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## Discussion of “Win-Win Concession Period Determination Methodology” by Xueqing Zhang

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We argue that there are inconsistencies in Eqs (5), (6) and (8) in Zhang (2009, p.555) and suggest revisions to Eqs (6) and (8) to rectify the inconsistencies.

The discount rates in Eq. (5) and Eq. (6) in Zhang are not consistent. Eq. (5) was the formula for calculation of the net present value of the total project construction cost, and was expressed by Zhang as

$$NPV_c = \sum_{i=1}^{T_c} \frac{C_i}{(1+R)^{i-1}} \quad (5)$$

where  $NPV_c$  is net present value of the total project construction cost,  $c_i$  is the project construction cost in year  $i$ ,  $R$  is discount rate,  $T_c$  is the project's construction completion time,  $c_i$  is the project construction cost in year  $i$ . The discount factor for cash flow in year  $i$  is  $\frac{1}{(1+R)^{i-1}}$ , which means that the reference year for discounting is the starting year of construction of the project.

Eq. (6) was the formula for calculation of the net revenues in the operation period and was expressed by Zhang as

$$NPV_o = \sum_{j=T_c+1}^{T_c+T_o} \frac{NCF_j}{(1+R)^j} = \sum_{j=T_c+1}^{T_c+T_o} \frac{Q_j P_j - OM_j}{(1+R)^j} \quad (6)$$

where  $NCF_j$  is the net cash flow ( $NCF$ ) in operation year  $j$ ,  $NPV_o$  is the net present value of  $NCFs$ ,  $t_o$  is the project franchise operation period,  $q_j$  is the service/product demanded in year  $j$  during the operation period,  $p_j$  is the price of a unit of service/product in year  $j$  during the operation period,  $om_j$  is the operation and maintenance cost in year  $j$  during operation.

Since the reference year for discounting in Eq. (5) is the starting year of construction of the project, in order to be consistent with Eq. (5) on the reference year for discounting, Eq. (6) in Zhang (p.555) thus should be modified as

$$NPV_o = \sum_{j=T_c+1}^{T_c+T_o} \frac{NCF_j}{(1+R)^{j-1}} = \sum_{j=T_c+1}^{T_c+T_o} \frac{Q_j P_j - OM_j}{(1+R)^{j-1}} \quad (6)^{revised}$$

The discount rates in Eq. (8) in Zhang (p.555) are also inconsistent. Eq. (8) was developed based on the principle that the franchise operation period should be long enough to enable the concessionaire to recoup his investment and earn a reasonable return over the period. The concession period is the sum of the project construction period plus its franchise operation period. Eq. (8) in Zhang was

$$\sum_{j=T_c+1}^{T_c+T_o} \frac{Q_j P_j - OM_j}{(1+R_a)^j} = \sum_{i=1}^{T_c} \frac{C_i}{(1+R_a)^{i-1}} \quad (8)$$

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4 where  $\tau_o$  is the minimum length of the project franchise operation period acceptable by the  
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7 concessionaire,  $p_j$  is lower than the maximum public affordable price for protecting the  
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10 public interest,  $R_a$  is an internal rate of return (IRR) on equity agreed by the host  
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13 government and the concessionaire.  
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18 The discount factor for cash flow in year  $i$  is  $\frac{1}{(1+R_a)^{i-1}}$ , again, this means that the  
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21 reference year for discounting is the starting year of construction of the project. In order  
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24 to be consistent on the reference year for discounting, the discount factor for cash flow in  
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27 year  $j$  during the operation period thus should be  $\frac{1}{(1+R_a)^{j-1}}$ , rather than  $\frac{1}{(1+R_a)^j}$ . Hence,  
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30 Eq. (8) in Zhang (2009) should be modified as:  
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$$\sum_{j=T_c+1}^{T_c+T_o} \frac{Q_j P_j - OM_j}{(1+R_a)^{j-1}} = \sum_{i=1}^{T_c} \frac{C_i}{(1+R_a)^{i-1}} \quad (8)^{revised}$$

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40 To summarize, in order to be consistent on the reference year for discounting, Eq. (6) and  
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43 Eq. (8) in Zhang have to be modified.  
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45 **Reference:**

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