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Selection of Credit Limit Methods: The Comprehensive Limit Credit Method or the Line-state Limit Credit Method

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Abstract: The selection of credit limit methods is a very important issue in international taxation but there exist some theoretical errors in the present literatures. Applying modeling, simulation and rigorous mathematical derivation the tax effects of the comprehensive limit credit method and the line-state limit credit method were compared. It was discovered that whether the comprehensive limit credit method is superior, equal or inferior to the line-state limit credit method depends on the combination of the types of its overseas branches. The results are much complicated than the general conclusion of the present literatures and indicated that the line-state limit credit method does not ensure the fiscal revenue. It was suggested that Chinese tax credit system should change from the line-state limit credit method to the comprehensive limit credit method.

Key words: Comprehensive limit credit method, line-state limit credit method, tax effect, comparison, selection

INTRODUCTION

Tax credit is that when a government taxes its resident's foreign incomes, it allows its resident offsets the tax payable by the taxes already paid in foreign countries. The actual tax for the resident should be the difference between the tax payable and the taxes already paid in foreign countries. In practice, the home country usually stipulates that the tax credited should not exceed the amount calculated by the foreign incomes and the tax rate in the home country, i.e., credit limit, in order to ensure its tax benefits. Internationally recognized basic limit methods are the line-state limit credit method and the comprehensive limit credit method.

Tax credit method was firstly adopted to deduct the international double taxation in the USA. The study in USA focuses on what principle to be adopted, the influence of credit rules and the regulation of anti-avoidance. In USA the capital export neutrality is thought to be conducive to economic efficiency and becomes the theoretical basis for overseas income tax (Thompson, 1995). Rohatgi (2002) summed up the main factors influencing the overseas income tax credit: Taxes paid in which countries creditable, credit limits method, exchange rates and cost-sharing, indirect credit, the carryover of transfinite credits etc. Brumbaugh and Gravelle (2007) studied the reform.

In China, the researches focus on the explanation and illustration of the relative rules, legislative suggestions to perfect the system, or comparison with and reference to other developed countries. Liu and Zhao (2011) discussed the problems existing in Chinese tax credit system and put forward corresponding improvement suggestions. Cai (2002) studied foreign tax credit system of American federal income tax law which is the contradictory unity of avoiding international double taxation and maintaining the tax revenue jurisdiction. How to draw lessons from American experience and how to improve the system of Chinese foreign tax credit were also discussed. Overall, the study focus on practice and the theoretical aspect is relatively thin.

Through a large number of literatures searching only a few researches especially for the credits methods were found. Most of Chinese scholars support the comprehensive limit credit method. The tax credit should not be limited to the line-state limit credit method and the comprehensive limit credit method should be conditionally allowed (Li, 1997). The comprehensive limit credit method can better reflect the government policy of encouraging outward direct investment, simplify tax calculation and be convenient on both sides of the taxpayers and publicans (Wu, 2012). For the multinational companies, country-by-country calculating credit limit is very cumbersome (Research group of Shanghai Municipal

Office, SAT, 2011). The line-state limit credit method is contrary to the direction of international practice adopting the comprehensive limit credit method. Considering the trend of outward direct investment distributed in more and more foreign countries, the change from the line-state limit credit method to the comprehensive limit credit method was suggested of American tax system (Liu and Zhao, 2011).

Of course, there are some scholars opposing to adopt the comprehensive limit credit method. Liu (2000) thought that the line-state limit credit method gives consideration to both host countries' and taxpayer' interests and determines the credit limit and the actual credits according to the specific conditions of different countries. Lun (2008) argued that the comprehensive limit credit method allow taxpayers to cross credits which distorts the flow of international investment and is not conducive to the realization of economic efficiency. China should not adopt the comprehensive limit credit method but should further perfect the present line-state limit credit method. Thinking from the perspective of international tax policy means that tax measures are likely to be used for the purpose of the specific economic tools. Cai (2007) maintained that the foreign tax credit should not be such a policy tool because adding too much policy factors into it will destroy its stability and predictability as legal rules.

