Risk Allocation in Public-Private Partnership Infrastructure Projects: Comparative Study

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Abstract: It is important for the public and private sectors to establish effective risk allocation strategies for public-private partnership (PPP) projects in order to achieve a more efficient process of contract negotiation and reduce the occurrence of dispute during the concession period. This paper aims first to identify the preferred risk allocation in PPP projects of mainland China and the Hong Kong Special Administrative Region (referred to as China and Hong Kong from here onward) and then to compare these preferences to those in the U.K. and Greece by a questionnaire survey based on the same risk register. The results in China and Hong Kong show that the public sector preferred to retain most political, legal, and social risks, and share most microlevel risks and force majeure risk; while the majority of mesolevel risks were preferred to be allocated to the private sector. The comparative analyses of risk allocation preference among these four countries/jurisdictions indicate that the public sector in the U.K. was most able to transfer the PPP risks to the private sector, followed by Greece, Hong Kong, and China. Respondents from Greece exhibited the greatest degree of support for the public sector to retain the macrolevel risks. All respondents agreed that private investors should take a more active role in managing the mesolevel risks. Respondents from China and Hong Kong considered that majority of the microlevel risks should be shared equally between the public and private sectors, while respondents from Greece indicated that the private sector should take a more active role in managing the microlevel risks. The comparative study provides international investors a better understanding of risk preferences in different countries/jurisdictions so that they could adjust their strategies according to the specific situation and achieve better value for money in running their PPP projects.

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Introduction

A public-private partnership (PPP) is defined by the National Council for Public-Private Partnerships, USA (2009) as "a contractual agreement between a public agency (federal, state, or local) and a private sector entity," through which the skills and assets of each sector are shared in delivering a service or facility for the use of the general public. It has been recognized as an effective way of delivering value for money for public infrastructure and services, which seeks to combine the advantages of competitive tendering and flexible negotiation, and to allocate risk on an agreed basis between the public sector and the private sector (Li et al. 2005). However, it is worth highlighting that PPP is not a panacea or a quick fix solution to deliver project financing and realization (European Commission 2003). It is essential for the public client and the private bidders to evaluate all of the potential risks throughout the whole project life. Risk is inherent and difficult to deal with, and requires a proper management framework both theoretically and practically. This is more so for PPP implementation, due to the large project scale, long concession period, complexity, and social sensitivity usually associated with PPP projects (Grimsey and Lewis 2002). Public and private sector bodies must place particular attention on the procurement process while negotiating contracts for PPP to ensure a fair risk allocation between them.

In preparing for a PPP project, government would state its preferred allocation of project risks; private investors would assess their capability of taking these risks, and then propose a bidding price. The contract negotiation would naturally focus on the risk sharing scheme. There are many techniques to identify a risk sharing scheme, among others, questionnaire survey is one of the most commonly adopted techniques, as evidenced in studies by Li et al. (2005), Roumboutsos and Anagnostopoulos (2008), and Jin and Doloi (2008). The same technique was therefore also adopted in this paper. Recently, research on the risk allocation in PPP projects were observed in the publications by Abednego and Ogunlana (2006), Medda (2007), Ng and Loosemore (2007), and Lam et al. (2007). These previous studies indicate that equitable risk allocation is highly related to the social, economic, and legal situation of the countries under scrutiny.

Although Hong Kong Special Administrative Region (referred to as Hong Kong from here onward) is part of China, the practice and experience of implementing PPP projects in these places are

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quite different. During the time when Hong Kong was governed by the British, the western practices of running projects proactively have been assimilated by the local government. In contrast, China has always adopted a more conservative Chinese approach to procuring projects. Due to the lack of advanced technology and management in the Chinese construction industry (Zou et al. 2007) and the lack of mature PPP administrative system in China (Chen and Doloi 2008), there is, hence, a need to conduct research of risk allocation and management with emphasis on the China's PPP projects and its culture. The research objective of this paper is to develop a risk allocation scheme for PPP projects both in China and Hong Kong. Another objective of this paper is to compare the preferences in China and Hong Kong to other countries in order to identify the influencing reasons for allocating a risk, which may provide references to both researchers and practitioners.

