Modeling Contingent Liabilities Arising from Government Guarantees in Indonesian BOT/PPP Toll Roads

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Abstract: By the end of 2010, the Government of Indonesia (GoI) issued a new regulation on government guarantee provision to protect project sponsors from government-related project risks in public–private partnered (PPP) infrastructure development. Whereas the provision of guarantees can help improve the creditworthiness of PPP projects, it also may expose the GoI to considerable fiscal risk as a result of contingent liabilities the GoI incurs when providing guarantees. This requires a systematic contingent liability analysis to understand the full extent of their exposures. The present paper discusses simple and operational methodologies of quantifying payments of guarantees given to PPP toll road projects to protect project sponsors from skyrocketing costs of acquiring land, delays in scheduled toll adjustment, and compensation payments in case of nationalization. The paper also includes extensive modeling of key project risks, i.e., land cost escalation, initial traffic volume, inflation rates, toll adjustment delays, and a nationalization event. The methodologies are tested on a case study of a PPP toll road project in Indonesia implemented under a build-operate-transfer (BOT) arrangement to demonstrate its application. A Monte Carlo–based simulation is performed to estimate two measures of exposures that are the expected and excess payment of each guarantee. Although the discussion is framed within the context of a specific sector and country, the methodologies offered herein can be adopted to other countries and sectors facing similar problems. **DOI: 10.1061/(ASCE)CO.1943-7862.0000555.**

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Introduction

The provision of government guarantees to protect project sponsors from govenrment-related project risks in public-private partnership (PPP) infrastructure development. When offering guarantees, the governments typically incur no immediate cash costs but only the possibility of future liabilities (Irwin 2003). These liabilities may soon represent an unmanageable level of exposure, not only because of their size relative to the size of the government's balance sheet but also because their contingent nature implies the possibility of sudden and substantial obligations due over a short period of time (Lewis and Mody 1998). Hence, systematic approaches to quantify the liabilities are necessary in order to better understand the full extent of their exposures to fiscal risks.

In 2008 the GoI launched land-capping instruments to protect toll road developers from unexpected high costs of acquiring land that have long been major impediments in the country's toll road development. By the end of 2010 the GoI enacted the new Presidential Regulation No. 78 on guarantee provisions for PPP infrastructure projects. The regulation is later translated into the Minister of Finance Regulation No. 260 that revoked the Minister of Finance Regulation No. 38/2006 as the implementation guidance of guarantee provision in PPP infrastructure projects. Whereas the old regulation covered a wide variety of risks from political to demand risks, the new regulation only covers project risks associated with government actions. This means that demand associated guarantees such as minimum traffic or minimum revenue guarantees to protect project sponsors from demand shortfall risks are no longer available at present, unless the risks are significantly triggered by government actions (e.g., a breach of contract on exclusivity terms by constructing a competing nontoll road in the same corridor).

This paper discusses simple and operational methodologies of quantifying contingent liabilities of three possible guarantee types that are associated with government-related risks, i.e., skyrocketing land costs, delays in toll adjustments, and asset nationalization in the context of Indonesian toll roads. The paper attempts to fill the gap of theoretical questions and practical considerations in at least two ways. To the best of the authors' knowledge, whereas reports on contingent liabilities of demand risk guarantees, such as minimum traffic or minimum revenue guarantees are abundant in the literature, previous research works that dealt with political risk and land cost guarantees are extremely limited. If available, it is

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often the case that the proposed models do not fit the real problems because they are either much simplified or too complicated to use. The paper is derived from Indonesian experiences that would be of interest to other governments facing similar problems. Thus, the paper is of particular relevance to both academicians and government officials especially those working on and experimenting with guarantee supports.

Contingent Liabilities Modeling

The following conventions and notations are used throughout the paper. All cash flows are measured on an end-of-year basis and the reference year is the start of the land acquisition process, set at $t = 0$.

Land-Capping Instrument

Land acquisition is frequently an important concern in infrastructure projects, particularly in transportation and hydroelectric projects; it can be a major source of project risk if not handled carefully (Kohli, Mody, and Walton 1997). In Indonesia, the land cost originally rested with the GoI but has been transferred to project sponsors since 1994. The risk transfer has been more of a hindrance than encouragement for prospective project sponsors to invest. One example is the development of the 21.5-km toll road project connecting Bogor-Depok-Antasari in South Jakarta that grounded to a halt in 2008 because of land-acquisition problems. A high-ranked government official acknowledged that the cost of land acquisition for toll road projects had increased to between 30 and 40% of the total investment from the original estimate of between 20 and 25%, making toll road projects commercially unfeasible (Widhiarto 2011).

