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Fiscal Policy, Regional Disparity and Poverty in China: A General Equilibrium Approach

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Abstract

The main objective of this research is to analyze the effects of the fiscal dimension of China's government transfer and preferential tax policy on regional income disparity and poverty reduction. Using a computable general equilibrium model with a three-region component, we find that the preferential tax policy on the eastern coastal region of China has a significant effect on household income, as well as on the FGT indicator. The simulation results suggest that tax policy is a more effective tool to counter against China's regional disparity than government transfer.

Key Words: China, Regional Disparity, Fiscal Policy, Government Transfer, Preferential Policy, Poverty, CGE, FGT

JEL Codes: D58, R13, H24, H32, H53

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1. Introduction

China is a large country with around 1.3 billion people and composed of 31 provinces with different levels of development. Since the early 1990s, China has followed Deng Xioaping's "let some get rich first" policy and "coastal development strategy", which switched the national development priority from "even" to "uneven"; from "inland" to "the eastern coastal regions". Due to area differences in comparative advantage and economic structure, as well as priority government policies directed to specific regions, the income gap widened from region to region in the past two decades. Table 1 provides some information on income disparity among the country's three regions[1]: eastern China[2], central China and western China. The table shows that in the 1980s, urban household income levels were quite similar among the regions because of the egalitarian income distribution system at the time. However, the pattern changed after that decade. In terms of household income, the ratio of eastern region to central region to western region increased from 1.20:1:1.18 in 1981 to 1.50:1:1.10 in 2001 in urban areas. At the same time, the ratio across the regions' rural areas increased from 1.25:1:0.91 in 1981 to 1.64:1:0.76 in 2001. The regional gap either in urban or in rural areas widened in the 1990s, and the regional income disparity in rural areas was larger than that in the urban areas.

From 2001 to 2005, with China adopting a "western region development strategy", the gap between the central region and eastern region became wider, while the disparity between the central and western was smaller than it was previously. For example, in terms of urban household income level, while the ratio of eastern region to central region increased from 1.50:1 in 2001 to 1.55:1 in 2005, the ratio of central to western region decreased from 1:1.10 in 2001 to 1:1.01 in 2005.

A recent comparison among the eastern, central and western regions shows that per capita GDP of western and central China accounted for 40.7 percent and 52.2 percent, respectively of that in eastern China. In terms of per capita consumption expenditure, the numbers are 57.6 percent and 69.6 percent, respectively in 2001.

[1] China is composed of the following provinces: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, Hainan, Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

[2] The country's eastern region includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan. Its central region includes Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. Finally, the western region consists of Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

Table 1: Regional disparities: per capita income of urban household and rural household unit: RMB, in current price

Region	1981	1989	1993	1996	1999	2001	2005
Urban household							
Average	458	1261	2337	4377	5854	6860	11320
Eastern region	476	1441	3140	5371	7146	8448	14585
Central region	397	1084	2118	3576	4837	5641	9393
Western region	468	1200	2287	3733	5302	6186	9418
Ratio of Eastern to Central to Western	1.20:1 1.18	1.33:1 1.11	1.48:1 1.08	1.50:1 1.10	1.48:1 1.10	1.50:1 1.10	1.55:1 1.01
Rural Household							
Average	134	398	784	1578	2210	2366	3142
Eastern region	164	513	1156	2346	3237	3542	6226
Central region	132	380	712	2058	2058	2155	4051
Western region	120	323	619	1520	1520	1640	3646
Ratio of Eastern to Central to Western	1.25:1: 0.91	1.35:1:0.85	1.62:1:0.87	1.65:1:0.78	1.57:1:0.74	1.64:1:0.76	1.54:1:0.90

Source: Calculated from "China Statistical Yearbook", 1994, 1997, 2000, 2003 and 2006.

Increasing income disparity has resulted in high poverty rates in the central and western areas of China, where the poor population is most concentrated and the degree of poverty is the most serious. In 2000, only 10 percent[3] of the poor population is distributed in the eastern region. The figure is 28 percent in the central region and 62 percent in the western region.

Why has the disparity in poverty across China's regions widened in the past 20 years? Aside from regional comparative advantages, can China's tax preferential policy and government transfers – which have been implemented in the past 20 years – be considered as the main reasons for the pattern of disparity? These are the core questions that we try to answer in this study. The paper is organized as follows. Section 2 introduces the determinants of China's regional disparity. Section 3 is a review of existing literature on the subject, while section 4 looks at the CGE framework used to simulate policy shocks on China's regional disparity and poverty. Section 5 reports the simulation results while section 6 concludes the study.

[3] The Rural Research Office of National Statistics Bureau, "A Monitoring Report on China's Rural Poverty" (2001). Note: Definition of eastern region, central region and western region is little different from the regions as described in Table 1.

2. Determinants of China's regional disparity

2.1 Factor market distortion and initial conditions

Factor market distortion and differences in some initial economic conditions at the beginning of the economic reform, including physical and human capital stocks, could be the first determinant that contributes to China's regional disparity. Advantageous geographic factors in China's coastal regions[4] reduce transportation and communication costs, which in turn attract more foreign direct investments and migrant labor[5]. Besides, China's labor market distortion such as the Hukou system[6] is also widely considered as one of the reasons for regional disparity[7]. Due to immobility of labor across geographical areas, less developed regions cannot get the needed technicians and specialists to upgrade the technologies and improve managerial capabilities in these areas. On the other hand, developed regions cannot get the needed unskilled labor to lower their costs in some industries, which in turn can bring relative technical advantages these unskilled laborers have learned to less developed regions.

2.2 China's centralized price management system

The second determinant is China's centralized price management system. There is a significant difference in industrial structure between China's eastern coastal region and its interior region mainly because of their respective natural resource advantages. Manufacturing is the backbone industry for eastern China, while mining is a key industry for the interior region because of its rich mineral resources. From 1979, although economic reform had already been implemented, the prevailing price management system was still highly controlled by government. Under these circumstances, the price for raw materials and natural resources was set much lower than the market price, while the price for manufacturing products was set higher than the products in the market system. This distorted price system makes the eastern region benefit from both buying the raw material and from selling the manufactured products, while the central and western regions – which are in China's interior – get penalized twice over. Similarly, agricultural goods also subsidize the manufacturing goods through this pricing system, and this is also one of the reasons for the disparity between China's rural and urban areas.

