Theoretical Derivation of "Structural Tax Cut" under Restriction of Income Growth

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Abstract -Since the actual implementation process may encounter the contradiction between the guarantee of government income and the stimulation of private sector expense, this study performed mathematical derivations on the effects of structural tax cut policies. Theoretical analysis shows that the structural tax cut polices (tax cut accompanied with increase of some specific taxes) may solve the contradiction between income growth and tax cut to some extent. At the same time, it plays a positive role in optimizing economic structure and promoting economic growth by developing tax structure according to the nature of tax and adopting differentiated tax policies.

Index Terms -Income Growth, Structural Tax Cut, Private Sector Expense Multiplier of Tax

1. Introduction

The concept of "structural tax cut" was officially proposed by the Chinese government in early December 2008 during the central economic work conference. This policy is expected to "expand domestic demands and maintain economic growth", with the purpose of alleviating the negative impacts of international financial crisis on domestic economy. The nature of "structural tax cut" is actually the optimization of tax structure to promote economic growth. Many previous studies about tax structure mainly focus on three aspects. Firstly, a majority of literatures focus on the relationship between tax structure and economic growth. It is an important research direction of public finance theory to investigate the impact of tax policies on economic growth through quantitative analysis. Since 1990s, some scholars such as Lucas (1990) and Jones (1993) estimated the economic growth effect of tax policies. Mullen and William (1994) investigated the relationship between marginal tax rate and economic growth in various states from 1969 to 1986. Their findings showed that, while all tax conditions are under control, a higher marginal tax rate would impact economic growth. Secondly, there are also a large number of literatures focusing on the diversified impacts of the heterogeneity of specific tax categories on economic growth. Although the research subject of Andrés and Doménech(2006) is EU countries, their conclusions were basically consistent with Zagler and Diirnecker, i.e., there is a positive correlation between the fluctuation of economic output and the capital income tax. Thirdly, there are also some literatures mainly focusing on tax optimization. Most of these studies investigated the relevant regulations by comparing the ratio between different taxes and GDP in various countries, and estimated the optimal tax rate (Branson & Lovell, 2001).

Although the above mentioned literatures have made outstanding contribution to the study about the relationship between tax structure and economic growth, most of them largely relied on the empirical research method to perform analysis at the national level or on an even wider scope. In addition, they were more inclined to adopt new research methods to investigate the macroeconomic theories and welfare economic theories related to tax system, tax structure and so on. With respect to this issue, most of the Chinese studies only analyzed China's existing tax system based on the qualitative point of view, and put forward some concrete paths on structural tax cut(An,2012; Pang & Zhang,2013). There are also some scholars who conducted empirical research from specific tax points of view. Cai and Wang (2012) mainly studied the impact of tax policies (income tax as a typical example) on China's macroeconomic fluctuation under the Dynamic Stochastic General Equilibrium (DSGE) framework.

This paper is organized as follows. Section 2 presents the theoretical derivations and proposes recommendations about the structural tax cut policy. Section 3, as a conclusion, highlights the limitations of this paper and points out the direction of further studies for econometrics improvement.

2. Theoretical Derivations and Recommendations about the Effect of the Structural Tax Policy

A. Theoretical Derivations about the Effect of the Structural Tax Cut Policy

In order to simplify the analysis, it is necessary to propose a few assumptions.

Assumption 1: the private sector expense is affected by taxation and its structure through the multiplier effect. The effect of taxation on the private sector expense is referred to as the private sector expense multiplier of tax, hereafter denoted as $\partial A / \partial T_i$.

Assumption 2: due to the differences in influential scope and degree of relevance, the value of the private sector expense multiplier will be different. To simplify the analysis, this paper classifies taxes into two categories: T_1, taxes with a larger multiplier effect, and T_2, taxes with a smaller multiplier

effect, i.e., $\left|\dfrac{\partial A}{\partial T_1}\right| > \left|\dfrac{\partial A}{\partial T_2}\right|$. Thus, the government expense and the private sector expense can be expressed as $G = G(T_1 + T_2)$ and $A = A(T_1, T_2)$, respectively.

