The Efficiency of China's Fiscal Policies on the Promotion of High-tech Industry

1 Background

1.1 Review of China's Fiscal Policies on the Promotion of High-tech Industry

China's High-tech industry is advancing rapidly in recent years. Many indexes of China's High-tech industry are growing fast and China's High-tech industry has been in the first three of the world based on the industry scale. As a developing country, the progression of China's High-tech industry is connected tightly to the background of the blooming of economy and science and technology (S&T) after China's Reforming and Opening, and also due to the implementation of supporting policies on High-tech industry to a certain extent. Besides industry policy, investment policy and the establishment of the High-tech zone, fiscal policies are critical to the development of China's High-tech industry. Specifically, the framework of fiscal policies on supporting China's High-tech industry includes enterprise income tax, value-added tax, business tax and personal income tax, among which the most efficient ways are the deduction of enterprise income tax and the enlargement of the scope and proportion of tax credit.

For the deduction of enterprise income tax, the Ministry of Finance (MOF) and the State Administration of Taxation (SAT) jointly issued the 'Notice of Preferential Policies of Enterprise Income Tax' in 1994, which stipulated definitely that the tax rate for High-tech companies in High-tech zones authorized by the State Council is 15 percent and a two-year tax exemption of enterprise income tax is offered to new established High-tech companies from the commissioning date. In the mean time, according to the 'Notice of the State Council on the approval of High-tech Zones and Related Policies' in 1991, if the proportion of export relative to total production is greater than 70 percent , the tax rate of enterprise income tax in the High-tech zones is 10 percent under the approval of tax authorities. In addition, this notice also authorized preferential policies to encourage technology transfer. Among High-tech industries, the main objective of the preferential police was Electronic Information Industry. Based on the 'Tax policies on encouraging the development of Software Industry and Integrated Circuit Industry', the tax rate of enterprise income tax is 15 percent for new established companies in these two industries from 2000; and moreover for companies which obtain profits for the first time, a two-year full exemption of enterprise income tax will be offered, continued by a three-year half exemption. In 2008, the 'Enterprise Income Tax Law of the People's Republic of China' was implemented formally, which authorized the unification of two taxation systems on domestic and foreign companies and the 20 percent unified tax rate. This law also approved a 15 percent tax rate for High-tech companies which need the support by the state. According to the new law, identified High-tech enterprises would not be in the High-tech zone definitely, which was an improvement relative to the 'Administration Work on identification of High-tech Enterprises' issued several years ago.

For the enlargement of the scope and proportion of tax credit, according to the 'Regulation of Tax Policies on Encourage the Technical Progress of Enterprises' in 1996, the R&D fees can be deducted by the proportion of 150 percent before the income tax. This regulation also authorized strict conditions of tax deduction that the deduction should be only permitted for profitable companies whose R&D fees in this year is greater than last year by at least 10 percent, the 50 percent above quota should be lower than total income tax in the current period, and forward or backward transfers of the tax deduction is strictly prohibited. In the 'Enterprise Income Tax Law of the People's Republic of China' implemented in 2008, the 50 percent additional deduction of R&D fees was retained and above restrictions was cancelled. Additionally, machines of electronic enterprises can be depreciated at an increasing rate, which was regulated in the 'Regulation of Tax Policies on Encourage the Technical Progress of Enterprises' in 1996 was implemented continually after the implementation of the income tax law. With the reform of enterprise value-added tax in 2009, the depreciation of fixed assets entered the scope of tax credit; therefore the implementation of the increasing-rate depreciation of High-tech companies was not only good for reducing income tax but also for value-added tax.

1.2 The Trend of the Tax Burden of China's High-tech Industry

On the grounds of the above analysis, 1996 and 2000 were crucial points of promoting the development of China's High-tech industry with on doubt. However, from the perspective of the tax burden of China's High-tech industry, the burden in 1996 was not decreased obviously relative to 1995, the same for 2001 relative to 2000. This had two main reasons: the first one is that besides mentioned preferential tax policies above, China's local governments also issued other ones to motivate the High-tech industry including consumption tax, sale tax and so on; the second one is that before the unification of two tax systems of domestic and foreign enterprises, foreign High-tech companies, which accounted an large part of the total High-tech industry, had been already offered a 15 percent preferential tax rate, therefore a 15 percent preferential tax rate of income tax of High-tech companies not causing distinct reduction of tax burden of the total industry.