[4] Most provinces and cities in the eastern region are actually located in China's coastal region.
[5] See Demurger et al.(Demurger et al., 2002) and Yao and Zhang (Yao and Zhang, 2001).
[6] Hukou refers to the system of residency permits which dates back to the early 1950s, where household registration is required by law in China. A household registration record officially identifies a person as a resident of an area and includes identifying information such as the name of the person, date of birth, parents' names, and name of spouse, if married. In China's labor market, Hukou is crucial for people to get a job. For example, if someone wants to get a job offered in Beijing, he must have a Beijing Hukou, otherwise he cannot get the job even though he is qualified.
[7] See Cai etc. (Cai, Wang &Du, 2002), Lin,Wang, and Zao (Lin,Wang and Zao, 2004)

2.3 Policies relevant to regional disparity[8]

2.3.1 China's regional development strategies

China's post-reform regional development strategies comprise another factor that contributed directly to its widening income variations. As early as 1980, China formally established four special economic zones located in the coastal provinces of Guangdong and Fujian. In 1984, another 14 coastal cities were opened in order to attract foreign direct investment and trade.

These special economic zones and open coastal areas had considerable autonomy, enjoyed special tax treatments, and received preferential resource allocations. As part of the country's Coastal Area Development Strategy, the government gradually extended special policies to all coastal areas in the late 1980s. Although some cities in the interior regions were eventually opened in 1994, the time lag had varied effects on attracting investments and generating growth, putting the non-coastal provinces at a significant disadvantage. Throughout the 1980s and early 1990s, the coastal provinces garnered a disproportionately high share of foreign investment and trade and became the cradle of rural enterprises, which have been the driving force behind China's income growth. During this period, the income levels of interior and coastal regions diverged.

2.3.2 Preferential taxation policy for eastern coastal regions from 1990 to 2000

Following the "let some get rich first" strategy at the onset of the reform program, the central government granted preferential treatment to coastal regions with respect to foreign direct investment (FDI) and taxation. In particular, while state-owned enterprises paid their income tax at 33 percent, foreign enterprises paid only 15 percent on average. These policies resulted in a rapid income convergence among coastal regions that were allowed to integrate with the outside world. However, the policies also caused regional disparity in terms of volume of FDI inflows and other types of private investment. Until 2005, FDIs in the eastern region comprised about 87 percent of China's total FDI, while the central and western regions only made up 9 percent and 4 percent, respectively of this total. Besides, collective investment in the coastal region comprised 74.6 percent of China's total investment in 1997, while the central and western regions only accounted for 25.4 percent of such investment. These private investments greatly promoted the effectiveness and the production structure of the enterprises located in the coastal region, and thus increased the level of development of different regions.

2.3.3 Preferential taxation policy for western regions from 2000 to 2005

As previously mentioned, preferential policies widened the income disparity between the coastal

[8] Yang (2002) emphasized fiscal and credit policies and a regional development strategy as the main causes of rising regional inequality in China. On the other hand, Kanbur and Zhang (2002) showed empirical evidence that fiscal centralization and trade liberalization have also systematically affected regional inequality. Besides, as a component of government transfers, an urban price subsidy and government subsidies to unprofitable state-owned enterprises (SOEs) based in urban centers, as well as preferential credit allocations to the state sector also contributed significantly to the increase in the rural–urban household income gap (Yang and Cai, 2000).

and western regions from 1990 to 2000.

To reduce this gap, government started to adjust the regional allocation structure of its poverty relief fund in 1994, and to formulate preferential policies to actively promote balanced development between the eastern and western regions. This was achieved by offering tax concessions and exemptions of three and two years, respectively, to local joint ventures and foreign-owned enterprises, as well as to key investment projects in the western region. In 2001, as a means of spurring enterprise in the western region, income taxes were reduced to 15 percent for the next 10 years for firms in the tourism and banking sectors.

2.3.4 Transfer payments

Transfer payments[9] have continued to play an important role in China's state budget, serving as the most important tool to deal with regional disparity and poverty. However, most of the transfers are merely a redistribution of tax revenues between the central and local governments as a result of the tax sharing system enforced during the 1980s and 1990s[10]. Transfer payments aimed at reducing the regional disparity were initiated after 1994, when the central government applied transitional measures such as fiscal transfer payments to the central and western areas. At that time however, the country had not yet reached the goal of an ideal tax-sharing system i.e., increasing fiscal transfers to balance public finance among regions. As a consequence of such a premature system, rich regions rather than poor regions received more transfers in the form of returned tax revenues. Only a very small proportion of the transfer aimed to reduce the regional disparities.

Table 2 shows the structure of China's government transfer in the years 1997, 2000, 2002 and 2006, in which tax rebates plus specific purpose grants that favored the eastern region make up approximately 80 percent of total government transfers.

Transitional measures, which is the only type of transfer arrangement that aims to narrow the regional gap, accounts for a small part of the total transfer as shown in the table. The total amounts of this type of transfer payment to the central and western regions are, respectively, double and triple the transfer payment to the eastern regions after year 2000.

Due to the transition transfer's small share relative to the total transfer, the effect of the government transfer on regional disparity is regarded as inconsequential. However, as a tool for equalizing regional gaps, the Chinese government plans to gradually increase the transfer to the central and western regions in the future.

[9] In the existing fiscal system, transfer payment items from the central government to local governments include tax refunds, fixed subsidies of the original system, transfer payments, and funds raised by government bonds.

[10] During the 1980s and 1990s, China's fiscal system was decentralized so that regional governments were required to finance their local development initiatives themselves.

Table 2: Structure of government transfer unit in billion RMB and %

	1997	%	2000	%	2002	%
Total	**285.4**	**100**	**466.8**	**100**	**824.0**	**100**
Tax rebates	201.2	70.5	220.7	54.4	301.4	36.6
Quota subsidies	11.2	3.9			32.3	3.9
Specific purpose grants	51.6	18.1	89.9	22.2	402.5	48.8
Transitional measures	5.0	1.8	8.5	2.1		
Final account subsidies	11.1	3.9				
Others (residual)	5.4	1.9				

Source: Ministry of Finance

3 Literature review

The link between fiscal policy and income distribution is one of the central questions of economic development. A number of approaches have been done to analyze this link; including the crafting of suitable tools to assess the impact of fiscal policies i.e. changes in trade or tax policies, on poverty and income distribution.

Among the variety of policy analysis tools, computable general equilibrium (CGE) models are widely used because of their ability to illustrate the feedback effect between different markets, and produce disaggregated results at the sectoral or microeconomic level within a consistent macroeconomic framework (Piggott and Whalley, 1985; De Janvry, Sadoulet et Fargeix, 1991; Adelman and Robinson, 1988; Dervis et al., 1982; Bourguignon and al., 1991; De Janvry and al., 1991; Decaluwé, Dumont and Savard 1999; Cogneau and Robillard, 2000; Cockburn, J., 2001). Among the varied applications of CGE models, regional CGEs can be used to geographically disaggregate the impact of state-wide economic policies, as well as regional development policies such as area-targeted transfer, tax policy, and local-based public spending.

