Valuing guarantees in a BOT infrastructure project

Andreas Wibowo

The author

Andreas Wibowo is based at the F.G. Bauwirtschaft und Baubetrieb, Institut für Bauingenieurwesen-TU Berlin, Sekr. TIB 1-B6 Geb. 13b, Gustav-Meyer-Allee 25, Berlin, Germany.

Keywords

Indonesia, Project management, Capital projects, Government, Private sector organizations, Construction industry, Loan guarantee scheme

Abstract

Host governments often provide guarantees in build-operate-transfer (BOT) infrastructure projects to attract private sector investors. Problems arise because the governments often do not know the full extent of contingent liabilities when issuing guarantees, and because they account and record guarantee costs only when guarantees come due. This paper discusses the guarantees' financial impact from the perspectives of the government and the project sponsor. A typical Indonesian BOT toll road project is taken as the case study. Stochastic simulation using Latin Hypercube technique is applied on the cash flow model with and without guarantees. Several types of guarantees including minimum revenue guarantee, maximum interest rate guarantee, debt guarantee, tariff guarantee and minimum traffic guarantee are discussed. Simulation results reveal that guarantees can reduce risk but are not free of cost. If compared with equivalent subsidies, however, some guarantees can be more effective in lessening the extent of project risk.

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Engineering, Construction and Architectural Management
Volume 11 · Number 6 · 2004 · pp. 395–403
© Emerald Group Publishing Limited · ISSN 0969-9988
DOI 10.1108/09699980410571543

Introduction

The build, operate and transfer (BOT) model has gained worldwide popularity as a means to use private sector resources in terms of capital, skills and management for infrastructure development in various sectors. In the Asian expressway sector, for instance, private sector participation has been equated with major BOT toll roads although worldwide experiences suggest that the model is difficult to implement (Asian Development Bank, 2000). Under a BOT arrangement, the private sector is required to finance, design, build, operate and manage the facility and then transfer the asset free of charge to the host government after a specified concession period (Tiong *et al.*, 1992).

A private infrastructure project is typically structured under project finance modality on a non-recourse or limited recourse basis. Unlike a traditionally corporate-financed infrastructure, a project-financed project is characterized by

(1) high concentration of project risks in the early phase of project life cycle; and
(2) a risk profile that undergoes important changes as the project comes to fruition with a relatively stable stream of cash flows that is subject to market and regulatory risks once the project is completed (Dailami *et al.*, 1999).

Given that a private infrastructure involves high-risks, unless the financial viability of the project over its entire lifespan can be clearly demonstrated, equity investors and other long-term investors will be unwilling to provide the amount of funding required at competitive interest rates (Levy, 1996). To attract private sector investors, host governments often provide financial support packages. These supports may take on several forms from a comfort letter, capital contribution (equity/debt/subordinated debt participation), preferential tax treatment, grant/subsidy and guarantees. Legally, governments' obligation to provide support can be defined in laws, decrees, statues, licenses, concessions, contracts or other legally binding documents (Dailami and Klein, 1997).

A special focus is placed on government guarantees rather than other supports owing to two important factors. First, guarantees are extensively used in private infrastructure. Tiong (1995), Mody and Patro (1995), Dailami and Leipziger (1997), Klein (1997), Engel *et al.* (1997), Lewis and Mody (1998a), World Bank and the Ministry of Construction of Japan (1999), Irwin *et al.* (1999), Estache *et al.* (2000), Mody (2002) and Irwin (2003) have presented guarantee provisions in real projects across countries

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and sectors. Second, most governments do not account for the contingent liabilities when an investment is guaranteed (Mody and Patro, 1995). Contingent liabilities represent real liabilities. A study shows that guarantee costs can average as much as a third of the amount guaranteed (Lewis and Mody, 1998b). In a more recent example, the Malaysian government had to compensate the toll road operator of the North-South Highway a total of MYR 161 million for 1996 and 1997 and MYR 145 million for 1998 for denying the full increase permitted under the concession agreement since 1996 (Mody, 2002). Starting with the United States 1991 Credit Reform Act, a number of OECD countries started to assess the fiscal impact of guarantees (Klein, 1997). Introducing new accounting methodology for guarantees, governments would have no fiscal incentives to issue guarantees rather than giving subsidies, because both would show up as expenditures affecting the deficit and both would require appropriation by the legislature (Thobani, 1998).