Background

Private participation in infrastructure development in China was first seen in the power industry in the 1980s. The Shajiao B power plant in Shenzhen, which came to operation in 1988, was regarded as the first build-operate-transfer (BOT) project in China. Thereafter, several state-approved pilot BOT projects have been awarded in order to introduce BOT on a larger scale since late 1996, such as Laibin B power project and Dachang water project, etc. Since then, the involvement of private investors in infrastructure development of public utilities such as transportation, water supply, gas supply, and waste disposal has improved greatly. However, at the end of last decade, the central government invested huge amounts of treasury bonds in infrastructure, and was determined to clean up the unregulated or illegal projects, which led to a termination of the first round of private investment (Shen et al. 2005). Stepping into the 21st century, in line with Beijing's success in the 2008 Olympic Games, public facilities are in high demand to cope with the rapid economic development. The huge investment in infrastructure area could not be completed by the government alone, thus providing a good business opportunity for private investors. Furthermore, in an effort to offset adverse global economic conditions and to boost domestic demand, the Chinese government introduced a series of measures to relax credit conditions, reduce taxes, and embark on a massive infrastructure spending program (Chinese Government's Official Web Portal 2008). With the 4 trillion RMB stimulus plan as announced by the Chinese government, only 1.18 trillion comes from the central government, the rest would have to be topped up by the local government, and/or the private sector (National Development and Reform Commission 2009). Since most of the local governments are still subject to severe budgetary pressure, there is a heavy reliance on the private sector investment. This provides opportunities for private investors to get more involved in infrastructure development via PPP mode.

Being the international gateway to China and arguably to Asia as well, Hong Kong represents a huge business market filled with opportunities and attractions. As a result of the foreseeable market links, Hong Kong has the potential to draw companies from across the world. Money coming in from outside is beneficial to the Hong Kong Government. Having seen the success PPP experienced by others, the Hong Kong Government is keen to bring innovation and efficiency into its public works projects. The approaches that they have taken mainly involve gaining experience from developed countries, notably from Europe and Australia (Efficiency Unit, Hong Kong SAR 2008). The approach of PPP in Europe and Australia is well developed; hence, their lessons are considered useful and relevant. But due to differences in geographic location, cultural background, local practices, and experiences in implementation, the suitability of using PPP in Hong Kong has yet to be ascertained. Ng and Wong (2006) reported that PPP may not be suitable for all public infrastructures, as the contractors in Hong Kong do not have the culture of partnership. Therefore, it would be interesting to study how the risk allocation preference for PPP projects might be similar to and different from these two administrative systems.

Research Methodology

Data Collection

To elicit useful data, an empirical questionnaire survey was undertaken in both China and Hong Kong from October 2007 to December 2007. The questionnaire of Li et al. (2005) was adopted with their prior permission for the current study as it included most risks identified from the literature. Administering the same questionnaire in different administrative systems would be of interest for comparison purposes so that common grounds or differences could be identified for further study. The original purpose of this research was to compare the risk allocations among the U.K., China, and Hong Kong. However, when preparing this paper, the writers found that Roumboutsos and Anagnostopoulos (2008) also adopted the same risk registers of Li et al. (2005) in the Greek PPP market. Their findings on risk allocation in Greece were included in the comparative analysis. The same questionnaire adopted in these three different surveys provides the writers the opportunity to undertake a comparative analysis of risk allocation preferences in different geographical locations. By adopting the questionnaire of Li et al. (2005), a three-level metaclassification was also used, whereby risks could be considered in terms of the nature of their relationship to projects. Macrolevel risks have their origins beyond the system boundaries of projects; meso level risks are concerned with factors directly concerned with the nature of each project; while microlevel risk factors are associated with the relationships between the parties involved within projects (Li et al. 2005).

In this study, the target survey respondents of the questionnaire included all industrial practitioners from the public, private, and other sectors as well as academic researchers. Target respondents were those with direct hands-on involvement in PPP projects or those with rich research experience in the field of PPP. Survey questionnaires were sent to 103 target respondents in China and 95 target respondents in Hong Kong. These respondents were requested to allocate the prescribed risk to either the private or the public sector, or describe it as "shared" between the public and private sectors.

Survey Description

A total of 53 completed questionnaires from China and 34 from Hong Kong were returned representing response rates of 52 and 36%, respectively. Both are higher than that achieved by Li et al. (2005). Such response rates are not uncommon in project and construction management research. The sample size is close to Li et al. (2005) and greater than Roumboutsos and Anagnostopoulos (2008). As shown in Figs. 1 and 2, the respondents represented a balanced role in their PPP projects and had a diversified exposure