Early studies on regional CGE models focused on simulating trade policy shocks. Dixon et al. (1982) presented a top-down regional disaggregation of the effects of tariff increases in Australia; Liew (1984) used a bottom-up approach to compare the effects of a tariff increase in Australia with the results achieved in a top-down framework; Whalley and Trela (1986) reported results from an interregional CGE model for the regional impacts of tariffs in Canada; and Gazel (1994) developed an inter-regional CGE model to measure the regional effects of the Free Trade Agreement between the US and Canada.

Mathur and Stein (1993) expanded the CGE framework to a dynamic setting by allowing for sluggish interregional adjustment processes. In 1998, using a regional CGE model, Dalenberg, Partridge and Rickman (1997) found that taxes used to finance increased public infrastructure investment led to increased state employment growth in the United States.

Some recent extensions to the early regional CGE literature include Seung and Kraybill (2001), and Conrad and Heng (2002). Both of these studies examined the role of public infrastructure in regional economic growth. They found that even when accounting for negative effects of increased taxes to finance public infrastructure, the reduced congestion increased regional output. Characterized by using "supra-regional " accounts as well as a consumer's or buyer's price in the model, Bernard Decaluwé *et al.* (2002) built a bi-region CGE (Québec and Rest-of-Canada) to mimic provincial and federal government policy shocks on the two economies.

Using an innovative technique developed by Decaluwe, Patry, Savard, and Thorbecke (1999), poverty analysis is integrated into the CGE methodology to allow for the endogenous determination of both the intra-group income distributions and the monetary poverty line. By applying standard poverty measures, national poverty lines, and distributions of income for each household group to the simulation, policy-induced changes in group-specific and national poverty can be evaluated. They showed that an important contribution of the dual-dual model *vis-à-vis* poverty analysis in a CGE model is its incorporation of inter-group migration. They also found that the changing population shares of the socio-economic groups that follow population shifts have important implications for the magnitude of changes in national poverty.

In general, CGE models can quantify income distribution effects in two key ways. One is in terms of returns to factors of production, where the households own the factors of production, which is given to firms; in return, factors of income are given for their services.

The other is to model more than one household rather than only one representative household. As regards relevant CGE studies on China, the model includes several types of households and results of these can be found in Yang and Huang (1997), Wang and Zhai (1998), Li and Zhai (2000), and Zhai and Hertel (2000).

Due to the unavailability of official regional data such as commodity inflow and outflow among regions, only a few CGE studies have been done to consider the regional situation within China upon its adoption of fiscal policy. Li and He (Li and He, 2005) apply a regional CGE model[11] to simulate trade and environmental policy shocks (such as reduction of CO2 emissions) on human health and other environmental end-points like crop and material damage. Horridge, J.M. and G. Wittwer (2008, 2009) establish a "bottom-up" computable general equilibrium model of the Chinese economy to analyze the regional economic impacts of region-specific shocks.

In this paper, we develop a three-region (western China, eastern China and central China) CGE model that maintains the characteristics of a CGE model while also highlighting the linkage between the CGE and FGT indicator.

[11] This model is created by the Development Research Centre (DRC). It is a three-region (Guangdong, Shanxi, and rest of China) CGE model; the earlier version was a two-region model.

4. Analytical framework

The three-region CGE model that serves as the analytical framework for this study has a similar structure to Cockburn's model. The difference lies in that, rather than looking at tariff, we focus on the effect of China's preferential tax policy and government transfer on poverty.

To address the issue of regional disparity, we divide China into eastern China, central China and western China for the following reasons. Firstly, China's preferential tax policy was implemented by these three regions in different years. The second reason is the availability of data. Although China has 31 provinces and autonomous regions, not all have their own input-output (I-O) table. These tables and data are created and compiled by the Department of Statistics for each province separately. The Social Sciences Academic Press published China's first "Multi-regional Input-Output Model" until 2005. This I-O table divides China into eight regions, from which we can easily construct regional I-O tables for the aforementioned regions. However, China's multi-regional input-output model is not a standard social accounting matrix (SAM). For a CGE model, we needed to create a SAM based on an I-O table and some statistical data such as tax rate and regional labor data. These data are normally reported by the three regions highlighted in this study.

Similar considerations are also taken into account when we selected the sectors and households for the study. The eight sectors are agriculture, mining industry, light industry, heavy industry, power industry, construction, trade and transportation industry, and other service sectors. We also included the rural and urban households in each region.

4.1 Macro CGE framework

Similar to the conventional CGE model, our model also describes the behavior of three agents: the producer, the consumer, and government. The representative producer in each region maximizes profit by optimally using composite factors and inputs, given their market prices. By producing the most profitable combination of goods and services, their products are sold in the domestic market and exported to the rest of the world by constant elasticity of transformation (CET) function given the different market prices. Consumers or individual households in each region receive income from the firm and other sources such as government transfers, and then consume goods and services according to maximized utility. The government collects taxes and also consumes. Prices and wages are determined to clear commodity and factor markets.

The model consists of eight blocks: price, firm behavior, household behavior, government behavior, trade, investment demand, and general equilibrium condition. The core equations of firm behavior, household behavior, government behavior, trade demand, and calibration of poverty index are explained as follows. The function related to the poverty issue FGT is separated from the CGE model.

The output function is set up according to national and regional levels. Firstly, the national sectoral output is a CES composite of sectoral output by region. Regional sectoral output is a Leontief function of value-added and the intermediate input of each sector. Sectoral value-added by region is a CES composite of primary factors. Sectoral output is sold in the domestic market and is exported in the international market through the CET function.

In many CGE models, representative household expenditure behavior functions are derived from the maximization of the Cobb-Douglas or constant elasticity of substitution (CES) utility. The limitation in using these functional forms for consumption is that they imply unitary income elasticity of demand. This fails to account for the way changes in income affect the structural adjustment of the economy to exogenous shocks. In order to avoid such drawbacks in our model, consumption demand is determined by using the utility function associated with the linear expenditure system (LES). Income of rural or urban households in different regions is the sum of wage income of unskilled labor or skilled labor, return to capital, and government transfer. After paying income tax, the household uses disposable income to save and to consume.

Similar to the definition of conventional government consumption, in this model government gets income from taxes such as capital income tax, household income tax, export taxes, tariffs, value-added taxes, and indirect taxes. The government consumption function is simplified as a proportion function of the total output. Except consumption, government transfer to the firms, transfer to households, and transfer to the rest of the world are also recorded as government expenditure.

Total national domestic demand includes household consumption, government consumption, intermediate input demand, and investment demand, which have been discussed above.

The closure rules are defined by a set of constraints that need to be satisfied by the economic system. These constraints are as follows: (1) the supply-demand balances in the product; (2) the equilibrium in factor markets (which means that labor is mobile between sectors but fixed and fully employed within each region; and capital is fixed within each sector and region); (3) the fiscal balance, showing that investment is determined by total saving; and (4) the external balance, equating the supply and demand for foreign exchange.

4.2 Functions related to the poverty issue

Following Cockburn's (2001) method, we calculate FGT index to mimic the policy shock on poverty.

