UUExport Taxes Policy and Industry Growth: Chinese Steel in 1990s and 2000s

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Abstract: This paper presents an overview of the development of Chinese steel industry. Chinese steel sector has made impressive progress both in quantity and quality in the past three decades. Many researchers have speculated the reasons for this miracle. Many of them thought that the rapid economic development, the process of industrialization and urbanization, and the increase in fixed asset investment are important success factors contributing to this miracle. However, considerable debate still exists as to whether export-promoting policies were another key driving force behind the miracle. This article develops a dynamic computable general equilibrium model to simulate the effect of export taxes policy on Chinese economics and industries especially steel industry. The simulation results indicate that the effect of canceling export rebates on steel export performance is not obvious while imposing export tariff on steel products, the growth rate of steel products export will decline significantly, and the influence of imposing export tariff on primary steel products is much more than on finished steel products. This shows that Chinese government could gain different short-run results on balancing steel trade surplus by canceling export rebates and imposing export tariff, the effect of the latter one is more obvious than the former.

Key words: Steel industry; Export rebates; Computable general equilibrium model; Industry growth

1. Introduction

Chinese steel sector has made impressive progress in the past three decades. According to the statistics from National Statistics Bureau, Chinese crude steel production climbed from 108.9 million tons in 1997 to 489.71 million tons in 2007, increasing by 34.97% year on year. Chinese crude steel production has entered a new fast developing period, the growth rate keeps increasing every year. This is not only fitted with rapidly growing domestic demand but also stimulated steel exports, which grew at over 40% annually. China became the world's largest steel producer since 1996, and had been the world's largest steel exporter in 2006 for the first time, surpassing Japan, Russia, and the European Union.

Many researchers have speculated the reasons for this miracle. Many of them thought that the rapid economic development, the process of industrialization and urbanization, and the increase in fixed asset investment are important success factors contributing to this miracle.

(1) The development of the national economy dominates the steel's consumption cycle

Tab.1 Steel consumption per unit of GDP in China

	GDP (0.1 billion Yuan)	Apparent consumption of steel products (10000 tons)	Per unit GDP steel consumption (tons/10000 Yuan)
1995	58478	9784	1673.1
1996	67885	10511	1548.4
1997	74463	10848	1456.8
1998	78345	11623	1483.6
1999	82068	13220	1610.9
2000	89468	14121	1578.3
2001	97315	17316	1779.4
2002	105172	21122	2008.3
2003	117252	27103	2311.5
2004	136515	31246	2288.8
2005	182321	37649	2065.0
2006	209407	44235	2112.4
2007	249530	48762	1954.2

Tab.1 showed the change of Chinese per unit GDP steel consumption from 1995 to 2007. As can be seen in Tab.1, per unit GDP steel consumption in 1995 was 1673.1 tons/10000Yuan. From 1996 to 2000, per unit GDP steel consumption was lower than in 1995. It was a slight decline stage. Since 2000, with the rapid development of Chinese economy, the level of Chinese per unit GDP steel consumption kept going up, from 1779.4 tons/10000Yuan in 2001 to 2311.5 tons/10000Yuan in 2003. Although the growth rate of per unit GDP steel consumption declined since 2004, it remained high level. The national economic rapid development provides a good opportunity to the steel industry.

(2) Fixed assets investment plays a key role on impacting steel consumption

Developed countries had realized the economic development model of the consumer demand-driven economy, but in China, to a large extent, the domestic demand expansion depends on the growth in fixed asset investment (FAI). Fundamentally speaking, in recent years, the growth of Chinese steel consumption mostly benefits from a series of FAI projects which represented by the domestic real estate, ports, bridges, roads, railways, and pipeline construction and so on. This kind of Changes in the process of fixed assets investment in steel industry can be divided into three phases as follows:

The first phase (1991-1995): the "Eighth Five-year Plan" period was the phase of expansion of steel investment. In 1991 China had a 9.2% growth rate in GDP, and kept an average annual growth rate of over 10% from 1992 to 1995. A corollary of this growth is China’s increasing demand for steel products. Investment in steel sector increased largely, the investment rose 4.47 times from 12.7 billion Yuan in 1991 to 56.8 billion Yuan in 1995, an average annual increase rate reached 34.8%. After discounting the effect of factors such as inflation, from 1991 to 1995 the average annual real growth rate was 19.0%.

The second phase (1996-2000): the "Ninth Five-Year Plan" period was the phase of the investment contraction. After Chinese economy experienced five years rapid growth, it turned to down from 1996, particularly due to the impact of the Asian financial crisis, in 1997 and 1998, GDP growth rate fell below 8%. It had a suppression role on steel demand and steel investment. In this phase, the year-on-year of the FAI growth rate is not high. However, in addition to 1999, from 1996 to 2000, the year-on-year growth rate of FAI was still higher than that of steel consumption growth rate year-on-year (Tab.2).

Tab.2 Fixed assets investment and steel consumption growth rate in China

	The year-on-year growth of FAI	Apparent consumption (10000 tons)	The year-on-year growth rate of steel consumption
1996	14.8%	10511	7.43%
1997	8.8%	10848	3.21%
1998	13.9%	11623	7.14%
1999	5.1%	13220	13.74%
2000	10.3%	14121	6.82%
2001	13.0%	17316	22.63%
2002	16.1%	21122	21.98%
2003	26.7%	27103	28.32%
2004	25.8%	31246	15.29%
2005	27.7%	37646	20.49%
2006	24.5%	44235	17.49%

The third phase (2001-2005): the "Tenth Five-Year Plan" period was the rapid growth period in steel investment. Since 2001, the national economy had a rapid growth, from 2003 to 2005 the consecutive three years average annual GDP growth rate maintained over 10%. This brought the consecutive five years maintained a high growth of the FAI in steel industry and with an average more than 30% annual growth rate. In 2003 the annual growth rate even exceeded 100%. During the "Tenth Five-Year Plan" period, the total investment reached 716.7 billion Yuan. It was 2.3 times more than that of in the "Ninth Five-Year Plan" period. According to the same conversion price, the investment amounted to 338.7 billion Yuan. It was 2.1 times more than that of in the "Ninth Five-Year Plan" period. The proportion of FAI increased to 2.4 % from 1.6% in the "Ninth Five-Year Plan" period".

2006 was the first year of Chinese "Eleventh Five -Year Plan". Although the central government tried to control the overheating situation of FAI in 2006, but in China, the overheating FAI situation has not fundamentally changed. In the first half of 2006, its growth rate even reached 31.3 percent. In 2008, the investment rose to 324 billion Yuan, the growth rate is 23.8% compared with the same period of 2007, the growth rate was 11.6% higher than in 2007.

(3) The process of industrialization and urbanization is an important force to promote the demand for various steel products

During the past three decades, the driving force behind China's economic development was the high-speed growth of textile and light industries which are aiming at solving the problem of food and clothing. While in recent years, the new economic growth poles are dwelling, automobile, education and urban infrastructure construction which are closely related to people's housing and transportation. As we know, such a consumption upgrade is based on steel consumption. At present, Chinese shipbuilding, automobiles, household electrical appliances such as refrigerators, electrical and mechanical equipment, and petrochemical equipment are all in high-speed growth. Many Chinese industrial products have become or are about to become the first in the world. China has become the largest manufacturing base all over the world. This illustrates the huge potential of China's plate products.

However, considerable debate still exists as to whether export-promoting policies were another key driving force behind the miracle. Some researchers judge that governments shaped the course of development, whereas others discount the role of government trade policies in the development process (Hiroshi Ohashi, 2004). Understanding the extent to which policy instruments contributed to rapid growth in Chinese steel industry is very important for policy maker to optimize the development policies for steel industry. For example, Chien-Hsun Chen (2006) develops a cournot quantity competition model to examine the effect of export tax rebate policy on export performance. Its test results of Spearman rank correlation coefficient show that China's export tax rebate policy has significant positive correlation with its exports, final domestic consumption, and foreign exchange reserve. Chen Kexin (2005) analyzed the change of domestic steel market due to the abolition of export rebates on steel billet. Wang Feibo and Lu Hongfen (2006) took Zhejiang local finance as an example and analyzed the impact on local finance for the different export ways. Zhang Shibao, Luo Yehua (2005) according to steel market shares analyzed favorable and unfavorable factors of the export rebates policy for the steel industry. These literatures provided much constructive ideas for us. However, all these literatures did not keep an eye on the economic impacts of export taxes policy on macro economy and steel industry.

This paper tries to build a model to introduce the export taxes policy variable into computable general equilibrium (CGE) model. Using this model, simulation allows us to consider different scenarios, and then show people a relative details and comprehensive analysis of the economic impacts of export rebate, thereby analyzing the contribution of government polices to economic growth.

The paper is organized as follows: Section 2 presents an overview of the Chinese steel industry, including production, consumption and demand prospect, international trade, technology efficiency and institutional development, and the policy of steel export taxes. Section 3 presents the empirical analytical framework, including the overview of MCHUGE and ways to explain the results. Section 4 presents simulation scenarios and results. Section 5 provides conclusions and policy implications.

2. The steel industry in China

2.1 Development Status

2.1.1 Production

In 1949, China's crude steel production amounted to 0.158 million tons. After three years of economic recovery period, Chinese crude steel production has reached 1.35 million tons in 1952. After the first Five-Year Plan, in 1957, it was 5.35 million tons, ranked No.9 in size in the world. In 1996, China's production of crude steel amounted to 101.24 million tons, rose to World No.1. In 2004, Chinese crude steel output reached 282 million tons with an annual growth rate of 24.8 percent, accounted for 26.24 percent of world total output (1.05 billion tons). Chinese crude steel output was the sum of that of Japan, USA and Russia. After the four consecutive rapid growth years appeared from 2001, in 2005 this growth rate declined firstly and was 24.8%. It decreased 2.4% compared with 27.2% in 2004. In 2006, Chinese crude steel output reached 422 million tons (Fig.1), which was the output sum of USA, Japan, South Korea, Russia, Germany and India. The year-on-year growth rate dropped slightly to 19.7 percent compared with 2005. Despite the current growth rate of Chinese steel industry declined, but because of the high base level, so the absolute increment of steel industry is still very high. As a result, China's share of world steel production increased from 14.75% in 1998 to 36.62% in 2007 (Tab.3).

