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Income Distribution and Labour Movement in China after WTO Membership

A CGE Analysis

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Abstract

Using a CGE model, PRCGEM, with an updated 2002 I/O table, this paper explores how earnings will be affected in each of 40 separate industries across 31 regions (or 8 regional blocks) of China for the period 2002–07. Labour movement between regions within China is considered. It is found that the direct contribution of WTO membership is small to the whole economy in terms of growth and development. Real GDP will rise only 6.48 per cent (5.6 per cent) in the pure WTO short-run (long-run) shock. Full economic structure change besides WTO shock makes regional output better-off, especially the coastal regions where the economies are well established. Regional labour movement increases by 69.2 per cent in the long-run closure of full economic structural change during the transition period. When regional labour movement is considered, it is found that the Gini coefficient is slightly decreased.

Keywords: applied CGE modelling, China, WTO, labour movement, inequality

JEL classification: C68, O18, R12, R23

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Tables and figures appear at the end of the paper.

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1 Introduction: the framework for WTO entry by China

Although China 'joined' the WTO in December 2001 it was actually one of the founding members of the GATT in 1947.[1] Negotiations over the resumption of its former status had been in progress since 1982. During this long and slow process trade and trade liberalization developed markedly and helped impart a dynamic to China's prospects that will continue for some time to come. The extra obligations and reciprocal benefits of WTO membership have to be overlain on that context. Barriers in China would not have been constant had the WTO negotiations failed. A raft of changes had already been agreed. This therefore has to form part of the baseline against which any WTO inspired changes will have to be judged. Indeed it is quite likely that there would have been other trade agreements, particularly perhaps on a more regional basis, had WTO membership not gone ahead. However, this latter is a speculation that we avoid and our baseline only includes what was already in progress, not hoped for or possible changes in the future.

From 1949 until 1978 China had a closely planned approach to foreign trade, which was managed through some 10-16 foreign trade corporations (Lardy 1992). In this administered regime conventional trade barriers such as tariffs, quotas and licences played little role (Huang and Chen 1999). Although changes started with the 'open door policy' in 1978 it was not until 1984 that foreign exchange earnings from exports became more available. At the same time the planning control of trade was reduced. However it was in the 1990s that the ability to trade with and invest in China on a more open basis really took hold (Tables 1 and 4). Thus by the start of the WTO accession period which we treat as being from 2002, it is possible to classify China's trade barriers and incentives in reasonably conventional terms, although a substantial proportion of imports still comes from 'priviledged' sources.

In our simulations we assumed that China has five years to implement the WTO agreement.[2] Hence the full accession is expected to be completed by 2007 (except the issues of foreign ownership and income payments, which are expected to take several years more). More specific sectoral reforms include reductions in tariffs and commitments not to raise tariffs across commodities and manufactures and improved access arrangements for services. For manufactures, tariffs on average fall from around 17 per cent to about 9 per cent in 2005. Tariffs on automobiles and auto-parts will fall dramatically from 80 per cent to 100 per cent before 2001 and to 25 per cent by 2006. Other industrial products will see complete elimination of all quotas by 2006, while tariffs on information technology equipment will be progressively phased-out. Liberalization of the services sector[3] will include lifting the permitted share of foreign

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1 China's membership was suspended in 1950.

2 Upon joining the WTO in 2001, China is supposed to implement all the required WTO protocol until 2010. Most will be finished by 2007, especially the trade barriers cut. Hence, we assume the transition period for China's WTO membership is in 2002~07.

3 According to the GATS, trade in services as the supply of a service can be classified into four models: cross-border supply; consumption abroad; commercial presence (FDI); movement of individuals (Mattoo 2002).

ownership of China's information technology and telecommunication companies to 49 per cent or more, which will mean more foreign direct investment (FDI) inflows in the near future.

The starting point for the simulations is affected by a number of special factors that make extrapolation of trends somewhat hazardous. The 1997 financial crisis in East Asia negatively affected the Chinese economy (although not as severely as other economies like South Korea and Thailand) during 1998 and the first half of 1999. While China's real GDP growth slowed only marginally from 8.8 per cent in 1997 to 7.8 per cent in 1998, 7.1 per cent in 1999, 8.0 per cent in 2000, 7.5 per cent in 2001, 8.3 per cent in 2002, 9.3 per cent in 2003 and 9.5 per cent in 2004, China's exports rose by only 0.5 per cent in 1998 after rising by 20.9 per cent in 1997. However, its exports rose again substantially by 22.3 per cent in 2002, 34.6 per cent in 2003 and 35.4 per cent in 2004.[4] In addition, FDI declined by 10 per cent during 1997-2000. China's FDI, in 2002, had increased by 33.5 per cent over the previous year and contractual foreign investment by 48 per cent. The FDI actually used totalling US$60.6 billion in 2003 is promoting China to top position as an FDI destination. It is expected that expansion of FDI in China will be associated with a rapid rise in both exports and imports. Our simulations need to avoid confusing short-run adjustments to shocks with the impact of WTO accession over the same time period.

Economic reforms have transformed China into a major trading power. Chinese exports rose from $13.7 billion in 1979 to nearly $325.6 billion in 2002 and $438.2 billion in 2003, while imports grew from $15.7 billion to $295.2 billion and $412.8 billion. With China's exports rising by 34.6 per cent, and imports by 39.8 per cent in 2003 alone the progress becomes increasingly dramatic. During the period of 1990-2003, China's share of world exports increased from 1.8 per cent to 5.84 per cent. Now China is the fourth largest exporting country (behind Germany, Japan and the USA) and the third largest importing country in the world behind USA and Germany. It is also important to recognise in assessing the impact of WTO liberalisation that over the past seven years, China has run trade surpluses; in 2003 the trade surplus was $25.47 billion. Merchandise trade surpluses and large-scale foreign investment have enabled China to accumulate the world's largest foreign exchange reserves to total $286.4 billion and $403.2 billion in 2002 and 2003 respectively. China's accession to the WTO has been quite smooth. Many anticipated negative effects have not occurred. A report from the World Bank (1997: 31) estimates that China's share of world trade could increase from 3.0 per cent in 1992 to 9.8 per cent by the year of 2020, possibly making China the second largest trading economy after the USA. It is important therefore to choose a plausible baseline without unsustainable growth rates or sectoral imbalances that could readily be derived from simplistic extrapolation.

The rest of the paper is organised as follows. In Section 2, we illustrate in details of China's trade liberalisation and sectoral/regional inequality and selectively survey some recent work on CGE study of China's income inequality under the impact of WTO membership. Section 3 describes the basic characteristics of the structure of the CGE model of China (or PRCGEM). Section 4 shows the database, baseline and designed

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4 China's imports increase at almost the same rate during the passing few years to reach US$32 billion, leaving a trade surplus of US$32 billion, 25.3 per cent higher than in 2003 (*China Statistical Yearbook*, various volumes).

simulation scenarios. Section 5 describes the simulation results at macro, sectoral and regional level. And Section 6 concludes with some possible policy implications.

2 Trade liberalization with sectoral/regional inequality and literature on a CGE model of China

2.1 Trade pattern

China has a heavily skewed economy. The agricultural sector employs a major portion of the total workforce, but its per capita output is very lowly.[5] Generally, China's trade pattern in agricultural commodities follows its comparative advantage: it tends to import land-intensive commodities (e.g. grains, especially in the 1990s) and export labour-intensive agricultural commodities (e.g. fish, fruits, vegetables and processed agricultural goods). Trade within the agricultural sector is managed by a complex institutional and policy regime. Non-tariff barriers[6] are playing important role in China's agricultural trade policies. Within the non-tariff barrier category, China is going to commit to relax (or remove) the state trading company monopoly system and replace its current import quota and licensing system with a tariff-rate quota system. Trade in major grains is handled exclusively by state-owned trading organisations. Domestic demand is satisfied by the allocation of import quotas. One of the big issues after China's accession is the increase of China's agricultural imports under undistorted market prices[7] with less government control by import quota. It is expected that WTO membership will facilitate the import of more resource-intensive products like wheat, rice, cotton, and soybean, and the export of more labour-intensive products like fruits, vegetables, livestock, and aquatics.

Over the last decade, China has developed strong comparative advantage in light manufacturing industries (e.g. textiles and garments, toys, consumer electrical appliances, consumer electronic products, etc.). The share of manufacturing in total employment in China is relatively small—amounting to around 18 per cent in 1997—but its share of value-added is quite substantial (33 per cent in 1997). Textiles and clothing, electronics and chemicals lead the way. A global market after the WTO accession is providing more export chances and more employment opportunities. Increasingly, China has gradually diversified its exports. During the period of 1994-2000, the exports share of textiles and garments has fallen from 28.3 per cent to 19.8 per cent and that of electrical machinery, consumer electrical and electronic products has risen from 16.3 per cent to 29.3 per cent (Table 2). Phasing out of textile quotas will dramatically boost the exports of textiles and garments. The key reason for significant growth of manufacturing industry may be due to the rapid expansion of exports and tariff exemption of imported of intermediate inputs used for the production of exports.

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5 Agriculture sector accounted for more than 55 per cent of total employment in China's economy in 1997, but its contribution to economy-wide value-added was only about 22 per cent (Hertel *et al.* 2002: table 2).

6 The most important such non-tariff barriers in agriculture are quotas, import licenses and the use of state trading companies.

7 The share of agricultural goods sold at state-fixed prices declined from 94 per cent in 1978 to around 17 per cent in 1995 (Ianchovichina, McDougall, and Hertel 2000: table 1).

In 1995, China's effective collection rate was only 5.6 per cent, which is much lower than the trade weighted average tariff of 32 per cent (World Bank 1994), while in 1997, its effective collection rate for the agriculture and manufacturing sectors was only 3.48 per cent, which is 25.36 per cent of the unweighted average tariff of 13.72 per cent (1997 China I/O data). However, the trend of diversification of China's exports can be expected to continue, especially after WTO membership.

China's abundance of cheap labour has made it internationally competitive in many low cost, labour-intensive manufactures. As a result, manufactured products comprise an increasingly large share of China's trade. The share of Chinese manufactured exports to total exports rose from 50 per cent in 1980 to 90 per cent in 2000, while manufactured imports as a share of total imports rose from 65 per cent to 79 per cent. A large share of China's manufactured imports are intermediates (e.g., chemicals, electronic components, textile machinery) used in manufacturing products in China. Major Chinese imports in 2000 included (1) electrical machinery, equipment, and related products, (2) mineral fuels and related materials, (3) base metals and related products, (4) chemicals and related products, (5) textile materials and products, and (6) plastics and related products. China's major exports in 2000 included (1) electrical machinery, equipment, and parts, (2) textile materials and products, (3) base metals and related products, (4) footwear and related products, (5) chemicals and related products, and (6) mineral fuels and related products. Intra- as well as inter-industry trade is already developing and China's WTO accession can be expected to bring opportunities for trading to other parts of industry. China is regarded as a net importer of skilled labour and capital intensive manufacturing products and net exporter of labour (especially unskilled labour) intensive manufacturing products.

It is also expected that liberalisation of imports and opening up of the service sectors in China are bound to exert pressure for its entire economy to rationalise and restructure in a much quicker pace (especially for the SOEs[8] reform process and accelerating transformation of China into a market-oriented economy). In 1997, the share of services in total employment in China was around 27 per cent and its contribution to economy-wide value-added about 45 per cent. China's economy is shifting rapidly from import substitution to an export-oriented economy. China has developed a highly competitive labour-intensive, export-oriented manufacturing sector dominated by foreign funded enterprises (FFE[9]). However, China maintains a fairly traditional capital-intensive industrial sector dominated by state owned enterprises (SOEs) and the agricultural sector still enjoys a relatively high degree of government support and tariff/non-tariff protection (UNCTAD 2002). From a dynamic point of view, the penetration of imported

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8 SOEs (which are characterised by low productivity, inefficient production with outdated facilities and technology, excessive employment—12 per cent in total employment and 47 per cent in manufacturing sector in the late 1990s: *China Statistical Yearbook 2000*—and high inventory levels) account for about half of China's exports and their sales are, on balance, directed primarily at domestic markets. SOEs are dominant in heavy industries like power, steel, chemicals, and armaments, and service sectors like banking, telecommunications, wholesale distribution, and some transport activities.

9 FFEs (which are mostly owned by investors from East Asia) include equity joint ventures, contractual joint ventures, wholly foreign-owned enterprises and joint exploration companies for special extraction industries. FFEs are becoming dominant in some light industries like footwear, garments, toys, etc.

goods and of services in the form of FDI will inject competition into the domestic market and bring more up-to-date technology, thereby providing the impetus for the local industries to raise efficiency and productivity, which may call for considerable restructuring and labour-shedding and generate adjustment problems that will affect the possible speed of the transition. Under this more transparent market-driven economic system, the consumers in China will benefit from having greater choice of cheaper and better quality goods with varieties of characteristics. In this paper, we only focus on comparative-static simulation. A dynamic study with FDI will form a later stage of the work.

2.2 Reductions in barriers

China cut tariffs more than seven times between 1992 and 2001, lowering the unweighted import tariff level from 43.2 per cent to around 15.3 per cent (Xinhua 29 December 2000: http://www.china.org.cn/english/2000/Dec/5896.htm). Furthermore, China decided to lower the tariff rates of 53,000 items in 2002, accounting for 73 per cent of the total items of tariffs, so as to cut the unweighted average tariff to 12 per cent by the end of 2002. The tariff reductions planned by China in the context of the accession are the continuation of a longstanding trend of a tariff cut in level and dispersion. China has already lowered it average tariff to 10.4 per cent. Besides the tariff reduction, there is a variety of non-tariff measures including import and export licensing, price controls, subsidies, quotas and tendering that are to be changed. Since 1992, China has reduced the number of products subject to import quota, licence administration, and import control, from 1,247 to 385, accounting for 5 per cent of the total import tariff lines (in 1997) as compared with the previous 20 per cent *(Deregulation Report 1997*, China, APEC).

China introduced tariff-rate quotas (TRQs), on some products, together with the tariff rates applicable to imports both in and out of quota in 1996. TRQs have been widely used in agricultural goods. China's liberalisation of agricultural products for WTO will thus have a major impact, not only on itself, but also on the rest of the world, especially on major agricultural exporters such as USA, Argentina, and Canada. China had made considerable progress in freeing agricultural commodities from state pricing and in guiding farmers to adjust the structure of agricultural production based on the demands of the market. According to the WTO protocol, China agreed to establish a more efficient (TRQ) system for imports of agricultural bulk commodities (e.g. wheat, corn, cotton, barley, rice, etc.) for the years 2002-04. This meant that China's imports up to a specified quota level would be assessed a low tariff (1-3 per cent) and imports above a certain level will get a much higher tariff rate.

China abolished direct subsidies for exports on 1 January 1991. However, many manufactured exports in China receive indirect subsidies through guaranteed provision of energy, raw materials or labour supplies, or other indirect subsidies like non-repaid or long-term bank loans with low interest rates. Furthermore, since the early 1990s when the value-added tax (VAT) was introduced to provide another means of increasing government tax receipts and to support exports or to discourage imports, tax rebates have been available for exporters, as have duty exemptions on imported inputs for export production, while the commodity (imported or domestic produced) bound for the domestic market faces a high VAT rate.

Due to the limited and unreliable data source/methodology, quantitative estimates of the impact of the NTBs in China are rarely attempted. The non-tariff barrier equivalents during 1984~87, 1988~90, and 1991~93 are 10.6 per cent (17.8 per cent for primary products and 7.9 per cent for manufactured goods), 23.2 per cent (27.2 for primary products and 21.9 per cent for manufactured goods), and 11.3 per cent (11.5 per cent for primary products and 11.3 per cent for manufactured goods) respectively (Pacific Economic Co-operation Council 1995). Zhang *et al.* (1998) calculate the tariff equivalents for China's NTBs at 22.1 per cent in total average, covering 30 per cent of all imports with highest protection in 1994. Li and Zhai (2000) establish the difference between domestic price and world undistorted price into the tariff rate and non-tariff barrier equivalent, and the land is assumed to create a pure rent to households. Their calculated un-weighted non-tariff barrier equivalents for manufactured products are 13.03 per cent for 1995. Li and Lejour (2000) estimate the non-tariff barrier equivalent by Hoekman (1995) at 3.3 per cent for 1997 on average. Wang (2001) calculates the non-tariff barrier equivalents for China at 9.6 per cent in total trade average for 1997, using the difference between import protection rate in version five GTAP database and China's tariff after adjustment for duty exemptions. This gives rather a wide range of estimates to draw on. In the light of this uncertainty our quantitative analysis of China's NTBs is decidedly circumspect in this paper.

