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CHINA'S WTO ACCESSION AND IMPLICATIONS FOR ITS REGIONAL ECONOMIES

Li Shantong & Zhai Fan[1]

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ABSTRACT. This paper analyses the impact on China's economy from its accession to the WTO. Using a two-region Chinese CGE model, the analysis shows the gains China would derive from a more efficient allocation of resources and from the elimination of MFA quota. It also indicates that the gains are unevenly distributed across sectors and across provinces. The paper's most original contribution is to assess the impact at the regional level. The coastal area, epitomized by the Guangdong province, would be the main beneficiary, due to its specialisation in labour intensive goods. However, inland provinces, especially those specialised in agriculture, would suffer losses. WTO membership would lead to widening regional disparities and loosen the already weak economic linkages between coastal area and the rest of the economy. The paper concludes that the government should enhance domestic regional integration through inter-provincial trade facilitation measures.

JEL Classification: F13; F14; F17; O18.
Keywords: China; Trade Policy; Computable General Equilibrium Model; Trade Simulation; Regional Analysis.

RÉSUMÉ. Cet article analyse les répercussions de l'adhésion de la Chine à l'OMC sur son économie. S'appuyant sur un modèle d'équilibre général calculable à deux régions, cette étude montre les gains que la Chine peut tirer d'une allocation des ressources plus efficace et d'une élimination des quotas issus de l'accord multi-fibres. Elle indique aussi que ces gains ne sont pas également répartis entre les secteurs et entre les provinces. L'apport le plus original de ce travail est d'évaluer, au niveau régional, cet impact de l'adhésion à l'OMC. La zone côtière, incarnée ici par la province de Guangdong, serait la principale bénéficiaire, du fait de

1. Corresponding author: LI Shantong, Economist, Development Research Center, The State Council, P. R. China (shantong@drc.gov.cn).
ZHAI Fan, Economist, Development Research Center, The State Council, P. R. China.
The views expressed in the paper are those of the authors and should not be attributed to their affiliated institution.

sa spécialisation dans les biens intensifs en main-d'oeuvre. Toutefois, les provinces de l'intérieur, particulièrement celles spécialisées dans l'agriculture, vont subir des pertes. L'adhésion à l'OMC pourrait accroître les disparités régionales et affaiblir les liens économiques déjà distendus entre la zone côtière et le reste de l'économie. L'article conclut que le gouvernement devrait renforcer l'intégration régionale en adoptant des mesures qui faciliteraient les échanges commerciaux entre les provinces.

Classification *JEL* : F13 ; F14 ; F17 ; O18.
Mots-clefs : Chine ; politique commerciale ;
modèle d'équilibre général calculable ; simulation commerciale ; analyse régionale.

Since the outset of economic reforms and the adoption of outward oriented economic policies, China's economy has been growing at a yearly rate of nearly 10 percent and its external trade has expanded by more than 15 percent a year. In 1999, China's trade reached $360.7 billion, ranking 9th in the world, with exports reaching $195 billion. China has emerged as a major player in the world trading system. The absence of China as a member of the World Trade Organisation (WTO) would have been the latter's failure to represent the global economy. Integrating China into the WTO's rules governing the global trading system would significantly expand world trade, strengthen the multilateral trading system and improve its credibility. After 15 years of negotiations, China became a member of the WTO at the end of 2001. As China is forced to fulfil its commitment to the WTO and further reform its foreign trade regime, substantial trade liberalisation is expected to be achieved in the coming 5 to 10 years.

China is a large country with a huge population, it is also a developing country with per capita GDP of around 840 US$ in the year 2000 (at nominal exchange rate). However, the disparities are great across the country. For example, the per capita GDP of Shanghai is nearly 12 times that of Guizhou province in the South Western region. It is therefore necessary not only to study the development of China from a national perspective, but also to take into account the development of its different regions. That is why the impact of China's accession to the WTO should also be analysed in a regional context.

Against a background of rapid economic growth, the difference in economic performance across provinces has widened, particularly since the late 1980s. After declining in the late 1970s and 1980s, the dispersion of provincial per capita income has increased steadily since. Despite a tendency towards convergence among the coastal provinces and among the inland provinces, there is a strong tendency towards divergence between coastal and inland provinces since the late 1980s (World Bank, 1997a).

The diverging trends in provincial development is the result of profound structural changes in the Chinese economy. Empirical literature has addressed the issue of regional disparity and its determinants in China (Jian, Sachs and Warner, 1996; Chen and Fleisher, 1996;

Naughton, 1999). However existing literature provides no clear evidence of how foreign trade expansion has affected regional disparities since the beginning of economic reforms and opening up. Undoubtedly, China's WTO membership will have important implications for provincial development. While overall welfare gains may arise from the WTO accession, the uneven distribution of these gains may raise strong opposition to trade liberalisation. Therefore, in order to ensure a successful implementation of trade policy reform, it is necessary to anticipate the effects of liberalisation at the regional level.

This paper aims to provide a relatively comprehensive analysis of the impact of WTO accession on China's economy. We try to provide some empirical evidence for policy makers, of the effects of China's WTO accession from both a national and a provincial perspective. This analysis mainly uses a 53-sector, 2-region recursive dynamic computable general equilibrium (CGE) model of China. It quantifies the impact of China's WTO accession by estimating the relevant benefits and costs, and helps to determine the challenges and opportunities arising from accession.

This paper is organised as follows: It first outlines the basic structure of the CGE model for China and presents major assumptions. Then it describes the basic characteristics of the base year data, and highlights the economic structure and market openness of China. It provides the simulation scenarios and uses simulation results to assess the impact of China's WTO accession (section 5). It concludes by drawing on policy implications.

Model Features

The two-region Chinese CGE model we use in this study is an extension of the single region Chinese CGE model that had been used in China's WTO accession study (Development Research Center, 1998; Zhai and Li, 2000). The Chinese CGE models are closely related to the applied general equilibrium model already used extensively over the past two decades to analyse the impact of trade policy reform (see Dervis, de Melo and Robinson, 1982; de Melo, 1988; Shoven and Whalley, 1992; de Melo and Tarr, 1992; Hertel *et alii*, 1997). The starting point for the structure of the single region Chinese model is the prototype CGE model developed for the Trade and Environment Programme of the OECD Development Centre (Beghin *et alii*, 1994). Nevertheless, some significant modifications were introduced in this model to capture the major features of the foreign trade and tax systems currently in force in the Chinese economy (Wang and Zhai, 1998; Zhai and Li, 2000). A more complete description of the model is provided in the APPENDIX 1. This section summarises its principal features.

An important feature of the single region Chinese CGE model is the explicit treatment of two separate foreign trading regimes. As pointed out by Naughton (1996), China has established two separate trading regimes since 1986-87. One is the export processing or export promotion regime, which is extremely open and in which most foreign-invested firms and some domestic firms operate. The other is the traditional, but increasingly reformed, ordinary trade regime. Since the 1990s, export processing has grown rapidly, and it now accounts for more

than half of all exports. Obviously, to analyse the behaviour of external trade and the impact of alternative changes in trade policy, it is very important to have an explicit treatment of this dualistic foreign trade regime in the model.

By extending a single region Chinese CGE model to a multi region setting, two regions – Guangdong province and the rest of China – are specified, each with a demand and production structure, and interregional trade in commodities and services. The interregional factor mobility and intergovernmental transfers are also embedded in the model. Guangdong province is located in Southern China and neighbour Hong Kong and Macao. It is the largest provincial economy in China, and it accounts for almost 40 percent of national foreign trade. The development of Guangdong since 1978 and its economic structure can be taken as a representation of China's coastal area. The regional disaggregation in our CGE model, which specifies Guangdong and the rest of China as endogenous agents and allows for interregional and national-regional feedback, makes it possible to assess the impact of trade or other policy reforms on coastal and inland areas.

Production is modelled using nested constant elasticity of substitution (CES) functions, and assumes constant returns to scale. Household demand is modelled using the Extended Linear Expenditure System (ELES). The other final demand accounts assume a fixed-coefficient expenditure function. Trade is modelled using the Armington assumption for import demand, and a constant elasticity of transformation (CET) for export supply. The small country assumption is adopted for imports. Hence world import prices are exogenously determined in foreign currency. Exports are determined according to constant-elasticity demand curves, the price-elasticities of which are high but less than infinite.

All commodity and factor markets are assumed to clear through prices. Within each labour skill category, labour is assumed to be perfectly mobile across sectors, and thus there is a single region-wide equilibrating wage rate for each labour type. Capital is assumed to be partially mobile, reflecting difference in the marketability of capital goods across sectors.

The model assumes imperfect interregional factor mobility to reflect the policies and institutional factors that limit factor movements across provinces, as well as the location preference of residents. The movement of capital is driven by the relative rental rates across regions and the constant elasticity of transformation. The movement of labour is determined by the relative real income across regions and the constant elasticity of transformation. The real income of labour is defined as the wage rate plus per capita net intergovernmental transfer income.

The current version of the China's CGE model has a simple recursive dynamic structure. Dynamics in the model originate from accumulation of productive factors and productivity changes. The base year of the data and the model is 1997. The model is solved for subsequent years in 1998, 2000, 2002, 2004, 2006, 2008 and 2010. The growth rates of the population, labour force and labour productivity are exogenous. The growth of capital is endogenously determined by the saving/investment relation.

Economic Structure and Market Openness in China

Our CGE model for China is constructed according to two Social Accounting Matrices (SAMs) for the year of 1997. Based upon the SAMs, this section outlines the basic features of China's industrial structure and market openness in 1997.

Table 1 summarises the sectoral structure and market openness of China's economy in the base year. For each of the 53 sectors, the base year data for shares of output, employment (volumes), imports, exports, trade dependence, and the share of ordinary trade are reported. Columns 10 and 11 give information on the degree of import protection. As may be seen in columns 1 through 4, the data show a strong asymmetry in the sectors' shares in output, employment, and trade. For example, the crop sectors (sector 1-5) account for 40 percent of China's employment but produce only 6 percent of its output and account for 2 percent of China's total foreign trade. On the other hand, textile, apparel and leather industries employ 2.5 percent of China's labour force, represent 7.7 percent of the country's total output and account for more than 26 percent of the country's total exports.

Export dependency is high for apparel, leather, social articles, electronics and instruments, with over 30 percent of output sold on foreign markets. The textile sector is also an export-oriented sector, with almost 20 percent of its output sold on international markets. The sectors which have the largest shares in imports are machinery and equipment, electronics and chemicals, which account for more than 10 percent each of China's total imports. Some raw material sectors (wool, crude oil and ferrous ore), as well as instruments, electronics and special equipment have a very high market penetration ratio. The electronic and instrument sectors have both a high export and import dependency, which reflects the importance of processing trade in these sectors.

Trade balances by industry (column 10) reflect China's comparative advantage. China is a net exporter of labour-intensive manufactures and a net importer of capital-intensive manufactures. The largest share of the trade surplus in China comes from apparel and textiles. In the agricultural sector, China is a net importer of grain, but has a trade surplus in other agricultural products.