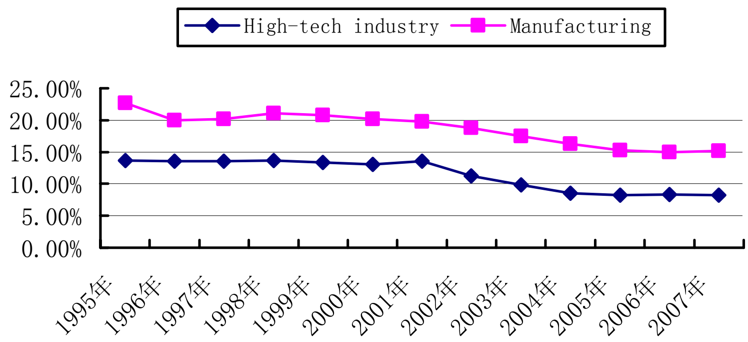

Figure 1 The Tax Burden of High-tech Industry and Manufacturing

Source: China's Statistics Yearbook ON High-tech Industry

But it should be also realized that fiscal policies of advancing the High-tech industry lowered the tax burden of High-tech enterprises. From the time, after 1996 there was a decreasing trend in the macro tax burden of China's High-tech industry. Specifically, the macro tax burden of China's High-tech industry was 13.7 percent in 1995, and decreased to 13.1 percent in 2000 and to 8.2 percent in 2007. From the perspective of the comparison between different industries, the tax burden of the High-tech industry was obvious lower than that of Manufacturing as a whole. As early as 1995, the average tax burden of China's High-tech industry was lower than that of Manufacturing by 9 percent before the implementation of the tax deduction. After that, the tax burden of Manufacturing also descended to some extent, but still greater than that of High-tech industry by 6 percent on the average.

For different sectors in the High-tech industry, Manufacture of Medicines and Manufacture of Medical Equipments and Measuring Instrument had the highest tax burdens which were 15.1 percent and 10.8 percent in 2007 respectively, greater than the average level. Manufacture of Computers and Office Equipments had the lowest one which was only 3.4% in 2007. For the structure of different High-tech sectors, if the foreign enterprises accounted a large proportion, the tax burden would be lower and not so volatile relatively over time. For example, for Manufacture of Computers and Office Equipments, the lowest tax burden sector, there were 121 projects in 2007 in total and foreign companies accounted 58 with the proportion of 47.9 percent, much greater the average level of 17.4 percent. Due to more tax deduction of foreign companies and relative stability of related policies before the unification, the tax burden was much lower in high foreign proportion sector and also the extent of the tax burden fluctuation.

Table 1 The Tax Burden of Sub Sectors of High-tech Industry

	2003	2004	2005	2006	2007
Average Level	9.8%	8.5%	8.2%	8.3%	8.2%
Manufacture of Medicines	18.3%	17.5%	16.1%	15.0%	15.1%
Manufacture of Aircrafts and Spacecrafts	9.2%	4.9%	5.8%	6.1%	4.1%
Manufacture of Electronic Equipment and Communication Equipment	8.3%	6.4%	6.9%	7.5%	7.2%
Manufacture of Computers and Office Equipments	3.8%	4.6%	3.7%	3.9%	3.4%
Manufacture of Medical Equipments and Measuring Instrument	14.4%	12.7%	11.5%	10.7%	10.8%

Source: China’s Statistics Yearbook ON High-tech Industry

2 Theoretical Analysis

2.1 Literature Review

Today, there are a large number of literatures concentrating on the effect of fiscal policies on the promotion of High-tech Industry, which make use of two main methods.

