The Publication Bias of the Chinese Real Estate Research: A Meta-Analysis

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Abstract. This article applies a meta-analysis to investigate the results from hedonic housing model in China. This paper investigates the publication bias and authentic empirical effect among those researches. Partial correlation coefficients between building area and house price reveal a strong evidence of publication bias and a genuine positive effect, in which, the financial crisis in 2007 will increase the effects of building area on house price. And the linear model partially account for the publication bias.

Introduction

The domestic scholars carried out a large amount of experiential research to study the real estate market by using the hedonic price theory and model, especially focus on structure characteristic, location characteristic and neighborhood characteristic of housing. However, these research conclusions are quite different. Meta-analysis provides a way to summarize and analyze results from previous quantitative studies with the same researcher subjects[1]. Meta-analysis has been widely applied mainly to medical, psychological, educational researches. In economic, there are increasing trend to use this method. Such as, Jarrell and Stanley (1990) evaluate union wage premiums and examine gender wage gap in 1998[2]. Card and Krueger (1995) test minimum wage effect and proved that the t-ratio and sample size have an inverse-square root relationship [3].

This paper using the multi-meta-analysis model investigates the relationship between building area and the housing price. In this study, several moderator variables are to explain the variation in estimated partial correlation coefficients for a giving housing character. Specifically, these moderator variables included (1) LOG and LINEAR (dummy variable, examine whether the function forms affect the estimated partial correlation coefficients). (2) Secondhand (dummy variable, does the second handed houses lower partial correlation coefficients between housing characters and house price?). (3) After 2007, (dummy variable, to see in what degree that 2007 financial crisis affects the partial correlation coefficients) (4) Income, (dummy variable, measures whether average income from studies’ location changed the lower partial correlation coefficients between housing characters and house price).

The remaining of this paper is structured as follow. Section 2 lists some literatures. Section 3 introduces the meta-analysis methodology. Section 4 explains the collected data and moderator variables. Section 5 presents the results of each housing characters. Section 5 concludes this whole thesis.

Literature Review

There are also some applications of meta-analysis on real estate. A 1995 study by Smith and Huang uses meta-analysis to examine market valuation of air quality. Brander and Koetse (2010) uses meta-analysis to measure the value of urban space to hedonic house pricing models[4]. Bateman and Jones (2003) apply meta-analysis in an effort to understand woodland recreation benefit estimates[5].
Meta-Analysis Model and Data

Publication bias is a widespread phenomenon in economic research, mainly because of different econometric models. Which means those larger, more statically significance or more meaningful effect to economic theory or reality is easier to be accepted by the researchers, reviewers and editors and those effect often seen as more convincible[8].

In this paper, the meta-analysis for publication bias and genuine empirical effect is examined by Funnel plots, FAT-PET, MST approach and PEESE approach.

Firstly, a common graphical test to detect publication bias is funnel plot. The graph compares the precision against effect size. The precision could be the inverse of standard errors or sample size and its square root. The effect size could be elasticity, regression coefficients and correlation coefficients.

Second, modeling publication selection star with finding out the relationship between individual estimated effect and its standard error as shown in Eq.1[8].

\[
effect_i = \gamma_0 + \gamma_1 Se_i + \epsilon_i
\]

Where \(\gamma_1 Se_i\) models publication bias, and \(\gamma_0\) serves as correction for publication bias. The error term \(\epsilon_i\) doesn’t have to be independently and identically distributed (See more explain on Stanley & Doucouliagos, 2012, p. 61).

Finally, the FAT test, PET test, MST test and PEESE test are pursued to test the relationships. Egger et al. (1997) hold that the intercept of equation (3.2.2-b), \(\gamma_1\), is a test for publication bias. In other words, if the test for \(H_0: \gamma_1 = 0\) is rejected, there exist publication bias (FAT test)[9].

Stanley and Doucouliagos (2012) argue that the coefficients on \(1/Se_i\) of equation (3.2.2-b), \(\gamma_0\) is the test of genuine effects beyond systematic contamination from publication selection[8]. Which means, if the test for \(H_0: \gamma_0 = 0\) is accept, the magnitude of reported estimate will close to zero (PET test).

Statistical power ensures that t-values increase with the square root of the sample size, ceteris paribus. Card and Krueger (1995a) first raise the equation to detect that relationship between t-values and the sample size as shown in Eq.2.

\[
t_i = (effect_i - \alpha_i)/SE_i
\]

Where \(\alpha_i\) is assumed to be zero as the null hypothesis and represent as population parameter (MST).

Stanley and Doucouliagos (2012) suggest an improved correction for publication selection that replaces the standard error in equation (3.2.2-a) with the variance. Hence, this MRA model is named precision-effect estimate with standard error (PEESE)[8].
The Eq 3. for PEESE test is as follow:

\[ \text{effect}_i = \alpha_0 + \alpha_1 \text{Se}_i^2 + \varepsilon_i \]  \hspace{1cm} (3)

Where \( \alpha_1 \text{Se}_i^2 \) is publication bias, and \( \gamma \) serves as correction for publication bias. The error term \( \varepsilon_i \) see as the error term in equation (3.2.2-a).