Domestic scholars generally calls for the comprehensive limit credit method but the government does not consider and implement it in view of tax revenue and host response (Zhan *et al.*, 2012). Is the line-state limit credit method certainly superior to the comprehensive limit credit method for government tax? This is related to the tax effects of the two methods, on which there exists not much literature specifically discussing. General conclusion of the literature is that the comprehensive limit credit method is favorable to the enterprise when the overseas branches all gain and the line-state limit credit method is favorable to the enterprise when the overseas branches some profit-making some loss-making. Zhu (2011) thought that under the circumstance of the overseas branches some profit-making or some loss-making the line-state limit credit method is favorable to the enterprise because it can avoid the offset of profits and losses from different host countries and reduce of credit limits. If the comprehensive limit credit method is used, the losses of branches from one country will offset the gains of branches from another country, therefore reducing the credit limit. Li (2006) asserted that if there exist loss-making overseas branches the line-state limit credit method is more favorable to a transnational taxpayer. Wu (2002) queried the general conclusion and using specific data illustrated

the different effects of the comprehensive limit credit method and the line-state limit credit method to an enterprise under three circumstances. Lv (2004) argued that this conclusion has the rationality to some extent, however, in some cases; it doesn't have to be so. When the income tax rate in the home country is between the upper and lower limits of the income rates in host countries of the profit-making overseas branches, if the income rates differ greatly, there will be a different conclusion. But Wu (2002) and Lv (2004) did not from the general point of view analyze the different tax effects of the comprehensive limit credit method and the line-state limit credit method. Therefore, in-depth studying the tax effects of the comprehensive limit credit method and the line-state limit credit method has theoretical meaning and practical value. This study attempts to compare the tax effects of the comprehensive limit credit method and the line-state limit credit method by modeling, simulation and rigorous mathematical derivation.

MATERIALS AND METHODS

Modeling: The line-state limit credit method is firstly comparing the credit limit and the tax paid in every host country then summing the difference and the actual credit amount is the sum of the smaller. The comprehensive limit credit method is the comparison of the sum of the credit limits and the sum of tax paid in host countries and the actual credit amount is the smaller.

Let the taxable income of the parent company be A and the tax rate is a in the home country. The overseas branches can be classified by three kinds:

Class 1: Profit-making or break even and the income tax rate in host country is more than or equal to that in home country

Here let the taxable income be W_i ($W_i \geq 0$) and the tax rate in host country be w_i ($w_i \geq a$), then the tax paid is $W_i \times w_i$.

Class 2: Profit-making or break even and the income tax rate in host country is less than that in home country

Here let the taxable income be X_j ($X_j \geq 0$) and the tax rate in host country be x_j ($x_j < a$), then the tax paid is $X_j \times x_j$.

Class 3: Loss-making

Here let the taxable income be Y_k ($Y_k < 0$) and the income tax rate in host country be y_k , then the tax paid is 0.

Let the actual credit amount under the line-state limit credit method be L , the actual credit amount under the comprehensive limit credit method be C , then:

$$L = \max\{0, \sum \min\{W_i \times a, W_i \times w_i\} + \sum \min\{X_j \times a, X_j \times x_j\} + \sum \min\{0, 0\}\} \quad (1)$$

$$C = \max\{0, \min\{(\sum W_i + \sum X_j + \sum Y_k) \times a, \sum(W_i \times w_i) + \sum(X_j \times x_j) + \sum 0\}\} \quad (2)$$

Let:

$$W = \sum W_i, w = \frac{\sum(W_i \times w_i)}{W} (w = a) \quad (3)$$

$$W = \sum W_i, x = \frac{\sum(X_j \times x_j)}{X} (x < a) \quad (4)$$

$$Y = \sum Y_k, y = \frac{\sum(Y_k \times y_k)}{Y} \quad (5)$$

Then:

$$L = W \times a + X \times x \quad (6)$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \quad (7)$$

Simulation: Running the MATLAB program “ $w = 0.3; a = 0.25; x = 0.2; W = 50; [X, Y] = \text{meshgrid}(0:2:100, -100:2:0); L = W \times a + X \times x; C = \max(0, \min((W+X+Y) \times a, (W \times w + X \times x)))$; $Z = L - C$; $\text{surf}(X, Y, Z)$; $\text{xlabel}('X(\text{Million US\$})')$; $\text{ylabel}('Y(\text{Million US\$})')$; $\text{zlabel}('Z(\text{Million US\$})')$ ”, Fig. 1 can be got. In Fig. 1, X denotes the taxable income of class 2, Y denotes the taxable income of class 3 and Z denotes the difference of actual credit amount under the two methods which equal L minus C .

