

AN EMPIRICAL EXAMINATION OF MORAL HAZARDS AND ADVERSE SELECTION ON PPP PROJECTS: A CASE STUDY OF GHANA

ABSTRACT

Purpose – Failures of Public-Private-Partnership (PPP) projects are often ascribed to the agency problem, which arise under conditions of inadequate and asymmetric information when a principal (the client) hires an agent (the contractor). This paper aims to identify the causes and effects of moral hazard and adverse selection on PPP construction projects using a synthesis of extant literature (to determine key variables) and analysis of survey questionnaire data collected.

Design/Methodology/Approach – Mean score ranking was used to rank the causes and effects of moral hazard and adverse selection problems in PPP construction projects. One sample t-test was conducted to establish the relative significance of these variables.

Findings – *Effort dimensions (which are not verifiable), low transfer of risk, lack of accurate information about project conditions, wrong party chosen to execute project and renegotiation of contracts* were the most significant causes of moral hazard and adverse selection problems in PPP construction projects. In addition, *reduction of competition, high transaction costs, consequences on profitability of project, siphoning of funds and negative implications on enforceability of contract* were the most significant effects of moral hazard and adverse selection problems in PPP construction projects.

Originality/Value – Research findings provide guidance to construction stakeholders in the PPP sector on the different causes and effects of adverse selection and moral hazard. This pioneering study is the first to conduct an empirical assessment of the causes and effects of moral hazard and adverse selection of PPP construction projects in a developing country.

Practical Implications - Application of these findings will help to mitigate moral hazard and adverse selection problems occurring when undertaking PPP construction projects.

KEYWORDS

Causes and Effects, Public-Private-Partnership, Moral hazard, Adverse Selection, Construction Projects, Ghana

INTRODUCTION

Public-Private Partnerships (PPPs) involve collaboration between two sectors involving a private entity and public body. Osei-Kyei *et al.* (2014) proffer that the public body is the contracting authority and consists of public departments and agencies, ministries, Metropolitan, Municipal and District Assemblies (MMDAs). The contracting authorities are normally offered support in undertaking the PPP by the Ministry of Finance and Economic Planning (*ibid*). Spreading of risk is another characterisation of PPP in Ghana. According to MOFEP (2011), the public sector does not enter into any partnership where risks are not shared over a given period of time. Hence, Design Build Finance Operate (DBFO) is the major form of PPP undertaken in the Ghanaian construction industry (Osei-Kyei *et al.*, 2014).

Moral hazard is defined as the lack of initiative to guard against risk especially when protected from its consequences. In a practical setting, this may involve discretionary or hidden actions of the contractor obscured from the client which are driven to save contract costs but invariably reduce product/ service quality (Biong, 2013; Pana, 2010; Wang *et al.*, 2007). Moral hazard is a phenomenon of information lopsidedness or asymmetry that occurs after the principal makes a decision. This phenomenon is also called *hidden action* since the actions and activities of the agent are not fully revealed to the principal (Pana, 2010). Similarly, within extant literature, adverse selection is acknowledged to be the exclusive or private information possessed by the contractor and which is not available to the buyer (Biong, 2013). In adverse selection, information gap occurs prior to the principal making a decision. It is alternatively referred to as hidden knowledge because the potential agent possesses information which the principal lacks and may result in the principal taking a wrong decision. Various authors have propagated theoretical development in the areas of adverse selection and moral hazard (*c.f.* Biong, 2013; Monteiro, 2010; Wuyts *et al.*, 2009; Blombäck and Axelsson, 2007). For example, Biong (2013) investigated reputation and pricing effects on choosing subcontractors in asymmetric markets whereas, Monteiro (2009) explored risk management in agency relationships. According to Monteiro (2009), in the project's bidding phase, the tenderer does not know clearly the bidder's technical strengths, level of management, and service quality among other service providers. The bidder is similarly unclear of the tenderer's

financial capacity and business reputation. Accordingly, this leads to both adverse selection and moral hazard problems. However, some gaps do exist in these works. For instance, Biong (2013) did not investigate the causes of the asymmetry but only on the effects whereas Monteiro (2009) was also silent on the effects of information asymmetry.