Assumption 3: economy consists of three components, government, enterprises and residents, and there is no interaction with foreign economy. Under such a closed economy, the national income of the three sectors model is decided by equations as below:

$$Y = AD \qquad (1)$$
$$AD = C + I + G \qquad (2)$$
$$C = C_0 + cY_d \qquad (3)$$
$$Y_d = Y - T + TR \qquad (4)$$
$$I = I_0 - dr - fT \qquad (5)^1$$
$$G = G(T) \qquad (6)$$

Combining equation (3) and (4), it can be seen that there is a reverse change relationship between consumption and taxation. Tax increase can directly reduce the personal disposable income, and thereby reduce the consumption. Therefore, consumption can be expressed as a decreasing function of tax $C = C(T^-)$.

From equation (5), it can be seen that investment is a decreasing function of interest rate and tax. To simplify the analysis, it is assumed that interest rate is exogenous in this study, and then investment is also a decreasing function of tax.

Thus, the total expense of the private sector, as the sum of consumption and investment, can be regarded as a decreasing function of tax, $A = C(T^-) + I(T^-) = A(T^-)$.

Finally, in equation (6), government expense is a function of tax. Because taxation is the main source of government income, the taxation level directly determines the government's fiscal income level, and then influences the fiscal expense in the next period. Therefore, government expense can be further considered as an increasing function of tax $G = G(T^+)$.

Based on the analysis above, the following equation is obtained:

$$Y = AD = C(T^-) + I(T^-) + G(T^+) = A(T^-) + G(T^+) = Y(T^-, T^+) \quad (7)$$

Obviously, taxation has both positive and negative effects on economic growth. On the one hand, tax increase will directly increase the government expense and thereby stimulate the economy; on the other hand, tax increase will also inhibit consumption and investment, and thereby reduce the private sector expense and ultimately impede economic growth.

On the basis of the three assumptions above, the following propositions are proposed:

Proposition 1: structural tax cut (tax cut accompanied with increase of some specific taxes) are beneficial for solving the contradiction between income growth and tax cut. It can be expressed using mathematical language as below:

For T_1 and T_2, if $\left|\dfrac{\partial A}{\partial T_1}\right| > \left|\dfrac{\partial A}{\partial T_2}\right|$

Then the sufficient conditions to satisfy $dA > 0$ **and** $dT > 0$ **are:** $dT_1 < 0$, $dT_2 > 0$ **and** $|dT_2| > |dT_1|$

Proof: assuming that the social government's total tax income T consists of two categories, T_1 and T_2, which are two different taxes that impose different multiplier effects on the private sector expense, i.e., $T = T_1 + T_2$. In order to guarantee the government income, the total tax income needs to increase, i.e. $dT > 0$.

Assuming T_1 and T_2 satisfies:

$$\left|\frac{\partial A}{\partial T_1}\right| > \left|\frac{\partial A}{\partial T_2}\right| \qquad (8)$$

I.e., the multiplier effect on the private sector expense of T_1 is larger than that of T_2.

Set $\exists \varepsilon > 0$ to realize the following equation:

$$\left|\frac{\partial A}{\partial T_1}\right| = \left|\frac{\partial A}{\partial T_2}\right| + \varepsilon \qquad (9)$$

Then, deriving the differential for the private sector expense function $A = A(T_1, T_2)$ we have

$$dA = \frac{\partial A}{\partial T_1} dT_1 + \frac{\partial A}{\partial T_2} dT_2 \Rightarrow -\left|\frac{\partial A}{\partial T_2}\right|(dT_1 + dT_2) - \varepsilon dT_1 \quad (10)$$

It is necessary to make sure $dT > 0$. As $T = T_1 + T_2$, so we have $dT = dT_1 + dT_2$. Since $|\partial A / \partial T_i| > 0$ (i=1,2), we have $dT_1 < 0$ while ensuring the condition of $dA > 0$. In order to guarantee the total tax income $dT = dT_1 + dT_2 > 0$, we have $dT_2 > 0$.

I.e., $dT_1 < 0$, $dT_2 > 0$

To make one step further, $dT_1 + dT_2 = -|dT_1| + |dT_2| > 0$, after transposition, we have $|dT_2| > |dT_1|$

Proposition is proved.

The economic implications of this conclusion lies in that, the tax categories with a larger multiplier on the private sector expense should be reduced, while the tax categories with a smaller multiplier on the private sector expense should be increased. Meanwhile, the total amount of tax increase should be larger than the total amount of tax cut. In this way, it will increase the private sector expense and thereby stimulate economy while guaranteeing the growth of the total tax income.

So far, this paper only explains the different effects of taxation on the private sector expense, but how to distinguish different tax categories, how to decide tax structure and how to develop tax policies for different tax structures? In order to solve these problems, the following proposition is proposed.

