Capital Structure Optimization of Staging Development Toll Road Project in Indonesia

Gibranius Berutu[1], Muhammad Firdaus[2], Hendro Sasongko[3]

[1]Business School, Bogor Agricultural University, Jalan Raya Padjajaran, Bogor 16151, Indonesia

[2]Bogor Agricultural University, Faculty of Economics and Management, Jalan Raya Darmaga, Bogor 16680, Indonesia

[3]University Pakuan, Faculty of Economics, Jalan Pakuan, Bogor 16143, Indonesia

Abstract: ***The characteristics of toll road project investment are lengthy payback and high upfront capital requirements, therefore, its funded with mixed debt-equity capital. The government Indonesia was invite investors to participate road infrastructure development, nevertheless financial viability of investment packages were not interesting enough for certain number of promoted projects. Staged development divided road into segments and it should be an alternative to generate traffic demand for assign minimum viability threshold. Each segment constructing schedule should not delayed to avoid cost escalation that borne to the next development. On-time construction start highly depend on traffic demand projection accuracy. The last constructed segment, would have shortest independent concession. Government own the authority to determine initial tariff and its adjustment, therefore, investors have no power to set price. Both internal and external condition of the industry must thoroughly examined because there was a time arrangement for staging investment. Optimal capital structure analysis was done to calculate minimum equity level and maximize profitability. Either interest rate or equity cost were modeled as the function of DER, where exact solution found by a trial-error approach. Simulation output was reveal that late start of construction schedule would escalate the investment cost and decrease viability of project.***

Keywords: DER, optimum capital structure, toll road project.

1. Introduction

Indonesia's logistics costs to Gross Domestic Product (GDP) hit 27 percent in 2013 (Wirabrata 2013) and slightly declined into 23.5 percent in 2014 (BMI 2015). The connectivity and inefficiency in the transportation sector have impacted on the high costs of transportation and logistics in Indonesia. One of the objectives of the government's infrastructure development is the reduction of logistics costs to GDP from 23.5 percent in 2014 into 19.2 percent in 2019 (BMI 2015). The falling off level of non-toll road services and the limitation of toll road connectivity are among the causes. Not all of the toll road investment packages offered by the government are appealing to investors. The government's support to stimulate business entities' participation to accelerate infrastructure development within Public-Private Partnership (PPP) scheme is needed. Initially, infrastructure availability will support economic acitivity.

Toll road tariff and traffic volume serve as determinants in the investment decision making. In the gradual construction scheme, the minimum investment feasibility is not attainable when the construction is completed at once. Economy activities surround toll road corridor should lead to generation of traffic demand. An accurate forecast of demand would determine the execution of staging development on schedule intended. The postponement of next segment construction schedule will severely impact to project funding and shorten the period of investment returns and so for profit gains. Government own the authority to determine initial tariff and its biennially adjustment, based on regional inflation rate. As the regulated industry, SPVs have limited rights for tariff negotiation. They are granted by regulations to get recovery of invested capital, operation costs and proper benefit during the concession period.

The characteristics of toll road project investment are lengthy payback and high upfront capital requirements, therefore, it is funded with mixed debt-equity capital (Wibowo 2009 and 2012). Iyer and Sagheer (2012) said that proportion of debt and equity in capital structure serve as a key variable to determine the project profitability. Zhang (2005) defines four dimensions of the capital structure that will affects the total project cost, they are types of financial instruments, the relative amounts, the source of the financial instruments and the corresponding contractual conditions. The equity holders tend to put lower level of equity because they have limited money and to minimizing their risks in the project. Lender prefer a high equity level to minimized creditor's default risk. The government concern on a long-term commitment of equity holders as project completion at schedule intended that will be a strategic issue in national infrastructure development program. This research analyze the optimal capital structure of toll road investment project that divided into segments that constructed gradually. SPV's secondary data are used to build the financial model, they are realization data for past time and projection data for future time until concession ends. These research output worth while for investors to formulating funding strategy. Investors shall determine the optimum proportion of debt and equity for funding toll road projects, exclusively for project package that constructed gradually.