This current research study extends existing knowledge by examining agency theory but also investigates the cause and effect of adverse selection and moral hazard of Public-Private-Partnership projects. Specifically, the paper empirically examines adverse selection and moral hazard of Public-Private-Partnerships (PPP) in Ghana. The research question arising is: what are the causes and effects of moral hazard and adverse selection of moral hazard and adverse selection of PPP construction projects in Ghana? The specific objectives of the study are therefore to identify and evaluate the causes and effects of moral hazard and adverse selection of moral hazard and adverse selection of PPP construction projects as a means of exonerating invaluable insight for industry and academia.

AGENCY THEORY AND PPPS

The agency problem is a conflict of interest inherited in any relationship where one party is expected to act in another's best interests (Lobner, 2009; Buvik and Rokkan, 2003). Agency theory is concerned with resolving problems that can exist in agency relationships due to unaligned goals or different aversion levels to risk. The most common agency relationship in constructions occurs between principals (clients) and agents (contractors) (Iossa and Martimort, 2008). As such, agency theory addresses problems that arise due to differences between the goals or desires between the principal and agent. This situation may occur because the principal is not aware of the actions of the agent or is prohibited by resources from acquiring the information. There exist different asymmetric information models discussing PPP (refer to Table I).

<Insert Table 1 About Here>

Causes of Moral Hazard and Adverse Selection of PPP Projects

The causes of moral hazard and adverse selection are myriad but extant literature reveals that the most common considerations are: lack of accurate information about project conditions; effort dimensions (which are not verifiable); wrong party chosen to execute the work; low incentives; low transfer of risks; inexperience; and limited ability to commit to contractual obligations. Each of these considerations are now elucidated upon in some further detail.

Lack of accurate information about project conditions. Due to the long-term scope of PPP projects, accurate information on the existing, future and indirect costs of the works are obscured – this elevates the tendency for experiencing moral hazard and adverse (Blanc-Brude, 2013; Loben, 2009).

Effort dimensions (which are not verifiable). The unobserved nature of the exact effort exerted by the contractor (which cannot be specified in a contract), leads to a moral hazard problem. Accordingly, the contractor then has the incentive to minimise effort when undertaking work to maximise profit (Guasch, 2004).

Wrong party chosen to execute the work. Adverse selection results when the contractor chosen is the wrong one to begin with and leads to moral hazard problems of cost overruns and poor risk management (Loben, 2009). In renegotiation of contracts, renegotiation incidents being persistent in PPPs lead to agency problems. However, this phenomenon is not limited to less developed countries. Several projects in both North America and Latin America have been abandoned because of the neglect of contract by either the private or public partner arising from renegotiation (Guasch *et al.*, 2008; Iossa and Martimort, 2008). Even though there have been calls for laws that prevent renegotiation of contracts in PPPs by some procurement models, many of these models cannot be adapted in modern contracts (Laffont 2003).

Low incentive. When the risks and liability of cost overruns are not borne by the party constructing, low incentive to control costs are created (Blanc-Brude, 2013). The behaviour of the agent influences the incentive to control costs. However, the challenge of retrieving information about agents and the risks associated with long-term contracts can also present an obstacle to overcoming cost control problems (Blanc-Brude, 2013).

Low transfer of risks. There are two broad dichotomous groups of private companies, which can undertake PPP infrastructural projects, namely: i) those who are effective and have the capability to lower costs and manage risks; and those who cannot (Blanc-Brude, 2013). The dilemma of government is to identify which firms should be awarded the contract to undertake the work (Boukendour, 2007). In contracts with little or no risk, the effective companies have an incentive to imitate ineffective firms at the bidding phase (adverse selection) and thereby do not attempt to lower and manage costs (moral hazard) (BlancBrude, 2013).

Inexperience. Inexperience occurs when inexperienced contractors bid for PPP projects and withhold vital information before the relationship begins. However, monitoring and reputation systems are expected to reduce the impact of this issue. Monitoring aims to lower the information asymmetry by providing more information regarding contractors, while reputation systems provide a signal of contractors' future performance based on their performance ratings entered by previous employers (Allen, 2003).

