

Do housing price changes affect mental health in South Korea?

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Abstract

Background: The share of real estate in the household assets of Korean households is around 74.7%, which is much higher than in most other countries. There is a growing concern over the association between mental health and depression in modern society. Thus, the objective of this research was to empirically analyze the impact of house prices on mental health.

Methods: This study carried out an empirical analysis of the impact of house price changes on depression, which is a proxy variable of mental health, by using Korea Health Panel data and a correlated random-effect (CRE) logit model. From Korea Health Panel data (2009-2015) – which is micro data of the status of healthcare services in Korea, spending on medical costs, health levels, and so on – a total of 191,121 samples of subjects aged over 20 were selected. For the housing price index, data was used from the Korea Appraisal Board.

Results: The results of this research found that females, older people, unmarried people, households with more members, and smokers are more likely to experience depression. The paper also found that housing price is negatively correlated with depression and is statistically significant. Furthermore, housing price is negatively correlated with depression and is statistically significant.” along with the increase in price of houses, the likelihood of experiencing symptoms of depression of home owners appeared decreasing with the value of estimated coefficient of 0.010, which was statistically significant. The likelihood that people who do not own houses experience depression is not correlated with changes in house prices.

Conclusions: This research is the first empirical analysis to find that house prices are negatively correlated with depression, a proxy variable of mental health. The results of this paper suggest that government policy of intervention in real estate markets may have an impact on the mental health of people, as well as the macro-economy. Hence, the government needs to closely examine various factors such as the mental health of people, as well as macro-economic aspects, when it establishes and implements real estate policies. [*Ethiop. J. Health Dev.* 2020;34(Special issue-3):48-59]

Key words: House prices, depression, CRE logit model, panel data

Background

According to 2018 data from Statistics Korea, real estate accounted for 74.7% of all household assets in Korea. This proportion is much higher than that in any other advanced economy in the world. This implies that real estate represents a very important entity for individuals and the national economy in Korea.

Housing is an asset, an investment good, and a consumer good (1). In particular, a house is seen prominently as an object of investment. Possession of houses is an indication of wealth and a means to increase and preserve assets. The type and scale of one's residence can demonstrate one's social position (2,3).

The concept of home ownership has changed over time. Home ownership is currently viewed more as the holding of a product, an investment, than as a means of residence. Numerous studies have found that a decision to purchase a house relies more on the merits of investment to boost assets than on its residential value (4,5). According to the 2018 Korea's Housing Finance and Bogeumjari Loan Demand Survey, a significantly high proportion of people purchased houses as a means to boost their wealth, not just as a place of residence. For residents with two or more houses, the share of home purchasers who assessed the possibility of house price appreciation was more than those who did not (6). The purchase of residential houses is currently founded on the basis of investment in the proliferation of assets rather than satisfying residential needs. Accordingly, a rise in prices of residential houses influences the sense

of happiness of owners of residential houses. These findings suggest that the rise of home prices can affect the mental health of homeowners.

Most studies in this area of research have focused on the macro-economic dimension of real estate, while studies that focus on the micro-economic dimension of real estate are insufficient. In addition, most previous studies have used cross-sectional data (7-12). There is little research that focuses on the potential link between real estate and mental health.

As studies based on cross-sectional data use home ownership and areas with higher house prices as a proxy of income, they can hardly capture the causation of specific events. Hence, to analyze the causation between two events, panel data are indispensable (13,14).

This paper aims to find empirical evidence regarding the relationship between house price changes and mental health by using data from the Korean Health Panel, and the CRE logit model. Furthermore, assuming that the impact of house price changes on mental health would vary between homeowners and renters, analysis was made for each of these two separate groups.