The land-guarantee program initiated in 2008 is aimed at protecting project sponsors from these skyrocketing costs. Since its initiation, the instrument has been experimented with in some toll road projects. It has been regulated that a project sponsor is only responsible for the actual land cost up to 110% of the base cost as agreed in the concession agreement or 100% of the base cost plus 2% of the total investment, whichever is greater. It can be readily proven that

$$C_L^u = \begin{cases} 1.10C_L^b & \text{if } \frac{C_L^b}{C_L^b + C_{nL}^b} \geq 0.20 \\ 1.02C_L^b + 0.02C_{nL}^b & \text{if } \frac{C_L^b}{C_L^b + C_{nL}^b} < 0.20 \end{cases} \tag{1}$$

where C_L^u = maximum cost assumed by the project sponsor; C_L^b = base land cost; C_{nL}^b = base investment cost *excluding* land cost. In case of the actual land cost exceeding the maximum guaranteed level, the GoI will make up the difference providing that the internal rate of return (IRR) remains equal to or greater than 12% after land cost escalation and the reduction in IRR attributable to land cost escalation does not exceed 4%. Technically, the GoI attempts to limit its direct payments to the project sponsor by setting the requirement. Let Δ be the threshold level for a direct payment. If the actual cost is higher than Δ, the project sponsor has the option to either terminate the contract or bear the difference for which the project sponsor is compensated with indirect payments in the form of initial toll adjustment and/or concession duration extension and/or changes in the scope of work. Fig. 1 exhibits the schematic flow of a land-capping compensation mechanism.

For the sake of simplicity without losing the generality, it is assumed that the land acquisition process is resolved at $t = 0$. Under this assumption

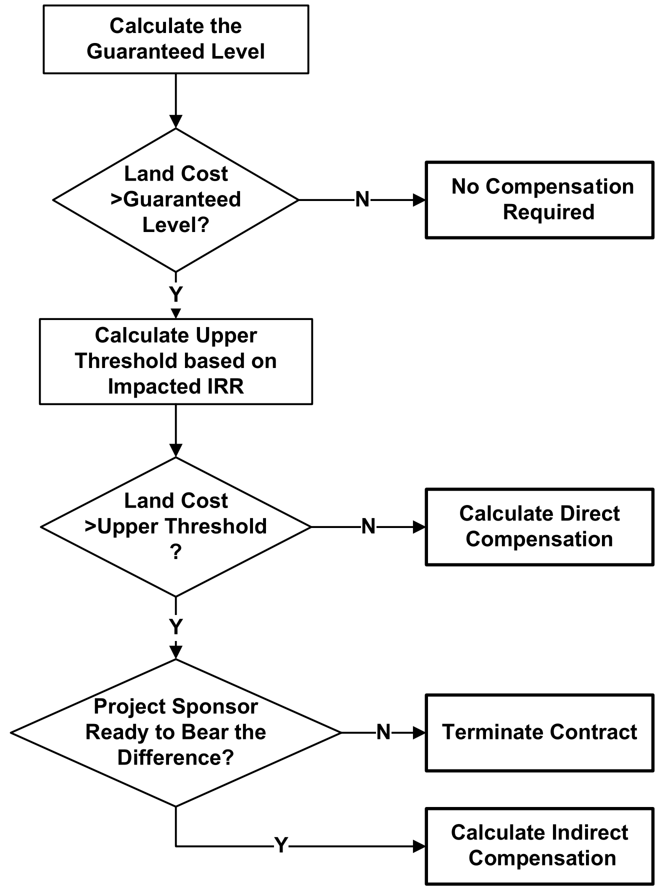

Fig. 1. Land-capping guarantee flow diagram

$$\Delta = \sum_{t=0}^{d_N} \frac{\mathrm{CF}_t^b}{[1 + \max(\mathrm{IRR}_{\min}, \mathrm{IRR}_b - \alpha)]^t} \tag{2}$$

where CF_t^b = base cash flows in year t; $\mathrm{IRR}_{\min}$ = minimum IRR after cost escalation (12%); IRR_b = base IRR; α = maximum reduction in IRR attributable to land cost escalation (4%); and d_N = concession duration. The land-capping payment in present value terms can be written as

$$\widetilde{\mathrm{GL}} = \begin{cases} 0 & \text{if } \tilde{L} \leq c_L^u \\ \min(\Delta, \tilde{L}) - c_L^u & \text{if } \tilde{L} > c_L^u \end{cases} \tag{3}$$

where $\widetilde{\mathrm{GL}}$ = land-capping payment in present value terms and $\tilde{L}$ = actual land cost. The value of indirect compensations if the project sponsor opts to continue the project is therefore equal to the gap between the actual cost and the threshold, or

$$\widetilde{\mathrm{NGL}} = \begin{cases} 0 & \text{if } \tilde{L} \leq \Delta \\ \tilde{L} - \Delta & \text{if } \tilde{L} > \Delta \end{cases} \tag{4}$$

where $\widetilde{\mathrm{NGL}}$ = value of indirect payment attributable to excessive land escalation. The governing risk variable in Eqs. (3 and 4) is the actual land cost whose probability distribution must be known or assumed. In practice, the upper threshold set forth by the regulation has effectively no meaning in so far as the GoI is always prepared to provide extra resources.