Limited ability to commit to contractual obligations. This cause can also be referred to as conditions of restricted commitment which represent instances where contractual parties are unable to abide by their obligations spelt out in the contract (Iossa and Martimort, 2008). This may lead to three situations according to Estache and Wren-Lewis (2008). First and with limited enforcement, the agent might renege on the contract even if the principal disagrees. Second and conversely, an instance of non-commitment may transpire where the government might renege on the contract, even if it is unfavorable for the private sector. Third, renegotiation and commitment may occur - in this instance, stakeholders abide by their responsibilities but if both parties desire, the contract may be renegotiated at a later time (Iossa and Martimort, 2008).

Effects of Moral Hazard and Adverse Selection on PPP Projects

Akin to the causes, the effects of moral hazard and adverse selection are: opportunistic behavior; high transaction costs; consequences upon profitability; reduction of competition; siphoning of funds; corruption; dishonesty; and negative implications on enforceability of contract. Each of these effects are now elucidated upon in some further detail.

Opportunistic behavior. Information asymmetry stimulates opportunistic behaviour (Schieg, 2008). In the project's bidding phase, the tenderer does not know clearly of the bidder's technical strengths, level of management and service quality among others. The bidder is similarly unclear of the tender's financial capacity and business reputation. Under such circumstance, adverse selection is prone to occur as a result given that the two parties' information is asymmetric (Martimort and Straub, 2008).

High transaction costs. High transaction costs arise because the government negotiates with and monitors the private sector partners who have their own interests and agendas. Being a long-term contract, the partnership contract engenders the traditional issues of moral hazard and adverse selection related to the choice of a bidder. This implies high transaction costs for both the public and private partners, due to duration of the negotiation and the skills and resources involved (Allen, 2003).

Consequences on profitability. Because of the inherent challenges involved in producing accurate estimates, the firm's profits are largely uncertain before the operation phase starts (Chong *et al.*, 2007). Private investment becomes difficult to attract, especially when projects are large and private sponsors are averse to risk (Iossa and Martimort, 2008). In Europe, cross border infrastructure has received little concern from private financiers. Even when private investors turn up, they tend to behave opportunistically leading to moral hazard (Chong *et al.*, 2007).

Reduction of competition. When bidders develop an innovative offer they risk losing the tender and not being repaid for the innovation (Badenfelt, 2008). These two negative consequences limit the number of bidders and successive failed bids erode competition as the opportunity to win a contract is outweighed by the cost of lost bids (Boukendour, 2007). Maintaining competitive

pressure for a PPP ex-post is also debatable (Chong *et al.*, 2007). In the absence of information asymmetry, a simple cost-plus contract would be ideal whereas a fixed price contract would owe rent to the private stakeholder. In both instances, it is difficult or costly to ascertain the type of bidder and measure their performance (Laffont and Tirole, 1986). Furthermore, the contractor benefits from the contractual irreversibility and the informational rent built up during the contract duration.

Siphoning of funds. The agent could siphon funds and this works against the principal hence, instead of focusing on work that drives success; the agent can divert money for private consumption and the remaining funds to create the impression of productivity. Monitoring this situation brings about three challenges (Chong *et al.*, 2007). First, firms may attempt to win the contract with limited effort and with the premeditated intention of siphoning all funds. Second, the firm, which has worked efficiently according to the contract, may start siphoning funds whilst waiting to exercise the option of revealing success at a future more convenient date. Third, towards the end of contract, a firm may cease exerting effort and start siphoning funds, because the probability of success fails to justify the exertion of more effort. For instance, a construction company may succeed at the end of a large project and then delay completion of the less demanding activities over time to stretch out payments received from the principal (Chong *et al.*, 2007).

Corruption. The construction industry worldwide has a negative reputation for bribery and corruption incidents (Sohail and Cavill, 2008). According to Martimort and Straub (2008) posit that reliance upon private stakeholders may provide avenues for widespread corruption, when compared to government provision. When subsidies from national budget are given to the government to undertake projects, corruption leads to alteration of price thereby leading to the rendering of lower service when a private firm is given the work - this is a disadvantage to consumers. Even where taxation schemes are effective, corrupt bureaucrats and officials at different levels can be prejudiced and influenced by the private partner.