Methods

To analyze the mental and psychological conditions of individuals in response to house price changes, this research used panel data. The equation below (Equation 1) shows a panel model estimation formula.

$$Y_{it} = \alpha + \beta_0 X_{it} + \beta_2 c_i + \mu_i + \epsilon_{it}$$

$$i = 1, 2, \dots, N$$

$$t = 1, 2, \dots, T \quad (\text{Equation 1})$$

Where i indicates each respondent, t refers to the period of sample i , Y_{it} is a dependent variable indicating the psychological health condition of sample i for period t , and X_{it} is vector of explanatory variable that can change depending on cross-sectional and time-series data. c_i is a variable that is fixed with time-series data, but changes with cross-sectional data. μ_i refers to the error of sample i that is fixed despite change of time-series t and random intercept. ϵ_{it} is the error of time series data and cross-sectional data. It is regarded

$$\bar{Y}_i = \alpha + \beta_1 \bar{X}_i + \beta_2 c_i + \mu_i + \bar{\epsilon}_i \quad (\text{Equation 2})$$

$$\bar{Y}_{it} - \bar{Y}_i = \beta_1 (X_{it} - \bar{X}_i) + (\epsilon_{it} - \bar{\epsilon}_i) \quad (\text{Equation 3})$$

A model that estimates coefficients that have no bias by removing an error term (u_i) is called a fixed effect model (15). Although this method can remove the fixed effect of individuals, it has weaknesses as it may remove the effect of some variables of X_{it} , that have relatively shorter period without showing significant changes during the analysis period.

The correlated random effect (CRE) model can estimate $\beta_1 X_{it}$ under the assumption of $\mu_i = \pi \bar{X}_i + v_i$.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 c_i + \pi \bar{X}_i + v_i + \mu_{it} \quad (\text{Equation 4}) \quad (16)$$

Results

Data: This research used Korea Health Panel data and the monthly housing trade price index of the Korea Appraisal Board from 2009 to 2015 to analyze the effect of house price changes on mental health (depression). In order to identify factors affecting mental health of individuals over the long term, panel data are needed. Korea Health Panel Data are panel data built to produce basic information regarding the status of healthcare services, levels of medical expenses, health level and behavior, and so on. For this paper, microdata of the panel data were used. This study used samples of respondents aged at least 20 years or older. A total of 191,121 samples were selected for analysis.

As shown in Table 1, the dependent variable (experience of depression) in this research is a binominal variable (i.e. depression: 1, no depression: 0).

as a white noise here.

To remove u_i , which causes bias of panel data, equation 2 is subtracted from equation 1, leading to a fixed effect model (equation 3). Here, mean \bar{X}_i is calculated with $N^{-1} \sum_{i=1}^T X_{it}$.

It can also estimate coefficients of c_i and coefficients of X_{it} that cannot be estimated with a fixed effect model due to relatively small volatility (16).

The CRE model is listed in equation 4 below, where π is the difference between “within-subject” and “between-subject” effects. As the dependent variable in this study is the status of mental health – depressed or not depressed (depressed: 1, not depressed: 0) – the CRE logit model was used.

The independent variable is housing price, which is represented by the housing trading price index. Beside prices, other factors related to housing that can cause depression, such as home ownership, floors of residence, and the type of residence, are added as independent variables. The control variables included are sex, age, marital status, number of household members, education level, status of employment, household income, smoking, and drinking. Among the control variables, sex does not change over time, while age, marital status, number of household members, level of education, smoking habits and drinking habits can vary over time, depending on individuals, but with less volatility than other variables. As for dummy variables, male (sex), age (20s), having a spouse, education of less than high school, unemployed, non-smoker, drinking alcohol, above-ground floor, and apartment are set as reference groups.