As with other emerging markets, Indonesia has been actively promoting development of toll facilities under BOT arrangements since 1990. History shows that the government had provided guarantees for some concession firms although as time elapsed, the government had to cancel these supports. In a toll road concession, for instance, the government promised to take over the project debt if a full payment of debt cannot be made at the concession period expiry. This debt guarantee was then cancelled as a result of renegotiation with the project sponsor few years ago. The government had also provided interest-free bridge financing to a concession firm in 1995. This support was given to cover any revenue shortfalls resulting from future government disapproval of the tariff rates agreed to in the concession contract's escalation formula (World Bank and the Ministry of Construction of Japan, 1999). The government had to revoke the concession, however, following the project sponsor's inability to meet obligation due to economic turmoil in the aftermath of Asian financial crisis in 1997. Currently, the Indonesian government is conceiving support provisions for private infrastructure projects. As this paper is written, the government is in the process of drafting a new regulation that will cover the possibility of support provisions for private infrastructure projects. This effort is part of policy reforms adopted by the government to promote more private sector participation in infrastructure. The present paper will focus on valuing government guarantees and their financial impact on BOT toll roads in Indonesia.

Guarantees as put options

Many innovative instruments have been introduced and traded in the financial market. One of these is an option that gives its owner the right to sell (put options) or to buy (call options) before and on the pre-specified date (American options) or only on the exercise date (European options). Option value depends on the market price of the underlying instrument. For instance, if by the exercise date, the asset market price is below the exercise price, the put option holder will exercise his option to sell the asset at the exercise price. In this case, the option is worth the difference between the market price and the exercise price. On contrary, if the market price of asset turns out to be higher than the exercise price by the exercise date, the holder will sell the asset at the market price without exercising his option. In this case, the put option is worthless. Likewise, the call option holder will exercise his option to buy the asset at the pre-specified price if the market price of the underlying instrument turns out to be higher than the exercise price; otherwise, he will buy the asset at the market price and the call option is worthless. Mathematically, a put option value can be formulated as

$$\text{Option's value} = \begin{cases} P - \tilde{V} & \text{if } P \geq \tilde{V} \\ 0 & \text{if } P < \tilde{V} \end{cases} \quad (1)$$

where P represents exercise price and $\tilde{V}$ represents asset market value at the exercise date.

A guarantee and an option are similar in the sense that they can provide a downside protection to their holders. The only difference is that a guarantee is often given for free. One of the major problems with guarantees, however, is that typically are difficult to value (Klein, 1997). Existing analytical methods for pricing options such as Black and Scholes model and the binomial model (Brealey and Myers, 2000) involve few variables. In addition, sufficient data and information are often available in the financial market. Using the option pricing theory, Sosin (1980), for instance, valued the federal loan guarantee program to corporations where the market value of a firm's underlying assets follows geometric Brownian motions. On the contrary, guarantee valuation of private infrastructure is typically associated with various risk factors arising from different distribution functions with some dependencies among them. The problems often involve a large and complex system. To deal with this issue, a stochastic simulation approach is applied. The Latin Hypercube technique is employed in this study. In general, this technique produces substantial variance reductions over

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standard Monte Carlo in risk analysis application (Saliby and Pacheco, 2002). Use of simulation techniques in valuing guarantees has also appeared in some previous research papers [see, for example, Lewis and Mody (1998b) and Irwin (2003)].

Modeling cash flows

The following are underlying assumptions applied in modeling project cash flows:

(1) debt repayment is not fixed depending on project financial performance without recourse to the project sponsor or its parent company;
(2) priority for use of any cash in any period is as follows: operating cost, interest payment, income tax, principal repayment, dividends;
(3) simulated cash flows are discounted at the risk-free rate, which is fixed over the project life;
(4) construction time is fixed and the completion date of construction is set as time zero in the discounting process;
(5) traffic composition is constant;
(6) the ramp-up period is not taken into account;
(7) if actual traffic has reached the design capacity, traffic remains constant for subsequent years;
(8) if called, the guarantee payment is instantaneously made at end of year; and
(9) unless otherwise specified, financial parameters (e.g. cost of debt) remain unchanged in the presence of guarantees.