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[1] Considering that some specific taxes, such as income tax and value-added tax, have a direct stimulatory effect on investment, this study introduces the variable of taxation into the general form of investment function, where f denotes the sensitivity coefficient of investment to the change of tax.

Proposition 2: the multiplier effect of taxation on the private sector expense is positively dependent on its degree of relevance and influential scope on the private sector expense. It can be expressed by the following mathematical equation:

$$\left|\frac{\partial A}{\partial T_i}\right| = f(\alpha_i^+, \beta_i^+) \tag{11}$$

Where, α_i **denotes the degree of relevance of the impact produced by** T_i **on** A . β_i **denotes the influential scope of** T_i . **In a standard manner, this proposition can be expressed as:**

$$\frac{\partial \left|\frac{\partial A}{\partial T_i}\right|}{\partial \alpha_i} > 0, \frac{\partial \left|\frac{\partial A}{\partial T_i}\right|}{\partial \beta_i} > 0 \tag{12}$$

Proof: the private sector expense can be regarded as a multivariate function about different categories of taxes. Specifically, according to the meanings of the two factors, degree of relevance and influential scope, the specific function form of the private sector expense about tax can be expressed as:

$$A = f(T_1, T_2, \ldots, T_n) = A_0 + (\beta_1 T_1)^{\alpha_1} + (\beta_2 T_2)^{\alpha_2} + \ldots + (\beta_n T_n)^{\alpha_n} \tag{13}$$

Where, α_i denotes the degree of relevance of the impact produced by T_i on A . $\alpha_i \geq 1$ because no matter how the impact of taxation on the private sector expense is, it will be at least equivalent to the amount of tax itself. As α measures the degree of relevance, it can be introduced into each item of the model in form of index, acting as the index of each category of tax. β_i denotes the influential scope of T_i . $\beta_i \geq 0$ because all tax categories have certain taxation objects, it must possess a positive influential scope. As β measures the influential scope, it can be introduced into the model in form of multiply, acting as the coefficient of each tax category. A_0 denotes the impact of all other factors on the private sector expense. In this paper, all these factors are regarded as exogenous. Considering that the various tax categories impact the private sector expense independently and there is no direct correlation between them, in this paper, the model is simply established through a linear addition of the various tax categories and other factors, without considering the cross item.

Then, calculating the derivation of A to T_i , the following equation is obtained:

$$\left|\frac{dA}{dT_i}\right| = \alpha_i \beta_i (\beta_i T_i)^{\alpha_i - 1} \tag{14}$$

Calculate the derivation of $\left|dA/dT_i\right|$ to α_i , we have,

$$\frac{\partial \left|\frac{dA}{dT_i}\right|}{\partial \alpha_i} = \beta_i (\beta_i T_i)^{\alpha_i - 1} + \alpha_i \beta_i^{\alpha_i} T_i^{(\alpha_i - 1)} \ln(\beta_i T_i) > 0 \tag{15}$$

Calculate the derivation of $\left|dA/dT_i\right|$ to β_i , we have:

$$\frac{\partial \left|\frac{dA}{dT_i}\right|}{\partial \beta_i} = \alpha_i \left[(\beta_i T_i)^{\alpha_i - 1} + \beta_i T_i (\alpha_i - 1)(\beta_i T_i)^{\alpha_i - 2} \right] > 0 \tag{16}$$

I.e.,

$$\frac{\partial \left|\frac{\partial A}{\partial T_i}\right|}{\partial \alpha_i} > 0, \frac{\partial \left|\frac{\partial A}{\partial T_i}\right|}{\partial \beta_i} > 0 \tag{17}$$

Proposition is proved.

The results indicate that, the multiplier effect of taxation on the private sector expense is positively dependent on the degree of relevance and influential scope of its impact on the private sector expense. With the deepening of the degree of relevance and the expansion of the influential scope, the multiplier effect of taxation on private expense will continue increasing.

This proposition can be easily validated in reality. The tax categories with a more direct impact on private expense have a relatively larger multiplier effect. A small change of such categories, such as value-added tax, corporate tax and personal income tax, will produce a greater impact on the private sector expense. On the contrary, the tax categories with a less direct impact on private expense have a relatively smaller multiplier effect, and the change of such tax categories will not produce a serious impact on the private sector expense. On the other hand, the tax categories with a larger influential scope have a relatively larger multiplier effect, and change of such tax categories will produce a significant impact on the private expense. On the contrary, the tax categories with a smaller influential scope have a relatively smaller multiplier effect, and change of such tax categories, such as property tax and action tax, will not impact the private expense significantly.