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Full Toll Guarantee

Toll risk relates to the unpredictability of future tolls because they cannot be increased as permitted by concession contracts or as agreed by the host government as in the case of the Bangkok Expressway Project (Estache, Romero, and Strong 2000) and all toll road projects in Indonesia during the period 1992–2005. To model toll risk, Irwin (2007) assumes a timely toll adjustment within a politically acceptable toll level. On the contrary, Wibowo (2004) posits that no politically acceptable toll is put in place but scheduled toll adjustments can be postponed for political reasons.

The two models are hybridized in one sitting to ensure full compatibility with real problems that may involve toll restriction and delay risks. The modeling begins with the determination of years of contractual toll adjustments

$$Y^b_m = Y^b_{m-1} + \lambda \quad \text{for } m = 1, 2, \ldots \tag{5}$$

where Y^b_m= year of the contractual mth adjustment; $Y^b_0 = d_c + 1$; λ = toll review interval [in year(s)]. Under toll delay risk considerations

$$\tilde{Y}_m = \begin{cases} \lambda.n + d_c + 1 + \tilde{D}_m & \text{if } \lambda.(n-1) + d_c + 1 \le \tilde{Y}_{m-1} < \lambda.n + d_c + 1 \\ \tilde{Y}_{m-1} + \lambda + \tilde{D}_m & \text{if } \tilde{Y}_{m-1} = \lambda.n + d_c + 1 \end{cases} \quad \text{for } n = 1, 2, 3, \ldots \tag{6}$$

where $\tilde{Y}_m$ = actual year of the mth toll adjustment ($m = 1, 2, \ldots$); $\tilde{D}_m$ = delay [in year(s)] of the mth toll adjustment. The geometric distribution to represent the delay risk (Wibowo and Kochendoerfer 2005) is adopted in the present study. In this context, the event of successful toll adjustment and the length of delay can be analogized with a success event and the number of failure events before the first success. Let p_d be the probability of the mth toll adjustment taking place on schedule. The probability that the contractual toll adjustment will be postponed for del_m years is

$$f(\tilde{D}_m = \text{del}_m) = p_d(1 - p_d)^{\text{del}_m} \quad \text{for del}_m = 0, 1, 2, 3, \ldots \tag{7}$$

and the expected toll delay can be computed as

$$E(\tilde{D}_m) = \frac{1 - p_d}{p_d} \tag{8}$$

Under the price-cap regime in which tolls are indexed to inflation, the future actual tolls are formulated as follows:

$$\tilde{P}_t = \begin{cases} \tilde{P}_{t-1} & \text{if } \tilde{Y}_{m-1} \le t < \tilde{Y}_m \\ \tilde{P}_{t-1} \min\left[\frac{\prod_{j=0}^{\tilde{Y}_m}(1+\tilde{F}_j)}{\prod_{j=0}^{\tilde{Y}_{m-1}}(1+\tilde{F}_j)}; 1 + \pi\right] & \text{if } t = \tilde{Y}_m \end{cases} \quad \text{for } t = d_c + 1, d_c + 2, \ldots, d_N \tag{9}$$

where $\tilde{P}_t$ = contractual toll rate at year t; $\tilde{F}_j$ = inflation rate at year j ($F_0 = 0$); π = maximum politically acceptable toll increase. Likewise, the future contractual tolls $\tilde{P}^b_t$ without additional requirement on maximum politically acceptable toll increase can be written

$$\tilde{P}^b_t = \begin{cases} \tilde{P}^b_{t-1} & \text{if } Y^b_{m-1} \le t < Y^b_m \\ \tilde{P}^b_{t-1} \frac{\prod_{j=0}^{Y^b_m}(1+\tilde{F}_j)}{\prod_{j=0}^{Y^b_{m-1}}(1+\tilde{F}_j)} & \text{if } t = Y^b_m \end{cases} \quad \text{for } t = d_c + 1, d_c + 2, \ldots, d_N \tag{10}$$

Eq. (10) implicitly assumes that the next immediate toll adjustment after a delay should be the nearest next contractual year. Next, to model evolving risk variables such as inflation rates, one may assume a mean reverting process (Dixit and Pindyck 1994)

$$\tilde{X}_t = \bar{X}(1 - e^{-\eta}) + \tilde{X}_{t-1}e^{-\eta} + \sigma_X \tilde{Z}_t \tag{11}$$

where $\tilde{X}_t$ = risk factor at year t; $\bar{x}$ = long-term average to which the risk variable has a tendency to revert; $\eta = a$ parameter between 0 and 1 that determines how quickly the variable tends to revert to the level; σ_X = volatility of $\tilde{X}$; $\tilde{Z}_t$ = standard normal random variable with mean 0 and variance 1 for year t. However, a t-test should be performed to investigate whether or not a risk variable evolves following a mean reverting or just a random walk process (see the step-by-step procedures in Dixit and Pindyck 1994).

