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Key to symbols used in tables

n.a.	not applicable
..	not available
-	zero
.	insignificant

Abbreviations

CCAP	Center for Chinese Agricultural Policy
CEPR	Centre for Economic Policy Research
GDP	gross domestic product
GTAP	Global Trade Analysis Project
MOA	Ministry of Agriculture
NIC	newly industrialised country
NRPs	nominal rates of protection
SEZ	special economic zone
SSB	State Statistical Bureau
SPS	sanitary and phytosanitary
STE	state trading enterprise
TFP	total factor productivity
TRQ	tariff rate quota
TVE	township and village enterprises

The impact of China's WTO accession on agriculture and rural–urban income inequality

At the end of 2001, after fifteen years of negotiations, China acceded to the World Trade Organization (WTO). During the negotiations, China continued to open up its economy, however substantial economic policy reforms are still needed before the transition from planned to market is complete and China has fulfilled its WTO Protocol of Accession legal obligations.

Keeping the momentum of growth-enhancing trade reform going requires convincing sceptics that there will be no significant losers. Yet such reforms necessarily involve structural adjustments on the parts of households, firms and bureaucracies. While the economy as a whole can gain substantially from such adjustments—although national gains are not guaranteed while major domestic policy distortions remain, such as in the labour market (Krishna and Yavas 2002)—losses can result for some unless complementary domestic policies are created. It is therefore important to perform initial analyses of the likely distributional consequences of reform and to create complementary safety-net policies. Of particular concern in many quarters is that farm incomes may fall, exacerbating rural–urban and inter-provincial (especially western–eastern) income inequality and possibly causing increased rural poverty.

The policy reforms still to be made will affect all areas of China's economy, with the impact on agriculture likely to be particularly severe, since for much of the past 23 years the country's trade policies for key farm products have remained untouched by reform. As a condition of accession to the WTO, China was required to commit to carrying out major changes in its farm trade policies by 2005—much greater and faster changes than those to which any other developing country committed to carrying out in the Uruguay Round Agreement on Agriculture.

The proposed changes will directly affect China's farm sector, its food, feed and fibre processors, and its food and beverage consumers. Imports of numerous land-intensive farm products may increase, with most observers predicting that this will put downward pressure on the prices received by China's farmers. Reduced protectionism may, however, boost output and exports of labour-intensive farm products in which China still has a comparative advantage.[1]

In addition, some of the proposed changes will indirectly affect farm households. The arrangements for phasing out 'voluntary' export restraints on China's textile and clothing trade, along with reductions in protection of the motor vehicles and parts industry, will be particularly significant in this respect. Similar effects will flow from the myriad commitments affecting the services sector, including state trading enterprises. These changes, together with the promised increase in a wide range of agricultural imports, will allow China to more fully exploit its strong comparative advantage in unskilled labour-intensive products, both farm and non-farm (Anderson 1990, 1992; Huang et al. 2000).

To assess the upcoming reforms' potential effects on farmer incomes and rural areas, it is necessary to examine them in the context of ongoing economic growth and structural change. This paper therefore begins with a summary of rural developments since the first reforms began in the late 1970s, recent policies affecting rural households, and the reforms still to be undertaken as part of China's WTO commitments. From this background, the paper goes on to describe the likely effects of the upcoming reforms on the welfare of different factor markets and hence different types of households. Not even the direction, let alone the magnitude, of some of the effects can be discerned from theory (Winters 2000; McCulloch, Winters and Cirera 2001), thus the GTAP numerical simulation model is used to address the issues. The paper concludes by drawing out implications for Chinese policymakers interested in pre-empting increases in food insecurity and rural poverty.

The setting

Rural developments since the late 1970s

The December 1978 decision to open up the Chinese economy was a major stimulus to economic growth. The pre-reform rate of per capita GDP growth of 3.1 per cent more than doubled, and has remained above 7 per cent for the past two decades (Table 1). Rapid economic growth is normally accompanied by a relative decline in the farm sector, but in China this trend was initially circumvented by the introduction of the farm household responsibility system (involving the replacement of collective farms with individually managed holdings) and the raising of prices for farm products. So began the shift away from excessive taxing of agriculture relative to other sectors—a shift made by most advanced economies in the early stages of industrialisation (Anderson and Hayami 1986; Lindert 1991).

During 1979–84, agriculture grew nearly as rapidly as industry. However, the one-off efficiency effects of the introduction of the household responsibility system and the raising of prices for farm products were mostly reaped by the mid 1980s, after which agriculture grew at only one-third the pace of industry and less than half that of the service sector, as industrialisation boomed with the development of special economic zones (SEZ's) on the eastern seaboard (Table 1). Meanwhile, employment and output and exports of rural township and village enterprises (TVEs) boomed (Table 2). At the end of the 1970s, however, the migration of farm workers to rural industrial and service activities (and their unauthorised migration to urban areas to work in areas such as construction) dropped off, and the average farm size and the share of farm household income from farming have fallen steadily ever since (Table 2). Table 3 shows the slowdown in the decline in agriculture's shares of GDP and employment in the 1980s, and its subsequent acceleration in the 1990s.

Income growth has boosted the demand for foods that are high in protein and nutrients relative to those that are high in carbohydrates, and this has led to major structural changes within agriculture as farmers responded to changes in domestic demand. For example, livestock and fish increased their share of agricultural output from less than one-fifth in the late 1970s to two-fifths by the late 1990s (Table 3), while within the crop sub-sector fruit and vegetable production grew two to three times as fast as grain production (Table 1). Grain and oilseed product markets have continued to be highly regulated, whereas markets for horticultural, livestock and fish products have become highly liberalised. This has accentuated the growth in output of the latter group relative to that of the former since the mid 1980s (Table 1). Meanwhile, the growth of direct consumption of grain by rural as well as urban households has virtually ceased (Table 4)—a consequence not only of rising income but also of slowing population growth (to less than 1 per cent per year) and cuts in the implicit consumption subsidy for foodgrains.

The use of grain for animal feed continues to increase. To date, this has been supplied almost entirely by rising domestic production, such that self-sufficiency in grain has tended to remain at a level of close to 100 per cent. From year to year, however, there have been considerable changes in grain exports and imports (Table 5). Overall, China has remained a net exporter of food and feed, with meat, fish, fruit and vegetables accounting for most of the growth in net export earnings (Table 5). In 2000, however, when the government lowered the tariff on soybean imports from 114 per cent to 3 per cent and phased out the import quota in anticipation of accession to the WTO, soybean imports grew substantially (from three to more than ten million tonnes per year).