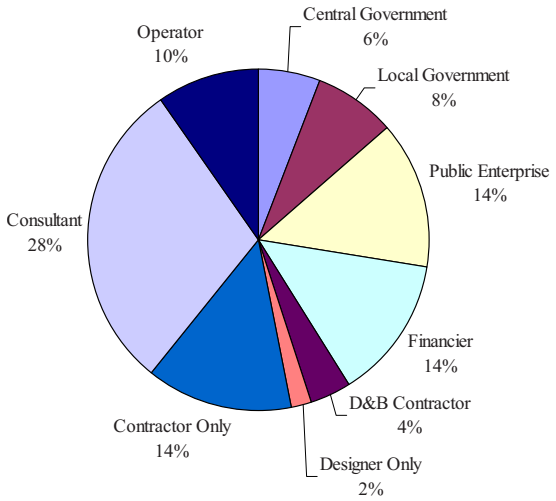

Fig. 1. Survey respondents' roles in PPP projects

to different types of PPP projects. Of the 53 respondents from China, 60% were from the industry and 40% from academic organizations, as presented in Table 1. Table 2 lists out the information of survey respondents from Hong Kong, which indicates that 62% of respondents were from the industry and the other 38% from academic organizations. As presented in Tables 1 and 2, 29 and 21 respondents in China and Hong Kong, respectively, did not have hands-on experience in PPP projects. This situation would limit the generalization of the findings of the study. Nevertheless, a large part of these respondents were academic researchers who are knowledgeable about PPP. The survey results are therefore still meaningful.

Presentation of Survey Results

Three risk allocation categories are defined as follows:

1. Risks that should be allocated to the public sector;
2. Risks that should be shared by both parties; and
3. Risks that should be allocated to the private sector.

In line with the earlier analyses conducted by Li et al. (2005), the principle of analysis is based on the level of majority opinion (>50%). In other words, if over 50% of the respondents are in favor of allocating a particular risk factor to the private sector, then the risk preference is considered to be allocated to the private sector. If none of the frequencies is over 50%, the risk factor is regarded as having no prevailing preference and therefore the risk allocation would have to be negotiated.

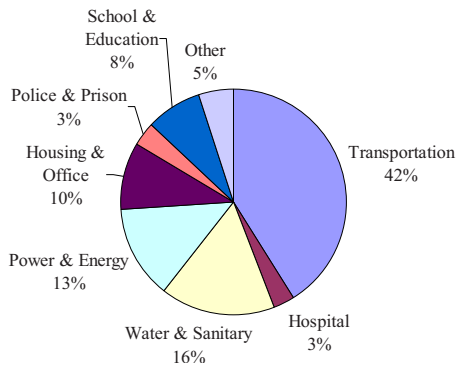

Fig. 2. Survey respondents' PPP projects

Table 1. Information of Survey Respondents from China

	Working experience (years)					PPP experience (project number)				
Role	<5	6–10	11–15	16–20	>20	0	1	2	3	>3
Industrial organization	12	7	5	4	4	14	4	8	2	4
Academic organization	12	0	3	3	3	15	1	3	1	1
Total	24	7	8	7	7	29	5	11	3	5

Preferred Risk Allocation in China

The survey feedback concerning the preferred risk allocation of China's PPP projects is presented in Table 3.

Risks to Be Allocated to the Public Sector

Seven risks to be allocated to the public sector as depicted in Table 3 are: all political (four), level of public opposition to project, and risk concerning legislation change. Additionally, "delay in project approvals and permits" risk was preferred to be assigned to the public sector with an obvious reason that the government is responsible for this task. Six of the seven risks in this category belong to the macrolevel.

Risks to Be Allocated to the Private Sector

Table 3 indicates that 22 out of 46 risks were preferred to be assigned to the private partner. Among those, "industrial regulation change," "environment," "interest rate volatility," "geotechnical conditions," and "weather" fall within the macrolevel group. Only one microlevel risk "staff crises" was preferred to be primarily allocated to the private sector. It could be observed that the majority of the mesolevel risks were preferred to be allocated to the private sector. There were 16 out of 21 mesorisks included in this category.

Risks to Be Shared

Eleven risks were preferred to be shared between the public and private sectors, seven out of them belong to microlevel, including all relationship (six) risks and one third party risk. The remaining sharing risks include "force majeure." "excessive contract variation." "poor financial market," and "influential economic events." All these risks have the same characteristic that both public and private sectors may not be able to deal with it solely. Hence, a shared mechanism would appear to be the best option.