Table 1: Variables

Variable	Description
Depression	Depression: 1, no depression: 0
Housing price	Annual housing price index
Home ownership	Owner: 1, not owner: 0
Sex	Male: 0, female: 1
20s	20s: 1, Not: 0
30s	30s: 1, Not: 0
40s	40s: 1, Not: 0
50s	50s: 1, Not: 0
60s	60s: 1, Not: 0
70s or older	70s or older: 1, Not: 0
Have spouse	Married with spouse: 1, Not: 0
Not married	Not married: 1, married: 0
Don't have spouse	Married but have no spouse due to death or divorce: 1, Not: 0
Number of household members	Number of family members
Less than high school graduate	Less than high school graduate: 1, Not: 0
High school graduate	High school graduate: 1, Not: 0
Graduate of university or higher	Graduate of university or higher level: 1, Not: 0
Employment	Employed: 1, Not: 0
Log of income	Logarithm of household income
Smoking	Smoker: 1, Not: 0
Drinking	Do not drink 1, Drink: 0
Above-ground floor	Resident of above-ground floor: 1, Not: 0
Semi-basement	Resident of semi-basement: 1, Not: 0
Underground floor	Resident of underground floor: 1, Not: 0
Loft	Resident of loft: 1, Not: 0
Detached house	Resident of detached house: 1, Not: 0
Multiplex housing	Resident of multiplex house: 1, Not: 0
Townhouse	Resident of townhouse: 1, Not: 0
Apartment	Resident of apartment: 1, Not: 0
Other types of housing	Other types of residence: 1, Not: 0
House price index	$\overline{House\ price\ index}_i = N^{-1} \sum_{i=i}^T House\ price\ index$
Log (income)	$\overline{Log(income)}_i = N^{-1} \sum_{i=i}^T Log(income)$

Descriptive statistics of variables are listed in Table 2. Of the total respondents, 132,261 owned houses (“home owners”) (69.2%), while 58,860 respondents did not own houses (“renters”) (30.8%). Of all samples, 8% experienced depression. Renters were more likely to experience depression than home owners. Home owners were more likely to live in above-ground floors than renters. Renters were more likely to live in underground and semi-basement floors than home owners. With regard to type of residence, home owners were more likely to live in apartments (52%), while renters were more likely to live in detached houses (37%) and multiplex houses (14%). As for control variables, the ratio of men to women was similar between home owners and renters. Renters were more likely to be in their 40s (22%), while those who owned

houses were more likely to be in their 60s (16%) and 70s (26%). Regarding marital status, home owners tended to have a spouse, while renters were more likely to be divorced (12%) or have no spouse (41%). As for the number of household members, home owners had 3.72 members on average, while renters had 3.67 members, showing no significant difference between the two. Levels of education and employment were similar between the two groups, regardless of home ownership. Employment status was also similar between the two groups. However, in terms of income level, home owners tended to earn higher incomes. Lastly, renters were more likely to smoke (26%), while the proportion of drinkers (76%) was similar between the two groups.

Table 2: Descriptive statistics

Variable	Total		Home owners		Renters	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Depression	0.08	0.28	0.08	0.27	0.10	0.30
Housing price	89.44	8.56	89.17	8.69	90.05	8.21
Home ownership	0.69	0.46	1.00	0.00	0.00	0.00
Sex	0.51	0.50	0.51	0.50	0.52	0.50
20s	0.16	0.36	0.15	0.36	0.17	0.38
30s	0.11	0.32	0.11	0.31	0.13	0.33
40s	0.17	0.37	0.14	0.35	0.22	0.41
50s	0.18	0.38	0.17	0.38	0.18	0.39
60s	0.15	0.35	0.16	0.37	0.11	0.31
70s or older	0.24	0.43	0.26	0.44	0.20	0.40
Have spouse	0.53	0.50	0.56	0.50	0.47	0.50
Not married	0.09	0.29	0.08	0.28	0.12	0.32
Don't have spouse	0.37	0.48	0.36	0.48	0.41	0.49
Number of household members	3.68	1.39	3.72	1.36	3.67	1.45
Less than high school graduate	0.42	0.49	0.42	0.49	0.42	0.49
High school graduate	0.28	0.45	0.28	0.45	0.29	0.45
Graduate of university or higher	0.30	0.46	0.30	0.46	0.29	0.45
Employment	0.55	0.50	0.55	0.50	0.54	0.50
Log of income	8.06	0.85	8.10	0.86	7.95	0.83
Smoking	0.22	0.41	0.20	0.40	0.26	0.44
Drinking	0.76	0.43	0.76	0.43	0.76	0.43
Above-ground floor	0.98	0.13	0.99	0.08	0.96	0.19
Semi-basement	0.01	0.12	0.01	0.08	0.03	0.18
Underground floor	0.00	0.05	0.00	0.03	0.01	0.08
Loft	0.00	0.02	0.00	0.02	0.00	0.03
Detached house	0.33	0.47	0.31	0.46	0.37	0.48
Multiplex housing	0.12	0.32	0.11	0.31	0.14	0.34
Townhouse	0.04	0.20	0.04	0.20	0.04	0.19
Apartment	0.48	0.50	0.52	0.50	0.38	0.48
Other types of housing	0.04	0.19	0.01	0.12	0.09	0.28
House price index	88.16	7.92	87.76	7.91	89.14	7.85
Log (income)	7.97	0.84	8.00	0.85	7.88	0.81
Number of samples	191,121		132,261		58,860	

