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Financing of Public-Private-Partnership Infrastructure Projects: the Effects of Guarantees

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Abstract: In Public-Private-Partnership infrastructure projects, guarantees provide value to the private party sponsoring the project and protection to the lender supplementing the private sponsor's equity with a loan; thus they have material impact on the financing of the project. Governments offer guarantees to encourage private parties and banks to participate in infrastructure projects. This paper examines several contractual structures between the stakeholders of Public-Private-Partnership projects, and qualitatively argues that guarantees significantly improve the return on equity of these projects. The paper also shows that that the insolvency risks of the projects are considerably reduced in the presence of guarantees. It finally concludes that by considering such matters in the design of guarantees, governments could offer more cost effective incentives to the projects.

1 Introduction

After the financial crisis in the early 1980s, developing countries limited public borrowing and as a result, public expenditure on infrastructure reduced (Dailami and Kelin 1997); yet the demand for infrastructure remained high. This led governments to seek private sector solutions for infrastructure investment. To entice the private sector to invest in public infrastructure, new arrangements had to be developed to allow the private sector to collect fees in exchange for its service to the public. These arrangements are usually referred to as Public-Private-Partnerships (P3). The most common form of P3 is Build-Operate-Transfer (BOT) (Grimsey and Lewis 2002).

To participate in the project, the private parties must be comfortable with the risks inherent in the project. If the impacts of such risk exceed their tolerance, they will withdraw from the project. In many instances, however, hedging instruments are not available for the mitigation of the risks to which the infrastructure projects are exposed. This is particularly true in developing countries where the financial market has not yet been well developed (Dailami and Leipziger 1997).To incentivize the private parties to participate in such cases, governments usually provide financial support of which guarantees constitute the most common form (Dailami and Leipziger 1997).

Guarantees bring significant value to the P3 projects. Being properly structured, they could make the cash flow of the infrastructure less volatile. A long term business opportunity with low-volatility cash flows potentially attracts many investors. It could have particular appeal to investors such as pension funds, which have relatively predictable long term commitments.

Similarly, guarantees serve significantly the interests of the lenders, as they have the senior claim on the future revenues of the P3 project. In BOT (the most common delivery method), the investor establishes an independent private legal entity, the project company, whose sole business is to build, operate, and manage the project during the concession. The project company acts as a special purpose vehicle for limited or non-recourse project finance (Zhang 2005). A simplified diagram of contractual arrangements between the project company and the stakeholders of the infrastructure project is depicted in Figure 1.

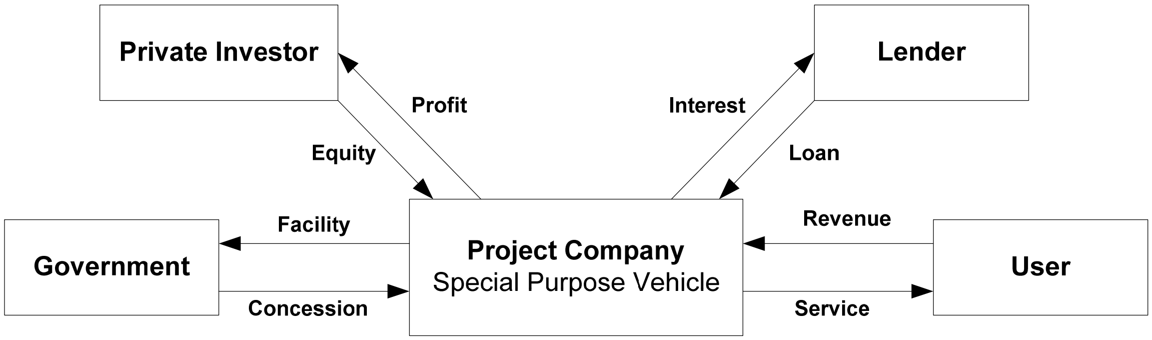

Figure 1: Contracts between the Project Company and the Stakeholders

In corporate finance, a lender could put a claim on all assets of the firm including machineries, patents, etc when the company defaults on its debts. In BOT project finance, the physical assets cannot readily be removed and utilized elsewhere when adverse economic conditions hit the project and the project company defaults on its debts obligations. As a result, the lender looks primarily at the revenue stream of the project to determine the amount of the loan and interest. Since guarantees kick in and provide cash to the project when economic conditions are unfavourable, they prevent the project company from entering a state of default. As such, banks can have more confidence that their loans and the associated interest will be paid when guarantees exist.