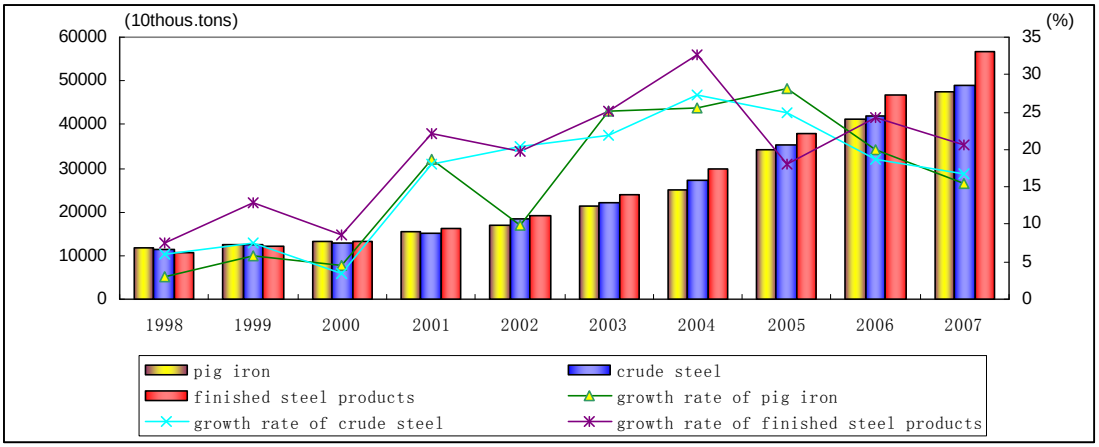

Fig.1 Output of major steel products

Tab. 3 Production of crude steel (million tons)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
China	114.6	123.9	127.2	150.9	182.2	222.4	280.5	355.8	422.9	494.9
World	777.3	788.9	847.7	850.3	904.1	969.9	1069.1	1146.7	1251.2	1351.3
% of world total	14.74	15.71	15.01	17.75	20.16	22.93	26.24	31.03	33.81	36.62

Source: Steel Statistical Yearbook 2008

In China, the steel industry has development in a unique way. Rather than specializing in particular production stages, many enterprises have produced a range of products from pig iron to crude steel to finished steel products. There were 1346 steel plants in 1980, 1639 steel plants in 1995, and 7161 steel plants in 2007. In 2005, China had 34 steel enterprises with annual production capacity more than 3 million tons. Among them, numbers of steel enterprises with annual production capacity more than 10 millions tons increased from 2 in 2004 to 8, numbers of steel mills with annual production capacity between 5 to 9.7 millions tons and between 3 to 5 millions tons are 10 and 16, respectively. A large number of small- and medium-sized steel enterprises were distributed across the country. Almost every province (except Tibet) has been involved in all stages of steel production from mining iron ore to producing pig iron, crude steel and finished steel products.

The four largest crude steel producers in 2007 were Hebei (105.69mts), Jiangsu (47.21mts), Shandong (44.07mts) and Liaoning (41.40mts). The shares of these four regions in crude steel are 21.58%, 9.64%, 9.0% and 8.45%. In terms of the number of steel mills (including ferroalloy mills), however, the four largest regions were Jiangsu (1104)，Zhejiang (736), Liaoning (547) and Hebei (494). This situation gives rise to serious concerns about the economies of scale and the industrial concentration degree in China's steel sector. The CR4[1] and CR10 leveled off from year 1992 to 2000, about 30% and 50%, respectively. Yet, since 2001 it declined sharply, by 2004, CR4 has lowered to 18.52%, which was reduced by 12% since 1992; CR10 also reduced by 15% since 1992 and stayed at the level of 34.77%. In 2006, CR10 further decreased to just 29.4%. Chinese steel industry is far from oligopoly. On world stage, number of big steel producers such as America, Japan, Korea and Russia have shared 60% to 80% of their own markets. For example, in 2004, the CR4 is 99.0％ in Brazil, 88.3％ in South Korea, 73.2％ in Japan, 67.7％ in India, 61.1％ in America and 69.2％ in Russia. The world steel markets are almost of oligopoly, some are incredibly highly of, such as Mittal and Arcelor, the world's Top 2 steel groups, the total production of them accounted for 10% of world's total. At the same time, the Top 1 steel enterprise of China names Bao Steel, its production only accounted for 6.50% of China's total in 2005, down by 1.36% than that of in 2004 (Lafang Wang, 2008).

In order to benefit from economies of scale and improve the industrial concentration degree, mergers and acquisitions (M&As) have been strongly encouraged by both government (including local government and central government) and enterprises. In 2005, Chinese government has issued the Guideline of Chinese steel industry Development, which is a guideline for the long-term development of Chinese steel industry. The development of the steel industry will be directed towards controlled volume, technology upgrade, industrial layout and product mix adjustment, so as to combine the impact of an increase in new capacity with the phasing out of laggards. According to the guidance, for example, blast furnace less than 300 M3 (total annual production capacity is 99.8 million tons) and EFT (Electric Furnace Transformer) less than 20 MT (total annual production capacity is 55 million tons) will be on

[1] CRn is the absolute degree of concentration index， means total market share of Top n firms in this industry.

the way of eliminating in 2006. The market concentration of China's ten largest steel makers' turnover amongst the total steel production (i.e. CR10) to over 50% by the year of 2010 and to reach 70% by the year of 2020 (Lafang Wang, 2008).

Under intense pressure from the interaction arising from global industrial concentration, and the pressure from China governments (both local and central government) administration targets, since 2005, Chinese steel enterprises have put focused attention on mergers and acquisitions (M&As). For example, An Steel acquired Ben Steel to form the new An-Ben Group; Wu Steel acquired E Steel and restructured Liu Steel in Guangxi province whilst now is trying to purchase Kun Steel; three steel giants in Hebei province Tang Steel, Yi Steel and Cheng Steel have been merged as a New Tang Steel; Bao Steel acquired Ba Steel, and so on. These have made enterprises scale expanded and stir up inner metamorphoses to boost competitiveness. Chinese steel companies have stepped in high M&As period with adversaries getting fiercer. Of course, due to the limitation of resources and hence constraint on the scale of operation, the domestic M&As is not all for Chinese steel industry's future strategy. They are looking to diversify their skills by entering more overseas markets, and seeking foreign investment at home to help drive growth and consolidate their positions in an increasingly competitive domestic market, although political business cycles in the steel industry have occurred as the result of both trade protection cycles and price control programs (Michael Tansey, 2005; R. Glenn Richey Jr., 2007). For instance, the world Top 1 and Top 2 steel giants Mittal and Arcelor purchased 36.67% and 38.44% shares of Hualing Steel and Lai Steel, respectively, with a 15% net premium asset price, aiming at exploration of Chinese mainland steel market. It is apparent that Chinese steel industry growth strategists will continue to adopt M&As as a feasible means to increase the industrial concentration degree in the 21st century (Lafang Wang, 2008).

In general, production in all categories of steel products has expanded significantly in the past three decades in China (Tab.4). In 2007, wire production is 79.2 million tons, account for about 13.99% of China's steel products. At the same year, concrete reinforcing bars products account for about 18.34% of China's steel products. China's steel production is still biased towards long products such as wires and sections; account for over 50% of China's total steel products, namely, China's steel production is mainly in lower value-added long products but lack of high value-added sheet products. The structure of steel production may reflect China's steel consumption pattern. Long products are mainly used in the development of infrastructure such as construction industry and flat products are mainly used in the manufacturing sector such as electrical appliance industries and automotive industries (Yanrui Wu, 2000; Jinlong Ma, 2002). In China, wire rod, medium plate and concrete reinforcing bars are the major consumption products.

Tab.4 Output of major steel products (10000tons)

	1997	Share (%)	2007	Share (%)
Steel products for railway	152.38	1.53	316.91	0.56
Large section	130.63	1.31	1035.44	1.83
M&S section	2954.88	29.59	2927.02	5.17
Concrete Reinforcing Bars	-	-	10390.94	18.34
Wire rod	1953.64	19.56	7920.97	13.99
Ultra-heavy plate	52.59	0.53	474.05	0.84
Medium plate	1195.88	11.97	8212.9	17.44
Sheet	1466.8	13.66	6864.81	14.58
Seamless pipe	346.7	3.23	1867.34	3.30
Welded pipe	450.6	4.20	2371.11	4.19

Source: The yearbook of iron and steel industry of China in 1998 and 2008.

2.1.2 Consumption and Demand prospects

Growth in Chinese steel production is largely driven by the burgeoning demand in the Economy. As we know, China has achieved an average annual growth rate of 9.8% during the past three decades. This continuing growth is indeed spectacular. A direct effect of such growth is the burgeoning demand for raw materials such as steel.

Tab. 5 Apparent steel use (million tons)

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Apparent steel use (crude steel equivalent)	China	122.9	136.2	138.1	170.6	205.7	258.6	296.6	361.9	393.4	426.6
	World	773.8	784.3	845.0	855.3	910.9	971.9	1068.8	1134.5	1242.4	1317.3
	% of world total	15.89	17.36	16.34	19.95	22.58	26.61	27.75	31.91	31.67	32.39
Apparent steel use (finished steel products)	China	110.6	122.6	124.3	157.9	191.3	240.5	275.8	340.2	369.8	413.7
	World	692.2	706.8	760.6	777.6	828.8	893.6	980.7	1044.8	1137.9	1221.0
	% of world total	15.98	17.34	16.34	20.32	23.08	26.91	28.13	32.56	32.50	33.88

Source: Steel Statistical Yearbook 2008

Apparent consumption of steel products in China grew from 97.85 million tons in 1995 to 520.29 million tons in 2007. Over past twelve years the domestic steel apparent consumption increased 422.44 million tones, which grew at over 30% annually. As a result, China's share of world steel consumption increased from about 16% in 1998 to about 33% in 2007 (Tab.5).

The major users of steel in China are construction, mechanism, shipbuilding, automobile, household appliances and Container and so on (Tab.6). This reflects the increasing domestic demand for housing, transport equipment and so on. The average annual growth rate of these major users of steel in 2006 in China is about 30%. Moreover, power supply is one of the main bottlenecks in the Chinese economy. China is undergoing a power expansion and reform program. According to CRS report, in 2008, China was ranked 5th globally in installed wind power capacity, with about 6 gigawatts (GW). Wind capacity is projected to be 20 GW by 2010 and 100 GW by 2020. The Global Wind Energy Council expects China to become the largest wind turbine market in 2010 (CRS report, 2008). It is reflects that there will be significant improvements and expansions in electricity generation in the near future in China. As a result, the demand for households appliances, in particular in the rural areas will increase. Furthermore, recent rural reforms in the "Home Appliances to the Countryside" Scheme and the "Automobiles to the Countryside" Scheme may provide new stimulus to the largely untapped rural consumption market, and then lead to a boom in demand for raw materials such as steel products.