In brief, the function of calibrating FGT is as follows:

$$P_\alpha = \frac{1}{N_{Z^\alpha}} \sum_{j=1}^{J} (z - y_j)^\alpha$$

where *j* is a sub-group of individuals with income below the poverty line (z), N is the total number of adult equivalents in the sample, y_j is the income of the individual *j* and α is a parameter that allows us to distinguish between the alternative FGT indices.

5. Simulation Results

First, we assume that China's preferential taxation policy is one of the reasons for its regional disparity and expect that if the preferential taxation policy is eliminated, regional disparity in the country can be improved. Since the main premise of the preferential taxation policy is to give income tax reduction to specific firms such as FDI enterprises and other private enterprises, we need to eliminate the preferential tax to these specific enterprises and then calculate its effects.

However, since the regional data decomposed by types of firms and by sectors are not available for each region, what we did was to take into account the share of different types of firms to total in each sector and each region. Using value-added output data from the yearbook, we find that 84.0 percent[12] of FDI firms and private firms were located in the eastern region in 1997; in other words, there are almost no FDI enterprises in the central and western regions.

In our simulation, we wanted to show that if the preferential taxation for the eastern region is eliminated, and the firm income tax rate is the same as that of the central and western regions, then the selling price for the products produced in the eastern region will increase. This will then change the output in the three regions as well as government revenue, which will in turn change household income and consumption. The resulting income and consumption effects will, in turn, feed back into the model and influence the overall results. For this consideration, we begin with the initial preferential tax rates for the eastern region and trace the impacts of eliminating this kind of preferential tax for the eastern region through the model.

To simulate the effect of this kind of policy, we need the actual enterprise income tax rate for foreign investment enterprises and other private-type enterprises. In the model file (see Appendix 1), the variable is tkk_{ir}, which is also the shock variable in our simulation for preferential tax policy. Due to lack of relative data by region, by type of enterprise (i.e. state-owned or privately-owned) and by sectors, we considered two exercises to simulate the effects of preferential taxation. The first involved simply using the change in the nominal enterprise income tax, which is 15 percent (given that 30% is the non-preferential tax rate while 15% is the preferential rate), since we do not know the actual preferential tax rate for FDIs and other private enterprises by region and sector. This simulation may result in a bigger shock than what is seen in reality.

[12] Figures are calculated by the authors using 1997 provincial investment data.

The second exercise is trying to mimic the change in actual preferential tax rate. In 1997, China's total FDI by sector is accounted for as follows: 1.89 percent by agriculture, 0.39 percent by mining industry, 63.85 percent by manufacturing industry, 1.1 percent by power industry, 2.05 percent by construction, 2.82 percent by trade and 29.95 percent by other service sector. In terms of FDI by region, 84.0 percent flowed into the eastern region, while the western and central regions received only 16 percent of total FDI combined; we thus assumed that foreign investment enterprises are just located in the eastern region. These FDI enterprises produced 23.29 percent of the total output in the eastern region, which we needed to take into account in the following calculation. In the second exercise therefore, we computed a 0 percent change in agriculture, mining, power, and construction sectors; and a 3.49 percent (23.29%*15%) in the manufacturing sector, light and heavy manufacturing industries, the trade sector, and services in the eastern region.

We then examined if China's current government transfer - which is represented in our model as TGH (see Appendix 1) - is an effective tool to narrow the regional disparity.

Similar to the first simulation, we initialed the government transfer the same as that in 1997, then we increased the government transfer to the central and western regions by 37.8 percent[13]. Theoretically, more government transfers increase government expenditure to the household, thus increasing household income as a result. The household income and consumption effects will feed back into the model and influence the overall results.

Table 3 presents sectoral supply and demand effects under scenario 1. From the simulation results, we find that when enterprise income tax increases in the eastern region's light manufacturing, heavy manufacturing, trade, and service sectors, the output for domestic use decreases in four sectors, while the output in mining, power, trade and transportation, and services sectors increase. The reason for such is that when the capital income tax increases in the sector, prices for the products from that sector increase, thus decreasing product demand, especially for light manufacturing and heavy manufacturing products. However, if the product is labor-intensive, demand for capital rises with the increase in product price, which may in turn result in increasing rather than decreasing demand. This could also explain why the demand for the service product increases when we increase the tax rate in the service sector in the eastern region, as noted in table 3. The imports and exports have the same pattern as domestic demand.

[13] Average nominal growth rate of government transfers during 1997-2002 is 37.8 percent. In terms of government transfer categories, only transition transfers aim at eliminating regional disparity, especially in the central and western regions.

Table 3: Effect on total supply and total demand, export and import unit in%

	Eliminating preferential tax policy to eastern region by 15%[14]				Eliminating preferential tax policy to eastern region by 3.49%			
	Total supply		Total demand		Total supply		Total demand	
	Domestic market	export	Domestic demand	import	domestic market	export	domestic produced	import
Agriculture	-0.100	-0.133	-0.100	-0.068	-0.026	-0.034	-0.026	-0.018
Mining	-0.121	-0.149	-0.121	-0.094	-0.031	-0.038	-0.031	-0.024
Light industry	-0.062	-0.109	-0.062	-0.015	-0.016	-0.028	-0.016	-0.004
Heavy industry	-0.193	-0.227	-0.193	-0.158	-0.050	-0.059	-0.050	-0.041
Power	0.192	0.010	0.192	0.092	0.013	0.003	0.013	0.024
Construction	-0.470	-0.501	-0.470	-0.440	-0.121	-0.129	-0.121	-0.114
Trade and transportation	0.780	0.686	0.780	0.875	0.202	0.178	0.202	0.226
services	0.197	0.143	0.197	0.251	0.051	0.037	0.051	0.065

However, when we examine the government transfer exercises (see Table 4) we find that an increase in government transfers to the central and western regions will increase the domestic sales in four sectors, with the agriculture sector having the biggest positive effect. The heavy industry, construction, trade and transportation, and services sectors respond negatively, with services having the biggest negative effect among these sectors.

[14] This treatment equals to an increase in the FDI enterprise income tax.

Table 4: Effect on total supply and total demand, export and import unit in %

	Increasing government transfer to central and western region by 37.8%				Increasing government transfer to central and western region by 50%			
	Total supply		Total demand		Total supply		Total demand	
	domestic market	export	Domestic demand	import	domestic market	Export	domestic produced	import
Agriculture	0.223	0.248	0.223	0.210	0.303	0.328	0.303	0.278
Mining	0.008	0.031	0.008	-0.015	0.011	0.042	0.011	-0.019
Light industry	0.055	0.075	0.055	0.035	0.072	0.099	0.072	0.046
Heavy industry	-0.017	0.002	-0.017	-0.036	-0.022	0.003	-0.022	-0.048
Power	0.003	0.018	0.003	-0.012	0.004	0.023	0.004	-0.016
Construction	-0.097	-0.078	-0.097	-0.116	-0.129	-0.103	-0.129	-0.154
Trade and transportation	-0.558	-0.505	-0.558	-0.611	-0.738	-0.668	-0.738	-0.808
services	-0.015	-0.003	-0.015	-0.028	-0.029	-0.003	-0.029	-0.037

Table 5 reports some results of breaking down the value-added output by region and sector so that we could find regional effects. With the increasing enterprise income tax in some sectors in the eastern region, value-added output increases in power, trade and transportation and service, and decreases in the light and heavy manufacturing industries, agriculture, mining, and construction. Since the pattern is the same as the change in domestic demand and supply as shown in table 3, we could explain the results in the same way as cited previously.