2. Literature Review

The Built Operate Transfer (BOT) model is generally applied for toll road PPP project in Indonesia. The business scope are engineering design, fund raising, construction and operation of facility. Physical assets ownership was inappropriate to SPV because the structure constructed provide a service to general public. At the end of concession period, SPV shall transferring back all facility assets to public sector. Gatti (2008) defines project finance as a structured non-recourse financing in Special Purpose Vehicle (SPV) where the assets of the project as collateral for their loans. The capital of PPP project is the combined of debt and equity because high upfront capital requirement. Revenues over the operation period are solely cash resource to service long-term debt repayment.

Financial instruments that constitute the capital structure have different cost reflected project risk quantification of lender's credit rating. Investor prefer a high leverage ratio of capital structure to funding the project (Scannela 2012) because cost of debt was relatively lower than cost of equity as debt has a higher level of claim to the assets of the SPV. A tax benefit advantage arise from leverage capital since interest charges are tax deductible. At the other side, SPV become more insolvent and financial distress inhere to project cash flow resulted bankruptcy cost (Kraus and Litzenberger 1973). Different financial instruments deploy as a means of acquisition fixed assets are equity, debt and mezzanine finance (Zhang 2005). Equity is capital that invested by the project sponsors, includes common stock, retained earnings and unappropriated profits. The money as retained earnings not paid out as dividend, they shall reinvested or used to settle debt obligation.

Numerous study subject to PPP infrastructure projects have done by researchers. Bakatjan et al (2003) was optimize capital structure of PPP hydro-powerplant multi period project with BOT scheme in Turkey. The local regulation ask for minimum requirement of equity at 25 percent of total capital. Simulation output was reveal the optimal equity level that maximizing equity returns at 31.69 percent. Islam and Mohamed (2009) work research on power plant project in Turkey and disclose a trade-off between project profitability and bid winning potential. Fuzzy theory embedded in genetic algorithm-based (GA) financial optimization model to take into account inaccurate input parameter. Either cost of equity or cost of debt assumed to be constant to leverage ratio changes. Optimum solution were bid-winning probablity at 38.77 percent at equity level of 33.94 percent.

Wibowo (2009) was attend his research on toll road project in Indonesia. He proposed a financial model of maximizing the equity net present value takes into account either loan interest rate and cost of equity as the function of leverage ratios. Optimal solution was the equity level at 29 percent and IRR on equtiy 24.95 percent. Iyer and Sagheer (2012) done their research on toll road project in India. Multiobective optimization model was developed on GA basis where constant cost of capital assumed. Optimum solution found at portion of equity 29.30 percent and IRR on equity 12.88 percent where no grant from government.

Staging development of PPP infrastructure project not covered in previous studies. The changes of project's risk profile was assumed not affected by recompositions of capital structure, eventhough in fact, both debt interest rate and cost of equity are function of leverage ratios (Wibowo 2009). This research will optimize capitatal structure of PPP toll road project which divided into segments and constructed gradually. Financial model developed with considering the changes of leverage ratio that directly affected the cost of debt and cost of equity.

3. Financial Model

3.1 Basic assumptions and cash flow modelling

Discounting cash flow was used to develop financial model as generally known. Cash flow model derived following steps in previous work of Islam and Mohamed (2009). Assumptions in this study for financial evaluation of gradually developed toll road project are:

1) Toll revenue is the solely income of project investment;
2) Cash flow distributed discreetly for years as the smallest unit of time;
3) Inflation rates are constant over the concession period;
4) Straight line depreciation is applied for project assets;
5) Financing-mix of debt and equty for project investment with three years of grace period as loan agreement. Debt withdrawal and interest are independently for each staging project constructions;
6) The debt interest rates both during construction period and repayment period are the same;
7) Debt interest rate and cost of equity are function of debt to equity ratios.