Guarantees provide value to the investors and protection to the lenders; thus, they have a material impact on the financing of P3 projects. In the presence of guarantees, banks could extend larger loans with less interest. This in return means that the investors need to bring less equity or pay less interest to the lenders, resulting in a significant boost in their return on the equity. These added values however, are eventually paid by the governments because guarantees are their contingent liabilities.

2 Objectives and Scope

As discussed, governments often provide incentives including guarantees to the private parties to encourage them to participate in P3 projects. The lenders as well as the investors benefit from guarantees. On the other hand, although the guarantees facilitate the participation of private parties and the realization of infrastructure projects with limited public funds, governments undertake the downside risk should the project not generate enough revenue.

The purpose of this paper is to qualitatively examine the effects of guarantees on the P3 stakeholders. Although very crucial, the valuation of guarantees is out of scope of this paper. Because of its generality, Australian guarantee framework (Chiara et al. 2007), in which M guarantees are redeemable at N exercise dates ($M \leq N$) at the investor's discretion, is adopted in this research. Here, using a hypothetical example, an examination of how the probabilities of default on the loan repayment change as the number of Australian guarantees varies is undertaken. Then, several hypothetical contract scenarios among the government, the bank, and the investor are considered. Finally, the return on equity of the investor as well as the value of the offered guarantees are explored.

3 Probabilities of Default on Loans

The effect of guarantee on the probabilities of default would be best explained using a graph (Figure 2). Suppose, there is a P3 project for which the government has offered one Australian revenue guarantee that can be exercised only at T1 or T2. The project company has also received a loan and has to pay it back in two installments at time T1 and T2.

Let's assume three scenarios for the revenue can be realized. In scenario 1, the revenues generated at T1 and T2 are sufficient to pay back the loan. Moreover, they are above the guaranteed revenue level that the project company would not exercise the guarantee at either of T1 or T2. Therefore, as observed in the graph, the probability of default (PD) on the loan payments at T1 and T2 for scenario 1 is 0. In scenario 2, the revenue generated at T1 and T2 are sufficient to pay back the loan payments thus PD1 is 0. However, at T1, the generated revenue is below the guaranteed level and the project company decides to exercise the guarantee and continue without any guarantee to T2. At T2, the generated revenue is also sufficient to pay the loan installment; thus PD2 is 0. But this time, although the generated revenue is below the guaranteed level, there is no guarantee left to exercise.

In scenario 3, the realization of the revenue, is very unfavorable. The revenue generated at T1 is not sufficient to pay back the loan; thus, the revenue guarantee has to be exercised. The PD1 therefore at T1 for this scenario is 0 but there is no guarantee left for T2 to exercise, or m=0 in the second interval. At T2, yet, the outcome is worse. Not only is the generated revenue not sufficient for loan repayment, but also there is no guarantee left. As such, the project company can not pay back the second installment and has to default, ie PD2=1.

No incident of default is observed at T1 with one guarantee at any of these scenarios. Since it was assumed these three scenarios make up of all possible scenarios, the PD at T1 is 0. At T2, however, one incident of default is observed among the three scenarios. If each scenario is equally likely to happen, the PD at T2 is thus 1/3.