China's services sector has been one of the most heavily regulated and protected. Consequently it is relatively under-developed and has had minimal foreign participation until recently. All kinds of NTBs are used in service sectors. Many service sectors (e.g. basic telecommunications, banking and insurance) are government monopolies. In telecommunications, China currently prohibits any foreign ownership of telecommunication firms. Upon WTO accession, foreign ownership up to 25-30 per cent is allowed only in a few cities and it will be raised to 49 per cent within three years after accession. For banking and finance, foreign financial institutions are prohibited from doing Chinese currency business with Chinese enterprises and stringent geographic restrictions are imposed on the establishment of foreign banks. However, five years after accession, all geographic and customer restrictions will be removed. For insurance, China will award more licences (e.g. foreign ownership) to foreign insurers in both the life and non-life sectors upon accession. Five years after accession, all geographic and ownership restrictions will be removed.

2.3 Regional industry structures

Since the initiation of economic reforms in 1978, efforts have been made to correct the structural imbalance raised from the policy of rapid, state-directed industrialisation with special emphasis on the development of steel and defence-related industries after 1949. During the period of 1979-2001, the output-structure of China changed a lot across regions. Manufacturing is located in seven main industrial regions. The North-Eastern region (LiaoNing) is China's oldest and most industrialised region. Its diversified resource base supports petroleum refining, coal mining, iron and steel, chemical, and timber industries. The Northern region (Mongolia) is a relatively new industrial region. The so-called Beijing-Tianjin industrial belt is a coal-mining district producing iron and steel, machinery, chemicals and textiles. The Eastern region is an old industrial region centred in Shanghai. The South-Central region has well-developed food-processing and handicraft industries. The region (ShananXi, GanSu) in the North-Western China is the newest industrial region supported by petroleum refining, petrochemical, iron and steel,

and cotton textile industries. The South-Western region (SiChuang, Yunnan and ChongQing) is the principal producer of non-ferrous metals. The province of GuangDong has more than 1/3 of total trade, followed by Beijing, ShangHai and JiangSu. The output of the regions along the sea is dominated by secondary industry (more than 50 per cent) and tertiary industry (over 30 per cent) (Table 3).

The upshot of this diversity is that the implementation of the WTO agreement will have a very diverse result on China's regions. There are two sides to this. First the initial impact is likely to be uneven. However, the second concern may be greater, in that WTO membership affects the nature of the permissible responses. To some extent the rapid growth rate in some parts of China has been facilitated by restraints on the spillover to other regions and industries. Some of the restraints in the transition process may have eased the transition. Nevertheless ultimately they have to be faced. Simulations have to take account of this.

China poses a further difficulty in assessing the impact of trade liberalisation in that there appears to be a considerable discrepancy between the restrictions nominally in place and the effective level of trade restrictions in practice. Therefore in computing the impact of liberalisation it is necessary not merely to tackle the usual problem of determining the tariff equivalent of quantitative restrictions (Li and Lejour 2000) but also the appropriate level for the actual barriers. According to China's Customs, in 1995 40 per cent of imports are ordinary imports without duty exemption/drawback[10] and according to the GTAP Database 4 (McDougall *et al*. 1998) for 1995, 14 per cent of imports are for final consumption. Thus, about 26 per cent of imports are used as intermediates. The GTAP Database 4 puts China's exports at around 10 per cent of its output, which implies that around 3 per cent of imports are used for the production of ordinary exports (Ianchovichina and Martin 2002). Lejour (2000), for example, finds a considerable effect from modelling duty exemptions explicitly. Failure to account of duty exemptions/drawback in case of China's WTO membership will overstate all the impacts including exports, welfare, output etc. (Ianchovichina and Martin 2001). However, deep duty exemptions for imported intermediate inputs and high trade barriers (tariff/non-tariff one) may disadvantage the industries relying more on domestic value added, rather than imported intermediate inputs, unless full liberalisation is considered.

2.4 Literature on a CGE model of China

It is possible to draw on the experience of a number of existing studies of trade liberalisation with China in addressing these problems. Most of these studies also use computable general equilibrium (CGE) models,[11] such as GTAP (Hertel 1997),

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10 Duty exemption/drawback is used as means of providing exporters with imported inputs at world prices or with very low tariff, so that the host country can increase its competitiveness in the world market and maintain the protection against rest of the world.

11 CGE models are widely applied to policy analysis in all the countries. Their comparative advantage, compared with other models like partial equilibrium models, lies in the analysis of policies when there is a need to consider links between different producing sectors, links between macro and micro levels, and the disaggregated impact of changes in policies and exogenous shocks (e.g. tariff cuts, technology progress, etc.) on sectoral structure, household welfare (i.e. equivalent variation or EV), investment allocation, income distribution, etc.

MEGABARE (Mai *et al*. 1998), G-CUBED World Model (McKibbin and Tang 1998), PRCGEM (Fan and Zheng 2000; Mai *et al*. 2003; Mayes and Wang 2003).[12]. In the main these are exercises in comparative statics so they give an idea of the longer-term impact rather than a year by year path. Almost all simulation results suggest that both China and its major trading partners (USA, EU, Japan, Taiwan, and Hong Kong) will gain from China's accession (McKibbin and Tang 1998; Ianchovichina, Martin, and Fukase 2000; Wang 2001). Not surprisingly the results also suggest that China (including Hong Kong and Taiwan) will be the biggest beneficiary. For example, a net welfare gain of about US$47.5 billion, amounting to 5.3 per cent of GDP in 1997 prices in the steady-state with capital market adjustment, is projected by Wang and Schuh (1998). Gilbert and Wahl (2000) show that accession will not have an impact on the overall level of employment in China, but there will be inter-sectoral shifts in employment and output in CGE models (particularly in GTAP).

The diverging trend in regional development is the result of profound structural changes in the China's economy. Empirical literature has addressed the issue of regional disparity and its determinants in China (Jian *et al*. 1996; Naughton 1999; Kanbur and Zhang 2004) and find that the evolution of inequality matches different political economic periods in China's history and globalisation (especially after WTO membership) may play an important role on economic development and regional inequality within China. However, the existing literature provides no clear evidence of how foreign trade expansion has affected regional development, especially after China's successful WTO accession. Undoubtedly, China's WTO membership will have important implications for provincial development. So far, CGE research on China's WTO membership is showing overall welfare gains by sectors, considering nearly nothing on the uneven distribution of these gains, which may raise strong opposition to trade liberalisation due to regional difference. Besides understanding the complexity of China's economic structure and adjustment change resulting from WTO membership, it is also important to understand the differential regional impacts within China well so that we can get a full picture of China's accession. Due to many reasons especially the data problem,[13] so far only a few CGE studies have been done to consider the regional situation within China upon WTO accession (Yang and Huang 1997; Fan and Zheng 2000;[14] Diao *et al*. 2002, 2003; Jiang 2003[15]).

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12 For details of literature on China's trade liberalisation, see Gilbert and Wahl (2002). For recursive dynamic single CGE models see Adams *et al*. (1994); for the MONASH model see Dixon and Rimmer (2001); for the DRC-CGE model see Hertel *et al*. (2002); for multi-regional recursive dynamic CGE models see Ianchovichina, McDougall, and Hertel (2000); and for the issue of growth features in CGE models see Bovenberg and Goulder (1991) and Baldwin and Forslid (1999).

13 It is very difficult to get a detailed regional I/O table, income, consumption and trade data in China. Besides this, inter-regional flows of products and factors will be different from their treatment in a global model, because there are no customs in each domestic region to track imports/exports between regions within China.

14 In their top-down PRCGEM, sectors are classified into local and national sectors. Local sectors produce products which are not tradable between regions, while national sectors can produce tradable products. And it is assumed that the same percentage change in sectoral output applies to all regions within China. Hence, the differences in regional responses to the WTO accession are similar to the structural changes.

One of the main difficulties in these exercises is to estimate the response of investment and the impact on the location of activity. FDI is an important element in determining the development of Chinese industry. Furthermore, as the new economic geography (Fujita *et al*. 1999) indicates, the attractions of agglomeration and the sheer size of China's markets may tend to encourage expansion of foreign firms in the direction of local production rather than simply export. Assuming constant or decreasing returns may not be appropriate in some cases. Nor, given China's size will it necessarily be sensible to play down the effects on the terms of trade. Some steps have been made in tackling these problems. Walmsley *et al*. (2004) use the GTAP-Dynamic Model (Ianchovichina and McDougall 2001) to analyse the impact of China's WTO accession on foreign investment. They find that accession doubles the extent of foreign ownership of China's assets in 2020, relative to the non-accession baseline. This not surprisingly has a substantial impact and the total welfare of China alone increases by as much as US$125 billion in 2020. Using this more dynamic approach enables an assessment of the costs of adjustment. The authors suggest that the short-term costs of trade liberalisation for highly protected goods industries will be significant both in terms of lost domestic output and lost jobs, while the long-term benefits of trade liberalisation will be substantial enough to compensate the short-term loss (e.g., Zhang *et al*. 1998).

Some CGE models with micro-simulations have been applied for the issue of income distribution.[16] Wage inequality between skilled and low-skilled workers is the outcome of the interaction of supply of skills (i.e. education), demand of skills (e.g., skill-biased technology which can come from the effect of FDI) and wage setting factors (e.g. labour market institutions—union) (Te Velde and Morrissey 2002). In the case of China, there is institutional segmentation in the labour market (i.e. Hukou household system[17]) and high labour mobility costs, so foreign investors have to pay a higher wage to attract the skilled labour from other ownership (i.e. SOEs). Consequently, the rising payment to the skilled labour will push the total average wage without bringing in skill-biased technology mentioned above.

CGE models can quantify income distribution effects in two key ways. One is in the Ricardian tradition, or in terms of returns to factors of production. The other is to model more than one household explicitly (e.g., peasant and non-peasant households in

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15 This model is using the 'bottom-up' approach to model each region (28 provinces in total) within China as an open economy with its own agents and behavioural functions. Labour mobility across regions is allowed, while assuming perfect mobility if capital cross domestic region sand sectors.

16 For example, the CGE study of Tongeren (1994) on Dutch firms, Cogneau (1999) on Antananarivo, and Cogneau and Robillard (2000) on a national model of Madagascar. They find that the neglect of general equilibrium effects in standard micro-simulations under the assumption of a fixed intra-group income distribution will strongly bias results.

17 The Hukou system was established in cities in 1951 and extended to the rural areas in 1955. It establishes a relation between a place of residence and access to consumer goods, employment opportunities, and social protection. It consists of agricultural registration (by rural residents) and non-agricultural registration system (by urban residents). Social welfare for non-agricultural Hukou holders is much better than for rural residents. One of the aims is to limit rural–urban migration in the labour market. Despite significant modifications since the early 1980s, the nature of the Hukou system is still unchanged today. More details refer to Chan and Zhang (1999).

PRCGEM)—this can be found from Yang and Huang (1997),[18] Wang and Zhai (1998),[19] and Li and Zhai (2000).

3 The basic model structure

The effects of trade policies in China after accession are studied here using the updated PRCGEM model[20] with updated database (2002 Regional/National I/O Table). PRCGEM is a relatively standard single-country comparative static model assuming perfectly competitive and constant returns to scale production.[21] The model distinguishes 40 sectors, 31 provinces, 2 occupations and 2 household types. Its theoretical structure follows the Australian ORANI-F model (Horridge *et al*. 1993). It is solved using GEMPACK (Harrison and Pearson 1996). We start with this PRCGEM model to study the tariff liberalisation. Then some minor modifications are made to capture the major features and impacts of non-tariff equivalent liberalisation in China's current economy. To separate China's trade regimes into ordinary trade regime and processing trade regime[22] can be the further adjustment of the original PRCGEM. A small duty exemption mechanism is introduced. A more detailed description of the PRCGEM can be found in Appendix I. This section only summarises its main features.

An important feature of this single country multi-regional CGE model is the explicit treatment of two separate trading regimes (EOPEs[23] and DOPEs[24]). Since the 1990s,

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18 Yang and Huang (1997) is the first paper to tackle the income distribution of China systematically with a single country CGE comparative-static model. They consider a 30 per cent reduction in the overall tariff, and in the agricultural tariff only. Their results show that comprehensive trade liberalisation leads to a Pareto improvement in China. Consequently, both the income inequality of rural-urban and rural income distribution will improve. If only agricultural liberalisation is undertaken, poorer rural households will be worse off, but the overall economic situation improves. If only industrial liberalisation is undertaken, both rural-urban equality and rural income distribution improve, but urban income distribution deteriorates. However, this paper only considers trade liberalisation, nothing related to investment liberalisation, and their results are only focused on the national, not provincial level, they do not account for tax replacement, and their model needs to be dynamic to make it suitable for China's economy.

19 In the seminal paper by Wang and Zhai (1998), tax replacement is introduced. In their simulations, the level of government revenue is assumed to be maintained by endogenous adjustment of various taxes. Therefore, their results indicate both increased economic efficiency and improved income equality as a result of trade liberalisation, both in terms of factor payments and household incomes, emphasising that increases in income disparity are not a necessary outcome of China's trade liberalisation and can be avoided by appropriate adjustment of the domestic tax structure.

20 Updated PRCGEM is an extension of the original PRCGEM that had been used in China's WTO accession study (Fan and Zheng 2000). Some significant modifications are introduced in this model to capture the major features of foreign trade/investment with regional extension. For simplicity, we still use the name of PRCGEM.

21 There are some dynamic features available which are not used in these simulations.

22 China had established two separate trading regimes by 1986~87. One is the export processing, which is extremely open, most foreign-invested firms and parts of domestic firm participate it; the other is traditional ordinary trade regime. And export processing has grown rapidly, getting over 50 per cent share of all exports in China (Naughton 1996).

23 Export-oriented processing enterprises (EOPEs) produce exclusively for export markets using imported intermediates that are either exempt from duties or eligible for refund on the import tax paid.

EOPEs have grown rapidly and their trade accounts for more than 50 per cent of total trade. Considering the different character and behaviour of trade between EOPEs and DOPEs, it is very important to have an explicit treatment of this dualistic trade regime in the CGE model.

PRCGEM considers 31 regions, each with a demand structure and foreign trade in commodities and services. The inter-regional input/output is also embedded. Production is modelled using nested CES functions, and assumes CRS. Household demand is modelled by the linear expenditure system (LES). Trade is modelled by the Armington assumption for import demand (i.e. intermediate, investment, household, government import demand, etc.), and a CET for export supply. The small country assumption holds for imports, which means that import prices are exogenously determined in the model. All demand and supply functions are assumed to be homogeneous of degree zero in prices (or money-neutral behaviour). All commodity and factor markets are assumed to clear by prices. Labour (whose movement is determined by the relative real income across sectors/regions and the CES) is assumed to be perfectly mobile within sectors/regions in the short/long-run closure, which assures a single region-wide equilibrating wage rate for each labour type (i.e. skilled or unskilled labour). Land is assumed to be fixed and only used for agricultural activity. Capital (whose movement is driven by the relative rental rates across sectors/regions and the CES) is assumed to partially mobile, reflecting the difference in the marketability of capital goods across sectors/regions—it is assumed capital is immobile in the short-run closure, while perfectly mobile in long-run closure.

The current PRGEM used for this research has a simple recursive dynamic structure. Dynamics in the PRCGEM originate from accumulation of the productive factors and productivity changes, taking into account of the changes in the industrial structure, in factor composition and comparative advantage. The original base year is 1997. The model is solved for subsequent years directly to 2002. Then, based on 2002 baseline, the model is solved for 2007, which is the approximate time that all the requirements from WTO protocol are implemented. The growth rates of the population, tariff/non-tariff barriers, duty exemption, capital, land, labour force, and labour productivity, etc. are exogenous.

4 Database, baseline and scenarios design

China's WTO accession includes a complex package of trade and investment liberalisation. Based on the final commitments made for market accession, this paper quantifies the impact of the following three aspects: (i) tariff reductions on agricultural and industrial products; (ii) elimination of duty exemption by 2007; (iii) non-tariff cut on agriculture and industrial commodities. At best, this analysis captures only one part of China's WTO membership. It does not consider other important issue like the

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and the so-called ordinary exports beyond the EOPEs are produced exclusively with domestic inputs. The reality is that complex administrative rules highly discourage EOPEs from selling domestically. Ianchovichina (2004) shows that in 1995 approximately less than 3 per cent of intermediate imports were used for the production of ordinary exports.