3.2 Cost of capital

Discounting rate given the present value of of futured cash flow stream to enable time based comparisons and it is required to compensate sistematic risk over the investor's capital invested on project. The discount rate shall rigorously estimated. If project sponsors applies the rates too high in valuation process, then it will reject valuable opportunities. On the other hand, setting it too low would worn away shareholder value (McNulty et al. 2002). Capital Asset Pricing Model (CAPM) generally used to approach the relationship between risks and cost of equity. The CAPM formula states that a project rate (R_a) is equal to the risk-free rate of return plus premium to represent the systematic risk of uncertain condition inherent on project (Sharpe, 1964). Formulation of R_a for estimating the expected returns is,

$$R_a = R_f + \beta_a (R_m - R_f) \tag{1}$$

where, R_a = project rate; R_f = risk free rate; β_a = beta assets, is a measure of the variance of the return of a project in the market; $(R_m - R_f)$ = market risk premium.

Beta (β) adjustment method will be used to estimate the cost of equity for any changes of project leverage (Wibowo 2013). Unlevered β is company's β value at no debt and calculated using equation (2) (Investopedia 2016). As a levered β at certain debt to equity ratio is known, then the unlevered β can be determined. Put the denominator in equation (2) to left hand side to calculated any value of levered β as capital structure changes. Putting levered betas into CAPM formula results in cost of capital (R_a) as function of leverage ratios.

$$\beta_u = \frac{\beta_L}{\left(1 + (1 - \mathrm{TAX})\frac{D}{E}\right)} \quad (2)$$

van Binsbergen et al. (2010) dicussed some previous studies from researchers that financial distress, taxes, debt overhang and agency conflicts are constitute the cost of debt (k_d). Weighted average cost of capital (WACC) is used to determined total project cost of capital with financing-mix between debt and equity. WACC set as the minimum threshold of project investment return. It is calculated using equation (3), where R_a = cost of equity, k_d = cost of debt, ξ = equity portion.

$$k_d = (k_1 \times w_1 + k_2 \times w_2) \times (1 - \mathrm{TAX}) \quad (3)$$

Where, k_d = total cost of debt, k_i = 1, 2,… = cost of debt from source 1, 2, etc., w_i=1,2,… = debt relative proportion from source 1, 2, dst., dan TAX = corporate tax.

Total cost of financing mix calculated using WACC concept and it is set as discounting rate to find project's net present value. WACC formulated as follow,

$$\mathrm{WACC} = (\mathrm{R}_a \times \xi) + (\mathrm{k}_d \times (1 - \xi)) \quad (4)$$

where, R_a = equity holders project rate or cost of equity, k_d = cost of equity, ξ = relative portion of equity.

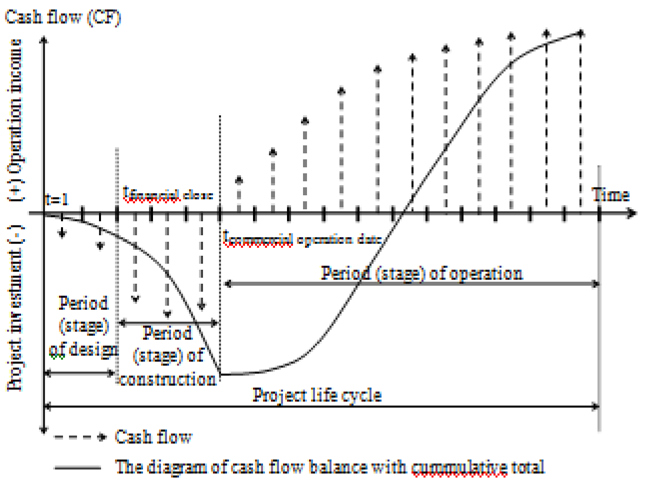

Figure 1: Typical cashflow diagram for PPP project (Khmel and Zhao 2015)

3.3 Financial viability indicators

Net Present Value (NPV) is a indicator that generally used to analized potential projects profitability. Project cashflows are start from the beginning (t = 0) of project until the end of concession period (CL = Concession length). Positive value of project NPV show that the investment would be at desirable profitability and vice versa.