In Fig. 1, sometimes L is more than C ($Z > 0$) and sometimes L is less than C ($Z < 0$) and the change is complex.

For further analyzing, intercepting the part in Fig. 1 of the actual credit amount under the comprehensive limit credit method more than which under the line-state limit credit method was attempted. Running the MATLAB program “ $w = 0.3; a = 0.25; x = 0.2; W = 50; [X, Y] = \text{meshgrid}(0:2:100, -100:2:0); L = W \times a + X \times x; C = \max(0, \min((W+X+Y) \times a, (W \times w + X \times x)))$; $Z = L - C$; $Z1 = \text{find}(Z > 0)$; $Z(Z1) = \text{NaN}$; $\text{surf}(X, Y, Z)$; $\text{xlabel}('X(\text{Million US\$})')$; $\text{ylabel}('Y(\text{Million US\$})')$; $\text{zlabel}('Z(\text{Million US\$})')$ ”, Fig. 2 can be got.

In Fig. 2, the occurrence of $Z < 0$ is regular and may be related to the occurrence of a series of lines, i.e., X and Y satisfy linear.

Mathematical derivation: According to the combination principle, seven situations can be classified: Only existing branches of class 1, only existing branches of class 2, only existing branches of class 3, including branches of class 1 and 2, including branches of class 1 and 3, including branches of class 2 and 3, including branches of all three classes.

- **Situation 1:** Only existing branches of class 1. Here, $X = 0$ and $Y = 0$:

$$L = W \times a + X \times x = W \times a$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} = \max\{0, \min\{W \times a, W \times w\}\} = W \times a$$

$$L = C$$

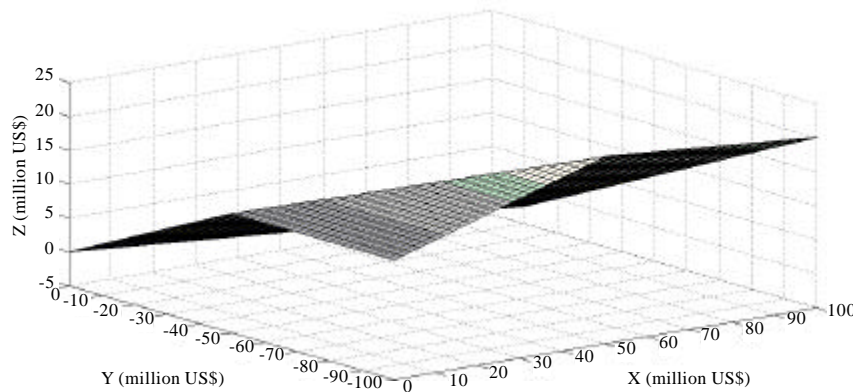


Fig. 1: Difference between the actual credit amount under the line-state limit credit method and that under the comprehensive limit credit method

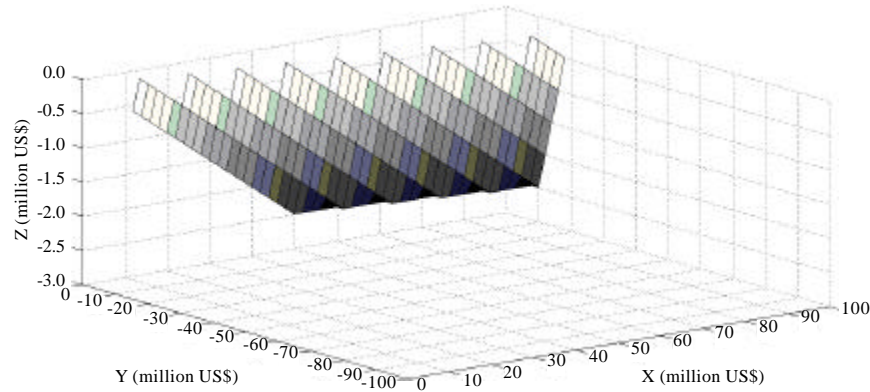


Fig. 2: Difference between the actual credit amount under the line-state limit credit method and that under the comprehensive limit credit method (when the latter outweigh the former)