Tab.6 Consumption of steel products by major sectors: 1998-2006 (10000 tons)

	Construction	Mechanism	Automobile		Shipbuilding	Railway
			Automobile	Agricultural vehicles		
1998	5235	1200	379	250	140	260
1999	6315	1600	437	274	130	270
2000	7335	2000	498	257	160	280
2001	8980	2400	638	220	200	290
2002	10520	2750	910	220	225	300
2003	12813	3163	1230	220	250	330
2004	15753	3864	1516	268	297	446
2005	19672	4825	1893	334	371	557
2006	25574	6273	2461	434	482	724
	Petroleum	Household	Container	Total	Total	%
1998	125	283	143	8012	11623	68.93
1999	120	325	170	9641	13220	72.9%
2000	130	360	230	11250	14122	79.66
2001	170	387	165	13450	17315	77.68
2002	290	455	180	15850	21122	75.04
2003	400	555	252	19213	26603	72.22
2004	505	892	297	23838	31200	76.40
2005	631	1114	371	29768	37100	80.24
2006	820	1448	482	38698	47600	81.30

Although large in aggregate terms, Chinese consumption of steel on a per capital basis is still low in comparison with other countries (Tab.7). For example, in 2007, the apparent steel use per capita (kilograms crude steel equivalent) in China was 321.1 while South Korea was 1190.5, 2114.9 in Qatar and 653.2 in Italy. This gap illustrates the huge potential of Chinese steel market. In order to catch up with other industrialized countries, China may require more crude steel and refine products to feed its construction and manufacturing sectors particular in the rural areas. This presents opportunities as well as challenges to Chinese steel industry as well as to the global steel industry.

2.1.3 International trades

Associated with the high growth in production and consumption is China's rising role in international steel trade. From 1995 to 2005，total apparent consumption of steel products (2.045 billion tons) was larger than the total domestic steel production (1.905 billion tons), the self-sufficiency rate was 93.14%, 6.96% relied on imported products. Since 2006, with the improvement of steel technologies, Chinese steel production was larger than its demand, as a result, steel exports expanded rapidly. For example, Chinese imported steel products amounted to 5.006 million tons in 1980 and peaked in 2003 at about 37.169 million tons. In 2005, imports of steel products had dropped to 25.81 million tons, and further declined to 16.87 million tons in 2007. While exports of steel products expanded gradually, exports volume of semi-finished and finished steel products was 8.507 million tons in 1997 and reached 51.706 million tons in 2006, surpassed Japan and became the world's largest steel exporter. International trade have gained foreign exchange through exports and hence imported advanced technology for China.

Tab.7 Apparent Steel Use per Capita

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
kilograms crude steel equivalent										
China	98.4	108.1	108.7	133.4	159.7	199.4	227.3	275.7	297.8	321.1
Hong Kong	764.4	765.5	784.2	749.2	727.1	703.1	739.7	594.3	553.2	547.1
Japan	573.3	560.1	626.6	590.9	577.3	598.5	629.9	648.9	651.0	671.3
South Korea	559.0	757.3	855.1	843.8	960.2	1000.2	1029.8	1023.6	1086.8	1190.5
Singapore	1261.7	945.4	927.9	865.1	908.9	718.0	936.8	692.8	684.9	856.9
Taiwan, China	1104.5	1109.1	1139.9	936.4	1089.0	1054.0	1163.0	1043.6	1032.8	936.2
Australia	352.8	348.8	318.7	309.8	346.9	352.8	373.5	364.4	360.4	390.5
Qatar	435.5	227.6	183.9	222.1	641.5	700.6	885.5	723.8	1336.0	2114.9
Canada	604.0	598.7	645.2	545.3	564.4	544.8	604.3	558.2	617.9	555.0
United States	484.9	453.9	468.1	397.4	406.7	360.0	417.2	377.9	424.5	372.9
Austria	508.4	493.6	513.3	525.7	480.5	477.6	455.7	478.3	562.1	565.2
Italy	554.2	546.6	563.0	561.2	546.4	577.0	595.3	568.8	659.3	653.2
Slovenia	441.0	471.1	537.9	560.2	576.5	534.2	625.2	564.7	648.7	751.1
kilograms finished steel products										
China	88.6	97.3	97.9	123.5	148.5	185.4	211.4	259.1	280.0	311.4
Hong Kong	698.8	701.5	720.6	690.4	672.0	650.6	685.0	551.3	513.5	507.9
Japan	555.9	543.5	599.1	575.2	562.4	575.2	600.9	599.9	604.4	622.0
South Korea	535.6	726.4	818.7	808.8	924.6	955.4	990.3	984.4	1044.2	1144.8
Singapore	957.6	754.1	741.3	684.6	720.9	686.3	702.6	692.8	456.6	653.2
Taiwan, China	920.7	924.2	949.7	780.1	907.4	878.4	969.3	869.7	860.4	780.1
Qatar	404.4	213.1	171.4	207.2	601.8	657.5	831.3	679.5	1254.2	1979.2
Italy	512.6	506.2	521.9	520.8	507.9	536.4	553.9	529.6	613.5	608.0
Slovenia	402.8	431.6	494.0	516.6	523.1	494.5	579.0	523.3	601.5	698.0
Germany	455.5	439.0	474.1	449.9	427.4	428.6	436.3	435.1	475.1	519.3
Spain	393.3	438.8	432.5	463.9	475.7	497.8	493.3	481.8	538.6	552.6
Sweden	393.9	397.3	410.4	349.8	366.0	398.0	444.3	453.8	492.2	531.6
Cyprus	336.2	272.6	277.3	213.5	349.1	407.5	448.9	420.3	453.8	583.4
Czech	Republic	360.6	324.2	382.6	390.8	409.6	432.7	508.1	513.7	585.9

Source: Steel Statistical Yearbook 2008

Generally speaking, China is a net steel export country in quantity, the supply of the high value-added sheet products are still shortage, such as cold-rolled sheet, plate plating, stainless steel plate, and so on. This reflect the fact that China's limited capacity to produce high quality steel products. Before 2006, China's exports of finished steel products are mainly in long products such as wire rod and concrete reinforcing bars (Tab.7). So, the technology and price of Chinese exports steel products are lower than that of the imports. Since 2006, total export proportion of flat products and tubular products was increased, accounts for 32.66% of world's total export of flat products and tubular products in 2007. Anyway, Chinese international trade structure depends on the level and character of the steel industry development phase and will last a long time.

Tab.7 Statistics on import & export of the steel products in China (million tons)

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Long products											
Export	China	0.7	0.8	1.5	1.6	2.2	3.1	5.7	7.7	15.1	23.2
	World	66.8	64.9	68.4	69.7	65.6	73.0	80.2	84.8	95.3	106.3
	% of world total	1.11	1.22	2.21	2.30	3.39	4.31	7.06	9.11	15.84	21.80
Import	China	3.1	1.9	1.2	1.5	1.9	2.8	2.8	2.3	1.9	1.6
	World	59.9	61.1	64.2	63.9	66.3	66.1	76.3	78.3	93.0	98.2
	% of world total	5.20	3.23	1.84	2.35	2.90	4.19	3.73	2.89	2.11	1.67
Flat products											
Export	China	1.8	2.0	3.5	1.8	1.8	1.8	5.8	8.5	20.4	28.3
	World	132.5	135.4	148.6	134.9	147.7	153.3	167.8	174.6	195.7	208.3
	% of world total	1.33	1.49	2.34	1.30	1.22	1.19	3.45	4.84	10.41	13.60
Import	China	8.3	12.2	14.1	14.9	21.2	33.3	25.1	22.5	15.5	14.3
	World	128.2	130.6	144.3	135.9	147.6	152.0	170.2	174.8	196.8	202.6
	% of world total	6.51	9.34	9.77	10.94	14.35	21.87	14.73	12.86	7.90	7.06
Tubular Products											
Export	China	0.8	0.5	0.8	0.9	0.9	1.4	2.1	3.5	6.5	7.3
	World	24.0	20.4	22.9	24.7	25.3	24.6	28.9	34.6	39.6	38.3
	% of world total	3.33	2.45	3.49	3.64	3.56	5.69	7.27	10.12	16.41	19.06
Import	China	0.8	0.6	0.6	0.8	1.4	1.1	1.3	1.1	1.0	0.7
	World	22.3	19.1	20.8	23.5	22.9	23.7	27.7	31.5	38.2	36.6
	% of world total	3.59	3.14	2.88	3.40	6.11	4.64	4.69	3.49	2.62	1.91

The rapid growth of China's steel industry brings the simultaneous increase in raw materials demand, in particular iron ore. Although China boasts an abundant storage of iron ores, most of which are low-grade ores featuring higher production cost and lower output, the self-supply rate in 2005 is only about 48%, about 52% of the aggregate demand relies on import. China's imports of iron ore have rapidly increased from 92.39 million tons in 2001 to 0.383 billion ton in 2007 (Tab.8). Anyway, under

such an era of energy shortage (both domestic and foreign), the actual imported iron ore demand may be greater than expected. This presents opportunities as well as challenges to Chinese iron ore industry as well as to the global iron ore industry.

Tab.8 Imported iron ore & its iron output in China (10000tons)

	Imported iron ore	Iron for imported ore	National iron output	Share (%)
1980	725.36	467.97	3802	12.31
1985	1011.40	652.52	4679	13.95
1990	1419.12	915.56	6237	14.68
1995	4115.00	2654.84	10529	25.21
1996	4387.0	2830.32	10721	26.40
1997	5510.58	3555.21	11211	31.71
1998	5177.07	3340.05	11852	28.18
1999	5527.4	3566.06	12533	28.45
2000	6997.16	4514.29	13101	34.46
2001	6230.83	5955.36	15554	38.29
2002	11149.59	7193.27	17079	42.12
2003	14812.84	9556.65	21367	44.73
2004	20808.86	13525.76	25674	52.68
2005	27526.05	17758.7	34473	51.51
2006	32630.33	21051.83	41364	50.89
2007	38309.33	24715.7	47660	51.86

Source: The yearbook of iron and steel industry of China in 2008.

For steel international trade, in 2007, the major foreign suppliers of China's billet steel production were Japan (0.1236 mts), Korea (0.0369 mts), EU-27 (0.0248 mts) and Taiwan (0.0168 mts), accounting for about 83.48% of the total imports of billet steel products in China. ASEAN, Korea, Taiwan and Middle East are the main importer of Chinese steel products. Steel products export to Korea, EU-27 and ASEAN was 11.60 million tons, 11.20 million tons and 10.53 million tons in 2007 respectively, accounting for about 18.52%, 17.88% and 16.82% of the total exports respectively (Fig.2-Fig.5).