$$\mathrm{NPV} = \sum_{t=0}^{\mathrm{CL}} \frac{R_t}{(1+r)^t} \quad (5)$$

NPV formula as shown in equation (4), where R_t = net cash flow, r = discount rate, t = time. Summation of discounted net cashflows over the concession period is the NPV. Internal rate of return (IRR) is a discount rate that makes the present value of all cash flows from a particular project equal to zero. IRR considered as a viability parameter for toll road investment. In Indonesia, minimum threshold for PPP toll road project set above four percent to commercial bank interest rate. Payback period is also consider by shareholders as an important determinant for a go or no-go decision. The payback period defined as the length of time required to recover the cost of project investment and as longer it needed are not desirable for investment positions. Figure 1 shows how a pay back is reached when the accumulated cashflows curve step up from negative axis to zero value at time j. Number of j years it takes to earn back the cash invested is the payback period.

3.4 Debt service ratio indicators

As non-recourse finance applied in, lender must surely evaluate the cashflow capacity are robust enough to service long term debt over the repayment period (Wibowo 2009 and Zhang 2005). Debt service cover ratio (DSCR) is an important indicator for lender to measuring project's debt carrying ability from operation revenue. DSCR calculated annualy which is the ratio of yearly net operating income to annual total outstanding debt as defined in the following formula,

$$\mathrm{DSCR}_j = \frac{(\mathrm{PBIT}_j + \mathrm{DEP}_j - \mathrm{TAX}_j)}{\mathrm{ADI}_j} \quad (6)$$

for $j \in [1, \mathrm{OP}]$;

DSCR_j = debt service coverage ratio at j^{th} year; PBIT_j = profit before interest and tax; DEP_j = assets depreciation; TAX_j = corporate tax; ADI_j = debt instalment; dan LRP = loan repayment period. The numerator in equation (6) is the net operating income which is total real cash of SPV before tax and also excludes principal and interest payment, capital expenditures, depreciation and amortization of assets.

Another indicator for project's debt carrying ability is Loan lifecycle cover ratio (LLCR). It is calculate ratio of net present value cashflow available for debt service (CFADS) to remaining outstanding debt over the maturity period of loan (LRP). Both CFDAS and outstanding debt are discounted at certain rate of r. LLCR at k^{th} year is formulated as defined in equation (7), where LLCR_k = loan lifecycle coverage ratio at k^{th} year; PBIT_k = profit before interest and tax; DEP_k = assets depreciation; TAX_k = tax; D_k = debt; r = discounting rate; and LRP = loan repayment period.

$$\mathrm{LLCR}_k = \frac{\sum_{j=k}^{\mathrm{LRP}} \frac{(\mathrm{PBIT}_j + \mathrm{DEP}_j - \mathrm{TAX}_j)}{(1+r)^{j-k+1}}}{\sum_{j=k}^{\mathrm{LRP}} \frac{\mathrm{ADI}_j}{(1+r)^{j-k+1}}} \quad (7)$$

for $k \in [1, \mathrm{LRP}]$;

In case there any difficulties of project cashflow to repaying debt in time, lender must evaluate the Project life cover ratio

(PLCR) indicator. PLCR measuring ratio between the discounted net cash flow before debt service for whole concession period to the debt outstanding.

3.5 Multiple objectives optimization

The formulation of multiple objectives optimization is approached with paretto optimal concept to characterized decision maker preference. The solution where its fitness is no worse with respect to all objectives and firmly better in at least one objective will be the best solution. The optimal solution not dominated by another solutions in a feasible objective space. Therefore different solutions will make trade off between different objectives as not possible to get better fitness fron one objecteive without worsening another objective(s). NPV maximized of invested capital set as objective in this research, where the capital structure of project is mixed finance between debt from finance institution and equity from project sponsor. The objectives of the problem are,