The first step of formulating a cash flow model is to calculate operating revenues generated by the project. In this paper, they are simply computed as the sum of the product of actual traffic and prevailing tolls for all vehicle types.

$$P\tilde{O}R_t = \sum_{u=1}^{v} \tilde{V}_{ut}\tilde{P}_{ut} \quad \text{for } t = 1, 2, \ldots, N \qquad (2)$$

where $P\tilde{O}R_t$ represents revenue at year t, $\tilde{V}_{ut}$ represents traffics of vehicle type u at year t, $\tilde{P}_{ut}$ represents tolls of vehicle type u at year t and N represents concession period.

Following the assumption that traffic composition is constant and there is normally a finite capacity of the facility, traffic at year t can be modeled as follows

$$\tilde{V}_t = \begin{cases} \sum_{u=1}^{v} w_u \tilde{V}_{ut} & \text{if } \tilde{V}_t \leq V_D \\ V_D & \text{if } \tilde{V} > V_D \end{cases} \qquad (3)$$

where w_u represents fraction of vehicle type u traffic of total traffic, V_D represents design capacity.

In equation (2), tolls are regarded as one of the risk factors. In this paper, it is assumed that the uncertainty of future tolls is sourced from delays in adjustments as is often the case in the Indonesian toll road industry. Recall that the adjustment period according to the concession agreement is c and delay for mth toll adjustment is $\tilde{d}_m$, the mth adjustment should materialize in

$$\tilde{Y}_m = \tilde{Y}_{m-1} + c + \tilde{d}_m \quad \text{for } m = 1, 2, \ldots \text{subject to } \tilde{Y}_m \leq N \qquad (4)$$

where $\tilde{Y}_m$ represents the year at which the mth adjustment happens; $\tilde{Y}_0 = 0$.

Indonesia has long applied price cap system with indexation to domestic inflation rates. In a more general term, toll settings under that system can be formulated as follows

$$\tilde{P}_{ut} = \begin{cases} \tilde{P}_{ut-1} & \text{if } \tilde{Y}_m \leq t < \tilde{Y}_{m+1} \\ \tilde{P}_{ut-1}\min\left[\gamma; \dfrac{\prod_{t=1}^{Y_{m+1}}(1+\tilde{f}_t)}{\prod_{t=1}^{Y_m}(1+\tilde{f}_t)}\right] & \text{if } t = \tilde{Y}_{m+1} \end{cases}$$
$$\text{for } t = 1, \ldots, N; \text{ for } u = 1, \ldots, v \qquad (5)$$

where $\tilde{P}_{ut}$ represents the tolls of vehicle type u at year t; $\tilde{f}_t$ represents the inflation rate at year t; γ represents the allowable maximum adjustment (if any)

Operating loss/profit at year t is computed by simply subtracting operating cost from operating revenue.

$$P\tilde{O}N_t = P\tilde{O}R_t - P\tilde{O}C_t \qquad (6)$$

where $P\tilde{O}N_t$ represents the project operating loss/profit; $P\tilde{O}C_t$ reperesents the project operating cost (e.g. land and building tax, O/M cost).

Because the interest payment ranks highest in the payment claim, operating profit must be first used to make the payment. With non-recourse basis, if the operating profit is not sufficient, the creditors will receive payment limited to the operating profit while unpaid interest is accounted for in computing the outstanding debt of the next term. The uncertainty of interest payment thus can be modeled as follows

$$I\tilde{N}T_t = \begin{cases} \tilde{r}_{t-1}\tilde{B}_{t-1} \\ \max(P\tilde{O}N_t; 0) \end{cases} \quad \text{for } t = 1, 2, \ldots, N \qquad (7)$$

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where $\tilde{r}_t$ represents the interest rate at year t; $\tilde{B}_{t-1}$ represents the outstanding debt at year $t-1$.

