Quantitative Value for Money Assessment for Transfer-Operate-Transfer Projects

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Abstract: Quantitative Value for Money (VFM) assessment is a useful method for government officials to choose an appropriate procurement method for a given project. In order to assess VFM quantitatively, the concept of net present cost is combined with waterfall charts to develop a VFM calculation formula. The discount rates required by the formula were determined according to the characteristics of cash flows. The cash flows of a project were classified into four categories: costs with certainty, costs with uncertainty, revenues with certainty and revenues with uncertainty, and a discount rate for each category was determined respectively. It is in the hope that the VFM formula could help government officials determine whether Transfer-Operate-Transfer is likely to offer a better deal compared to conventional approaches to operate and maintain the same infrastructure and public utilities.

Keywords: Value for money, transfer-operate-transfer, net present cost

DOI: 10.7492/IJAEC.2015.010

1 INTRODUCTION

As one of public-private partnership (PPP) procurement methods, Transfer-Operate-Transfer (TOT) for existing projects is drawing much interest in developing countries (e.g., China) for their ability to access new financing sources and transfer certain operation and maintenance risks to the private sector. However, whether TOT is likely to offer a better deal compared to conventional approaches to operate and maintain the same infrastructure and public utilities is the concern of government officials. The concept of value for money (VFM) is created to help government officials make a right decision.

VFM can be defined as the optimal use of resources to achieve the intended outcomes. It can be evaluated qualitatively and quantitatively. In order to assess VFM, many organizations over the world have published their own guidelines or manuals. For example, HM Treasury (2006), Infrastructure Ontario (2007), Efficient Unit of Hong Kong (2008), Infrastructure Australia (2008a), Public Private Infrastructure Investment Management Center of Korea (2010), Federal Highway Administration (2012), Ministry of Finance of the Netherlands (2013), etc. have all published their own guidelines or manuals. Most of these guidelines or manuals quantitatively assess VFM by comparing a public sector comparator (PSC) to shadow bid. The concept of assessing VFM by the comparison between PSC and SB is applicable to all kinds of PPP projects, but it is necessary to customize a general quantitative VFM assessment method to TOT projects in order to catch TOT projects’ characteristics.

In order to customize the general quantitative VFM assessment method to TOT projects, cash flows in a conventional operation and maintenance (O&M) model (hereinafter referred to as the conventional model) and in a TOT model are systematically analyzed. Then the net present cost (NPC) of the conventional model is compared with TOT model’s NPC to develop a VFM calculation formula, with the assistance of waterfall charts. Finally, the characteristics of project’s cash flows are analyzed and classified into four categories: costs with certainty, costs with uncertainty, revenues with certainty and revenues with uncertainty. Methods for determining an appropriate discount rate are recommended for each category of cash flows. It is in the hope that the VFM formula, interplayed with qualitative VFM assessment, could help government officials determine whether TOT is likely to offer a better deal.
compared to conventional model to operate and maintain the same infrastructure and public utilities.

2 VFM CALCULATION FORMULA FOR TOT PROJECTS

Quantitative VFM assessment for TOT projects compares costs to the government in a conventional model with those in the TOT model to determine which model will deliver greater value. Therefore, developing a VFM calculation formula for TOT projects begins with analyzing cash flows of each model.

2.1 Cash Flow Analysis of TOT Projects

In the conventional model, the government operates and maintains a facility and provides goods and service. Costs to the government include:

- Unrecovered capital cost, which is referred to as the capital expenditures (i.e., costs for development of the facility) after deduction for accumulated depreciation as of the time point of transfer. This cost is in terms of present value.
- O&M cost, which is referred to as day-to-day costs of operating and maintaining the facility and other costs such as administrative costs and costs for office space, supplies, employee salaries, etc.
- Rehabilitation cost, also known as heavy maintenance, which is referred to as costs for items such as replacement of dysfunction parts.
- Retained risk cost, which is referred to as the cost of risks borne by the Government itself in the conventional model, including the government’s part of shared risks.
- Competitive neutrality adjustment, which is referred to as costs (e.g. insurance premiums or taxes, duties, fees, etc.) that are only levied on or paid by private firms. By including equivalent costs, it removes any net advantages or disadvantages that accrue to a government by virtue of its public ownership, and allows a fair and equitable comparison between the conventional model and TOT model.

