) (%)
H_product	Households with the business activity in the living space (1 = Yes, 0 = No)

Table 2: Statistics of continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Average residential area	663	26.117	27.619	1.5	280
Total income per person per month (million VND)	663	5.422	5.047	0.417	60
Duration of working time of main earner (year)	663	9.766	8.821	0	53
Houshold size	663	4.555	2.363	1	25
Rate of children (<6 years)	663	6.643	12.360	0	66.667
Rate of elder (<60 years)	663	10.176	16.189	0	100
Age of main earner	663	43.691	11.518	18	86

Table 3: Statistics of discrete variables

Criteria	Freq.	Percent	Cum.
Career of main labour			
Unskill labour	153	23.08	23.08
Staff	99	14.93	38.01
Working in the field of transport and tourism	74	11.16	49.17
Lecturer	167	25.19	74.36
Jobless	39	5.88	80.24
Self-employ	74	11.16	91.4
Others	57	8.6	100
Education of main labour			
Primary and lower	100	15.08	15.08
Secondary	164	24.74	39.82
High school	190	28.66	68.48
College	72	10.86	79.34
University and post-graduate	137	20.66	100
Marital status of main labour			
Married	521	78.82	78.82
Single	140	21.18	100
Household with production in the living space			
No	457	68.93	68.93
Yes	206	31.07	100
Housing tenure			
Private house	375	56.73	56.73
Living with other member of the family	152	23	79.73
Rent	134	20.27	100

Table 4: Statistics on living space area and form of house ownership

Criteria	N	Mean	SD	Min	Max
Private house	375	29.708	30.538	2.143	280
Living with other member of the family	152	22.881	18.476	1.5	110
Rent	134	19.778	26.416	2.5	200
Total	661	26.125	27.659	1.5	280

Table 5: Regression results by OLS method with housing area per capita

Criteria	Logarit of Housing area per capita			
	Model 1 (Whole group)	Model 2 (Owner)	Model 3 (Living with other member)	Model 4 (Rent)
Total income of household/person	0.03*** (0.009)	0.037*** (0.007)	0.006 (0.011)	0.052*** (0.014)
Main earner				
Time of employment	0.006* (0.003)	0.005 (0.004)	0.005 (0.007)	-0.001 (0.01)
Age	0.016*** (0.003)	0.009** (0.004)	0.012** (0.005)	0.024*** (0.008)
Gender (0 = Female)	0.038 (0.069)	-0.034 (0.09)	0.238 (0.144)	-0.103 (0.164)
Career of main earners				
Staff	0.047 (0.099)	-0.037 (0.127)	0.183 (0.177)	-0.456 (0.275)
Working in the field of tourism and transportation	-0.101 (0.099)	-0.124 (0.13)	-0.017 (0.29)	0.129 (0.213)
Lecturer	0.13 (0.094)	0.141 (0.121)	0.295 (0.194)	-0.14 (0.21)
Student, retired, unemployed	0.273** (0.125)	0.12 (0.147)	0.289 (0.348)	0.858*** (0.323)
Self-employed	0.147 (0.102)	0.171 (0.136)	0.422** (0.177)	-0.124 (0.222)
Others	-0.043 (0.108)	-0.002 (0.14)	0.142 (0.225)	-0.027 (0.234)
Education of main labour				
Secondary	0.12 (0.093)	0.016 (0.125)	0.399** (0.182)	0.169 (0.21)
High school	0.182** (0.091)	0.173 (0.122)	0.327* (0.17)	-0.038 (0.203)
College	0.222** (0.109)	0.154 (0.138)	0.439** (0.208)	0.253 (0.281)
University and post graduate	0.272** (0.105)	0.211 (0.131)	0.564*** (0.204)	-0.061 (0.229)
Household characteristic				
Marital status	-0.046 (0.083)	-0.014 (0.115)	-0.23 (0.147)	-0.202 (0.195)
Household size	-0.096*** (0.015)	-0.114*** (0.025)	-0.088*** (0.022)	-0.147*** (0.035)
Rate of children	-0.002 (0.002)	-0.002 (0.003)	0.001 (0.005)	-0.001 (0.006)
Rate of older	0 (0.002)	0 (0.002)	-0.007* (0.004)	0.004 (0.008)
Households with production in the living space	0.186*** (0.064)	0.12 (0.081)	0.227 (0.156)	0.473*** (0.161)
Cons	2.162*** (0.159)	2.793*** (0.229)	2.253*** (0.264)	1.929*** (0.401)
Num.	663			
Rsquare	0.249			

