Interaction between Theory and Practice in Civil Engineering and Construction
Edited by Komurlu, R., Gurgun, A. P., Singh, A., and Yazdani, S.

ISBN: 978-0-9960437-2-4

A COMPARATIVE STUDY BETWEEN CHINA AND USA ON THE INFLUENCING PATH OF TRANSACTION COSTS IN CONSTRUCTION PROJECTS

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The actual cost of a construction project is composed of not only production costs, but also transaction costs. The presented model includes the uncertainty of the owner's behavior, the uncertainty of the contractor's behavior, the uncertainty in the transaction environment and mechanism, and project management efficiency, to illustrate the influence path of the transaction costs borne by the owner. The model is tested by the structural equation modeling (SEM) using the data collected from construction project owners. The finding indicate that uncertainty in the transaction environment and mechanism appears to be the core construct of the model due to its strong linkages with transaction costs and the owner's behavior, the contractor's behavior, and project management efficiency. The uncertainty of the contractor's behavior is also found to affect project management efficiency positively. A certainty behavior on the part of the owner reduces the uncertainty in the transaction environment and mechanism, increases the efficiency of project management, and reduces the transaction costs of construction project.

Keywords: Construction project, Transaction cost, Influence path, Structural equation modeling.

1 INTRODUCTION

In transaction cost economics, a transaction occurs when a good or service is transferred across a technologically separable interface (Williamson 1987). The transaction cost economics approach provides a useful framework for analyzing the inevitable differences in interest between different contracting parties who are members of the project coalition (Winch 1989). Transaction costs are different from production costs; while production costs are the costs of transforming inputs into outputs, transaction costs arise from economic exchange. The majority of these studies on transaction costs in construction projects have focused on the theoretical and qualitative aspects of this issue. Williamson (1985) argue that transaction costs include the costs of drafting, negotiating and enforcing an agreement, and the costs of governance and bonding to secure commitments. The generation of transaction cost has its path dependence. Not only the amount of transaction cost of construction project is different under different institutional environment, but also the influence path to the transaction

cost is different. We first present a review of transaction cost literature as the theoretical background of the study. Then, we discuss a research model and corresponding research hypotheses. After presenting the research method adopted to test our research hypotheses, we report cross-country data analyses and results. The paper concludes with a discussion of findings and implications for theory and practice.

2 TRANSACTION COSTS IN CONSTRUCTION PROJECTS

Hughes *et al.* (2006) classify transaction costs by project phase, namely pre-tendering costs (marketing, forming alliances, and establishing reputations), tendering costs (estimating, bidding, and negotiating) and post-tendering costs (monitoring performance, enforcement of contractual obligations, dispute resolution). In this study, pre-contract transaction costs include the cost of market research, the cost of exploring financing opportunities, the cost of conducting a feasibility study, the cost of bidding/ negotiation, and the cost of day-to-day pre-contract project management. Post-contract transaction costs include the cost of day-to-day contract administration, the cost of administering claims and change orders, the cost of dispute resolution, and incentive payments. Respondents are asked to estimate the approximate cost of pre-contract and post-contract transaction costs with respect to contract value in the last project they completed for their company/agency.

3 RESEARCH HYPOTHESES

In this study, the latent variables that determine transaction costs are considered to be the uncertainty of the owner's behavior, the uncertainty of the contractor's behavior, the uncertainty in the transaction environment, and project management efficiency. Four hypotheses are put forward from four factors that affect transaction costs. On basis of the four hypotheses, and the relationship between them, another five hypotheses are put forward. Finally, there are nine hypotheses in total.

H1: The uncertainty of owner's behavior have a positive effect on the transaction costs; H2: The uncertainty of contractor's behavior have a positive effect on the transaction costs; H3: The efficiency of project management have a negative effect on the project transaction costs; H4: The uncertainty of trading environment and mechanism have a positive effect on the project transaction costs; H5: The uncertainty of owner's behavior have a positive effect on the transaction environment and mechanism; H6: The uncertainty of owner's behavior have a negative effect on the efficiency of project management; H7: The uncertainty of transaction environment and mechanism have a negative effect on the efficiency of project management; H8: The uncertainty of transaction environment and mechanism have a positive effect on the uncertainty of contractor's behavior; H9: The uncertainty of contractor's behavior have a negative effect on the efficiency of project management;