This paper collected the data from CNKI.net and Wanfang Data. The initial search by using keywords specified to the housing character, such as: green rate, building area, CBD, floor, capability, traffic, rooms, ages and housing price. But different from foreign researches, most resent researches are about the effect of new forming public transportation on house price. And different researches are use different units to put those variables (e.g., some using the distance, some using the numbers of station around 500 meters and some are within 1km) and most of the researches focus on analyze the effect of different stations.

**Results**

As can be seen from the Fig. 1, there is not sign of a funnel and terribly asymmetric, it implies the present of publication bias in collected data.

![Funnel plot with pseudo 95% confidence limits](image)

**Figure 1. Funnel Graph of Partial Correlation Coefficient between Building Area and House Price.**

**Table 1. Testing for Publication Bias and Authentic Empirical Effect of the Building Area on House price (MRA FAT-PET, MST, PEESE models).**

| Model Variables | FAT-PET t | MST ln|t| | PEESE pcc |
|-----------------|-----------|-------|-------|-----------|
| \( 1/\text{Se} \) | 0.122*** (14.87) |       |       |           |
| \( \ln(\text{df}) \) | -0.267 (-1.13) |       |       |           |
| \( \text{Se}_i^2 \) |           | -163.7** (-2.41) |       |           |
| \_cons \) | 5.948*** (3.57) | 2.52 (2.52) | 0.640*** (9.69) | |
| N              | 37        | 37    | 37    |           |

Notes: \( t \) statistics are reported in parentheses. *\( p < 0.1, **p < 0.05, ***p < 0.01 \). N devoted the numbers of collecting studies. **FAT tests \( H_0: \gamma_1 = 0 \) in equation (3.2.2-b), \( t_i = \text{effect}_i/\text{Se}_i =\gamma_1 + \gamma_0(1/\text{Se}_i) + \nu_1. **PET tests \( H_0: \gamma_0 = 0 \) in equation (3.2.2-b).** **MST tests \( H_0: \beta_1 \leq 0 \) in equation (3.2.3-b), \( \text{E}(\ln |t|) = \beta_0 + \beta_1 \ln(\text{df}_i). **PEESE test \( H_0: \alpha_0 = 0 \) in equation (3.2.4), \( \text{effect}_i = \alpha_0 + \alpha_1(\text{Se}_i)^2 \).**
Table 1 reveals the results of publication bias in partial correlation coefficients between building area and house price and the existence of genuine empirical effect. The coefficient of “1/Se” is $\gamma_0 = 0.122$. Because p-value of $\gamma_0$ is 0.000 < 0.001, so reject $H_0: \gamma_0 = 0; t = (0.106: 0.139)$. There is a clear publication bias or selections around our collected data. So, corresponding to the visual impression of the previous funnel graph, it provides obvious evidence that there is publication selection bias.

As it shows in the column 2, the slope coefficient ($\beta_1 = -0.267$) is not statistically significant, suggesting that there is no genuine empirical partial correlation between building area and house price (accept $H_0: \beta_1 \leq 0, t = -1.13; p > 0.01$). The absolute value will not rise as the sample size increases. Moreover, when further test $H_0: \beta_1 = 0.5$, it shows Prob > F = 0.0025, which means reject $\beta_1 = 0.5$ at 0.01 significance level, suggesting the genuine underlying effect is slight, which contradicted to the previous PET test conclusion and also the major points located in the funnel plot are greater than zero. But this finding strongly proved that in present of severe publication bias, the slope coefficient will not be statistically significant (Stanley, 2005). In conclude, this MST result cannot be decided whether there is a genuine effect or not due to the severe publication bias. And this is also the drawback of MST test. Therefore, refer to the PET test results, it sustains that there is an authentic positive empirical effect of building area on house price.

In column 3, the PEESE estimator of building area’s effect on housing price $\alpha_0 = 0.646$ is much larger, in magnitude, than the precision effect, $\gamma_0 = 0.122$, form PET test. The reason behind the difference is due to the strong publication selection on the effect of building area on housing price. From the funnel graph, the visual estimate of the top correlation coefficients between building area partial is within both the confidence interval of both estimates. One more things worth to mention, publication bias is so serious that the correct estimate ($\gamma_0$) becomes approximately one-fifth the average estimate ($\bar{\alpha}_0$).

Conclusion

This article aims to evaluate the existence of empirical evidence of building area on house price and, if so, measure the magnitude of these effects. The results of building area, after investigating 37 estimated partial correlation coefficients, reveals a strong evidence of publication bias and a genuine positive effect. Furthermore, no clear evidence to prove that is the choice of different model formation caused the publication bias but the linear model worsens this issue. And the financial crisis in 2007 will increase the partial correlation coefficients between building area and house price.

References