Table 5: Sectoral value-added output effects in different region unit, in %

	Eliminating preferential tax policy to eastern region by 15%			Eliminating preferential tax policy to eastern region by 3.49%		
	Eastern region	Central region	Western region	Eastern region	Central region	Western region
Agriculture	-0.101	-0.098	-0.102	-0.026	-0.025	-0.026
Mining	-0.129	-0.125	-0.118	-0.033	-0.032	-0.031
Light industry	-0.066	-0.070	-0.071	-0.017	-0.018	-0.018
Heavy industry	-0.196	-0.198	-0.196	-0.051	-0.051	-0.051
Power	0.041	0.048	0.056	0.011	0.012	0.015
Construction	-0.471	-0.473	-0.468	-0.122	-0.122	-0.121
Trade and transportation	0.745	0.785	0.773	0.193	0.203	0.200
services	0.178	0.219	0.182	0.046	0.057	0.047

As we had expected in the beginning of this study, the outcome of government transfers as shown in table 6 has weak effects on value-added output when compared with the effect of preferential taxation policy, and this result has been tested in previous research i.e. Zhang, 2005 (in Chinese).

Table 6: Sectoral value-added output effects in different region unit in %

	Increasing government transfer to central and western region by 37.8%			Increasing government transfer to central and western region by 50%		
	Eastern region	Central region	Western region	Eastern region	Central region	Western region
Agriculture	0.254	0.226	0.215	0.336	0.299	0.285
Mining	0.033	0.010	-0.006	0.044	0.013	-0.008
Light industry	0.067	0.060	0.054	0.088	0.079	0.071
Heavy industry	-0.001	-0.014	-0.020	-0.002	-0.019	-0.026
Power	0.03	0.008	-0.012	0.040	0.011	-0.016
Construction	-0.083	-0.096	-0.105	-0.110	-0.128	-0.139
Trade and transportation services	-0.512	-0.564	-0.564	-0.677	-0.746	-0.746
	0.020	-0.020	-0.026	0.027	-0.026	-0.034

Policy effects on household income are the major concern of our report. Tables 7 and 8 note the simulation results on change in household income. When we eliminated the preferential tax policy in the eastern region, we find that all households have a positive response in terms of household income. Since household income is sourced from factor returns and government transfers in our model, if capital income tax increases to some degree, household income may in turn increase. Besides, from table 7 we learn that households in the western and central regions have bigger positive response than that of households in the eastern region, which may mean that if the preferential tax treatment is eliminated, the income gap between different household groups will be smaller. Similar to the above simulation results, a smaller change in tax rate results in a smaller response, but the pattern of the change remains the same.

Table 7: Effects on household income unit in %

		Eliminating preferential tax policy to eastern region by 15%	Eliminating preferential tax policy to eastern region by 3.49%
Eastern region	Rural household	0.048	0.013
	Urban household	0.048	0.013
Central region	Rural household	0.059	0.015
	Urban household	0.059	0.015
Western region	Rural household	0.058	0.015
	Urban household	0.058	0.015

In scenario 2, when government transfers to households in the central and western regions increase by 37.8 percent and 50 percent, respectively (see Table 8), household income for all six types of households increase, with households in the eastern region registering the smallest increase, while households in the western region increase the most. Since we assume that household income comes from government transfers, the income will thus increase with more transfer payments.

Table 8: Effects on household income unit in %

		Increasing government transfer to central and western region by 37.8%	Increasing government transfer to central and western region by 50%
Eastern region	Rural household	0.024	0.032
	Urban household	0.024	0.032
Central region	Rural household	0.066	0.087
	Urban household	0.066	0.087
Western region	Rural household	0.080	0.106
	Urban household	0.080	0.106

In terms of welfare, the Hicksian EV decreases by 0.041 percent, 0.07 percent, 0.016 percent and 0.017 percent under the above scenarios. The consumer price increase in all the cases is shown in table 9.

Table 9: Change in consumer price unit in %

	Eliminating preferential tax policy to eastern region by 15%	Eliminating preferential tax policy to eastern region by 3.49%	Increasing government transfer to central and western region by 37.8%	Increasing government transfer to central and western region by 50%
Agriculture	0.064	0.016	0.037	0.049
Mining	0.050	0.013	0.042	0.055
Light industry	0.088	0.023	0.037	0.049
Heavy industry	0.061	0.016	0.034	0.045
Power	0.082	0.021	0.029	0.039
Construction	0.061	0.016	0.038	0.050
Trade and transportation	0.185	0.048	0.105	0.139
Services	0.105	0.027	0.025	0.033

Finally, following Cockburn (2001), we calculate the FGT poverty index using the household data sourced from NBS in 1997 and DAD software. Table 10 reports the results.

Table 10: Change in FGT poverty index (%)

Index	Eliminating preferential tax policy to eastern region by 15%			Increasing government transfer to central and western region by 37.8%		
	Eastern region	Central region	Western region	Eastern region	Central region	Western region
Head count ratio (α= 0)	-0.100	-0.621	-0.812	-0.068	-0.532	-0.586
Poverty gap (α= 1)	-0.067	-0.223	-0.454	-0.035	-0.213	-0.273
Poverty severity (α= 2)	-0.043	-0.101	-0.176	-0.012	-0.063	-0.0682

6. Conclusion

Given that the fight against poverty has significant positive effects on the welfare of the whole society, it is thus an unavoidable obligation of government to implement poverty-alleviation strategies. As has been illustrated in this paper, anti-poverty strategies employed in China since the middle of the 1980s have been characterized as regionalistic, beginning with the preferential tax policy given to the eastern coastal region from the end of 1970s up to western region development strategies from the start of this century.

Using some statistical data and a computable general equilibrium model with a three- region component, we find that a preferential tax policy to a specific region could be an important reason for China's regional disparity and could have a significant effect on household income as well as FGT indicators. On the other hand, government transfers have similar - and in some cases, weaker - effects on both household incomes and FGT indicators. The simulation results suggest that a tax policy is a relatively more effective tool against China's regional disparity more than government transfers.