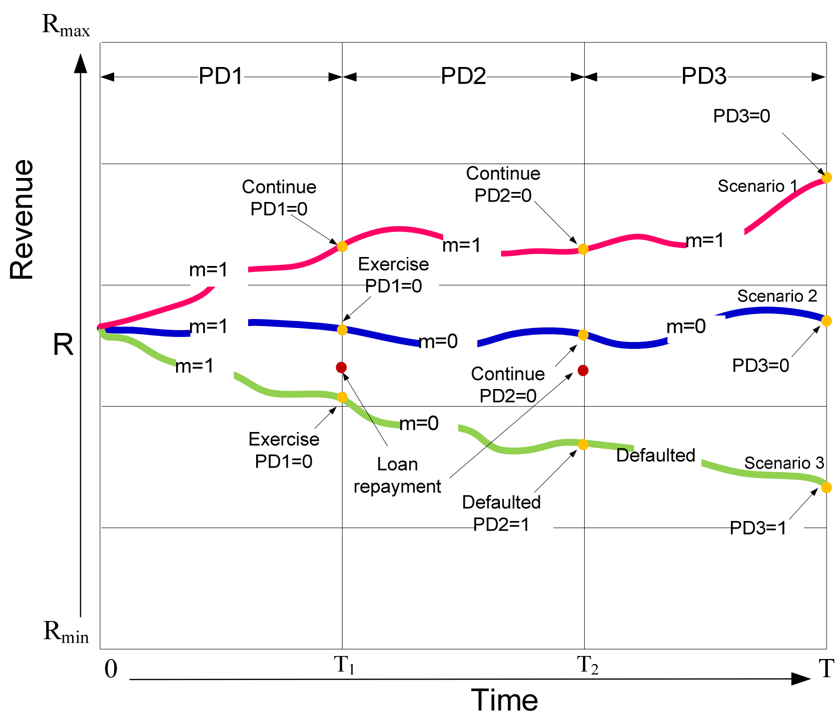

Figure 2: Guarantee and the Probability of Default (I)

If the project company is offered two guarantees (Figure 3), the loan would be paid at T2 in scenario 3 and thus PD at T2 would be 0. Conversely, if no guarantee had been offered to the project company, it would have defaulted in T1 as well and thus the PD at T1 would have become 1/3. This simple example clearly shows how guarantees reduce the risk of default.

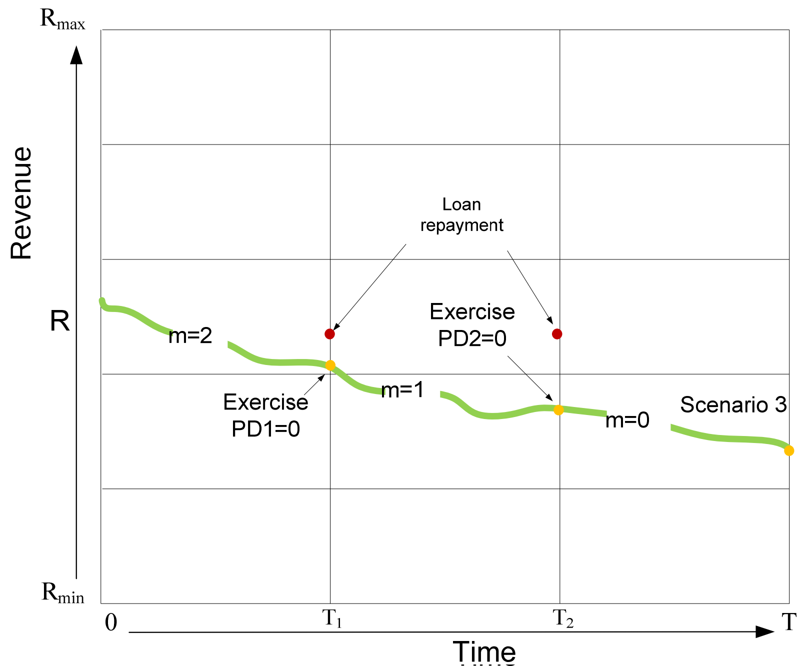

Figure 3: Guarantee and the Probability of Default (II)

This effect of Australian guarantees on probabilities of default are examined in a hypothetical example. Assume a BOT toll road project is exposed to uncertain traffic demand that jeopardizes its financial viability. The forecast for the daily traffic obtained on the first day of the operation is demonstrated in Table 1, along with the pre-specified fare for each operational year and the loan payment schedule. The concession for this project is 10 years. The government gave m number of Australian guarantees that secure a revenue associated with the case when the annual average daily traffic is 90% of the forecasted daily demand at the end of the operation year. These guarantees are exercisable at the end of each operation year.

For modelling the risk factor, ie the traffic demand, the stochastic differential equation (SDE) proposed by Almassi et al. (2012) is employed. The model parameters are set to be $\sigma = 0.2$ and $\alpha = 0.02$. Finally, the interest rate is assumed to be $r = 0.05$.