Processing trade is the most rapidly expanding component of China's foreign trade. It accounted for 50 percent China's total exports and 46 percent of China's total imports in 1997. It was more important for finished goods than for primary and intermediary products. For instance, almost 80 percent of China's exports of primary iron and steel, electric machinery, electronics and instruments, and more than two thirds of its exports of leather, social articles and chemical fibbers, come from processing trade. Processing operations also constitute a significant portion of China's exports of apparel, paper and printed products. The high shares of processing exports in these sectors require a large volume of raw materials, components, and semi-processed products imported from abroad as inputs. Column 8 in Table 1 shows that in sectors such as textiles, apparel, leather, ordinary imports amounted to

Table 1 - Economic structure and market openness in China, 1997

(%)

	Output	Employment	Imports	Exports	Import/ Domestic Use	Export/ Output	Ordinary Exports/ Total Exports	Ordinary Imports/ Total Imports	Net Export (bn. Yuan)	Nominal Tariff Rate	Collected Tariff Rate
Rice	1.2	7.5	0.2	0.1	0.9	0.9	100	92	0.0	1.0	0.4
Wheat	0.7	4.1	0.9	0.0	7.9	0.0	–	78	–11.3	1.0	0.2
Corn	0.4	2.6	0.1	0.4	1.1	7.9	100	21	6.3	1.0	0.0
Cotton	0.3	2.0	0.6	0.0	10.7	0.0	100	17	–7.7	3.0	0.6
Other non-grain crops	3.8	23.8	0.5	1.1	0.8	2.3	100	25	12.8	4.4	5.7
Forestry	0.4	2.0	0.5	0.2	6.8	3.6	96	33	-2.6	28.6	8.3
Wool	0.0	0.0	0.3	0.0	56.0	8.9	100	6	-3.8	15.0	0.7
Other livestock	3.8	8.2	0.1	0.4	0.1	0.9	97	47	6.8	5.0	2.1
Fishing	1.1	3.2	0.0	0.2	0.2	1.2	92	77	2.5	0.8	0.5
Other agricultural pro.	0.6	2.2	0.0	0.1	0.0	1.2	88	12	1.5	16.0	1.7
Coal mining	1.1	1.2	0.1	0.6	0.4	3.1	100	63	8.6	6.0	3.3
Crude oil and natural gas	0.8	0.2	3.6	1.5	24.6	14.4	100	71	–20.6	1.5	1.0
Ferrous ore mining	0.2	0.1	1.1	0.0	30.2	0.0	100	43	–14.4	0.0	0.0
Non-ferrous ore mining	0.4	0.2	0.5	0.1	6.5	1.1	92	37	–4.9	0.0	0.0
Other mining	0.9	0.8	0.8	0.6	5.5	4.3	79	36	–0.5	2.9	0.9
Vegetable Oil	0.6	0.1	1.2	0.3	12.3	4.3	19	46	–10.3	17.0	5.3
Grain mill and forage	1.6	0.2	1.1	0.3	4.0	1.6	76	94	–7.9	4.7	4.4
Sugar	0.2	0.1	0.2	0.1	6.0	3.3	12	36	–0.8	30.0	9.5
Processed food	2.6	0.6	1.0	3.3	2.5	9.7	72	18	42.4	23.2	3.7
Beverage	1.3	0.3	0.1	0.5	0.5	3.1	84	45	7.5	60.2	24.0
Tobacco	0.7	0.1	0.2	0.3	1.3	3.2	96	24	3.3	49.1	10.6
Textile	4.6	1.5	6.8	11.4	10.1	18.4	60	1	104.5	27.5	0.2
Apparel	1.9	0.6	0.7	9.9	3.6	37.0	45	2	156.2	41.8	0.7
Leather	1.1	0.3	1.8	5.0	13.2	32.6	29	1	61.4	35.5	0.3
Sawmills and furniture	1.1	0.4	0.9	2.1	5.6	13.1	61	20	22.8	14.4	2.5
Paper & printing	1.7	0.6	2.9	0.5	9.9	2.0	35	33	–29.2	11.0	3.1
Social articles	1.1	0.3	1.0	6.0	9.0	40.0	32	28	87.6	3.1	1.0
Petroleum refining	1.6	0.2	3.1	1.2	11.8	5.7	69	62	–19.6	8.7	4.8

Chemicals	4.0	1.0	11.8	4.2	16.7	8.3	80	31	–77.8	10.8	3.0
Medicine	0.9	0.2	0.2	0.7	1.8	5.9	84	75	8.5	10.9	7.2
Chemical fibers	0.6	0.1	2.1	0.5	18.3	6.6	31	7	–17.4	15.5	1.0
Rubber and plastics	2.1	0.6	2.1	4.2	7.0	15.7	28	12	42.8	19.8	2.0
Building materials	4.4	2.1	0.8	2.1	1.2	3.4	82	20	23.9	20.8	3.6
Primary iron and steel	2.7	0.7	3.8	1.8	8.6	5.5	21	28	–17.5	8.1	2.0
Non-ferrous metals	1.2	0.3	2.6	1.2	13.0	8.0	56	14	–13.1	7.1	0.9
Metal products	2.5	0.7	2.6	4.1	7.0	13.1	57	20	36.4	13.1	2.4
Machinery	2.5	1.0	5.6	1.8	13.3	5.9	61	35	–41.0	13.7	4.2
Special equipment	1.7	0.6	8.0	1.1	23.6	5.6	63	21	–82.9	14.1	2.6
Automobile	1.6	0.4	1.1	0.4	4.2	1.9	63	73	–7.6	50.7	32.6
Oth. Transport equipment	1.3	0.4	2.6	1.6	12.1	9.7	24	28	–5.8	5.6	1.3
Electrical machinery	2.8	0.6	4.0	5.5	9.6	15.9	21	20	42.2	17.9	3.1
Electronics	2.5	0.4	13.2	11.5	34.7	36.3	9	20	25.2	11.8	2.1
Instruments	0.4	0.2	2.7	2.7	44.3	49.5	15	20	12.3	12.5	2.3
Other manufacturing	0.8	0.6	0.4	0.9	3.1	8.1	29	3	9.6	38.9	0.9
Utilities	2.2	0.5	0.0	0.2	0.0	0.9	100	–	3.8	0.0	0.0
Construction	8.7	5.8	0.4	0.1	0.3	0.1	100	100	–2.6	0.0	0.0
Transportation	2.5	3.1	0.7	2.8	1.8	9.4	100	100	38.9	0.0	0.0
Post and communication	1.0	0.3	0.2	0.7	1.3	5.7	100	100	8.7	0.0	0.1
Commerce	6.6	9.0	1.2	0.7	1.2	0.9	100	100	–4.2	0.0	0.0
Finance	1.8	0.5	0.4	0.1	1.2	0.5	100	100	–2.7	0.0	0.0
Social services	3.8	1.6	2.9	4.5	5.2	10.1	100	100	38.8	0.0	0.0
Education & health	3.3	4.0	0.2	0.3	0.4	0.7	100	100	1.7	0.0	1.7
Public administration	2.2	1.8	0.2	0.0	0.5	0.1	100	100	–1.5	0.0	0.0
Total/Average	100.0	100.0	100.0	100.0	6.4	7.7	51	32	409.5	11.2	2.5

Notes: 1) Imports/Domestic use and Exports/output are at domestic prices. The sectoral share of imports and exports are at world prices.
2) The imports of rice, wheat, corn, cotton, grain mill & vegetable oil are averages over the 1993-97 period.

Source: Chinese Social Accounting Matrix, 1997, Development Research Center of the State Council.

only 5 percent of total imports. Almost all imports were used for the production of processed exports. Most imports of paper products, building materials, chemicals, basic metal and metal products, machinery and electronics were also used by foreign or joint-venture companies as intermediate inputs to produce processed exports.

Another notable feature of the base year data is the significant differences between China's nominal tariff rate and the actual collected rate (given in the last two columns of TABLE 1). It is well known that China's tariff collection rate is significantly below its nominal tariff level because of the importance of processing trade, which implies extensive import duty exemptions (World Bank, 1994, Bach, *et alii*, 1996). In particular, one can see dramatic discrepancies between the nominal and the actual tariff rates for certain sectors. The discrepancies range from 140 in the textile sector to less than 2 in the medicine and automobile sectors. In general, it is the more export-oriented sectors which have the largest nominal-to-actual gaps due to the tariff exemptions applied to their imports of intermediate inputs for processing trade.

China's tariff structure is typical of that of developing countries in so far that it provides a high degree of protection for the manufacturing sector, especially to capital-intensive manufactures and final consumption goods. However, at the aggregated level, China's actual tariff rate is moderate. The automobile sector is subject to the highest nominal tariff rate of 50% and its actual collection rate for ordinary import is 45%. The tariff rates applied to other manufactures, textiles and apparel are also relatively high, although their effective rates are limited because most imports are actually exonerated from import duties.

China is a large country and its provinces have different factor endowments, industrial structures and comparative advantage, and vary in their degree of openness.

The coefficient of location can be used to analyse the provinces' comparative advantage. If the coefficient of location of one sector in province j is larger than 1, it means that this particular province has a comparative advantage in this sector. TABLE A2.1 in the APPENDIX 2 reveals that the Eastern region has a comparative advantage in manufactured goods and in services; some provinces of the Central region (Inner Mongolia, Jilin, Anhui, Jiangxi, and Hunan) and the Western region (Sichuan, Guizhou) have a comparative advantage in agriculture; and some provinces in the Central and Western region have a comparative advantage in mining and quarrying. Many provinces in the Central and Western region have therefore a comparative advantage in resource-based sectors. We should point out that in most provinces of the Western region the coefficient of location for services is larger than one, but this does not mean they have a strong service sector, since these provinces' share of agriculture is larger than the national average whereas the share of industry is lower (TABLE 2). In other words, their level of industrialisation level is lower.

TABLE A2.2 (APPENDIX 2) presents the distribution of China's manufacturing production by province. Guandong, Jiangsu and Shanghai are the most important producers of electrical and electronic machinery. Jiangsu is also the most important producer of textile and clothing.

TABLE A2.3 (APPENDIX 2) presents the distribution of rice, wheat and cotton production by province, and the per capita output of these agricultural products for each province. The per capita output of agricultural products could be taken as an index of the level of interregional exports and thus of the exposure of the provinces to competition from imports of agriculture products after WTO accession. The TABLE shows that Hebei, Shandong and Henan are important wheat producers, that some provinces in central China are specialised in rice production (such as Hunan, Jiangxi and Hubei) and that Xianjiang, Hubei, Henan and Jiangsu are important suppliers of cotton.

TABLE A2.4 and TABLE A2.5 (APPENDIX 2) highlight the importance of foreign trade and FDI in the different provinces. TABLE A2.4 provides evidence that the degree of dependency on external trade is very high in the Eastern region compared to the Central and Western regions. The export dependency ratio of Guangdong province is more than seven times that of provinces in Western region. TABLE A2.5 presents the distribution of cumulated FDI by province in 1999, and shows that FDI flows in China are also unevenly distributed among provinces and autonomous regions.

Given the importance of Guangdong province in China's economy and foreign trade, we split Guangdong province and the rest of China in our two-region model and base year SAMs. Guangdong province, which has been at the forefront of economic reforms and liberalisation since 1978, has achieved an extraordinary economic performance. From 1978 to 1997, its average annual growth rate of GDP was 14.2 percent, representing 4.4 percentage points higher than the national average of 9.8 percent. The share of Guangdong's output in China's GDP rose from 5.1 percent in 1978 to 9.8 percent in 1997, while its share in China's population is just 5.7 percent. In 1997, Guangdong's GDP ranked as the largest in China.

Due its locational advantage and its broad connections with overseas Chinese in the business field, Guangdong's foreign trade recorded an outstanding growth rate of 24.6 percent a year between 1978 and 1997. The share of Guangdong in China's foreign trade reached nearly 40 percent in 1997. It should be pointed out that Guangdong's trade is dominated by processing trade. The share of processing trade in the province's exports rose from 0.83 percent in 1978 to more than 70% in 1997. Guangdong accounted for more than 50 percent of China's processing trade in 1997.