To model the uncertainty of traffic volumes, previous empirical studies are used in this study. It has been widely acknowledged that problems with lower-than-expected forecast are regular (Fisher and Babbar 1997). Bain and Polakovic (2005) found out that the ratio of actual to traffic forecast in the first year of operation is normally distributed with mean 0.76 and standard deviation 0.26, reflecting an error and optimism bias in the traffic forecast. The research finding well supports the conclusion of previous empirical studies, such as Bain and Wilkins (2002), Bain and Plantagie (2003), and Bain and Plantagie (2004).

Based on over 100 privately financed toll road projects, Bain (2009) further demonstrates that no systematic improvements are observed in toll road traffic forecasting accuracy after the first year of operation. The empirical findings should be of particular relevance to the provision of minimum traffic or revenue guarantees. As these types of guarantees are not discussed here, the interested reader may refer to existing studies on the issues (see, for instance, Huang and Chou 2006; Cheah and Liu 2006; Chiara, Garvin, and Vecer 2007; Brandao and Saraiva 2008; Blank, Baidya, and Dias 2009; Galera and Soliño 2010; Shan, Garvin, and Kumar 2010; Ashuri et al. 2012).

Based on Bain (2009) it can be conveniently assumed that the first-year traffic volume is critical to define traffic volumes in subsequent years of operation and that the volatility of traffic forecast inaccuracy remains constant over the operation period. Under the assumptions, the traffic volume at year t, $\tilde{V}_t$ can be written

$$\tilde{V}_t = (1 + g_t)\tilde{V}_{t-1} \tag{12}$$

$$\tilde{V}_1 = V_1^b \tilde{e} \tag{13}$$

where V_1^b = first year traffic forecast; g_t = traffic growth forecast for year $t-1$ and t; $\tilde{e}$ = ratio of actual to forecasted traffic volume. The growth rate is not regarded as another random variable (Cheah and Liu 2006) to avoid risk overestimation. The proposed model is similar to that of Shan, Garvin, and Kumar (2010). It is simple but fits empirical evidence. Some other studies assume a random walk with drift or a binomial lattice model to represent traffic uncertainties (see, for example, Ho and Liu 2002; Huang and Chou 2006; Brandao and Saraiva 2008; Blank, Baidya, and Dias 2009; Galera and Soliño 2010; Ashuri et al. 2012). However, the application of these models is not as simple as it appears. In many instances, traffic behaves unlike stock prices. There is the so-called ramp-up period in early years of operation, which reflects the time for users to become aware of the new toll road, change their travel patterns and recognize the potential time-savings of using new toll roads (Kriger et al. 2006). In the course of the ramp-up period, unusually high traffic growth may occur, especially if traffic embarks from a base that is considerably lower than expected (Bain and Wilkins 2002). This calls for careful and considerate use of the models.

The toll delay compensation paid to the project sponsor at year t, $\widetilde{\mathrm{GP}}_t$, is therefore

$$\widetilde{\mathrm{GP}}_t = \begin{cases} 0 & \text{if } \tilde{P}_t = \tilde{P}_t^b \\ (\tilde{P}_t^b - \tilde{P}_t)\tilde{V}_t & \text{if } \tilde{P}_t < \tilde{P}_t^b \end{cases}$$
$$\text{for } t = d_c + 1, d_c + 1, \ldots, d_G, d_G \leq d_N \tag{14}$$

The government payment in present value terms is equal to the sum of future payments discounted at their corresponding discount rates

$$\widetilde{\mathrm{PFT}} = \sum_{t=d_c+1}^{d_T} \frac{\widetilde{\mathrm{GP}}}{\prod_{i=0}^{t}(1+\tilde{r}_i)}, \qquad d_T \leq d_N \tag{15}$$

where $\widetilde{\mathrm{PFT}}$ = full toll guarantee payment in present value terms; d_T = duration of full toll guarantee; $\tilde{r}_i$ = discount rate at year t; $r_0 = 0$. Selecting the correct discount rate poses another complex problem to resolve when performing stochastic NPV analysis. Two schools of thought are available in the literature between risk-adjusted and risk-free interest rate. The risk-free rate can be used to avoid prejudging risk but there is no economic rationale for the discounting process because the risk-free rate is not the opportunity cost of capital (Brealey and Myers 2003). Davis (1995) argues that stochastic analysis has only helped to understand the degree of uncertainty surrounding the expected value; thus, it is incorrect to reduce the risk-adjusted to risk-free discount rate. The present paper in no way discusses which one is superior, but rather recommends the GoI to define the discount rate, or at least, the framework of defining it. In this paper, the after tax weighted average cost of capital (WACC) is used to discount future payments

$$\mathrm{WACC} = (1-T)r_d D/(D+E) + r_e E/(D+E) \tag{16}$$

where T = tax rate; r_d = cost of debt; D = debt capital; E = equity capital; r_e = cost of equity. The use of WACC implies that the GoI's payment risk is equal to the risk of project sponsors. The cost of debt is assumed equal to the borrowing interest rate while the cost of equity is estimated using the well-known Capital Asset Pricing Model (CAPM)

$$r_e = r_f + \beta \times \mathrm{MRP} \tag{17}$$

where r_f = risk-free interest rate; β = levered beta that measures the sensitivity of the expected asset return to the expected market return; MRP = market risk premium.