4 RESEARCH METHOD

First, the sample testing of questionnaire was carried out in a small scale. After adjustment, the questionnaire was distributed to the owners who were responsible for construction managing, including public enterprises and institutions, and real estate development companies. Respondents were asked to evaluate the previous completed

project of their organizations, using Likert Scale 1-5. Samples of China were mainly from the owners of public enterprises, and real estate development companies. Samples of America were mainly from the Construction Owners Association of America (COAA), Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials Members (AASHTO), and the list of the top owners in 2009 from Engineering News-Record (ENR). Respondents were asked to evaluate the previous completed project of their organizations, using five Likert Scale to answer. From March 2011 to April 2011, 502 Chinese questionnaires were sent out, and 108 completed responses were returned. The rate of response is 21.6%. 2628 English questionnaires were sent out, and 239 completed responses were returned. The rate of response is 9.09%.

4.1 Comparison of Measurement Models

The data from China and the United States were input into the measurement model, and the indicator of reliability test for each latent variable was received. As shown in Table 1, the Cronbach's α of each latent variable is above 0.7 in samples from China and America. The most standardized loading of factors are above 0.7, and the values of construct reliability and composite reliability are both above 0.6. The factor loads of each latent variable are greater than the acceptance criteria 0.5. The amount of average variance extracted (AVE) of each latent variable are above 0.5, which indicates that the explanatory power of measurement index exceeds the error variance, and the measurement of each constructed variable has sufficient convergent validity.

From data of both China and the United States, as shown in Table 2, all the indices of the measurement model are meet the requirement. The fitting effect is well. This model is suitable for the study of the influencing path of transaction costs in China-US construction projects.

Table 1. The measurement model—confirmatory factor analysis.

Latent variables	Cronbach's alpha (α)		Average variance extracted		Composite reliability	
	China	USA	China	USA	China	USA
The uncertainty of owner's behavior	0.701	0.714	0.650	0.640	0.944	0.898
The uncertainty of contractor 's behavior	0.724	0.786	0.577	0.646	0.844	0.927
The efficiency of project management	0.917	0.921	0.585	0.707	0.873	0.922
The uncertainty of transaction environment and mechanism	0.720	0.810	0.65	0.579	0.944	0.925
The uncertainty of transaction environment and mechanism	0.720	0.810	0.65	0.579	0.944	0.925
Transaction costs	0.728	0.811	0.714	0.757	0.833	0.862

Table 2: The measurement model—model fit indices.

Goodness of fit indices	China	US
Chi-square (χ^2)	788.8	876.5
Degree of freedom (df)	340	340
χ^2/df	2.320	2.580
Root mean square residual (RMR)	0.048	0.042
Goodness-of-fit index (GFI)	0.903	0.908
Adjusted goodness-of-fit index (AGFI)	0.854	0.900
Parsimonious goodness-of-fit index (PGFI)	0.610	0.620
Comparative fit index (CFI)	0.901	0.932
(Root mean squared error (RMSEA)	0.070	0.072

4.2 Comparison of Structural Models

The data from China and the United States are input into the structural model, the received fitting indexes are shown in Table 3. All of the indices meet the requirement of the model fit. From the above fit indexes, the fitting effect is better, and the model can be accepted. Thus, it can be concluded that data from China and the United States are suitable for this model.

Table 3. The structural model—model fit indices.

Goodness of fit indices	China	US
Chi-square (χ^2)	592.47	740.7
Degree of freedom (df)	331	331
χ^2/df	1.790	2.238
Root mean square residual (RMR)	0.049	0.032
Goodness-of-fit index (GFI)	0.889	0.901
Adjusted goodness-of-fit index (AGFI)	0.805	0.842
Parsimonious goodness-of-fit index (PGFI)	0.673	0.681
Comparative fit index (CFI)	0.935	0.921
Root mean squared error (RMSEA)	0.063	0.071

As seen from the comparison on influencing path of transaction costs in China and US construction projects in Table 4, we found support for all hypotheses except for the path from the uncertainty of owner's behavior to transaction cost (H1), which was not supported by the US sample. It has indirect effect on the transaction cost through the project management efficiency and the uncertainty of project transaction environment. While the other eight hypotheses have been validated. Conclusions about the relationship between latent variables are also similar to Chinese samples. There are different coefficients between Chinese and US samples, is it caused by the different systems of the two countries? There is need to make a multi-group comparison.