Recent and prospective policies affecting rural areas

As in most developing countries (Sah and Stiglitz 1992; Anderson 1995), during the early stages of industrialisation, agriculture in China was squeezed, with gross fiscal contributions to the sector

Table 1 **Chinese economy growth rates, 1970–2000** (per cent per year)

	Pre-reform		Reform period	
	1970–78	1979–84	1985–95	1996–00
Gross domestic product	4.90	8.50	9.70	8.20
Agriculture	2.70	7.10	4.00	3.40
Industry	6.80	8.20	12.80	9.60
Service	..	11.60	9.70	8.20
Food production volume				
Grain	2.80	4.70	1.70	0.03
Oilseed crops	2.10	14.90	4.40	5.60
Fruit	6.60	7.20	12.70	8.60
Red meat	4.40	9.10	8.80	6.50
Fish	5.00	7.90	13.70	10.20
Value of output of non-farm rural enterprises	..	12.30	24.10	14.00
Population	1.80	1.40	1.37	0.90
Per capita GDP	3.10	7.10	8.30	7.10

Note: Figures for GDP in 1970–78 are the growth rate of national income in real terms. Growth rates are computed using the regression method. Growth rates of individual and groups of commodities are based on volume of production data, while sectoral growth rates refer to value added in real terms.
Source: State Statistical Bureau, n.d. *Statistical Yearbook of China*, Various issues, China Statistical Press, Beijing; Ministry of Agriculture, n.d. *Agricultural Yearbook of China*, Various issues, China Agricultural Press, Beijing.

Table 2 **Farm and rural enterprise (RE) developments in China, 1980–99**

	RE's share in rural labour (per cent)	RE's share in total GDP (per cent)	RE's share in total export (per cent)	Farmland size (per cent)	Non-farm income share (ha/farm)
1980	9	4	0	0.56	17
1985	19	9	15	0.51	25
1990	23	14	43	0.43	26
1995	34	25	48	0.41	37
1999	35	30	48	0.40	47

Source: State Statistical Bureau, n.d. *Statistical Yearbook of China*, Various issues, China Statistical Press, Beijing; Ministry of Agriculture, n.d. *TVE Yearbook of China*, Various issues, China Agricultural Press, Beijing.

Table 3 **The changing structure of China's economy, 1970–2000**

	1970	1980	1985	1990	1995	2000
Share of GDP (%)						
Agriculture	40	30	28	27	20	16
Industry	46	49	43	42	49	51
Services	13	21	29	31	31	33
Share of employment (%)						
Agriculture	81	69	62	60	52	50
Industry	10	18	21	21	23	23
Services	9	13	17	19	25	27
Share of agricultural output (%)						
Crops	82	76	69	65	58	56
Livestock	14	18	22	26	30	30
Fish	2	2	3	5	8	10
Forestry	2	4	5	4	3	4
Share of population that is rural	83	81	76	72	71	64

Source: State Statistical Bureau, n.d. *Statistical Yearbook of China*, Various issues, China Statistical Press, Beijing; and Rural Social and Economic Survey Team, State Statistical Bureau, n.d. China Rural Statistical Yearbook, Various issues, China Statistic Press, Beijing.

Table 4 **China's grain production, consumption and trade, 1980–98 (million tonnes)**

	1980–89	1990–94	1995–98
Production	332	396	442
Net imports	8	-1	6
Change in stocks	1	11	45
Consumption	339	384	403
Food—urban	35	42	44
Food—rural	177	190	191
Feed	64	86	98
Other (seed, industrial use, waste)	63	66	70

Source: Huang, J., 2001. Agricultural policy and food security in China, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing (unpublished), based on SSB publications and the CCAP database.

more than outweighed by implicit taxation in the form of depressed prices for farm products, neglect of public infrastructure, and capital outflows via the financial system (Huang and Ma 1998). Later, price and other market reforms associated with China's policy shift from a socialist to a market-oriented economy were introduced, beginning with non-strategic commodities such as vegetables, fruit, fish, livestock, and oil and sugar crops. The aims of the early reforms were to raise farm-level prices and gradually deregulate the market. As the right to private trading was extended to include surplus output of all categories of agricultural products after contractual obligations to the state were fulfilled, the foundations of the state marketing system began to be undermined (Rozelle et al. 1997). Despite periodic stop–go cycles in the reform process, the proportion of retail commodities sold at market prices has continued to rise. According to Lardy (2001), the share for agriculture was just 6 per cent in 1978 but had risen to 40 per cent by 1985, 79 per cent by 1995 and 83 per cent by 1999.

Table 5 **The structure of China's food and feed trade, 1980–99** (US$ million)

	SITC	1980	1985	1990	1995	1999
Export						
Live animals	00	384	304	430	473	374
Meat	01	361	448	791	1,349	1,054
Dairy products	02	71	57	55	61	71
Fish	03	380	283	1,370	2,875	2,969
Grains	04	423	1,065	614	281	1,273
Fruit and veg.	05	746	825	1,759	3,399	3,150
Sugar	06	221	79	317	321	214
Coffee and tea	07	328	435	534	523	561
Animal feeds	08	58	241	623	351	239
Other foods	09	49	66	107	290	541
Oilseeds	22	n.a.	n.a.	n.a.	522	373
Vegetable oils	4	n.a.	n.a.	n.a.	454	132
Total food		3,021	3,803	6,600	10,899	10,951
Imports						
Live animals	00	5	18	14	18	22
Meat	01	1	6	54	97	503
Dairy products	02	5	31	81	60	160
Fish	03	13	44	102	609	890
Grains	04	2,458	982	2,353	3,631	574
Fruit and veg.	05	48	52	83	185	384
Sugar	06	316	274	390	935	183
Coffee and tea	07	56	40	30	74	72
Animal feeds	08	14	83	182	423	620
Other foods	09	2	23	46	92	182
Oilseeds	22	n.a.	n.a.	n.a.	110	1,531
Vegetable oils	4	n.a.	n.a.	n.a.	2,596	1,352
Total food		2,918	1,553	3,335	8,828	6,474
Net exports						
Live animals	00	379	286	416	455	352
Meat	01	360	442	737	1,252	551
Dairy products	02	66	26	-26	1	-89
Fish	03	367	239	1,268	2,266	2,079
Grains	04	-2,035	83	-1,939	-3,350	663
Fruit and veg.	05	698	773	1,676	3,214	2,766
Sugar	06	-95	-195	-73	-614	31
Coffee and tea	07	272	395	504	449	489
Animal feeds	08	44	158	441	-72	-381
Other foods	09	47	43	61	198	359
Oilseeds	22	n.a.	n.a.	n.a.	412	-1,158
Vegetable oils	4	n.a.	n.a.	n.a.	-2,142	-1,220
Total food		103	2,250	3,265	2,071	4,477

Source: Matthews, A., (forthcoming). 'The possible impact of China's WTO accession on the WTO agricultural negotiations', *The World Economy*, based on UN COMTRADE statistics.

