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The impact of trade liberalisation on income distribution in China

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abstract

While poverty has been declining with strong income growth, China's income distribution has deteriorated in recent years. Trade policy has been advocated to address income disparities, especially those between rural and urban households. Using a computable equilibrium model this paper analyses the impact of trade policy on incomes of different households. Particular attention is given to te various non-farm sources of incomes for rural and urban factor markets.

The impact of trade liberalisation on income distribution in China: a general equilibrium analysis

With rapid economic growth since the economic reform beginning in the late 1980s, the distribution of household income in China has gone through marked change. During the period of the late 1970s to the mid-1980s, when reform was largely confined to agriculture, rural household income was growing more rapidly than urban income and hence rural-urban income distribution improved. As reform was gradually extended to the urban sector, income growth in rural China slowed and urban income growth accelerated. As a result, the rural-urban income gap began to enlarge. At the same time, income disparities among regions were also on the rise, as economic growth in coastal China grew more rapidly than inland areas. In addition, income distribution within both rural and urban China has also become less equitable.

How to deal with the growing income gaps has become an important policy issue in recent years. As these rising gaps are the result of profound structural change in the Chinese economy, policies for addressing income distribution issues have critical implications for sustained growth which underlines ongoing structural change. For example, some have advocated border protection to protect farmers' income as well as to ensure food self-sufficiency. Others argue that China should make minimum reductions in its industrial tariffs, especially those that are vital for 'infant industries' and industries of 'national interests', in order to avoid drastic structural adjustment and growing income disparities.

In this paper, we attempt to analyse the impact of trade liberalisation on income distribution in China. We address the issue with special emphasis on the changing composition of household incomes, especially those of rural incomes. A multi-household computable general equilibrium model (CGE) is applied in the analysis. The advantage of this approach is that it takes into account both sources of incomes and the pattern of household consumption simultaneously. In the following section

we provide a brief overview of the development of income distribution since economic reform. The CGE model is then introduced, followed by a discussion of the model closure issues. We then report on some preliminary simulation results on the impact of trade liberalisation on income distribution, and draw some conclusions.

The distribution of income since the late 1970s

Table 1 presents rural and urban incomes over the period 1978-95. The change in the ratio of urban to rural income over time summarises income inequalities between the rural and urban sectors. It should be noted, however, that statistics in Table 1 do not provide a complete picture of rural-urban income gaps, as they do not include implicit government subsidies to urban households. Rental control in urban China has kept housing expenditure extremely low, normally no more than a few per cent of total household income. There is a whole range of other subsidies to urban households in the areas of food consumption, medical services, education and public transport. Subsidies to rural households are much smaller.

Bearing these in mind, one finds that the late 1970s, and the first half of the 1980s, saw steady declines in the income gap between rural and urban households. Two factors helped reduce the rural-urban income inequality: strong growth of agricultural production and increases in farm prices. The introduction of the household responsibility system and the abolition of the Commune System greatly increased production incentives and generated substantial productivity improvement (Lin 1992; McMillian, Whalley and Zhu 1990). In the period 1978-84, agricultural output grew 15 per cent per annum, while industrial production increased 10 per cent per annum. The decline in the rural-urban income gap was halted after 1984 when urban reform began earnestly. However, it was not until the early 1990s when the rural-urban income gap began to widen. In 1995, rural income grew slightly more rapidly than urban income. It is not clear that this represents a reversal of the trend in the previous four years.

The accelerated growth of the urban economy marked profound structural change in the Chinese economy. On the demand side, the consumption of manufactured commodities has been growing more rapidly than agricultural commodities because of more elastic demand for manufactured commodities. Trade liberalisation in the manufacturing sector, both in China and the rest of the world, has also provided a boost to demand for manufactured goods. On the supply side, as capital and skills accumulate with rapid growth, the manufacturing sector has grown strongly, especially in rural China. Most of the expansion of rural manufacturing has, however, occurred in the coastal regions.