To effectively use government transfers against poverty, the Chinese government should either need to use more money for transferring to the country's poor regions and people, or change its old transfer structure in order to really benefit its poor. Other transfer-related strategies that are also being implemented include reforms in the pension system, social insurance system, and employment system to protect the low-income population and those living in rural areas. Regional disparity and the poverty problem are expected to be addressed in this regard, in the name of China's "harmonious society".

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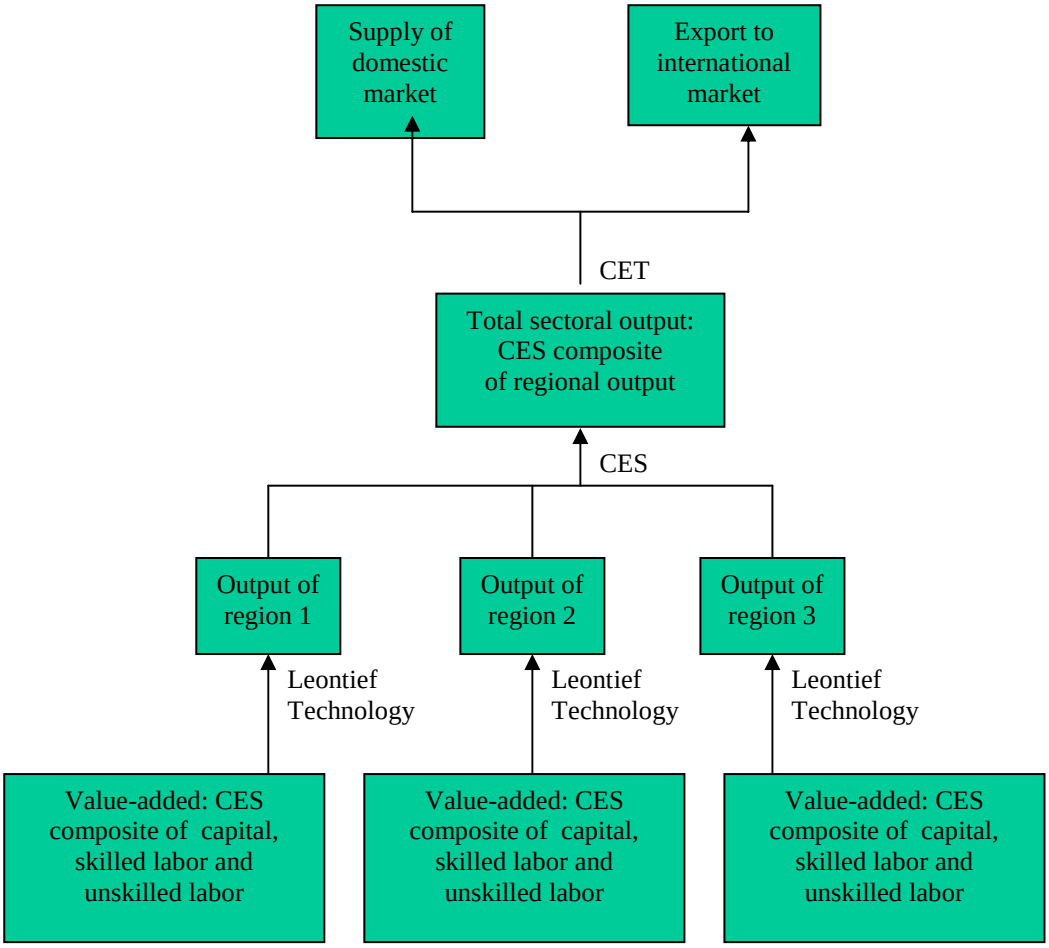
Appendix 1: The core equations in the CGE model for China

Firm behavior

Following is the structure of production as has been described above.

Figure 1 Structure of production



Suppose:

i = Agriculture, Mining industry, Light industry, Heavy industry, Power industry, Construction, trade and transportation, Other service sectors

h = rural households in eastern China,
rural household in western China,
rural household in central China
urban households in eastern China,
urban household in western China,
urban household in central China

f = Capital, Unskilled labor, Skilled labor

r = eastern China, western China, central China

Total national output (or CES composite of sectoral output by each region)

$$XST_i = \beta_i \sum_r (\delta_{ir} * XS_{ir}^{-\rho_i^y})^{-1/\rho_i^y} \quad (1)$$

in which, XST_i : Total output of sector

XS_{ir} : Sector output in region *r*

$\beta_i, \delta_{ir}, \rho_i^y$ are parameters

Regional sectoral output

$$XS_{ir} = VA_{ir} / v_{ir} \quad (2)$$

in which, VA_{ir} : Variable sector production cost in region *r*

v_{ir} : Leontief coefficient of value-added in region *r*

$$XS_{ir,r=eas} = (\delta^{xs}{}_{ir,r=wes} / \delta^{xs}{}_{ir,r=eas})^{\sigma_i^{xs}} * (P_{ir,r=eas} / P_{ir,r=wes})^{\sigma_i^{xs}} * XS_{ir,r=wes} \quad (3)$$

$$XS_{ir,r=cen} = (\delta^{xs}{}_{ir,r=wes} / \delta^{xs}{}_{ir,r=cen})^{\sigma_i^{xs}} * (P_{ir,r=cen} / P_{ir,r=wes})^{\sigma_i^{xs}} * XS_{ir,r=wes} \quad (4)$$

where, P_{ir} : price for product *i* in region *r*.

$\delta^{xs}{}_{ir}, \sigma_i^{xs}$: parameters

Regional Value-added

$$VA_{ir} = \alpha_{ir} (\varphi_{ir} * KT_{ir}^{-\rho^v} + (1-\varphi_{ir}) * LD_{ir}^{-\rho_i^v})^{-1/\rho_i^v} \quad (5)$$

in which, KT_{ir} : capital demand in region *r*

LD_{ir} : labor demand in region *r*

$\alpha_{ir}, \varphi_{ir}, \rho^v$ are parameters

Total labor demand

$$LD_{ir} = ((1-\varphi_{ir}) / \varphi_{ir})^{\sigma_i^v} * (RR_{ir}(1+tkk_{ir}) / W_{ir})^{\sigma_i^v} * KT_{ir} \quad (6)$$

in which, RR_{ir} : capital price in region *r*

W_{ir} : labor price in region *r*

$\varphi_{ir}, \sigma_i^{\,v}$: parameters

tkk_{ir} : capital income tax rate

Unskilled labor demand

$$LDQ_{ir} = ((1-\varphi_{ir}^{\,L})/\varphi_{ir}^{\,L})^{\sigma_i^{\,L}} * (WNQ_r / WQ_r)^{\sigma_i^{\,L}} * LDNQ_{ir} \qquad (8)$$