Dishonesty. Asymmetric information can engender dishonesty to create a major project risk in construction (Martimort and Straub, 2008). Where adverse selection prevails, a harmonious project management team (including all stakeholders) cannot be formed (Muhwezi *et al.*, 2014).

Negative implications on enforceability of contract. Moral hazard is the undesirable situation where economic actors make profit-maximising but inefficient decisions since they can avoid costs associated with their conduct. The problem of moral hazard is often associated with insurance - when someone takes out insurance against a given type of harm, they no longer have an incentive to take prudent (efficient) steps to reduce the risk of that harm occurring. In practice, it leads to challenges with enforcing the contract (Chong *et al.*, 2007).

METHODOLOGY

Questionnaires were utilized as the main data collection instrument (Creswell, 2005) and in ensuing analysis, both primary and secondary quantitative data were utilised (Sarantakos, 2005). All questionnaires were self-administered and deliberately sought responses from professional practitioners (including construction firms, consultancy firms and government agencies) with responsibility for delivering PPP construction projects. The questionnaire instruments were pre-tested and piloted before the main survey to ensure extensiveness, clarity and validity (Oppenheim, 2000; Creswell, 2005; and Yin, 2009). Pre-testing/ piloting, also sought to note the time taken to answer the questionnaires by respondents. Using the stratified sampling technique, two respondents each from government agencies, consultancies and construction firms (who were involved in PPP projects and had relevant and insightful expertise) were asked to pre-test the questionnaires. These six respondents were asked to check the research instrument for ambiguity, clearness and time used to finish answering the questionnaires. They were also invited to give insights, which would improve the preciseness of the questionnaires. Feedback received indicated that the questionnaires were very clear to comprehend and were likely to elicit pertinent answers in the main survey. Comments from the piloting were used to make a few additions and fine-tuning of the questionnaires for the main survey.

The main survey was conducted over a two-month duration and respondents were asked to rank eight causes of moral hazard and adverse selection of PPP construction projects and nine effects

of moral hazard and adverse selection of PPP construction projects. A 5-point Likert item system was used, where 1 = not significant; 2 = moderately significant; 3 = significant; 4 = very significant; and 5 = extremely significant. From this Likert item system, mean values > 3.00 were significant as deemed in similar studies (c.f. Li *et al.*, 2005). The sampling technique for this study with relation to its design, purpose, and realistic inference on this research topic is purposive sampling. Purposive sampling indicates the strategies where the researcher applies discretion as to who will best provide answers concerning field of study, and then deliberately requests those definite viewpoints into the study. Purposive sampling is very useful for instances where one needs to contact a targeted sample fast (Creswell, 2005). Furthermore, snowball sampling was used in getting the sample size due to the challenges encountered in evaluating the population size (*ibid*). Snowball sampling is a solution to reaching hard-to-reach or concealed populations. It exists on the assumption that a link exists among the original sample and extras in the similar target population. Hence, the snowball sampling was used for identifying respondents with rich information that are relevant to the current study. This process continued until a representative sample size of fifty-six government agencies, consultancy firms and construction companies in charge of Public Private Partnership projects was obtained. Questionnaires were distributed to five respondents in each of these companies and agencies resulting in a total of two hundred and eighty respondents.

Two hundred and ten questionnaires representing seventy five percent (75%) response rate was attained and useable. This sample size is suitable for conducting the data analysis as noted and reported by El-Gohary and El-Gohary (2016); El-Gohary (2014); El-Gohary (2012) and El-Gohary (2009). Comparing this with past recent studies conducted, this response rate is high due to follow-up telephone calls made. For example, a study conducted by Osei-Kyei *et al.* (2014) in Ghana yielded 56% response rate (45 out of 81). Ismail (2013) in Malaysia had a response rate of 49% (122 out of 250) while that undertaken by Cheung *et al.* (2012) in Hong Kong had 36% response rate (34 out of 95). Other studies conducted had small samples. There were 31 responses in Wang *et al.* (2004); 27 responses in Sachs *et al.* (2007); 17 responses in Voelker *et al.* (2008) and 19 responses in Choi *et al.* (2010). The response rate for this study is therefore appropriate for analysis.