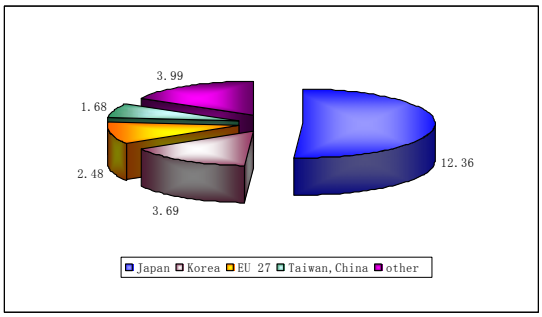

Fig.2 Imported billet (10thous.tons), 2007

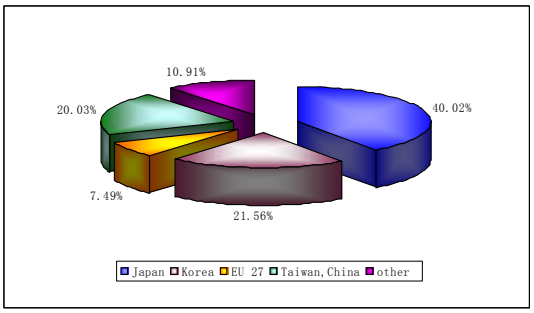

Fig.3 Import of the steel products (%), 2007

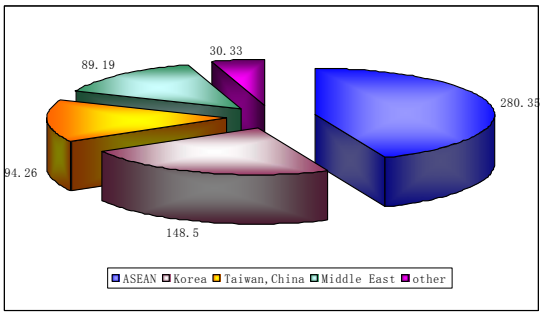

Fig.4 Export of billet (10thous.tons), 2007

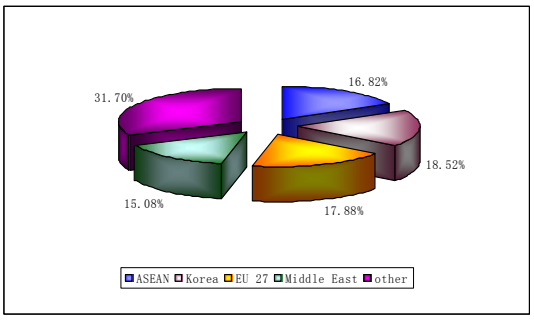

Fig.5 Export of the steel products (%), 2007

2.2 Institutional development and Technology efficiency

Growth in steel industry is largely attributed to China's industrial policy which has for la long time favored the development of heavy industry. There are two types of steel enterprises in China: key enterprises and local enterprises. The former one are under the direct supervision of the central government, and the latter one are directly supervised by the provincial governments. Before 1980, Chinese steel enterprises implemented the policy of planning economy. At that time, government completely controlled the development of enterprises, and the state-owner enterprises dominated the

whole industry. With the rapid development of steel industry and the reform policy, the ownership structure of the industry in 1990s has changed dramatically. Non-state ownership (including collectively-owned, rural, cooperative, share-holding and foreign-invested enterprises) has been encouraged. The crude steel production by non-state sector has expanded rapidly, although the state sector still has a dominant share. For example, the non-state steel sector had an output share of 40.2% of the national total crude steel and 45.0% of the national total pig iron in 2007. As a result, the combined share of the state sector has declined.

In accordance with the ownership changes, the production of steel industry has become more market-oriented. The management methods and production technology have improved dramatically (Tab.9). Before 1980, many steel plants co-exist with small-scale and outdated technologies. In 1962, continuous casting ratio was only 0.1 percent. In 1985 it was up to 10.83 percent, and then it grown every year. By 1995, it was 46.48 percent; in 2004, it has reached 95.8 percent (at the same year, the world's average ratio was 90.3%). In 2007, it was 97.69 percent. At present, the continuous casting ratio reached 100 percent in 56 major enterprises such as Baosteel, Shougang steel Group, Wuhan Steel Group, Anshan Steel Company, Tangshan Steel, Laiwu Steel and do on.

Tab.9 Major technological indices of ironmaking blast furnace in China in 2007

	2007	2006
Volume of pig iron (10000tons)	42660.4	41364.09
Utilization coefficient of a blast furnace	2.677	2.71
Comprehensive coke ratio(kg/t)	518	516
Ratio of putting coke into furnace	392	397
Injection ratio of pulverized coal	137	134
Hot breeze temperature	1125	1037
Energy Consumption of Ironmaking Process (Kg,sc/t,iron)	426.8	439.59

Source: The yearbook of iron and steel industry of China in 2008.

The fastest progress is the open-hearth furnace (OHF). Open-hearth steel ratio in 1981 was the 31.43 percent, for the year 2000 all of that had eliminated. At the same time, because of using advanced technology, it is further enlarged to eliminate the equipment of outdated technology, such as small blast furnace, small electric furnace, and small converter. There were over 1300 blast furnaces in China in 2007, most of which were less than $1000M^3$. Due to the strong demand for pig iron, some backward ironmaking equipment still existed in small- and medium-size steel enterprises. For example, there are about 60 million tons backward small blast furnaces (less than 300 M3) still be used. Anyway, the improvement of continuous casting technology improved the efficiency and productivity of the caster, and further improved the steel-making capacity. At present, the blast furnace ironmaking technology in some major enterprises such as BaoSteel, Wuhan Steel Group and so on has achieved or closed to the international advance levels.

By the end of 1998, the continuous rolling ratio of small section was 44 percent, the continuous rolling ratio of HR&W strip and CR&W strip was 80 percent and 70 percent respectively. The ratio of plate and pipe was 12.3 percent in 1952 and it was up to 40.2 percent in 2001. By 2006, all the proportion has made great improvement.

However, it should be notice here that although new production technologies have gradually penetrated the China’s steel industry and the technical indicators in China made great progress, the current mix of technologies still lags behind that of industrialized countries. For example, the ratio of plate and tube in the developed countries has reached 60-70 percent, while in 2005 it is only 48.14 percent in China. The level of the ratio of plate and tube, which represents the high value-added and high-tech steel products, is one of the most important indicators to measure the strength of a country's steel industry. Lower ratio of plate and tube shows that Chinese steel product structure is still in the low status and can not fully meet the needs of economic development, in particular in the special steel products, so import demand for these steel products is still large.

2.3 Policy of steel export taxes

Export rebates refer to the practice of refunding to exporters part or whole of the domestic taxes levied. All taxes levied in the domestic production and circulation on such commodities shall be refunded to the taxpayers, so that exported commodities are on the international markets at prices net of taxes, in which end domestic products shall compete with overseas commodities on equal grounds, so to tone up competitive force of exported commodities and increase foreign exchange returns through exports (Lian Lian, 2004). Export tax rebates are allowed by the rules of the World Trade Organization and are commonly adopted by many countries.

China began implementing export tax rebate policy in 1985. In its 1994 tax system reform, the zero tax rate policy for exported goods has been declared. China’s Provisional Statute for Value-added

Tax also stipulates a zero tax rate for exported goods; its Provisional Statute for Consumption Tax stipulates a consumption tax exemption for taxable consumer goods designated for export (Chien-Hsun Chen, 2006). Since the tax reform in 1994, China's has implemented seven major adjustments over its policies on export rebates.

The first policy adjustment was made on export rebate during the period 1995-1996, when the 0% rate on exported commodities was adjusted to three levels, 3%, 6%, and 9% respectively. A second adjustment was organized over exports, raising export rebate rates for some exported commodities to four levels, 5%, 13%, 15% and 17% respectively. In 1998, under the effect of Asian financial crisis, the export declined very large, China was faced with steep challenges in exports. So China government decided to increase the export rebate rate, the comprehensive export rebates rate increased from 6% to 15% to stimulate export. However, there was the problem of export rebates in arrears by the financial sector, due to the prominent export boost for three consecutive years in the country. Then China adjusted its export rebate rates to five levels of 5%, 8%, 11%, 13% and 17%, commencing Jan 1, 2004 (Tab.10). For example, the rate for some mechanical and electrical products, apparel and cotton textile products dropped from 17% to 13%. The rebate rate for some other natural resources fell from 8% to 5%. In 2005, China had the fourth export taxes adjustment, it reduced or cancelled export rebate rates on some "high energy consumption, high pollution & resource dependence" products, degraded the rates for textile and other exported products which would be more prone to cause trade friction, and meantime raised export rebate rates for major technical equipment, IT products, and biomedical products. China adopted its fifth adjustment on July 1, 2007, which involved 2831 commodities, uptake around 37% of total included in the list of commodities specified by the customs for export taxation. Export rebate rates fell to 5%, 9%, 11%, 13% and 17%, in five levels. With the sixth export rebate policy adjustment effective since Aug 1, 2008, export rebate rates for some textile and garment products changed from 11% to 13%, meantime those for some bamboo products to 11%. The seventh adjustment and the last so far, took effect on Nov1, 2008. Export rebate rates were moderately raised on labor-intensive commodities such as textile products, garments and toys, and other high-tech and high value added commodities, to be a new system of six levels of 5%, 9%, 11%, 13%, 14% and 17% (Lian Lian, 2004).

In order to encourage steel products export, form 1985 to present, China government adopted much policies especially export rebates policy to make China steel trade from net import to net export, and became the biggest steel exporter in the world.

Steel industry is energy intensive, and its expansion could not have been achieved without a very large increase in energy input, especially in the form of coal. As a result, (1) the environmental problems in the coal mining regions and around the steel producing plants were very severely. In 1994, China's total GHG emissions to be about 4,060 million tons of carbon dioxide equivalent (MMTCO2e)[2]. In 2004, China's total GHG emissions to be about 6,100 MMTCO2e, a growth of 50% in one decade. Of the estimated emissions in 2004, approximately 83% were carbon dioxide (CO2), 12% were methane (CH4), and 5% were nitrous oxide (N2O), with less than 1% of sulfur hexafluouride (SF6), hydrofluourocarbons (HFC) and perfluourocarbons (PFC) (CRS report, 2008). According to IEA estimates, China is responsible for about 17% of global GHG emissions, and is increasing rapidly. Chinese government has recognized these environmental and energy problems, and has made many policy changes over the past three decades. This has brought the energy consumption per unit of output of steel industry has declined consistently over the past two decades. However, though comparable energy consumption per ton of crude steel was 628 kg of standard coal in 2007, a decrease of 17kg of standard coal than that of in 2006. It was still very large. (2) Steel market in China is already oversupply. (3) China was faced with many antidumping cases due to the rapid growth in steel export in recent years. (4) The export rebates is the main expenditure items of the central government. The central and local governments burden the export rebates together. In 2005 export rebates amounted to 337.158 billion Yuan, of which, 311.871 billion Yuan was burdened by the central government, accounts for 35.54% of the total financial expenditure of the central government (877.597 billion Yuan); In 2006 export rebates amounted to 487.7 billion Yuan, the central government burden is 455.7 billion Yuan, accounts for 45.6% of the total financial expenditure of the central government (999.2 billion Yuan). The export rebates of steel products is an important part of national export rebates policy, which is the government's expenditure burden. It is obviously not conducive to the further development of China's steel industry. To protect the existing international market share of steel exports, it is necessary to limit the further growth of Chinese steel export. So, the government lowered

[2] MMTCO2e means "million metric tons of carbon dioxide equivalent," which is an aggregate of all greenhouse gases with each gas weighted by its effect on climate change compared to CO2.

steel export rebates rate for many times (Tab.10). Further, China has levied 5%-10% export duty rate of over 80 items steel products in May 21, 2007 and hiked export duty rate of semis steel products such as steel ingot, pig iron and billet from 10% to 15%. Now, only some special steel products still enjoy export rebate (Tab.11).