Table 2. Information of Survey Respondents from Hong Kong

	Working experience (years)					PPP experience (project number)				
Role	<5	6–10	11–15	16–20	>20	0	1	2	3	>3
Industrial organization	0	0	3	5	13	10	1	1	3	6
Academic organization	2	3	0	3	5	11	1	1	0	0
Total	2	3	3	8	18	21	2	2	3	6

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Table 3. Preferred Risk Allocation in China's PPP Projects

Risk factors	Group	Subgroup	Public (%)	Private (%)	Shared (%)	Preferred allocation
Expropriation or nationalization of assets	Macro	Political	62	17	21	To the public sector
Unstable government	Macro	Political	62	17	21	
Delay in project approvals and permits	Meso	Design	60	21	19	
Poor public decision-making process	Macro	Political	59	12	29	
Legislation change	Macro	Legal	56	22	22	
Strong political opposition/hostility	Macro	Political	53	12	35	
Level of public opposition to project	Macro	Social	50	33	17	
Lack of tradition of private provision of public services	Macro	Social	46	37	17	Without prevailing preference
Change in tax regulation	Macro	Legal	35	35	30	
Land acquisition (site availability)	Meso	Project selection	39	24	37	
Late design changes	Meso	Construction	12	49	39	
Level of demand for project	Meso	Project selection	6	47	47	
Inflation rate volatility	Macro	Macroeconomic	12	40	48	
Force majeure	Macro	Natural	6	15	79	Shared
Excessive contract variation	Meso	Construction	6	19	75	
Differences in working method and know-how between partners	Micro	Relationship	11	16	73	
Inadequate distribution of responsibilities and risk	Micro	Relationship	17	11	72	
Inadequate distribution of authority in partnership	Micro	Relationship	13	16	71	
Lack of commitment from either partner	Micro	Relationship	27	9	64	
Third party tort liability	Micro	Third party	15	22	63	
Inadequate experiences in PPP/PFI	Micro	Relationship	17	23	60	
Poor financial market	Macro	Macroeconomic	4	36	60	
Influential economic events	Macro	Macroeconomic	10	31	59	
Organization and coordination risk	Micro	Relationship	8	42	50	
Residual risk	Meso	Residual risk	7	50	43	To the private sector
Industrial regulation change	Macro	Legal	11	52	37	
Environment	Macro	Natural	4	54	42	
Interest rate volatility	Macro	Macroeconomic	12	55	33	
Operational revenue below expectation	Meso	Operation	10	59	31	
High finance cost	Meso	Project finance	9	62	29	
Geotechnical conditions	Macro	Natural	4	62	34	
Staff crises	Micro	Third party	15	63	22	
Availability of finance	Meso	Project finance	2	64	34	
Financial attraction of project to investors	Meso	Project finance	11	66	23	
Weather	Macro	Natural	0	67	33	
Operation cost overrun	Meso	Operation	12	69	19	
Low operating productivity	Meso	Operation	13	70	17	
Maintenance costs higher than expected	Meso	Operation	12	70	18	
Insolvency/default of subcontractors/suppliers	Meso	Construction	8	70	22	
Design deficiency	Meso	Design	14	72	14	
Maintenance more frequent than expected	Meso	Operation	13	74	13	
Construction cost overrun	Meso	Construction	0	77	23	
Unproven engineering techniques	Meso	Design	13	79	8	
Poor quality of workmanship	Meso	Construction	13	79	8	
Labor/material availability	Meso	Construction	2	79	19	
Construction time delay	Meso	Construction	0	86	14	

Risks without Prevailing Preference

Finally, six risks could not be grouped in any of the above categories, including "lack of tradition of private provision of public services," "change in tax regulation," "land acquisition (site availability)," "late design changes," "level of demand for project," and "inflation rate volatility." The public and private sectors therefore would need to consider the allocations carefully with regard to these risks.

Preferred Risk Allocation in Hong Kong

The survey feedback concerning the preferred risk allocation of Hong Kong's PPP projects is presented in Table 4.

Risks to Be Allocated to the Public Sector

Eight risks which were preferred to be primarily allocated to the public sector include seven macrolevel risks and one mesolevel