$$\text{Max } NPV_{project} \tag{8}$$

$$\text{Max } IRR_{project} \tag{9}$$

Both objectives above are constrained with concession and debt agreement conditions. The first, there is a minimum threshold of NPV to ensure investment return. Secondly, NPV on equity must in positive value because equity holder desire profitable investment. The another third, fourth and fifth constraints are lender's circumstances to warrant the capacity of project company repaying all debt with revenue stream from operation activities. Constraints as the criterion space of solution are define as follow,

$$NPV_{project\text{-}min} \geq 0 \tag{10}$$

$$NPV_{equity\text{-}min} \geq 0 \tag{11}$$

$$DSCR_{min} \geq 1{,}5 \tag{12}$$

$$LLCR_{min} \geq 1{,}65 \tag{13}$$

$$PLCR_{min} \geq 1{,}80 \tag{14}$$

4. Case Study

This research will consider a toll road trace operating in West Java Province, Indonesia which was developing in staged schedule. Construction of toll road not done at once but it was dividing into four segments to completion gradually, where first and second segment had been fully operating. The capital structure for the two operating road segment at DER 70:30. The third segment will be constructed at 2017 as shceduled in business plan and the fourth is ignored from research because feasibility study for it is being processed. Realization data are use for financial model limited to 2014 and so projection data are use into the model starting from 2015 until concession period terminated. Inflation rate assumed at 7 percent per year constantly. Optimalization analysis restricted only for capital structure of the third road segment project will be build. Project profitability and viability will be evaluated as a bundling investment of all segments exclude the fourth segment. The capital was financing mix where equity from project sponsors and debt from bank sindycated loan facility. There are two scenarios will be simulated, scenario one if the third segment begin to construct on schedule at 2017 and scenario two if project is late start one year after intended schedule (2018) as the impact of traffic demand below the forcasted position. Concession begin at 2009 and ended at 2054 as stated in business agreement between government and SPV. Cash flow analysis start from 2006 until 2054 because SPV was expense some cash for prepared the detailed engineering design three years before concession start to count.

5. Results

Project's cost of equity is determined using CAPM formula. Rate of return for riskless investment (R_f) set at 11 percent, equal to coupon bond issued by Indonesia government for 19 years maturity. The long tenor bond is choosen to represent long term investment characteristics. Market risk premium stated at 7.5 percent as suggest by Aswath Damodaran for Asian markets except Japan. Beta (β) adjustment method is deployed in model for estimating cost of equity as a function of leverage ratios which was simulated in Wibowo (2013). This study uses value of β from PT Jasa Marga (Persero) Tbk (JSMR) to represent the investment risk in toll road industry in Indonesia as it operates more than 70 percent of total toll road nationally where the β is 0.96 (Ifinancial 2017) at the DER 2.06 (JSMR 2016). The bank interest rate influenced by relative amount of loan proposed by SPV which is based in information in Wibowo (2009). Table 1 respectively shows cost of equity (R_a) and debt interest rate (k_D) as the function of the DER. Optimalization model will be simulated using "trial-error" approach to find the solution which is satisfy all objectives and constraints.

Table 1: Cost of equity calculation

DER	k_D (%)	R_a (%)	WACC (%)
0.111	10.30	14.81	14.36
0.250	10.30	15.16	14.19
0.429	10.30	15.61	14.02
0.667	10.70	16.21	14.01
1.000	11.00	17.05	14.03
1.500	11.25	18.31	14.07
2.333	11.50	20.41	14.17
4.000	12.50	24.60	14.92
9.000	12.50	37.19	14.97

5.1 Scenario-1

The third stages development simulated in this scenario as no delay for project start in 2017. Traffic demand realization is accurate enough compared to forecasting data result that construction of the third segment start on schedule. In Table 2, analysis results are given. A set of optimal solutions subject to series of constraints are minimum equity level at 40.6 percent, NPV_P = Rp241.01 billion, NPV_E = Rp0.23 billion, DSCR = 1.73, LLCR = 1.97, PLCR = 9.19. At the DER of 0.594 : 0.406 (1.46) total investment cost is Rp1.05 trilion. Rate of return on project IRR_P = 15.82 percent and on equity IRR_E = 18.05 percent. Project payback period (bundling segments 1, 2 and 3) is 18 years 10.9 month counted from 2006.