Impact of home ownership and house price on depression

Table 3 shows analysis of experience of depression due to house price changes through the CRE logit model. Model 1 sets home ownership as an independent

variable and Model 2 sets house price as an independent variable. Analysis results show that home ownership is negatively correlated with depression, although the correlation is not statistically significant. On the other hand, in model 2, which used house price

as an independent variable, house price is negatively related to depression. This suggests that when housing price rises, people are less likely to experience depression. As for the location of residence, residents of semi-basement and underground floors were more likely to experience depression. Regarding demographic variables, women were more likely to suffer from depression. As for age, older people were more likely to have depression. In particular, people in their 60s were more likely to experience depression than those in their 20s. Those who did not have a

spouse were more likely to have depression than those who did have a spouse. Households with more members were more likely to experience depression. Graduates of college or higher were less likely to have depression than graduates of less than high school. Those who were employed with higher household incomes were less likely to suffer from depression. Smokers were more likely to suffer from depression than non-smokers, but drinkers were less likely to experience depression than non-drinkers.

Table 3: Impact of home ownership and house price changes on depression

Variable	Model1				Model 2			
	Estimated coefficient	Standard error	OR	P	Estimated coefficient	Standard error	OR	p
Not House owner	Reference				Reference			
House owners	-0.062	0.062	0.94	0.313	-0.011	0.003**	0.989	0.002**
Men	Reference				Reference			
Women	0.602	0.043**	1.825	0.000**	0.6	0.043**	1.822	0.000**
20s	Reference				Reference			
30s	0.308	0.104**	1.36	0.003**	0.302	0.105**	1.353	0.004**
40s	0.462	0.121**	1.587	0.000**	0.454	0.121**	1.574	0.000**
50s	0.612	0.125**	1.843	0.000**	0.601	0.125**	1.823	0.000**
60s	0.783	0.141**	2.188	0.000**	0.768	0.140**	2.155	0.000**
70s or older	0.462	0.147**	1.588	0.000**	0.443	0.147**	1.557	0.003**
Married	Reference				Reference			
Unmarried	0.299	0.068**	1.349	0.000**	0.307	0.068**	1.36	0.000**
No spouse	0.321	0.088**	1.379	0.000**	0.314	0.087**	1.368	0.000**
Number of family members	0.11	0.029**	1.116	0.000**	0.11	0.029**	1.116	0.000**
Less than high school graduate	Reference				Reference			
High school graduates	-0.075	0.06	0.928	0.208	-0.073	0.06	0.93	0.225