Table 1 **Income disparities between rural and urban households, 1978-95**

Year	Annual per capita net income of rural houeholds (yuan)	Annual per capita income of urban households (yuan)	Ratio of urban to rural income
1978	134	316	2.4
1980	191	439	2.3
1985	398	685	1.7
1986	424	828	2.0
1987	463	916	2.0
1988	545	1119	2.1
1989	602	1261	2.1
1990	686	1387	2.0
1991	709	1554	2.2
1992	784	1826	2.3
1993	922	1337	2.5
1994	1221	3179	2.6
1995	1578	3893	2.5

Source: SSB, 1996. *Statistical Yearbook of China 1996*, Beijing, China Statistical Publishing House.

Table 2 summaries these disparities among three broad regions: east, central and west China. In the pre-reform period, income levels were quite similar among the regions because of the egalitarian income distribution system at the time. Since 1978, income inequalities among the three regions have income substantially over time. The income gap between east and west is the largest. On average, per capita income in the east was twice as high as in the west in 1995. It should be noted, however, that this comparison of average income conceals potentially much greater income disparities between poor and wealthy households, both within and between the regions.

Table 2 **Regional comparisons in rural income, 1978-95** (yuan per capita)

Region	1978	1981	1985	1990	1995
East	147	275	489	839	2269
Middle	117	224	362	549	1381
West	121	193	314	487	1117

Source: SSB, various years. *Statistical Yearbook of China*, Beijing, China Statistical Publishing House.

In terms of consumption, which is perhaps a more accurate indication of living standards, the gaps among the regions are smaller. This is presumably due to the fact that the poor regions receive greater poverty relief than wealthier regions, and that wealthy households save more. Nevertheless, in 1995 an average household in the east consumes 50 per cent more than its counterpart in the west (Ministry of Agriculture 1996). Similar to income levels, the consumption gaps among the regions are growing over time.

China's rural reforms tended to benefit poor provinces first, while industrial reform had its greatest impact in the coastal region. Most industrial reform measures were first experimented with in the coastal regions, especially in the four special economic zones (Shenzhen, Xiamen, Zhuhai and Shantou). This has led to much more rapid growth in the coastal region and exacerbated the regional income gaps which had already existed in the pre-reform era. Because of the 'trickle-down effects', the middle part of the country has also experienced more rapid growth than in the west, albeit less rapidly than in the coastal region. Growing geographical income disparities have become a political issue in China with regional leaders from the middle and the west continuing to ask for more autonomy and resources from the central government.

Rural industry has been the most dynamic sector of the Chinese economy in the past two decades. Regional disparities are largely the result of different degrees of contribution of the non-agricultural sector to household incomes in these regions. Structural change resulting from rapid economic growth is most marked in the coastal region. Export-oriented policies have led to sustained growth of labour-intensive manufactured exports in the region. As a result, the sources of household incomes in this region have changed drastically. In some traditionally agricultural areas in southeast China, agriculture is no longer the main source of rural incomes.

Comparable regional data for urban populations are not available. Table 3 shows per capita income over time for various income groups of urban households. Clearly, there are considerable disparities between poor and wealthier households, and similar to regional incomes in rural areas, inequalities among urban households have been increasing rapidly. For example, the ratio of the income for the wealthiest ten per cent of households to the poorest 5 per cent increased by 25 per cent over the period 1985-95.

Several factors may explain the differences in income and consumption levels among urban households and the growing inequalities over time. Although wages are quite egalitarian, there are considerable variations in dependency ratios among households. Wealthier households tend to have fewer dependent family members than poor households (Griffin and Zhao 1993). As a result of industrial restructuring, many enterprises, especially state-owned enterprises, have experienced great

difficulties and wages for their employees tend to grow less rapidly than those enterprises which have performed well during the reform period. Unemployment has risen. Employees in poorly performed enterprises also receive fewer bonuses than their counterparts in well performed enterprises. Bonuses, including those in kind, constitute a large part of employees' incomes from their enterprises. As the private sector grows, there is an increasing number of people who have become wealthier.