5.2 Scenario-2

The third stages development simulated in this scenario is project start lately one year behind in 2018. The delay due to traffic demand realization below the forecasting data, therefore construction of the third segment is postponed. Analysis results are given in Table 3. A set of optimal solutions subject to series of constraints are minimum equity level at 46.7 percent, NPV_P = Rp153.48 billion, NPV_E = Rp0.36 billion, DSCR = 1.71, LLCR = 1.90, PLCR = 9.35. At the DER of 0.533 : 0.467 (1.14) total investment cost is Rp1.12 trilion. Rate of return on project IRR_P = 15.21 percent and on equity IRR_E = 17.24 percent. Project payback period (bundling segments 1, 2 and 3) is 19 years 10.4 month counted from 2006.

Table 2. Analysis results of financial model for Scenario-1 simulation

DER	WACC (%)	IRR_P (%)	IRR_E (%)	NPV_P (Rp Billion)	NPV_E (Rp Billion)	DSCR	LLCR	PLCR
0.111	14.36	15.68	17.40	147.9	194.5	5.56	3.09	14.89
0.250	14.19	15.71	17.54	176.7	164.3	3.41	2.77	13.26
0.429	14.02	15.75	17.68	207.2	129.1	2.63	2.52	11.96
0.667	14.01	15.78	17.78	212.1	86.8	2.18	2.29	10.83
1.000	14.03	15.82	17.91	213.7	40.3	1.90	2.11	9.90
1.500	14.07	15.82	18.04	205.9	-9.9	1.71	1.95	9.11
2.333	14.17	15.79	18.16	187.7	-58.6	1.56	1.82	8.43
4.000	14.92	15.75	18.22	84.3	-91.1	1.43	1.68	7.72
9.000	14.97	15.75	18.32	79.3	-72.9	1.35	1.58	7.23

Table 3. Analysis results of financial model for Scenario-2 simulation

DER	WACC (%)	IRR_P (%)	IRR_E (%)	NPV_P (Rp Billion)	NPV_E (Rp Billion)	DSCR	LLCR	PLCR
0.111	14.36	15.15	16.71	85.1	137.4	4.82	2.80	14.15
0.250	14.19	15.17	16.82	109.2	110.7	3.00	2.52	12.67
0.429	14.02	15.20	16.95	136.3	81.1	2.35	2.30	11.49
0.667	14.01	15.21	17.08	139.5	46.3	1.99	2.11	10.46
1.000	14.03	15.21	17.20	136.7	6.5	1.76	1.94	9.59
1.500	14.07	15.19	17.31	128.3	-35.9	1.60	1.80	8.85
2.333	14.17	15.17	17.44	112.5	-74.8	1.49	1.69	8.22
4.000	14.92	15.01	17.48	8.7	-98.6	1.38	1.56	7.54
9.000	14.97	14.95	17.60	-2.2	-73.9	1.32	1.47	7.08

Note: The subscribe "P" means on project investment and "E" means on equity investment.