If there are user payments, which are referred to as expected third-party revenues, they will offset part of the cost to the government.

In a conventional model, the unrecovered capital cost occurs at the current time, while O&M costs, user payments, rehabilitation costs, retained risk cost, and competitive neutrality will occur in the future. Typical cash flows of government in the conventional model are shown in Figure 1.

In a TOT deal, a local government enters a contract with an operator (a firm or consortium). According to the contract, an existing facility is turned over to the operator to operate and maintain for a concession period, at the expiry of which the legal title to the facility is turned over to the government. Usually, the operator pays the government a certain amount of money (hereinafter referred to as a transfer price) to obtain the legal title to the facility. In return, the operator is allowed to charge the users of the facility (or the government) appropriate tolls, fees, rentals, or charges during the concession period. This enables the operator to recover its investment, operating and maintenance expenses. As a result, the costs to the government, besides the unrecovered capital cost, also include:

- Miscellaneous cost, which is referred to as costs incurred in making a TOT deal, including bidding costs, bargaining costs, etc.
- Viability gap funding (VGF), which is referred to as payments to bridge the ‘gap’ between the revenues needed to make a project commercially viable and the revenues likely to be generated by user fees. VGF is designed to make projects that are economically viable over the long term, commercially viable for investors.

Figure 1. Cashflows of Government in Conventional Projects
• Retained risk cost, which is referred to as the cost of risks borne by the Government itself in the TOT model, including the government’s part of shared risks. Usually, there are different levels of risk transfer in the conventional and the TOT models.
• Regulation costs, which is referred to as the costs resulted from monitoring and enforcement of the TOT contract in the interests of the public.

If there is a transfer price, it will offset part of the cost to the government.

In a TOT model, the unrecovered capital cost, transfer price and miscellaneous costs occur at the current time, while VGF, retained risks and regulation costs will occur in the future. Typical cash flows of government in TOT model are shown in Figure 2.

2.2 Development of VFM Calculation Formula

Based on the concept that quantitative VFM assessment for TOT projects compares costs to the government in a conventional model with those in the TOT model, VFM is the difference between the net present cost (NPC) to the government in the conventional model and those in the TOT model.

The NPC to the Government in the conventional model (hereinafter referred to as \( NPC_C \)) is the difference between the sum of unrecovered capital cost, O&M cost and retained risks and the sum of user payments and competitive neutrality in terms of present value. That is,

\[
NPC_C = (C_X + C_O + C_{R1}) - (C_P + C_N) \tag{1}
\]

Where, \( C_X \) is unrecovered capital cost, \( C_O \) is O&M cost, \( C_{R1} \) is cost of retained risks in the conventional model, \( C_P \) is user payments, \( C_N \) is competitive neutrality.

The NPC to the government in the TOT model (hereinafter referred to as \( NPC_T \)) is the difference between the sum of unrecovered capital cost, viability gap funding (VGF), retained risks and miscellaneous costs and the transfer price in terms of present value. That is,

\[
NPC_T = (C_X + C_V + C_{R2} + C_M) - T_P \tag{2}
\]

Where, \( C_V \) is estimated VGF, \( C_{R2} \) is cost of retained risks in the TOT model, \( C_M \) is estimated miscellaneous costs, \( T_P \) is transfer price.

Therefore, VFM of a TOT project can be calculated by making a comparison between \( NPC_C \) and \( NPC_T \), i.e.,

\[
VFM = NPC_C - NPC_T \tag{3}
\]

Figure 3 is a waterfall chart of VFM for TOT projects.

If VFM>0, it is recommended to use the TOT model rather than the conventional model. If VFM<0, it is recommended to use the conventional model rather than the TOT model. If VFM=0, either the TOT model or the conventional model is acceptable.

After bidding, value for money is formally tested. That is, the actual transfer price, viability gap funding, miscellaneous cost and retained risk are used to calculate \( NPC_T \). The overall value for money of a TOT project can only be fully determined at the end of the TOT contract term.

3 CHOICE OF DISCOUNT RATE FOR VFM ASSESSMENT

There are many difficulties in quantitative VFM assessment, such as cost estimation, revenue projection, risk quantification, choice of discount rates, and so on. Among these difficulties, discount rate is one of the most important factors.