TABLE 2 summarises the economic structure of Guangdong in the base year. The first four columns report the sectoral composition of output, employment and foreign trade. Columns 5 to 7 report the trade dependence of Guangdong, both on foreign and interregional trade. The share of ordinary trade and net exports are reported in the last four columns. In comparison to the national economy, Guangdong is specialised in services and in export-oriented and labour-intensive manufacturing industries. Relative to the national average, agriculture in Guangdong's total output and employment is low, even though it still accounts for more than 40 percent of the labour force. Guangdong is an extremely open economy, with imports from foreign countries amounting to 20 percent of the products used domestically

Table 2 - Economic structure in Guangdong, 1997

(%)

	Output	Employment	Imports	Exports	Imports/ Domestic Use	Exports/ Outputs	Inter-regional Imports/ Domestic Use	Inter-regional Exports/ Outputs	Ordinary Exports/ Total Exports	Ordinary Imports/ Total Imports	Net Exports (bn. Yuan)	Net Inter-regional Exports (bn. Yuan)
Rice	0.9	7.2	0.2	0.0	3.5	0.0	23.3	8.1	100	89	–0.9	–4.2
Wheat	0.0	0.0	0.2	0.0	92.2	0.0	2.1	8.1	–	17	–0.9	0.0
Corn	0.0	0.0	0.0	0.0	100.0	–	0.0	–	100	0	–0.2	0.0
Cotton	0.0	0.0	0.2	0.0	99.1	–	0.9	–	100	11	–0.8	0.0
Other non-grain crops	2.5	19.9	0.2	0.5	1.7	5.1	23.7	8.1	100	37	1.9	–10.8
Forestry	0.3	1.5	0.3	0.1	15.3	6.2	5.0	0.0	84	32	–0.7	–0.4
Wool	0.0	0.0	0.1	0.0	99.9	–	0.1	–	100	5	–0.6	0.0
Other livestock	1.9	4.1	0.0	0.3	0.3	4.2	4.7	0.3	92	56	1.9	–1.9
Fishing	1.4	7.0	0.0	0.2	0.6	2.8	3.8	12.5	79	63	0.8	2.9
Other agricultural pr.	0.5	2.5	0.0	0.0	0.0	2.7	1.4	0.2	58	21	0.3	–0.1
Coal mining	0.0	0.2	0.0	0.0	0.6	4.4	94.9	2.8	100	55	–0.1	–15.1
Crude oil and natural gas	0.9	0.0	1.9	1.4	42.8	42.6	0.2	0.0	100	48	0.4	0.0
Ferrous ore mining	0.1	0.1	0.1	0.0	16.8	0.5	37.6	27.4	100	29	–0.4	–0.5
Non-ferrous ore mining	0.1	0.1	0.1	0.0	9.1	8.9	54.1	26.3	100	68	–0.1	–1.4
Other mining	0.6	0.3	0.8	0.3	17.4	12.4	27.2	0.2	39	19	–1.5	–5.5
Vegetable Oil	0.3	0.1	1.1	0.4	49.4	28.4	7.2	12.7	3	23	–2.8	0.2
Grain mill and forage	0.9	0.2	0.4	0.2	8.4	6.2	12.7	12.7	31	81	–0.5	–0.1
Sugar	0.3	0.1	0.1	0.1	11.8	8.6	32.2	45.7	8	1	0.0	1.1
Processed food	1.7	0.8	0.8	1.4	12.3	21.0	17.5	26.6	49	30	5.2	5.1
Beverage	1.0	0.3	0.1	0.5	1.9	12.6	26.9	34.6	84	75	2.8	3.1
Tobacco	0.3	0.1	0.1	0.1	5.7	10.1	43.9	14.9	100	22	0.1	–3.0
Textile	4.0	1.5	9.9	11.3	48.4	66.5	26.8	8.6	50	0	26.0	–16.5
Apparel	3.5	2.4	0.6	8.7	8.6	54.2	4.0	9.9	38	1	50.9	6.5
Leather	2.7	1.5	2.5	6.8	32.4	61.4	9.9	5.0	18	1	30.8	–0.4
Sawmills and furniture	1.4	0.5	1.6	2.4	16.8	41.6	47.4	10.9	40	13	8.1	–16.1
Paper & printing	1.8	0.8	4.6	0.8	35.2	10.8	15.2	18.7	19	9	–15.2	–1.2
Social articles	3.5	1.3	0.9	10.1	14.7	69.5	0.7	2.6	17	4	58.4	1.8

Petroleum refining	0.7	0.2	4.2	0.5	36.6	18.0	53.9	51.6	52	58	–15.4	–19.0
Chemicals	1.1	0.8	12.7	1.3	63.6	29.6	31.5	53.1	53	8	–47.7	–14.5
Medicine	0.7	0.3	0.1	0.2	5.6	5.8	32.7	52.9	87	71	0.4	4.9
Chemical fibers	0.7	0.2	1.1	0.3	27.6	10.1	30.0	43.5	24	3	–3.3	1.8
Rubber and plastics	4.0	1.2	3.1	6.2	19.6	41.3	15.5	7.5	20	5	24.8	–4.2
Build materials	3.0	1.8	1.0	1.9	7.0	15.2	17.7	11.8	69	7	7.1	–3.6
Primary iron and steel	0.5	0.3	5.3	0.3	41.0	15.2	45.4	11.9	35	9	–21.6	–24.5
Non-ferrous metals	0.7	0.2	4.8	0.4	42.5	17.2	40.8	29.4	32	9	–18.3	–15.6
Metal products	3.4	1.0	2.9	4.2	22.1	32.9	8.4	13.6	34	3	13.4	5.3
Machinery	0.8	0.6	3.6	0.9	49.2	28.1	19.5	15.9	29	18	–10.7	-3.4
Special equipment	0.3	0.5	5.3	0.6	89.8	56.3	7.9	35.4	20	7	–19.3	0.6
Automobile	0.5	0.1	0.4	0.3	14.8	14.6	33.1	29.0	24	67	–0.1	–0.7
Oth. Transport equipment	1.4	0.6	1.2	1.0	17.1	18.0	6.0	7.2	8	54	0.9	0.4
Electric machinery	5.9	1.7	5.3	9.2	34.4	41.7	35.3	42.5	13	8	33.4	31.7
Electronics	7.0	2.0	18.0	18.4	62.1	67.9	29.1	24.9	5	6	34.1	1.5
Instruments	1.1	0.4	1.5	3.8	84.3	84.9	3.9	11.1	7	8	16.6	2.3
Other manufacturing	1.2	0.9	0.5	1.3	8.4	26.3	19.4	7.6	12	1	5.7	–2.8
Utilities	2.8	0.5	0.0	0.6	0.0	6.1	2.3	3.6	100	–	3.8	0.9
Construction	7.0	8.1	0.0	0.0	0.0	0.0	0.0	0.0	100	100	0.0	0.0
Transportation	4.0	3.5	1.2	1.2	4.6	8.1	24.2	1.5	100	100	2.0	–25.7
Post and communication	1.5	0.5	0.0	0.2	0.0	3.2	0.0	0.0	100	100	1.0	0.0
Commerce	8.9	12.0	0.9	0.5	2.0	1.7	4.4	2.7	100	100	–0.6	–3.4
Finance	2.3	0.9	0.0	0.0	0.1	0.1	0.0	0.0	100	100	0.0	0.0
Social services	5.2	2.4	0.0	1.3	0.0	6.9	0.0	0.0	100	100	7.9	0.0
Education & health	2.8	5.0	0.0	0.0	0.0	0.0	0.0	0.0	100	100	0.0	0.0
Public administration	1.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0	100	100	0.0	0.0
Total/Average	100.0	100.0	100.0	100.0	19.8	25.1	17.0	11.4	29	14	177.1	–124.5

Notes: 1) Imports/Domestic use and Exports/output are at domestic prices. The sectoral share of imports and exports are at world prices.
2) The imports of rice, wheat, corn, cotton, grain mill & vegetable oil are averages for 1993-97.

Source: Chinese Social Accounting Matrix, 1997, Development Research Center of the State Council.

and exports to overseas markets accounting for 25 percent of the province's output. The dependency of Guangdong's economy on overseas markets is higher than its dependence on interregional trade. A mere 17 percent of Guangdong's external needs for domestic use are covered by products coming from the rest of China and only 11 percent of its output are sold to other Chinese provinces. At the industry level, textile, apparel, leather, social articles, electronics and electrical machinery are important export sectors, which together contribute to 64 percent of Guandong's exports. The electronics, chemicals and textiles sectors are the three largest import sectors, accounting for 41 percent of total imports. The electronics, instruments, special equipment and textiles sectors have both high export and import dependency. Guangdong depends on interregional imports for most of its energy goods and primary metals, as well as electrical machinery and electronics. Electrical machinery and electronics are also the largest sectors in terms of interregional exports. Exports of chemical products to the rest of China are also significant. The trade balance shows that the largest share of foreign trade surplus in Guangdong comes from apparel, textiles, leather products, electrical machinery and electronics. Guangdong also derives a large interregional trade surplus in electrical machinery. It is a net importer of energy, chemicals and primary metal.

This SAM-based data analysis provides an overview of the characteristics of China's economic structure and its degree of market openness. These features have important implications for the impact of trade liberalisation and facilitate the understanding of simulation results reported in subsequent sections of this paper.

Base Case Projections and Simulations Design

China's accession to the WTO includes a complex package of trade and investment liberalisation measures. Based on the final commitments made for market accession, this paper quantifies the impact of the following four aspects: (1) tariff reductions on industrial products; (2) elimination of quotas on industrial products by 2005; (3) agricultural trade liberalisation, i.e. tariff reduction for agricultural products, introduction of a tariff rate quota system for agricultural goods; and (4) the phasing out of the Multi-Fiber Arrangement (MFA) quota on textile and clothing under the WTO Agreement on Textiles and Clothing (ATC). As China becomes a member of the WTO, its exports of textiles and apparel to North-America and the EU will benefit from an accelerated growth since MFA quotas will increase up to 2004, and as the remaining export quota restrictions will be terminated in 2005. At best, the analysis captures only one part of the issue. It does not take into account other major aspects of WTO membership, such as the dismantling of barriers in services and foreign investment, protection of intellectual property rights, securing market access, enforcement of commitments, and cooperation in dispute settlements.

Since China's commitments will be implemented over a transition period of 5-8 years, a recursive dynamic model was used to assess the impact of China's WTO membership. The

dynamic model captures changes in the industrial structure, in factor composition and comparative advantage over the next 10 years.

The base case projection over the next 10 years is established first, by determining a reference growth trajectory in the absence of trade and other reforms. It assumes that China will maintain its policy of grain self-sufficiency, and that import quotas of agricultural goods will grow at 3 percent annually from 2000 to 2010. We then consider four scenarios in reference to the baseline scenario. The first scenario considers the tariff reductions and quota eliminations on industrial products that China negotiated for its accession. The sectoral reduction rates of import tariffs are aggregated from the Harmonized Commodity Description and Coding System (HS) tariff schedules for the period of 2000-2008 in China's WTO accession final offer and weighted by 1997 ordinary trade data. In this scenario, the growth rate of import quotas for petroleum refining products and automobiles will also be accelerated in 2000-2005 and the quantitative restrictions will be eliminated in 2005. The second scenario focuses on the agricultural trade liberalisation. The tariff rate quota (TRQ) system will be introduced to replace the current quota system for rice, wheat, corn, cotton, wool, vegetable oils and sugar. Moreover, the tariff rate for other agricultural goods will also be reduced. The third scenario looks at the impact of MFA elimination. In this case, China benefits from an accelerated quota growth rate for its textile and clothing exports, and quantitative restriction will be terminated in 2005. The last scenario combines all of these three aspects of China's WTO accession. The aim is to measure the overall impact of China's accession to the WTO. All the assumptions for the baseline scenario and the four policy scenarios are summarised in TABLE 3.