Table 4. Preferred Risk Allocation in Hong Kong's PPP Projects

Risk factors	Group	Subgroup	Public (%)	Private (%)	Shared (%)	Preferred allocation
Legislation change	Macro	Legal	77	7	16	To the public sector
Expropriation or nationalization of assets	Macro	Political	70	8	22	
Lack of tradition of private provision of public services	Macro	Social	69	10	21	
Unstable government	Macro	Political	66	15	19	
Strong political opposition/hostility	Macro	Political	63	7	30	
Land acquisition (site availability)	Meso	Project selection	63	17	20	
Poor public decision-making process	Macro	Political	57	7	36	
Change in tax regulation	Macro	Legal	56	28	16	
Delay in project approvals and permits	Meso	Design	48	23	29	Without prevailing preference
Late design changes	Meso	Construction	19	44	37	
Industrial regulation change	Macro	Legal	18	36	46	
Third party tort liability	Micro	Third party	11	43	46	
Influential economic events	Macro	Macroeconomic	16	36	48	
Lack of commitment from either partner	Micro	Relationship	10	10	80	Shared
Force majeure	Macro	Natural	13	13	74	
Differences in working method and know-how between partners	Micro	Relationship	3	28	69	
Inadequate distribution of authority in partnership	Micro	Relationship	15	19	66	
Inadequate distribution of responsibilities and risk	Micro	Relationship	26	13	61	
Staff crises	Micro	Third party	7	34	59	
Weather	Macro	Natural	3	43	54	
Inadequate experiences in PPP/PFI	Micro	Relationship	7	40	53	
Level of public opposition to project	Macro	Social	41	7	52	
Excessive contract variation	Meso	Construction	13	35	52	
Inflation rate volatility	Macro	Macroeconomic	6	42	52	
Residual risk	Meso	Residual risk	13	37	50	
Geotechnical conditions	Macro	Natural	6	44	50	
Organization and coordination risk	Micro	Relationship	10	51	39	To the private sector
Level of demand for project	Meso	Project selection	16	55	29	
Environment	Macro	Natural	3	55	42	
Interest rate volatility	Macro	Macroeconomic	0	56	44	
Poor financial market	Macro	Macroeconomic	0	58	42	
Financial attraction of project to investors	Meso	Project finance	13	59	28	
Availability of finance	Meso	Project finance	9	70	21	
Labor/material availability	Meso	Construction	0	72	28	
Insolvency/default of subcontractors/suppliers	Meso	Construction	3	75	22	
Operational revenue below expectation	Meso	Operation	6	76	18	
Maintenance costs higher than expected	Meso	Operation	6	76	18	
Maintenance more frequent than expected	Meso	Operation	6	76	18	
Unproven engineering techniques	Meso	Design	0	77	23	
High finance cost	Meso	Project finance	0	81	19	
Low operating productivity	Meso	Operation	0	81	19	
Poor quality of workmanship	Meso	Construction	3	82	15	
Design deficiency	Meso	Design	0	82	18	
Construction time delay	Meso	Construction	0	84	16	
Construction cost overrun	Meso	Construction	0	88	12	
Operation cost overrun	Meso	Operation	0	88	12	

risk. Of the seven macrorisks, there were all political (four) risks, one social risk, and two legal risks. The risk of land acquisition was also suggested to be assigned to the public sector. The results are shown in Table 4.

Risks to Be Allocated to the Private Sector

Twenty risks fall in the risk category of being allocated to the private sector. Table 4 shows that fourteen risk factors received a high support to be assigned to the private sector and little or no preference for allocation to the public sector. All these fourteen risks belong to mesolevel, including five construction risks, five operation risks, two design risks, and two project finance risk. Risks such as "organization and coordination risk," level of demand for project, environment, interest rate volatility, poor financial market, "financial attraction of project to investors,"

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Table 5. Shared Risk Allocation Preferences among China, Hong Kong, U.K., and Greece

			China			Hong Kong			U.K.			Greece		
Group	Subgroup	Risk	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.
Macro	Natural	Force majeure	6	15	79	13	13	74	18	16	68	32	4	64
Macro	Political	Unstable government	62	17	21	66	15	19	58	25	17	69	4	27
Macro	Political	Strong political opposition/hostility	53	12	35	63	7	30	63	21	16	69	4	27
Macro	Political	Poor public decision-making process	59	12	29	57	7	36	69	7	24	73	0	27
Meso	Construction	Labor/material availability	2	79	19	0	72	28	0	94	6	4	80	16
Meso	Construction	Construction cost overrun	0	77	23	0	88	12	0	92	8	0	80	20
Meso	Construction	Poor quality of workmanship	13	79	8	3	82	15	3	92	5	0	100	0
Meso	Design	Unproven engineering techniques	13	79	8	0	77	23	0	97	3	4	76	20
Meso	Design	Design deficiency	14	72	14	0	82	18	0	95	5	8	64	28
Meso	Operation	Operation cost overrun	12	69	19	0	88	12	0	97	3	0	75	25
Meso	Operation	Operational revenue below expectation	10	59	31	6	76	18	3	89	8	0	60	40
Meso	Operation	Maintenance costs higher than expected	12	70	18	6	76	18	0	97	3	0	84	16
Meso	Operation	Maintenance more frequent than expected	13	74	13	6	76	18	0	92	8	5	82	13
Meso	Project finance	Financial attraction of project to investors	11	66	23	13	59	28	3	70	27	20	56	24
Meso	Project finance	High finance cost	9	62	29	0	81	19	3	76	21	9	72	19

"availability of finance," and "labor/material availability" were preferred to be allocated primarily to the private sectors, but with perceived opportunities for sharing with the public sector.