What have these policies meant for nominal rates of agricultural protection in China (that is, the percentage by which domestic prices exceed prices at the country's border)? Table 6 shows new estimates based on quota and negotiated procurement prices and on wholesale market prices for key agricultural commodities for some recent years. It suggests that rice, meat, fish and fruit and vegetables have been priced at less-than-border prices while other grains, oilseeds, sugar, cotton and milk have been priced one-fifth to two-fifths higher than border prices. Maize and cotton also enjoyed export subsidies in 2001 (amounting to one-third and one-tenth of f.o.b. prices, respectively).

Table 6 also shows what China has committed to in its WTO Protocol of Accession. Tariff rate quota will apply to grains, sugar and cotton for which out-of-quota tariffs are quite high, but otherwise, after the phase-in period, the tariffs range between just 1 and 15 per cent—representing substantial liberalisations from 2001 levels. In addition, producers of major crops may continue to be affected by commodity-specific policies of government procurement of a portion of the crop at lower-than-market prices (as in the past, see Sicular 1988) or at higher-than-market prices (as in 1998, see Huang 1998 and Lu 1999).

Table 6 **Nominal rates of Chinese protection (tariff or tariff equivalent) of agricultural products, 1978–2000** (per cent)

	1995	1997	2001	2007 in-quota tariff	2007 out-of-quota tariff	Assumed NRP in 2007
Rice	-5	-5	-3	1	65	-3
Wheat	25	17	12	1	65	12
Coarse grains	20	28	20	1	65	32
Vegetables & fruits	-10	-8	-4	11	11	-4
Oilseeds	30	28	32	3	3	3
Sugar	44	42	40	15	50	20
Cotton	20	17	17	1	40	20
Meats	-20	-19	-15	12	12	-15
Milk	30	30	30	11	11	11

Source: Based on research subsequently reported in summary form in Huang, J. and Rozelle, S., 2002. 'The nature of distortions to agricultural incentives in China and implications of WTO accession', Revised version (2 April) of paper presented at the second project meeting on WTO Accession and Poverty Reduction in China, World Bank Resident Mission, Beijing, 26–27 October 2001.

What will these reforms mean for agricultural trade? As many analysts have observed, in the course of its rapid industrialisation over the past two decades or so, China has become ever more dependent on agricultural imports. Some extremists (for example, Brown 1995) have even suggested that China could come to seriously deprive other developing countries of food. Yet, as reported above, net food import growth has not yet occurred, at least not in a sustained way, and China has remained a net exporter of meat, fish, fruit and vegetables, indeed at times during the late 1990s it even became a net exporter of grain and cotton (Table 5). How much of this was due to government policies that constrained domestic demand, including occasional export subsidies, is a moot point.

In its WTO Protocol of Accession, China agreed to eliminate all agricultural export subsidies and to limit domestic support to farmers to 8.5 per cent of the value of production (compared with 10 per cent for other developing economies). China's import market access commitments also look substantial on paper. Tariff rate quotas (TRQs) will be retained only on wheat, rice, maize, edible oils, sugar, cotton and wool, domestic production of which in aggregate only accounts for about one-sixth of China's agricultural GDP. The quota volumes are to grow over the next three years at annual rates ranging from 5 to 19 per cent. A further commitment by China is that state trading monopolies will disappear (except on tobacco). Although some state trading enterprises (STEs) will continue to operate, competition from private firms in the importing and exporting of farm products will continue to increase.

Farmers and the rural sector more broadly will also be affected by China's commitment to improve market access for industrial products. Mineral and manufacturing tariffs will be bound and generally reduced on a broad basis, with many tariffs falling to 10 per cent or less. Tariffs were to be cut upon accession, and further cuts are to be made by 2005 (with just a few exceptions). Furthermore, for industrial products, China will significantly reduce non-tariff measures and eliminate all quotas, tendering and import licensing on non-farm merchandise by no later than 2005. Quotas on Chinese imports of automobiles and parts will grow by 15 per cent annually (from around US$6 billion in 2000) and be eliminated by 2005. For textiles and clothing, however, the current 'voluntary' export restraints will not be phased out completely until the end of 2008. Substantial commitments to open up Chinese service markets have also been made.

During the 1990s, average scheduled tariff rates for manufactured goods fell faster than those for agricultural goods, and by 2005 they will be much lower (a simple average of 7 per cent for manufacturing versus 17 per cent for agriculture). This does not, however, give a true indication of the extent of change in protection that is taking place, since in the 1990s many manufactured goods entered China at reduced or zero tariffs via duty drawbacks, allowed in order to encourage foreign investment in the processing of imported intermediate goods for subsequent export. Certain agricultural products also entered at less than the scheduled rate, some through smuggling.

What all this information means with regards to incentives for different industries is difficult to discern precisely, but it is more useful for empirical analysis of the economic effects of China's WTO accession than any that has been available to date. We have undertaken this analysis bearing in mind the marked differences in per capita income among eastern, central and western provinces, and between urban and rural areas (as shown in Tables 7 and 8, and in Kanbur and Zhang 2001).

Table 7 **Income and employment differences across regions of China, 1998**

	Per cent Income per capita (yuan)	Per cent of population that is rural	Per cent of labour force in agriculture
Eastern provinces	9,690	71	45
Central provinces	5,280	75	55
Western provinces	4,090	81	64

Source: Carter, C.A. and Estrin, A., 2001. China's trade integration and impacts on factor markets, University of California, Davis (unpublished).