MAJOR SIMULATION RESULTS

Aggregate effects

TABLE 4 reports the main efficiency and other macroeconomic indicators under the four scenarios of China's WTO accession. It measures the deviations from the base case, in the year 2010. The results show that China will benefit from its WTO accession in terms of real GDP and social welfare. In 2010, China's real GDP will be 2.1 percent higher than in the base case. The welfare gains represented by Hicksian equivalent variations (EV), are smaller (1.89 percent of 2010 GDP), because of a 1.1 percent deterioration in the terms of trade. Private consumption would be 2.06 percent higher than in the base scenario, indicating the benefits to consumers from trade liberalisation, and investment would be 2.09 percent higher. China's trade expansion is expected to become significant after it becomes a member of the WTO. Exports and imports are projected to increase by 25.4 percent and 23.8 percent respectively over the base case scenario. The real exchange rate is projected to depreciate slightly because of the increase in imports, originating from a reduction in import protection.

Many factors are interacting to determine these general equilibrium results. Generally, the large gains in GDP result from the enhanced efficiency of resource allocation arising from

Table 3 - Summary of simulations

Experiment	Description
E1	**Base case:** – Real GDP and agricultural output (exogenous) – Sectoral-specific TFP growth rate (endogenous) – 3% growth rate of import quota for goods subjected to quantitative restrictions (rice, wheat, corn, cotton, wool, vegetable oil, sugar, petroleum refining products, automobiles) – Exogenous export quota growth for textiles and apparel – Textiles: 5.0% apparel: 6.2% (annual average) – All tax rates are fixed at its base year level – National trade balance gradually declines to 30% of its base year level in 2010
E2	**Tariff reduction and quota elimination on industrial products** – An average 55% tariff cut of 2000 level from 2000-2008 – Phased elimination of import quotas on petroleum refining products and automobiles from 2000-2005 Initial quota in 2000 – ***petroleum refining:*** 27.6 bn yuan ***automobile:*** 496.8 bn yuan Annual growth rate of quota from 2000-2005 – ***petroleum refining:*** 15% ***automobile:*** 15%
E3	**Agricultural trade liberalization** – Introduction of TRQ system

	Initial quota in 2000 (10 bn yuan, 1997 price)	*Annual growth rate of quota*
rice	0.857	18.9%
wheat	1.158	7.2%
corn	0.325	12.5%
cotton	1.046	4.7%
wool	0.635	4.5%
vegetable Oil	5.471	13.3%
sugar	0.387	5.0%

	– Tariff cut for other agricultural goods
E4	**Phasing out of MFA** – Acceleration of MFA quota growth rate from 2000-2004 – Zero export tax on textiles and apparel in 2005
E5	**The whole WTO accession package** – E2, E3 and E4 combined

increased specialisation, along with comparative advantage. However, two other reasons also contribute to GDP growth, namely (1) the removal of high protection rates induces a real depreciation, enhancing the international competitiveness of China's industries; (2) the elimination of the MFA further increases the competitiveness of China's textiles and apparel sectors, leading to an expansion of exports in these sectors, in which China has a comparative advantage.

A remarkable outcome is the significant expansion of China's foreign trade after it joins the WTO. As previously stressed, processing trade accounts for more than half of China's total trade. As a result, its exports have a high import content. Growth of exports will result in a corresponding growth of imports, thereby increasing the pressure of a real currency depreciation, thus contributing to further growth in exports. This exchange rate factor partly contributed to the rapid increase in China's trade dependence during the last 20 years, and explains the significant trade expansion effect expected to results from China's WTO accession.

Although China will benefit from its WTO accession, the overall gains are distributed unevenly. The results presented in TABLE 4 show that the income of urban households and rural households are higher by 2.6 and 1.6 percent respectively in 2010. Up to now the slow growth of import quotas for food and agricultural products is associated with high domestic costs in agricultural production, thus keeping domestic prices higher than world market prices. With the introduction of TRQ (Tariff rate quota) system for agricultural goods after China joins the WTO, the domestic prices of agricultural products are expected to decrease sharply, thereby reducing the return of production factors in agriculture. Obviously, rural households will suffer a loss during this process. The slower the move to liberalise the agricultural sector, the higher the costs of protection and therefore the larger the welfare losses for rural households and the higher the political and budgetary costs for the Chinese government.

There are great concerns about the harmful impact that the agricultural trade liberalisation may have on China's food security. Our simulation results suggest that even though crops

Table 4 - Major macroeconomic results under China's WTO accession scenarios, 2010

(percentage change relative to base case, except Grain self-sufficiency Rate)

	Whole WTO accession package (E5)	Tariff and NTBs reduction on industrial products (E2)	Agricultural trade liberalization (E3)	MFA elimination (E4)
EV (% of GDP)	1.89	0.33	0.88	0.41
GDP	2.07	0.36	0.86	0.51
Consumption	2.06	0.51	0.88	0.43
Investment	2.09	0.15	1.05	0.48
Exports	25.43	8.84	2.90	7.77
Imports	23.81	8.40	2.78	7.18
Government Revenue	0.78	–2.34	0.12	1.84
Urban Households Income	2.63	0.51	1.56	0.40
Rural Households Income	1.59	0.54	0.25	0.47
Terms of Trade	–1.68	–0.56	–0.17	–0.68
Real Exchange Rate	0.71	2.57	1.20	–1.88
Grain self-sufficiency Rate	0.887	0.968	0.898	0.966

Note: The results of E5 do not equal to the sum of E2, E3 and E4 due to the interactive effects.

Source: Simulation results.

imports are likely to increase significantly, by as much as 200 percent relative to the base case, China's grain self sufficiency rate would still be as high as 89 percent in 2010. China's dependence on the world market for grains would remain low even when China is to open up its grain market. Moreover, given the rapid increase in laid-off workers in state-owned enterprises and the level of urban poverty, agricultural trade liberalisation will improve food security in so far as it will enable the urban poor to get a secure access to adequate food (Sen, 1981).

By decomposing China's market accession package, one can appreciate the impact of different trade reform measures. Given the scarcity of agricultural land and the growing demand for food and agricultural products, the population growth over the next decade, and the current high level of import protection in the agricultural sector, it is not surprising that agricultural trade liberalisation will bring significant welfare gains to China. As simulation results show, the elimination of import quotas on food and agricultural products will increase China's real GDP by 166 billion yuan in 2010, representing 41 percent of the gains that China would accrue from its WTO entry. However, agricultural trade liberalisation would lead to adverse domestic terms of trade effects, to a 1.56% increase in urban households' income, and a mere 0.25% increase in rural households' income.

Due to the low collection rate of tariff and tariff exemptions granted to processing trade, the gains arising from MFA quota elimination and the reduction of tariff and non-tariff barriers in industrial goods are relatively small. Real GDP will increase by 97.9 billion yuan in the MFA elimination scenario, and 69.1 billion yuan in the tariff reduction scenario. The welfare gains are smaller compared to real GDP due to adverse terms of trade effects. Their effects on income distribution are relatively neutral. The gains resulting from these two scenarios are slightly smaller in the case of urban households than for rural households, due to the fact that urban workers are mainly employed in the industrial sector, whereas most labour-intensive manufactures such as apparel and shoe exports are produced in rural areas.

Sectoral adjustments

While the aggregate results of the WTO accession scenarios show the overall welfare gains resulting from lower price distortions and an expansion of foreign trade, they reveal only part of the story. Economy-wide efficiency gains are not distributed uniformly across sectors, and the adversely affected sectors are likely to strongly oppose trade reforms. It is necessary to investigate the adjustment in sectoral output, employment and trade induced by China's WTO accession.

TABLE 5 shows that changes in gross output and trade vary significantly across sectors. The output of the agricultural and food sectors subject to import quota restrictions would fall by between 1.5 percent (corn) and 25.1 percent (vegetable oil). The increase in imports for these sectors is dramatic, ranging from 18 percent (wool) to 969 percent (rice). A large portion of wool imports is for processing trade and not subject to quota restrictions, so the introduction of TRQ has a relatively small effect on these imports. Because the amount of

grain imports is very small in the base case, the sharp increase in imports would not affect domestic production significantly. Due to the slow growth of quotas for wheat and cotton, their quotas would bind and result in smaller increases in imports compared to rice and corn. While the highly protected agricultural sectors suffer a contraction, livestock products (excluding wool), which are more labour intensive and less land intensive than grain productions, would increase their production and exports. However, their exports are quite marginal in absolute terms because of high domestic demand for those products.

The contraction in agricultural production will divert agricultural labour forces and capital to non-agricultural sectors. Given the large share of agricultural employment in China today, the most important adjustment will be the relocation of agricultural labour. The simulation results on employment changes suggest that around 6.0 million agricultural workers will be transferred to the manufacturing and service sectors after China enters the WTO. Undoubtedly, this will bring adjustment costs and challenges to both the central and local government to make such a relocation possible.

The elimination of MFA quotas significantly enhances China's export competitiveness in textiles and clothing. Exports of textiles and apparel would increase by 180 percent and 206 percent respectively. The production of textiles and apparel would increase by 43 percent and 70 percent respectively, thus creating about 6.2 million new jobs altogether.

The food sectors, which will benefit from the lower costs of imported intermediate inputs, would also record an increase in output and exports. However, sectors with a high degree of protection, such as automobiles, petroleum refining products and beverages, would experience a sharp increase in imports. Lower import prices will induce consumers to substitute imported goods for domestic products, resulting in a dramatic decline in domestic output.

The removal of tariff and non-tariff barriers is only one factor that contributes to the significant surge in imports after China joins the WTO. The export growth due to the further strengthening of China's comparative advantage in labour-intensive products will also contribute to the increase in imports. The expansion of labour-intensive production not only drives up the demand for capital and technology intensive equipment, but also increases the demand for semi-processed products and intermediate inputs. As pointed out earlier, there is a large proportion of processing exports in China's total exports. This makes China's exports growth particularly dependant on imports. This is illustrated by the charp increase in textiles, apparel and chemical fibers, since processing imports account for more than 90 percent of total imports in these industries.

All capital-intensive sectors, even those which are not highly protected, such as machinery, electronics and instruments, would experience a relatively large contraction of their production due to the high cost of capital. The rapid expansion of labour-intensive sectors, especially textiles and apparel, will displace capital from other manufacturing industries. At the same time, the large amount of labour released from the previously highly protected agricultural sectors will push up the rental price of capital relative to labour.