24 Domestic-oriented processing enterprises (DOPEs) produce no exports and supply exclusively the domestic market in China.

dismantling of barriers in services and FDI, effective enforcement of full commitments, etc.

In view of the high and unpredictable tariff exemption and some other things in China's imports,[25] we use the MFN tariff rates as the representative of the effective tariff rate, not the nominal tariff rate. As a result, welfare and other effects from this tariff cut will not be dramatic, given the low share of government tariff revenue since the early 1990s. China's government tariff revenue share of total tax revenue is drifting in the range of 3.38-6.45 per cent between 1990 and 2003. Thus, the tariff revenue in China is a very small component of the total government revenue. Therefore, it is more likely that trade liberalisation (tariff cut) will not have a noticeable impact on government policy or expenditure decisions. The reduction in tariff duties is expected to reduce the decreasing government revenues. However, reducing relatively high import tariff rates may actually increase tariff revenues in some cases. This is due to the reason, to some extent, that the relatively high tariff rates create an incentive to bypass the collection of tariffs, either by smuggling or illegally eliciting the support from customs officials to reduce the declared value of the imports or other grey market behaviour. Therefore, lowering the import duty may reduce the incentive to cheat and result in more goods trading by official import channels legally and in the end an increase in tariff revenues. However, it is very difficult to consider this fact in any empirical economic model (i.e. CGE model of China). Furthermore, the government can relatively easily offset a decline in tariff revenue with an increase in other sources of revenue such as income tax. The tariff rates projected in Table 5 fall gradually from 1997/2002 and the change after 2007 is negligible, even though China will not finish all the promised tariff cuts until 2010. Therefore, we take 2007 as the 'final year' for China's tariff cut, upon WTO accession.

4.1 Data

The base case projection over the five-year period (2002~07) is established with the 2002 Regional/National I/O Table (derived from the 1997/2000 National I/O Table and 2000 Regional I/O Table by RAS method[26] supported by the data from various *China Statistical Yearbook*s).

4.1.1 Input-output tables

The input-output (IO) accounts provide detailed information on the flows of the goods and services that make up the production process of industries. They are presented in the form of use, make, direct requirements and total requirements tables. The source used in this PRCGEM model is the updated 2002 Regional/National I/O table based on *Input-Output Table of China, 1997* (which includes 124 sectors, 2 households and 31 regions), 'Intermediate Use Part of 2000 Input-Output Table'[27] (from *China Statistical Yearbook* 2003) and *Multi-Regional Input-Output Model for China 2000*. In this

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25 It is well known that China's tariff collection is significantly below its nominal tariff level due to the reason of a large volume of processed trade, extensive import duty exemptions and widespread smuggling activities (World Bank 1994; Bach *et al*. 1996).

26 It is by means of a 'biproportional' row and column operation (Bacharach 1970).

27 In this input-output table, only 17 sectors are considered.

research, we aggregate to 40 sectors[28] with the 31 regions and 2 households. Of the 40 sectors, there is 1 for agriculture (sector 1), 25 for manufactures (sector 2-26), 1 for construction (sector 27) and 13 for services (sector 24-40 in Table 5). The intermediate input matrix (a commodity by commodity matrix) refers to the sum of domestic and imported intermediate transactions. Household consumption, government consumption, capital formation, exports and change in inventories are the final demand categories. Exports are valued at FOB. The unit of measurement of the 2002 I/O Table is 10,000 RMB but PRCGEM is expressed in 100 million RMB.

4.1.2 Tariff data

We use the MFN tariff rate for the agriculture and manufacturing sectors, instead of the nominal tariff rate, to take some account of the tariff exemptions. Between 1997 and 2000, the tariff rate (MFN) did not change much, compared with the period of 1992-97. Due to incomplete tariff information between 1997 and 2000, we assume initially that there is no tariff change between 1997 and 2000. In 1997, the unweighted average effective tariff rate for agriculture and manufacturing sectors was 5.50 per cent (Table 5), while the unweighted average MFN counterpart was 13.72 per cent. According to the tariff revenue data in 1997, the effective tariff rate is much smaller than the MFN tariff rate (Table 5).[29] The sectoral reduction rates of import tariffs are aggregated from the harmonized commodity description and coding system (HS) tariff schedules for the period of 2002-07 in China's WTO accession final offer. The MFN tariff data after 2002 are from China's WTO protocol and the percentage change in MFN tariff from 2002 to 2007 is used to shock the effective tariff change after 1997/2002. The unweighted average MFN tariff rate for agriculture and manufacture sectors is planned to fall from 12.06 per cent upon accession to 7.51 per cent in 2007. Table 3 shows that the imports are dominated by manufactured goods (more than 80 per cent) compared with agricultural commodities (less than 8.4 per cent) and it also shows that the effective tariff rate is very low, especially manufactured imports at 0.32 per cent in 1997.

4.1.3 Problems and special considerations

The data in the trade, tariff, and production data-set have been grouped and simplified for ease of presentation. An exchange rate of 829 RMB against US$100, the 1995-2003 average, is used. This paper does not take into account other major aspects of WTO accession, such as reduction of barriers in service trade (sectors 24-40), foreign investment (i.e. FDI), phase out of MFA for textile and apparel, protection of intellectual property rights, securing market access, co-operation in dispute settlement, etc. For notation, if we use W to represent factor prices, K as capital and P as output prices, the focus will be on the $\partial W/\partial P$ and $\partial W/\partial K$, namely the effects on factor prices (e.g. W) of changing prices due to free trade and impacts on factor prices of changing

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28 Due to the data limitation, here we have to choose 40 sectors for our model so that the results are not biased much. Also this is easy for comparison with other similar studies, which mostly involve similar number of sectors.

29 Furthermore, the share of tariff revenue in China's government tax revenue is less than 6 per cent on average in the period of 1990-2003. Therefore, it is expected that the tariff liberalisation will not directly affect China's government tax revenue very much.

capital stocks due to foreign investment. So far CGE models generally contain only very aggregate household categories, which limit their usefulness for poverty and income distribution analysis.

4.2 Baseline and scenarios design of trade liberalization

In order to simulate the impact of China's accession, we select one baseline scenario (in 2002) and two main simulations in the period of 2002-07. In the baseline scenario, we assume that there is no trade reform (tariff/non-tariff or duty exemption cut) during the period of 2002-07 (Table 5). We also assume economic development without WTO membership in 2002-07 is the as over 1997-2002[30]. Two kinds of simulations (or closures)[31] beyond the baseline simulation are considered (one is the 'short-run' and the other is the 'long-run' simulation) to isolate and quantify the impacts of the tariff/tariff and non-tariff reductions and duty exemption cut for China's WTO accession. There are two different macro closures for the short/long-run simulations. In both cases, CIF foreign currency import prices, exchange rate, number of households, power of tariffs/non-tariffs, use of land, most technical change and shift variables are treated as exogenous. The main differences between these two closures are:

(i) In the closure of short-run simulations, aggregate use of capital is fixed, aggregate real investment expenditure is also fixed and allocated among industries according to the changes of the investment capital ratio, and the labour supply between regions/sectors is mobile but total labour supply is exogenous;

(ii) In the closure of long-run simulations, the supply of capital is elastic across sectors and regions, capital stocks are determined by the exogenous rate of return, the investment capital ratio is fixed, and the labour supply (e.g. aggregate employment with wage bill weights) is fixed and is mobile between 40 sectors. And still total labour supply is exogenous.

We use equivalent variation (EV) as a measure of the welfare impacts of China's trade liberalisation.[32] Determining the total welfare effect of China's accession is complicated because PRCGEM does not incorporate an inter-temporal utility function. Thus, in this paper, we take EV as a measure of the change in the consumer surplus—the social welfare impact of China's trade liberalisation. Here, EV takes the pre-policy equilibrium income and consumer price index as given and measures the changes in

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30 This is a strong assumption that economic structural change and development are same in both 1997-2002 and 2002-07, which might be true if the business cycle period is five years.

31 The closure is the classification of the variables in the model as endogenous (values are determined by the model) or exogenous (values are pre-determined/shocked outside the model) variables. And the number of endogenous variables has to equal the number of equations.

32 The most direct way to measure the welfare effects of a price change is to access how it affects the maximum utility level that a consumer can achieve. Two measures based on expenditures are widely used; EV—the minimum (maximum) amount of money which would have to be given to (taken away) an individual to make them as well off as they would have been after the price fall (rise)—and CV—the amount of money that leaves a person as well off as they were before a change, measuring the amount of money required to maintain a person's satisfaction, or economic welfare, at the level it was at before the change.

income required to obtain the post-policy utility level at pre-policy consumer price index:

$$EV = CPI \left(\sum_i CA_i - \sum_i CB_i\right) = \sum_i CB_i(1 + c_i\%) - \sum_i CB_i = \sum_i CB_i c_i\%$$

where *CPI* is the pre-policy (baseline) consumer price index, which is assumed unity; CA_i is the sectoral post-policy (simulation) consumption; CB_i is the sectoral pre-policy (baseline) household consumption; *c* is the percentage change of consumption. Therefore, positive EV means improved welfare (gain) and negative EV means reduced welfare (loss).

Movement of labour[33] is becoming a prominent feature of China's economic development, reflecting ongoing changes in the internal division of work under the impact from both reforms inside and outside. Early rural reforms (i.e. development of TVEs[34]) led to an initial increase in rural income. Due to the success of the agricultural reforms under Deng Xiaoping in the late 1970s and early 1980s, food supply in China's cities increased dramatically, which makes it possible for more people to come in from rural areas and survive without food ration. When rural incomes began to level off, farmers started to look for alternative sources of income, which initiate the main reason of labour movement. In the middle of 1980s, labour movement regulations are revised to relax temporarily the enforcement of labour movement restrictions. Since 1986, and especially after 1997/98, inequality (mainly rural-urban inequality) widened again as the effects of other reform policies (i.e. the growth of the non-state sector) started to make their impact. Transition to a market-oriented economy creates a high regional disparity in economic development. Labour movement in China mainly consists of surplus labour moving from rural area to urban areas with faster development.[35] And the majority of rural moving people have high school or primary school education. However, these moving labours have also made a positive contribution to the rapid growth of the coastal areas. Not only have these moving labours build China's new urban infrastructure, but also they have been a key factor in making the labour-intensive sectors in coastal regions internationally competition due to the cheap labour cost. Meanwhile, these labours constantly transfer resources (remittances, investments, and information, etc.) back to where they are originally from, contributing to economic development of their hometown, which may reduce income inequality.

In this research, we focus on the inter-regional labour movement and its consequent impact on regional income inequality. Further research will be done on rural–urban and

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33 Considering the short-term characteristics of labour movement between regions and other difficulties of tracking this mobility, we use the term of labour movement instead of migrant in case of any confusion.

34 Township and village enterprises (TVEs) were initially established in late 1950s, responsible for establishing and promoting rural industry. Now TVEs have become the single largest source of employment for industrial workers. See Fu and Balasubramanyam (2003) for more details.

35 More details about labour movements/migrants in China can be found in Huang and Pieke (2003) and Wan *et al*. (2005).

intra-regional labour movement. For simplicity, we assume the wage difference across regions results in labour movement.[36] This may overestimate labour movement.[37]

$$L_{e,r}^{move} = \alpha_{e,r} \cdot (W_e - W_r) \qquad e,r = 1,2,3\ldots\ldots31$$

$L_{e,r}^{move}$ = labour movement from region *e* (origin) to region *r* (destination)

$\alpha_{e,r}$ = coefficient

W_i = wage rate ($i = e,r$)

The idea of introducing labour movment between regions is to re-measure the regional inequality, traditionally calculated without considering the massive labour movement. In this case, it is hypothesised that potential regional inequality will be lower when net labour movement is considered in the calculation of per capita income across regions.

We only quantify the impact from tariff and non-tariff liberalisation with removal of duty exemption on agricultural and manufactured sectors under China's protocol of accession to WTO (November 2001) in the short and long-run simulations. Francois and Spinanger (2002) provide estimates of the tariff equivalents of those non-tariff barriers before and after China's accession for service sectors,[38] based on gravity equation estimates. The focus of this paper is on the agriculture and manufacturing sectors. In the service sector there are no import tariffs but only other trade barriers (e.g. quota or licences). We leave service sector liberalisation for further research, due to lack of data.[39] Service sector trade liberalisation not only directly affects the service production and trade but also has significant implications for other sectors in the economy through the channel of international transportation margins and forward-linkages through inter-industry input-output relations (Robinson *et al*. 2002). Thus, the impacts on social welfare, export, and import growth, etc. in this paper will tend to be underestimated.

Furthermore, China is receiving the reciprocal benefits from WTO membership. As the model used in this paper is for a single country it can only consider a single rest of the world input and does not include any feedback effects. One way to find the effects of reciprocal benefits from WTO in PRCGEM is to shock export demand, which can be viewed as the direct response from the reciprocal tariff liberalisation.

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[36] When the wage in the destination region is relatively high, labour movement will occur to pursue the higher wage, and vice versa. In reality, labour movement/migration is decided by many factors beyond the wage rate difference, for example, regional unemployment rate different, population in total or by density, agricultural contribution to GDP (mostly labour movement is coming from rural labour surplus), distance, etc. For more details, see Wan *et al*. (2005).

[37] Besides regional wage difference, other important factors (i.e. distance, culture shock etc.) may make it difficult for labour movement/migration. See Wan *et al*. (2005) for more details.

[38] Service sectors include wholesale and retail trade, transportation services (land, water, air), communications, construction, finance, insurance and real estate services, other commercial services and other services (i.e. public, health, etc.).

[39] In a separate exercise, we introduce the tariff equivalent tariff cut on services from Francois and Spinagner (2002) and associated sector-specific productivity impacts from Mai *et al*. (2003) to study China's service liberalisation due to WTO membership.

In the policy simulations we analyse the effects of trade liberalisation on GDP, household, export and stocks demands, supply of domestic and imported goods, price of exports, capital, land and labour, employment and investment. Sensitivity analysis follows to check how sensible the simulation results are on the key parameters (i.e. export elasticity, Armington index, etc.).

5 Simulations and results of trade liberalisation

In this research, we only consider two closures: (i) the closure of a unilateral tariff/tariff and non-tariff[40] cut with removal of duty exemption[41] in non-service sectors as required from WTO accession,[42] (ii) the closure of full economic structural and development besides closure (i).[43] Gradual liberalisation will be considered—gradual liberalisation allows domestic firms to adjust and to transform their productive structure gradually to face competition with foreign products on the domestic market.

Base case: 2002 I/O Table (40 sectors, 2 households, 31 regions)

2002 Regional I/O Table (31 regions, 40 sectors)

(i) Short-run only WTO (tariff/non-tariff and duty exemption);

(ii) Long-run only WTO (tariff/non-tariff and duty exemption);

(iii) Short-run full economic structural and development (tariff/non-tariff and duty exemption plus normal economic development with same trend of 1997~2002[44]);[45]

(iv) Long-run full economic structural and development (tariff/non-tariff and duty exemption plus normal economic development with same trend of 1997~2002).[46]

One of the features that our CGE model does reveal is an indication of the adjustment costs involved, especially the short-run, due to the incomplete movement of some factors. This can be detected in part by the comparison of the short-run and long-run simulations. The principle routes of impact from China's WTO accession within the

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40 Assume it is decreasing from 1997 to 2005 by 90 per cent. Then 2006 should be zero for non-tariff barrier in agriculture and manufacturing sectors.

41 Duty exemption is supposed to be reduced to zero gradually in 2002~07.

42 Actually this is the limited WTO effect. For simplicity, we use only WTO to represent this effect in the whole paper.

43 In this research, the reaction of other WTO membership countries is ignored in this single-country CGE model. More detailed research on treating the response of the rest of the world requires a multi-country CGE model, which is beyond this paper.

44 The baseline of 1997 I/O Regional/National Table is used to calibrate the economic growth with liberalisation for the period of 1997~2002, according to the updated 2002 I/O Regional/National Table. It is assumed that if WTO liberalisation is not involved, China's economy will continue like 1997~2002 until 2007.