A review of similar studies in the past including that of Cheung *et al.* (2009) and Ameyaw and Chan (2013) indicated that the main analytical tool used was descriptive statistics mean score ranking.

DATA ANALYSIS AND DISCUSSION:

Before conducting the detailed data analysis, Cronbach's alpha was conducted to test internal consistency of the data. According to Norusis (2005), the Cronbach's Alpha Reliability must exceed 0.70. From Table II, the Cronbach's alpha for the study is 0.780 which implies that this study has reliable data.

<Insert Table II About Here>

Descriptive Statistics for Causes of Moral Hazard and Adverse Selection:

It was deemed necessary to know the causes of moral hazard and adverse selection of PPP construction projects and to know their level of importance. In this section, respondents ranked these causes on a Likert item scale. Mean values and standard deviation were used for the ranking. From Table III below, *effort dimensions (which are not verifiable)* was ranked 1st with a mean of 4.10; with a standard deviation of 0.780 and standard error mean of 0.054. *Low transfer of risk* was ranked 2nd with a mean of 4.09, standard deviation of 0.892 and standard error mean of 0.062. *Lack of accurate information about project conditions* was ranked 3rd with a mean of 4.06, standard deviation of 0.746 and standard error mean of 0.051. *Wrong party chosen to execute project* was ranked 4th with a mean of 3.93, standard deviation of 0.712 and standard error mean of 0.049. *Renegotiation of contracts* was ranked 5th with a mean of 3.78, standard deviation of 0.770 and standard error mean of 0.053. All the factors had a standard deviation less than one, indicating that there exists consistency in agreement between respondents' interpretations. This is probably because the respondents understood these factors very well. Moreover, almost all the factors had means greater than the hypothesised mean of 3.5 and their standard error means were also close to zero indicating that there was great consistency among agreement between the respondents. Only *low incentives to control costs* had mean less than the hypothesised mean of 3.50.

< Insert Table III About Here >

One Sample T-Test for Causes:

The one sample t-test was used to establish the relative significance of the variables. This is used in ascertaining whether a sample mean is significantly deviant from a hypothesised mean (Ahadzie, 2007). For a single sample test, its hypothesis is:

$$H_0: U = U_0$$

$$H_a: U <, > U_0$$

With H_0 representing the null hypothesis, H_a representing the alternative hypothesis and U_0 representing the hypothesised mean. Ahadzie (*ibid*) records that for a usual one-sample t-test, the mean of the test group, degree of freedom for the test (an approximate of the sample size), the t-value (strength of test) and the p-value (probability of test being significant) are reported usually. A statistical test of the mean was undertaken to decide whether the population considered a variable to be important or not. The mean ranking of each criterion was compiled to articulate the decisions that the respondents expressed. Moreover, the mean for each variable with its corresponding standard deviation and standard error are presented.

For each variable, the null hypothesis was that this variable was not significant ($H_0: U = U_0$). The U_0 is the critical rating above which the variable is considered to be important. In this research, the higher ratings of 4 and 5 were chosen for the rating scale as important and very important respectively while the U_0 was set at 3.5. In this study, the hypothesised mean is set at 3.5. This is because if 5 = very important and 4 = important, then for a variable to be consistently considered agreed, it should have a mean above the neutral point 3. Hence, the hypothesised mean was set between three and four (i.e. 3.5). All the means that are above 3.5 are considered as consistently agreed to by the study's respondents.

The significance level was set at 95% in accordance with the levels of risk. This is premised on the five point Likert item rating where a success variable is deemed important if its mean was equal to or more than 3.5 (Field, 2005). All the factors had t-values (the strength of the test) that

were positive indicating that their means were above the hypothesised mean of 3.5 except *Low incentives to control costs* which had a t-value of (-2.610). This is because it had a mean of 3.35, which is below the hypothesised mean of 3.5. All of the factors had a p-value (significance of the test) less than 0.05 and this implies that the means of these variables are not significantly different from the hypothesised mean of 3.5. Furthermore, the 95% confidence level interval estimates the difference between the population mean weight and the test value (i.e. 3.5).