The first one is investment effect by fiscal policies, which can influence the industry size. Gordon&Jorgenson (1974) calculate to what extent the tax credit of investment tax can influence investment base on the data from 1964 to 1974 and argue that if the rate of the investment tax credit grows from 7 percent to 15 percent, investment rate will increase by 12.5 percent approximately. Eckstein（1976）analyzes the influence of enterprise income tax to investment by building 800 models using the data from 1970 to 1980 of U.S., and concludes that if the enterprise income tax rate falls from 33 percent to 15 percent, the capital stock and the investment of companies will increase by 9.9 percent and 15.5 percent respectively. Feldstein&Fane(1973) compute the influence of tax to private investment by using the data of U.K., and conclude that for every one percent decrease of investment yield tax rate, total private investment will raise by 0.6 percent approximately.

The second one is technology effect by fiscal policies, which can influence the industry efficiency. Gorgenson(1981) analyzes the relation between the fiscal encouraging and the technology level, and confirms that the tax rate of capital has an obvious negative relation with technology progress, high capital tax rate could cause low technology progress , vice verse.

In sum, most literatures reach one point that reducing tax rates could cause the enlargement of industry size the progress of industry technology level. However, the main objective of the empirical research of these studies is developed countries. For China, a big developing country with 'dual-gap', owing to different develop stages, the conclusion may be not the same as developed countries. Besides other conditions, China's High-tech industry development is connected closely with Foreign Direct Investment (FDI) inflow under the background of globalization especially. As a result, the influence of fiscal polices to China's High-tech industry development requires further quantitative analysis.

2.2 Index Determination

2.1.1 The Measurement of the encouraging extent of fiscal policies

According to the former analysis, only implemented polices are not enough to reflect the encouraging extent to China's High-tech industry. This paper will analyze the real encouraging extent to China's High-tech industry by fiscal policies through the fluctuation of the macro real tax burden, which leads to the requirement of a relative index. In order to do this, the gap between the tax burden of Manufacturing as a whole and that of High-tech industry can be employed to reflect the encouraging extent of fiscal policies. The formulation is as follows,

$$TAXF=TAXM-TAXH$$

where TAXM is the macro tax burden of Manufacturing as a whole and TAXH is that of High-tech industry or one sub sector.

2.2.2 The Measurement of the Innovation Capacity of China's High-tech Industry

Compared with traditional industries, besides gross product, value-added, tax and so on, the innovation capacity and the technology level are more suitable to reflect the development of China's High-tech industry. Generally speaking, Total Factor Productivity (TFP) is often used to measure the development level of one industry. However, it is difficult to obtain TFP directly and econometric models have to be used. But different econometric models tend to reach different outcomes, which illustrates that the calculation of TFP index is subjective to some extent. In this paper, the value-added rate is employed to measure the innovation capacity and the technology level of China's High-tech industry, where the value-added rate is the proportion of value-added product relative to gross product. Under unchanged input, higher value-added rate means more output, which can exemplify the effect of technology progress in producing and reflects more innovation capacity. The formulation is as follows,

$$VAD\_RATE=VAD/OUTPUT$$

where VAD_RATE is the value-added rate to measure the innovation capacity and the technology level, VAD is value-added product in the industry level and OUTPUT is gross product。

2.3 Theoretical Model

There are two ways to measure the effect of fiscal policies on the advancement of China's High-tech industry: first, the influence of policies on the industry size will be depicted and the main variable being explained is the gross product of the industry; second, whether the innovation capacity has been triggered by policies will be analyzed based on characters of China's High-tech industry and the main variable being explained is the value-added rate created above.

2.3.1 Industry Size Analysis

In traditional production functions, output can be mainly explained by capital and labor. In this paper, the focus is the effect of fiscal policies, therefore the variable of the encouraging extent of fiscal policies entering the function. The new model is as follows:

$$HIOUTPUT = f(K, L, TAXF) \qquad (1)$$

where K is capital stock and in this paper the data source of K is the 'Original Value of Productive Equipment' from China's Statistics Yearbook ON High-tech Industry; L is the volume of labor force and TAXF is the encouraging extent variable.