45 Including closure (i).

46 Including closure (ii).

model are straight-forward. China's consumers benefit as a result of reduction in trade barriers, which reduces prices. They also benefit from increased choice but that is not picked per se in the calculations. Some industries (e.g. heavy industries or agriculture) will be hurt by the reduction in protection, but other industries (especially export-oriented industries like textiles and clothings etc.) will benefit a lot due to the improved access to overseas markets and reduced costs of intermediate imports. Aggregate output and real GDP will expand by 43.26 per cent and 31.72 per cent in the long-run full closure respectively, not just because of larger markets (domestic and overseas) but also because of more efficient resource allocation across sectors and regions. Liberalisation with economic structural change can play an important role right across the economy but we have not tried to model how responsiveness changes or whether there is any growth rate effect from a less restricted economy. It is hypothesized that labour movement should be stronger in the short-run, compared with long-run closure, which is confirmed in this paper. Total regional labour movement under full short-run closure is 5.8 per cent higher than full long-run one. Besides, regional picture is confirming that regional inequality is still significant, especially in the full closure.[47]

5.1 Macro results

Table 6 shows the key efficiency and other macroeconomic indicators under the short/long-run scenarios of China's WTO accession. It measures the deviations from the baseline of 2002. Due to the low real collection rate of tariff and tariff exemptions granted to EOPEs, the gains arising from only WTO scenario are relatively small. The results show that China will benefit from its WTO accession in terms of real GDP, household consumption and trade etc. In 2007, China's real GDP will be 6.48 per cent (5.60 per cent) higher than in the baseline of 2002 under the pure short-run (long-run) WTO shock and 22.46 per cent (31.72 per cent) under short-run (long-run) full economic structural and development shock. Real investment would be 2.2 per cent (14.94 per cent) higher than in the base scenario in the long-run simulation of only WTO and full economic structural and development respectively. Real household consumption will be 6.48 per cent/5.60 per cent higher in the pure short/long-run WTO shock, indicating the benefits to consumers from trade liberalisation are small. In the short-run (long-run) full shock, it becomes 22.46 per cent (31.72 per cent). China's trade (exports plus imports) is growing fast especially in the full closure. The pure WTO effect is only 5.96 per cent (10.1 per cent) for real imports (exports) in the long-run, which may be due to considering the 100 per cent duty exemption tariff cut for EOPEs with already low real tariff rate.[48] The contribution of pure WTO effect on exports (imports) is US$35.01 (US$6.67) billion in the short-run closure, while it becomes US$29.43 (US$16.33) in the long-run closure. The real exchange rate depreciates in the pure WTO, while it appreciates in the full closure because of the relatively strong increase in imports, originating from the reduction in import protection for import intermediates used in EOPEs. Trade (exports and imports), in the full closure, increases by approximately 50 per cent. The other reason may come from relatively low growth of real investment, which is only 2.2 per cent (14.94 per cent) in the long-run pure WTO

[47] Regions along the coast are much better-off, compared with inland regions in China.

[48] Consequently, the results are trivial because most of the barriers do not exist significantly.

closure (full closure). Sectoral gross allocation effect (GAE)[49] is positive with 1.38 per cent (1.44 per cent) higher than the base line in short-run (long-run) pure WTO closure, which is confirming that labour movement is playing a role in labour productivity, while the GAE increases to 6.29 per cent (6.2 per cent) in short-run (long-run) full closure. Factors inter-act each other. Generally, the gains in GDP and welfare result from the enhancing efficiency of resource allocation arising from increased specialisation with comparative advantage. Removing of tariff/non-tariff protection rates enhances the cheap imports of intermediates used in EOPEs, especially in the short-run simulation of only WTO, inducing a real appreciation. Trade in EOPEs accounts for more than 50 per cent of China's total trade (exports plus imports). And exports in EOPEs have high import content due to the policy orientation and other factors (i.e. feature of FDI). Thus, growth of exports is expected to result in a corresponding growth of imports, increasing the pressure of the real depreciation. However, relatively strong growth of exports result in a real currency appreciation, which contributing to further growth of imports. This real exchange currency factor partly contributed to the rapid increase in China's trade dependence and FDI inflows during the last two decades. This is confirming the situation that processing trade (from EOPEs) accounts for more than 50 per cent of China's total trade. More exports will result in a corresponding growth of imports. Only WTO shock is showing slightly terms of trade worse off, while terms of trade is better off with full economic structural and development, especially in the short-run closure. There is no significant difference for demand on both non-peasant and peasant labour at around 13.5 per cent. In the full economic structural and development closure, significant labour moving happens from rural to non-rural, given the exogenous aggregate labour growth rate.

5.2 Sectoral results

Macro results of the WTO accession show the overall welfare gains from an expansion of exports plus imports due to lower price distortions on imports. It is highly possible that macro efficiency gains may not be evenly distributed across sectors due to various industry features between sectors. Table 7 reports the percentage change in real output, employment and trade etc. induced by China's WTO accession and full economic structural and development. The results vary significantly across sectors. The agriculture sector imports less and exports more in the pure WTO shock, which is mainly due to a significant increase of real output[50]. However, full economic structural and development shows totally the opposite picture of more real imports with decreasing real exports of agriculture in short/long-run closure—real imports increase by 102.41 per cent (102.59 per cent), while real exports decrease by 10.16 per cent (4.58 per cent) in the short-run (long-run) closure. Furthermore, WTO membership is pushing up both labour-intensive sectors (clothing, textiles, etc.) and capital-intensive sectors (electric equipment, machinery, etc.) significantly, especially in the closure of long-run full economic structural and development. In the long-run full closure, the imports

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[49] GAE is used to measure the growth in aggregate labour productivity that may take place with employment shifts among sectors, given relative labour productivities (Syrquin 1986). For simplicity, the baseline GAE is assumed to be one.

[50] Uniform technology improvement is assumed across sectors, so that real output is making a significant improvement when sectoral output share is big enough, given small contribution of only WTO shock. When full liberalisation is introduced, the story may change.

growth in textiles and clothings industries is much stronger than their exports growth rate. Considering natural average employment growth of 13.82 per cent in the simulation period, only WTO shock is not making much difference for employment movement between sectors, while full economic structural and development is significantly transferring labour from land-intensive agriculture to labour-intensive industry (clothings, textiles, etc.) in the long-run. However, the sectoral employment growth rate result shows that employment growth rate in the clothing industry is 1.4 (2.8) times faster than the national one in the short-run (long-run) full closure, while the opposite is true for textile industry. Industry of construction is under huge development, whose employment growth rate is more than 2.5 times of national one. The industry of electronic and telecommunication is much better-off, leading the export growth and manufacturing development. Average total output growth in manufacturing sectors is more than 40 per cent in the long-run full closure, less than 27 per cent in agriculture, 68 per cent in construction sector and more than 38 per cent in service sectors.

The difference between short-run and long-run simulation is significant across sectors, especially in the full closure, which implies some significant industry reconstruction adjustment upon further reform and liberalisation besides WTO membership. Manufacturing industries are leading China's economic development.

5.3 Provincial/regional results

Besides the different sectoral results economy-wide efficiency gains are also not distributed uniformly across regions within China. Provinces in China have different factor endowments, different industrial structures, basic infrastructure and comparative advantages. Consequently, it is becoming important and necessary to investigate the details of regional output, employment and trade (exports and imports) induced by China's WTO membership and full economic structural and development. The larger the shares of industries in a provincial/regional output or trade which is relatively advantaged by full economic structural and development (i.e. WTO membership), the bigger will be the benefits from this province/region. According to economic geography and regional I/O table, China's 31 regions are divided into 8 regional blocks.[51]

Table 8 and Table 9 show the uneven distribution of gains/loss from China's WTO and full economic structural and development. It shows that simulation result with only WTO effect does not make significant difference (i.e. around 1.1 per cent annual real GDP growth), except real imports and exports, which is as expected, because China has already made a huge effort for liberalisation before the accession. Expansion of foreign trade becomes significant, especially in the long-run simulation. The foreign trade in regions of NMR, NCR, and SCR is bigger than in the rest of China, which may be due to relatively big share of intermediate imports (used in EOPEs) in total imports and relatively high export dependence. More rapid economic growth in the region of NMR,

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51 North-Eastern Regions <NER> (LiaoNing, JiLin, HeiLongJiang); North Municipalities Regions <NMR> (Beijing, Tianjin); North Coastal Regions <NCR> (Hebei, Shandong); Central Coastal Regions <CCR> (Shanghai, Jiangsu, Zhejiang); South Coastal Regions <SCR> (Fujian, Guangdong, Hainan); Central Regions <CR> (Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan); North-Western Regions <NWR> (Mongolia, Shaanxi, Gansu, Qinghai, Ningxia, Xingjiang); South-Western Regions <SWR> (Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet).

NCR and SCR will increase the demand for labour. Rising wages in these regions will divert labour away from the rest of China. For example, the employment of the NMR and SCR will increase by 25.13 per cent (24.17 per cent) and 15.12 per cent (16.88 per cent) in the short-run (long-run) full economic structural and development closure respectively. The contribution from only WTO shock is not significant, considering the national average labour force growth is around 13.82 per cent. The welfare gain mostly comes from coastal regions. It is as expected that everyone is better off upon liberalisation, but some region develops faster than other, so that the regional inequality still exists.

Traditionally, the study of China's regional income inequality uses the per capita income, relying on the household registration population, which may bias the true picture when a huge labour movement is involved. The result shows that total inter-regional labour movement increases from 42.42 million people in 2002 to 75.94 (71.78) million in the short-run (long-run) full closure, while the contribution of pure WTO closure is slightly negative for labour movement (from 42.42 million people in 2002 to 37.43 million and 38.52 million people in the short-run and long-run closure respectively).[52] This may be due to the relatively decreasing regional wage difference under the pure WTO closure. The distribution of inter-regional labour movement is still biased to coastal regions (i.e. North Municipalities Regions, Central Coastal Regions, South Coastal Regions, etc.). In 2002, 35.51 per cent, 22.07 per cent, and 6.91 per cent of total labour movement move to Guangdong province, CCR, and the NWR respectively (Figure 3). In the short-run full closure, 18.05 per cent of total moving labours move to Guangdong province located in the SCR (which is the most developed region in China), and the CCR (where China's business center of Shanghai is located) gets the share of 18.53 per cent, while moving labours share in the NWR is only 8.28 per cent (Figure 6). In the long-run full closure, Guangdong's share increases to 19.22 per cent, and the CCR's share stays at around 18.75 per cent, while 7.73 per cent in the NWR (Figure 7). In the WTO closure, the distribution of moving labours is more biased to coastal regions. For instance, 35.5 per cent (22.34 per cent) of total moving labours move to Guangdong province (SCR) in the short-run WTO shock, while only 6.83 per cent moves to the NWR where economic development is far behind coastal areas (Figure 4). The situation under the long-run WTO closure is more or less the same (Figure 5). Huge labour movement shows regional income inequality. As to the moving labour origins, Sichuan province and the CR dominate at 22.86 per cent (21.62 per cent) and 36.96 per cent (37.78 per cent) in the short-run (long-run) full closure respectively (Figures 6 and 7). Same story happens in the WTO shock with Sichuan province and the CR at 16.11 per cent (16.22 per cent) and 43.6 per cent (43.62 per cent) in the short-run (long-run) closure (Figures 4 and 5). The result generally shows that moving labour distribution becomes slightly better off across regions with full economic structural change and development, even the number of moving labours increases dramatically by more than 69 per cent.

Therefore, China's regional income inequality is slightly over-estimated, if we ignore the issue of labour movement and its consequent contribution for economic development (Table 11). The Gini in the baseline of 2002 is 0.281 (0.311) with (without) a consideration of inter-regional labour movement. The Gini coefficient

[52] Detailed result of inter-regional labour movement for 31 regions is available upon request.

changes to 0.311 (0.317) in the short-run closure and 0.309 (0.312) in long-run closure of only WTO (full economic structural and development) when regional labour movement is not considered. And it becomes 0.285 (0.269) in short-run closure and 0.281 (0.268) in long-run closure of only WTO (full economic structural and development), considering the regional labour movement after WTO implementation. As to 8 regional blocks, same story happens—Gini coefficients decrease in 8 regional blocks when labour movement is considered in terms of regional income inequality (Table 11). The regions where a huge labour movement is involved get relatively significant change for the Gini coefficients—costal regions (which are the key destinations of labour movement) and central regions (which are the key origins of labour movement) are playing an important role. In short-run (long-run) WTO shock, the income inequality in the CCR is over-estimated by 18.54 per cent (19.49 per cent) when inter-regional labour movement is ignored in calculating the GINI coefficient. It becomes more significant in the full economic development simulation—GINI coefficients at the CCR are overestimated by 31.26 per cent (29.11 per cent) in the short-run (long-run) closure. As to the CR, the Gini coefficient decrease by around 6 per cent (21 per cent) in the WTO (full economic development) short/long-run simulation. Hence, labour movement does matter when measuring the regional income inequality not only in China as a whole, but also at regional blocks.

6 Major policy implications and limitation

This paper analyses the impact of China's WTO accession using a multi-region multi-sectoral single country CGE model (PRCGEM). Here, only tariff/non-tariff liberalisation and duty exemption cut are considered in agricultural and manufacturing sectors. Still China will gain a lot in terms of economic efficiency. When China fully implements its requirement commitment on market access in agricultural and manufacturing sectors, in 2007, its real GDP and welfare (measured in Hicks EV) beyond normal economic development will be increased by 6.48 per cent (5.60 per cent) and RMB7615.15 billion (RMB6585.69 billion) in short-run (long-run) WTO closure respectively. This means pure WTO shock contributes approximate 1.1 per cent extra real GDP growth rate annually. The large gains in real GDP are mainly due to enhanced efficiency of resource allocation brought about by a rapid trade growth and real output in accordance with regional/sectoral comparative advantage in China. When full economic structural and development with recursive closure is considered, China's efficiency gains (due to technology improvement in production factor of capital, land and labour especially) are even larger. However, the gains are not evenly distributed either across sectors or across regions due to the different industry features and regional economic differences. There are a couple of ways for globalisation to play some role in rising regional inequality in China as follows: (i) some regions have a location advantages (i.e. coastal regions) to exploit benefits of trade/investment better (Lin 2002); (ii) industrial infrastructure under the government preference policy can place some regions in a better position to attract investment and trade (Demurger 2001; Wan *et al*. 2003[53]); (iii) different customs and traditions across regions result in different

53 Wan *et al*. (2003) find that domestic capital plays a dominant role in rising regional inequality after the middle 1980s and infrastructure comes next in contributing to regional inequality, but privatisation may help equalise incomes across regions to some extent.

ability to accept foreign capital with technologies despite the uniform national policy of opening up; (iv) there is some unjustified fiscal transfer towards the affluent east regions in China, etc. This means that China's WTO membership with full economic structural and development may imply some kind of dramatic economic structural adjustments, which will involve adjustment costs. One direct consequent impact is on structural unemployment upon liberalisation. Here, full employment is assumed, so labour moves across sectors and regions to clear the labour market. Considering only the inter-regional difference on wage, a huge labour movement happens in the full closure. Labour movement share of total employment increases from 5.75 per cent in 2002 to 9.93 per cent (9.14 per cent) in the short-run (long-run) full closure, while decrease slightly to 4.45 per cent (4.61 per cent) in the pure WTO closure.[54] In China, labour movement mostly involves millions of farmers transferring from agricultural sector (region with high share of agriculture) to the non-agricultural sector (region with fast growth of the manufacturing and service sectors). Hence, internal reform (or liberalisation) as well as foreign trade/investment liberalisation is playing a role. Labour intensive sectors (i.e. textile and clothing) will be the main beneficiaries. In the only WTO closure, the agricultural sector is better off, compared with the full economic structural and development closure.

These results will have some important implications for policy makers. Even the total welfare improves a lot, some adjustment costs (i.e. industry structure change due to the liberalisation and reform etc.) may happen. With the structural adjustment besides the economy-wide benefits, the role of both central and local governments will become crucial. Due to a low degree of regional integration resulting mainly from local protection in China, regional disparity is becoming a significant issue upon further liberalisation. Labour movement between regions is reflecting part of the full story of regional inequality. Removing the limitation of labour movement may help reduce regional disparity, but it can be harmful for regional economic development and stability. Huge labour movement between regions in China is becoming an important economic issue and social problem. A healthy and complete social security system is urgently needed to facilitate labour movement. Besides, it is suggested that government (both central and local) should encourage regional integration by investing more in infrastructure, education and transport not only in faster growing coastal provinces but also inland regions, so that economic efficiency benefits upon liberalisation can be more widely spread across regions in China. Due to many factors (i.e. factor endowment, geography, basic infrastructure, etc.), the economic gaps among different regions represent a potential obstacle to further economic growth in China. And, fast economic growth does not automatically result in the improvement of well-being of all individuals in the whole society. The result shows that inequality across regions is getting better, even still some region gains more than others. Joining the WTO, China will eventually develop into a more open economy, facing the extreme pressure both from global competition and domestic disparity. Hence, income inequality may get worse off in the short-run, while getting better off after the transition with adjustment policy over time. However, simple arithmetic over whether the gains compensate the losses does not tell us whether the gainers will actually provide that compensation. Inter-regional and inter-

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[54] In terms of people, total labour movement will increase from 42.42 million to 75.94 million (71.78 million) in the short-run (long-run) full closure, while decrease to 37.43 million (38.52 million) in the short-run (long-run) WTO shock.

household transfers will be required in addition to public sector investment, financed in the main by taxation of the gainers. The extent of that taxation will in itself affect the incentives for investment by the successful and the profits available for reinvestment. A complex set of concerns therefore has to be addressed in the simulations.