Risks to Be Shared

Five risks under the category of macro level (three natural, one social, and one macroeconomics) risks and two mesolevel risks (excessive contract variation and "residual risk") were considered by the majority of respondents to be shared by the public and private sectors. There are also another six microlevel risks in this shared risk category option, including five relationship risks, and one third-party risk.

Risks without Prevailing Preference

Finally, there were five risks which could not be included in any category. These risks are: delay in project approvals and permits, late design changes, industrial regulation change, "third party tort liability," and influential economic events.

Comparing the Preferred Risk Allocation

As described in the methodology section, having noted that Roumboutsos and Anagnostopoulos (2008) also adopted the same risk registers of Li et al. (2005) in the Greek PPP market, this paper then attempts to compare the preferred risk allocation among China, Hong Kong, the U.K., and Greece in accordance with the findings reported in these two papers. These comparative analyses would be adopted to identify the level of common disposition toward risks and provide an indication of the potential to collaborate (Roumboutsos and Anagnostopoulos 2008). It is worth noticing that some minor adjustments concerning the risk register were made in the survey by Roumboutsos and Anagnostopoulos (2008), such as including the risk "archeological findings" and excluding four risks "expropriation or nationalization of assets," "construction time delay," "insolvency/default of subcontractors/suppliers," and "low operating productivity." Therefore, the following comparative analysis would only focus on the allocation difference of the remaining 42 risk factors.

The numbers of risks allocated to the public and private sectors are six and 19 in China; seven and 17 in Hong Kong; four and 29 in the U.K.; nine and 23 in Greece. This suggests that PPP arrangements in the U.K. may be most able to transfer risk from the public sector to the private sector. In contrast with the U.K., both the public and private sectors have less experience of PPP in the other three countries/jurisdictions. It is hence understandable that the private sectors showed a greater degree of risk averseness expressed in avoiding risks, while their U.K. counterparts would be willing to undertake, especially for the macro level risks. Compared to Greece, respondents from China and Hong Kong were more willing to share different levels of involvement and responsibility between the public and private sectors. The Greek private sector might have full understanding of the limitations of the public sector and was therefore willing to take full responsibility for the partnership risks (Roumboutsos and Anagnostopoulos 2008), instead of sharing these risks as indicated in China and Hong Kong.

Table 5 shows the common preferences of risk allocation among the four administrative systems/jurisdictions. Differences among the preferred risk allocation as per different risk level groups are presented in Table 6 and discussed as follows:

Common Risk Allocation Preference

Among these 42 risks, there are 15 risks that received the same allocation preference among four different countries/jurisdictions as shown in Table 5. 11 risks at mesolevel are related to the construction, design, finance, and operation of a PPP project, which could be regarded as the complementary skills of the private sector, and thus were preferred to be assigned to the private sector. This observation also suggests that the driving force for the government to introduce PPP vehicle is to tap in the efficiency and business skills of the private sector. The general principle that risks should be allocated to the party best able to manage them and at the least cost (Cooper et al. 2005) prevails. The nature of force majeure risk is such that public and private sectors may not be able to deal with it alone. It is thus understandable for both parties to share this risk. Respondents from four countries/jurisdictions also shared the same allocation preference for all the political risks, i.e., "unstable government," "poor public decision-making process," and "strong political opposition/hostility." The

Table 6. Difference in Risk Allocation Preferences among China, Hong Kong, U.K., and Greece