2. Innovation Capacity and Technology Level

The variable of the innovation capacity of China's High-tech industry created above will be employed to measure the industry competitiveness. According to other literatures, the Research and Development (R&D) input and the quality of labor force are generally main elements influencing the innovation capacity and the technology level of industry. Specifically, more R&D input can trigger the increase of the innovation capacity, therefore causing the increase of the value-added rate; in the total labor force, if research and development personnel account for a higher proportion, the innovation capacity of one industry will be higher relatively. By introducing the variable of the encouraging extent of fiscal policies, a new model can be reached,

$$VAD\_RATE = f(R\&D, HR, TAXF) \qquad (2)$$

where VAD_RATE is the value-added rate to measure the innovation capacity of China's High-tech industry, R&D is the Research and Development input, HR is the proportion of research and development personnel relative to total labor force and TAXF is the encouraging extent variable.

3 Empirical Analysis

In China, different sub sectors of High-tech industry have different backgrounds. Electronic and Information Industry has a close connection with the inflow of FDI and the market demand is the main promoting factor of the industry development. Manufacture of Aircrafts and Spacecrafts has a tight relation with the state strategy and large scale companies account for a great proportion in this industry. Thus, different backgrounds lead to different tax burdens. Moreover, due to the industry character, the R&D input and the quality of labor force are not the same across sub sectors. As a consequence, panel data will be employed in the empirical work to the influence of fiscal policies on different sectors. The data is all from the 'China's Statistics Yearbook ON High-tech Industry' and in the form of natural logarithm.

3.1 Output Analysis

High-tech industries are mostly technology intensive and capital intensive and therefore labor yield a limited influence. In the calculation, labor has only a little effect on industry output and therefore is deleted from the model. In regression, the data from 1996 to 2007 are used based on formula (1). After Hausman Test, outcomes in table 2 can be reached by adopting fixed-effect model of panel data.

In table 2, C is the constant term, TAXF_M, TAXF_AS, TAXF_EE, TAXF_CO, TAXF_MM represent the encouraging extent of fiscal policies on Manufacture of Medicines, Manufacture of Aircrafts and Spacecrafts, Manufacture of Electronic Equipment and Communication Equipment, Manufacture of Computers and Office Equipments and Manufacture of Medical Equipments and

Measuring Instrument respectively. Based on the test of equations, adjusted R-square can reach 0.92, which illustrates that variables selected can represent explaining factors of the output of China's High-tech industries.

For explaining variables, capital stock is deterministic on output and if it rises by 1 percent, output will increase by 0.8 percent. For the variable of the encouraging extent of fiscal policies, the influence is not the same across sectors. Based on regress outcomes, the t-value of Manufacture of Medicines and Manufacture of Aircrafts and Spacecrafts is higher than that of other sectors relatively, which indicates that fiscal policies have more obvious effects on these two sectors. The elasticity coefficients of the encouraging extent for these two sectors are 0.19 and 0.37 respectively, which states that if the encouraging variable grows by 1 percent, the output of Manufacture of Medicines and Manufacture of Aircrafts and Spacecrafts will increase by 0.19 percent and 0.37 percent respectively. Among the other three sectors, the encouraging variable is not significant, which states that fiscal policies have limited effects on these sectors.

Table 2 Regress Outcomes of the Output Equation

Dependent Variable: Ln(OUTPUT)

Method: Pooled Least Squares

Sample (adjusted): 1996 2007

Included observations: 12 after adjustments

Cross-sections included: 5

Total pool (balanced) observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.38	1.25	-5.11	0.00
Ln(K)	0.81	0.08	10.51	0.00
Ln(TAXF_M)	0.19	0.08	2.55	0.01
Ln(TAXF_AS)	0.37	0.25	1.45	0.15
Ln(TAXF_EE)	0.20	1.04	0.19	0.85
Ln(TAXF_CO)	0.06	0.10	0.61	0.55
Ln(TAXF_MM)	-0.39	0.54	-0.73	0.47