Nationalization Compensation Payment

It is true that governments neither gain nor lose when compensations are fair but it does not imply that contingent liability analysis is unnecessary; they are still exposed to cash flow risks where they may get the projects but do not necessarily get any cash or other liquid assets to help pay compensation (Irwin 2007). The motivation of nationalization is usually based on national or security interests and not other reasons related to the obsolescing bargaining propositions or that are economically motivated (Permana 2011). The probability of the risk event is thus independent of the project value that allows the discounted cash flow analysis to be chosen over the option-pricing model for modeling the guarantee (Mahajan 1990).

Quantifying nationalization risk is quite a challenging task. It is often not an exercise in financial analysis but one of political assessments (Damodaran 2001). Following Andersson (1991), each trial of nationalization or expropriation is assumed to have only two possible outcomes between occurrence and nonoccurrence of the event of interest. Here, the problem is represented in a binomial tree-like model where there is a p probability of nationalization and a $(1-p)$ probability that the project is allowed to continue to operate for the next year (see Fig. 2).

Given the annual probability, the probability that the nationalization event does not occur over the concession period is

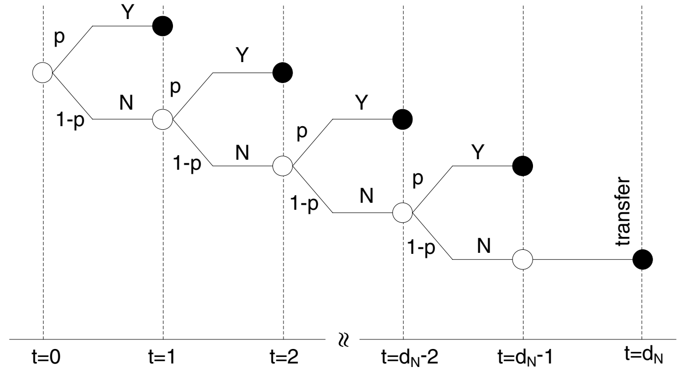

Fig. 2. Binomial tree-like diagram of nationalization event

$$1 - P_T = \prod_{i=1}^{d_N - 1} (1 - p_{ai}) \quad (18)$$

where P_T = probability that nationalization occurs during the concession duration; p_{ai} = probability of nationalization occurring at year i. If $p_{a1} = p_{a2} = \cdots = p_a$, then the probability of nationalization occurring at year t can therefore be expressed as

$$f(\tilde{t} = t_x) = \begin{cases} p_a & \text{for } t_x = 1 \\ p_a(1 - p_a)^{t_x - 1} & \text{for } t_x = 2, 3, \ldots, d_{N-1} \\ 1 & \text{for } t_x = d_N \end{cases} \quad (19)$$

where t_x = year of nationalization. The project sponsors should fare neither better nor worse off in the event of nationalization. Thus, only future cash flows should be relevant in the calculation of compensation. Under this assumption, the government payment in present value terms can be formulated as follows:

$$\widetilde{\text{PGN}} = \sum_{t=0}^{d_G} \frac{\delta_t \widetilde{\text{CF}}_t}{\prod_{i=0}^{t} (1 + \tilde{r}_i)}, \qquad d_G \le d_N \quad (20)$$

and

$$\delta_t = \begin{cases} 0 & \text{if } t \le t_x \\ 1 & \text{if } t > t_x \end{cases} \quad (21)$$

where $\widetilde{\text{PGN}}$= nationalization government payment; d_G = duration of nationalization guarantee. To deal with heavy computational requirements, the Monte Carlo—based simulations are employed with the aid of the Crystal Ball software package.

Numerical Example

The methodologies are tested on an Indonesian toll road project as the case study to demonstrate their application. The project is based on a build-operate-transfer (BOT) procurement model with a 34-year concession, including three years of pre- and construction periods. The base total investment at the end of construction period is estimated at Indonesian Rupiah (IDR) 1.66 trillion (1 USD = IDR 9,000). The traffic is estimated to grow at 29.47% in year 4–5, 15.56% (year 5–6), 11.28% (year 6–7), 9.14% (year 7–8), 7% (year 8–15), 5% (year 15–24), 3% (year 24–end). The initial traffic volumes at the first year of operation are estimated at 38,200 vehicles per day (vhd) for group I, 2,100 (group II), 600 vhd (group III), 300 vhd (group IV), and 350 vhd (group IV) with the toll ratio of 1:1.22:1.44:1.78:2.11. The inital toll rate for group I is IDR 9,000. Other input data include the tax rate (30%) and the base inflation rate of 7%. A straight-line depreciation is applied to provide the project sponsor with a depreciation tax shield (see Table 1 for the abridged project base-case flows).The project cash flows are expressed in nominal terms. In most cases, real and nominal cash flows should result in the same decision on the project viability evaluation if inflation is treated in a consistent manner, i.e., both cash flows and hurdle rates are expressed in the same way in either nominal or real terms. Cash flows might be higher because of the expected inflation but the discount rate must also increase by the same magnitude, thus resulting in an identical net present value (NPV); the choice between the two boils down to one of convenience (Damodaran 2010). In the context of Indonesia, however, the use of real cash flows is not particularly advisable because the inflation effect cannot be cancelled out as the toll rates are subject to biannual adjustments whereas other components of the flows continue to increase annually with inflation.