			China			Hong Kong			U.K.			Greece		
Group	Subgroup	Risk	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.	Pu.	Pr.	Sh.
Macro	Legal	Legislation change	56	22	22	77	7	16	17	22	61	67	29	4
Macro	Legal	Change in tax regulation	35	35	30	56	28	16	18	51	31	76	4	20
Macro	Legal	Industrial regulation change	11	52	37	18	36	46	0	75	25	62	4	34
Macro	Macroeconomic	Poor financial market	4	36	60	0	58	42	0	89	11	12	30	58
Macro	Macroeconomic	Inflation rate volatility	12	40	48	6	42	52	7	56	37	27	23	50
Macro	Macroeconomic	Interest rate volatility	12	55	33	0	56	44	2	78	20	15	31	54
Macro	Macroeconomic	Influential economic events	10	31	59	16	36	48	8	69	22	24	12	64
Macro	Natural	Weather	0	67	33	3	43	54	0	82	18	0	55	45
Macro	Natural	Geotechnical conditions	4	62	34	6	44	50	5	87	8	8	44	48
Macro	Natural	Environment	4	54	42	3	55	42	0	84	16	20	20	60
Macro	Social	Lack of tradition of private provision of public services	46	37	17	69	10	21	27	59	14	0	80	20
Macro	Social	Level of public opposition to project	50	33	17	41	7	52	46	42	13	24	16	60
Meso	Construction	Late design changes	12	49	39	19	44	37	26	53	21	4	76	20
Meso	Construction	Excessive contract variation	6	19	75	13	35	52	33	26	41	0	92	8
Meso	Design	Delay in project approvals and permits	60	21	19	48	23	29	35	32	33	56	0	44
Meso	Project finance	Availability of finance	2	64	34	9	70	21	0	85	15	28	20	52
Meso	Project selection	Level of demand for project	6	47	47	16	55	29	8	73	19	59	21	20
Meso	Project selection	Land acquisition (site availability)	39	24	37	63	17	20	61	12	27	55	16	29
Meso	Residual risk	Residual risk	7	50	43	13	37	50	22	55	23	4	40	56
Micro	Relationship	Organization and coordination risk	8	42	50	10	51	39	0	80	20	0	86	14
Micro	Relationship	Inadequate experiences in PPP/PFI	17	23	60	7	40	53	13	43	43	0	78	22
Micro	Relationship	Inadequate distribution of responsibilities and risk	17	11	72	26	13	61	0	23	77	4	70	26
Micro	Relationship	Inadequate distribution of authority in partnership	13	16	71	15	19	66	4	29	67	0	86	14
Micro	Relationship	Differences in working method and know-how between partners	11	16	73	3	28	69	0	73	27	0	88	12
Micro	Relationship	Lack of commitment from either partner	27	9	64	10	10	80	24	10	66	5	81	14
Micro	Third party	Third party tort liability	15	22	63	11	43	46	3	60	37	6	56	38
Micro	Third party	Staff crises	15	63	22	7	34	59	7	60	33	0	76	24

public sector has a stronger power to deal with the consequence of these political risks and is therefore better able to undertake them.

Differences for Macrolevel Risks

For the three legal risks, i.e., "legislation change," industrial regulation change, and change in tax regulation, few respondents from the U.K. indicated their preference to allocate these risks to the public sector. These legal risks would have an impact on project revenue and the payment mechanism of a PPP project. With less PPP experience in other three administrative systems/jurisdictions, it is not surprising that respondents preferred the public sector to share these risks. Respondents from other jurisdictions therefore indicated a higher preference for the public sector to undertake or share these legal risks.

Only a relatively small proportion of respondents considered that the four macroeconomic risks should be undertaken by the public sector. Respondents from the U.K. and Hong Kong were in higher agreement concerning the allocation of these risks to the private sector, while a higher percentage of support for both sectors to share these risks was seen in the results from Greece and China. This reinforces the risk averseness attitude of the private sector expressed in avoiding risks in Greece and China. This is believed to stem from unique country experience (Roumboutsos and Anagnostopoulos 2008). For example, from 1998 to 2000 in China, the issuing of additional RMB 360 billion national debt for infrastructure made many local governments turn to traditional public provision instead of PPP for those projects under negotiation during that time (Sachs et al. 2007). Due to these past experiences, the respondents in China thus expected the government to share part of these macroeconomic risks.

Table 6 shows that a similar perspective concerning the allocation of the other three natural risks weather, geotechnical conditions, and environment from China and the U.K. They were all preferred to be undertaken by the private sector. However, according to (Roumboutsos and Anagnostopoulos 2008), projects in Greece always encounter very dramatic geotechnical conditions which may not be easily foreseen and have an enormous impact on project design and cost. Therefore, geotechnical conditions and environment risks were preferred to be shared in Greece. Similarly in Hong Kong, it is often affected by severe weather phenomena including tropical cyclones, strong winter and summer monsoon, monsoon troughs, and thunderstorms with associated squalls that are most frequent from April to September (Hong Kong Observatory 2009). The public sector was therefore expected to share this high risk.

Most survey respondents from the U.K. and Greece thought the risk lack of tradition of private provision of public services should be allocated to the private sector. For the other social risk

"level of public opposition to project," there was an agreement between respondents from Hong Kong and Greece to assign it to the shared option.