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Appendix I

31-Region, 40-Sector PRCGEM

1 The Price Block

Under the 'small country' assumption,[55] which despite its name is appropriate here given China's role in world trade, China is a price taker. Thus, world import prices are treated as exogenous in terms of foreign currency. Purchasers' prices are sums of basic values and sales taxes. All demand and supply functions in PRCGEM are assumed to be homogeneous of degree zero in prices, so behaviour is money-neutral—only relative price matters to determine the quantities of commodities. Normally the exchange rate (which is the price of a dollar in terms of the Chinese currency) is taken as an exogenous numeraire. Zero-pure-profits conditions (e.g. zero pure profits in importing—import price is equal to foreign currency import price times exchange rate and tariff) and constant returns to scale are assumed, implying the basic values are

[55] It is assumed that China is able to export or import any desired quantity at international prices that are fixed in foreign currency.

functions just of input prices. Different users minimise their costs by consuming the composite commodities from imported and domestic sources. Producers maximise their profits by selling the commodities to the domestic market and the rest of the world.

2 The Production Block

There are 40 sectors in the PRCGEM model. All sectors operate at constant returns to scale in production. Each industry can only produce one product, which means there are 40 commodities. Each producer uses domestic and imported intermediates and primary goods (such as labour, capital, and land) for production under nested Leontief/CES[56] production functions and then supplies the domestic absorption and exports on a CET basis to maximise profits and pay wages to labour factor and rentals to owners of land and capital. All foreign producers and consumers are treated as the 'rest of the world' under the assumption of 'same tastes'.

3 Demand Block (Household, Government and Investor)

The household sector is disaggregated into peasant and non-peasant households. Its aggregate spending is exogenous and proportional to GDP. Its utility functions allow substitution between commodities through a linear expenditure system (LES)[57] (Phlips 1974) and between domestic and imported sources. Government consumption demand is exogenous. Its revenue is from indirect taxation (taxes on basic flows plus the tariff revenue). After the 1994 taxation reform in China, VAT (which is based on the value added of industries) has become the most important source of domestic tax revenues for the government in the face of the declining import tariff revenue due to trade liberalisation. The investor creates capital goods from domestic and imported commodities on a CES basis. Investment is bound by exogenous investment/capital ratios or related to relative rates of return.

4 The Trade Block

Most CGE models incorporate imperfect competition in all markets, imperfect substitution in all markets and imperfect substitution between foreign and domestic goods and between alternative sources of imports (as in the Armington, 1969, model of trade).[58] Here the Armington specification is also adopted to model foreign trade as a CES aggregation of imported and domestically produced commodities from the

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56 CES functions are constantly used in CGE modelling due to its advantages of being well-behaved, reasonably flexible and consistent with assumptions commonly used in economic models, especially linear homogeneity or homotheticity. Cobb-Douglas and Leontief functions are just special cases of the CES functions

57 Expenditure on each good in an LES is a linear function of prices and total expenditure.

58 There are some criticisms of this approach. Senhadji (1997) pointed out two common problems with the use of the Armington aggregator in CGE analysis. First, it fixes the weight coefficients in the CES function based on the factor shares, which is incorrect because those coefficient weights correspond to the input shares only in the Cobb-Douglas case. Second, by requiring that the calibrated model must replicate a given benchmark data it entails that the variation in the elasticity of substitution must not affect the initial benchmark expenditure shares. This has been refuted by Willenbockel (1999); see Tongzon (2001).

viewpoint of domestic producers and consumers, while CET export transformation functions are used to describe how production can be transformed into domestic and foreign parts. In sectors where there are no imports, the CES function is dropped, which means that the composite good demand is equal to the domestic sales. In sectors where there are no exports, the CET function is also dropped, resulting in equality between domestic output and domestic sales.

5 The Market Clearing Block

In the product market, equilibrium is reached when total supply of each composite commodity (goods and factors) is equal to all domestic demands in the same category and each sector earns zero profit. The labour market is not cleared. In the short-run comparative-static capital market, capital is sector-fixed (shocked for forecasting, un-shocked for short-run simulation) and investment/capital ratios are linked to capital rental rates (deflated by new capital prices) in the endogenous investment industries. While in the long-run comparative-static capital market, capital stocks are determined by rates of return, because capital is assumed to be inter-sectorally mobile. Capital stock in the PRCGEM model is defined as the last period's capital stock plus net investment deflated by the depreciation rate. In the long run, gross investment is endogenously specified for allocation among industries according to a fixed investment/capital ratio or relative rate of return in each sector while the gross rate of return on new capital (investment) is exogenous.

6 Closure

PRCGEM has the flexibility to allow different variables to be chosen as exogenous (so-called closure). By altering the closure, it is easy to switch for comparative-static long/short-run simulations or dynamic long/short-run forecasts (similar to the MONASH model—a dynamic model of the Australian economy: Adams *et al*. 1994; Dixon and Rimmer 2001), because different closures represent different assumptions about factor/good market and macro behaviour. Comparative-static simulations describe the deviation of the economy with a policy change (e.g. tariff cut) from the baseline where there is no policy change. For instance, simulations are trying to answer questions such as 'if tariffs are reduced by 5 per cent on a range of goods, how different will the whole economy be in one year from what it would otherwise have been (i.e. from the baseline)?'. Dynamic simulations replicate known development patterns and forecast the possible future development patterns by incorporating the technical changes and adjustment costs. For forecasting, it is necessary to consider all the exogenous shocks to the model over time to check the changes in the endogenous variables in a specified time (e.g. five years). A dynamic model is closer to the real world but much more complex and unpredictable and sometimes more misleading than its comparative static counterpart. Figure 1 shows the comparative-static interpretation of exports under the tariff liberalisation. The AC (baseline) represents the state of the economy as it would be without tariff change over time. AB (post-simulation line) represents the state of the economy as it would be with only tariff liberalisation over time. Then the result from GEMPACK will be the percentage change from A to D.

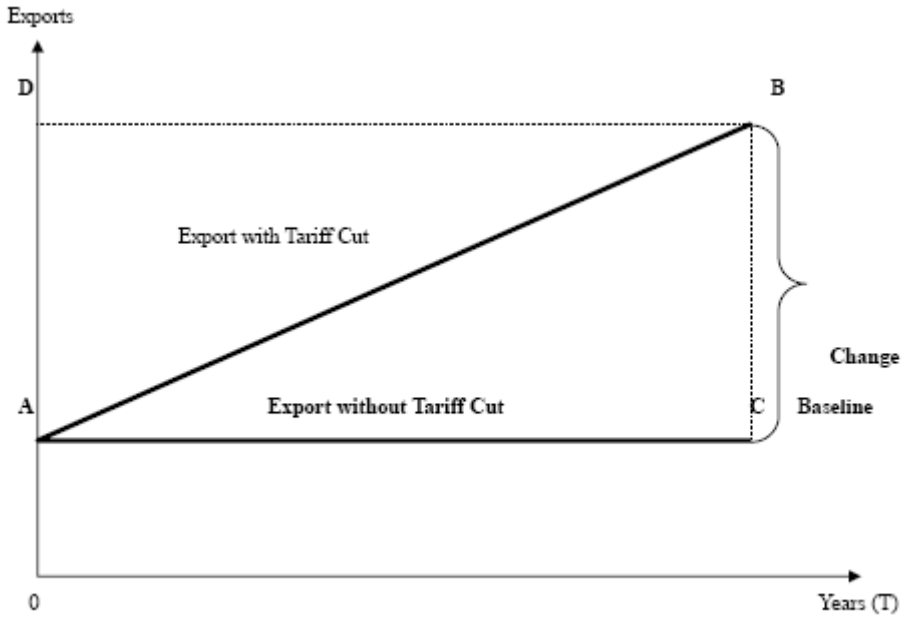

Figure 1: Comparative-Static Simulation

7 The equation system

Following the structure we have described, the equations of PRCGEM can be grouped according to the following classification:

- Producers' demands for produced/intermediate inputs and primary factors;
- Demands for inputs to capital creation/investment goods (no primary factors are used directly as inputs to capital formation. The use of primary factors in capital creation is recognised through inputs of the construction commodity/service.);
- Household demands;
- Export demands (Traditional and non-traditional exports);
- Government demands;
- Demands for margins (wholesale and retail trade, and transport);
- Prices: output, exports, imports, labour, capital, land (zero pure profits in production, capital creating and importing; zero pure profits in distribution; the price received by the producer is uniform across all customers);
- Market-clearing conditions for commodities and primary factors (demand equals supply for domestically produced margin and non-margin commodities and imported commodities respectively);
- Indirect taxes;
- Regional and national macroeconomic variables and price indices.

8 Solution methods[59]

Four solution methods for multi-step simulations[60] are used in PRCGEM: Johansen (only one step), Euler, Gragg, and Midpoint. The Johansen solution is more inaccurate for larger shocks. Using subtotals, we can divide up the effects of the shocks in PRCGEM. Johansen solutions are defined to be solutions obtained by solving the linearised equations of the model just once, so the inaccuracy will increase with the size of the shocks. In Euler's method, the direction to move under the shock at each step is essentially that of the tangent to the curve at the appropriate point. Gragg's and the midpoint method are similar to Euler's method, following the tangent along the curve from the initial solution. However, the difference is that Euler's method follows this tangent from the current point while Gragg's and the midpoint method follow the tangent from the previous point. And Gragg's method uses an even more accurate method than Euler's method for calculating the direction in which to move at each step. Furthermore, Gragg's method and the midpoint method are the same except that Gragg's method does one extra pass compared with midpoint counterpart. In order to get better simulation results, we need to have as many solution steps as possible. The idea behind the multi-step simulation is to divide the exogenous shocks into at least two pieces and in each step, the linearized equations are calculated with these smaller shocks so as to be more close to the real economy. And the subintervals[61] are chosen subsequently. In general, the more steps and subintervals the shocks are broken into, the more accurate will be the simulation results. In this paper we use simple Johansen solution.

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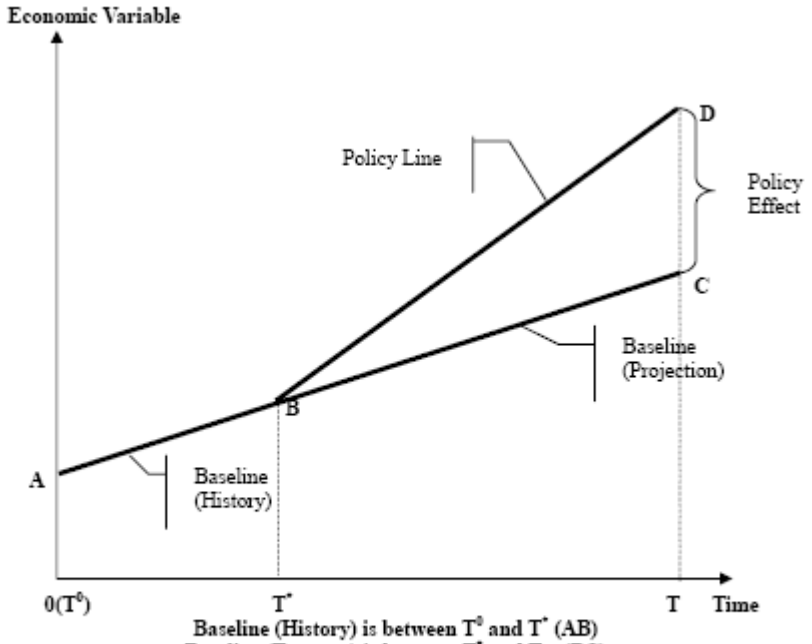
59 Detailed information can be found from the GEMPACK User Documentation—GPD-3 (Release 7.0) (http://www.monash.edu.au/policy/gpdoc.htm).

60 The idea of a multi-step simulation is to break each of the shocks (from closure) up into several smaller pieces. In each step, the linearised equations are solved for these smaller shocks and meanwhile the data, shares and elasticities are recomputed to take into account the changes from the previous stop. Therefore, the more steps involved for the shocks, the more accurate will be the simulation.

61 The solution method is employed across each subinterval with the multi-step calculations (usually with a small number of steps) and then extrapolated before starting the next subinterval.



Baseline (History) is between T^0 and T^* (AB)
Baseline (Forecast) is between T^* and T (BC)
Policy Line is between T^* and T (BD)
Policy Effect (CD)

Figure 2: Simulation from Baseline

Appendix II

Table 1 China's average annual GDP growth rates (%), merchandise world trade and FDI (US$ billions) (1960-2003)

Year	Real GDP growth (% per year)	Exports[a]	Imports[b]	Trade balance	FDI[c]
1960-1978 (Pre-reform average per year)	5.1	4.6[d]	4.8[d]	-0.2[d]	N/A
1979-2003 (Post-reform average per year)	9.3	120.0[e] (2.41)	111.1[e] (2.24)	8.9[e]	499.8[f] (666.8)[f]
1990	3.8	62.9 (1.80)	53.9 (1.50)	9.0	3.5 (6.6)
1991	9.2	71.9 (2.05)	63.9 (1.76)	8.1	4.4 (12.0)
1992	14.2	85.5 (2.26)	81.8 (2.08)	3.6	11.0 (58.1)
1993	13.5	91.6 (2.43)	103.6 (2.68)	-11.9	27.5 (111.4)
1994	12.6	120.8 (2.80)	115.6 (2.61)	5.2	33.8 (82.7)
1995	10.5	148.8 (2.88)	132.1 (2.50)	16.7	37.5 (91.3)
1996	9.6	151.1 (2.80)	138.8 (2.51)	12.3	41.7 (73.3)
1997	8.8	182.7 (3.28)	142.2 (2.49)	40.5	45.3 (51.0)
1998	7.8	183.7 (3.34)	140.2 (2.48)	43.5	45.5 (52.1)
1999	7.1	194.9 (3.41)	165.8 (2.81)	29.1	40.3 (41.2)
2000	8.0	249.2 (3.87)	225.1 (3.36)	24.1	40.7 (62.4)
2001	7.5	266.1 (4.29)	243.55 (3.77)	22.55	46.9 (69.2)
2002	8.3	235.6 (5.02)	295.17 (4.40)	-59.57	52.7 (82.8)
2003	9.3	438.23 (5.84)	412.76 (5.31)	25.47	53.5 (115.1)

Notes: [a] China's share of world exports in parenthesis (%).

[b] China's share of world imports in parenthesis (%).

[c] Total amount FDI actually used. FDI authorised by the signed agreements and contracts in parenthesis.

[d] Data for 1962~78.

[e] Data for 1980~2003.

[f] Accumulated FDI.

Source: *China Statistical Yearbook* (various volumes), Almanac of China's Foreign Economic Relations and Trade, www.wto.org, and China Foreign Economic Statistical Yearbook.

Table 2 Exports by Selected Sectors (US$ Billion) 1994~2003

Year	Total exports	Textile and garment	Electrical machinery, consumer electrical and electronic products	Chemicals and related products	Plastics, rubber and related products
1994	121.0 (32.0)	34.2 (31.0) [28.3]	19.7 (41.7) [16.3]	5.8 (31.8) [4.8]	3.1 (40.9) [2.6]
1995	148.8 (23.0)	35.9 (5.0) [24.1]	27.7 (40.6) [18.6]	8.4 (44.8) [5.6]	4.3 (38.7) [2.9]
1996	151.1 (1.5)	35.0 (-2.5) [23.2]	31.1 (12.3) [20.6]	8.4 (0.0) [5.6]	4.4 (2.3) [2.9]
1997	182.7 (20.9)	43.2 (23.4) [23.6]	38.3 (23.2) [21.0]	9.4 (11.9) [5.1]	5.8 (31.8) [3.2]
1998	183.8 (0.6)	40.5 (-6.3) [22.0]	43.6 (13.8) [23.7]	9.6 (2.1) [5.2]	6.2 (6.9) [3.4]
1999	194.9 (6.0)	41.3 (2.0) [21.2]	52.1 (19.5) [26.7]	10.0 (4.2) [5.1]	6.3 (1.6) [3.2]
2000	249.2 (27.9)	49.4 (19.6) [19.8]	72.9 (25.4) [29.3]	11.6 (1.6) [4.7]	7.9 (25.4) [3.2]
2001	266.1 (6.8)	49.8 (0.8) [18.7]	84.9 (16.5) [31.9]	12.7 (9.5) [4.8]	8.3 (5.1) [3.1]
2002	325.6 (22.4)	57.8 (16.1) [17.8]	115.9 (36.5) [35.6]	14.6 (15.0) [4.6]	10.0 (20.5) [3.1]
2003	438.2 (34.6)	73.3 (26.8) [16.7]	172.3 (48.7) [39.3]	15.8 (8.2) [3.6]	12.5 (25.0) [2.9]

Notes: Sectoral share in total exports (%) in square brackets and annual growth rate (%) in parenthesis.
Sources: *China Statistical Yearbook* (various volumes).