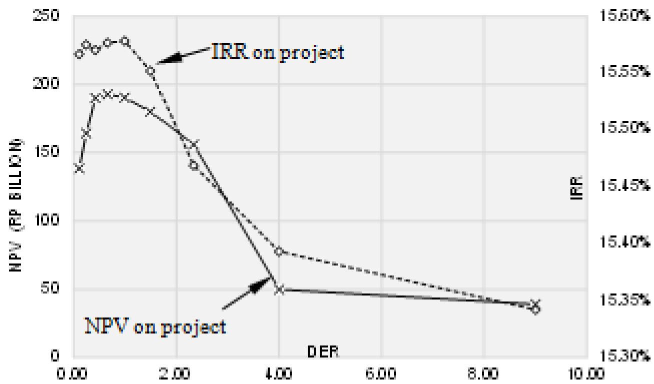

Figure 2: Variations of IRR_P and NPV_P to capital structures for Scenario 1

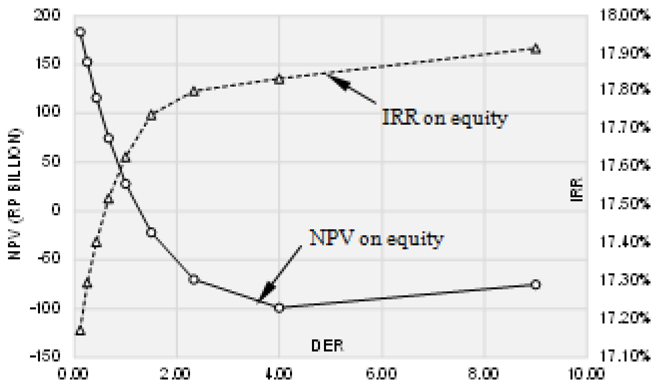

Figure 3: Variations of IRR_E and NPV_E to capital structures for Scenario 1

6. Discussion

Project start delay causing investment cost to be escalated. Based on simulation result, total cash needed for project completion are increased about 6.23 percent as impacted by one year late for third segment construction. At optimum capital structure condition, equity holders shall provide cash Rp427.65 billion or at level 40.6 percent to funding the project if it construct on schedule and Rp522.54 billion or 46.7 percent if delayed one year. Consider the payback period, Scenario-2 needs nearly twelve month behind than Scenario-1 to earning back the investment. Payback duration mainly depend on total money invested at the beginning of particular project. The longer break event point meet, then enjoyment period for earning the profit become shorter, in addition, NPV will be more smaller too.

The previous part explained that demand forecasting accuracy determines the staged developing project schedule to executed on time. The third stages development simulated in Scenario-2 starting project to constructed one year behind the schedule because minimal demand below the projected value. The simulation results of Scenario-2 shows that project's viability is drop because of total project cost increase and operating period become shorter. Equity proportion of optimal capital structure become larger too that not desirable for equity holders. Either Scenario-1 or Scenario-2 simulation results were figure out that IRR on equity will be increase when equity level decrease, therefore IRR on project apply vice versa. These are affected by SPV's obligation to paying the debt outstanding increase. NPV both on project and on equity tend to decrease as the debt level in capital structure for financing the third segment development increase.

Figure 2 and 3 explains IRR and NPV variations for DER changes in simulation of Scenario-1. NPV on project reach maximum value (curve peak) for about 0.67 DER and WACC as project's reinvestment rate is fall to minimum (Table 1). The raise of debt level affect significantly to the investor's risk as cost of equity increased. NPV on equity do simultaneously step down with increasing of debt proportion and switch to negative value at DER greater than 1.4 since IRR on equity is less than cost of equity (R_a). Contrary to IRR on project, the values of IRR on equity are climb rapidly parallel to increasing of leverage ratio. It is clearly understand since equity return will be earned in shorten period as the investors money are less in project capital proportion.

Dominant debt particulary at the DER greater than or equal to 4.0 not statisfy the DSCR and LLCR constraint defined for optimization model, however, it is drive a strictly flexible bargain for project to lender. High level of debt will be increasing the interest rate and forced to expose greater possibility of bankcrupcity risk. The equity holders will consider it for raising desired return as figuring CAPM formula over the interest rate, since debt has highest priority for claims on project cashflow and assets (see Table 1). The greater equity reinvestment rate (R_a) desired by equity holders than IRR on equity will lead to negative value of NPV on equity, reflecting project profitablity is not preferable.

7. Conclusion

Staged development may executed by dividing toll road into segments and arrange the schedule based on minimum traffic demand threshold to make investment package more attractive for investors. Traffic volume realization primarily influences go/no go decision to starting the staged segments construction. Since demand below the minimum threshold, delayed schedule for next segments construction impacts on total investment cost to escalate and downdrag project viability. Consequently, traffic demand study should be done accurately at planning phase. Equity holders tend to allocated their money into toll road PPP project as lower as possible. However, carefully evaluation must be passed before, since the bankrupcity risk will arise severely than tax shield benefit as consequence of greater debt in capital structure. Further reseach would be interesting to take into account funding alternatives from another sources, considering the capital market existence and its maturity in country where the project run.