Differences for Mesolevel Risks

As described in Table 5, there is a general agreement to transfer most mesolevel risks to the private sector across these countries/jurisdictions. Eleven risk items in total received the same allocation preference to be undertaken by the private sector. Respondents from China and Hong Kong thought that late design changes could not be clearly assigned to either public or private sector and the allocation may depend upon which sector taking major responsibility for the occurrence of this risk. A high percentage of support to share the risk excessive contract variation is seen in the results from China and Hong Kong, while respondents from the U.K. thought it should depend upon the situation of the project considered. Different opinions also existed for the allocation of delay in project approvals and permits. Only respondents from Greece considered that the public sector should share the risk of availability of finance, but the rest agreed to assign it to the private sector. Only those from China did not agree to allocate the risk land acquisition (site availability) to the public sector. For the other project selection risk level of demand for project, Table 6 indicates that the private sector in the U.K. should take the greatest responsibility for this risk followed by Hong Kong, China, and Greece. Finally, the residual risk was preferred to be assigned to the private sector in China and the U.K., but to be shared by both sectors in Hong Kong and Greece.

Differences for Microlevel Risks

There is a general agreement that it would not be necessary for the public sector to take major responsibility for any microlevel risks. For the two risks related to a third party, third party tort liability and staff crises, respondents from the U.K. and Greece thought they should be assigned to the private sector. But those from China considered that it might be more appropriate for the public and private sector to share the risk of third party tort liability. It could be seen through past PPP projects in China that state-owned enterprises are the principal players in the current round of private investment in infrastructure development (Ke et al. 2009). The Chinese government should surely have stronger power to ensure the third parties to perform their responsibilities and it would greatly enhance the potential of success if the government could undertake part of this risk. Respondents from Hong Kong also thought staff crises risk should be shared between the public and private sectors.

For all six relationship risks, respondents from China considered that it may be the best option to share the risk by both the public and private sectors, while those from Greece suggested assigning them to the private sector. This observation yet again testifies that the construction and operation of any PPP projects in China cannot proceed successfully without the governments' cooperation and assistance (Sachs et al. 2007). In contrast, the private sector in Greece may have full understanding of the limitations of the public sector and is thus willing to take full responsibility for the partnership risks when involved in PPP projects (Roumboutsos and Anagnostopoulos 2008). Similar to China, five out of six relationship risks fell within the shared category in Hong Kong except organization and coordination risk, which was preferred to be allocated to the private sector. In the results from the U.K., organization and coordination risk and "differences in working method and know-how between partners" were assigned to the private partner, and the risk of "inadequate experiences in PPP/PFI" received an equally high percentage both for the private and shared options.

Conclusions

Li et al. (2005) conducted an impressive analysis of preferred risk allocation in PPP projects in the U.K. Their work inspired the writers to carry out a similar research to first identify the preferred risk allocation for PPP projects in China and Hong Kong and then to compare the findings with those reported in the U.K. A survey questionnaire originally developed by Li et al. (2005) was used to canvass the opinions of practitioners with experience in PPP projects in both China and Hong Kong from October 2007 to December 2007. At the time of writing up this paper, the writers found that Roumboutsos and Anagnostopoulos (2008) also carried out a similar research in Greece based on the same risk register list, therefore their findings were also reported in this paper to enrich the comparative study, covering China, Hong Kong, the United Kingdom, and Greece. These analyses will aid international comparison of risk allocation perception and encourage potential collaboration for future research endeavors.

The results show that the public sector partner preferred to retain political and social risks as well as the risks of legislation change and delay in project approvals and permits in China. Risks such as third party tort liability, force majeure, excessive contract variation, poor financial market, and influential economic events were preferred to be shared by both parties. The majority of the remaining PPP risks, especially those at the mesorisk level were preferred to be allocated to the private sector. The respondents from Hong Kong perceived that the public sector should take major responsibility for political, legal risks and the risks of lack of tradition of private provision of public services and land acquisition (site availability). Natural, relationship risks, and other risks such as excessive contract variation, residual risk, inflation rate volatility, level of public opposition to project, and staff crises were preferred to be shared by the public and private sectors. Similar to China, the majority of the meso risks were preferred to be transferred to the private partner.

The comparative analyses of risk allocation preference among four countries/jurisdictions indicate that the public sector in the U.K. was most able to transfer the PPP risks to the private sector, followed by Greece, Hong Kong and China. The comparative study also indicates that no matter whether it is a developed or a developing PPP market private investors should take a more active role in managing the mesolevel risks. Respondents from China and Hong Kong considered that majority of the micro level risks should be shared equally between the public and private sectors, while respondents from Greece indicated that the private sector should take a more active role in managing the micro level risks. Certainly the maturity of the PPP market would influence the private sector's willingness to undertake more risks in PPP projects.

The findings reported in this paper would shed some insights into PPP risks and their preferred allocation between the public and private sectors in general. In particular, this study would provide international investors a better understanding of risk preferences in different countries/jurisdictions so that they could adjust their strategies according to the specific situation and achieve better value for money in running their PPP projects.

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