Table 5 - Changes in sectoral output, employment and trade after China's WTO accession (E5)

	Output		Employment		Imports		Exports	
	Bn Yuan	%	10 000 Person	%	Bn Yuan	%	Bn Yuan	%
Rice	–26.1	–8.7	–222.6	–8.4	32.6	969.3	0.0	7.2
Wheat	–9.4	–4.9	–73.2	–5.3	14.5	79.8	0.0	–
Corn	–1.9	–1.5	–22.1	–2.0	6.2	345.7	0.2	10.9
Cotton	12.7	11.5	101.3	10.8	19.3	169.6	0.0	21.0
Other non-grain crops	–34.8	–2.6	–410.9	–3.0	23.5	134.6	0.3	8.7
Forestry	–17.7	–11.2	–141.7	–11.3	15.6	32.6	–0.2	–7.5
Wool	–0.9	–13.7	–2.0	–14.1	2.0	18.1	0.0	2.3
Other livestock	70.6	3.5	137.2	3.0	0.0	–0.9	1.0	13.1
Fishing	12.3	1.8	28.6	1.6	0.2	9.0	–0.1	–0.6
Other agricultural pr.	2.7	1.2	6.2	0.5	0.0	16.4	0.0	13.9
Coal mining	–3.3	–0.9	–12.4	–1.0	–0.2	–3.1	0.0	2.1
Crude oil and natural gas	–16.5	–7.1	–13.8	–6.9	3.7	1.8	–0.4	–1.6
Ferrous ore mining	–2.5	–3.8	–2.1	–2.9	–2.5	–4.3	0.0	–15.9
Non-ferrous ore mining	–6.8	–3.8	–4.3	–3.2	–0.9	–3.8	0.0	–4.4
Other mining	1.0	0.2	2.7	0.4	1.1	2.6	–0.2	–1.4
Vegetable Oil	–61.6	–25.1	–13.2	–19.5	66.6	187.9	5.7	29.6
Grain mill and forage	0.7	0.1	0.2	0.1	16.2	21.4	0.9	9.1
Sugar	–9.5	–13.6	–10.2	–13.4	7.2	154.9	–0.6	–8.6
Processed food	24.5	2.0	8.0	1.6	4.5	9.5	10.7	10.3
Beverage	–9.1	–1.5	–2.0	–0.7	16.8	239.2	0.3	2.7
Tobacco	–3.8	–1.2	–0.4	–0.9	9.3	81.1	0.3	5.0
Textile	873.9	43.2	355.5	30.2	340.0	144.8	581.5	179.5
Apparel	673.0	69.9	267.6	44.4	25.5	94.2	651.2	205.9
Leather	–16.9	–3.4	–7.0	–2.5	2.7	4.0	–15.2	–9.0
Sawmills and furniture	1.5	0.3	3.0	0.8	7.0	15.3	–1.5	–2.5
Paper & printing	–31.3	–3.9	–17.0	–3.0	25.6	16.7	–1.2	–7.1
Social articles	–20.7	–3.3	–5.0	–1.8	3.9	7.1	–23.4	–8.6
Petroleum refining	–29.0	–3.2	–9.7	–3.1	38.9	59.6	4.2	3.3
Chemicals	–46.8	–2.6	–16.4	–2.2	65.3	12.8	3.8	2.2
Medicine	2.0	0.4	1.3	0.6	3.4	32.4	1.2	3.8
Chemical fibers	47.9	16.4	12.2	13.5	81.4	112.3	1.8	4.5
Rubber and plastics	–45.1	–3.9	–18.2	–3.0	6.7	6.7	–13.4	–5.3
Build materials	6.8	0.3	3.3	0.2	4.2	9.8	–0.4	–0.6
Primary iron and steel	–67.5	–4.8	–32.3	–4.3	16.5	7.2	–0.8	–0.8
Non-ferrous metals	–20.6	–4.0	–7.3	–3.1	–3.3	–2.1	–0.7	–2.0
Metal products	–30.8	–2.6	–12.2	–2.0	15.7	9.3	–4.0	–2.9
Machinery	–69.0	–5.6	–38.5	–4.4	36.7	13.1	–3.6	–4.3
Special equipment	–22.2	–2.9	–12.6	–2.4	38.2	9.9	–0.9	–2.3
Automobile	–305.4	–34.2	–96.1	–28.9	154.2	679.7	–2.3	–13.5
Oth. Transport equipment	–1.5	–0.2	2.2	0.5	4.6	2.6	–4.5	–4.8
Electrical machinery	–76.5	–4.5	–19.6	–3.1	35.8	14.9	–26.8	–7.3
Electronics	–164.3	–9.3	–39.1	–8.8	42.2	5.4	–60.1	–6.8
Instruments	–31.1	–12.7	–24.3	–11.7	15.7	11.8	–14.8	–10.5
Other manufacturing	–16.6	–3.8	–11.0	–2.2	3.8	21.0	–10.5	–16.3
Utilities	–0.5	0.0	–2.0	–0.5	0.0	–2.0	0.5	2.5
Construction	97.6	1.9	101.9	1.5	–0.4	–1.3	0.1	3.6
Transportation	16.5	1.1	25.7	0.8	2.0	5.7	3.5	2.2
Post and communication	8.4	1.2	3.2	1.0	–0.1	–1.7	1.3	1.7
Commerce	107.9	2.9	211.7	2.1	2.2	2.4	0.1	0.5
Finance	8.5	0.8	1.3	0.3	0.2	0.5	0.0	–1.1
Social services	39.3	1.7	20.9	1.3	–2.5	–1.5	5.2	2.6
Education & health	3.7	0.2	1.3	0.0	0.1	0.3	0.0	–0.7
Public administration	3.4	0.3	4.1	0.2	–0.1	–0.4	0.0	0.6

Source: Simulation results.

Regional effects

The impact of WTO accession will differ across Chinese provincial economies since provinces have different factor endowments, different industrial structures and comparative advantages. The benefits of trade liberalisation will thus be spread unevenly across regions. In general, the larger the shares of industries in provincial output which benefit from China's WTO accession, the larger the gains for the province. Conversely, the larger the shares of industries in a provincial output which are relatively disadvantaged by China's WTO accession, the smaller will be the gains for the province. Moreover, the more dependent is a province on foreign trade, the more the province would gain from China's WTO accession, especially for those provinces whose foreign trade mostly operated under an ordinary trade regime.

The uneven distribution of benefits from China's WTO accession is confirmed in TABLE 6. The simulation results show that the real GDP of Guangdong will increase by 8.9 percent in 2010 relative to the base case, while the real GDP in the rest of China will only increase by 1.24 percent. The increase of Guangdong's GDP will be around 187 billion yuan, and will account for 47 percent of the gains in the country's GDP.

When China joins the WTO, investment in Guangdong will increase faster than private consumption, while in the rest of China, the increase in investment due to China's WTO accession is almost zero. The different patterns of investment growth between Guangdong and the rest of China result from changes in domestic capital flows, which are driven by the relative rental rates of capital across regions. The higher economic growth and export expansion in Guangdong when China joins the WTO will raise the local return of production factors and will attract more capital inflows. On the other hand, the rest of China will experience more capital net outflows. As a result of increased capital outflows, the trade surplus of the rest of China in 2010 will decline by 159 percent and its investment ratio to GDP will decline.

Expansion of foreign trade will be significant for both regions. However, the growth of exports and imports in Guangdong are smaller than in the rest of China. Two factors account for this. First, the share of agricultural imports in total imports in Guangdong is much smaller than the national average. Agricultural trade liberalisation in the framework WTO accession will not result in a dramatic increase of agricultural imports for Guangdong. Second, the export dependence of Guangdong is higher than the rest of China. Even a small expansion of exports could induce a large increase in factor prices in Guangdong. Due to the imperfect factor mobility across regions, the relatively rapid growth of factor costs would weaken the competitiveness of Guangdong's products, and result in a relatively small expansion of its exports.

Changes in interregional trade and the trade surplus are driven by interregional capital flows. The increase of capital flows to Guangdong will reduce exports from Guangdong to the rest of China, and increase its imports from the rest of China. The trade surplus of Guangdong with the rest of China will decline by 24 percent. Because of the high share of processing exports in total exports, Guangdong exports have a low dependence on intermediate inputs

coming from the rest of China. The simulation results suggest that the expansion of China's foreign trade after WTO accession would not induce a large increase in interregional trade.

More rapid economic growth in Guangdong will increase the demand for labour. Rising wages in Guangdong will divert labour away from the rest of China and into Guangdong. The labour force and population of Guangdong will increase by 3.3 percent in 2010, due to migrations from the rest of China. The labour force in the rest of China will decline by 0.23 percent.

Table 6 - Major macroeconomic effects on Guangdong and the rest of China, 2010

(percentage change relative to base case)

	Whole WTO accession package (E5)	Tariff and NTBs reduction on industrial products (E2)	Agricultural trade liberalization (E3)	MFA elimination (E4)
Guangdong				
EV (% of GDP)	9.14	3.17	0.79	2.26
GDP	8.86	2.77	0.60	2.85
Consumption	8.23	3.47	1.04	1.94
Investment	14.06	4.21	0.66	3.44
Exports	19.01	7.45	2.12	4.86
Imports	16.64	7.75	1.79	3.14
Interregional Exports	–9.47	–4.19	–0.15	–2.87
Interregional Imports	3.33	–0.63	1.43	1.15
Trade Surplus	–23.83	–5.72	1.26	–3.83
GDP Deflator	–0.58	–2.04	–0.72	1.35
Per Capita Households Income				
Urban	2.76	1.12	1.37	0.13
Rural	4.45	2.22	0.40	0.69
Labour force	3.34	1.31	0.13	1.11
Rest of China				
EV (% of GDP)	1.00	–0.02	0.89	0.18
GDP	1.24	0.06	0.89	0.22
Consumption	1.41	0.20	0.87	0.27
Investment	0.67	–0.34	1.10	0.13
Exports	30.07	9.85	3.46	9.88
Imports	27.58	8.74	3.30	9.31
Interregional Exports	3.33	–0.63	1.43	1.15
Interregional Imports	–9.47	–4.19	–0.15	–2.87
Trade Surplus	–159.55	–38.35	8.43	–25.69
GDP Deflator	–1.18	–2.72	–1.21	1.77
Per Capita Households Income				
Urban	2.23	0.29	1.56	0.31
Rural	1.27	0.35	0.23	0.44
Labour force	–0.23	–0.09	–0.01	–0.07

Source: Simulation results.

The different components of the WTO accession package result in quite different regional impacts. Guangdong will gain less than the rest of China in the scenario in which only agricultural trade is liberalised, because unlike the rest of China, Guangdong's agricultural imports consist mainly of rice which was less protected than wheat, corn and cotton. Furthermore, the share of agriculture in Guangdong's economy is smaller than in the rest of China. Therefore, Guangdong would not benefit significantly from cheaper imports of agricultural goods and the shifts in agricultural labour forces to industries and services.

The aggregate effects on efficiency and welfare in the rest of China for scenarios E2 and E4 are limited. Although the increase of foreign trade in Guangdong is smaller than in the rest of China in both cases, Guangdong enjoys almost all benefits because its share in China's foreign trade is large, especially in the manufacturing sectors.

TABLE 7 provides the simulations results on sectoral production and employment for Guangdong and the rest of China. The sectoral impacts on the two regions are quite similar to those on the whole country. However, because the ratio of foreign trade to GDP is higher in Guangdong than in the rest of China, the impact on Guangdong's production is larger for most sectors than on the rest of China.

Owing to the high level of protection of grains, these are agricultural products which will be the most seriously affected by China's entry in the WTO. Provinces which are specialised in the production of these products and especially the farmers in these provinces are likely to suffer losses. The per capita output of agricultural products could be an indicator of the level of interregional exports. Generally, provinces with higher per capita output are expected to be net exporters to other provinces or to world markets. When China becomes a member of the WTO, the provinces with net outflows of these agricultural products would suffer a negative effect, while the provinces with net inflows of these agricultural products would benefit. Wheat production in Hebei, Shandong and Henan, which are important wheat producing regions with a high per capita output of wheat, would be adversely affected by China's WTO accession. Some provinces in Central China which are specialised in rice production, such as Hunan, Jiangxi and Hubei, could experience losses owing to competition from imports supplying coastal markets. In the meantime, Xianjiang, Hubei, Henan and Jiangsu, which are important suppliers of cotton in China, will also suffer slight losses.

It should be pointed out that the crop sector as a whole would suffer a decline in production after China enters the WTO, but that the livestock sector would gain from entry. Although the major grain producing provinces would experience a decline in grain production, they should benefit from the expansion of the livestock sector if they swiftly transfer from crop to livestock production, as these provinces have relative cheaper labour and feed supply.