- **Situation 2:** Only existing branches of class 2. Here, $W = 0$ and $Y = 0$:

$$L = W \times a + X \times x = X \times x$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \\ = \max\{0, \min\{X \times a, X \times x\}\} = X \times x$$

$$L = C$$

- **Situation 3:** Only existing branches of class 3. Here, $W = 0$ and $X = 0$:

$$L = W \times a + X \times x = 0$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \\ = \max\{0, Y \times a\} = 0$$

$$L = C$$

- **Situation 4:** Including branches of class 1 and 2. Here $Y = 0$:

$$L = W \times a + X \times x$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \\ = \min\{(W+X) \times a, W \times w + X \times x\}$$

Here $w \geq a > x$:

$$C = L$$

- **Situation 5:** Including branches of class 1 and 3. Here, $X = 0$:

$$L = W \times a + X \times x = W \times a$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \\ = \max\{0, \min\{(W+Y) \times a, W \times w\}\}$$

Here, $w \geq a$ and $Y < 0$:

$$C < L$$

- **Situation 6:** Including branches of class 2 and 3. Here, $W = 0$:

$$L = W \times a + X \times x = X \times x$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\} \\ = \max\{0, \min\{(X+Y) \times a, X \times x\}\}$$

Here, $a > x$:

$$\text{if } (X+Y) \times a \geq X \times x, \text{ i.e., } Y \geq (x/a-1)X$$

$$C = L$$

$$\text{if } (X+Y) \times a < X \times x, \text{ i.e., } Y < (x/a-1)X$$

$$C < L$$

- **Situation 7:** Including branches of all three classes:

$$L = W \times a + X \times x$$

$$C = \max\{0, \min\{(W+X+Y) \times a, W \times w + X \times x\}\}$$

Here, $w \geq a > x$:

$$\text{if } (W+X+Y) \times a > W \times a + X \times x, \text{ i.e., } Y > (x/a-1)X$$

$$C > L$$

if $(W+X+Y) \times a > W \times a + X \times x$, i.e., $Y = (x/a-1)X$

$$C = L$$

if $(W+X+Y) \times a < W \times a + X \times x$, i.e., $Y < (x/a-1)X$, $C < L$

RESULTS AND DISCUSSION

Results analysis: Obviously, the results are much complicated than that of the present literatures. Table 1 is the comparisons of the results of the study with that of previously published studies.

Theoretical interpretation: Branches of class 1 are on the excess credit positions, branches of class 2 are on the excess limitation positions and under the comprehensive limit credit method branches of class 3 reduce credit limits. If the branches of class 3 were not considered, the situation 7 degenerates into the situation 4. Under the comprehensive limit credit method the excess limitation of the branches of class 2 can offset the excess credit of the branches of class 1. At this time the excess limitation partly or totally be used, so the comprehensive limit credit method is favorable to the enterprises. If the branches of class 2 were not considered, the situation 7 degenerates into the situation 5. Under the comprehensive limit credit method branches of class 1 are on the excess credit positions which means the credit limits are insufficient. At this time branches of class 3 reduce credit limits which makes the credit limit furthermore insufficient, so the line-state limit credit method is favorable to the enterprises. On situation 7, branches of all three classes exist and which of the above two functions is heavier need further discussion.