The base land cost of the project is estimated to be IDR 578,475 million. Based on the financial feasibility evaluation, the project generates the expected IRR of 17.84%. Given that the ratio of the base land cost to total investment is greater than 20%, the project sponsor must be responsible for the actual land cost at a maximum of 110% of the base cost or IDR $636,322 = 1.1 \times 578,475$ million. The upper threshold computed using Eq. (2) is IDR 902,221 million or about 156% of the base land cost. Fig. 3 schematically exhibits the relationship between land cost and the impacted project's IRR.

Estimating Risk Parameters

The distribution of land cost uncertainty is based on actual and forecast data of 12 toll road projects in Indonesia. Given that the sample size is very small, the data are resampled using the nonparametric bootstrapping technique (Stine 1989; Campbell and Torgerson 1999). The Kolmogorov-Smirnov goodness of fit test suggests that a normal assumption for the mean distribution is statistically accepted at the 0.05 level ($Z = 0.747$, $p = 0.632$) with mean 0.56 and mean standard error 0.16. For modeling traffic uncertainties, the traffic error at the first year of operation is assumed to follow a normal distribution with parameters obtained from Bain and Polakovic (2005). This approach is used to deal with insufficient,

Table 1. Project Base Cash Flow (Abridged)

Year	Capital expenditure	Revenue	Operation/maintenance cost	Depreciation	Taxable income	Tax	Cash flows after tax
0	−578,475	0	0	0	0	0	−578,475
1	−17,350	0	0	0	0	0	−17,350
2	−452,039	0	0	0	0	0	−452,039
3	−452,039	0	0	0	0	0	−452,039
4		140,945	23,707	48,384	68,854	20,656	96,582
5		182,481	23,070	48,384	111,027	33,308	126,103
6		241,431	28,141	48,384	164,906	49,472	163,818
7		268,664	25,716	48,384	194,565	58,369	184,579
—		—	—	—	—	—	—
28		3,574,225	113,719	48,384	3,412,122	1,022,046	2,438,460
29		3,681,452	131,836	48,384	3,501,231	1,048,779	2,500,836
30		4,341,341	122,494	48,384	4,170,462	1,249,548	2,969,298
31		4,471,581	127,812	48,384	4,295,385	1,287,025	3,056,744
32		5,273,098	247,221	48,384	4,977,493	1,491,658	3,534,220
33		5,431,291	155,399	48,384	5,227,509	1,566,662	3,709,230
34		6,404,834	157,461	48,384	6,198,989	1,858,106	4,389,267

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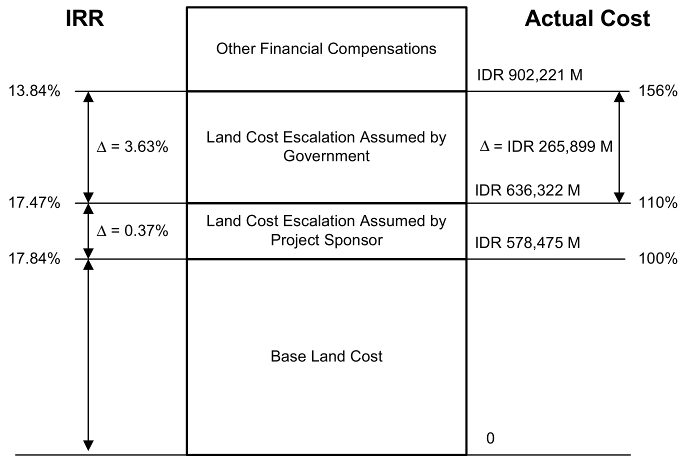

Fig. 3. Relationship between land cost and project's IRR

unavailable, and inaccessible traffic forecast database/s in the country as an actuarial basis.

Based on the *t*-test on inflation data from 1980 to 2009, the assumption that inflation rate follows a mean-reverting process can be accepted at the 0.05 level. The volatility is about 3.24% with $\eta = 0.275$, indicating that the inflation takes about 3.6 years to revert to the long-run average. The long-run inflation rate is assumed to be 7% that also serves as the initial inflation rate. This assumption is made to reflect the real situation in the time this case study was prepared.

The parameter of toll delay distribution is difficult to quantitatively assess because the period for data collection is too short for a robust statistical analysis. Since the promulgation of the new regulation on the toll road in 2005, no remarkable delay has been observed. So far, the delay only spans months, mostly from two to three months, not years as prior to 2005. However, it does not automatically mean that the toll delay risk can be neglected, as whether or not a consistent political decision can last for the long-run is not known for certain. The impact of toll delay on the government contingent liability will therefore be investigated for three different scenarios of the expected delay, i.e., 3 months ($p = 0.80$), 1 year ($p = 0.50$), and 2 years ($p = 0.33$) with and without restrictions on a politically acceptable toll hike.