Guandong, Fujian and Shanghai, which are the most important producers of labour intensive manufactured products and the most export oriented provinces, would be the major beneficiaries from China's WTO accession and from the expected expansion of China's labour intensive sectors. Jiangsu is also an important producer of textiles and clothing, but is less

Table 7 - Sectoral output and employment changes for Guangdong and rest of China, (E5)

	Output				Employment			
	Guangdong		Rest of China		Guangdong		Rest of China	
	Bn Yuan	%	Bn Yuan	%	10 000 Person	%	10 000 Person	%
Rice	–7.5	–24.9	–18.6	–6.9	–38.7	–26.1	–183.9	–7.3
Wheat	0.0	–21.3	–9.3	–4.8	–0.1	–22.8	–73.1	–5.3
Corn	0.0	–	–1.9	–1.5	0.0	–	–22.1	–2.0
Cotton	0.0	–	12.7	11.5	0.0	–	101.3	10.8
Other non-grain crops	–4.3	–4.3	–30.5	–2.4	–30.8	–6.0	–380.1	–2.9
Forestry	–1.2	–10.5	–16.4	–11.3	–3.4	–10.9	–138.3	–11.3
Wool	0.0	–	–0.9	–13.7	0.0	–	–2.0	–14.1
Other livestock	9.5	8.7	61.1	3.2	10.1	7.0	127.1	2.9
Fishing	2.3	2.4	10.0	1.7	4.1	1.8	24.6	1.6
Other agricultural pr.	0.6	2.7	2.2	1.1	1.3	1.4	4.9	0.4
Coal mining	–0.3	–22.3	–3.0	–0.8	–3.1	–22.4	–9.3	–0.8
Crude oil and natural gas	–2.4	–7.6	–14.1	–7.0	–0.2	–7.6	–13.6	–6.9
Ferrous ore mining	–0.4	–16.2	–2.2	–3.4	–0.3	–14.8	–1.9	–2.6
Non-ferrous ore mining	–1.2	–14.8	–5.6	–3.3	–1.1	–15.0	–3.1	–2.5
Other mining	0.1	0.4	0.9	0.2	0.0	–0.3	2.7	0.4
Vegetable Oil	–3.3	–16.3	–58.3	–25.9	–0.8	–24.0	–12.5	–19.3
Grain mill and forage	0.6	1.4	0.1	0.0	0.0	–0.6	0.3	0.2
Sugar	–2.0	–13.7	–7.4	–13.6	–1.2	–14.2	–9.0	–13.3
Processed food	–1.9	–2.2	26.4	2.3	–1.3	–3.7	9.3	2.1
Beverage	–8.2	–12.9	–1.0	–0.2	–2.1	–12.7	0.2	0.1
Tobacco	–1.7	–17.1	–2.1	–0.7	–0.3	–15.2	–0.1	–0.3
Textile	258.6	120.8	615.3	34.0	56.2	91.7	299.3	26.8
Apparel	192.4	102.8	480.6	61.9	100.6	82.2	166.9	34.8
Leather	–15.3	–11.7	–1.6	–0.4	–8.3	–11.3	1.3	0.6
Sawmills and furniture	–2.9	–4.0	4.4	0.9	–1.0	–4.4	3.9	1.1
Paper & printing	–10.1	–8.2	–21.2	–3.1	–4.2	–8.8	–12.8	–2.5
Social articles	–16.7	–7.0	–4.0	–1.0	–4.7	–6.2	–0.2	–0.1
Petroleum refining	–2.3	–2.7	–26.8	–3.3	–1.0	–3.1	–8.7	–3.1
Chemicals	0.1	0.2	–46.9	–2.7	–0.8	–2.2	–15.7	–2.2
Medicine	–1.2	–3.9	3.3	0.7	–0.5	–4.6	1.8	0.9
Chemical fibers	8.0	19.6	39.9	15.9	1.3	14.6	10.9	13.4
Rubber and plastics	–17.1	–5.8	–28.1	–3.3	–5.1	–6.6	–13.1	–2.5
Build materials	9.1	4.4	–2.3	–0.1	2.1	2.0	1.2	0.1
Primary iron and steel	–1.2	–4.9	–66.3	–4.8	–0.9	–5.7	–31.4	–4.3
Non-ferrous metals	–2.5	–9.9	–18.0	–3.7	–0.8	–9.7	–6.4	–2.9
Metal products	–7.8	–4.1	–23.0	–2.3	–2.4	–4.6	–9.8	–1.8
Machinery	–4.2	–11.4	–64.8	–5.4	–2.6	–10.6	–35.9	–4.2
Special equipment	–1.3	–8.2	–20.9	–2.8	–1.8	–8.0	–10.9	–2.2
Automobile	–14.6	–57.4	–290.8	–33.5	–3.2	–53.8	–92.9	–28.5
Oth. Transport equipment	–3.2	–4.3	1.6	0.3	–1.4	–4.7	3.6	0.9
Electrical machinery	–49.1	–9.3	–27.4	–2.4	–11.8	–9.6	–7.8	–1.6
Electronics	–53.0	–8.3	–111.2	–9.9	–12.9	–8.2	–26.2	–9.2
Instruments	–9.0	–12.3	–22.0	–12.9	–2.7	–11.5	–21.6	–11.7
Other manufacturing	–9.1	–8.0	–7.5	–2.3	–5.1	–8.2	–5.9	–1.3
Utilities	8.7	4.4	–9.2	–0.9	0.1	0.4	–2.1	–0.5
Construction	67.9	13.3	29.7	0.7	60.0	10.8	41.9	0.7
Transportation	8.9	3.8	7.6	0.6	3.4	1.9	22.3	0.7
Post and communication	8.0	6.4	0.4	0.1	1.2	3.7	2.0	0.7
Commerce	56.5	9.6	51.4	1.6	55.8	7.3	155.9	1.7
Finance	10.4	6.1	–1.9	–0.2	1.7	3.6	–0.4	–0.1
Social services	23.2	5.8	16.1	0.8	4.7	3.4	16.2	1.1
Education & health	5.3	3.0	–1.6	–0.1	5.2	1.8	–3.9	–0.1
Public administration	3.2	2.7	0.2	0.0	1.8	1.3	2.3	0.1

Source: Simulation results.

export oriented, so that its gain from China's WTO accession would be relatively smaller than for Guandong and Fujian.

Machinery, transport equipment, electrical machinery and electronics will be adversely affected. Jiangsu and Shanghai could thus be affected because of the importance of these sectors in their production. Furthermore, the machinery sector in Liaoning and Shandong, and the automobile sector in Jilin and Hubei, would also be adversely affected. Guandong province accounts for an important share of China's electronic sector, but the negative impact of accession would be small because of the export oriented nature of its electronic sector.

Conclusion and Policy Implications

This paper analysed the impact of China's WTO accession using a two-region Chinese CGE model. The results of simulation show that by becoming a member, China would gain significantly in terms of economic efficiency. When China fully implements its commitment on market access, in 2010, its real GDP and welfare measured in Hicks equivalent variations (EV) would be increased by 2.1% and 1.89% of real GDP of 2010 respectively. The large gains in real GDP mainly results from the enhanced efficiency of resource allocation brought about by an increased specialisation in accordance with China's comparative advantage. Moreover, the elimination of MFA quotas will strengthen China's competitiveness in the textile and apparel sectors, leading to a rapid export expansion of these products, which will also contribute to real GDP growth. If one takes into account the gains to TFP improvement and economic growth from trade liberalisation, China's efficiency gains will be even larger.

Notwithstanding these economy-wide benefits, the gains are not evenly distributed, neither across sectors nor across provinces. Accession to the WTO implies relatively dramatic economic structural adjustments. Output of highly protected agricultural sectors (i.e., cotton, wheat, etc) and of capital intensive industrial sectors (i.e., automobiles and instruments) would contract significantly, while the labour intensive sectors such as textiles and clothing would be the main beneficiaries. At the regional level, the coastal area will gain most from trade expansion and increased exports of labour intensive goods. On the other hand, provinces in inland areas, especially those provinces which specialise in agricultural production, could experience losses.

Structural adjustments involve adjustment costs. Structural unemployment may rise following China's accession to the WTO. Millions of farmers would have to transfer to the non-agricultural sector. Although growth in the textile and service industries should open up a large number of positions for rural migrants, the transition could be painful in the short term. Undoubtedly, the role of the government would be crucial in the process of structural adjustment.

These results have important implications. First, accession to the WTO is a challenge for China, but it also means a great opportunity. Shortage of arable land and capital and the

existence of large pools of unskilled labour are the fundamental conditions characterising China. This situation cannot be changed radically in the near future. These basic conditions will be the major decisive factors in the identification and choice of China's development strategy. Joining the WTO will integrate China into the world economy, which is consistent with China's medium and long term development strategy.

Second, overall income distribution would deteriorate after China enters the WTO, in terms of either rural-urban or coastal-inland gap. But the rise in rural-urban income disparity is due largely to the food self-sufficiency policy that would continue in the future, rather than to trade liberalisation. Protection of agriculture can improve the farmer's income temporally, but this is not sustainable. The cost of agricultural protection will grow as China continues to industrialise. The later the reform, the larger the distortions and the more serious the problem of income distribution. The appropriate strategy for China's WTO accession is to open its agricultural and food markets and in exchange to have the developed countries lift their protection on imports of labour-intensive products from China, to phase out the protection of manufacturing sectors over a period of time, and to create the necessary economic and social conditions for the shift of agricultural labour force. These measures will benefit both the efficiency and equity in China.

The widening regional disparity between coastal and inland areas induced by China's WTO accession is mainly due to the low degree of domestic regional integration and to the structural features of China's foreign trade profile. Since processing trade is very important, the linkage between foreign trade and the domestic economy is weak in China. The export sector in coastal areas depends more on labour migration from inland areas than on intermediate inputs from inland areas. Therefore, the increase in exports in coastal areas would not increase the demand for interregional imports, but instead will divert labour from inland areas to coastal areas. Although imposing limitations on labour mobility within regions would reduce regional disparities, it would be harmful to economic efficiency. Instead of exacerbating existing distortions in factor markets, the central government should foster domestic regional integration in commodity markets by investing in infrastructure, transports, communication, etc., and by reducing the institutional separation between the export sector and the domestic economy. This will allow efficiency gains from trade liberalisation to spread evenly across regions in China without hurting economy efficiency.

Third, it is urgent for China to create a social security system that will facilitate a smooth transition of the labour force. The State Council issued a series of directives in the 1990s that aim to establish a nation-wide three-pillar social security system. However, the current social security system is far from ready for structural changes in employment that would be brought about by WTO accession (World Bank, 1997b).

Fourth, domestic tax policy should play a more prominent role in redistributing income, in order to reduce the impact of income inequality resulting from the accession to WTO. One of our previous studies investigated the welfare and distribution effects of tariff reduction

under alternative tax replacement assumptions (Wang and Zhai, 1998). The study suggested that imposing a progressive households income tax would be an appropriate policy choice to replace the loss in tariff revenue, by reducing the Gini coefficient and retaining most of the efficiency gains.

L.S. & Z.F.

Appendix 1

The Two-Region Recursive Dynamic Chinese CGE Model

■ Model Dimension

Each region in the model has 53 industries, 5 factors of production and 2 representative households (one urban and one rural). Among the factors of production, labour and capital are used by all sectors, while land is used only by agricultural activities. Labour is disaggregated into three types: agricultural labour, production workers, and professionals. Out of the 53 sectors, 10 are agricultural, 5 are mining, 29 are manufacturing sectors, 1 is a utility and 8 are services. The detailed disaggregation of agricultural and food sectors make it possible to explicitly model the quantitative restrictions on agricultural commodities and food.