Tab.10 History of measures implemented by China

Export rebate rate	Time
Steel export duty rebate fixed at 17%	1994
Rebate reduced to 9%	1995-96
Rebate increased to 15%	1998-99
Rebate reduced to 13% from 15%	Jan 1, 2004
Rebate on pig iron, billets, and other semis scrapped	April 1, 2005
Rebate on flats, wire rods/Rebars reduced to 11% from 13%	May 1, 2005
Rebate on flats reduced from 11% to 8%	Sep 15, 2006
Levied 10% export tax on steel semis & Ferro alloys	Nov 1, 2006
Rebate reduced to 5% for alloys, stainless steel and CR products	April 15, 2007
Rebate for other steel products abolished	April 15, 2007
Export tax raised from 5% to 10% on more than 80 items including wire rod, flat products, sections	May 21, 2007
Export tax on semis raised from 10% to 15%	June 1, 2007

Tab.11 Products that still enjoy export rebate

	Steel rail	Bar	Large section	M&S section	Medium plate	Narrow CR band	Wire rod	HR thin wide steel band	Medium heavy wide steel band
rate	5%	5%	5%	5%	5%	5%	5%	5%	5%
	CR sheet	HR sheet	Plated sheet/band	Color coated sheet/band	Electric tool steel plate/band	Seamless tube	Cat iron pipe	Welded angle section	Steel pipe joint, pipe case
rate	5%	5%	5%	5%	5%	13%	5%	5%	5%

Steel products as a typical "high energy consumption, high pollution & resource dependence" products, a large number of its exports will be equal to brought the energy and resources indirectly out of the country. Currently, the Chinese steel production lag behind largely, steel production is relatively high energy consumption and low value-added products. A lot of iron ore still need to import, it is not appropriate that steel products continue to encourage to export. As a necessary part of Chinese macro-control policies, reduction or even abolition of the export rebates rate of steel products and levy appropriate export tax will speed up Chinese steel industry restructuring and eliminate the outdated production capacity. However, we must have a clear understanding of Chinese steel export rebates policy and the results of its implementation. As a result, studying the change of the total exports and other macro-economic indicators caused by the changes of export rebates rate will help the enterprises facing the reform of export rebates policy.

3. Empirical analytical framework: MCHUGE model

3.1 Overview of MCHUGE model

Our empirical analysis builds on MCHUGE (MONASH-China Hunan University General Equilibrium) model, a MONASH-style dynamic model of China devised by the CoPS of MONASH University in Australia and College of Economics and Trade of Hunan University in China jointly (Mingyong Lai, 2008). This model incorporates 57 sectors (see Tab.12), 3 primary factors (labor, capital and land), 6 economic agents (industry, investment, household, government, foreign sectors and inventory) and 4 margins (retail and wholesale trade, shipment, air service and other).

The MCHUGE model[3] has a theoretical structure which is typical of an AGE model. It consists of tens of thousands of equations, economic data and parameters, such as producers' demands for produced inputs and primary factors, producers' supplies of commodities, demands for inputs to capital formation, household demands, export demands, government demands, inventory demands, the relationship of basic values to production costs and to purchasers' prices, market-clearing conditions for commodities and primary factors; and numerous macroeconomic variables and price indices. The demand and supply equations for private-sector agents are derived from the solutions to the optimization problems (cost minimization, utility maximization, etc) which are assumed to underlie the behaviour of the agents in conventional neoclassical microeconomics (Kaludura ABAYASIR silva, 1996; Mark Thissen, 2001; Mark Horridge, 2005). What's more, the model is a large system of laniaries equations. In MCHUGE, production functions display constant return to scale, also, agents are

[3] The details introduction of MCHUGE is described by Yinhua Mai (2006).

assumed to be price takers, with producers operating in competitive markets which prevent the earning of pure profits.

Tab.12 List of industries

No	industry	No	industry	No	industry
1	Paddy Rice	20	Meat products nec	39	Transport equipment nec
2	Wheat	21	Vegetable oils and fats	40	Electronic equipment
3	Cereal grains nec	22	Diary products	41	Machinery and equipment nec
4	Vegetables, fruit, nuts	23	Processed rice	42	Manufacture nec
5	Oils seeds	24	Sugar	43	Electricity
6	Sugar cane, suger beet	25	Food products nec	44	Gas Manufacture, distribution
7	Plant-based fibers	26	Beverages and tobacco products	45	Water
8	Crops nec	27	Textiles	46	Construction
9	Cattle, sheep, goats, horses	28	Wearing apparel	47	Trade
10	Animal products nec	29	Leather products	48	Transport nec
11	Raw milk	30	Wood products	49	Sea Transport
12	Wool, silk-worm cocoons	31	Paper products, publishing	50	Air Transport
13	Forestry	32	Petroleum, coal products	51	Communication
14	Fishing	33	Chemical, rubber, plastic prods	52	Financial services nec
15	Coal	34	Mineral products nec	53	Insurance
16	Oil	35	Ferrous metals	54	Business services nec
17	Gas	36	Steel	55	Recreation and other services
18	Minerals nec	37	Metals products	56	PubAdmin/Def/Health/Edu.
19	Meat: cattle, goats, horse	38	Motor vehicles and parts	57	Dwellings

Note: “nec” means “other”, for example, food products nec means the other food products.

The production specification is kept manageable by a series of separability assumptions, illustrated by the nesting shown in Fig.6. Each commodity composite is a CES (constant elasticity of substitution) function of the domestic good and the imported equivalent. The primary-factor composite is a CRESH[4] (constant ratios of elasticity of substitution, homothetic) aggregate of land, capital and composite labor. Composite labor is a CES aggregate of occupational labor types. Commodity composites, primary-fact composite and “other costs” are combined using a Leontief production function, while the industry activity is derived from nested CET (constant elasticity of transformation) aggregation functions.

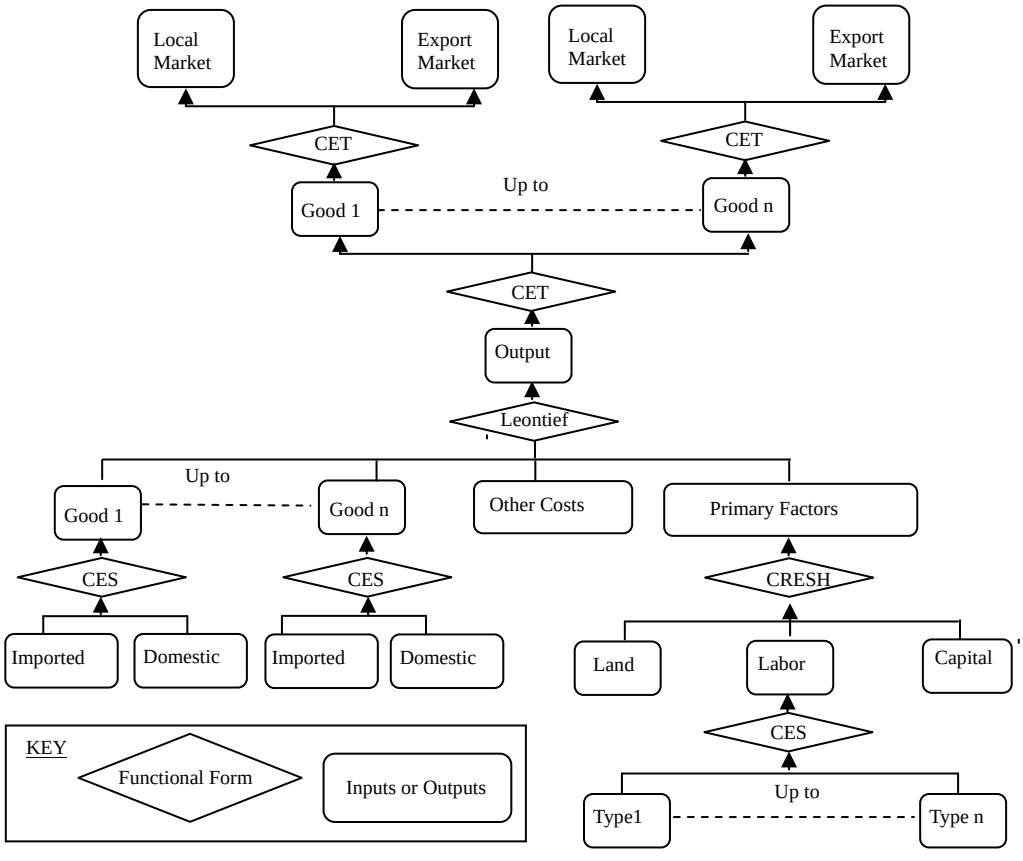

Fig.6 Structure of Production

[4] See DIXON 1997

In the original MCHUGE model, it is assumed that each industry produce only a typical product. In order to study that the government levy export tariffs on steel products, this paper needs to build a new database. First, we divided the steel industry into three categories including pig iron (pig), crude steel (cru) and finished steel products, which further divided into 10 categories including wire rod (wir), medium plate (mdb), Concrete Reinforcing Bars (rsb), clad sheet (gal), HR sheet (hsh), CR sheet (hch), Steel products for railway (ral), seamless tube (nsp), welded tube (wep) and the other (nec). We realized the split via the addition of two layers of CES nests (see fig.7).

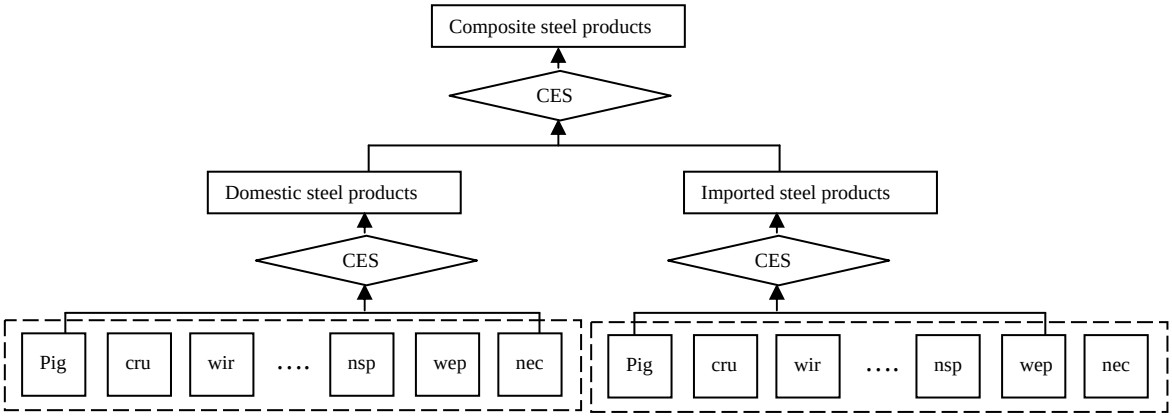

Fig.7 Two layers of CES nests

The Fig.8 presents the MCHUGE's input-output database. It reveals the basic structure of MCHUGE model. The columns identify the following agents: domestic producer divided into I industries; investors divided into I industries; a single representative household; an aggregate foreign purchaser of export; an "other" demand category, broadly corresponding to government; and changes in inventories of domestically produced goods. The rows show the structure of the purchases made by each of the agents identified in the columns. Each of C commodity types identified in the MCHUGE can be obtained locally or imported from overseas. The source-specific commodities are used by industries as inputs to current production and capital formation are consumed by households and governments, are exported, or are added to or subtracted from inventories. Only domestically produced goods appear in export column. M of the domestically produced goods is used as margins services which are required to transfer commodities from their sources to their users. Commodities tax are payable on purchases. Each cell in the illustration absorption matrix in Fig.7 contains the name of the corresponding data matrix. For instance, V2MAR is a 4-dimensional array showing the cost of M margins services on the flows of C goods, both domestically produced and imported (S=1 means domestically produced; S=2 means imported), to I investors. V1BAS…V6BAS, shows flows in year t of commodities to producers, investors, households, exports, government consumption and inventory accumulation. All of the flows in V1BAS…V6BAS are valued at basic prices and so on (Peter B.DIXON, 2002; Mingyong Lai, 2008).