<Insert Table IV About Here>

Discussion of Causes

Based on the review of the related literature, *effort dimensions (which are not verifiable)* is another significant cause. This is assumed to be the main cause of information asymmetry problem. Due to the unobserved nature of the exact effort exerted by the contractor, it leads to moral hazard problem. The extent of effort exerted in the work cannot be specified in contracts hence leading to problems. The contractor then has the incentive to minimise effort when undertaking work to maximise profit (Guasch, 2004). *Low transfer of risks* causes moral hazard and adverse selection.

There are two broad dichotomous groups of private companies, which can undertake PPP infrastructural projects. These are those who are effective and have the capability to lower costs and manage risks and on the other hand, those who cannot (Blanc-Brude, 2013). The dilemma of government is knowing which of the firms should be given the contract to undertake the work (Boukendour, 2007). In contracts with little or no risk, the effective companies have an incentive to imitate ineffective firms at the bidding phase (adverse selection) and thereby make no attempt to lower and manage costs (moral hazard) (BlancBrude, 2013). *Lack of accurate information about project conditions* is a cause of moral hazard and adverse selection. Due to the long-term scope of PPP projects, accurate information on the existing, future and indirect costs of the works are obscured. This makes the tendency of moral hazard and adverse selection high (Blanc-Brude, 2013; Loben, 2009).

Descriptive Statistics for Effects of Moral Hazard and Adverse Selection

Respondents ranked the effects of moral hazard and adverse selection on PPP construction projects and to know their level of severity on a Likert item scale. Mean values and standard deviation were used for the ranking. From Table VI below, *reduction of competition* was ranked 1st with a mean of 4.18 and standard deviation of 0.84. *High transaction costs* was ranked 2nd with a mean of 4.06 and standard deviation of 0.81. *Consequences on profitability of project* was ranked 3rd with a mean of 3.98 and standard deviation of 0.80. *Siphoning of funds* was ranked 4th with a mean of 3.88 and standard deviation of 0.78. *Negative implications on enforceability of contract* was ranked 5th with a mean of 3.87 and standard deviation of 0.77. All the factors had a standard deviation less than one, indicating that there exists consistency in agreement between respondents' interpretations. This is probably because the respondents understood these factors very well. Moreover, all the factors had means greater than the hypothesised mean of 3.5 and their standard error means were also close to zero indicating that there was great consistency among agreement between the respondents.

<Insert Table V About Here>

One-Sample Test for Effects

One sample t-test was used to establish the relative significance of the variables. This is used in ascertaining whether a sample mean is significantly deviant from a hypothesized mean (Ahadzie, 2007). For a single sample test, its hypothesis is:

$$H_0: U = U_0$$

$$H_a: U <, > U_0$$

All means above 3.5 are considered as consistently agreed to by study respondents. The significance level was set at 95% in accordance with the levels of risk. This is premised on the five point Likert item rating where a success variable is deemed important if its mean was equal to or more than 3.5 (Field, 2005). All the factors had t-values (the strength of the test) that were positive indicating that their means were above the hypothesised mean of 3.5. All of the factors had a p-value (significance of the test) less than 0.05 and this implies that the means of these variables are

not significantly different from the hypothesised mean of 3.5. Furthermore, the 95% confidence level interval estimates the difference between the population mean weight and the test value (i.e. 3.5).

<Insert Table VI About Here>

Discussion of Effects

Reduction of competition occurs because of moral hazard and adverse selection. When bidders develop an innovative offer they risk losing the tender and not being repaid for the innovation (Badenfelt, 2008). These two negative consequences limit the number of bidders and successive failed bids erode competition as the opportunity to win a contract is outweighed by the cost of lost bids (Boukendour, 2007). Maintaining competitive pressure for a PPP ex post is also debatable (Chong *et al.*, 2007). In the absence of information asymmetry, a simple cost-plus contract would be ideal whereas a fixed price contract would owe rent to the private stakeholder. In both instances, it is difficult or costly to ascertain the type of bidder and measure their performance (Laffont and Tirole, 1986). Furthermore, the contractor benefits from the contractual irreversibility and the informational rent built up during the contract duration. *High transaction costs* are a consequence of moral hazard and adverse selection.