Historical records revealed that the GoI only took over several Dutch firms, including some state-owned construction firms that are still operating to date, shortly after the proclamation of independence in 1945. Whereas the transfer of ownerships of the firms during that period should not count as nationalization, Wells (1999) claims that a nationalization event happened in the 1980s as the GoI nationalized a subsidiary of a foreign-owned telecommunication company. This has so far been the only information on infrastructure nationalization in the country after independence.

Recalling that only one nationalization event in the infrastructure sector occurred throughout a period of 65 years (1945–2009), to the extent practicable, the average probability is assumed to be about 0.015 $(1/65)$ per year. Given the average probability, the total probability computed using Eq. (18) is 0.635 for 65 years. Nevertheless, recent political situations have been getting more favorable for years. To reflect the different degrees of political risk, the period is split into three intervals based on the era of ruling governments: the old or transition order (1945–1965), the new order (1966–1997), and the present order (1998–2009). It is further assumed that the probabilities of nationalization in the old order and the new order are three and two times higher than in the present order. By maintaining the total probability of nationalization, the annual probability can be recalculated as follows:

$$1 - 0.635 = \prod_{i=1}^{21}(1 - 3p_a)\prod_{i=1}^{32}(1 - 2p_a)\prod_{i=1}^{12}(1 - p_a) \tag{22}$$

Solving the equation results in $p_a = 0.0069$ per year that is equivalent to a 0.205 probability over 34 years of concession. This figure results from simply taking the inverse of Eq. (18) to find the total probability given the annual probability. This has been a conservative judgment because the toll road sector is less risky than telecommunications in terms of nationalization.

Estimating Discount Rate

This study uses the financial data of PT Jasa Marga (JM), a state-owned enterprise that operates more than 70% of toll roads in Indonesia that may represent the country's toll road business risks. According to Bloomberg's data in August 2011, the JM's levered beta is 0.921 at a debt-to-equity ratio (DER) of about 1.41 or 1.22 at a DER of 2.33 ($= 70/30$) (see Brealey and Myers 2003 for discussion on beta adjustment). If the market risk premium and the risk-free rate are 7.5% and 10%, respectively, the cost of equity calculated using the CAPM is 19.15%. At the borrowing interest rate of 14%, the after-tax WACC is equal to 12.61%. Using the Fisher Equation (Brealey and Myers 2003), the real-term expected rate is equivalent to 5.24%, which is assumed to be constant over the concession period. Anchored to the 5.24% real rate, the nominal rate will automatically change with the inflation during simulation processes.

Discussion

A total of 10,000 trials are executed for each scenario. Table 2 presents the key statistics of simulation outputs. Two important measures of the government's exposure to loss are the expected payment (mean) and the excess payment (the 95th percentile value). The latter refers to the smallest payment governments can expect with a 95% confidence level not to pay more (Irwin 2007). It can also be interpreted in a slightly different way; it explains the exceedance probability, a risk measure widely used in the catastrophe modeling of natural disasters (Grossi, Kunreuther, and Windeler 2005) to represent the probability that actual payment exceeds a given value, calculated as one minus the percentile of the value.

The median value of land-capping direct payment is greater than the mean, indicating that the distribution is left-skewed. The explanation is as follows. The maximum guaranteed cost for a direct payment is IDR 902,221 million, which is almost equal to the expected land cost of IDR 902,420 [$= (1 + 0.56) \times 578,475$] million, causing the guarantee very likely to be called at the full amount (IDR 265,899 million). Underestimating the cost has effectively translated the contingent nature of a land-capping guarantee into a noncontingent liability. If the project sponsor decides to continue the project, the expected nondirect financial compensation will be about IDR 37,022 million whereas the excess nondirect compensation can reach as high as IDR 152,385 million. The resulting figures can be used as a basis for negotiations between the GoI and the project sponsor to determine, for instance, concession duration extension. As a negotiation can take time to resolve that may even cause additional delay, it is therefore imperative for the GoI to have more accurate land cost estimate and to carefully design the land-capping guarantee instrument. To address the former issue, the GoI can hire more professionals to help it appraise the

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Table 2. Key Statistics of Contingent Liabilities (10,000 Trials)

	Contingent liabilities in present value terms (IDR million)					
	Land-Capping		Full toll guarantee[a]			
			Expected delay			
Statistics	Direct payment	Indirect payment	3 months	1 year	2 years	Nationalization
Minimum	0	0	0	0	0	0
Maximum	265,899	353,420	337,497	1,053,365	1,744,575	3,872,978
Mean	229,129	37,022	42,798	150,108	276,021	239,526
Standard deviation	53,712	54,095	34,881	102,604	186,567	579,460
5% percentile	113,818	0	1,980	34,062	64,389	0
50% percentile	265,899	186	34,486	126,311	233,366	0
95% percentile	265,899	152,385	109,964	346,217	629,291	1,710,440

[a]Without restriction on toll increases.

cost. Recently, the appraisal team primarily consists of government officials that may have inadequate skills and knowledge in these areas. To deal with this, the GoI should undertake a comprehensive risk analysis that becomes a part of the contingent liability evaluation processes.