4.3 Multi-Group Comparison

In order to test whether the differences in transaction systems of construction project between the two countries have a significant impact on the path coefficients of the model. The multi-group comparison model of the structural equation model is employed. Presupposing a benchmark model A, and model B (assuming the path

coefficients of H1 between China and the United States are equal, i.e. $W_C=W_M$) is the one that fixed parameter limit is more than model A, hereby assuming the path coefficients of H2-H9 respectively, with each model comparing with model A, and taking model B as an example, the null hypothesis and the alternative hypothesis under test are:

Null hypothesis: Model A= Model B

Alternative hypothesis: Model A ≠Model B

As in Table 5, after being tested, only path hypotheses of H1, H2 and H7 are significant, while H3, H4, H5, H6, H8 and H9 are not significant. It indicates that the influence of the uncertainty of owner's behavior on the transaction cost in China is more than in the US; while the influence of the uncertainty of contractor's behavior on the transaction cost in the US is more than in China. The influence of the uncertainty of the transaction environment on the project management efficiency in China is more than in the US.

Table 4. Comparison of the path coefficient of China and the United States.

Hypotheses	Path coefficient(China)	Supported	Path coefficient(US)	Supported
H1	0.21	Y	0.07	N
H2	0.25	Y	0.42	Y
H3	-0.32	Y	-0.29	Y
H4	0.23	Y	0.35	Y
H5	0.36	Y	0.21	Y
H6	-0.13	Y	-0.14	Y
H7	-0.56	Y	-0.48	Y
H8	0.42	Y	0.25	Y
H9	-0.17	Y	-0.18	Y

Table5. Hypothesis Testing—Mutil-Group Comparison.

Hypothesis	**DF**	**CMIN**	**P**	**NFI Delta-1**	**IFI Delta-2**	**RFI rho-1**	**TLI rho-2**	**Sig.**
H1	1	2.100	0.024	0.000	0.000	-0.001	-0.001	Sig.
H2	1	3.982	0.046	0.001	0.001	0.000	0.001	Sig.
H3	1	0.002	0.967	0.000	0.000	-0.001	-0.001	No
H4	1	1.518	0.218	0.000	0.001	0.000	0.000	No
H5	1	1.523	0.217	0.000	0.001	0.000	0.000	No
H6	1	3.168	0.075	0.001	0.001	0.000	0.000	No
H7	1	15.133	0.000	0.004	0.005	0.004	0.005	Sig.
H8	1	3.132	0.077	0.001	0.001	0.000	0.000	No
H9	1	3.118	0.077	0.001	0.001	0.000	0.000	No

5 CONCLUSION

This study starts from the determinants that influence the project transaction costs: the uncertainty of owner's behavior, the uncertainty of contractor's behavior, the uncertainty of transaction environment and mechanism and the project management

efficiency, which construct nine hypothetical models of the influencing path of the construction project transaction cost. From the comparative analysis on the influencing path model of the transaction cost in China-US construction projects, it can be found that the model is suitable for data from both China and the US. In addition, each indicator of the measurement model of American data meets the requirements, while only H1 is not supported in the structural model, which indicates that the uncertainty of owner's behavior in the United States has no direct influence on the transaction cost of construction projects. It is mainly because the US project management market is more developed, if the owner has little engineering experience, he can solve the problem by hiring a professional project management company in the market for the project management contracting, so, the uncertainty of the owner behavior has little effect on the transaction costs. But whether in the United States or China, the same is that the transaction cost in the project transaction process can be reduced by reducing the uncertainty of contractor behavior and the uncertainty of trading environment and mechanism, and it can also be reached by increasing the efficiency of project management. The cohort analysis is carried out in the model, it can be found that the influence of the uncertainty of owner behavior on the transaction cost in China is more than in the US; while the influence of the uncertainty of contractor behavior on the transaction cost in the US is more than in China; the influence of the uncertainty of the trading environment on project management efficiency in China is more than in the US.

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