in which, LDQ_{ir} : skilled labor demand in region *r*

WNQ_r : unskilled labor price in region *r*

WQ_r : skilled labor price in region *r*

$LDNQ_{ir}$: unskilled labor demand in region *r*

$\varphi^{L}{}_{ir}, \sigma_i^{\,L}$: parameters

$$LD_{ir} = \beta_{ir}^{\,L}(\varphi_{ir}^{\,L} * LDNQ_{ir}^{\,-\rho_i^{\,L}} + (1-\varphi_{ir}^{\,L}) * LDQ_{ir}^{\,-\rho_i^{\,L}})^{-1/\rho_i^{\,L}} \qquad (7)$$

in which, $\beta_{ir}^{\,L}, \varphi_{ir}^{\,L}, \rho_i^{\,L}$: parameters

Intermediate input1

$$ICJ_{ijr} = aij_{ijr} IC_{jr} \qquad (9)$$

in which, ICJ_{ijr} : intermediate input in region *r*

IC_{jr} : intermediate input in region *r*

aij_{ijr} : coefficient

Intermediate input2

$$IC_{ir} = io_{ir} XS_{ir} \qquad (10)$$

in which, io_{ir} : coefficient

domestic market supply and export to international market

$$EX_i = \left[\frac{PE_i}{PD_i}\right]^{\sigma^t} \left[\frac{1-\gamma_i}{\gamma_i}\right]^{\sigma^t} * D_i \qquad (11)$$

$$XST_i = \beta^{cet}\left[\ \delta^{cet} EX_i^{\ \rho^t} + (1-\delta^{cet}) * D_i^{\ \rho^t}\ \right]^{1/\rho^t} \qquad (12)$$

in which: D_i : local market sales

EX_i: sales at international market

PE_i: Price of goods for export

PD_i: Price of goods sold at home region

$\beta^{cet}, \delta^{cet}, \rho^t, \sigma^t, \gamma_i$: parameters

Household behavior block

Household consumption function

$$CH_h = \eta_h + \frac{\mu_h}{PC_h}(CTH_h - \sum PC_h * \eta_h) \qquad (13)$$

in which, CH_h: consumption of households in region *r*

PC_h: consumer price in region *r*

CTH_h: disposable income of households in region *r*

η_h : minimum subsistence requirements for households in region *r*

μ_h : marginal propensity to consume for households in region *r*

Household income function

$$YH_h = \sum (WNQ_r * \sum_i LDNN_{ir} + WQ_r * \sum_i LDQ_{ir} + \sum_i RR_{ir} * (1+trr_{ir}) * KT_{ir})$$
$$+ div_h + PINDEX * TGH_{\ h} + E * TRH_{\ h} \qquad (14)$$

in which, YH_h: households income

div_h: dividend to the household

PINDEX: price index

TGH_h: government transfer to the household

E: exchange rate

TRH: foreign transfer payment to household

Household disposable income function

Household disposable income is household income minus income tax of the household.

$$YDH_h = YH_h(1 - ty_h) \quad (15)$$

in which, YDH_h: household disposable income

ty_h : household income tax rate

Household consumption expenditure function

$$YTH_h = YDH_h - SH_h \quad (16)$$

in which, SH_h: household savings

Dividend transfer to household

$$DIV_h = dvr_h * YK \quad (17)$$

in which, DIV_h : dividend transfer to household

dvr_h : share of dividend to capital income

YK: capital income

Firm income function

$$YF = YK + PINDEX * TGF + TRF * E \quad (18)$$

In which, YF: firm income

TGF: government transfer to firm

TRF: foreign payments transfer to firm

Capital income function

$$YK = \sum_r (1 - \sum_h \gamma_{hr}) \sum_i rr_{ir} * KT_{ir} \quad (19)$$

Firm saving function

$$SF = (1 - tk) * YF - \sum_h div_h - E * TFR \quad (20)$$

in which, *tk*: firm income tax

Government behavior block

government total spending function

$$CTG = \sum CG_i * PC_i \qquad (21)$$

in which, CTG : government total expenditure

CG_i : government consumption in region *r*

government consumption function

$$CG_i = \omega_i * Q_i \qquad (22)$$

in which : ω_i: The share of government consumption in output

government revenue function

$$YG = \sum_h TXY_h + TK * YK + E * TRG + \sum_i TVA_i + \sum_r \sum_i TXS_{ir} + \sum_i TXM_i + \sum_i TXE_i \qquad (23)$$

in which, YG: government revenue

TXY_h: household income taxes

TVA_i: value-added taxes

TXS_{ir}: indirect taxes

TXM_i: import duties

TXE_i: export taxes

Household income taxes

$$TXY_h = ty_h * YH_h \qquad (24)$$

Value-added taxes

$$TVA_i = \sum_r (TV * PVA_{ir} * VA_{ir}) \qquad (25)$$

Indirect taxes

$$TXS_{ir} = (tx_{ir}) * P_{ir} * XS_{ir} \qquad (26)$$

Import duties

$$TXM_i = (tm_i) * PWM_{0i} * E * IM_i \qquad (27)$$

Export taxes

$$TXE_i = (te_i) * PE_i * ES_i \qquad (28)$$

Government savings

$$STG = YG - CTG - PINDEX * \sum_h TGH_h + TGF - E * TGR \qquad (29)$$

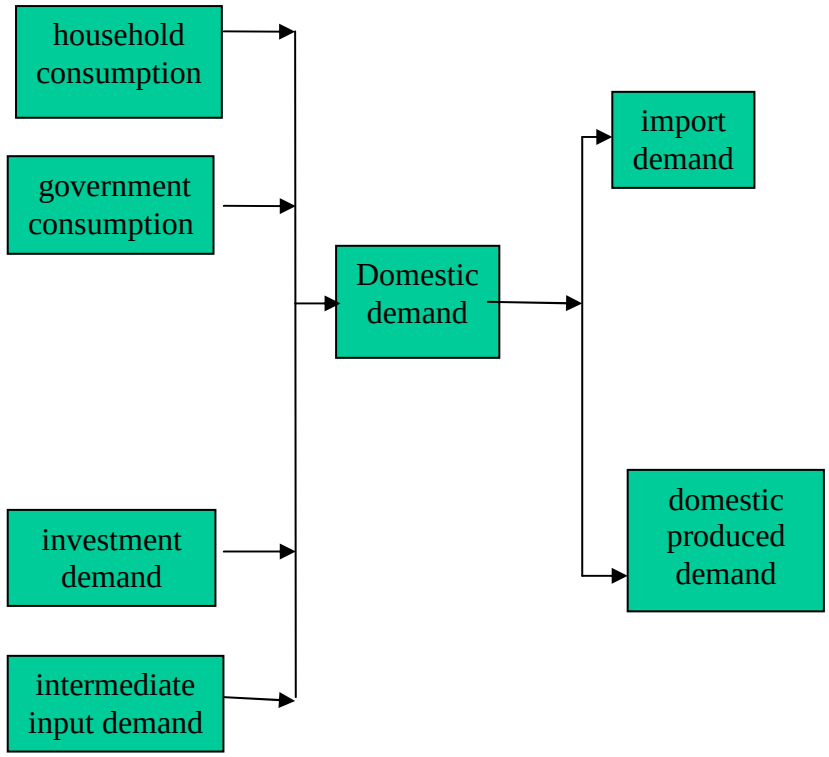
wherein STG is government savings

Other demand function

Figure 2 shows the structure of demand in the model. Total domestic demand includes household consumption, government consumption, intermediate inputs demand, and investment demand. Consumption functions for different agents (household and government) have been discussed as above, as well as the intermediate inputs demand equation. Investment demand is simply defined as a portion of total output.