The next step is to calculate the income tax that the project sponsor must pay to the government. Because the interest payment and depreciation reduce taxable income, the amount of tax should be

$$\tilde{TAX}_t = t_c \max(0; \tilde{PON}_t - D_t - \tilde{INT}_t) \quad \text{for } t = 1, 2, \ldots, N \tag{8}$$

where t_c represents the income tax rate; D_t represents the depreciation at year t.

Next, the project sponsor is required to repay the outstanding debt using the following formula

$$\tilde{PRI}_t = \begin{cases} \tilde{B}_{t-1} \\ \max(\tilde{PON}_t; 0) - \tilde{INT}_t - \tilde{TAX} \end{cases} \quad \text{for } t = 1, 2, \ldots, N \tag{9}$$

where $\tilde{PRI}_t$ represents the debt principal repayment made at year t.

The next term outstanding debt can be written as follows

$$\tilde{B}_t = \tilde{B}_{t-1} + \tilde{r}_{t-1}\tilde{B}_{t-1} - \tilde{INT}_t - \tilde{PRI}_t \quad \text{for } t = 1, 2, \ldots, N \tag{10}$$

Finally, the project sponsor's cash flow at year t can be computed as

$$NPV_W = -C_0 + \sum_{t=1}^{N} \frac{\tilde{PON}_t - \tilde{INT}_t - \tilde{TAX}_t - \tilde{PRI}_t}{(1+r)^t} \tag{11}$$

where NPV_W represents the project sponsor NPV without guarantees; C_0 represents the equity contribution; r represents the discount rate.

Taking account guarantees in the project sponsor's cash flow, equation (11) is extended to

$$NPV_G = -C_0 + \sum_{t=1}^{N} \frac{\tilde{PON}_t - \tilde{INT}_t - \tilde{TAX}_t - \tilde{PRI}_t}{(1+r)^t} + \sum_{t=1}^{T} \frac{\tilde{G}_t}{(1+r)^t} \tag{12}$$

where NPV_G represents the project sponsor NPV with guarantees; T represents the guarantee period; $\tilde{G}_t$ represents the guarantee payment if called at year t.

The last term in the right hand side of equation (11) is the guarantee payment made by the government.

Modeling uncertainties of risky variables

Risky variables whose future values are expected to equal current values (e.g. interest and interest rates) are assumed to evolve following a Wiener process or Brownian motions with a zero drift, which can be written as follows

$$x_t = x_{t-1} \exp\left(\sigma\sqrt{dt}\tilde{Z}\right) \tag{13}$$

where x_t represents the variable value at year t; x_{t-1} represents the variable value at previous year; σ represents the variable volatility per unit time; $\tilde{Z}$ represents the normally distributed random variable with a zero mean and a unit standard deviation.

For risky variables that are expected to grow at a constant rate (e.g. traffics or revenues), they are assumed to evolve following the geometric Brownian motion, which can be mathematically expressed as (Irwin, 2003):

$$x_t = x_{t-1} \exp\left[\left(\mu - \frac{\sigma^2}{2}\right)dt + \sigma\sqrt{dt}\tilde{Z}\right] \tag{14}$$

where μ represents the expected drift per unit time of x.

Delays in toll adjustment are assumed to obey a geometric distribution with parameter p as shown in equation (15).

$$f(d_m) = p(1-p)^{d_m} \quad \text{where } d_m \in (0, 1, 2\ldots) \tag{15}$$

where d_m represents the delay of mth toll adjustment.

Other risky variables are simply assumed to follow normal distributions.