Table 8 **Income and its distribution, rural and urban China, 1980–99**

	Real per capita income index		Gini coefficient	Real per capita net income (in 1999 yuan)		
Year	Rural	Poorest 20 per cent		Rural	Urban	Urban/rural ratio
1980	100	100	0.24	616	2,062	3.4
1985	189	165	0.26	1,193	2,605	2.2
1990	218	177	0.31	1,380	3,217	2.3
1995	272	193	0.33	1,702	4,713	2.8
1999	349	252	0.35	2,210	5,854	2.7

Note: In 1999 the exchange rate was 8.28 yuan/US$.
Source: State Statistical Bureau, 1989–2000, *Statistical Yearbook of China*, Various issues (1989–2000), China Statistical Press, Beijing; and rural household income and expenditure surveys conducted by the State Statistical Bureau.

Applying the GTAP model

Here we use version 5 of the GTAP computable general equilibrium model.[2] Being an economy-wide model, GTAP describes both vertical and horizontal linkages among all product markets within the individual countries and regions as well as among different countries and regions via bilateral trade flows. For our present purposes, the 1997 database is aggregated to 25 sectors and 20 regions, and projected forward first to 2001 and then to 2007, using World Bank projections of population, income, and factor endowments (Appendix Table A). The initial base case assumes that China retains its protection policies as of 1995 and Taiwan retains its protection policies as of 1997, but that all other countries carry out all their Uruguay Round obligations on schedule before 2005. China's trade policy changes between 1995 and 2001 are assumed to have been made in anticipation, and hence as part of, its WTO accession obligations. These are analysed in detail in Ianchovichina and Martin (2002), as are the potential effects of meeting the remainder of China's commitments as recorded in its WTO Protocol of Accession.[3] Here we focus only on the commitments to be met between 2002 and 2007 (relative to the revised base case in which China's reforms up to 2001 only are in place). For key agricultural import policies, these remaining reform commitments are assumed to shift nominal rates of protection (NRPs) from column 3 to column 6 of Table 6. As well, the export subsidies in place in 2001 (34 per cent for maize, 10 per cent for cotton) are to be eliminated, and we assume that no new farm production subsidies are introduced (even though China's WTO Protocol of Accession allows it to provide an aggregate level of support of up to 8.5 per cent).[4] The choices for new agricultural NRPs fall into three categories: no change if they were negative in 2001 (rice, meats, vegetables and fruits); a move to partway between the in-quota and out-of-quota tariffs if the TRQs bite (wheat, coarse grains, cotton); and a move to the new in-quota tariffs otherwise (oilseeds, sugar, milk). The sensitivity of the results from the first two categories is addressed in the qualifications section.

If this reform requires a movement of unskilled labour out of farming, then three impediments need to be kept in mind. First, the moving farm workers will be less-than-perfect substitutes for those already engaged in non-farm activities. Econometric work by Sicular and Zhao (2002) suggests that restraint on mobility could be modelled via a CET function with an elasticity of transformation of 1.3, and we have incorporated this into our GTAP model for China. Second, urban social welfare benefits such as subsidies to housing, food, education and health are not available to non-urban people unless they purchase a residence permit, or *hukou* (Zhao 1999). Third, farm workers who permanently cut their ties with the rural sector may lose entitlement to returns from their family's land, and even the direct support of family members (Hussain 2001). The last two impediments have contributed to the persistence of a very wide gap between farm and non-farm returns to unskilled labour. Even after adjusting for differences in work effort, Sicular and Zhao (2002) estimate the gap to be one-third of the urban unskilled wage. We therefore assume that the gap will remain even if workers do move off the farm in the initial simulation (though the sensitivity of the results to that assumption is explored in the qualifications section).

With these modifications to the GTAP model, what results emerge from implementing the remainder of China's WTO commitments after 2002? Here we focus on the comparison of farm and non-farm results. This is not quite the same as a comparison of rural versus urban given the many non-farm rural activities (see Table 2), but is the best we can do with the GTAP model which does not distinguish activities by location within a country.[5]

What results can we anticipate?

Carter and Estrin (2001) develop a model with two sectors, agriculture and non-agriculture, that assumes capital is sector-specific and labour is inter-sectorally mobile. The authors assume that the trade reform ensuing from China's WTO accession will lower the relative price of non-farm goods (with larger tariff cuts for non-farm than farm products). If the economy starts from equilibrium in the labour market, then this price change will lower labour's wage in terms of farm goods and cause labour to migrate from non-farm to farm activities. If, however, the economy starts from a situation where farm workers face impediments to moving to non-farm employment, the wage in the non-farm sector will exceed that in agriculture. In this case, a fall in the relative price of non-farm products would lower the non-farm wage without affecting the low farm wage (if both are again measured in terms of agricultural goods). Thus trade reform would bring an additional gain, namely a reduction of distortion in the labour market. If the government simultaneously removes the barrier to out-migration for farm labour, the economy will enjoy yet another welfare gain. Farm workers will benefit from trade reform alone, since they consume non-farm products whose prices will fall with reform, and they will benefit even more if impediments to their migration are eliminated. For non-farm workers, however, both these policy changes will cause wage cuts in terms of farm products, which may more or less offset the fall in price of the non-farm products they consume. Carter and Estrin (2001) therefore conclude that further trade liberalisation will help reduce China's rural–urban income inequality (at least for labourers), and more so if the current policies that inhibit off-farm migration are relaxed.

Neat though Carter and Estrin's analysis is, it has several flaws. First, it ignores differences between skilled, unskilled non-farm and unskilled farm workers. Second, its assumption that the incentive to produce non-farm relative to farm products will fall following WTO accession needs to be tested, since there will be likely be positive and negative changes to the prices of both sets of tradables, and the demand for non-tradables will likely rise on account of income gains from trade reform, and their cost of production will change. Does the Carter and Estrin conclusion, that WTO accession will reduce rural–urban income inequality, hold up when these facts are taken into account in a detailed empirical model like GTAP? And how will poverty be affected, bearing in mind that rural incomes are currently only one-third of urban ones (Table 8) and that 85 per cent of rural households in the bottom quartile of income distribution farm (Sicular and Zhao 2002)?

What then are our results? Our analysis begins with the core accession scenario, followed by three alternative scenarios.