Using the SDE, 10,000 scenarios are generated for the traffic demand. After calculating the strategies for exercising the Australian guarantees (Almassi et al. 2012), the strategies are applied on each scenario to keep track of the number of remaining guarantees in each operational year. Then, the number of times that the generated net revenue is less than the loan payment for each operational year is determined. These incidents indicate the number of defaults in that operational year. Note that if a default occurs in a scenario for an operational year, it is assumed that the project company will stay in default for the remaining operational years in that scenario. Thus, the ratio of observed defaults to the number of simulations, ie 10,000, will indicate the probability of default. Figure 4 shows the probabilities of default when the number of offered Australian guarantees (m) is 5, 3, 1, or 0.

Table 1 : Traffic Demand, Financial Projection, and Loan Payments Schedule

period	Daily Traffic	Toll per Vehicle $	Annual Gross Revenue $	Total Operation Cost $	Debt Service $
1	30,000	2.00	21,900,000	(7,008,571)	(10,000,000)
2	32,100	2.00	23,433,000	(7,206,343)	(10,000,000)
3	34,347	2.25	28,207,474	(7,417,958)	(12,000,000)
4	36,751	2.25	30,181,759	(7,644,360)	(15,000,000)
5	39,324	2.50	35,883,150	(7,886,677)	(18,000,000)
6	42,077	2.75	42,234,789	(8,115,265)	(20,000,000)
7	43,339	3.00	47,456,205	(8,358,663)	(22,000,000)
8	44,639	3.25	52,953,014	(8,609,390)	(23,000,000)
9	45,978	3.50	58,736,895	(8,867,639)	(24,000,000)
10	47,358	4.00	69,142,680	(9,133,795)	0

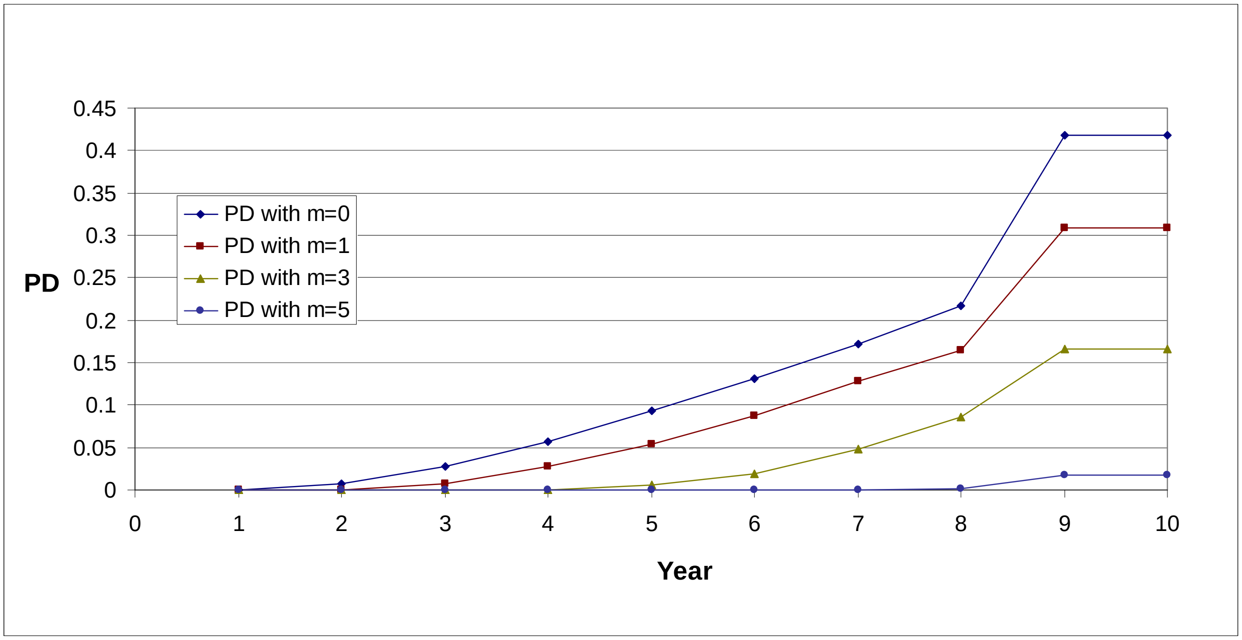

Figure 4 : The Effect of Number of Australian Guarantees on Probability of Default (PD)

As expected, the probability of default decreases when more Australian guarantees are offered. Interestingly, in this hypothetical example, the maximum probability of default on loan payments would decrease to almost 2%, when m=5, which is half the number of operational years.