Graduates of college or higher	-0.149	0.074*	0.862	0.043*	-0.144	0.074*	0.866	0.050*
Not Employed	Reference				Reference			
Employed	-0.281	0.037**	0.755	0.000**	-0.282	0.037**	0.754	0.000**
Household income	-0.145	0.042**	0.865	0.001**	-0.136	0.042**	0.873	0.001**
Not Smokers	Reference				Reference			
Smokers	0.171	0.051**	1.187	0.001**	0.171	0.051**	1.187	0.001**
Not Drinkers	Reference				Reference			
Drinkers	-0.092	0.044*	0.912	0.038*	-0.098	0.044*	0.906	0.027*
Above-ground floor	Reference				Reference			
Semi-basement	0.361	0.173*	1.435	0.037*	0.368	0.173*	1.444	0.034*
Underground floor	0.883	0.281**	2.418	0.002**	0.89	0.281**	2.435	0.002**
Loft	0.27	0.89	1.31	0.762	0.289	0.89	1.335	0.745
Apartment	Reference				Reference			
Detached house	0.065	0.072	1.067	0.362	0.069	0.071	1.071	0.333
Multiplex house	0.117	0.087	1.124	0.179	0.123	0.087	1.131	0.158
Townhouse	0.092	0.117	1.096	0.433	0.088	0.118	1.092	0.454
Other housing types	0.051	0.123	1.052	0.681	0.068	0.122	1.071	0.576
House price index	-0.006	0.004	0.994	0.136	0.005	0.005	1.005	0.392
Log (income)	-0.285	0.061**	0.752	0.000**	-0.297	0.061**	0.743	0.000**
(Constant term)	-0.97	0.512	0.379	0.058	-1.004	0.511*	0.366	0.049*

*, p<.05; **, p<.01.

Impact of house price changes on depression depending on home ownership: As we assumed that the relation between housing prices and probability of depression would depend on whether people own houses or not, samples were divided into those who owned houses and those who did not own houses. The probability of depression due to housing price fluctuation was empirically analyzed using the CRE logit model.

Table 4 shows that as house prices increase, the probability of depression decreases for home owners. On the other hand, the probability of depression was not related to housing price changes for those who did not own houses. Meanwhile, for home owners, location of residence was not related to probability of depression. However, for renters, residents of underground floors were more likely to experience depression than those living in above-ground floors, with statistical significance. For home owners, type of residence was correlated with depression symptoms. Such correlation was statistically significant, with residents of detached houses being more prone to

depression than those living in apartments.

As for demographic characteristics, regardless of home ownership, women were generally more prone to depression than men. In particular, women who were renters were more likely to have more severe depression than women who owned houses. Age, marital status, and number of household members had an impact on home owners only, with statistical significance. Specifically, elder ones, those who do not have spouse or are unmarried, and families with more members were more likely to experience depression. For renters, the level of education had an impact on depression, with statistical significance, with the more educated renters being less likely to be depressed. Regardless of home ownership, those who had jobs were less likely to experience depression than those who were jobless. For home owners, those with more household income were less likely to have depression. Regardless of home ownership, smoking was found to be positively correlated with depression. For home owners, drinkers were less likely to have depression than non-drinkers.

Table 4: Impact of house price changes on depression depending on home ownership

Variable	Home owners				Renters			
	Estimated coefficient	Standard error	OR	p	Estimated coefficient	Standard error	OR	p
Not House owner	Reference				Reference			
Housing prices	-0.01	0.004*	0.99	0.012*	-0.01	0.007	0.99	0.17
Men	Reference				Reference			
Women	0.573	0.051**	1.774	0.000**	0.654	0.083**	1.923	0.000**
20s	Reference				Reference			
30s	0.474	0.133**	1.606	0.000**	-0.114	0.178	0.892	0.52
40s	0.629	0.152**	1.875	0.000**	0.027	0.209	1.027	0.899
50s	0.749	0.159**	2.115	0.000**	0.291	0.215	1.338	0.175
60s	1.002	0.175**	2.723	0.000**	0.317	0.249	1.373	0.204
70s or older	0.658	0.183**	1.931	0.000**	0.06	0.264	1.062	0.821
Married	Reference				Reference			
Unmarried	0.294	0.082**	1.341	0.000**	0.144	0.127	1.155	0.258
No spouse	0.421	0.108**	1.523	0.000**	0.037	0.161	1.038	0.817
Number of household members	0.138	0.036**	1.148	0.000**	0.052	0.05	1.053	0.301
Less than high school graduate	Reference				Reference			
Graduate of high school	-0.044	0.071	0.957	0.534	-0.252	0.114*	0.777	0.027*
Graduate of university or higher	-0.053	0.088	0.948	0.55	-0.476	0.139**	0.621	0.001**
Not Employed	Reference				Reference			