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Household	Export	Other	Change in Inventories
	Size	← I →	← I →	← 1 →	← 1 →	← 1 →	← 1 →
Basic Flows	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Margins	↑ C×S×M ↓	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	n/a
Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	n/a
Labour	↑ O ↓	V1LAB					
Capital	↑ 1 ↓	V1CAP					
Land	↑ 1 ↓	V1LND					
Other Costs	↑ 1 ↓	V1OCT					

C = Number of Commodities
I = Number of Industries
S = 2: Domestic,Imported,
O = Number of Occupation Types
M = Number of Commodities used as Margins

Fig.8 MCHUGE input-output database

The methodology described above is based on some key assumption. The first assumption concerns the labor market. As it mentioned above, it assumed that real wage rates are sticky in the short run and flexible in the long run[5]. This means that export rebate can lead to changes in aggregate employment in the short run. However, in the long run it assumes that the real wage rates are adjusting so that the export rebate has no effect on aggregate employment. The second assumption concerns the rates of return on capital. MCHUGE allow for capital mobility, which means it causes a change in capital formation sufficient to keep rates of return at the initial levels. People can justify the rate of return or capital stock assumption by appealing to small country arguments. With no restrictions on international flows of financial capital, the industries in one country face perfectly elastic supply-of-funds schedules in the long run. The long run closure (Lafang Wang, 2007; Lafang Wang, 2008) is assumed that the rates of return on capital and employment are exogenous. The flexible real wage insures that the labor market can get equilibrium. Capital, labor and total factor productivity set the growth rate of GDP jointly. The variation of national saving and investment influences the GNP through net foreign liabilities. Consumption (household consumption and government consumption) is effected by GDP and GDP growth (See Fig.9).

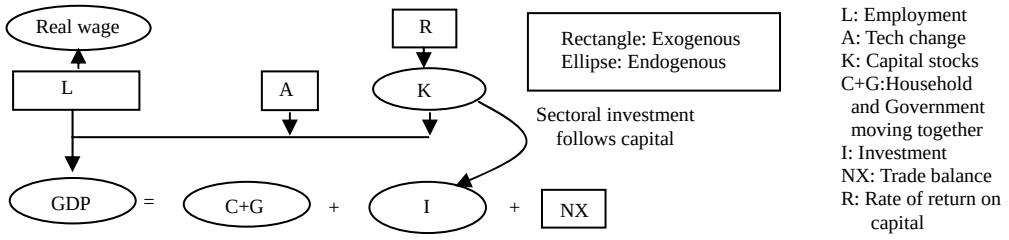

Fig. 9 Long-run closure

3.2 The methodology of results explanation

The methodology of results explanation is represented by Fig.4. Year 1997 to 2006 is the historical simulation period based on the conceivable historical data to track the genuine development path of steel industry. In the historical simulation, MCHUGE operates in a reverse fashion with GDP, production, consumption and international trade exogenous, and the corresponding technical and preference change variables (such as multi-factor productivity) endogenous. That means in the historical simulation, the model is informed of changes in GDP, consumption, investment, and other observed variables during a historical period. It then calculates the necessary changes in technology and preferences. The forecast simulation from 2006 to 2015[6] is used to forecast the natural development of the economy without any exogenous shock. Instead of exogenizing everything that we know about the past (such as GDP, consumption, investment, and so on), in the forecasting simulation we exogenize everything that we think we know about the future (such as technology and preferences). The historical simulation from 1997 to 2006 and the forecast simulation from 2006 to 2016 produce a businesses-usual scenario or a baseline for the model (Yinhua Mai, 2006). Under a dynamic CGE framework, the effects of any policy changes are measured as deviations of economic variables from their baseline levels for macro and industry variables which would be caused by the changes of export rebate rate or export tariff rate (Fig.10).

Through the simulations, we can derive the effects of the policy imposed on the economic system. If the simulation results are positive, the policy line shall be above the forecast line, which means the implementation of such a policy shall induce macro index to change more sharply. It is by no means that these indicators are positive. Similarly, if the simulation results are negative, the policy line shall be below the forecast line, which means the implementation of such a policy shall induce macro index to change less than that of in benchmark. It is by no means that these indicators are negative. We simulate the effects of the export taxes policy by the changes in export rebates rate or export tariff rate. In our case, we are interested in the directions of the changes, not the magnitude.

[5] In our case, we treat the first year as a short-run closure. It assumed that real wage and capital stocks are fixed.
[6] The simulation year can be set flexible.

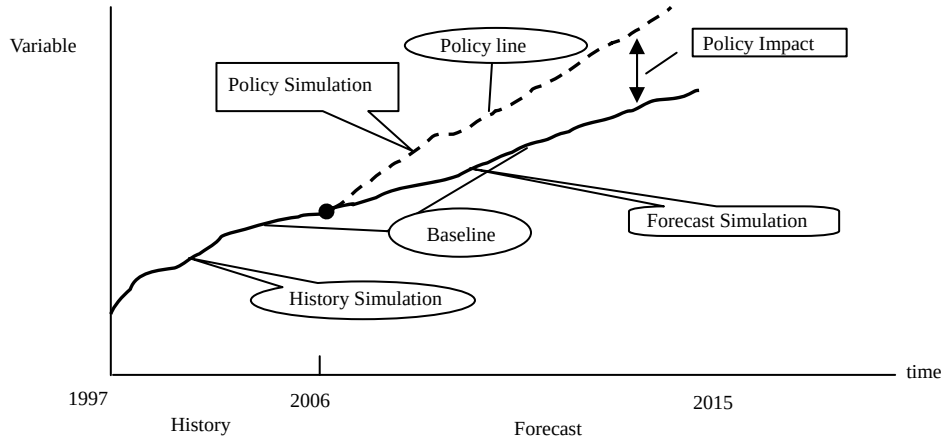

Fig.10 Results explanation

4. Simulation scenarios and results analysis

4.1 Simulation scenarios

4.1.1 Historical simulation: the Chinese steel industry from 1997 to 2006

We use an historical simulation to estimate changes in tastes and technologies for 1997 to 2006 with special emphasis on steel. We use a forecast simulation to project output and employment for the export taxes policy to 2016 in the absence of further changes in export taxes policy beyond 2006 and use a policy simulation to work out the deviations from the baseline paths for macro and industry variables which would be caused by the change of export rebates rate or export tariff rate in Chinese steel industry.

In our case, the main data source used for the growth rates of real GDP and its expenditure-side components is the World Bank World Development Indicators (WDI). Export and import volumes have been estimated from COMTRADE data for 2002 and 2005. We base the domestic expenditure side shocks on real GDP recorded for 2003 to 2006 and forecasts over the decade ahead.

In the historical simulation, we exogenized all of the observed variables and shocked them with their observed movements. Thus the results are consistent with all our statistical information. For example, we set growth in steel output at 28.82% and growth in steel exports at 57.09%. To allow MCHUGE to hit these and many other targets, we endogenized variables concerned with primary-factor-saving technical change, intermediate-input-saving technical change, preferences for imported goods relative to domestic goods, household tastes, and rates of return on industrial capital. We found for the period 1997 to 2006 that the primary factor input (the share-weighted average of the percentage changes in capital and labour input) to the steel industry declined over the period 1987 to 1994 by about 1.388%, the intermediate inputs to the industry increased by 9.382% and the industry's technology towards the use of capital was 5.41%. This means that the steel industry's technology changed so that at any given ratio of the wage rate to the rental rate on capital, the steel industry would choose a ratio of capital and labour 5.41% higher in 2006 than in 1997. We also found that the consumer preferences towards the purchase of steel production increased by 18.099%. This means that at any given set of prices and per capital income, consumption per household of steel productions would be about 18.099% higher in 2006 than in 1997. There was a shift across industries towards the use of steel as an intermediate input and as a capital good. Simulation results indicated that steel input per unit of output and per unit of capital creation averaged over all industries was 9.386% higher in 2006 than in 1997.

4.1.2 Forecast simulation: prospects for the Chinese steel industry, 2007 to 2016

Tab.13 provides estimates for 1997 to 2006 and forecast for 2007 to 2016 for macro and steel variables. As can be seen in Tab.15, we assumed that real GDP will settle down to a slower longer-term trend of around 6%. The growth of GDP components shows similar characteristics as in history, that is, higher growth in investment than in consumption and high growth in trade volumes. We forecast that exports of steel will grow at 27.84% a year. The rate achieved in the historical period was 57.09%. The slowdown reflects our forecast that the rate of growth of steel exports will be below the very high rates of growth since 2007. Tab.15 also shows that the output of steel is smaller than that of in historical

simulation. The rate of growth of steel output in forecast relative to history is a slowdown in the rate of growth of exports.

Tab.13 Growth rates in macro and steel variables: 2007 to 2016

Percentage annual growth in	Estimates for 1997 to 2006	Forecast for 2007 to 2016
Macro variables		
Real GDP	9.5	6
Real investment	12.1	11.3
Real consumption	6.5	7.0
Government expenditure	8.8	9.2
Export Volumes	17.5	16.6
Import Volumes	17.3	16.1
Steel industry		
Output	28.82	17.54
Export Volumes	57.09	27.84
Import Volumes	3.95	4.21
Basic price of domestic product	1.43	1.30

4.1.3 Policy simulation I: canceling steel export rebates

Policy simulation scenarios 1(Sim 1): Taking an integrated export rebates rate 8% of steel enterprises in 2006 as the shock variables (Tab.14). The results will tell us the effect of the steel export rebate rate of 8% in 2006 on Chinese macro economy and steel industry from 2007 to 2015.