On the other hand, from the supply side of these demand points of view, total demand is sourced from domestically produced goods and imported goods.

Figure 2: Structure of demand



Total consumption demand function

$$C_i = \sum_h CH_{hi} + CG_i \qquad (30)$$

In which, C_i: total consumption demand

Total intermediate demand function

$$INTD_i = \sum_r \sum_j ICJ_{ijr} \qquad (31)$$

Investment demand function

$$DI_i = \varpi_i * IT / PC_i \qquad (32)$$

In which, DI_i: investment demand

ϖ_i : Share of investment in total investment

Import demand function

$$IM_i = \left[\frac{PD_i}{PM_i}\right]^{\sigma_m} \left[\frac{\psi_i}{1-\psi_i}\right]^{\sigma_m} * D_i \qquad (33)$$

In which, IM_i: import

D_i: Total demand

PM_i: import price

ψ_i is parameter

Armington function

$$Q_i = \beta^{arm}\left[\ \delta^{arm} IM_i^{\rho^a} + (1-\delta^{arm}) * DM_i^{\rho^a}\ \right]^{1/\rho^a} \qquad (34)$$

Price block

Import price

$$PM_i = PWM_i * (1 + tm_i) * E \qquad (35)$$

Export price

$$PE_i * (1 + te_i) = PWE_i * E \quad (36)$$

Value-added price

$$PVA_{ir} * VA_{ir} = P_{ir} * XS_{ir} - \sum_j ICJ_{jir} * PC_j \quad (37)$$

Sales price

$$PT_i * XST_i = PD_i * D_i + PE_i * EX_i \quad (38)$$

Production cost

$$RR_{ir} * KT_{ir} = PVA_{ir} * VA_{ir} - W_{ir} * LD_{ir} \quad (39)$$

Wage

$$W_i * LD_i = WQ_i * LDQ_{ir} + WNQ_i * LDNQ_{ir} \quad (40)$$

Consumer price

$$PC_i * Q_i = PD_i * D_i + PM_i * IM_i \quad (41)$$

Price index

$$pindex = \sum_r \sum_i \beta^{va}_{ir} PVA_{ir} \quad (42)$$

General equilibrium and model closure

Equilibrium in goods market

Total demand=goods supplied by domestic market + goods supplied by importation

$$Q_i = C_i + INTD_i + INV_i \quad (43)$$

Equilibrium in factor market

Total unskilled labor demand =total unskilled labor supply

$$\sum LDNQ_{ir} = \overline{LSNQ_r} \quad (44)$$

Where, $\overline{LSNQ_r}$ is total unskilled labor supply

Total skilled labor demand =total skilled labor supply

$$\sum LDQ_{ir} = \overline{LSQ_r} \quad (45)$$

Where, $\overline{LSQ_r}$ is total skilled labor supply

Capital demand =capital supply

$$KT_{ir} = KT_{0ir} \quad (46)$$

Equilibrium in investment and savings

$$IT = \sum_h SH_h + SF + STG + E * CAB \quad (47)$$

Capital account balance

$$CAB = TFR + TGR + \sum PWM_i * IM_i + \sum_h TRH - TRF - TRG - \sum_i PWE_i * EX_i \quad (48)$$

wherein *CAB*: Balance of trade

Appendix 2: Data and parameters

Source of the SAM

As in any general equilibrium model applied, the main database used is the Social Accounting Matrix (SAM). SAM for eastern China, western China and the rest of China in this project is based on "China's multi-regional input-output table"[15] published in 2005. The structure of the I-O table is in table 11. Our aim in applying this I-O table is to get a standard SAM (see Table 12) that can be used in our CGE model.

Table 11: China's multi-regional I-O table

	Intermediate demand Region 1……..Region 8	Final demand	export	Import	errors	Total output
Intermediate Input	Region 1 . Region 8					
Value-added						
Total input						

Table 12: SAM structure in the 3-region CGE model for China

	Expenditures								
Receipts	factors	household	Firm	government	the rest of the world	activity	commodity	investment	Total
factors						Value-added			Factor income
household	Labour income			Government transfer					Household income
firm	Capital income to firm								Firm income
government		Income tax				Indirect tax	tariff		government income
the rest of the world							imports		imports
activity							Domestic supply, export supply		Total sales
commodity		Household consumption		Government consumption		Intermediate input		investment	Total domestic sales
ings		Household savings	Firm savings	Government savings	Trade balance				Total savings

[15] See China Information Centre (2005), "Multi-regional Input-output Model for China", Social Sciences Academic Press. China's National Bureau of Statistics (NBS) began to compile national income accounts from 1952 to 1984 according to Material Product System (MPS). From 1985 to 1992, national accounts featured the coexistence of MPS and the System of National Accounts (SNA). Since 1993, the SNA has been the sole basis for the national accounts system. Every five years the NBS publishes a new I-O table. Although it was not really a SAM according to an SNA system in developed countries, it was very similar and was thus able to serve the purpose of the study.

Total	Factor costs	Household expenditure	firm Expenditure	government Expenditure	Foreign cost	Total cost	Total absorption	Total investment	

Source of the elasticity

Elasticity of the substitution in the model includes elasticity of substitution between primary factors, and elasticity of transformation between domestic sales and exports. The best way to get the elasticity is to estimate it using either an econometric approach or a "validation" procedure. To make the work easier and reasonable, the authors will borrow these elasticities directly from the GTAP database, or otherwise estimate these by themselves. Besides some elasticity, and before solving the CGE model, a so-called parameter calibration procedure must be undertaken so that the values of some key parameters (except elasticity of substitution) are directly calculated from the model's equilibrium conditions. Such a methodology is widely used in CGE models. Further, we use equilibrium data to find the values of the share and scale parameters in the production functions and CET function, as well as parameters in the LES functions.

Source to classify household

It is clear that data on households' behavior is crucial in analyzing the impact of policies on income distribution and poverty. We draw data for this issue directly from the "Multi-regional I-O Model for China" to disaggregate households into two different groups in each region (one group is for the rural area and another group is for the urban area)[16].

[16] Actually, in the China Statistical Yearbook, NBS classifies 7 groups of urban households and 5 groups of rural households.