Employment	-0.225	0.045**	0.799	0.000**	-0.448	0.070**	0.639	0.000**
Household income	-0.168	0.053**	0.846	0.001**	-0.019	0.076	0.981	0.804
Not Smokers	Reference				Reference			
Smoker	0.123	0.062*	1.13	0.048*	0.219	0.095*	1.244	0.021*
Not Drinkers	Reference				Reference			
Drinker	-0.165	0.052**	0.848	0.002**	0.068	0.087	1.07	0.438
Above-ground floor	Reference				Reference			
Semi-basement	0.467	0.311	1.595	0.134	0.197	0.223	1.218	0.376
Underground floor	0.915	0.508	2.498	0.071	0.871	0.360*	2.39	0.015*
Loft	0.975	0.946	2.652	0.303	-	-	-	-
Apartment	Reference				Reference			
Detached house	0.188	0.093*	1.207	0.043*	0.03	0.126	1.03	0.814
Multiplex housing	0.175	0.114	1.191	0.124	0.154	0.15	1.166	0.305
Townhouse	0.085	0.145	1.088	0.56	0.208	0.23	1.232	0.365
Other types of residence	0.205	0.193	1.227	0.288	-0.137	0.174	0.872	0.431
House price index	0.003	0.006	1.003	0.651	0.007	0.011	1.007	0.542
Log (income)	-0.187	0.076*	0.829	0.014*	-0.573	0.108**	0.564	0.000**
(Constant term)	-1.934	0.623**	0.145	0.002**	0.711	0.909	2.036	0.434

*, p<.05; **, p<.01.

Discussion

Results of analysis revealed that home ownership was negatively correlated with depression symptoms, although the correlation was not statistically significant. In addition, housing prices were negatively correlated with depression. Such correlation was statistically significant.

As housing prices increased, home owners were less likely to experience depression. On the other hand, for renters, the probability of depression was not related to housing price changes. Depression among home owners was not affected by floors of residence. However, for renters, those who were residing in underground floors were more likely to have depression than those who were residing in above-ground floors, showing statistical significance. Furthermore, regardless of home ownership, women were more likely to experience depression than men, and women who did not own a house were more seriously affected by depression than those who did own a house.

Conclusions

The asset portfolios of Koreans shows that housing accounts for over 60% of their total assets, which is higher than in other advanced economies. Thus, it was assumed that changes in house prices affect the mental health of the public. This study conducted an empirical analysis of the impact of housing price changes on mental health by using Korea Medical Panel data and the CRE logit model. The research found that females, older people, unmarried people, households with more members, and smokers are more likely to experience depression. The paper also found that the housing price is negatively correlated with depression symptoms, and this was statistically significant. That is, when housing prices rise, the likelihood that home owners experience depression decreases. The results also indicate that for people who do not own homes, the likelihood is that depression is not correlated with house price changes.

This study is the first empirical analysis that has found that, among the general public, housing price is negatively correlated with the experience of depression, a proxy variable of mental health. The results of this research suggest that government intervention in real estate markets affects the mental health of people, as well as the macro-economy.

Limitations

This paper analyzed the relationship between the mental health of respondents and house prices. Due to the limited scope of the data, house prices were confined to houses in metropolitan cities only, meaning that this study could not precisely reflect housing

prices of all respondents. More segmented housing price data by region would make future research more complete.

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