Table 3 Share of China's agricultural and selected manufactured imports in total imports

Year	Total imports (US$ bn)	Agricultural imports[a] (US$ bn)	Agricultural share of total imports (%)	Manufactured imports (US$ bn)	Manufactured share of total imports (%)	Chemical & related products	% of total imports	Textile & light industrial products[b]	% of total imports	Machinery & transport equipment	% of total imports	Effective tariff rate[c] (%)
1990	53.3	4.32	8.11	43.49	81.60	6.65	12.47	8.91	16.71	16.85	31.60	6.23
1991	63.79	3.52	5.52	52.96	83.02	9.28	14.54	10.49	16.45	19.60	30.73	5.52
1992	80.59	3.67	4.55	67.33	83.55	11.16	13.84	19.27	23.91	31.31	38.85	4.79
1993	103.96	2.71	2.61	89.75	86.33	9.70	9.33	28.53	27.44	45.02	43.31	4.28
1994	115.61	4.95	4.28	99.13	85.74	12.13	10.49	28.08	24.29	51.47	44.52	2.74
1995	132.08	8.74	6.62	107.67	81.52	17.30	13.10	28.77	21.78	52.64	39.86	2.65
1996	138.83	7.37	5.31	113.39	81.68	18.11	13.04	31.39	22.61	54.76	39.45	2.61
1997	142.37	5.99	4.21	113.75	79.90	19.30	13.55	32.22	22.63	52.77	37.07	2.71
1998	140.24	5.28	3.76	117.29	83.63	20.16	14.37	31.08	22.16	56.85	40.53	2.70
1999	165.7	4.99	3.01	138.85	83.80	24.03	14.50	34.32	20.71	69.45	41.91	4.10
2000	225.09	5.74	2.55	178.36	79.24	30.21	13.42	41.81	18.57	91.93	40.84	4.03
2001	243.55	5.74	2.36	197.81	81.22	32.10	13.18	41.94	17.22	107.02	43.94	4.17
2002	295.17	6.86	2.32	245.90	83.31	39.04	13.22	48.49	16.43	137.01	46.42	
2003	412.76	8.96	2.17	340.00	82.37	48.98	11.87	63.90		192.83		

Notes [a] Agricultural imports refer to food and live animals, animal and vegetable oils, fats and waxes. [b] Includes rubber products, minerals and iron products [c] Ratio of total tariff revenue against total imports.

Source *China Statistical Yearbook* (various volumes).

Table 4 Regional macro-economy in 2002, 100 million RMB

No	Regions	Regional GDP[a]	Primary industry[b]	Secondary industry[b]	Tertiary industry[b]	Exports[c]	Imports[c]	Total trade[c]	Openness Index1 (Exports/GDP) (%)	Openness Index2 (Trade/GDP) (%)
1	Beijing	3212.71 (2.72)	98.05 (3.05)	1116.53 (34.75)	1998.13 (62.19)	690.04107 (2.56)	1520.0934 (6.22)	2210.134 (4.30)	21.48	68.79
2	TianJin	2051.16 (1.74)	84 (4.10)	1001.9 (48.85)	965.26 (47.06)	917.41192 (3.40)	973.89913 (3.99)	1891.311 (3.68)	44.73	92.21
3	HeBei	6122.53 (5.19)	957.01 (15.63)	3046 (49.75)	2119.52 (34.62)	344.13117 (1.28)	221.11095 (0.91)	565.2421 (1.10)	5.62	9.23
4	ShanXi	2017.54 (1.71)	197.8 (9.80)	1083.79 (53.72)	735.95 (36.48)	227.74579 (0.85)	70.010177 (0.29)	297.756 (0.58)	11.29	14.76
5	Mongolia	1734.31 (1.47)	374.69 (21.60)	728.34 (42.00)	631.28 (36.40)	85.428572 (0.32)	135.18493 (0.55)	220.6135 (0.43)	4.93	12.72
6	LiaoNing	5458.22 (4.62)	590.2 (10.81)	2609.85 (47.82)	2258.17 (41.37)	998.1971 (3.70)	940.80024 (3.85)	1938.997 (3.77)	18.29	35.52
7	JiLin	2246.12 (1.90)	446.17 (19.86)	978.37 (43.56)	821.58 (36.58)	154.62264 (0.57)	182.60883 (0.75)	337.2315 (0.66)	6.88	15.01
8	HeiLongJiang	3882.16 (3.29)	447 (11.51)	2169.15 (55.87)	1266.01 (32.61)	199.67352 (0.74)	188.32327 (0.77)	387.9968 (0.76)	5.14	9.99
9	ShangHai	5408.76 (4.58)	88.24 (1.63)	2564.69 (47.42)	2755.83 (50.95)	2566.9361 (9.52)	3413.3032 (13.97)	5980.239 (11.64)	47.46	110.57
10	JiangSu	10631.75 (9.01)	1119.12 (10.53)	5550.98 (52.21)	3961.65 (37.26)	3229.2567 (11.98)	2936.1888 (12.02)	6165.445 (12.00)	30.37	57.99
11	ZheJiang	7796 (6.61)	694 (8.90)	3982 (51.08)	3120 (40.02)	2612.611 (9.69)	1224.1774 (5.01)	3836.788 (7.47)	33.51	49.21
12	AnHui	3569.1 (3.02)	772.55 (21.65)	1552.21 (43.49)	1244.34 (34.86)	192.54868 (0.71)	155.47682 (0.64)	348.0255 (0.68)	5.39	9.75
13	FuJian	4682.01 (3.97)	664.78 (14.20)	2159.94 (46.13)	1857.29 (39.67)	1521.9143 (5.65)	988.43189 (4.05)	2510.346 (4.89)	32.51	53.62

14	JiangXi	2450.48 (2.08)	535.98 (21.87)	951.77 (38.84)	962.73 (39.29)	87.564038 (0.32)	77.71027 (0.32)	165.2743 (0.32)	3.57	6.74
15	ShanDong	10552.06 (8.94)	1390 (13.17)	5309.54 (50.32)	3852.52 (36.51)	1779.6121 (6.60)	1313.4655 (5.38)	3093.078 (6.02)	16.87	29.31
16	HeNan	6168.73 (5.23)	1288.36 (20.89)	2951.06 (47.84)	1929.31 (31.28)	193.32672 (0.72)	115.44015 (0.47)	308.7669 (0.60)	3.13	5.01
17	HuBei	4975.63 (4.22)	707 (14.21)	2446.05 (49.16)	1822.58 (36.63)	171.61118 (0.64)	203.51405 (0.83)	375.1252 (0.73)	3.45	7.54
18	HuNan	4340.94 (3.68)	847.25 (19.52)	1737.2 (40.02)	1756.49 (40.46)	149.27983 (0.55)	121.65617 (0.50)	270.936 (0.53)	3.44	6.24
19	GuangDong	11769.73 (9.97)	1032.8 (8.78)	5935.63 (50.43)	4801.3 (40.79)	9857.2084 (36.58)	8803.4023 (36.03)	18660.61 (36.32)	83.75	158.55
20	GuangXi	2455.36 (2.08)	595.68 (24.26)	863.96 (35.19)	995.72 (40.55)	122.22232 (0.45)	93.554103 (0.38)	215.7764 (0.42)	4.98	8.79
21	HaiNan	604.13 (0.51)	228.95 (37.90)	125.33 (20.75)	249.85 (41.36)	55.83747 (0.21)	92.579073 (0.38)	148.4165 (0.29)	9.24	24.57
22	ChongQing	1971.3 (1.67)	315.78 (16.02)	827.55 (41.98)	827.97 (42.00)	92.383736 (0.34)	75.070735 (0.31)	167.4545 (0.33)	4.69	8.49
23	SiChuan	4875.12 (4.13)	1027.62 (21.08)	1982.44 (40.66)	1865.06 (38.26)	217.67103 (0.81)	151.60236 (0.62)	369.2734 (0.72)	4.46	7.57
24	GuiZhou	1185.04 (1.00)	280.83 (23.70)	474.68 (40.06)	429.53 (36.25)	46.807263 (0.17)	34.331341 (0.14)	81.1386 (0.16)	3.95	6.85
25	YunNan	2232.32 (1.89)	470.5 (21.08)	951.48 (42.62)	810.34 (36.30)	107.10686 (0.40)	85.546934 (0.35)	192.6538 (0.37)	4.80	8.63
26	Tibet	161.42 (0.14)	39.68 (24.58)	32.93 (20.40)	88.81 (55.02)	5.6416032 (0.02)	4.7220285 (0.02)	10.36363 (0.02)	3.49	6.42
27	ShaAnXi	2035.96 (1.73)	303.79 (14.92)	925.78 (45.47)	806.39 (39.61)	130.56057 (0.48)	99.88187 (0.41)	230.4424 (0.45)	6.41	11.32
28	GanSu	1161.43 (0.98)	214.45 (18.46)	530.36 (45.66)	416.62 (35.87)	42.251602 (0.16)	43.687661 (0.18)	85.93926 (0.17)	3.64	7.40

29	QingHai	341.11 (0.29)	44.9 (13.16)	154.01 (45.15)	142.2 (41.69)	13.431916 (0.05)	5.9726832 (0.02)	19.4046 (0.04)	3.94	5.69
30	NingXia	329.28 (0.28)	52.84 (16.05)	151.16 (45.91)	125.28 (38.05)	29.745883 (0.11)	11.159879 (0.05)	40.90576 (0.08)	9.03	12.42
31	XinJiang	1598.28 (1.35)	305 (19.08)	672.1 (42.05)	621.18 (38.87)	106.7973 (0.40)	148.32632 (0.61)	255.1236 (0.50)	6.68	15.96
	Total	118020.7 (100)	16215.02 (13.74)	55566.78 (47.08)	46238.89 (39.18)	26949.578 (100.00)	24431.232 (100.00)	51380.81 (100.00)	22.83	43.54

Notes: [a] Regional GDP share of total GDP in parenthesis (%). [b] Regional industry (e.g. primary, secondary, and tertiary industry) share of regional GDP in parenthesis (%).
[c] Service trade is excluded.

Source: *China Statistical Yearbook* (2003)

Table 5 Disaggregated tariff and NTB data in the period 1997~2006, %

No	40 Sectors in PRCGEM	MFN Tariff Rate [a] %					Tariff Equivalent Rate [b] %								
		2001	2002	2003	2004	2005	1997 [c]	2002 [d]	2001	2002	2003	2004	2005	2006	2007 [e]
1	Agriculture	22.52	21.455	20.415	19.392	19.288	0.38	2.91	52.73	40.52	32.44	26.98	24.07	22.31	19.29
2	Coal mining and processing	5.77	5.77	5.77	5.77	5.77	0.02	1.95	11.70	9.51	8.13	7.26	6.71	6.37	5.77
3	Crude petroleum and natural gas products	6.8	6.53	6.53	6.53	6.53	0.10	0.36	12.73	10.28	8.89	8.02	7.47	7.13	6.53
4	Metal ore mining	0	0	0	0	0	0.00	0.00	5.93	3.74	2.36	1.49	0.94	0.59	0.00
5	Non-ferrous mineral mining	2.989	2.981	2.968	2.964	2.964	0.33	1.20	5.48	4.55	3.96	3.59	3.36	3.21	2.96
6	Manufacture of food products and tobacco processing	26.963	24.479	22.118	19.932	19.169	0.98	5.51	28.44	25.41	22.71	20.30	19.40	18.80	18.65
7	Textile goods	16.071	13.806	11.726	10.033	9.204	3.07	9.43	20.49	16.60	13.48	11.14	9.90	9.65	9.20
8	Wearing apparel, leather, furs, down and related products	18.969	17.809	16.799	15.777	15.269	2.35	7.81	22.19	19.84	18.08	16.58	15.78	15.59	15.27
9	Sawmills and furniture	6.808	5.84	5.093	4.483	4.369	1.28	5.43	10.60	8.23	6.59	5.43	4.97	4.75	4.37
10	Paper and products, printing and record medium reproduction	12.221	10.293	8.494	7.102	6.13	1.74	5.68	17.72	13.76	10.69	8.48	7.00	6.68	6.13
11	Petroleum processing and coking	6.416	6.366	6.306	6.306	6.306	0.68	0.77	7.68	7.17	6.81	6.62	6.51	6.43	6.31
12	Chemicals	11.555	10.506	9.68	8.986	8.562	1.73	3.60	12.37	11.02	10.01	9.19	8.69	8.60	8.50
13	Non-metal mineral products	15.009	14.252	13.647	13.228	13.051	0.48	10.18	15.01	14.25	13.65	13.23	13.05	13.05	13.05
14	Metals smelting and pressing	8.779	8.321	8.159	8.081	8.069	0.79	2.06	11.30	9.91	9.17	8.71	8.47	8.32	8.07
15	Metal products	12.59	11.78	11.25	11.04	11.04	1.48	3.63	12.59	11.78	11.25	11.04	11.04	11.04	11.04
16	Machinery and equipment	5.607	5.151	4.834	4.636	4.605	3.04	3.08	7.50	6.35	5.59	5.12	4.91	4.79	4.60
17	Transport equipment	11.143	10.044	9.013	8.254	7.586	2.77	4.34	21.54	16.61	13.15	10.87	9.23	7.42	6.38
18	Electric equipment and machinery	12.563	11.187	10.283	9.84	9.764	2.30	3.86	16.42	13.62	11.82	10.81	10.38	10.15	9.76

19	Electronic and telecommunication equipment	9.896	7.642	6.475	6.065	6.007	2.19	2.68	14.82	10.74	8.43	7.30	6.79	6.50	6.01
20	Instruments, meters, cultural and office machinery	13.84	12.967	12.468	12.254	12.187	3.45	3.95	13.84	12.97	12.47	12.25	12.19	12.19	12.19
21	Maintenance and repair of machinery and equipment	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	Other manufacturing products	14.404	13.586	12.808	12.093	11.467	3.23	12.37	14.40	13.59	12.81	12.09	11.47	11.47	11.47
23	Scrap and waste	4.32	4.01	3.85	3.67	3.51	0.00	0.00	4.32	4.01	3.85	3.67	3.51	3.34	3.18
24	Electricity, steam and hot water production and supply	1.45	1.05	0.76	0.55	0.4	11.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.90
25	Gas production and supply	6.22	6	6	6	6	11.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.90
26	Water production and supply	0	0	0	0	0	11.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.90
27	Construction	0	0	0	0	0	13.68	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.84
28	Transport and warehousing	0	0	0	0	0	3.97	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.99
29	Post and telecommunication	0	0	0	0	0	0.18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.09
30	Wholesale and retail trade	0	0	0	0	0	1.84	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.92
31	Eating and drinking places	0	0	0	0	0	1.84	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.92
32	Passenger transport	0	0	0	0	0	3.97	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.99
33	Finance and insurance	0	0	0	0	0	8.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.04
34	Real estate	0	0	0	0	0	8.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.04
35	Social services	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87
36	Health services, sports and social welfare	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87
37	Education, culture and arts, radio, film and television	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87
38	Scientific research	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87
39	General technical services	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87
40	Public administration and other sectors	0	0	0	0	0	25.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.87

Notes to Table 5: [a] MFN tariff rate (or tariff bound) for 40 sectors is calculated according to the tariff rate for 124 sectors weighted by tariff revenue in 1997.

