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**Research Report**

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# Analysis and Implications of the Determinants of CIRR for the Seamless Execution of PPP Projects

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\* Rewritten based on Kim, Kang Soo, *Analysis on the Determinants of the CIRR of Korean PPP Projects*, Policy Study 2018-16, Korea Development Institute, 2018 (in Korean) and Kim, Kang Soo, "The Determinants of the CIRR of Korean PPP Road Projects," Road Policy Brief, No. 139, Korea Research Institute for Human Settlements, April 2019 (in Korean).

# Summary

- The contracted internal rate of return (CIRR) of Korea's public-private-partnership (PPP) projects does not properly reflect the risks associated with the different types and characteristics of facilities and government support. Rather, the rates are set at the same level as similar preceding projects.
  - The characteristics of a project, e.g. facility type, amount of private investment, and operation period, and the ensuing risks are not sufficiently reflected in the decisions over CIRR. Moreover, the construction subsidy—a government risk-sharing and support policy—inadequately contributes to lowering the rate.
  - The project review period and VfM test do not have a meaningful effect on determining the CIRR, implying that project evaluations and analyses need to be improved.
- For the seamless execution and invigoration of PPP projects and lower user fees, the CIRR must be fixed at an appropriate level through more active negotiations and efforts in addition to taking the CIRR of similar existing PPP projects into account.
  - A significantly low CIRR relative to the risks could diminish the incentive to privately invest or could even lead to the bankruptcy of an ongoing project. On the other hand, an excessively high rate could raise the user fee or necessitate larger government subsidies.
  - To determine the suitable CIRR, the risks and effects of government support must be analyzed. In particular, policies that encourage competition in the PPP market must be developed to lower user fees through policies, e.g. transparent disclosure of information, simplified implementation procedures, increased provision of guarantees, and the provision of compensation for the cost of failed proposals, etc.

## 1

### Issues

- The CIRR of PPP projects should be determined by the risks associated with construction, operation and financing costs, inherent aspects of the project, and the government's share of the risks.
  - A significantly low CIRR could undermine the incentive to privately invest in a project. For projects already underway, it may result in a suspension of operations or even bankruptcy, causing great discomfort to the public.
  - An excessively high CIRR could result in higher user fees and more government subsidies, inciting backlash over the project's eligibility as a PPP.
- By analyzing the determinants of CIRR, this study provides policy implications for the smooth execution and vitalization of PPP projects and the adequacy of government support.
  - It also presents important policy implications for the future direction of PPP policy based on the premise that the tariff level of recent controversial road and railway PPP projects could be lowered through CIRR.

## 2

### Status of the CIRR of PPP Projects

<sup>1</sup> The Alpha ( $\alpha$ ), which is the risk premium rate, is determined through negotiation competitions and negotiations between the government and preferred bidders. It is affected by the risks associated with construction and operation and financing costs.

- PPP projects aim to utilize the creativity and efficiency of the private sector by using private capital to build and operate infrastructure (also known as social overhead capital or SOC) previously handled through the government budget, such as roads, ports and railways.
  - With limited resources, these projects can build numerous and diverse SOC, enhance service level through performance-oriented management, and reduce operation costs through creativity and efficiency.
  - However, the burden that continuously arises for the government during the operation period is inevitably passed onto the users. Additionally, the long-term nature of the contracts places a strain on their management, and prioritizing can lead to conflicts between the interests of the private sector (profitability) and that of the government (public interest).
- PPP can be implemented in many ways, but Build-Transfer-Operate (BTO) and Build-Transfer-Lease (BTL) are the most common procurement types in Korea.
  - In a BTO contract, the private firm builds the SOC, transfers ownership to the government or others, and manages operations for a period of time to recoup its investment.
  - In a BTL contract, the private firm builds the SOC, transfers ownership to the government or others, and recoups its investment through interest rates or a lease fee.
    - BTL contracts have become increasingly popular with PPP projects branching out into SOC for education, welfare and culture, etc., which are significantly less profitable.
- The CIRR of PPP projects is determined through negotiations between the government and private investors, taking into account the construction costs and operating profits.
  - With all conditions identical, a high CIRR will result in higher user fees in a BTO contract and a higher lease fee—paid by the government to the private firm—in a BTL contract.
- The average after-tax CIRR of BTO projects has continued to decrease since the adoption of the PPP system in 1994, and the real after-tax CIRR has been approximately 6% since 2007.
  - The CIRR of BTO projects has remained stable since 2007 with declines in government bond yields and market interest rates.
- The average after-tax CIRR of BTL projects was set at 5.96%, which gradually increased until 2009 and descended to the low 4% range thereafter.
  - The CIRR of BTL projects is calculated by adding the benchmark interest rate (five-year government bond yield) and Alpha ( $\alpha$ ), which is the risk premium,<sup>1)</sup> and it appears to move in line with the changes in the benchmark interest rate.