Case study

The case study presented here is a typical BOT toll road project in Indonesia. The total construction cost amounts to Indonesian Rupiah (IDR) 30 billion per km, which is equivalent to about USD 3.5 million per km under assumption that USD 1 is rated at IDR 8,500. The project will be carried out under a BOT arrangement with a fixed concession period of 25 years. Assuming that the facility construction will be completed in three years, the remaining 22 years will be the commercial operation period. The project debt equity ratio (DER) is 70/30 with interest rates floating 200 bps over the Jakarta Inter Banks Offered Rates (JIBOR). Traffic is classified into three categories: class I for small vehicles, class IIA for medium vehicles and IIB for large vehicles with a composition of 85/10/5. Toll rate indexes of vehicles class I, vehicles class IIA and vehicles class

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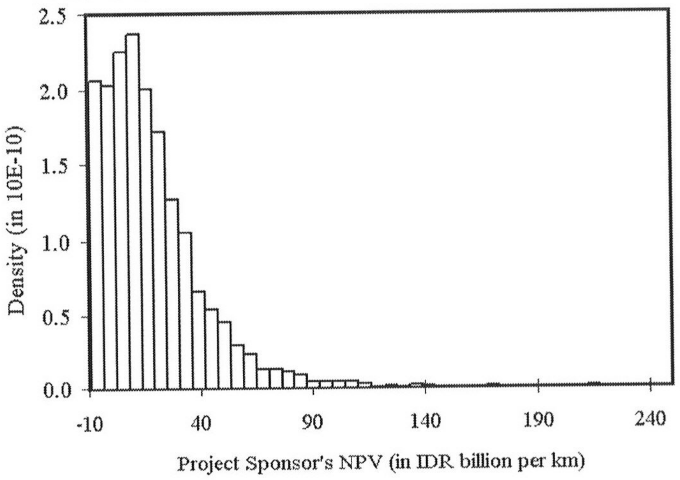
IIB are, respectively, 100, 150 and 200 percent. The facility is designed to be capable of serving the maximum traffic of 180,000 vehicles per day (vhd). The initial tolls of vehicles class I are set at IDR 400/km. According to the project agreement, tolls can be raised at every two years following the increase of domestic inflation rate. Traffic in the first year after opening is estimated to start at about 18,000 vhd and grow at 8 percent annually. The income tax rate in Indonesia is 30 percent. Current JIBOR and inflation rate are 13.5 and 7.0 percent pa, respectively. The 3-month Bank of Indonesia note (Sertifikat Bank Indonesia) is used as the risk-free rate and is taken as 12.75 percent pa. The initial operating cost is IDR 950 million/km and will rise following the increase of domestic consumer price indexes. Additionally, land and building tax, amount to 1 percent of operating revenue. Key risk factors include traffic in the first year of operation, traffic growth, JIBOR, domestic inflation rates and delay in toll adjustment. First-year traffic is assumed to follow a normal distribution with expected traffic as means and coefficient of variation of 10 percent. Inflation rate and JIBOR are assumed to follow a zero drift wiener process with annual volatilities of 11.34 percent and 6.75 percent, respectively, while traffic is assumed to follow geometric Brownian motions. It is also assumed that the expected growth and volatility are 8 and 10 percent, respectively. The parameter of geometric distribution of delay is assumed to be 0.8.

Figure 1 Distribution for project sponsor's NPVs



Simulation results

A sample size of 5,000 runs should be more than sufficient to generate distributions of selected simulation outcomes. The risk analysis tool used in this study is @Risk 4.05 developed by Palisade Corporation. Simulation is first carried out on the project sponsor cash flow model without guarantees to see inherent project risk level. Figure 1 shows the distribution of project sponsor NPVs. Simulation results show that mean of the project sponsor's NPV per km is IDR 18.6 billion with a standard deviation of about IDR 22.4 million.

Simulation results show that the project sponsor NPV can be as low as minus IDR 9.0 billion per km. This figure can reveal two factors. First, there is a possibility that the project sponsor can receive no payment because the obligation service has finished off all the funding. Note that in this case the project sponsor may receive payment only if all obligations have been satisfied. Second, with the loss amounting to the equity contribution, there should be only operating profit; otherwise the project sponsor must suffer a loss greater than equity contribution. Furthermore, there is 82.1 percent confidence level that NPV is greater than zero. If the confidence level is set at 95 percent as normally applied in value at risk (VaR) analysis [see the application of VaR in BOT infrastructure project in Ye and Tiong (2000)], the risk level appears intolerable from the project sponsor's perspective (if the simulation is applied on creditors' cash flow, the project is risk-free for the creditors because there is 97.6 percent confidence level that their NPV is greater than zero).