B. Recommendations on Structural Tax Cut Policy

Based on above theoretical derivations and conclusions, the following reforms related to structural tax cut can be implemented:

1) Tax Cut Policies

Firstly, the Chinese government is recommended to promote reforms of personal income tax to reduce the tax burden of low-income groups. As a modern tax category concerning both the income and adjustment functions, personal income tax does not account for a very big proportion in China's total tax income. However, compared with other taxes, especially with the various turnover taxes implied in price, people's sensitivity to personal income tax is very high. Therefore, for the personal income tax, which has a more direct impact on the private sector expense, a feasible approach is to raise its starting point and increase the tax rate for high-income groups. This is to reduce the impact of person income tax on low-income groups, so as to stimulate consumption and reduce the income gap.

Secondly, the Chinese government is recommended to further promote the value-added tax reform, in order to improve the investment environment of small and medium sized enterprises. According to data released by Shanghai

Bureau of Statistics in August 2013, the tax burden of about 60% enterprises was reduced or unchanged. Up to August 1st, 2013, the reform to replace the business tax with value-added tax has been extended to nationwide, which has reflected the government's target and direction of tax structure reform. In addition, value-added tax classifies taxpayers into two categories according to the operation scale and the standard of accounting system: general taxpayers and small-scale taxpayers. On the one hand, it is possible to further loosen the recognition criteria of general taxpayer, and on the other hand, the tax rate of small-scale taxpayers should be reduced in order to offer a policy support for small and medium-sized enterprises.

2) Tax Increase Policies

Tax rate should be increased for large-scale monopoly enterprises, and should be cut for small and medium sized enterprises. Although the future downturn of the world economy will be a downturn for all enterprises, it is more harmful for small and medium sized enterprises. When the system reform has not yet been completed, it could be a temporary measure to increase the tax rate for large-scale monopoly enterprises.

Also, it is recommended to expand the tax increase scope of resource tax and implement environmental protection tax. Nowadays, developed countries have paid more attention to the regulation role of resource tax and environmental protection tax. On the one hand, this tax category can alleviate the resource waste and environmental damage caused by economic development, and on the other hand, it can increase government income. The taxation objects of resource tax and environmental protection tax are mainly enterprises or individuals that discharge emission products. Its influential scope is relatively small, and the multiplier effect of its impact on the private sector expense is also relatively small. The increase of this tax category will not produce inhibition effect on enterprise and personal investment, but it can increase the government income.

3. Conclusion

Based on the three assumptions mentioned above, this paper proposes two propositions. The first proposition explains the different impacts of taxation on the private sector expense. According to the relevant derivations and proof, it is recommended to adopt different policies for the two types of taxes with different multiplier effects on the private expense, i.e., tax cut should be implemented for tax categories with a higher multiplier effect on the private sector expense, and tax increase should be implemented for tax categories with a lower multiplier effect on the private sector expense. Meanwhile, the total tax increase amount should be larger than the total tax cut amount. The second proposition further explores the factors that affect the multiplier effect of taxation on the private sector expense. The relevant derivations and proof show that the multiplier effect of taxation on the private sector expense is determined by the degree of relevance and influential scope of the related impact. To further illustrate these two propositions, it can be concluded that, when the influential scope is the same, tax cut should be implemented for tax categories with a more direct impact on the private sector expense, while tax increase should be implemented for tax categories with a less direct impact on the private sector expense. Meanwhile, when the degree of relevance of the impact is the same, tax cut should be implemented for tax categories with a larger influential scope, while tax increase should be implemented for tax categories with a smaller influential scope.

Due to space constraint, this paper only performs theoretical derivations for the issue of "structural tax cut" under the restriction of income growth. For the future research, large amounts of empirical data can be used to validate the conclusions obtained here, and on such basis, more comprehensive theoretical derivations can be conducted to investigate structural tax cut policies under other assumptions and conditions, such as considering a four-sector general equilibrium model etc. This is to make sure the policy development for tax cut and income growth will be more accurate and appropriate. The outcome of policy development should be a comprehensive set of measures which may benefit the long run, rather than a "compensation-like" legislation.

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