4 Investor's Return on Equity

As established in the previous section, the presence of guarantees reduces the risk of default on the bank's loan. The investor thus could negotiate a loan with more favorable conditions, ie a larger loan with smaller interest charges. The effects of guarantees on the return on equity of the banks are discussed in the following scenarios.

Note that the scenarios are hypothetical ones based on the example in the previous section. For simplicity, it is assumed that the loan repayment installments are the same as the payment schedule in Table 1, yet the amount of the loan that the lender granted for the construction is different in each scenario. Furthermore, assume that the project costs $190 million; and this money is financed from two sources: the loan and investor's equity.

4.1 Scenario 1 - No Guarantee

Since no guarantee is granted by the government and the risk of default is high, suppose that the bank extends only $85 million loan. As a result, the investor should complement the remaining $105 million with its equity. The $85 million loan with the payment schedule of Table 1 means that the bank charges almost 12% interest for this loan. The project, on the other hand, generates only $82.5 million for the investor, 78% of the amount that the investor brings to the project. Clearly, no investor would participate in a P3 project under in such a scenario. This scenario is depicted in Figure 5.

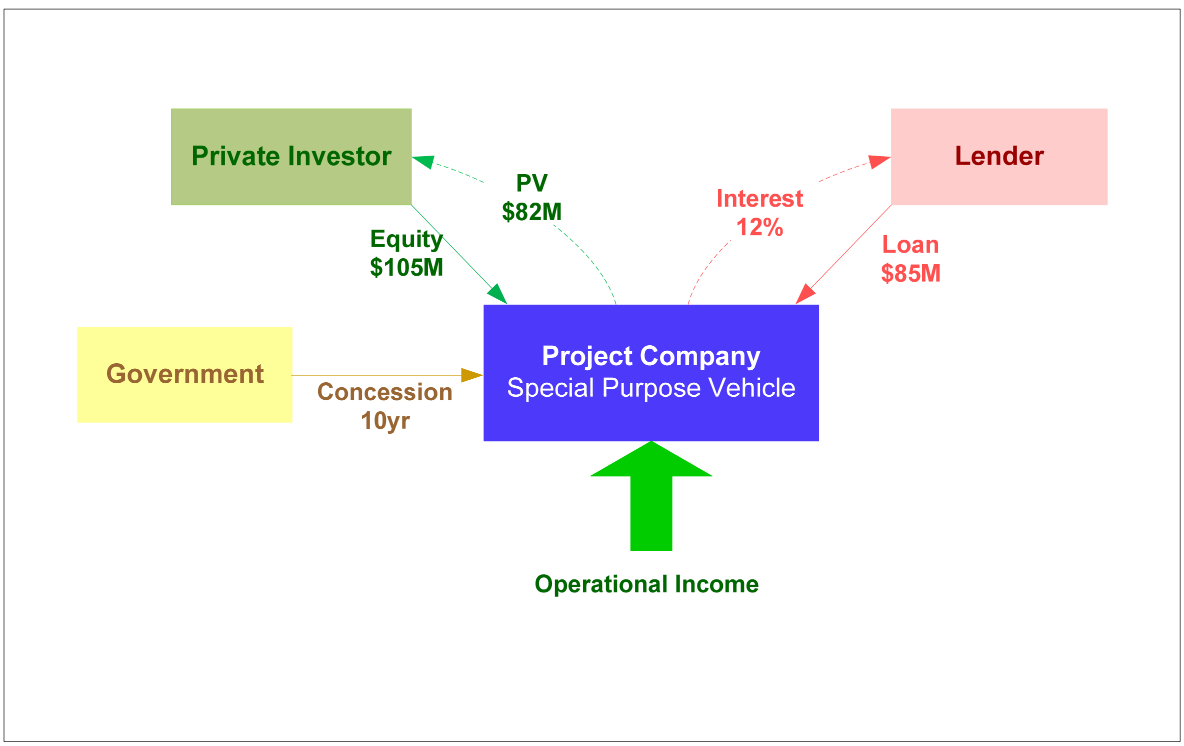

Figure 5: Scenario 1 - No Guarantee

4.2 Scenario 2 – Six Australian Guarantees

Because of the six Australian guarantees, the insolvency risk deemed by the lender is significantly reduced. In this scenario, the bank extends $110 million loan and charges almost 6% interest rate. The investor brings $80 million to the project. After valuing the investor's cashflow, which includes the guarantee payoffs (Almassi et al. 2012), it is revealed that the present value of the cashflow is $102.2 million, 128% of the equity or 28% return on the equity. This scenario is depicted in Figure 6.