3.1 Existing Methodologies for Determining a Discount Rate

VFM is in terms of present value. The calculation of VFM is based on discounted cash flows and influenced
There are four methodologies for determining the discount rate, that is,

- **Social Time Preference Rate (STPR)** represents the rate that society is willing to pay for receiving something now rather than in the future;
- **Weighted Average Cost (WACC) of Capital** is equivalent to the project’s internal rate of return;
- **Capital Asset Pricing Model (CAMP)**, a risk markup is added to a risk-free discount rate to account for “risky” cash flows;
- **Risk-Free Rate** is the return on capital that investors demand on riskless investments. The public sector’s long-term borrowing rate (e.g., Treasury bill or Treasury bond) is usually accepted as its estimate.

However, there is no international consensus on the appropriate methodology for determining the rate. Each organization has its own preferences. For example,

- **HM Treasury (2003)** recommends using STPR as the standard real discount rate and a lower discount rate for a longer term.
- **Partnerships British Columbia (2014)** uses WACC to set the discount rate as the cost of capital based on standard investment portfolio theory.
- **Infrastructure Australia (2008b)** recommends using the discount rate determined by CAMP. Since systematic risks borne by the government vary from project to project, different discount rates are used for different projects.
- **The Department of Public Expenditure and Reform, Ireland**, recommends using the Risk Free Rate (e.g., the yield on the appropriate long term Government Bond) as the discount rate to discount the risk free cost of debt to the public sector (PPP Policy Unit 2006).

Moreover, some countries use fixed discount rates for all projects irrespective of their individual characteristics, while others determine project-specific discount rates. For example, PPP Policy Unit (2006) suggests that all cash flows must be discounted at the same discount rate. **Infrastructure Australia (2008b)** suggests PSC and PPP bids use different discount rates respectively because systematic risks borne by the government under conventional procurement methods are different from those under PPP procurement methods.

Although there are four methods for determining a discount rate, each has its own challenges. There is a call for a solution to determine appropriate discount rates.

### 3.2 Suggested Methodology for Determining a Discount Rate

Literally, the discount rate is a multiplier that converts future cash flows to their present value. For a given stream of future cashflows, the greater the discount rate is, the smaller their present value; and vice versa. Therefore, discount rates play a very important role in VFM assessment.

Which of the methods should be used to determine an appropriate discount rate for a given stream of costs? CAPM is originally used to determine a theoretically
appropriate required rate of return of an asset. The higher the uncertainty of revenues, the higher the rate of return is required. For a given stream of revenues in the future, the NPV will be lower with higher discount rates, which makes such future revenues not so attractive. In contrast, for a given stream of costs in the future, the NPC will be lower with higher discount rates. As a result, the costs in the future may be underestimated. Therefore, the discount rate must be realistic to avoid masking the government’s payment obligations.

Cash flows of a PPP project consist of revenues and costs. Revenues can be further broken down into revenues with certainty (i.e., financially underwritten and guaranteed revenues) and revenues with uncertainty (i.e., financially un-guaranteed revenues) according to their degrees of certainty. Costs can also be further broken down into costs with certainty (i.e., definitely occurred costs) and costs with uncertainty (i.e., possibly occurred costs) according to their degrees of certainty. As a result, there are four categories of cash flows.

In VFM assessment, the discount rate not only considers the time value of money, but also the risk or uncertainty of future cash flows. Thus, different discount rates must be used to convert different categories of cash flows to their present values respectively so as to reflect their characteristics. For revenues with certainty, WACC is recommended as the discount rate. For revenues with uncertainty, CAMP is recommended because an extra return is required to compensate the risk that the cash flow might not materialize after all. For costs with certainty, risk-free rate ($r_F$) is recommended as the discount rate. For costs with uncertainty, a discount rate should be lesser than risk-free rate because an extra fund is required to cope with worse-than-expected outcomes. The choice of discount rates is shown in Table 1.