[b] Total trade barriers including tariff and non-tariff barriers. Tariff data in the period of 1997~2000 are from (http://trade.chinavista.com/tariffsearch.html) and (http://www.apectariff.org/) and NTB tariff equivalent data are taken from Li and Lejour (2000) and Wang (2001). Here we use the MFN tariff rate, considering the high tariff exemption in China. According to the updated China's WTO accession protocol it is assumed that NTB equivalents cut 100% gradually for agriculture and manufacture sector during the period of 2001~07.

[c] Data in sector 1-23 are effective tariff rate according to the real tariff revenue in 1997. Data in sector 24-40 are tariff equivalent rate based on gravity equation estimates (Francois and Spinanger 2002)

[d] Data in sector 1-23 are effective tariff rate according to the real tariff revenue in 2002.

[e] Data in sector 24-40 are reflecting an assumed 50% drop in cross-border trading cost estimates.

Other tariff data (2001-06) are from China's WTO protocol in 2001. N/A refers to none available.

Table 6 Macro results, %

	Short-run		Long-run	
	Only WTO	**Full economic structural and development**	**Only WTO**	**Full economic structural and development**
Macros	**2002~07**	**2002~07**	**2002~07**	**2002~07**
% (Balance of Trade)/GDP	1.98	2.96	0.66	0.38
Aggregate Employment- Wage Bill Weights	13.82	13.82	13.82	13.82
Total Sum of Welfare (EV): Household + Investment + Government + Trade (RMB Billion)	7191.32	25041.20	6191.83	74201.33
Welfare-Investment (EV) (RMB Billion)	3144.53	10902.69	2719.46	54221.00
Welfare-Government (EV) (RMB Billion)	896.05	10021.81	774.92	9918.45
Welfare-GDP (EV) (RMB Billion)	7615.15	26403.15	6585.69	37278.37
Welfare-Net Export or Trade (EV) (RMB Billion)	3150.74	4116.70	1769.47	3763.84
Sectoral Gross Allocation Effect (GAE)	1.38	6.29	1.44	6.20
GDP Price Index, Expenditure Side	-5.29	39.63	-1.17	35.06
Duty-paid Imports Price Index, RMB	0.33	0.33	0.33	0.33
Real Devaluation	5.29	-39.63	1.17	-35.06
Terms of Trade	-2.40	15.95	-2.02	8.57
Average Capital Rental	7.36	95.61	5.62	68.77
Rental Price of Land	5.24	15.74	8.52	16.14
Average Input/Output Price	-4.99	14.49	-3.33	11.60
Aggregate Investment Price Index	-1.15	67.00	7.19	63.08
Consumer Price Index	-7.89	17.97	-6.04	17.06
Exports Price Index	-2.40	15.95	-2.02	8.57
Total Demand for non-Peasant labour	13.52	25.01	14.86	20.92

Total Demand for Peasant labour	14.45	-12.94	12.30	-4.64
CIF RMB Value of Imports	2.26	51.35	5.99	48.61
Nominal GDP from Expenditure Side	1.19	62.10	4.43	66.77
Value of Imports plus Duty	2.57	51.75	6.29	49.09
Aggregate Tariff Revenue	-40.60	11.25	-37.11	10.80
Aggregate Payments to Capital	7.36	95.61	8.20	90.08
Aggregate Payments to Labour	-4.51	61.71	-0.35	56.07
Aggregate Payments to Land	5.24	15.74	8.52	16.14
Aggregate Primary Factor Payments	0.31	73.49	3.17	68.06
Aggregate Nominal Investment	-1.15	67.00	9.39	78.02
Nominal Total Household Consumption	-1.41	40.44	-0.44	48.77
RMB Border Value of exports	9.61	66.19	8.08	55.74
Import Volume Index, CIF Weights	2.26	51.35	5.99	48.61
Real GDP from Expenditure Side	6.48	22.46	5.60	31.72
Import Volume Index, Duty-Paid Weights	2.24	51.42	5.96	48.76
Aggregate Capital Stock, Rental Weights	0.00	0.00	2.58	21.31
Aggregate Output: Primary Factor Cost Weights	8.15	37.71	9.14	40.60
Activity Level or Value-Added	7.80	39.84	9.20	43.26
Aggregate Real Investment Expenditure	0.00	0.00	2.20	14.94
Real Household Consumption	6.48	22.46	5.60	31.72
Export Volume Index	12.01	50.23	10.10	47.17

Source: Simulation results

Table 7: Percentage change in sectoral real output, employment, real trade upon China's WTO accession, %

		Only WTO effect (tariff/non-tariff deduction and 100% duty exemption cut)								Full economic structural and development							
		Real Output		Employment		Real Imports		Real Exports		Real Output		Employment		Real Imports		Real Exports	
		S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run
1	Agriculture	12.79	10.94	14.45	12.30	-6.51	0.89	43.53	34.37	17.57	27.12	-12.94	-4.64	102.41	102.59	-10.16	-4.58
2	Coal mining and processing	7.16	8.74	11.39	13.41	-0.33	8.11	15.02	9.87	40.90	33.39	5.15	-1.25	40.49	37.94	69.50	51.87
3	Crude petroleum and natural gas products	1.61	4.84	10.24	11.30	20.36	19.41	-10.04	-4.61	52.58	41.02	50.11	31.03	20.50	9.71	93.71	78.01
4	Metal ore mining	7.23	9.14	14.82	16.22	7.35	12.53	8.41	6.62	44.56	38.66	-2.67	-5.43	29.72	30.70	81.93	63.66
5	Non-ferrous mineral mining	6.43	10.29	11.05	14.89	-1.23	7.82	10.50	8.23	45.99	46.05	12.07	11.16	34.91	37.57	73.77	63.34
6	Manufacture of food products and tobacco processing	9.31	8.16	24.83	16.70	-16.63	-15.66	21.57	18.89	24.40	52.07	-14.71	33.45	31.86	73.47	34.24	29.26
7	Textile goods	12.09	11.31	26.80	21.28	7.65	8.67	15.86	14.11	35.97	36.07	13.18	10.36	54.87	53.54	43.56	37.64
8	Wearing apparel, leather, furs, down and related products	12.03	11.17	20.24	15.91	-6.57	-6.14	20.05	18.42	40.55	66.76	19.87	38.78	44.85	86.44	59.14	53.18
9	Sawmills and furniture	7.48	9.12	14.11	15.40	-0.50	8.03	15.13	11.52	39.29	36.33	19.44	7.57	68.37	58.82	39.31	37.19
10	Paper and products, printing and record medium reproduction	9.41	8.52	17.03	15.44	2.30	6.50	15.93	11.57	36.51	36.09	14.39	6.10	65.90	59.85	35.81	33.93
11	Petroleum processing and coking	7.35	9.40	22.71	28.66	2.78	6.57	3.94	3.68	43.57	36.25	30.85	49.71	29.70	21.70	70.18	57.59
12	Chemicals	9.05	9.62	20.63	16.94	3.56	4.68	8.38	8.39	37.35	31.37	14.89	7.08	41.61	36.00	50.30	39.56
13	Nonmetal mineral products	5.18	10.04	9.85	15.97	-5.93	4.58	12.25	8.91	44.83	49.64	32.33	26.78	75.58	70.25	33.57	35.62
14	Metals smelting and pressing	7.37	9.91	12.64	18.13	-2.86	4.90	9.13	6.36	43.65	42.80	23.72	31.99	47.18	49.13	54.71	44.36
15	Metal products	7.03	9.78	12.75	14.48	-5.29	1.76	8.77	7.51	44.30	45.97	25.98	18.79	52.37	47.41	48.63	47.78
16	Machinery and equipment	6.60	10.35	14.34	16.61	1.23	8.85	8.56	8.27	43.04	49.68	27.46	22.65	60.82	58.83	46.95	52.07
17	Transport equipment	5.00	8.60	10.86	12.20	6.44	12.86	6.22	7.20	42.60	42.44	24.93	17.91	63.85	56.99	49.36	52.38

18	Electric equipment and machinery	5.86	7.64	12.06	10.67	-0.43	4.11	7.32	5.60	48.86	54.69	36.16	30.84	55.40	48.46	72.46	70.81
19	Electronic and telecommunication equipment	6.51	6.69	15.59	12.28	4.23	6.21	6.81	5.52	54.15	61.71	53.77	44.58	59.10	53.66	69.73	73.10
20	Instruments, meters, cultural and office machinery	7.98	9.25	16.42	13.24	0.17	3.57	6.37	6.29	52.36	59.08	44.88	30.36	52.66	40.42	61.99	69.47
21	Maintenance and repair of machinery and equipment	6.92	8.26	12.49	14.10	0.00	0.00	0.00	0.00	42.31	33.21	23.89	-0.66	0.00	0.00	0.00	0.00
22	Other manufacturing products	7.82	8.96	16.74	14.64	4.80	6.91	12.81	12.02	37.31	33.57	17.63	0.14	46.24	37.01	34.84	36.72
23	Scrap and waste	7.61	9.60	16.83	19.07	0.00	0.00	0.00	0.00	39.77	36.88	37.27	12.39	0.00	0.00	0.00	0.00
24	Electricity, steam and hot water production and supply	6.44	8.28	23.77	17.56	20.47	15.57	-7.78	-0.35	39.48	37.58	30.94	41.63	203.76	223.69	35.41	5.38
25	Gas production and supply	5.55	5.77	7.09	11.29	0.00	0.00	9.92	5.14	36.35	27.00	10.03	16.28	0.00	0.00	49.93	32.62
26	Water production and supply	5.93	7.39	20.85	18.92	0.00	0.00	0.00	0.00	46.19	37.13	-33.28	3.38	0.00	0.00	0.00	0.00
27	Construction	3.70	11.45	5.18	15.17	3.69	11.45	12.95	12.27	52.87	68.28	34.18	34.82	53.60	69.01	40.39	54.61
28	Transport and warehousing	7.50	8.64	15.86	21.22	0.00	0.00	10.67	2.85	39.11	30.07	22.26	22.42	0.00	0.00	32.51	7.93
29	Post and telecommunication	5.05	7.32	26.56	26.51	7.29	10.22	-3.15	-3.50	40.82	24.34	58.54	30.63	61.45	42.33	-0.92	-11.87
30	Wholesale and retail trade	8.15	8.84	13.70	15.33	0.00	0.00	16.09	10.98	37.08	36.05	17.45	6.96	0.00	0.00	30.79	29.05
31	Eating and drinking places	8.72	8.64	16.14	16.04	-1.35	1.31	25.91	20.41	35.84	29.75	12.42	-14.04	51.43	40.80	26.38	23.74
32	Passenger transport	6.69	5.15	15.47	14.96	6.23	6.72	10.96	3.79	40.49	25.26	29.54	17.08	51.75	43.23	29.87	3.65
33	Finance and insurance	5.99	7.73	13.81	10.90	6.79	7.97	1.80	8.40	37.29	25.84	30.26	-0.64	46.47	36.00	14.61	27.57
34	Real estate	1.23	4.16	8.60	10.25	0.00	0.00	0.00	0.00	27.97	14.12	22.60	5.57	0.00	0.00	0.00	0.00
35	Social services	6.75	7.51	11.41	10.70	3.93	5.31	9.33	8.57	42.21	36.08	23.37	12.98	51.94	40.18	29.30	22.78
36	Health services, sports and social welfare	5.24	4.19	6.15	4.96	0.05	0.34	13.21	9.93	51.53	61.72	28.21	34.38	69.23	74.41	38.00	46.85

37	Education, culture and arts, radio, film and television	6.56	5.72	7.71	6.75	-1.36	-0.03	19.77	14.59	57.70	53.13	36.28	25.76	82.82	64.50	7.08	14.59
38	Scientific research	6.57	6.16	8.51	7.95	0.00	0.00	0.00	0.00	65.80	63.72	49.45	40.21	0.00	0.00	0.00	0.00
39	General technical services	7.48	7.83	17.49	14.66	0.00	0.00	0.00	0.00	54.12	55.35	62.51	54.93	0.00	0.00	0.00	0.00
40	Public administration and other sectors	6.49	5.61	8.09	7.14	6.48	5.60	16.80	12.33	72.42	71.68	56.07	48.31	74.34	73.59	22.89	28.71

Note: S-Run refers to short-run simulation and L-Run refers to long-run simulation.

Source: Simulation results.

Table 8 Regional impacts of only WTO and full economic structural and development (%)

	Only WTO								Full economic structural and development							
	Real Output		Employment		Real Imports		Real Exports		Real Output		Employment		Real Imports		Real Exports	
	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run
Beijing	7.20	8.70	12.44	14.04	2.04	6.26	9.91	8.18	51.12	50.87	37.01	38.38	59.12	56.56	59.48	58.13
Tianjin	7.41	8.84	14.43	14.27	2.04	6.26	8.16	7.35	31.27	31.04	11.33	7.74	43.80	41.18	53.07	55.82
Hebei	8.09	9.34	14.15	13.58	0.66	5.01	13.17	10.93	42.64	43.43	8.77	11.73	55.68	56.20	48.88	43.71
Shanxi	7.71	9.17	13.40	13.63	2.68	6.61	12.01	9.43	40.56	40.60	11.08	13.25	42.37	40.91	47.30	40.55
Mongolia	8.11	9.05	14.10	13.21	1.34	5.84	14.54	11.55	54.97	55.37	19.03	23.95	66.11	65.38	54.13	47.56
Liaoning	7.66	9.23	13.78	13.86	3.36	7.07	10.88	9.01	21.54	21.03	-13.18	-11.99	32.76	29.37	34.84	30.85
Jilin	8.11	9.30	13.80	13.23	3.36	7.07	11.07	9.43	59.01	59.16	29.23	31.12	66.15	62.76	62.67	57.61
Heilong	7.61	9.21	13.65	13.27	3.36	7.07	9.68	8.29	24.51	23.49	-11.94	-11.96	34.08	30.55	37.36	30.73
Shanghai	7.74	9.22	13.83	15.07	1.88	6.01	10.67	9.09	36.62	35.30	21.17	15.68	44.00	41.39	51.13	48.67
Jiangsu	8.06	9.34	14.42	14.13	1.88	6.01	12.23	10.46	42.17	42.41	11.48	12.76	51.33	48.77	52.34	49.33
Zhejiang	8.11	9.34	14.35	13.97	1.88	6.01	13.44	11.41	29.37	30.46	-7.00	-1.99	39.57	37.09	41.28	37.88
Anhui	8.14	9.28	14.31	13.25	2.68	6.61	14.22	11.88	40.29	41.70	4.22	9.76	43.86	42.42	49.40	45.51
Fujian	8.07	8.94	14.32	13.09	2.61	5.70	13.65	11.33	45.12	44.43	7.96	11.23	50.95	47.65	53.51	50.16
Jiangxi	8.16	9.11	14.06	12.77	2.68	6.61	14.36	11.69	18.08	17.82	-17.77	-13.63	26.82	25.28	27.85	23.31
Shandong	7.97	9.29	14.23	13.51	0.66	5.01	12.86	10.87	60.51	60.55	27.76	29.70	69.85	70.31	65.41	61.35
Henan	8.08	9.28	14.24	13.32	2.68	6.61	13.55	11.29	41.23	41.78	5.74	9.17	51.90	50.38	46.50	41.71
Hubei	7.87	9.20	14.22	13.38	2.68	6.61	13.43	11.38	34.50	35.08	-2.09	1.88	45.70	44.24	41.64	37.72
Hunan	8.00	9.12	13.71	12.87	2.68	6.61	13.93	11.16	13.81	14.04	-21.89	-18.07	22.80	21.31	23.92	19.55
Guangdong	7.90	8.98	14.52	13.78	2.61	5.70	11.25	9.47	50.34	49.48	20.48	20.82	56.17	52.86	62.51	60.54
Guangxi	8.07	8.99	14.04	12.77	2.63	7.68	14.80	11.87	1.25	2.02	-36.43	-31.62	24.53	22.43	11.14	7.12
Hainan	8.99	8.95	14.23	12.47	2.61	5.70	17.29	13.84	38.02	39.14	1.77	7.78	47.71	44.46	37.97	33.47
Chongqing	7.62	8.95	13.05	13.04	2.63	7.68	12.15	10.04	20.76	20.83	-14.20	-11.61	39.98	37.86	28.01	24.00
Sichuan	7.81	9.06	13.46	13.01	2.63	7.68	11.86	9.70	30.88	32.01	-5.11	-0.56	48.84	46.75	43.51	41.45

Guizhou	8.00	9.05	13.80	12.67	2.63	7.68	13.72	11.28	18.24	20.05	-19.24	-12.94	36.97	34.93	27.03	23.10
Yunnan	7.86	9.02	13.81	12.88	2.63	7.68	15.41	12.37	34.02	36.33	-3.92	3.76	52.08	50.08	34.63	30.50
Tibet	8.32	8.56	13.26	12.03	2.63	7.68	17.73	13.31	33.79	35.42	7.80	12.31	38.53	36.46	29.57	25.17
Shaanxi	7.74	8.91	13.73	13.03	1.34	5.84	10.77	8.82	26.69	26.70	-6.42	-2.50	41.70	40.97	41.87	39.77
Gansu	7.88	9.13	13.88	13.68	1.34	5.84	11.07	9.20	42.87	42.24	9.39	11.75	55.07	54.24	52.09	45.70
Qinghai	7.65	8.96	13.06	13.31	1.34	5.84	10.86	8.85	35.66	35.04	9.18	11.08	47.49	46.70	43.04	36.12
Ningxia	7.80	9.09	13.74	13.71	1.34	5.84	11.26	9.29	37.48	37.27	5.72	8.69	50.59	49.83	43.85	37.63
Xinjiang	7.93	8.97	13.79	12.99	1.34	5.84	10.15	8.70	39.78	37.27	6.21	6.49	51.56	50.59	49.12	39.93

Note: S-Run refers to short-run simulation and L-Run refers to long-run simulation.