■ Production and Factor Markets

The model assumes that there are two types of competitive firm – *ordinary firms* and *export processing firms* – that produce the same product in the same industry. The products of ordinary firms are assumed to be sold in the domestic market or are exported to the rest of the world by a constant elasticity of transformation (CET) function, whereas for export processing firms, products are exported only.

All sectors are assumed to operate under constant returns to scale and cost optimization. Production technology is represented by a nesting of constant elasticity of substitution (CES) functions. At the first level, output results from two composite goods: a composite of primary factors plus energy inputs (i.e., value-added plus the energy bundle) and aggregate non-energy intermediate inputs. At the second level, the split of non-energy intermediate aggregates into intermediate demand is assumed to follow the Leontief specification (i.e., there is no substitution among non-energy intermediate inputs). Value-added plus the energy component are decomposed into an aggregate labour and energy-capital bundle. Aggregate labour is further split into 3 types of labour force. And energy-capital bundles are decomposed into energy and capital-land bundles. Finally, the energy bundle is made up of 3 types of base fuel components, and capital-land is split into capital and land in the agricultural sector.

The model distinguishes between *old* and *new* capital goods. This assumption of vintage capital allows the elasticity of substitution in the production function to differ according to the vintage of capital. The model also includes adjustment rigidities in capital markets. It is assumed that new capital goods are homogeneous and old capital goods are supplied to second-hand markets. The old capital located in a sector can be disinvested when this sector is in decline. The supply curve

of old capital is a simple constant elasticity function of the relative rental rates. The higher the rental rate on old capital, the higher the supply of old capital. But the rental rate on old capital is not allowed to exceed the rental rate on new capital. Within a sector, capital is assumed to be fully mobile among ordinary firms and export processing firm.

Each type of labour force is assumed by be fullly mobile across sectors and across the two types of firms. The agricultural workers work only in agricultural sectors and production workers work only in non-farm sectors. There is no substitute between agricultural workers and production workers in the production function. Although this is progressively changing, there are still high barriers for rural labour forces to migrate to urban areas. These barriers include the household registration regime, discrimination in employment, education and social security, etc. This segmented labour market is modelled by incorporating partial mobility between agricultural workers and production workers. We assumed agricultural workers and production workers could be converted from one to another. A CET function is used to capture this specification (i.e., this transfer is determined by the relative wage of agricultural and production workers, as well as the constant elasticity of transformation).

The model assumes imperfect interregional factor mobility. CET functions are utilised to describe the regional movement of labour and capital. The movement of capital is determined by the relative rental rates and the constant elasticity of transformation, whereas the movement of labour is determined by the relative real income and the constant elasticity of transformation. The real income of labour is defined as the wage rate plus per capita net intergovernmental transfer income, deflated by the regional consumer price indices.

■ Interregional and Foreign Trade

The rest of the world supplies imports and absorbs exports. Given China's small share in world trade, import prices are exogenous in foreign currency (representing an infinite price-elasticity). Exports are demanded according to constant-elasticity demand curves, the price-elasticities of which are high but less than infinite.

The ordinary firms allocate their output between export and domestic sales in order to maximise their profits, subject to imperfect transformation between the two alternatives. All the output of export processing firms is sold to overseas markets. We assume that exports by ordinary firms and exports by processing firms are heterogeneous A CES aggregation function with relatively high substitute elasticities is employed to form the composite exports. In other words, we assume that the buyers of the rest of the world choose a mix between the two types of exports in order to minimize their cost.

The domestic sales of ordinary firms are further split into local sales and interregional exports using a nesting of CET functions. At the top level, regional suppliers optimally allocate aggregate domestic sales between the local market and the rest of China. At the second nest, aggregate interregional exports are optimally allocated across each trading region within China as a function of relative prices.

Three types of imports are distinguished in the model. The first one relates to ordinary trade imports, which operate under an ordinary trade regime, and are subject to import tariff and non tariff barriers. The second type concerns duty-free imports of raw materials and components for

processing trade export. Most of these imports are used as intermediate input for export processing firms, although some of these are transferred to the domestic market. The third type represent duty-free imports of investment goods for foreign invested enterprises and export processing enterprises.

Products are assumed to be differentiated by region of origin, i.e. the Armington assumption (Armington, 1969). A three-level nesting CES aggregation function is specified for each Armington composite commodity. At the top level, agents choose an optimal combination of the aggregate domestic good and an import aggregate, which is determined by a set of relative prices and the degree of substitutability between the two. At the second level of the nest, the import aggregate is further split into ordinary imports, duty-free imports of investment and the imports of processing trade which are transferred into the domestic market, again as a function of the relative import prices and the degree of substitution across different import types. Import prices are specific to each import type because of the duty-free nature for the last two types of imports. At the same level of the nest, aggregate domestic goods are split into local goods and interregional imports from the rest of China. At the third level, the demand for the aggregate interregional imports is optimally allocated across the trading regions within China.

We establish the difference between the domestic price and the world price in two parts, i.e. the tariff rate and non-tariff barriers (NTBs). NTBs are modelled as the tariff equivalent, which creates a pure rent to households. The quantitative restriction on agricultural products is modelled explicitly. It is either modelled through a Leontief specification, where imports cannot exceed the quota allocation and the rates of quota rent are solved endogenously to clear the market, or through the tariff rate quota as complementarity constraints, where rates of quota rent become endogenous when the constraints bind.

In the textile and apparel sectors, China's exports to the USA, Canada, EU and other countries face MFA quota. In our model, we treat this quota as an export tax equivalent that is added to the domestic export price. The quota premium is assumed to be borne by households. In the simulations, the MFA quotas are exogenous, with export tax rates adjusted endogenously.

■ Income Distribution and Demands

Factor income is distributed to four major institutions: enterprises, households, the government and extra-budget public sector.

Household income derives from capital, labour and land income. Additionally, households receive distributed enterprise profits, transfers from the government and rest of the world. All kinds of import and export quota rents are also allocated to households. It is assumed that the rural households earn all the land returns. Rural households earn their labour income from both agricultural workers and production workers, while urban households obtain their wages from both production and professional workers. When transformation occurs between agricultural labour and production workers and when some agricultural workers are transferred to non-agricultural sectors and became production workers, their wages would be allocated to rural households. Vice versa, if production workers are transferred to the agricultural sector and became agricultural workers, their wages are still distributed to urban and rural households according to the distribution share of production workers' wages.

Capital revenues are distributed among households and enterprises. Enterprise earnings equal a share of gross capital revenue minus corporate income taxes. A part of enterprise earnings is allocated to households as distributed profits based on fixed shares, which are the assumed shares of capital ownership by households. Another part of net company income is allocated to extra-budget public sectors as fees. Retained earnings (i.e., corporate savings for new investment and capital depreciation replacement) equal a residual of after-tax enterprise income minus the distributed profits and fees.

Household disposable income is allocated to goods, services and savings. Households maximize utility using the extended linear expenditure system (ELES) which is an extension of the Stone-Geary demand system. Saving enters the utility function, which is evaluated using the consumer price index. Social consumption and investment final demand follow a fixed share expenditure function.

Stock change is assumed to reflect a change in demand for domestic products. The intermediate inputs for ordinary firms are provided by the Armington composite goods. The intermediate inputs for export processing firms are composed of composite goods and duty-free imports of raw materials. Components used in processing trade export through a CES function. The intermediate inputs for ordinary firms, the domestic part of intermediate input for export processing firms, household consumption, and other final demands constitute the total demand for the same Armington composite of domestic products and imported goods from the rest of the world.

■ Central and Regional Governments, and Extra-budget Public Sector

An important difference in the model relative to other applied general equilibrium models is the separate treatment of central government and regional governments. The governments collect taxes from the producers, households and foreign sector, transfer money to the household sector, and purchase public goods. There are also transfers between central and regional governments. The central government derives revenues from direct corporate income taxes, import tariffs, and various types of indirect taxes. Regional governments derive revenues from direct corporate income and household taxes, as well as from various indirect taxes. Subsidies and export tax rebates enter as negative receipts. There are two types of indirect taxes in the model. The value-added tax, which is the most important type of indirect tax in China since the 1994 tax reform, is treated as a tax levied on production factors. Its revenues equal total sector value-added multiplied by a tax rate. Three quarters of value-added tax is allocated to the central government and the rest is allocated to the regional government. The value-added tax is also levied on imports, although firms obtain rebates when they export. The other indirect tax, including various agricultural taxes and business taxes on construction and services, are treated as a production tax levied on sectoral outputs.

Extra-budget public sectors collect fees from enterprise and households. Their income is allocated to consumption and saving. The consumption of extra-budget public sectors and government spending compose a type of final demand, i.e. the social consumption.

■ Macro closure

Macro closure determines the manner in which the following three accounts are brought into balance: (i) the government budget; (ii) aggregate savings and investment; and (iii) the balance of payments. Real government spending is exogenous in the model. All tax rates and transfers are fixed,

while real government savings is endogenous. The total value of investment expenditure must equal total resources allocated to the investment sector, which are retained corporate earnings; total household savings; government savings; extra-budget saving; and foreign capital flows. In this model, the aggregate investment is the endogenous sum of the separate saving components. This specification corresponds to the "neoclassical" macroeconomic closure in the CGE literature.

The value of imports, at world prices, must equal the value of exports at border prices, i.e., inclusive of export taxes and subsidies, plus the sum of net transfers and factor payments and net capital inflows. An exchange rate is specified to convert world prices, i.e., in dollars, into domestic prices. Either this exchange rate or total foreign capital inflows can be fixed while the other is allowed to adjust providing alternative closure rules. With foreign saving set exogenously, the equilibrium would be achieved through changing the relative price of tradables to nontradables, or the real exchange rate.

Since the purpose of this paper is to estimate the impact of trade liberalisation, we keep the trade balance denominated in foreign currency terms. Thus, any changes in real absorption do not result from changes in lending to, or borrowing from, overseas.

■ Recursive Dynamics

The current version of China's CGE model has a simple recursive dynamic structure where agents are assumed to be myopic and to base their decision on static expectations about prices and quantities. The dynamics of the model originate from the accumulation of productive factors and productivity changes. The base year of the data and the model is 1997. The model is solved for subsequent years in 1998, 2000, 2002, 2004, 2006, 2008 and 2010. The time periods are linked together through factor growth (labor/land) and accumulation (capital), and changes in productivity.

The growth rates of population, labour forces, and labour productivity are exogenous. The growth of capital is endogenously determined by the saving/investment relation. In the aggregate, the basic capital accumulation function equates the current capital stock to the depreciated stock inherited from the previous period plus gross investment. At the sectoral level, the specific accumulation functions may differ because the demand for (old and new) capital can be less than the depreciated stock of old capital. We assume the producer decides the optimal way to divide production of total output across vintages. If sectoral demand exceeds what can be produced with the old capital, the producer will demand new capital. Otherwise, the producer will disinvest some the installed capital.

In defining the reference simulation, a single economy-wide Hicks neutral efficiency factor (TFP) and sector specific agricultural productivity are determined endogenously to get a pre-specified growth path of real GDP and agricultural output. When alternative scenarios are simulated, the TFP growth rate is exogenous, and the growth rate of real GDP is endogenous.

■ Data

The model is calibrated to the 1997 two-region Chinese Social Accounting Matrices (SAM) developed from the 1997 national and Guangdong Input-Output tables. Some key parameters of the model – essentially substitution and income elasticities – were derived from the literature. All other parameters – mainly shift and share parameters – are calibrated in the base year using the key parameters and the base data.