Transaction costs arise because the government negotiates with and monitors the private sector partners who have their own interests and agendas. Being a long-term contract, the partnership contract engenders the traditional issues of moral hazard and adverse selection related to the choice of a bidder. This implies high transaction costs for both the public and private partners, due to duration of the negotiation and the skills and resources involved (Allen, 2003). *Consequences on profitability* is another effect. Because of the inherent challenges involved in producing accurate estimates, the firm's profits are largely uncertain before the operation phase starts (Chong *et al.*, 2007). Private investment becomes difficult to attract especially when projects are large and private sponsors are averse to risk (Iossa and Martimort, 2008). In Europe, cross-border infrastructure has received little concern from private financiers. Even when private investors turn up, they behave opportunistically leading to moral hazard (Chong *et al.*, 2007).

CONCLUSIONS

The literature review led to the identification of eight causes of moral hazard and adverse selection of PPP construction projects. These variables were examined through the data collected by a research questionnaire for the respondents to rank its importance using a Likert item. Mean score ranking was used to rank these factors. From the findings, *effort dimensions (which are not verifiable)*, *low transfer of risk*, *lack of accurate information about project conditions*, *wrong party chosen to execute project* and *renegotiation of contracts* were ranked as the most important causes of moral hazard and adverse selection problems in PPP construction projects. One sample t-test was conducted on these different causes to establish the relative significance of such variables. All the factors had t-values (the strength of the test) that were positive indicating that their means were above the hypothesised mean of 3.5 except *low incentives to control costs*, which had a t-value of -2.610. This is because it had a mean of 3.35, which was below the hypothesised mean of 3.5. All of the factors had a p-value (significance of the test) < 0.05 and this implies that the means of these variables are not significantly different from the hypothesised mean of 3.5.

From the literature review, nine effects of moral hazard and adverse selection of PPP construction projects were also identified. These variables were examined through the data collected through a research questionnaire targeting the respondents to rank its importance using a Likert scale. Mean score ranking was used to rank these factors. *Reduction of competition*, *high transaction costs*, *consequences on profitability of project*, *siphoning of funds* and *negative implications on enforceability of contract* were the most important effects of moral hazard and adverse selection problems in PPP construction projects. One sample t-test was conducted on these different effects to establish its relative significance. All the factors had t-values (the strength of the test) that were positive indicating that their means were above the hypothesised mean of 3.5. All of the factors had a p-value (significance of the test) < 0.05 , which implies that the means of these variables are not significantly different from the hypothesised mean of 3.5. Furthermore, the 95% confidence level interval estimated the difference between the population mean weight and the test value (i.e. 3.5).

This study even though carefully undertaken has its own limitations. One of the limitations of this study is that the whole research was restricted to PPP stakeholders in Ghana. Because professional

expertise and experiences varies globally, there is a likelihood of having significant variations in the research findings if conducted in other countries or in another context. Notwithstanding, construction industries in developing countries particularly in Africa and sub-Saharan African countries are similar. Therefore, this limitation will not weaken the validity of the research findings and its future application in these developing countries.

In summary, the study's findings are useful and should be incorporated by PPP construction stakeholders especially in assessing the causes and effects relationship between moral hazard and adverse selection. Further studies should be conducted into determining the impact of moral hazard and adverse selection at the pre-contract, construction and post-construction phases respectively. Future studies should also use other data collection tools and techniques such as interviews to solicit information from PPP stakeholders on the causes and effects relationship between moral hazard and adverse selection.