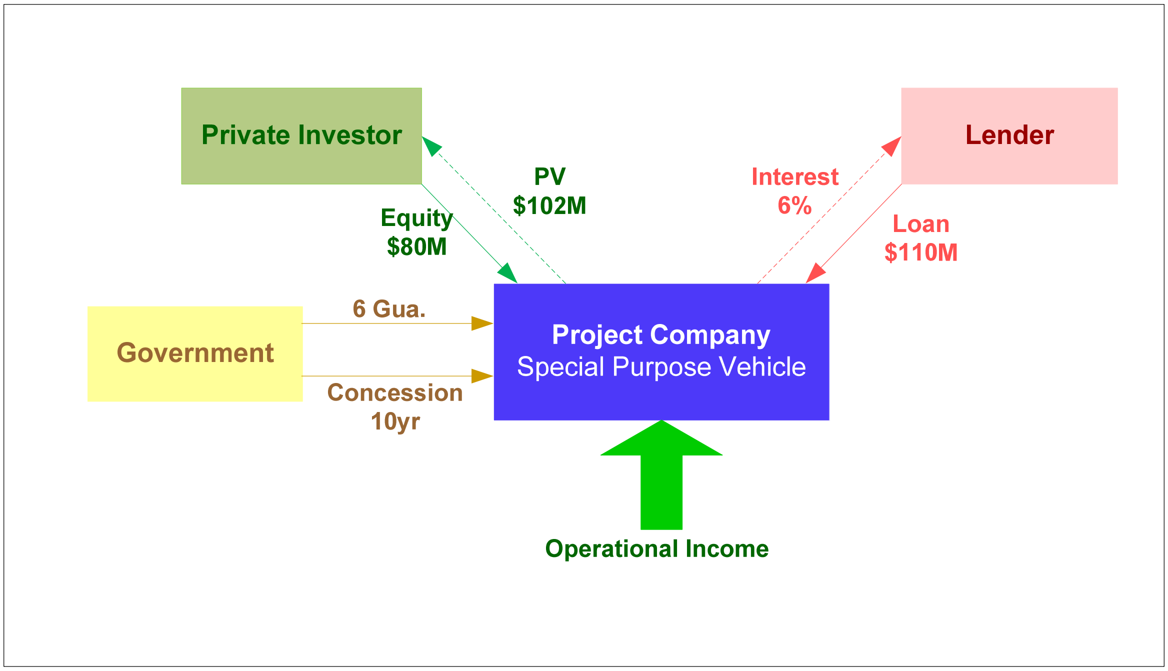

Figure 6: Scenario 2 – Six Australian Guarantees

4.3 Scenario 3 – Full Coverage

Because the government has offered a guarantee for all operational years, the default risk on loan should be at the minimum. In this scenario, the bank offers $120 million loan; with the payment schedule of Table 1, it bears the interest charge of 5%. As a result, the investor should bring $70 million to the project. The present value of the project's cashflow is $104.2 million, 149% of the equity which means 49% return on the equity. This scenario is depicted in Figure 7.