Guarantee provisions

Several common guarantees are discussed, including revenue, traffic, tariff, debt and maximum interest rate guarantees. Table I contains listing of key terms and conditions of each guarantee.

A Latin Hypercube simulation of 5,000 trials is now applied to the cash flow model with guarantees. Figure 2 shows the distribution of minimum revenue guarantees' present value. Distributions of other guarantees are not shown for reasons of brevity. Table II details key statistic outputs for payments of all guarantees. Simulation results exhibit that guarantees are not cost-free. The expected costs can vary in the range from IDR 0.5 billion/km to IDR 2.2 billion/km. The least expected cost is found when the government guarantees the debt repayment. This result does make sense because, as previously mentioned, it is most unlikely that the debt cannot be fully serviced during the concession period. Specific attention,

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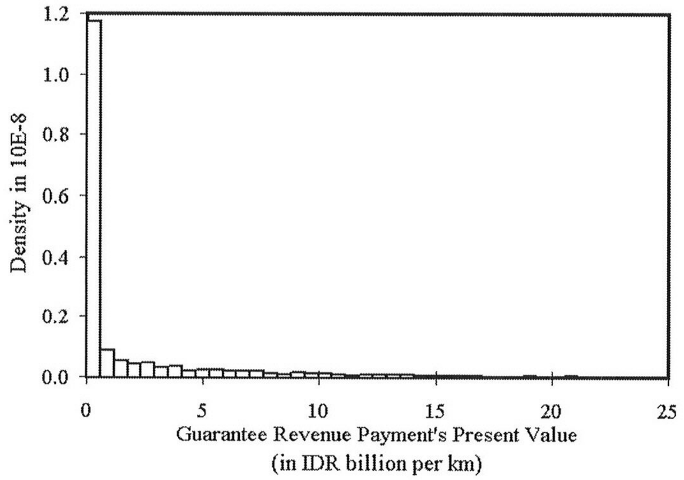
Table I Term and condition of guaranteesCH^mode

Type of guarantee	Term and condition
Minimum revenue	The government pays nothing to project sponsor if the annual operating revenue is equal or higher than 70 percent of the expected annual revenue; otherwise the government compensates the project sponsor an equivalent amount. This guarantee is callable during the concession period
Minimum traffic	The government pays nothing to the project sponsor if actual traffic is equal or higher than 70 percent of the expected traffic; otherwise the government compensates the project sponsor an equivalent amount. This guarantee is callable during the concession period
Tariff	The government guarantees that tolls can be adjusted in a timely manner following the increase of domestic consumer price indexes. If not, the government compensates the project sponsor an equivalent amount. This guarantee is callable during the concession period
Debt	The government will take over the outstanding debt if at the expiry of the concession duration. Under this debt guarantee, it is simply assumed that the creditors are willing to lower interest rates to 175 bps over JIBOR. This guarantee can be called at the expiry of the concession period
Maximum interest	The government compensates the project sponsor an equivalent amount if JIBOR turn out to be higher than 110 percent of their expected value. This guarantee is callable only during the debt service period

Figure 2 Distribution for revenue guarantee payment's present value



however, must be paid because this guarantee has the largest standard deviation, in particular if compared with its mean. If everything goes wrong, this guarantee can incur cost that equals almost fivefold of total investment. The versatility of this guarantee is more evidenced by its highest degree of skewness if compared with that of other guarantees. As seen in Table II, entire payment distributions are positively skewed, indicating that they have long tails in the positive direction. This effect can be explained simply by the fact that they have a lower limit of zero while the maximum possible output can be indefinite. A positively skewed asset is perhaps favorable to many investors, but in this case a high degree of skewness implies that the government is exposed to high risk of being confronted with exceptionally high payments. Simulation results show also that entire distributions show leptokurtosis, indicated by kurtosis of above 3.0. This reflects that there is higher frequency of outcomes near the mean than would be expected in a bell-shaped distribution.