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Table I - Asymmetric Information Models of PPPs

TASK BUNDLING	
<i>Model</i>	<i>Features and Assumptions</i>
Bentz <i>et al.</i> (2005)	<ol style="list-style-type: none"> 1. Two different equilibriums: low one-off service set up cost high one off service set up cost 2. All the agents are risk-neutral
Iossa and Martimort (2008)	<ol style="list-style-type: none"> 1. Two different externality-settings: positive externality: quality-improvement reduces operational cost negative externality: quality-improvement increases operational cost 2. Incentive constraints rely on sign of externality 3. Government: risk-neutral, private firm/consortium: risk-averse
Iossa and Martimort (2009)	<ol style="list-style-type: none"> 1. A little dissimilar purpose as compared to their preceding paper: 2. Focus on transportation sector reveals further how task bundling is related with risk transfer 3. Government: risk-neutral, private firm/consortium: risk-averse
FINANCING	
<i>Model</i>	<i>Features and Assumptions</i>
Iossa and Martimort (2008)	<ol style="list-style-type: none"> 1. Extension of their basic model 2. Modelling transaction cost: external financiers possess expertise to gain access to some educational signal, which the government cannot monitor. 3. Government: risk-neutral, private firm/consortium: risk-averse

Adapted from Lobner (2009)

Table II - Reliability Statistics

Cronbach's Alpha Based on		
Cronbach's Alpha	Standardized Items	N of Items
.780	.780	21

Table III - One Sample Statistics for Causes

CAUSES	Mean	Std. Deviation	Std. Error Mean	Rank
<i>Effort dimensions which are not verifiable</i>	4.10	0.780	0.054	1
<i>Low transfer of risk</i>	4.09	0.892	0.062	2
<i>Lack of accurate information about project conditions</i>	4.06	0.746	0.051	3
<i>Wrong party chosen to execute project</i>	3.93	0.712	0.049	4
<i>Renegotiation of contracts</i>	3.78	0.770	0.053	5
<i>Inexperience</i>	3.76	0.687	0.047	6
<i>Limited ability to commit to contractual obligations</i>	3.69	0.767	0.053	7
<i>Low incentives to control costs</i>	3.35	0.846	0.058	8

Table IV - One-Sample Test for Causes

	Test Value = 3.5					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
<i>Effort dimensions which are not verifiable</i>	10.965	209	.000	.590	.48	.70
<i>Low transfer of risk</i>	9.511	209	.000	.586	.46	.71
<i>Lack of accurate information about project conditions</i>	10.921	209	.000	.562	.46	.66
<i>Wrong party chosen to execute project</i>	8.724	209	.000	.429	.33	.53
<i>Renegotiation of contracts</i>	5.287	209	.000	.281	.18	.39
<i>Inexperience</i>	5.425	209	.000	.257	.16	.35
<i>Limited ability to commit to contractual obligations</i>	3.600	209	.000	.190	.09	.29
<i>Low incentives to control costs</i>	-2.610	209	.010	-.152	-.27	-.04

Table V - One Sample Statistics for Effects

<i>EFFECTS</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>	<i>Rank</i>
<i>Reduction of competition</i>	4.18	0.766	0.053	1
<i>High transaction costs</i>	4.06	0.743	0.051	2
<i>Consequences on profitability of project</i>	3.98	0.708	0.049	3
<i>Siphoning of funds</i>	3.88	0.760	0.052	4
<i>Negative implications on enforceability of contract</i>	3.87	0.739	0.051	5
<i>Corruption</i>	3.86	0.695	0.048	6
<i>Cost overruns on budget</i>	3.81	0.820	0.057	7
<i>Dishonesty</i>	3.81	0.693	0.048	8
<i>Opportunistic behavior</i>	3.69	0.695	0.048	9

Table VI - One-Sample Test for Effects

	Test Value = 3.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
<i>Reduction of competition</i>	12.800	209	.000	.676	.57	.78
<i>High transaction costs</i>	10.869	209	.000	.557	.46	.66
<i>Consequences on profitability of project</i>	9.741	209	.000	.476	.38	.57
<i>Siphoning of funds</i>	7.171	209	.000	.376	.27	.48
<i>Negative implications on enforceability of contract</i>	7.186	209	.000	.367	.27	.47
<i>Corruption</i>	7.544	209	.000	.362	.27	.46
<i>Cost overruns on budget</i>	5.473	209	.000	.310	.20	.42
<i>Dishonesty</i>	6.472	209	.000	.310	.22	.40
<i>Opportunistic behavior</i>	3.973	209	.000	.190	.10	.28