Appendix 2
The Statistical Data

Table A2.1 - Coefficient of location* by regions and provinces, 1997

	Agriculture	Mining and quarrying	Consumption goods	Intermediate Input	Capital Goods	Construction	Service
Eastern	**0.57**	**0.64**	**1.09**	**1.25**	**1.56**	**1.00**	**1.15**
Beijing	0.15	0.12	0.50	0.75	1.25	1.14	2.00
Tianjin	0.22	0.73	1.06	1.20	2.18	0.86	1.34
Hebei	0.75	1.06	1.14	1.66	1.01	0.97	0.89
Liaoning	0.56	1.12	0.68	1.74	1.28	0.93	1.16
Shanghai	0.09	0.00	0.85	1.49	2.47	0.87	1.45
Zhejiang	0.55	0.21	1.46	1.42	2.06	0.92	0.99
Jiangsu	0.56	0.33	1.29	1.45	1.67	1.11	0.99
Fujian	0.77	0.51	1.05	0.78	1.12	1.12	1.20
Shandong	0.72	1.36	1.01	1.12	1.30	0.89	1.09
Guangdong	0.54	0.49	1.28	0.98	1.80	1.11	1.16
Guangxi	1.27	0.97	0.87	0.75	0.73	0.83	1.05
Central	**0.96**	**1.55**	**0.98**	**1.10**	**0.96**	**0.89**	**0.93**
Shanxi	0.54	3.65	0.45	1.51	0.60	1.02	0.97
Inner Mongolia	1.17	1.44	0.80	0.93	0.33	1.09	0.99
Jilin	1.02	0.81	0.65	1.07	1.57	0.94	0.99
Heilongjiang	0.72	3.83	0.90	0.93	0.78	0.90	0.87
Anhui	1.10	0.87	1.15	1.40	1.22	0.70	0.81
Jiangxi	1.10	1.06	0.74	0.88	1.07	1.08	1.01
Henan	0.98	1.37	1.06	1.09	0.90	0.97	0.90
Hubei	0.89	0.62	1.23	1.27	1.07	0.74	1.01
Hunan	1.14	1.09	1.15	0.82	0.92	0.87	0.95
Western	**0.98**	**0.99**	**0.93**	**0.93**	**0.99**	**1.09**	**1.05**
Chongqing	0.91	0.47	0.45	0.85	2.12	1.18	1.11
Sichuan	1.11	0.74	1.00	0.92	1.06	1.06	0.97
Guizhou	1.34	0.69	0.86	0.83	0.66	0.93	0.96
Yunnan	0.95	0.45	2.05	0.81	0.45	1.00	0.97
Gansu	0.72	1.23	0.60	1.63	0.74	0.55	1.14
Ningxia	0.85	1.32	0.43	1.58	0.64	1.15	1.05
Qinghai	0.81	1.24	0.31	0.96	0.40	1.77	1.23
Shaanxi	0.82	1.08	0.62	0.90	1.50	1.27	1.14
Xinjiang	0.95	2.86	0.60	0.62	0.23	1.46	1.14

* Quotient of Location is a_{ij}/a_i a_{ij} is the share of the *i*'th industry output in the *j*'th region output a_i is the share of the *i*'th industry output in national output.

Source: Calculated from 1997 Input-Output table.

Table A2.2 - Distribution of manufacturing value-added by province, 1997

Share of provincial value-added (%)

	Textile, Clothing & Social Articles	Machinery	Transportation Equipment	Electrical & Electronic Machinery
Beijing	2.0	2.5	5.4	4.7
Tianjin	1.9	2.6	4.5	6.5
Hebei	4.2	4.0	2.6	2.2
Shanxi	0.6	1.6	0.9	0.4
Imongolia	0.8	0.4	0.3	0.2
Liaoning	1.8	7.8	4.2	5.0
Jilin	0.4	0.8	9.4	0.3
Helongjiang	0.5	2.1	2.2	1.0
Shanghai	8.0	9.8	14.9	11.2
Jiangsu	20.8	17.5	10.0	13.2
Zhejiang	11.7	7.4	4.1	6.4
Anhui	2.7	3.1	1.5	1.7
Fujian	5.0	1.5	0.8	2.7
Jiangxi	0.9	1.2	2.0	0.9
Shandong	8.7	9.8	5.5	5.1
Henan	3.8	5.6	2.8	2.5
Hubei	4.7	4.0	6.9	1.6
Hunan	1.0	2.5	2.7	1.4
Guangdong	14.8	4.0	6.6	22.9
Guangxi	0.9	2.4	2.0	0.8
Hainan	0.1	0.0	0.5	0.1
Sichuan	1.5	4.7	5.8	4.3
Guizhou	0.2	0.5	1.3	0.3
Yunnan	0.4	1.0	0.5	0.4
Tibet	0.0	0.0	0.0	0.0
Shaanxi	0.9	1.5	2.5	3.7
Gansu	0.5	0.6	0.2	0.4
Qinghai	0.0	0.2	0.0	0.0
Ningxia	0.0	0.4	0.0	0.1
Xinjiang	1.0	0.3	0.1	0.1

Sources: – China Regional Economy: A Profile of 17 Years of Reform and Opening-up, SSB, 1996.
– The Data of the Third National Industrial Census of the People's Republic of China in 1995.

Table A2.3 - Distribution of rice, wheat and cotton production, 1997

	Rice		Wheat		Cotton	
	Share of provincial output, %	Per capita output (kg/person)	Share of provincial output, %	Per capita output (kg/person)	Share of provincial output, %	Per capita output (kg/person)
Beijing	0.1	13	1.0	80	0.1	0.2
Tianjin	0.2	43	0.6	73	0.2	1.3
Hebei	0.5	14	10.4	165	7.8	5.8
Shanxi	0.0	1	2.6	88	1.9	3.0
Imongolia	0.2	17	2.6	115	0.0	0.0
Liaoning	1.4	65	0.6	16	0.5	0.6
Jilin	1.6	116	0.2	7	0.0	0.0
Helongjiang	2.5	127	2.7	73	0.0	0.0
Shanghai	0.9	122	0.2	18	0.1	0.3
Jiangsu	9.7	255	8.7	126	11.8	7.9
Zhejiang	6.6	278	0.5	12	1.3	1.4
Anhui	6.9	212	6.8	117	6.3	5.0
Fujian	3.9	229	0.2	6	0.0	0.0
Jiangxi	8.0	366	0.1	2	2.5	2.9
Shandong	0.5	10	20.2	237	9.9	5.4
Henan	1.6	33	17.2	193	16.2	8.5
Hubei	9.3	300	3.6	63	12.3	10.2
Hunan	13.2	384	0.3	4	4.7	3.5
Guangdong	7.9	215	0.1	1	0.0	0.0
Guangxi	6.8	277	0.0	1	0.0	0.0
Hainan	0.9	222	0.0	0	0.0	0.0
Sichuan	11.3	188	7.2	65	2.4	1.0
Guizhou	2.3	124	1.1	32	0.0	0.0
Yunnan	2.8	128	1.3	34	0.0	0.0
Tibet	0.0	2	0.2	106	0.0	0.0
Shaanxi	0.3	18	4.0	117	0.8	1.1
Gansu	0.0	2	2.5	104	0.5	0.9
Qinghai	0.0	0	0.7	144	0.0	0.0
Ningxia	0.2	90	0.7	135	0.0	0.0
Xinjiang	0.3	28	3.9	237	20.8	59.8
Total	100.0	155	100.0	85	100.0	4.0

Source: Rural Statistical Yearbook of China, 1996, SSB.

Table A2.4 - External trade dependency ratio by province in 1999

	Imports and Exports/GDP	Exports/GDP	Imports/GDP
Eastern			
Beijing	0.70	0.24	0.46
Tianjin	0.77	0.37	0.40
Hebei	0.08	0.05	0.03
Liaoning	0.29	0.16	0.13
Shanghai	0.78	0.38	0.41
Zhejiang	0.35	0.20	0.15
Jiangsu	0.31	0.21	0.10
Fujian	0.43	0.25	0.18
Shandong	0.23	0.13	0.09
Guangdong	1.41	0.77	0.63
Hainan	0.08	0.05	0.03
Guangxi	0.18	0.10	0.09
Central			
Shanxi	0.13	0.08	0.04
Inner Mongolia	0.08	0.04	0.04
Jilin	0.13	0.06	0.07
Heilongjiang	0.09	0.04	0.04
Anhui	0.08	0.05	0.03
Jiangxi	0.06	0.04	0.02
Henan	0.04	0.02	0.02
Hubei	0.07	0.03	0.03
Hunan	0.06	0.03	0.02
Western			
Chongqing	0.07	0.03	0.04
Sichuan	0.06	0.03	0.04
Guizhou	0.06	0.04	0.02
Yunnan	0.08	0.04	0.04
Tibet	0.13	0.06	0.06
Shaanxi	0.12	0.06	0.06
Gansu	0.05	0.03	0.02
Qinghai	0.07	0.04	0.02
Ningxia	0.14	0.10	0.04
Xinjiang	0.14	0.07	0.07

Source: China Statistical Yearbook, 2000.

Table A2.5 - Distribution of cumulated FDI by province at the end of 1999

Region	No. Registered Enterprises and shares		Registered capital (U.S.$. 10 000)	Capital Invested by Foreign partner and shares		Order of rank
	Number	Share of Total %		Amount (U.S.$ 10 000)	Share of Total %	
Eastern						
Beijing	8,621	4.1	2,098,591	1,383,035	4.37	6
Tianjin	9,924	4.67	1,696,650	1,284,473	4.06	8
Hebei	34,011	1.89	860,228	467,343	1.48	13
Liaoning	13,825	6.51	2,584,599	1,524,605	4.81	5
Shanghai	15,059	7.09	4,940,130	3,453,171	10.90	2
Zhejiang	9,646	4.54	1,602,594	960,244	3.03	10
Jiangsu	18,843	8.87	4,029,616	2,761,820	8.72	3
Fujian	17,965	8.46	3,050,255	2,579,989	8.15	4
Shandong	12,358	5.82	2,327,187	1,303,472	4.12	7
Guangdong	53,644	25.25	12,893,567	9,593,830	29.66	1
Guangxi	3,018	1.42	640,533	400,820	1.27	15
Hainan	6,993	3.29	1,366,865	1,100,250	3.47	9
Central						
Shanxi	1,204	0.57	253,339	127,215	0.40	25
Inner Mongolia	919	0.43	157,492	83,686	0.26	27
Jilin	2,931	1.38	506,102	285,978	0.90	21
Heilongjiang	3,788	1.78	612,968	351,655	1.11	17
Anhui	2,439	1.15	582,506	320,714	1.01	18
Jiangxi	2,149	1.01	313,552	199,568	0.63	23
Henan	3,772	1.78	790,302	431,165	1.36	14
Hubei	5,407	2.55	1,016,187	603,077	1.90	12
Hunan	2,513	1.18	442,332	266,023	0.84	22
Western						
Chongqing	2150	1.01	498,381	313,228	0.99	19
Sichuan	3730	1.76	701,051	357,784	1.13	16
Guizhou	947	0.45	153,188	100,574	0.32	26
Yunnan	1596	0.75	279,746	160,825	0.51	24
Tibet	70	0.03	11,552	5,839	0.02	32
Shaanxi	2604	1.23	471,904	291,090	0.92	20
Gansu	759	0.36	119,222	64,779	0.20	28
Qinghai	83	0.04	37,805	19,727	0.06	31
Ningxia	392	0.18	62,402	32,961	0.10	30
Xinjiang	447	0.21	83,853	46,796	0.15	29
State Administration for Industry and Commerce	629	0.30	1,170,239	792,499	2.50	11
Total	212,436	100	46,354,938	31,668,235	100	

Note: Derived from China's Statistical Yearbook 2000, China Statistics Press.

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