Under the line-state limit credit method, the branches of class 3 do not take effect and can be unconsidered. But under the comprehensive limit credit method, they reduce the credit limits. The derivation starts by the loss from zero up. When the loss of the branches of class 3 is zero, the situation 7 degenerates into the situation 4, the comprehensive limit credit method is favorable to the enterprises. With the loss of the branches of class 3 increasing, it consumes more and more excess limitation provided by the branches of class 2. When the loss is little, the consumed excess limitation is not heavy. At this time the excess limitation provided by the branches of class 2 is more than the excess limitation consumed by the branches of class 3, i.e., $(a-x) \times X > -Y \times a$. So, the difference can offset the excess credit provided by the branches of class 1 and the comprehensive limit credit method is favorable to the enterprises. When $-Y \times a = (a-x) \times X$, the excess limitation consumed by the branches of class 3 equals to the excess limitation provided by the branches of class 2. At this time no excess limitation can offset the excess credit provided by the branches of class 1. So the comprehensive limit credit method equals to the line-state limit credit method for the enterprises. when $Y \times a > (a-x) \times X$, the excess limitation consumed by the branches of class 3 is more than the excess limitation provided by the branches of class 2. At this time the comprehensive credit limit is unduly little. Not only no excess limitation can offset the excess credit provided by the branches of class 1 but also the tax paid by the branches of class 2 can not be totally compensated. So the comprehensive limit credit method the comprehensive limit credit method is unfavorable to the enterprises. Therefore, the turning point is at $-Y \times a = (a-x) \times X$ which corresponds to the lines in Fig. 2.

Table 1: Comparisons of the results of the study with that of previously published studies

Situations	Result of the study	Result of previously published studies	Comparisons
1	Comprehensive limit credit method is equal to the line-state limit credit method	Comprehensive limit credit method is equal to the line-state limit credit method	Consistent
2	Comprehensive limit credit method is equal to the line-state limit credit method	Comprehensive limit credit method is equal to the line-state limit credit method	Consistent
3	Comprehensive limit credit method is equal to the line-state limit credit method	Comprehensive limit credit method is equal to the line-state limit credit method	Consistent
4	Comprehensive limit credit method is superior or equal to the line-state limit credit method	Comprehensive limit credit method is superior the line-state limit credit method	Almost the same
5	Comprehensive limit credit method is inferior to the line-state limit credit method	Comprehensive limit credit method is inferior to the line-state limit credit method	Consistent
6	Comprehensive limit credit method is equal to the line-state limit credit method when $Y \geq (x/a-1)X$; the comprehensive limit credit method is inferior to the line-state limit credit method when $Y < (x/a-1)X$	Comprehensive limit credit method is inferior to the line-state limit credit method	Inconsistent
7	Comprehensive limit credit method is superior to the line-state limit credit method when $Y > (x/a-1)X$; the comprehensive limit credit method is equal to the line-state limit credit method when $Y = (x/a-1)X$; the comprehensive limit credit method is inferior to the line-state limit credit method when $Y < (x/a-1)X$	Comprehensive limit credit method is inferior to the line-state limit credit method	Inconsistent

Policy implication: In general, transnational corporations often choose to invest in low-tax countries and if loss-making branches exist, situation 6 or 7 occurs. In situation 6 or 7, when the loss is much enough the line-state limit credit method is favorable to enterprises. Because of the intensifying competition, increasing investment risk and popular transfer pricing, occurrence of loss-making increases. That is to say, the probability of the line-state limit credit method favorable to enterprises increases; conversely, the probability of the line-state limit credit method unfavorable to governments increases.

At present China selects the line-state limit credit method out of ensuring revenue. But according to the analysis above, the line-state limit credit method does not necessarily ensure finance income of a country which is more and more obvious in the era of globalization. Moreover, the procedure of the line-state limit credit method is miscellaneous. Thus the following question for Chinese government can be asked. From taxation and anti-tax-avoidance perspective, whether it is wise for the government to stipulate the line-state limit credit method in the tax law? Should the tax credit system change from the line-state limit credit method to the comprehensive limit credit method?

CONCLUSION

For an international taxpayer, whether the comprehensive limit credit method is superior, equal or inferior to the line-state limit credit method depends on the combination of the types of its overseas branches. The types are profit-making or loss-making, more or less the income tax rates in host countries than that in the home country and the losses of the loss-making branches, if any. The actual results are much complicated than the general conclusion of the present literatures. The line-state limit credit method does not ensure the fiscal revenue.

The innovation of this study is that it analyzed systematically the tax effects of the comprehensive limit credit method and the line-state limit credit method. The study corrected the related theoretical errors, obtained the discriminate rules to judge which of the two methods is favorable to enterprises and gave the relevant theoretical interpretation. The policy implication of this study is that Chinese tax credit system should change from the line-state limit credit method to the comprehensive limit credit method.

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