The core WTO accession scenario

To begin with the bottom line of our core scenario, the results lead us to the opposite conclusion to Carter and Estrin's. The main reason for this difference is that the GTAP model suggests that the relative producer prices not only of farm products but also of textiles will be lower following completion of the remaining WTO accession reforms than if these reforms are not carried out. Despite the removal of 'voluntary' export restraints on sales of textiles to the US and EU, relative textile prices are lower for three reasons. First, demand for labour on farms is lower, which lowers the cost of unskilled labour in manufacturing. Second, import taxes on the intermediate inputs used in manufacturing are lower because of accession. Third, the real exchange rate effect of tariff reductions lowers the cost of non-traded goods and other factors used as inputs in production.

By 2007, the lower cost structure of unskilled labour-intensive manufacturing activities causes demand for unskilled non-farm labour to increase (by 0.8 per cent), however lower farm product prices cause demand for unskilled farm labour to decrease (by 1.7 per cent). A consequence of the reform is a 0.7 per cent fall in real wages for unskilled farm labour, and a rise in real wages for unskilled non-farm labour of 1.2 per cent (after adjusting for changes in the aggregate cost of living).[6] Farmers are also made worse off by lower demand for farmland, the return from which is 5.5 per cent lower following WTO accession reforms. Meanwhile, the real wages of skilled labour increase by 0.8 per cent, and returns to non-farm capital are 1.3 per cent higher. Together these results suggest that proportionally the owners of non-farm capital gain almost the same amount as unskilled labourers in non-farm employment, but the latter do better than skilled workers. Thus, income inequality may improve slightly among non-farm households dependent mainly on labour income[7], however it can be expected to worsen between farm and non-farm households. With only 1.7 per cent of unskilled farm workers (about 6 million) leaving agriculture for non-farm work (because of the assumed impediments to out-migration), and with land returns depressed by 5.5 per cent and farm labour returns by 0.7 per cent, the gap between farm and non-farm incomes—even within rural areas, and certainly between rural and urban areas—looks set to rise unless remedial action is forthcoming.

Sectoral details of the GTAP results are summarised in Table 9. The largest declines in consumer prices due to accession are for motor vehicles, oilseeds and sugar (and for beverages and tobacco, although if China uses import taxes on these items as a form of consumption tax and their decline is matched by an increase in domestic sales taxation, their prices might not decrease). Prices for textile products and to a lesser extent clothing also decline. Among farm products, consumer prices for livestock products rise slightly, somewhat more for grains, and

Table 9 **Sectoral volume effects of China's WTO accession reforms (core case), 2002–07** (per cent and 1997 US$ million)

	Output	Household consumption	Exports	Imports	Trade balance (US$ million)	Producer prices	Consumer prices
Rice	-2.1	-0.1	6.1	-7.1	64	-0.9	0.9
Wheat	-2.0	-	18.9	-10.1	174	-2.8	0.4
Feedgrains	-2.3	-0.1	-77.8	-2.4	-596	-1.5	1.9
Vegetables and fruits	-3.4	0.1	14.6	-6.3	214	-2.1	-0.1
Oilseeds	-7.9	0.9	29.8	20.9	-789	-6.2	-4.7
Sugar	-6.5	0.6	13.9	24.1	-73	-2.2	-3.1
Plant based fibres	15.8	-0.6	-51.8	7.7	-189	-0.4	3.1
Livestock & meat	1.3	-	15.5	-8.9	837	-0.1	0.2
Dairy	-2.0	-	13.5	23.8	-143	-1.2	0.2
Other food	-5.9	0.4	11.4	62.6	-3,460	-1.7	-1.8
Beverages & tobacco	-33.0	1.5	9.7	112.4	-14,222	-9.0	-6.9
Extractive industries	-1.0	-0.2	7.5	-4.4	2,088	-0.2	1.2
Textiles	15.6	0.7	32.7	38.5	-10,366	-1.8	-3.2
Apparel	57.3	0.5	105.8	30.9	49,690	2.3	-1.9
Light manufacturing	3.7	-	5.9	6.8	1,786	0.1	-
Petrochemical industry	-2.3	-0.2	3.1	11.8	-8,810	-0.7	0.8
Metals	-2.1	-0.3	3.7	6.8	-1,893	-0.2	1.3
Autos	1.4	1.0	27.7	24.0	516	-5.3	-4.2
Electronics	0.6	0.5	6.7	6.8	453	-0.4	-1.7
Other manufactures	-2.1	-0.2	4.1	18.9	-11,291	-0.1	0.8
Trade and transport	-	-0.3	0.8	-0.4	493	0.5	1.6
Construction	0.9	-0.4	2.7	17.5	-436	0.4	1.7
Communication	-0.5	-0.4	-0.5	10.9	-56	1.1	1.9
Commercial services	-2.0	-0.5	-0.4	35.4	-1,749	-0.1	1.9
Other services	-1.7	-0.3	1.4	33.6	-1,525	-	1.6

Source: Authors' GTAP results. For details contact Elena Ianchovichina at the World Bank.

significantly for cotton (plant-based fibres). Producer prices fall further for farm products than for most other products except autos, and farm output is down for all products except cotton and meat. Moreover, with the abolition of export subsidies feedgrain exports shrink by three-quarters and cotton exports by half. Differences in the effects on production and consumption shown in Table 9 reveal that China's food, feed and fibre self-sufficiency will be reduced at least slightly by these reforms. But the reductions are really quite minor. As the trade balance column in Table 9 suggests, net imports or all agricultural and food products would be increase by only US$3.96 billion per year by 2007 (in 1997 US$), representing only 1 per cent of total imports.

The above results depend, as always, on the assumptions in the model. To check the sensitivity of some of these assumptions, three alternative scenarios were run and their results compared with those of the base scenario. The three alternative scenarios are characterised by greater agricultural protection cuts, removal of negative agricultural protection and removal of the wedge between farm and non-farm wages.