Source: Simulation results.

Table 9 Regional blocks' real output, employment, real imports and real exports effects

	Only WTO								Full economic structural and development							
	Real output		Employment		Real imports		Real exports		Real output		Employment		Real imports		Real exports	
	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run
N_Eastern	7.72	9.23	13.74	13.49	3.36	7.07	10.59	8.90	28.82	28.24	-1.23	-0.26	36.91	33.50	40.50	35.61
N_Munici	7.30	8.76	13.36	14.15	2.04	6.26	8.74	7.63	42.11	41.87	25.18	24.26	53.54	50.97	55.19	56.58
N_Coastal	8.02	9.31	14.20	13.54	0.66	5.01	12.96	10.89	53.79	54.11	20.06	22.42	67.67	68.14	60.27	55.87
C_Coastal	8.00	9.31	14.33	14.19	1.88	6.01	12.15	10.36	36.72	36.88	7.23	8.79	45.85	43.28	49.05	46.08
S_Coastal	7.97	8.97	14.43	13.46	2.61	5.70	11.81	9.90	48.66	47.89	15.06	16.76	55.59	52.29	60.40	58.13
Central	8.00	9.21	14.07	13.21	2.68	6.61	13.68	11.32	32.69	33.21	-2.94	0.94	40.32	38.84	41.00	36.57
N_Western	7.90	9.00	13.85	13.21	1.34	5.84	11.41	9.38	40.03	39.42	6.88	10.07	53.52	52.70	47.32	42.02
S_Western	7.86	9.02	13.61	12.90	2.63	7.68	13.13	10.67	23.39	24.58	-14.94	-10.03	42.57	40.50	32.44	29.28

Notes: S-Run refers to short-run simulation and L-Run refers to long-run simulation.

Source: Simulation results.

Table 10 Regional EV, real consumption and per capita income with/without considering labour movement

	Only WTO								Full economic structural and development							
	EV-household (RMB 100 million)		Real consumption (%)		Per capita income[a] (RMB)		Per capita income[b] (RMB)		EV-household (RMB 100 million)		Real consumption (%)		Per capita income[a] (RMB)		Per capita income[b] (RMB)	
	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run
N_Eastern	297.59	276.10	6.49	6.02	11051.23	11426.95	11041.53	11413.47	577.31	928.14	12.60	20.25	18748.24	18133.26	18868.67	18241.83
N_Munici	203.29	184.04	9.67	8.75	20036.96	20504.53	17996.49	18327.80	730.72	881.06	34.76	41.91	37995.43	36133.87	30714.01	29477.04
N_Coastal	424.95	366.64	6.38	5.51	10214.85	10539.69	10228.69	10555.72	2640.84	3224.44	39.66	48.42	20618.26	20105.07	20281.74	19837.56
C_Coastal	812.45	724.17	8.54	7.61	18684.63	19142.65	17331.99	17720.65	2026.39	2839.88	21.31	29.86	33673.33	32185.36	29940.93	28924.88
S_Coastal	490.20	387.87	7.33	5.80	13171.31	13497.24	11659.81	11919.92	2309.52	2831.49	34.51	42.32	25702.99	24820.67	20572.64	20047.55
Central	535.89	453.04	5.15	4.35	6357.23	6584.04	6643.05	6890.88	1604.53	2719.71	15.41	26.11	11505.33	11254.54	12538.75	12172.33
N_Western	159.02	138.67	5.34	4.66	6125.56	6321.58	6045.06	6238.57	771.76	1051.16	25.92	35.31	11516.03	11181.86	11353.26	11099.44
S_Western	221.15	188.93	3.95	3.38	5000.68	5190.83	5193.33	5395.56	241.63	917.54	4.32	16.40	8844.27	8609.08	9565.59	9263.33

Note: S-Run refers to short-run simulation and L-Run refers to long-run simulation. [a] Labour movement is not considered. [b] Labour movement is considered.

Source: Simulation results.

Table 11 Regional Gini coefficient with/without a consideration of inter-regional labour movement

	Baseline in 2002		WTO				Full economic structural and development			
	No consideration of labour movement	Consideration of labour movement	No consideration of labour movement		Consideration of labour movement		No consideration of labour movement		Consideration of labour movement	
			S-Run	L-Run	S-Run	L-Run	S-Run	L-Run	S-Run	L-Run
All	0.310935	0.281246	0.311286	0.308682	0.284635	0.281251	0.316587	0.311986	0.26855	0.267544
N_Eastern	0.09875	0.092077	0.100349	0.101856	0.093809	0.094923	0.060516	0.059878	0.054799	0.055271
N_Munici	0.025707	0.002891	0.000276	0.002465	0.017459	0.016579	0.034728	0.038819	0.011938	0.009983
N_Coastal	0.061036	0.060173	0.072986	0.072287	0.071673	0.071039	0.093491	0.092834	0.081729	0.081885
C_Coastal	0.195252	0.158334	0.184675	0.182767	0.150435	0.147143	0.175569	0.171494	0.120679	0.121565
S_Coastal	0.137983	0.115887	0.146586	0.143717	0.127519	0.127803	0.141905	0.140123	0.13113	0.12914
Central	0.068304	0.065805	0.071821	0.071518	0.06745	0.066942	0.07772	0.078409	0.060792	0.061918
N_Western	0.112083	0.100102	0.103143	0.103076	0.093255	0.093018	0.113201	0.114811	0.105446	0.108636
S_Western	0.104282	0.104292	0.10908	0.109201	0.113026	0.113442	0.128262	0.123075	0.126765	0.122658

Note: S-Run refers to short-run simulation and L-Run refers to long-run simulation.
Source: Authors' calculation.

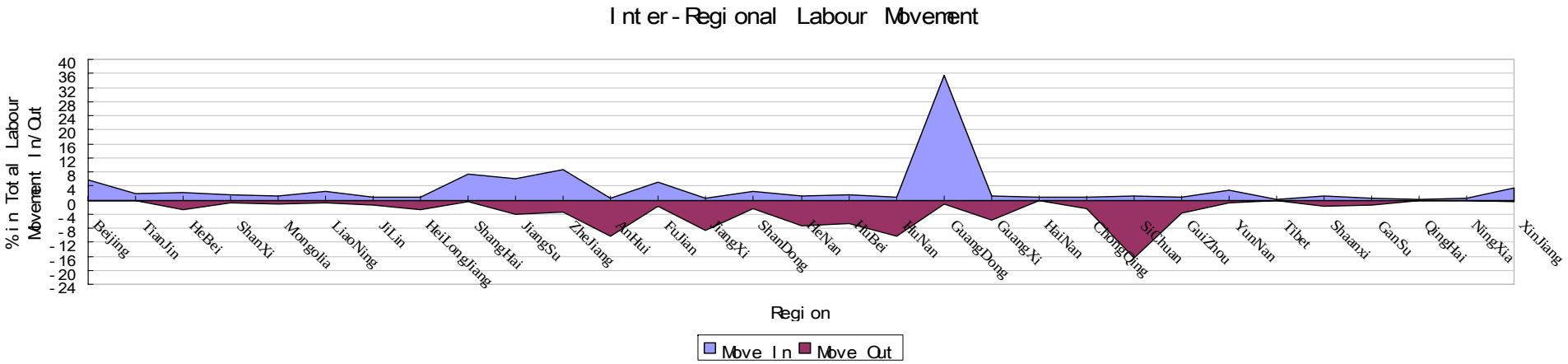


Figure 3: Inter-Regional Labour Movement in 2002

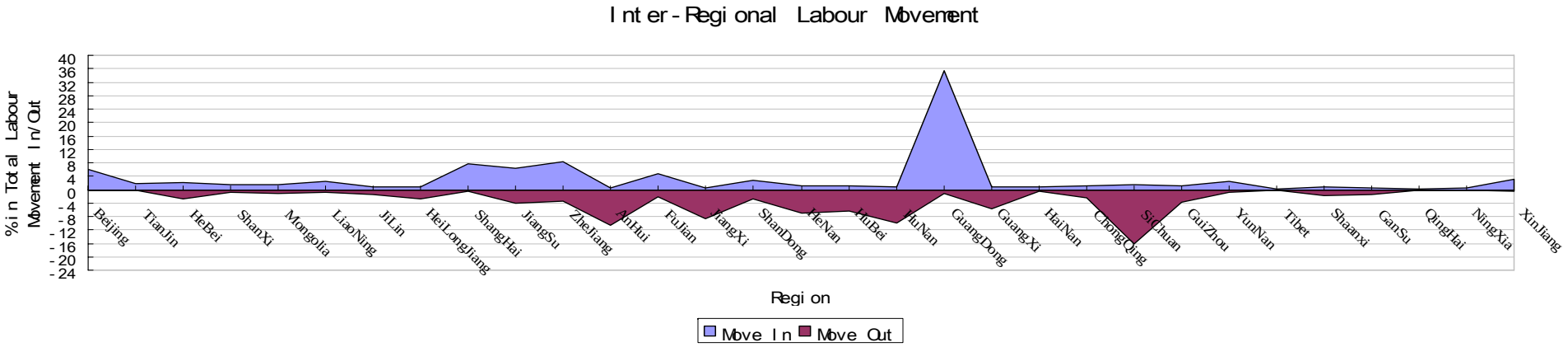


Figure 4: Inter-Regional Labour Movement under Short-Run WTO Shock

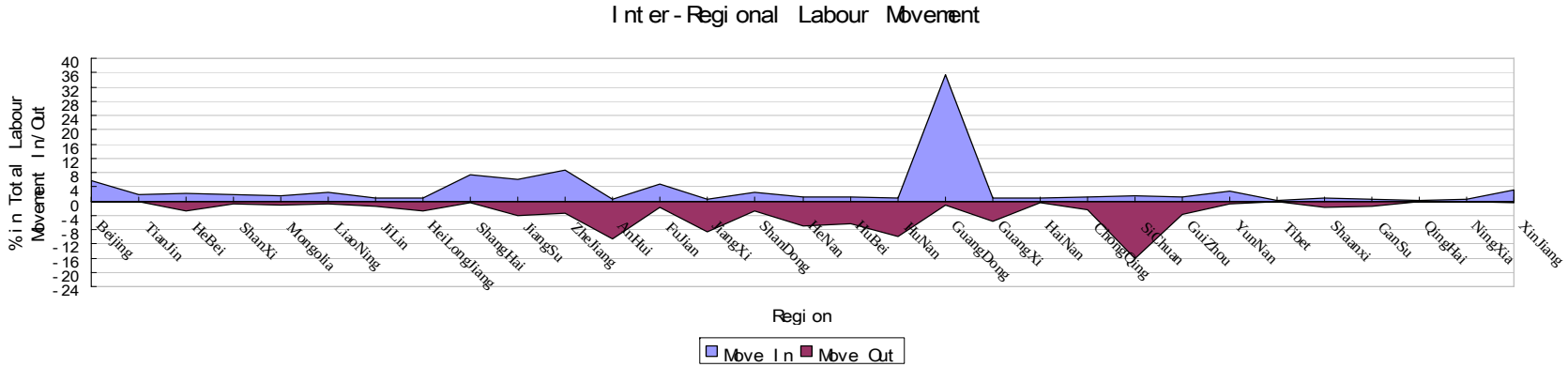


Figure 5: Inter-Regional Labour Movement under Long-Run WTO Shock

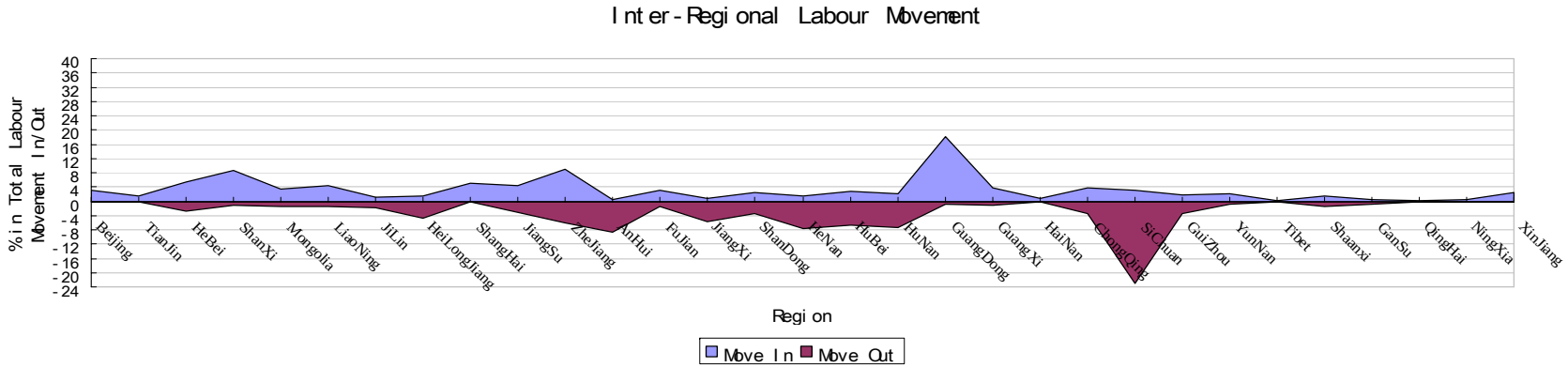


Figure 6: Inter-Regional Labour Movement under Short-Run Full Economic Structure and Development Shock

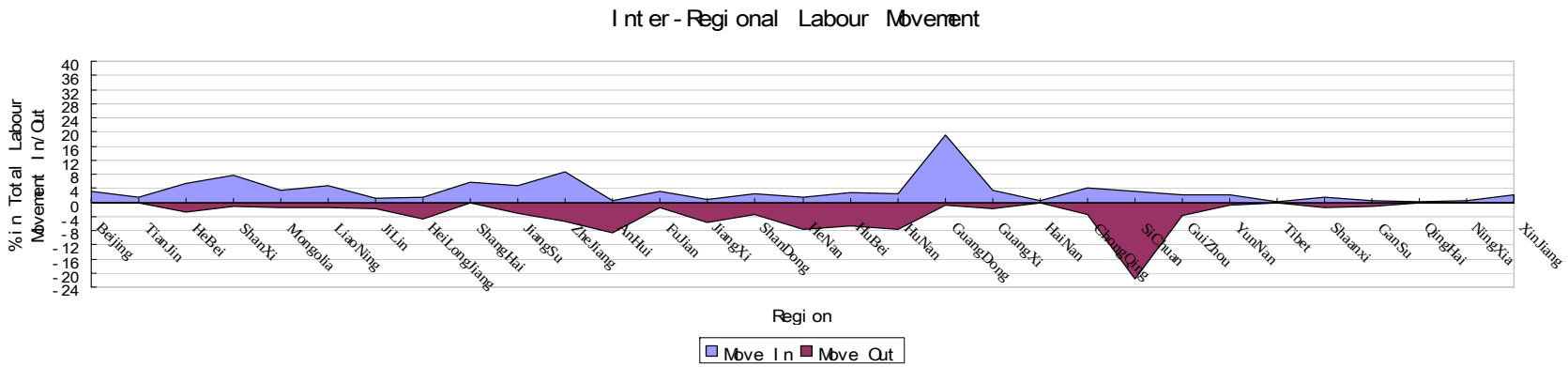


Figure 7: Inter-Regional Labour Movement under Long-Run Full Economic Structure and Development Shock