Policy simulation scenarios 2 (Sim 2): in 2007, the export rebates rate of most of steel products is 0, but some special steel products still enjoy export rebate 5%. To simulate the impact of canceling export rebates rate, this paper assume that in 2008 the export rebates rate of steel products is 0.1%, and take this as shock variable. The simulation results might tell us the impact on Chinese macro economy and steel industries, when the export rebates rate of steel products in 2008 is 0.1%,

4.1.4 Policy simulation II: imposing export tariff

Policy simulation scenarios 3 (Sim 3): from 2006 to 2008, the average export tariff of pig iron is 16.7 percent; crude steel will impose 16.7 percent export tariffs. Taking a combination of these values as the policy impact variables from 2006 to 2008, the results shall be the policy line3. The simulation results shall tell us what are the effects of imposing 16.7 percent export tariff on pig iron and crude steel from 2006 to 2008 on Chinese macro economy sectors and various industries, in particular the steel industry and its upstream and downstream industries from 2009 to 2015.

Policy simulation scenarios 4 (Sim 4): in 2008, wire, medium plate and clad sheet are imposed a 10 percent export tariff, while HR sheet is imposed 5 percent tariff and welded tube levies 15 percent export tariff. Taking a combination of these values as the policy impact variables in 2008 for policy simulation, the result is the policy line 4. The results shows that in 2008, imposing export tariff on finished steel products will bring what's the impact on Chinese macro economy sectors and various industries, in particular the steel industry and its upstream and downstream industries, from 2009 to 2015.

Tab.14 Simulation scenarios

		Time	Shock
Canceling steel export rebates	Sim1	2006	The export rebate rate of total steel products is 8%
	Sim2	2008	The export rebate rate of total steel products is 0.1%
Imposing export tariff	Sim3	2006-2008	Levy 16.7% export tax on pig iron and crude steel
	Sim4	2008	Levy 16.7% export tax on wire rod, medium plate and clad sheet Levy 5% export tax on HR sheet Levy 15% export tax on welded tube

4.2 Results and discussion

4.2.1 The simulation results and analysis of canceling export rebates

1. Macro effects

(1) Analysis on macro results of 8 percent export rebate rate

Column 2 in Tab.15 shows that the 8% export rebate rate pulled out China's real GDP growth. According to our simulation, China's real GDP in 2015 increases by 0.7% compared with its baseline level. Because in the long run simulation, the national employment level and capital rate of return are supposed to be unchanged and the technical is exogenous, so the GDP varies with the total capital stock.

The simulation results show that by 2015, the cumulative growth of capital stock shall be 2.037% relative to that of the benchmark, and then leads to an increase of the real GDP.

Under our labour market assumption, in the short run, real wage is sticky, that is it will adjust only slowly to eliminate deviations between the policy and benchmark levels of employment. In our case, there have a short run increase in labour, which leads to increase demands for real wages, generate increase in real wage. As seen in Tab.14 column 2, by 2015, the cumulative growth of real wage shall be 1.477% relative to that of the benchmark.

Export rebate benefit for stimulating exports, the simulation results show that exports continued to increase but the growth rate is small. According to our simulation, China's export in 2015 increases by 0.044% compared with its baseline value. The reason not only because the weak ability of stimulating export due to the reduction of export rebate rate, but also because Chinese steel exports have a large growth rate, at this base, the further increase is limited. When the steel products are implemented export rebate, the cost of steel exports and the purchase price of steel export products will drop. But this policy will also cause that the export purchase price of some industries rise. If steel export prices drop less than other industries export prices rise, then the export price index increase slightly (0.076% in 2015). In 2015, it is an increase of 0.957 percent for imports. This shows that the continued reduction of export rebate rate promote trade balance in the long run.

As can be seen in Tab.15, the export rebate policy has a positive impact on the terms of trade, but change is not large, in 2015, compared to baseline values, it improved 0.077 percent. The main reason for improving the terms of trade is that the decrease of purchase price of steel exports products can not offset the increase of purchase price of other exports goods. So the total export price index rises, when the import price index remained unchanged, terms of trade improves.

Export rebates are a large part of government expenditure all the time, when the export rebates rate is down to 8 percent, the government deficit will increase 0.010 percent.

Tab.15 Macro effects ---The Deviations from baseline, percent (Sim1 and Sim2)

	Sim1					Sim2				
	2006	2010	2012	2014	2015	2008	2010	2012	2014	2015
Real GNP	0.911	0.753	0.715	0.701	0.700	0.012	0.011	0.010	0.009	0.009
Real GDP(exp)	0.912	0.831	0.801	0.797	0.795	0.012	0.011	0.011	0.010	0.010
Real Household Consumption	0.604	0.380	0.314	0.274	0.260	0.008	0.006	0.005	0.004	0.004
Real Investment	2.924	2.476	2.523	2.596	2.637	0.035	0.030	0.030	0.030	0.031
Real government demands	0.602	0.379	0.313	0.273	0.259	0.008	0.006	0.005	0.004	0.004
Export volume	-0.141	0.096	0.062	0.046	0.044	-0.001	0.002	0.001	0.001	0.001
Export price index	0.100	0.049	0.063	0.073	0.076	0.001	0	0.001	0.001	0.001
Import volume	1.210	0.961	0.942	0.948	0.957	0.014	0.012	0.011	0.011	0.011
Deficit	0.007	0.009	0.009	0.010	0.010	0	0	0	0	0
Real GDP (inc)	0.912	0.831	0.801	0.797	0.795	0.012	0.011	0.011	0.010	0.010
Average capital rental	2.554	1.181	0.951	0.805	0.752	0.031	0.020	0.015	0.012	0.011
Real wage	0.311	1.083	1.283	1.422	1.477	0.004	0.010	0.014	0.016	0.017
Rental price of land	2.600	2.373	2.304	2.281	2.271	0.032	0.030	0.028	0.027	0.026
Employment	1.577	0.763	0.556	0.434	0.395	0.020	0.014	0.010	0.007	0.006
Capital stock	-0.006	1.302	1.654	1.924	2.037	0	0.010	0.016	0.020	0.022
GDP price index	0.514	0.399	0.414	0.432	0.448	0.012	0.011	0.011	0.010	0.010
Aggr. investment price index	0.082	-0.081	-0.085	-0.091	-0.095	0	-0.002	-0.002	-0.002	-0.002
CPI	0.787	0.688	0.716	0.741	0.752	0.009	0.008	0.008	0.008	0.009
Real devaluation	-0.523	-0.399	-0.424	-0.442	-0.449	-0.005	-0.004	-0.004	-0.005	-0.005
Terms of trade	0.100	0.050	0.063	0.073	0.077	0.001	0	0.001	0.001	0.001

(2) Analysis on macro results of abolition of export rebates

Above is analysis the change of the macro-economic indicators when the export rebate rate is 8%. In order to fully understand the impact of the abolition of export rebates, we can consider that the process that the export rebates rate climbs down from 8% to 0.1% as the process that export rebates rate goes down until the elimination. From analysis of the results, the simulation results can be concluded as follows:

Firstly, with the reduction of export rebates rate, the major economic indicators take on negative growth. It implies that it will have an inhibition on export and other economic indices due to the reduction of export rebates rate. Among them, an unusual indicator is the total social consumption. The simulation results show that the total consumption is negative increase. The emergence of this situation is linked with a total investment of the community, the export rebates rate decreases, although the total investment declines, there is a slight increase in the price index of capital goods. Part of the consumer

goods turn to capital goods, which makes the current number of consumer goods relative decline.

Secondly, with the reduction of export rebates rate, export decline but the change rate is small. This means that the effect of inhibition export is not obvious through the abolition of export rebates. At the meantime, imports go down slightly (-0.946%) which is on the one hand due to the reduction of domestic demand; on the other hand, due to the abolition of export rebates, export products turn to domestic sales, domestic supply increase. The replacement of imports goods lead to the further reduction of the demand for imports. The decrease in imports is more than the decline in exports, which seemed to imply that the effect on balancing the trade surplus is not obvious by the abolition of the steel export rebates. Even to a certain extent, it may widen trade surplus, but little effect. This indicates that although export rebates rate is one of the important factors of affecting export, it is not the only decision factor. In fact, the international trade environment, the competitive advantages of the product itself are the most fundamental factor of impacting on exports.

Thirdly, the abolition of the steel export rebates will shock the labor market, real wages continued to decline, the level of employment rebound gradually from the beginning of the rapid reduced. It shows that with the reduction or cancellation of export rebates rate, in order to maintain the price gap between China's products and international commodities, the companies will lower the cost of production to make up for the reduction or cancellation of export rebates.

Fourthly, with the reduction of export rebates rate, government deficit decrease a little, but total tax revenues increase inconspicuously.

In a word, abolishing export rebates on steel industry have a certain negative economic effects, but it seems that the effect of inhibition the export performance and balance of trade surplus is not the same as expectation.

2. Industry effects

Tab.16 Results for steel industry-----Percentage deviation from baseline (Sim1 and Sim2)

	Sim1					Sim2				
	2006	2010	2012	2014	2015	2008	2010	2012	2014	2015
Output	11.616	13.667	14.378	15.057	15.39	0.136	0.148	0.152	0.163	0.167
Price	-1.829	-2.366	-2.46	-2.531	-2.56	-0.026	-0.030	-0.031	-0.033	-0.033

First, the adjusting of export rebates rate and the growth of steel product export are positive relevant (Tab.16). That is, decline or the cancellation of the export rebates rate would result in a decrease in steel exports growth. It is reflect that the export rebates policy exerts an important stimulus to the growth of steel products export.

Second, canceling the export rebates will increase the cost of steel product export. On the one hand, the declination of export demand leads to the reduction of the growth of domestic production, so the output of steel industry decrease. On the other hand, because export products turn to domestic market, the price in domestic market will decline and then the price of steel production will go down. The result is consistent with the real economic performances in China. After canceling the export rebates, with the increase of the pressure of export cost, export enterprises must maintain the price gap between China and international steel market, so the product price of domestic steel product had to climb down.

Third, after abolition the export rebates, upward pressure on export prices will put pressure on the upstream industries and downstream industries of steel, so these industries will be suffered. However, the high-tech products, machinery and electronic products, energy, raw materials product, as well as the general products have different impact. For example, other transportation production industries and metallurgical industries as well as coking, steel export rebates cancellation does not curb their exports. Fabricated metal products industry, the automobile industry, machinery and equipment manufacturing as well as the construction industry, and so on, have a reduction of output growth rate, but have a rise in output prices. The electricity industry and the service sector output also grow, but the price has dropped.

Fourth, because of surplus labor, real wages dropped, the elimination of export rebates benefit for labor-intensive industries. So some agricultural products, leather products, textile and garment industry have a positive effect.

Although the export rebates rate plays a key role on impacting the steel industry, it is not the only decision factor. Many factor such as the changes of demand and price of steel products in the world, various macro economic indicators in China and the technology of the steel industry become more and more important, and have a significant effect. From the long-term perspective, the cancellation of the export rebates rate of steel products will help China to rectify the domestic

steel market. So that the weak small-scale steel enterprise will be out under the pressure and push the big steel enterprises to improve the technology, to achieve economies of scale and lower the production costs, and then to enhance international competitiveness in a higher-level.