Alternative scenario 1: greater agricultural protection cuts

What if the grain, sugar and cotton NRPs were to drop to the in-quota tariff levels shown in Table 6, for example? The differences for factor returns are not great in aggregate, but they would be in the case of increasing income inequality. On the one hand, unskilled farm wages would fall 0.9 per cent instead of 0.7 per cent and returns to farm land would fall 6.4 per cent instead of 5.5 per cent. On the other, non-farm wages would rise 1.4 per cent instead of 1.2 per cent for the unskilled and 1.0 per cent instead of 0.8 per cent for skilled workers. These changes would attract only another million workers from farms, given the assumed impediments of off-farm migration. However, domestic production of grains, sugar and cotton would be less, and domestic consumption would be greater, thus self-sufficiency in these products would be slightly lower. Even so, net imports of all food and agricultural products would only increase by US$1.5 billion per year by 2007 (totaling US$5.43 billion instead of US$3.96 billion). Such an import increase would be within the TRQs for all these items, with the possible exception of maize (depending on the extent to which other feedgrains that are not TRQ-restricted, such as barley, are substitutable for maize). National economic welfare would increase only slightly in this case, as compared with the core scenario (bottom row of Table 10).

Alternative scenario 2: removing negative agricultural protection

If negative NRPs for rice, meats, vegetables and fruits were to be raised to zero, the income distributional effects would go in the opposite direction to those in the first alternative scenario, though the changes would not be great. By comparing columns 1, 2 and 3 of Table 10, it can be seen that the second alternative scenario would cause as much improvement in income distribution as the first alternative scenario would worsen it. The national economic welfare gain would be about 3 per cent more than that of the core case (bottom row of Table 10).

Alternative scenario 3: removing the wedge between farm and non-farm wages

If one expected all off-farm migrants to move to rural rather than urban non-farm jobs, and if those migrants were just as adept at such non-farm work as they were at farm work (for example, if they were young and thus similar to other new entrants to unskilled rural non-farm work), the assumption of a one-third wedge between unskilled farm and unskilled non-farm wages could be dropped.[8] Rerunning the model without the assumed wedge has a significant impact on the estimated number of farm workers moving to non-farm employment and on the industry composition of the Chinese economy. If this barrier to farm out-migration was removed,

Table 10 **Change in China's real factor prices and national economic welfare due to WTO accession, 2002–07** (per cent, welfare in 1997 US$ billion)

	Core accession case	Alternative 1: greater agricultural protection cuts	Alternative 2: core case plus removing negative agricultural protection	Alternative 3: core case plus removing labour market distortion
Farm unskilled wages	-0.7	-0.9	-0.5	16.8
Rental price of land	-5.5	-6.4	-4.7	-9.7
Non-farm unskilled wages	1.2	1.4	1.1	-3.8
Skilled labour wages	0.8	1.0	1.5	-1.7
Rental price of capital	1.3	1.5	1.5	-1.4
National economic welfare ($ billion increase)	9.56	9.57	9.87	11.05

Source: Authors' GTAP results. For details contact Elena Ianchovichina at the World Bank.

approximately 28 million people could be expected to leave their farm jobs following accession, compared with the 6–7 million people expected to leave if the *hukou* system remained in place.

The impact of the removal of this labour market distortion on industry composition is substantial, and if it occurs then WTO accession will have a much stronger positive impact on China's manufacturing and service sectors, allowing increased production of metals, automobiles and electronic equipment, and increased services. But this is only possible because agricultural output is less, meaning more imports of food and agricultural products would be needed (US$10.2 billion by 2007 instead of the US$3.96 billion of the core scenario).

The consequences for income distribution are also significant. Table 10 shows that greater off-farm migration would cause the earnings of farm workers (mostly self-employed farmers) to rise by 16.8 per cent, rather than fall by 0.7 per cent as in the core accession scenario. Although reduced demand for land would cause rental values to fall further (by 9.7 per cent instead of 5.5 per cent), because land's share of agricultural value added in China is roughly only half that of labour's share, farmers' overall earnings would still be considerably greater in this scenario. On the other hand, the earnings of all other factor owners fall in this scenario, particularly those of unskilled non-farm labour (by 3.8 per cent). However, given that farmers are among the country's poorest households, this scenario suggests that if the labour market distortion associated with the *hukou* system is eliminated then WTO accession will reduce income inequality and poverty. It also suggests that the boost to national economic welfare could be greater in aggregate if WTO accession were accompanied by labour market reform (US$11 billion per year instead of the US$9.6 billion per year of the core accession scenario).

Conclusions and policy implications

The assumption in GTAP that all households are identical in their consumption patterns is of course a fiction. They differ between urban and rural areas, between farm and non-farm households within rural areas, and within each of these groupings by region and income level. Post-simulation analysis at this level of detail is provided in Hertel, Zhai and Wang (2002) and Chen and Ravallion (2002), however even without this detail it is possible to draw some broad conclusions about the implications of WTO accession for agriculture and income distribution.

Our initial analysis assuming no reform of the *hukou* system affecting the labour market suggests that rural non-farm incomes will rise on average absolutely and possibly even relative to urban incomes in the case of households depending just on labour income (assuming urban labourers are more skilled). However, farm households facing increased import competition may be worse off in this case if, other things being equal, they are

- unable to send household members to jobs in expanding industrial and service industries
- are too poorly served with infrastructure to attract such activities to their own region
- are unable to diversify into producing farm goods whose relative price has risen and/or
- do not have relatives able to repatriate non-farm earnings.

In the core scenario then the incidence of rural non-farm poverty will fall, mainly because of growth in wages for unskilled workers in rural non-farm activities. Meanwhile, in agriculture-based hinterland provinces far from markets and in regions poorly served with the necessary infrastructure to attract investment in such expanding activities as textiles and clothing, poverty may well increase.

Table 11 **Effect on agricultural self-sufficiency of China's WTO accession with and without cuts in agricultural protection in OECD countries** (domestic production as a percentage of domestic consumption)

	Base case (no WTO accession for China)	China's WTO accession with no change in OECD policies	China's WTO accession with EU, US and Japan removing agric tariffs,export subsidies and domestic support
Rice	99.9	99.4	99.6
Wheat	93.0	88.2	89.1
Feedgrains	98.1	98.1	99.6
Vegetables and fruits	99.7	99.7	99.9
Oilseeds	81.0	81.3	82.3
Sugar	77.2	77.4	82.9
Plant-based fibres	83.8	83.7	83.9
Ruminant meat	88.5	88.2	89.4
Non-ruminant meat	97.7	97.8	98.9
Dairy products	81.8	80.0	84.9

Source: Yu, W. and Frandsen, S.E., 2002. China's WTO commitments in agriculture: does the impact depend on OECD agricultural policies? Paper presented at the Fifth Conference on Global Economic Analysis, Taipei, 5–7 June:Table 4.