If the expected toll delay is maintained at three months, the expected and excess payment will be IDR 42,798 million and IDR 152,385 million. In the worst scenario, if the future tolls are too unpredictable with the expected delay of two years, the compensation to the project sponsor may fall within the range of IDR 64,389 million to IDR 629,291 million with a 90% confidence level and the expected payment of IDR 276,021 million.

The GoI should be particularly aware of a high payment potential (IDR 239,526 million) when it takes action to nationalize private assets although, as mentioned previously, it is only associated with cash flow risk. Given the full control over the risk, the GoI can isolate itself from payment risk by just letting the project run until the contract lasts. This also holds for the full toll guarantee where the GoI can opt for either meeting or reneging on their obligation to approve contractually permitted toll adjustments. Political risks are often merely about perceptions rather than facts. Hence, the country's strong commitment and continuous improvements to develop infrastructure projects are expected to unfasten opportunities for more investments. As the most effective way to make this possible is by keeping promises in a consistent way; it takes time to convince private investors but will require much more time to change perceptions once trust has been impaired.

Effect of Maximum Politically Acceptable Toll Increase

A maximum politically allowable toll increase was present in 2001 as the new ruling government issued Government Regulation No. 40 that is somewhat controversial from the authors' perspective. Fortunately, this regulation had never been in effect because the next government administration issued Government Regulation No. 15/2005 that prevails to date. Regulation No. 40/2001 stipulated that toll rates could be adjusted every three years with a maximum increase of 25%. If the GoI is tempted to again adopt politically acceptable increases but offers a full toll guarantee at the same time, it accordingly puts itself at greatest risk of future payments. Fig. 4 displays the expected and excess payments under different scenarios of toll-increase constraint and the expected delay of three months. For instance, the GoI has to expect to pay IDR 251 billion when permitting tolls to only increase at a maximum of 25%. Under the worst-case scenario, the payment can even soar to IDR 823 billion that is obviously unjustifiable

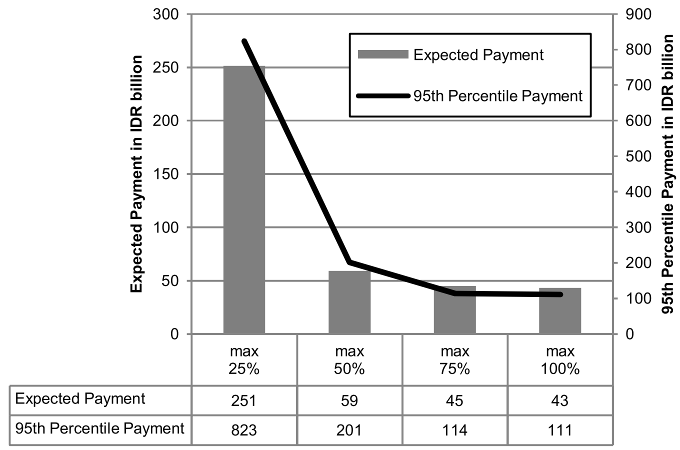

Fig. 4. Effect of restriction of toll increases on contingent liabilities

as the payment is higher than the project's capital expenditures. This simple illustration dictates the GoI to carefully examine the impacts of any new regulation prior to its issuance.

Conclusion

As with other governments, the GoI is also prepared to provide guarantees to protect project sponsors from specific project risks in PPP infrastructure development. This guarantee provision should help improve the creditworthiness of the projects of interest but it can expose the GoI to substantial fiscal risk as a result of contingent liabilities emanating from guarantees. A systematic contingent liability analysis is therefore imperative to understand the full extent of exposures to the GoI's fiscal position. This paper presents the methodologies of quantifying contingent liabilities of three types of guarantees, including land-capping instrument, full toll adjustment guarantee, and fair compensation guarantee in the event of nationalization. Whereas there has been a large body of knowledge on contingent liability analyses, previous research works on guarantees of government-related project risks are quite limited. This paper is based on Indonesian experiences in managing government guarantees, which might be of interest to other goverments facing similar problems. The methodologies are tested on a case of an Indonesian BOT toll road project. As illustrated in the case study, the methodologies can help the GoI estimate the expected and excess payment of each guarantee. The GoI is strongly recommended to have accurate cost estimates and carefully design a land-capping guarantee instrument. The GoI should also be aware of high

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payment potential when providing guarantee to cover project risks that are even under its control, such as full toll adjustment and nationalization guarantee. It is also imperative for the GoI to carefully examine the impacts of a new regulation that may relate to project cash flows and guarantee payments.

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