Table III lists key statistics on the financial impact of guarantees on the project sponsor's cash flow. As shown, the project sponsor's risk of having negative NPVs can be reduced. Under a maximum interest rate guarantee, for instance, the risk is reduced from 17.9 to 15.3 percent. Nevertheless, no guarantees can bring the project risk level to an acceptable one.

Equivalent direct subsidies

As with guarantees, subsidies can reduce the project risk. This possibility arises because the total construction cost is reduced while anticipated cash flows remain unchanged. In this section, it will be compared the financial impacts of guarantees and direct subsidies for equal expected payoff. This comparison method is particularly justifiable when the government acts as a risk-neutral individual if it is assumed that the government can effectively spread risks to taxpayers. Under risk neutrality assumption, the government is indifferent to a set of alternatives that give equal expected payoffs. Figure 3 shows impacts of different values of subsidies ranging from IDR 0/km to IDR 2.5 billion/km on the risk of the project sponsor having negative NPV. As shown, as subsidy amounts increase, risk decreases. All guarantees except the tariff guarantee lie at or below the line, indicating that at equal expected payoffs guarantees reduce risk more than equivalent direct subsidies do. For example, the expected cost of traffic guarantees is about IDR 1.5 billion/km with corresponding risk of 13.8 percent. If the government provides equivalent direct subsidies, simulations results show that risk is about 14.0 percent.

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Table II Output statistics of government payments

	Guarantees				
Statistics	**Revenue**	**Interest**	**Debt**	**Tariff**	**Traffic**
Minimum	0.00	0.00	0.00	0.00	0.00
Maximum	23.43	21.12	146.39	79.04	46.66
Mean	1.65	0.63	0.53	2.23	1.45
Standard deviation	3.46	1.46	4.32	2.88	3.64
Skewness	2.77	4.49	18.20	8.10	4.27
Kurtosis	11.22	32.68	456.51	152.18	29.47
Mode	0.00	0.00	0.00	0.00	0.00
5 percent	0.00	0.00	0.00	0.00	0.00
10 percent	0.00	0.00	0.00	0.00	0.00
15 percent	0.00	0.00	0.00	0.45	0.00
20 percent	0.00	0.00	0.00	0.63	0.00
25 percent	0.00	0.00	0.00	0.78	0.00
30 percent	0.00	0.00	0.00	0.92	0.00
35 percent	0.00	0.00	0.00	1.06	0.00
40 percent	0.00	0.00	0.00	1.22	0.00
45 percent	0.00	0.00	0.00	1.37	0.00
50 percent	0.00	0.02	0.00	1.54	0.00
55 percent	0.00	0.05	0.00	1.75	0.00
60 percent	0.10	0.10	0.00	1.97	0.00
65 percent	0.30	0.20	0.00	2.18	0.10
70 percent	0.70	0.34	0.00	2.44	0.32
75 percent	1.41	0.54	0.00	2.74	0.84
80 percent	2.46	0.84	0.00	3.19	1.62
85 percent	3.90	1.34	0.00	3.81	2.91
90 percent	6.14	2.02	0.00	4.71	5.11
95 percent	9.72	3.38	0.11	6.46	8.82

Note: Figures are in IDR billion per km except skewness and kurtosis, which are dimensionless