In the first alternative scenario, this situation would be exacerbated slightly if the TRQ-protected items (grains, sugar and cotton) became even less protected than initially expected. On the other hand, the second alternative scenario suggests that the situation could be made slightly less extreme by removing the negative protection affecting rice, meats, vegetables and fruits. However, these two alternatives involve only changes to the magnitudes of effects rather than the sign of those effects, and add only a small amount to aggregate gains from trade liberalisation.

What the third alternative scenario makes clear, by way of contrast, is that the sign of the effects could be switched to favour the poorer farm households—albeit at the expense of the richer non-farm ones—if WTO accession were accompanied by reform of the *hukou* system that allowed some members of those households to obtain higher-paying non-farm employment and repatriate earnings back to their farm families. This would entail a national economic welfare gain one-sixth greater than that of the core scenario without labour market reform.

National self-sufficiency in food, feed and fibre will fall somewhat, particularly as demand for livestock products grows with income gains from trade reform and as production of natural fibre-based textiles and clothing expands. Overall, however, most of these self-sufficiency effects of the remaining reforms required as part of WTO accession are relatively very small in magnitude, and especially so when compared with the changes that take place in the course of normal economic growth, as shown in earlier analyses by Anderson et al. (1997a; 1997b). They would be largest in the third alternative case, where labour market distortions are also removed, however this is not to say that food security would decrease in that case. It is changes in the incomes of the poor, and hence in their capacity to purchase food, that affect food security, and in the third alternative scenario the poorest aggregate group (farm households that have been heavily dependent on agriculture) gains most.

What else should be done if the labour market is not reformed? If in this case some farmers' incomes decrease relative to those of non-farm households, and if there is concern about the fall in agricultural self-sufficiency, the most obvious policy solutions would involve investments in rural human capital, rural infrastructure and R&D, and changes in grain marketing.

First, the government could consider further investments in basic rural education and health services, in order to reduce the adverse effects of trade reform on the poor and on food security. Better education and health for farmers' children would not only boost their farm productivity should they choose to stay on the farm after finishing school, but also increase their capacity to find more lucrative off-farm work and to adjust to non-agricultural employment and living (Schultz 1975).

Second, improvements in rural infrastructure such as roads and rail would mean that a greater proportion of the final price received at the end of the marketing chain for farm products can come back to farmers. Such improvements would also lower the barriers to off-farm work for members of farm families, making it easier for them to take advantage of expanding employment opportunities in rural townships.

Third, agricultural R&D would ease both urban and rural poverty (Fan, Fang and Zhang 2001; Hazell and Haddad 2001). A boost in agricultural productivity could significantly offset the 2–8 per cent drop in agricultural production estimated in the core scenario to result from WTO accession. An important policy issue here is whether China should deny itself the use of GMOs in food production. Since our results suggest that China will export less food after its WTO accession than before, there is less sense in banning GMOs in food in China if such a ban were based on fears of otherwise being denied access to overseas food markets abroad (Anderson and Yao 2001).

Fourth, the government could reduce its regulation of grain marketing, in particular by bringing an end to compulsory procurement at less-than-market prices and reducing the provision of grain to urban consumers at less-than-market prices.

If all this were considered insufficient support for the incomes of the poorest farm households, then short-term adjustment assistance via infra-marginal (hence non-output inducing) producer price subsidies could be provided to boost farm incomes without boosting farm output (in an equal but opposite way to that used to tax farmers in earlier decades—see Sicular 1988). Such an intervention would probaby be deemed WTO-consistent because of its decoupled nature. In any case, if it was just targeted to poor farmers it would be unlikely ever to exceed 8.5 per cent of the value of China's output of the product concerned (its *de minimis* exemption limit for product-specific support under Article 6.4 of the Agreement on Agriculture).

Finally, now that China is in the WTO it has the opportunity to take part in new rounds of multilateral trade negotiations, whereby it can seek increased market access for its exports of farm (and other) products abroad. If WTO membership improves China's chances of expanding its access to agricultural markets more than other markets abroad in the future, China's farmers and rural areas would benefit. Martin (forthcoming) points out that Chinese farm exports face particularly high barriers abroad, thus this potential benefit is not insignificant in theory (although in practice it may be difficult to realise, especially if the main barriers are SPS measures).[9] This proposition was tested recently by Yu and Frandsen (2002), also using the GTAP model. The authors find that reductions in barriers to agricultural imports and in domestic support to farmers in OECD countries reduce the extent to which China's farm output would fall with WTO accession and in some cases leads to expanding rather than contracting output. As a consequence, China’s agricultural imports decrease slightly and its agricultural exports increase. As Table 11 shows, not only would China’s food self-sufficiency be higher with than without agricultural protection in the European Union, United States and Japan, but the difference in most cases would be more than enough to offset the fall in self-sufficiency expected to result from China’s WTO accession. Such reform in the OECD would clearly benefit farm households in China, representing a further pro-poor consequence of trade reform.

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Appendix Table A Cumulative (and annual) percentage growth rates over the period 1997–2007

Regions	Population	Unskilled labour	Skilled labour	Capital	Manufacturing TFP*
North America	11 (1.05)	11 (1.08)	12 (1.11)	49 (4.07)	High
Western Europe	0 (0.03)	-1 (-0.08)	1 (0.07)	30 (2.69)	High
Australia/New Zealand	10 (0.98)	12 (1.14)	10 (0.99)	55 (4.45)	High
Japan	1 (0.06)	-2 (-0.19)	-7 (-0.71)	35 (3.02)	Medium
China	8 (0.81)	13 (1.26)	50 (4.15)	174 (10.62)	High
Taiwan, China	9 (0.86)	11 (1.05)	14 (1.36)	96 (6.97)	High
Other NICs	10 (0.93)	-1 (-0.10)	55 (4.47)	88 (6.53)	Medium
Indonesia	16 (1.50)	17 (1.59)	123 (8.36)	25 (2.27)	Low
Vietnam	15 (1.40)	32 (2.79)	36 (3.10)	111 (7.78)	Medium
Other Southeast Asia	18 (1.70)	22 (2.04)	134 (8.87)	60 (4.83)	Low
India	18 (1.67)	23 (2.10)	78 (5.92)	88 (6.54)	Medium
Other South Asia	25 (2.22)	30 (2.69)	80 (6.06)	72 (5.55)	Medium
Brazil	14 (1.31)	19 (1.77)	72 (5.60)	31 (2.75)	Medium
Other Latin America	18 (1.68)	6 (0.57)	90 (6.65)	54 (4.42)	Low
Turkey	16 (1.47)	19 (1.75)	107 (7.55)	55 (4.46)	Low
Other Middle East and North Africa	24 (2.16)	37 (3.23)	67 (5.24)	28 (2.50)	Low
Transitional economies	-1 (-0.11)	6 (0.56)	9 (0.90)	33 (2.88)	High
South African Customs Union	15 (1.39)	31 (2.76)	47 (3.92)	34 (2.94)	Low
Other sub-Saharan Africa	30 (2.65)	40 (3.42)	54 (4.42)	38 (3.26)	Medium
Rest of world	18 (1.63)	23 (2.10)	35 (3.05)	68 (5.32)	Low