4.2.2 The simulation results and analysis of levying export taxes

1. Macro effects

Levying export tariff on pig iron and crude steel will lead a negative effect on China's real GDP and imposing export tariff on finished steel products will cause a relative small change on real GDP (Tab.17).

Tab.17 Macro effects---The Deviations from baseline, percent (Sim3 and Sim4)

	Sim3					Sim4				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Real GDP	-2.347	-2.3	-2.27	-2.256	-2.252	-0.165	-0.160	-0.156	-0.154	-0.153
GDP price index	-0.682	-0.705	-0.727	-0.746	-0.763	-0.059	-0.061	-0.063	-0.066	-0.067
Real GNP	-2.173	-2.113	-2.073	-2.049	-2.035	-0.152	-0.146	-0.142	-0.139	-0.137
Real Household Consumption	-1.102	-1.008	-0.935	-0.88	-0.837	-0.081	-0.072	-0.065	-0.060	-0.056
Real Government demands	-1.100	-1.006	-0.933	-0.878	-0.835	-0.080	-0.072	-0.065	-0.060	-0.055
CPI	-1.551	-1.576	-1.603	-1.629	-1.654	-0.117	-0.119	-0.122	-0.124	-0.126
Terms of trade	-0.132	-0.143	-0.154	-0.164	-0.172	-0.006	-0.007	-0.009	-0.010	-0.011
Deficit	-0.022	-0.022	-0.023	-0.023	-0.024	-0.002	-0.002	-0.002	-0.002	-0.002
Real wage	-2.706	-2.985	-3.211	-3.395	-3.548	-0.176	-0.201	-0.222	-0.238	-0.252
Employment	-1.949	-1.633	-1.384	-1.193	-1.047	-0.170	-0.142	-0.120	-0.103	-0.089
Aggr. investment price index	0.739	0.75	0.76	0.769	0.778	0.030	0.030	0.031	0.031	0.031
Investment	-6.444	-6.447	-6.482	-6.539	-6.607	-0.451	-0.450	-0.453	-0.457	-0.463
Average capital rental	-2.874	-2.512	-2.226	-1.997	-1.808	-0.249	-0.218	-0.194	-0.176	-0.161
Capital stock	-3.237	-3.717	-4.127	-4.48	-4.79	-0.195	-0.236	-0.270	-0.299	-0.325
Import volume	-2.005	-1.962	-1.943	-1.942	-3.491	-0.164	-0.159	-0.156	-0.155	-0.155
Export volume	0.006	0.035	0.058	0.069	0.071	-0.025	-0.021	-0.017	-0.014	-0.012
Export price index	-0.132	-0.143	-0.154	-0.163	-0.328	-0.006	-0.007	-0.009	-0.010	-0.011

Levying export tariffs on primary iron and steel products affects the steel export price directly. It will increase domestic steel mills' export costs, and lead them to increase export prices. When other conditions are unchanged, this has resulted in a certain degree fluctuation of Chinese export. Tab.17 shows that when primary steel products are imposed on export tariff, the enthusiasm of export enterprises has not affected significantly, the export growth remains positive (about 0.324% in 2015). However, imposing tariffs on the finished steel products will result in the reduction of exports (about -0.012% in 2015).

Obviously, levying export tariffs on the primary steel products, the growth rate of export did not fluctuate in the same direction. From 2006 to 2008, the positive changes are more obvious, in 2008, compared to baseline value, exports increase 0.224%, and then the changes slow down (in 2015 exports increase 0.071%). The main reason is, on the one hand, the strong demand for steel in domestic and foreign market, so the increase in the cost is difficult to suppress the enthusiasm of enterprises. That is, even if the export tax further increases, as long as the international market accepts the prices, exports will continue. On the other hand, there is a lag time for the implementation of the policy, so the export inhibiting effect on export enterprises is not significant. Imposing export tariff on finished steel products, however, in addition to in 2008, the increase in exports is a slight increase (0.01 percent), other year export growth rate reduce due to this policy, compared to the baseline, in 2015, the exports growth rate drop 0.012%.

The exports cost of Chinese steel increases, on the one hand, in short run, prices of primary steel products will rebound because China has a large share and an important role in the international steel market, thus Chinese imports will further reduce. On the other hand, export products turn to sale in domestic market will lead to reduce the demand for imports. Such as in 2015, compared to baseline value, it decreases 3.491% and 0.155% in two different simulation scenarios. However, they lead to the different change trend of reduction in imports. Sim3 is an approximate consecutive decline of imports, while in Sim4 the reduction rate of imports is gradually narrowing. Overall speaking, through imposing export tariff on the primary steel products and finished steel products to balance the trade surplus does not seem to be obvious.

Tab.17 also shows the change of the terms of trade. The simulation results indicate that the change of terms of trade is negative, that is, terms of trade is deterioration. After composition, we find that steel products have a positive contribution to terms of trade (the export purchase price of pig iron rises 0.874 percent), but other products have a negative contribution to terms of trade. And the former one is smaller than the latter, so terms of trade is deteriorates.

Imposing export tariff is beneficial for the decline of government deficit (the ratio of financial deficit and GDP). Relative to benchmark, by 2015, the government deficit decrease 0.024% and 0.002% respectively (Tab.17). The simulation results show an abnormal result, that is, this policy has a negative effect on national total revenues (compared to baseline, in 2015, the revenue decreases 1.274%). The reason may be that although the export taxes expenditure decrease by imposing export tax on steel products, the pressure on steel export will affect other industries, which may lead to the reduction of other government revenues (such as the middle investment indirect tax, household consumption tax and so on). This conclusion no doubt illustrate that imposition of export tariffs would not necessarily prompted the increase of government tax revenues. The total tax revenue is affected by the macro-economic environment.

2. Industry effects

Tab.18 Results for steel industry-----Percentage deviation from baseline (Sim3 and Sim4)

	Sim3					Sim4				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Output	-23.66	-24.14	-24.62	-25.08	-25.54	-2.173	-2.226	-2.278	-2.329	-2.379
Price	7.898	8.001	8.086	8.161	8.221	0.474	0.484	0.492	0.499	0.505

The results of Sim3 and Sim4 are more significant, and the effect of imposing export tariff on the primary steel products is greater than on the finished steel products (Tab.18). As can be seen in Tab.18, after imposing tariff on steel products, the stimulus for imported steel products is not large. For example, in 2015, crude steel import volume will increase 0.799% compared to base line, while wire rod imports will decrease 4.485%.

In a word, the implementation of this policy on steel industry will lead to the output decrease of steel industry. For the small and medium enterprises, due to the poor ability of cost-passed, they may face to the reduction of output and even the elimination of outdated production capacity, which will no doubt have a negative impact on employment in steel industry. There might be more unemployment in the steel industry (from 2006 to 2015, the cumulative decline is possible up to 2.764%) or transferred to other industries. Hence, the labor market is weak, and real wages fall down. In particular steel industry is a base industry, linked with a lot of industries. It is not neglect that the impact on other industries due to imposing on steel products.

The simulation result also shows that a part of domestic products has strong substitution rate of imports, as in 2015, domestic iron ore strongly takes place of imported iron ore (2.256% and 0.207% in Sim3 and Sim4). It is reflects that the ratio of function and price of some products have increased, and these products can replace imported products. To some extent, the imposition of export tariff will stimulate to upgrade industrial technology, and enhance the competitiveness.

The fluctuation of industries' development will leads to the fluctuation of their labor market. Simulation results shows that imposing export tariff will cause the reduction of industries' output in domestic market and the redundant of labor, and such a policy has large long-term cumulative effect. Such as metal product industry, whether the government's macro-control goals or the enterprise itself cost pressures, the sector has the pressure to decrease the output and the rate may be large. So the employees in this industry will face to unemployment or reselection the careers.

Finally, Fig.11 shows the changes in the proportion of some finished steel products in the total steel production. As can be seen in Fig.11, levying export tariffs on primary steel products push the proportion of medium plate (mdb), clad sheet (gal), HR sheet (hsh), CR sheet (hch), seamless tube (nsp) and welded tube (wep) increases, while the proportion of wire rod (wir), concrete reinforcing bars (rsb) and steel products for railway (ral) decreases.

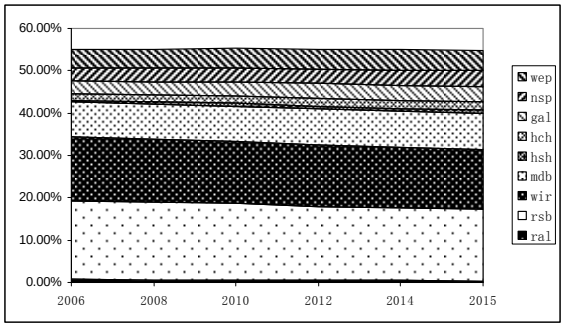

Fig.11 Changes in the proportion of some finished steel products (sim3)

5. Conclusion and policy implications

China had reformed the export taxes policy on steel products and the reform strength is constantly increasing. These policies will have a profound impact on Chinese macro-economy and various industries. This article develops a dynamic computable general equilibrium model to simulate the effect of export taxes policy on Chinese economics and industries especially steel industry. The simulation results showed that the elimination of export rebates for steel products has not an obvious effect on export trade. The reason might be there are some positive factors exist in the world such as strong demand. Levying export tariff will increase the cost pressure of steel export enterprises, and exports decline obviously. The effect of imposing tariff on primary products is greater than levying on finished steel products. This shows that Chinese government could gain different short-run results on balancing steel trade surplus by canceling export rebates and imposing export tariff, the effect of the latter one is more obvious than the former. In the long run, the force of the policy is strong, which can inhibit the steel export, thereby control the steel output.

Based on the above analysis, theoretically speaking, further export tax increases or eliminate the export tax rebates will increase domestic steel enterprises' export costs, and lead them to increase export prices. However, as long as the international market accepts the prices, exports will continue. In the long run, if China's steel product export prices become too high, importers will either import steel products from elsewhere or restart their own long-abandoned steel industries. This will provide opportunities as well as challenges to Chinese steel industry as well as to the global steel industry.

According to the above-mentioned, the suggestions are as followings:

(1) Using the cost pressure to promote the steel industry's structural adjustment. The sharp rise in iron ore prices and the reform of export rebates on steel products will result in the steel costs pressure. Confronting with this cost pressure, steel enterprises either bear the loss of cost increase lonely, or transfer the cost pressure. But small and medium-sized steel factories are weak in this field, which may reduce the output or even close down. In other words, the reform of export rebates policy may promote structural adjustment in steel industry.

(2) Enhancing the ability of technical innovation of Chinese steel enterprises. In order to maintain a profit under the high-cost in the steel enterprises, the enterprises must shorten the gap with developed countries and produce the products of high-tech, high value-added and high product performance to increase international market share and change the situation of dependence on imported special steel. Therefore, from this point of view, steel cost pressure could benefit from technical innovations in steel industry. Domestic steel enterprises should positively create new technology of steel making.

Acknowledgement

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