# 3

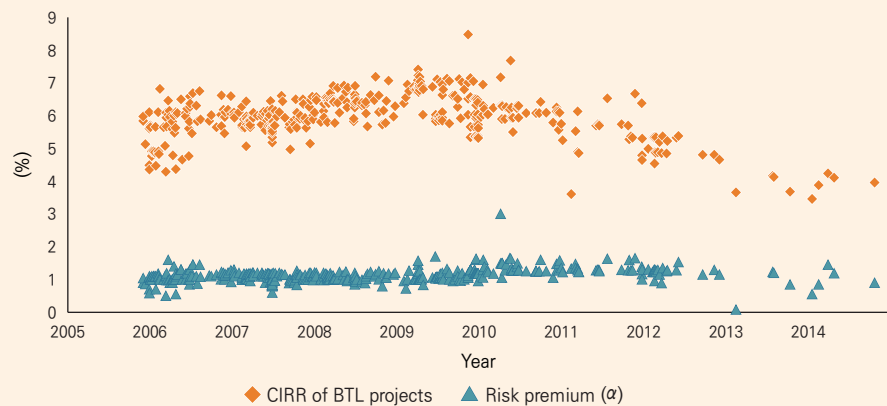
## Analysis of the Determinants of CIRR

[Figure 1] Changes in the After-tax CIRR of BTO Projects



Source: KDI PIMAC Infra-info DB system.

[Figure 2] Changes in the After-tax CIRR of BTL Projects



Source: KDI PIMAC Infra-info DB system.

- To analyze the determinants of CIRR, this study used the KDI PIMAC Infra-info DB system which covers the period from 1994 to 2014.
  - The database includes information on each stage of a PPP project: 1) request for proposal notice or third party proposal notice, 2) concession agreement, 3) construction, and 4) operation.
- The factors that affect the CIRR of PPP projects selected for analysis are the average CIRR of three similar preceding projects, financial market conditions, facility type, operating period, type of competent authority, and size of private investment.
  - Considering that CIRR falls and stabilizes, the time variable was included to control the effects of time.
- The results reveal that financial market conditions (financing cost and rate of return on five-year government bond yields used as proxies), have no meaningful impact on the CIRR of BTO projects.

- This is because CIRR is somewhat contingent on the creditability and financing capabilities of the large construction firms and financial institutions participating as investors than on the conditions of the financial market.
  - Moreover, investors who participate as a shareholder are often also lenders of direct loans, which means that they have little incentive to maximize their returns through low financing costs.
- For BTL projects, the CIRR increases as the Alpha ( $\alpha$ ) rises, implying that the loan spread becomes larger during the construction period.
    - A 1%p change in the loan spread results in about a 0.17%p change in the Alpha ( $\alpha$ ), implying that an increase in financing costs could raise the CIRR.
    - Considering that BTL investors are mostly SMEs, efforts should be made to reduce the financial costs by expanding the supply of credit support to lower the CIRR.
  - The construction and operational risks need to be reflected in the CIRR, and it should also vary according to the type of facility (e.g. road, railway or port, etc.). However, there are no significant differences in the CIRR of different types of facilities.
    - The CIRR of PPP projects is usually settled at 6%, regardless of facility type.
- The risks to operation revenue at the beginning stages of a project are greater for road and railway PPP projects than for ports. However, the risks become greater for port PPP projects as operations progress because demand such as cargo volume fluctuates on changing economic conditions.
- Longer operation periods could lead to more uncertainties about the future, which could, in turn, increase the operation and investment risks, and affect decisions over CIRR.
    - The operation period does not affect the CIRR of BTO projects but it has a proportional relationship with that of BTL projects.
      - For BTL projects, longer operation periods come with long-term investment premiums, which could raise the financing costs and hence, increase the risk premium.
  - Large-scale PPP projects entail greater risks in terms of financing and execution. Thus, the CIRR could increase if all conditions remain constant.
    - The risk premium rate decreases as the size of private investment grows for BTL projects while there is little significance for BTO projects.
      - For BTL projects, there are no additional or new risks when the size of investment is expanded. Rather, the size of investment is increased to pursue more stable returns.