Therefore, NPC can be calculated by the following formula.

$$NPC = \sum_{i=1}^{n} \frac{C_{CI}}{(1 + r_{CC})^i} + \sum_{i=1}^{n} \frac{C_{UI}}{(1 + r_{CU})^i} - \sum_{i=1}^{n} \frac{R_{CI}}{(1 + r_{RC})^i} - \sum_{i=1}^{n} \frac{R_{UI}}{(1 + r_{RU})^i}$$  \hspace{1cm} (4)

Where,

- $n =$ number of years of a concession period
- $C_{CI} =$ costs with certainty in the $i^{th}$ year
- $C_{UI} =$ costs with uncertainty in the $i^{th}$ year
- $R_{CI} =$ revenues with certainty in the $i^{th}$ year
- $R_{UI} =$ revenues with uncertainty in the $i^{th}$ year
- $r_{ CCC} =$ a discount rate for costs with certainty
- $r_{CU} =$ a discount rate for costs with uncertainty
- $r_{RC} =$ a discount rate for revenues with certainty
- $r_{RU} =$ a discount rate for revenues with uncertainty

### 3.3 Procedure for VFM Calculation

In order to assess VFM for TOT projects quantitatively, the cashflows of a project are firstly analyzed and classified into four categories: revenues with certainty, revenues with uncertainty, costs with certainty, and costs with uncertainty. Then, WACC, CAPM, risk-free discount rate, and adjusted risk-free discount rate are recommended for the four categories of cashflows respectively. Thirdly, NPC$_C$ and NPC$_T$ can be calculated by Eq. (4) respectively. Finally, VFM is calculated by Eqs. (1), (2) and (3).

In the conventional model, the uncovered capital cost occurs at the current time point and is expressed in terms of present value, while O&M costs, user payments, retained risks and rehabilitation costs occur in the future and must be discounted into present values at reasonable and appropriate discount rates respectively. The O&M costs can be broken down into two parts: an O&M cost with certainty and an O&M cost with uncertainty. The retained risks and rehabilitation costs are usually treated as cost with uncertainty. The third party income can be treated as revenues with uncertainty if it depends on market conditions, otherwise, it can be treated as revenues with certainty. NPC$_C$ can be calculated by Eq. (4).

In the TOT model, the uncovered capital cost, transfer price and miscellaneous costs occur at the point of transaction and are expressed in terms of present value, while VGF, retained risks and regulation costs occur in the future and must be discounted into present values at reasonable and appropriate discount rates respectively. Among them, the retained risks are usually treated as cost with uncertainty. The regulation costs can be treated as cost with certainty. VGF can be treated as revenues with certainty if it is fixed or revenues with uncertainty if it is adjusted with risk factors. NPC$_T$ can be calculated by Eq. (4).

After the calculations of NPC$_C$ and NPC$_T$, it is easy to calculate VFM by Eq. (3).

### 4 CONCLUSION

Whether the TOT model is employed or not for existing projects, the government should make VFM assessment so as to justify its decision. VFM can be assessed by comparing NPC$_C$ with NPC$_T$. If NPC$_C$ is greater than NPC$_T$, the TOT model will deliver good value for money compared to the conventional model. Otherwise, TOT will not deliver good value for money.

The calculation of NPC is influenced by discount rates. Since the cashflows of a project consist of components with different uncertainties, the choice of discount rates should reflect their characteristics. There are four categories of cashflows: revenues with certainty, revenues with uncertainty, costs with certainty, and costs with uncertainty. WACC, CAPM, risk-free discount rate, and adjusted risk-free discount rate are
Table 1. Choice of Discount Rates

<table>
<thead>
<tr>
<th>Types of Cashflows</th>
<th>Certain</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>Cost of Capital (WACC)</td>
<td>Rate by CAMP ($r_f + Risk premium)</td>
</tr>
<tr>
<td>Costs</td>
<td>Risk-free rate</td>
<td>Adjusted risk-free rate (e.g., Treasury rate ($r_f - Risk premium*))</td>
</tr>
</tbody>
</table>

*Note: risk premium can be determined by CAPM

recommended for the four categories of cashflows respectively. Therefore, reasonable and appropriate discount rates can avoid masking the government’s payment obligations and improve the reliability of VFM calculation.

The concept of calculating VFM by comparing present value of two procurement methods includes net present cost (NPC) based calculation and net present value (NPV) based calculation. If the cashflows of a project are mainly negative (i.e., net cash outflows for the government), NPC is used; if its cashflows are mainly positive (net cash inflows for the government), NPV is used. Furthermore, the application of the formula ($VFM = NPC_C - NPC_T$) can be extended to other kinds of PPP procurement methods.

ACKNOWLEDGMENT

This study was supported by a grant from the National Natural Science Foundation of China (No.: 71171017). The writers would like to thank the support from the Foundation.

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