Note: The number in brackets is standard error; ***, **, *, statistically significant at the 1%, 5%, and 10% levels.

Table 6: The Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
University and post graduate	2.38	0.420
High school	2.19	0.457
Secondary	2.06	0.485
Lecturer	2	0.500
Staff	1.71	0.586
College	1.67	0.598
Age	1.6	0.625
Gender (Male)	1.54	0.650
Married	1.45	0.687
Self-employed	1.41	0.707
Working in the field of tourism and transportation	1.4	0.714
Others	1.34	0.746
Student, retired, unemployed	1.26	0.797
Time of employment	1.22	0.820
Time of employment	1.21	0.827
Total income of household/per person	1.18	0.848
Rate of older	1.18	0.849
Household size	1.17	0.856
Rate of children	1.12	0.892
Mean VIF	1.53	

tions for three groups: owning houses (Group_1), living with other members in households (Group_2), and rental groups (Group_3). The number of observations after grouping is larger than the minimum allowed sample size to ensure the generalizability of the component regressions. Regression results show that the Total income of household/per person has a positive impact on housing area per capita, implying that when the household's income increases by 1 million VND, the living space area increases by 0.03% for the whole group; 0.052% for Group_1, 0.037% for Group_3 and has no impact on the Group_2 (staying in their relatives' house). The result can explain that these people (Group_2) who live in the house are only occupiers but do not have the right to own the house, so if their income increases, it will not affect the expansion of the living space of the householder. Renters will be more inclined to rent larger living spaces as their income increases rather than having to spend on major repairs and home renovations for existing homeowners. This makes the value of the β coefficient of the rental group is higher.

The age of the main worker has a positive effect on housing area per capita, implying that the older the main labor is, the larger the living area of the household will be. This is not difficult to explain when the older people have had particular success in life or have had accumulated assets in the past, so the quality of living space in terms of living area is also high. If observing separately by groups, the regression parameter's highest value belongs to the renters group, then they come to the group living with other family member and the group living in private houses. The retired group had a 0.273% higher average living space (all observations) when comparing to the references while there was no significant difference in the remaining groups with the reference group (self-employed workers). This is because this group may have accumulated accumulations in the past and need a quality living space to retire in old age. The variables of gender, marriage, the proportion of older people, percentage of children have no impact on the model. Education level (general regression and accommodation group) has a positive effect on the model, show-

ing that the higher the education level of the household representative, the higher the quality of living space. People with a high level of education will often have a high and stable income. Therefore, their demand for living space is also higher.

If household size increases to 1 person, the living space will decrease by 0.096%; 0.114%; 0.088%, and 0.147% in four models, respectively. This value is highest for the rental group. Families with small businesses at home have a higher housing area than the reference group. Regression results for the whole model of observations are 0.186% and 0.473% for the rental group. This shows that the tenant group is willing to pay a higher cost to enhance their living space to support their business activities.

CONCLUSION AND POLICY IMPLICATIONS

Income and education level positively impact the size of living space, showing that policies that improve income and raise people's educational level significantly impact inequality related to living space. In addition, age has a positive relationship in the model, showing that the government needs policies to support housing for young workers to reduce the gap in housing access. Because young groups often have low incomes and need the accumulated assets to access high-quality housing. Families who rent houses and operate a small business at home have higher demands for living space than other groups to serve their operation activities. Therefore, the government's policies should focus on developing the spacious rental housing segment in suitable locations to help this group. Moreover, the larger the household size, the lower the housing space decreases, and the component models show the difficulty in accessing quality housing in urban areas. Therefore, in the coming time, the government should have policies to improve the living space for households with many members living together to ensure improved quality of life in urban areas. To conclude, a variety of solutions should be considered by the government in the future to enhance equality in housing affordable access and improve the living standard in terms of housing quality in Ho Chi Minh city.