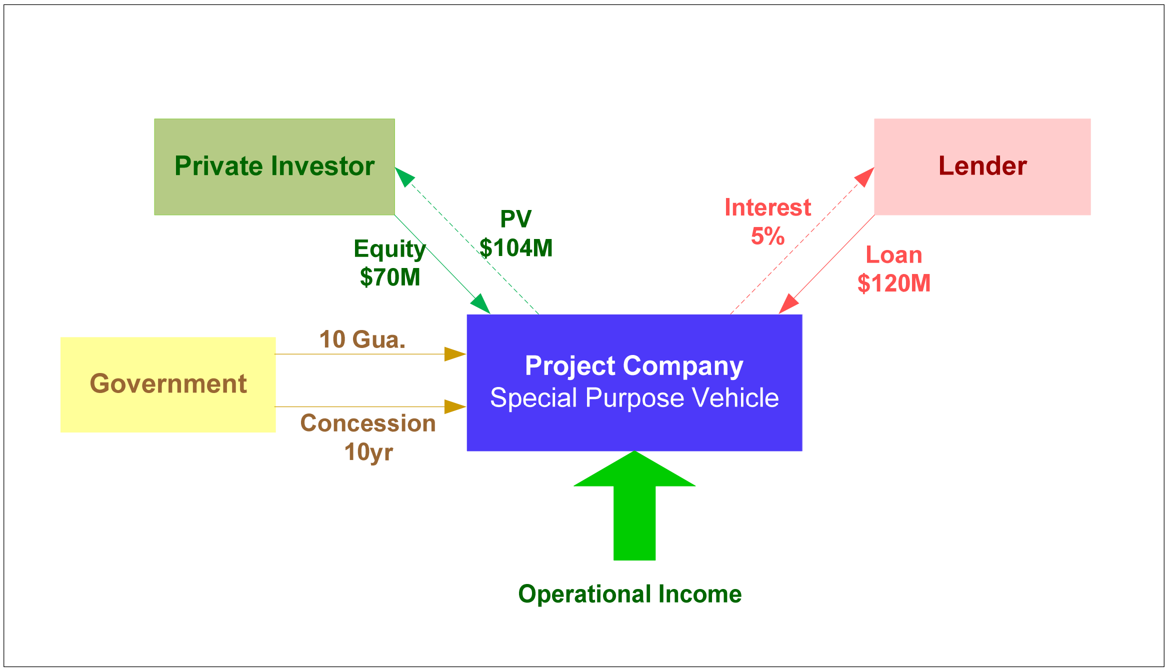

Figure 7: Scenario 3 – Full Coverage

5 Government Exposure

Guarantees offered by the government ensures the participation of a private investor and therefore the actualization of the infrastructure. Clearly, the greater the numbers of Australian guarantees granted, the greater the cost would become. Table 2 shows the variation of the cost of guarantees for the government and the present value of the project cashflow as the number of guarantees changes.

Table 2: The Variation of Cost of Guarantees and Project Cashflows with the Number of Australian Guarantees

# of Australian Guarantees	*Cost of Guarantees ($M)*	*PV Project Cashflow ($M)*
0	0	82.560
1	3.433	85.993
2	6.695	89.255
3	9.727	92.287
4	12.566	95.126
5	15.323	97.883
6	17.762	100.322
7	19.633	102.193
8	20.952	103.512
9	21.722	104.282
10	21.963	104.523

As it can be observed, the value of guarantees are reflected in the present values of the project cashflow; yet it has much more profound effect on the return on equity of the investor as Table 3 indicates. This effect stems from the fact that in the presence of government guarantees, lenders are extending loans with greater principals and smaller interest charges. That would decrease the required supplemental equity amount to construct the project thereby result in improved return on the equity.

Table 3: Summary of Cost of Guarantees, PV Project Cashflow, and Return on Equity for the Studied Scenarios

Scenario	*# of Australian Guarantees*	*Cost of Guarantees ($M)*	*PV Project Cashflow ($M)*	*Return on Equity*
1	0	0	82.56	-22%
2	6	17.762	100.322	28%
3	10	21.963	104.523	49%

In offering guarantees, the government not only needs to consider the cost of the guarantees which would be the value added to the project revenue stream, but also should take into account the loan terms under the new circumstances, ie the presence of guarantees. Therefore, knowing how lenders perceive and measure the risk of default is of great importance for the government when offering guarantees.

6 Conclusion

As stated, governments usually offer guarantees to encourage private investors to participate in P3 projects. In addition to improving the revenue stream for the investors, however, guarantees have a material effect in the financing of such projects. As established using a hypothetical example, the probability of default on loan decreases in the presence of government guarantees. This would assist the investor with negotiating a loan with better conditions, greater principal and smaller interest charges. This would then result in improving the return on equity.

Considering these matters when structuring a P3 project could result in more cost-effective guarantees. For this purpose, examining various guarantee structures as well as understanding lenders' perception of risk is necessary. These subjects are potential areas of future research.

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