Note: *The low, medium, and high growth assumptions for total factor productivity (TFP) in manufacturing correspond to annual growth rates of 0.1per cent, 1.0 per cent and above 2.0 per cent (between 2 per cent and 4 per cent) respectively.

Source: Ianchovichina, E. and Martin, W., 2002. Economic impacts of China's accession to the WTO, Paper presented at the DRC/World Bank Conference on China's WTO Accession and Poverty Alleviation, Beijing, 28–29 June.

Appendix Table B

	Eastern provinces[a]	Central provinces[a]	Western provinces[a]	National total[a]
Share (per cent) of national agricultural industry output of,				
Rice	36.9	44.8	18.3	100
Wheat	41.4	37.3	21.3	100
Corn	34.4	41.6	24.0	100
Vegetables	53.6	32.9	13.5	100
Fruits	61.3	18.9	19.8	100
Oilseeds	34.3	48.9	16.8	100
Sugar	62.7	11.5	25.8	100
Cotton	28.5	35.2	36.3	100
Livestock (meat)	41.9	36.6	21.5	100
Dairy and products	34.8	35.6	29.6	100
Pulse	24.7	60.1	15.2	100
Aquatic products	79.5	17.5	2.6	100
Eggs	54.9	35	10.1	100
Share (per cent) of regional total food and agricultural output due to,				
Rice	9.04	16.17	13.64	
Wheat	5.64	7.48	8.82	
Corn	4.03	7.17	8.54	
Vegetables	10.92	9.88	8.37	
Fruits	9.17	4.17	9.01	
Oilseeds	4.04	8.49	6.02	
Sugar	0.88	0.16	0.36	
Cotton	1.21	2.20	4.69	
Livestock (meat)	18.50	23.81	28.88	
Dairy & products	0.96	1.45	2.49	
Pulse	1.20	4.32	2.26	
Aquatic products	28.61	9.28	2.85	
Eggs	5.64	5.30	3.15	
Total	100	100	100	
Total agricultural output value (billion yuan)	1,213	841	438	2,492
Sum of 13 products above	832	565	274	1,671
Others[b]	380	276	165	821
Share of 13 products in total (per cent)	68.6	67.2	62.5	67.1

[a] Eastern provinces include Beijing, Tianjin, Hebei, Liaonin, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, Hainan; central provinces include: Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Hunan, Hubei, Henan; western provinces include Sicuan, Chongqing, Yunan, Guizhou, Tibet, Shaanxi, Gansu, Ninxia, Qinghai, Xinjiang.
[b] Others include millet, sorghum, tuber crops, peanuts, sesame, non-cotton fiber crops, tobacco, medicinal plants, melons, succulence, tea, flowers, wool, honey, silk-cocoon, forest products and so on.
Note: All data in this table are for 2000.

Notes

[1] The difficulties China had in 2000 in exporting food products to Japan, Korea and the United Kingdom because of these countries' quarantine/SPS measures should have eased following WTO accession, or at least become challenge-able under WTO Dispute Settlement provisions. In the empirical analysis that follows, however, they are ignored, as is the possibility that China itself may use quarantine measures to limit its imports of farm products.

[2] The GTAP (Global Trade Analysis Project) model is a multi-regional, static, applied general equilibrium model based on neoclassical microeconomic theory, including full employment of all factors of production, constant returns to scale and perfect competition. See Hertel (1997) for comprehensive documentation. The Version 5 data base is described at www.gtap.org. The model is solved with GEMPACK software, described in Harrison and Pearson (1996).

[3] A particularly important feature of the authors' analysis is the inclusion of China's duty exemptions in the base scenario, since otherwise the model would overstate gains from tariff reductions. Tariff cuts are from 2001 applied rates to post-accession bound rates (or zero if the latter exceed the former). In this application aggregate trade balance and government tax revenue are both assumed to remain a fixed share of GDP. As explained in Ianchovichina and Martin (2002) the 2001 trade data are from COMTRADE, and the 2001 applied tariffs for China are from CDS Consulting Co. (2002).

[4] Three non-farm reforms are worthy of mention here. First, the 'voluntary' export restraint on China's textile and clothing exports to the United States and European Union, expressed in the base scenario as taxes on those exports, is removed. Second, restructuring of the motor vehicles and parts industry following WTO accession is modelled as a 20 per cent productivity boost to vehicle assembly, following Francois (2002). Third, liberalisation of China's services sector also follows Francois (2002).

[5] For a more detailed breakdown showing both farm and non-farm rural households, see Hertel, Zhai and Wang (2002).

[6] The present version of the GTAP model has only one aggregate household, so it cannot distinguish between the different consumption bundles and factor endowments of different types of households. Here, real price changes refer to changes in price relative to changes in the consumer price index, given the consumption bundle of the aggregate household.

[7] The wages of skilled workers might increase more than suggested here, since we do not take into account endogenous productivity growth resulting from liberalisation of the service sectors.

[8] Evidence of increased flexibility in China's labour markets in recent times is presented in Lohmar (2001).

[9] There also remains the question of how China's membership will alter the relative strengths of liberal versus protectionist forces in the next round of multilateral WTO farm trade negotiations. Mathews (forthcoming) argues that China's accession is likely to affect both sides, thus the net effect is difficult to predict *a priori*.