This study has limitations, including a minor observation, which restricts the generalizability of the study findings. Another limitation of this study is that only the opinions of urban residents were surveyed, and the study did not analyze the extended housing tenure model combined with choosing a housing type. Consequently, the generalization and interpretation of our findings can be improved by future research, which employs a larger sample size of respondents together with developing an extended model.

ABBREVIATION

GDP: Gross domestic product
 OECD: The Organization for Economic Co-operation and Development
 OLS: Ordinary Least Squares

CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest.

AUTHORS' CONTRIBUTION

The author is the main author and is responsible for the entire content of the article.

APPENDIX

Figure 1.

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Criteria	ln_living_area	time_emp	age	gender	staff	transport & Tourism	lecturer	retired	self-employ	others	secondary	highschool	college	university and post graduate	married	household size	rate of children	rate of older	small business in the living spac	
ln_living_area	1																			
time_emp	0.1381	1																		
age	0.2295	0.384	1																	
gender	-0.0233	0.0301	0.0404	1																
staff	0.0109	-0.0681	-0.1322	-0.1221	1															
transport & tourism	-0.0822	0.0306	-0.0267	0.0669	-0.1485	1														
lecturer	0.1007	0.0181	0.1222	-0.3014	-0.2431	-0.2057	1													
retired	0.0836	0.0575	0.0195	0.0495	-0.1047	-0.0886	-0.1451	1												
self-employ	0.0708	-0.0036	0.0557	0.154	-0.1485	-0.1256	-0.2057	-0.089	1											
others	-0.0511	0.085	0.033	0.1368	-0.1285	-0.1087	-0.178	-0.077	-0.1087	1										
secondary	0.0064	0.0366	0.201	-0.0089	-0.1323	-0.0034	0.078	-0.069	-0.0367	-0.076	1									
highschool	0.033	-0.0165	0.0098	0.0401	-0.1064	-0.0234	0.0702	0.0259	0.0826	-0.004	-0.3633	1								
college	-0.0029	0.006	-0.1001	0.0985	0.0306	0.0148	-0.0574	-0.026	-0.0467	0.0486	-0.2001	-0.2212	1							
university and post graduate	0.0451	-0.0287	-0.2219	0.0158	0.3192	0.0912	-0.1588	0.0624	-0.0271	0.0428	-0.2926	-0.3235	-0.178	1						
married	-0.0033	0.0921	0.2537	0.399	-0.1526	0.0099	0.0997	0.0211	-0.0018	-0.05	0.1289	0.0138	-0.007	-0.1603	1					
household size	-0.3102	0.0876	0.0464	0.1403	-0.0662	0.0242	0.0196	-0.062	0.012	0.0806	-0.0267	0.0304	-0.014	-0.0316	0.1554	1				
rate of children	-0.1322	-0.0464	-0.168	0.0837	0.0101	0.0161	-0.0146	0.0676	-0.0048	-0.026	-0.0728	0.0005	-0.006	0.0509	0.134	0.1829	1			
rate of older	0.0234	0.0621	0.2666	0.0209	-0.005	0.0905	-0.0244	0.0893	-0.0386	-0.012	-0.0582	-0.0135	0.026	0.0598	-0.0318	0.0975	0.0226	1		
small business in the living spac	0.0952	-0.0162	0.0897	-0.0206	-0.1624	-0.0931	0.3537	-0.071	0.0622	-0.066	0.0154	0.0718	-0.035	-0.1334	0.1201	0.1293	0.0275	-0.016	1	

Figure 1: Correlation coefficient matrix

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