Table III Key statistics of guarantees' financial impact

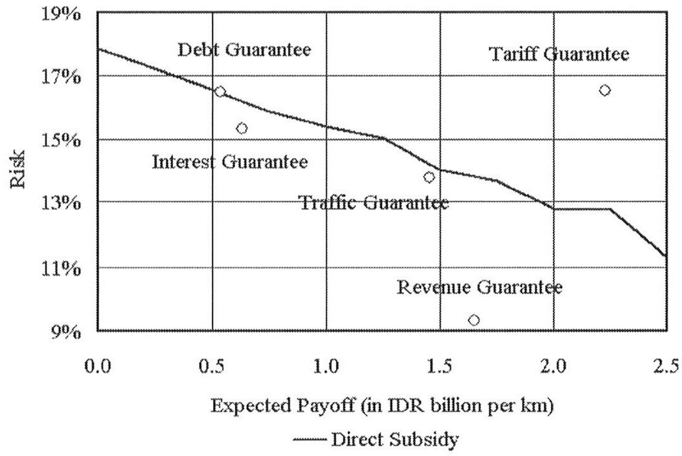
	Government		Project sponsor	
Type of guarantee	**Mean (IDR billion/km)**	**Probability guarantee being called (percent)**	**Mean (IDR billion/km)**	**Probability of negative NPV (percent)**
No guarantee	0.0 (0.0)	0.0 (0.0)	18.6 (22.4)	17.9
Revenue	1.7 (3.5)	44.5	19.6 (21.8)	9.3
Traffic	1.5 (3.6)	38.9	19.8 (24.2)	13.8
Tariff	2.2 (2.9)	89.3	19.4 (23.7)	16.5
Debt	0.5 (4.3)	5.0	19.1 (22.7)	16.5
Interest	0.6 (1.5)	54.0	19.1 (22.2)	15.3

Note: Figures in parentheses indicate corresponding standard deviation

The difference indeed is not significant. One can see a material effect of guarantees, however, when the government guarantees minimum revenue where risk can be reduced to 9.3 percent vs 13.9 percent of equivalent subsidies. On contrary, the tariff guarantee can reduce the risk to 16.5 percent while equivalent subsidies can bring the risk to a level below 13.0 percent. In other words, if the government has two options either to provide a tariff guarantee or to give subsidies in amount of IDR 2.2 billion/km, the government should choose the latter.

The discussion can be extended in the same way to determine what guarantee level can make the project privately financiable or to value a combination of direct subsidies and guarantees or of two or more different guarantees. For instance, the government may guarantee minimum revenues of 80 percent of expected revenues. Simulation results show that under this new condition risk is reduced to 3.1 percent or lower than the pre-specified limit of 5.0 percent.
The expected payment of these guarantees is IDR 3.2 billion/km.

Figure 3 Risks and costs of subsidy and guarantee



Conclusions

To attract private sector investors, host governments often provide guarantees for their BOT infrastructure projects. Evidence has shown, however, that governments often do not know the full extent of their contingent liabilities when providing guarantees. This paper discusses financial impacts of guarantees on cash flows from the perspective of the project sponsor and the government. By understanding the full extent of their contingent liabilities, governments should no longer be more motivated to issue guarantees rather than give direct subsidies. Contingent liability analysis may enable the government to select the most appropriate financial instrument support for its private infrastructure projects. A case study of a typical toll road project in Indonesia is presented. A number of key risk factors have been identified with some assumptions. Several types of guarantees are discussed. Latin Hypercube simulations of 5,000 iterations are applied on cash flow model both with and without guarantees. As shown, the guarantees are not cost free. If compared with equivalent subsidies, however, some guarantees are proven to be more effective in term of reducing risk of the project sponsor having negative NPVs.

The methodology used here is not without difficulties. To define a density function of a risk factor, an extensive set of sample data is required. Some data (e.g. inflation rates and interest rates) are often observable while some others are not, simply because of insufficient number of samples for making appropriate judgment. Qualitative assessments are thus required. As this paper is written, private toll facilities in Indonesian are still on going. According to existing concession agreements, the earliest possible transfer to the government of current concessions is as late as 2016 while transfers of other facilities will take place during the period of 2021-2028. As the number of reference projects increases, a refinement of existing models can be made.

Finally, government guarantees should not be deemed the only tool to attract private sector investors. In the long-term, private sector investors should be willing to bear project risk without demanding guarantees. One the best things government can do to make project more attractive without issuing guarantees is to put in place good policies that generally reduce risks and raise expected returns (Irwin *et al.*, 1999). Firms are less likely to insist on guarantees when investing in a country with a good regulatory framework, non-political regulatory agencies and a strong and independent judiciary (Thobani, 1998). This also holds for the Indonesian government that wishes to promote increased private investment in its toll road industry. In addition, the government needs to be aware of the possible moral hazard that the project sponsor is less motivated to be efficient in managing risks because it believes that the government will provide a downside protection resulting from risk occurrence.

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