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.93	Mean dependent var	7.34
Adjusted R-squared	0.92	S.D. dependent var	1.27
Log likelihood	-17.87	Hannan-Quinn criter.	1.11
F-statistic	68.37	Durbin-Watson stat	1.54
Prob(F-statistic)	0.00		

Source: The Author's Caculation

3.2 Innovation Capacity Analysis

The equation of panel data has been created to analyze the innovation capacity of High-tech industry based on formula (2) and the sample is from 1995 to 2007. The variable being explained is the value-added rate and explaining variables are the R&D input, the proportion of research and development personnel relative to total labor force and the encouraging extent variable. By Hausman test, outcomes in table 3 can be reached by adopting fixed-effect model of panel data.

Table 3 Regress Outcomes of the Innovation Capacity Equation

Dependent Variable: Ln(VAD_RATE)

Sample (adjusted): 1995 2007

Included observations: 13 after adjustments

Cross-sections included: 5

Total pool (balanced) observations: 65

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.50	0.21	-2.36	0.02
Ln(HR)	0.17	0.06	2.74	0.01
Ln(R&D)	0.05	0.02	2.42	0.03
Ln(TAXF_M)	0.01	0.06	0.13	0.90
Ln(TAXF_AS)	-0.01	0.05	-0.16	0.87
Ln(TAXF_EE)	0.20	0.15	1.36	0.18
Ln(TAXF_CO)	0.86	0.16	5.53	0.00
Ln(TAXF_MM)	-0.09	0.09	-0.94	0.35
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.93	Mean dependent var		-1.33
Adjusted R-squared	0.92	S.D. dependent var		0.22
Log likelihood	94.08	Hannan-Quinn criter.		-2.37
F-statistic	65.35	Durbin-Watson stat		1.68
Prob(F-statistic)	0.00			

Source: The Author's Caculation

According to regress outcomes, the adjusted R-square reaches 0.92, which states that selected variables can reflect main elements on influencing the innovation capacity of China's High-tech industry. Specifically, the significances of the proportion of research and development personnel and R&D both exceed 5 percent and the coefficients are positive, which indicates that these two variables are imperative to determine the innovation capacity of China's High-tech industry. The coefficient of the proportion of research and development personnel is 0.17 and that of R&D is 0.05, which illustrates that the influence of the former variable is greater relatively.

Not the same as output equations, the encouraging extent variable of fiscal policies has some positive effects on the innovation capacity of Manufacture of Electronic Equipment and

Communication Equipment and Manufacture of Computers and Office Equipments to some extent, but not significant on other sectors. Specifically, the t-values of these two sectors are 2.74 and 2.42 respectively, both passing the significance test at 1 percent and 3 percent. Moreover, the elasticities of the encouraging variable of these two sectors are 0.2 and 0.86 respectively, which means that fiscal policies have more influence on the latter sector relatively. For the other three sectors, it can be concluded that fiscal policies have little influence on their innovation capacities because the statistical test is not significant.

4 Conclusion

With China's Reforming and Opening, especially after 1990s, a number of fiscal polices have been implemented to promote the development of High-tech industry. As a result, the tax burden of China's High-tech industry was much lower than that of Manufacturing as a whole in the same period and had a decreasing trend over time. However, for sub sectors of China's High-tech industry, the tax burden was not the same across sectors. Because of more preferential policies on foreign companies, the tax burdens of Manufacture of Electronic Equipment and Communication Equipment and Manufacture of Computers and Office Equipments, with high proportion of foreign companies, were lower than the average level of High-tech industry as a whole. According to outcomes derived from the panel data model with the sample since 1995, fiscal policies have supported the advancement of China's High-tech industry indeed, but the influence on different sub sectors is not the same. Specifically, fiscal policies have more effects on the output of Manufacture of Medicines and Manufacture of Aircrafts and Spacecrafts, and on the innovation capacity of Manufacture of Electronic Equipment and Communication Equipment and Manufacture of Computers and Office Equipments.