8. Acknowledgment

We would like to show our gratitude to Ir. Hendro Atmodjo and Ir. R Gip Setiawan for sharing their knowledges with us during the course of this research.

References

[1] BMI, Business Monitor International, Indonesia infrastructure report Q2 2015, 2015.
[2] A. Wirabrata, "Peningkatan logistic performance index (LPI) dan rendahnya infrastuktur pendukung." Info Singkat, 5(9), pp. 13-16, 2013.
[3] A. Wibowo, "Maximizing equity net present value of project-financed infrastructure project under build, operate, transfer (BOT) scheme", In Proceedings of the International Conference on Sutainable Infrastructure and Built Environment in Development Countries, pp. 198-204, 2009.
[4] A. Wibowo, "Inflasi dalam analisis finansial investasi jalan tol: Perlakuan dan pengaruhnya bagi badan usaha dan pemerintah," Jurnal Teknik Sipil. 19 (1), pp. 15-24, 2012.
[5] K. C. Iyer and M. Sagheer, "Optimization of bid winning potential and capital structure for build-operate-transfer road project in India," Journal of Management and Engineering, 28 (2), pp. 104-113, 2012.
[6] X. Zhang, "Financial viability analysis and capital structure optimization in privatized public infrastructure projects," Journal of Construction Engineering and Management, 131 (6), pp. 656-668, 2005.
[7] S. Gatti, Project finance in theory and practice. London, Elsevier, 2008.
[8] E. Scannela, "Project finance in energy industry: new debt-based financing models," International Business Research, 5 (2), pp. 83-93, 2012.
[9] A. Kraus and RH. Litzenberger, "A state-preference model of optimal financial leverage," Journal of Finance, 28 (4), pp. 911-922, 1973.
[10] S. Bakatjan, M. Arikan, and RLK. Tiong, "Optimal capital structure model for BOT power projects in Turkey," Journal of Construction Engineering and Management. 129 (1), pp. 89-97, 2003.
[11] M. Islam dan S. Mohamed, "Bid-winning potential optimization for concession schemes with imprecise investment parameters," Journal of Construction Engineering and Management, 135 (8), pp. 690-700, 2009.
[12] JJ. McNulty, TD. Yeh, WS. Schulze and MH. Lubatkin. "What's your real cost of capital?" Harvard Business Review. 80 (10) pp. 114-121, 2002.
[13] WF. Sharpe, Capital asset proces: A theory of market equilibrium under condition of risk, Journal of Finance, 19 (3), pp. 425-442, 1964.
[14] A. Wibowo and HW. Alfen, "Fine-tuning the value and cost of capital of risky PPP infrastructure projects," Engineering, Construction and Architectural Management, 20 (4), pp. 406-419, 2013.
[15] Investopedia. "Unlevered beta." investopedia.com. [Online]. Available: http://www.investopedia.com/terms/u/unleveredbeta. [Accessed: October 26, 2016].
[16] JH. van Binsbergen, J. Graham and J. Yang, "The cost of debt," Journal of Finance, 65 (6), pp. 2089-2136, 2010.

[17] V. Khmel and S. Zhao, Arrangement of financing for highway infrastructure projects under the conditions of Public–Private Partnership, IATSS Research, 9 (2), pp. 138-145, 2015.
[18] JSMR. "Jasa Marga Update 3Q 2016," jasamarga.com. [Online]. Available: http://www.jasamarga.com /dok_presentations/Jasa%20Marga%20UPDATE%203Q16.pdf. 2016. [Accessed: Feb. 15, 2016].
[19] Ifinancials. "PT Jasa Marga (Persero) Tbk: Levered/ Unlevered Beta," infinancials.com. [Online]. Available: http://www.infinancials.com/fe-EN/30432FD/PT-Jasa-Marga-Persero-Tbk/beta. 2017. [Accessed: Jan. 16, 2017].