<Table 1> Determinants of the CIRR of PPP Projects

BTO Project		Category	BTL Project		
Coefficient signs (significance level)	Explanatory variable		Explanatory variable	Coefficient signs (significance level)	
+ (★★★)	Average CIRR of similar preceding projects (CIRR_S_three)	Negotiation practices	Average spread rate of similar preceding projects (Alpha_S_three)	+ (★★★)	
+	Risk free rate (Rf_5yrs)	Financial market conditions	Loan spread (Beta)	+ (★★★)	
— + (★)	Railway	Project characteristics & risks	Facility type	National defense	—
	Port			Education	+
—	Environment			Culture, tourism, welfare	+
+	Competent authority		Competent authority	—	
—	Operation period		Operation period	+ (★)	
+	Ln_P_Investment		Ln_P_Investment	— (★)	
— (★)	Share of construction subsidy	Government support	Share of construction subsidy	+ (★★)	
+ (★★)	Minimum revenue guarantee (MRG)				
— + — +	Proposing body	Systems and environment	Preparation&negotiation period	—	
	Value for money test (VfM)				
—	Preparation period				
+	Negotiation period				
+	Project experience	Market maturity level	Bidding competition rate	—	
— (★★)	Bidding competition rate				
— (★)	Time		Time	+ (★)	
+ (★)	Intercept		Intercept	— (★)	
150	Observations			391	
0.748	Adjusted R-squared			0.446	

Significance level: ★★★ 0.001 ★★ 0.01 ★ 0.05

- CIRR has a tendency to decrease slightly as the construction subsidy ratio increases; but the effect is negligible.
  - A 1%p increase in the construction subsidy ratio relative to the total project cost reduces CIRR by 0.008-0.011%p.
    - This implies that the effectiveness of policies on the government's risk-sharing and support need to be improved to lower the CIRR.
- The bidding competition rate in BTO projects has very strong negative statistical significance for the CIRR level, which has important implications for PPP policy.
  - CIRR is estimated to drop by 0.257%p with every one additional participant in the competition as a preferred bidder.
    - This means that the CIRR level is closely tied to the number of competitors.
- Above of all, it should be noted that the CIRR of PPP projects in Korea is settled by referring to the CIRR of similar existing projects.
  - It has become common practice in this field to determine the CIRR based on the average CIRR of three similar preceding projects, and this appears to be the most significant factor affecting the decision-making for the CIRR of current PPP projects.

# 4

## Conclusion and Policy Suggestions

- CIRR should be determined properly based on a thorough analysis of facility type, characteristics and the ensuing risks, and the government's risk-sharing and support policies.

- Although the practice of relying on previous CIRRs to determine the current level has been long established, changes are needed to properly reflect the level of risks and characteristics of a project, and the government's support policies.
  - Because risk variables (e.g. financing cost, project type and size and operation period) are not meaningfully connected to CIRR, they do not contribute to the seamless execution of PPP projects.
  - Efforts are needed to improve the effectiveness of government support policies.
- In order to strengthen the publicness of PPP projects by lowering user fees and seamlessly executing and invigorating PPP projects, efforts are required to set the CIRR through more differentiated and active negotiations.
  - To determine an appropriate CIRR level, the risks related to the characteristics of PPP projects must be measured and analyzed, and explicit rules for government support must be established.
    - The Value for Money (VfM) test<sup>2)</sup> must include not only risk identification and quantification but also careful analysis of the effectiveness of government support and risk-sharing policies.
    - In particular, to lower user fees, government policies should focus on measures to bolster competition in the PPP market, including increasing the transparency of project information, simplifying project procedures, increasing the supply of guarantees from the Korea Infrastructure Credit Guarantee Fund, and providing compensation for the cost of failed proposals.
- More thorough analysis is needed to understand the effects of the project operator and structural characteristics of the CIRR.
  - In-depth analysis is needed on the effects of the equity structure of a project, know-how about the construction and operation of a specific facility, and actual loan interest rates.

2 The VfM test is a preliminary study that determines whether a PPP project should be pursued by comparing the total life-cycle costs of the Public Sector Comparator (PSC) and Private Financial Initiative (PFI). When the CIRR of a PPP project rises, it increases the government subsidy in the PSC, making it difficult for the project to move forward to the PPP procurement.

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- KDI PIMAC Infra-info DB system.