Table 3 **Per capita urban income by household group, 1985-95** (yuan)

Household group	1985	1990	1995
Lowest five percent	438	783	1985
Lowest decile	483	860	2178
Second decile	599	1077	2778
Second quintile	692	1267	3364
Third quintile	805	1489	4074
Fourth quintile	836	1757	4958
Ninth decile	1098	2072	6036
Highest decile	1384	2676	8231

Source: SSB, various years. *Statistical Yearbook of China*, Beijing, China Statistical Publishing House.
Note: numbers in the parentheses are ratios with the lowest five percent as the benchmark (1.0)

Trade liberalisation and the inflow of foreign direct investment have accelerated industrial restructuring. However, it is not clear how trade liberalisation has affected income inequalities. Most import-competing industries in China are heavy industries. In the central planning era, employees in these industries tend to be better paid than those in light industries. Thus, trade liberalisation has probably exacerbated the unemployment problem in the short run. However, trade liberalisation has greatly boosted the exports of light industries, thus reducing urban income inequalities. Similarly, much foreign direct investment has been made in labour-intensive industries and the coastal region. In addition, trade liberalisation and foreign investment have been an important part of the strong growth of township and village enterprises. This of course tends to reduce rural-urban income inequalities, but exacerbates rural and regional income inequalities. At the same time, trade liberalisation has changed relative prices of various commodities in domestic markets. As various households have different patterns of consumption, the impact of changes in relative prices differs among real households.

Thus, the analysis of the effect of trade liberalisation on various households is complicated. Not only does trade liberalisation affect the incomes of various

households through its impact on different industries, but also household consumption. To take these effects simultaneously, a general equilibrium approach is highly desirable.

The model

There is a growing body of literature dealing with the relationship between trade policy and income distribution (Kim and Turrubiate 1984; Lundborg 1984; Bourguignon and Morrisson 1989). Dervis, de Melo and Robbinson (1982) suggested three potential mechanisms affecting the distribution of income in an economy: (1) the impact of sectoral structure of production, employment and prices; (2) policy changes or external shocks affecting income distribution through operation of factor and product markets; and (3) the direct and indirect effects of the determining factors. They then argued that analysis of income distribution requires a general equilibrium rather than a partial equilibrium framework. A large number of studies have attempted to incorporate income distribution mechanisms in CGE models (Adelman and Robbinson 1978; Ahluwalia and Lysy 1979; Lysy and Taylor 1980; Coxhead and Warr 1991). The study by Anderson and Warr (1987) was particularly interesting as they focused on the relationship between agricultural price distortion on income distribution in a simplified CGE model.

Major features of the model

The model used in this study stems from an earlier CGE model built by Huang (1993) for the analysis of China's rural reform. It falls into the Johansen type of general equilibrium models. There are several salient features of this model which make it suitable for the analysis of income distribution issues in China.

The most important of them is the introduction of multiple households. There are altogether six household categories: three rural and three urban. The rural-urban break-down is obviously important in any analysis of income distribution in China, but further disaggregation of rural households is critical. As discussed earlier, one of the most important outcomes of China's economic reform has been growing disparities among different regions. The contrast of income levels is the most salient among the three broad regions: the coast, the middle and the west. For this reason, our three categories of rural households are classified in broad concordance with the three regions.

The second most important feature of the model is the break-down of rural and urban industries. Rural industries are different from urban industries. They tend to be more labour-intensive than the urban counterparts. Rural industries are an

integral part of the rural economy and tend to be segregated from urban industries, both because of geographical reasons and policy barriers. Most labour and capital employed in rural industries are from rural households, and value added in these industries accrue to these households. The break-down of rural industry from urban industry is therefore crucial to capture the potential effects of agricultural trade policy on rural households through their linkages to various rural industrial activities.

Another important feature of the model is that labour is classified in many categories. China still maintains a restrictive internal migration policy separating rural population from its urban counterpart. This policy is enforced through a household registration regime, which classifies households into rural and urban. In the central planning era, the rationing of food and other necessities was the major barrier to potential rural migrants. As this barrier has fallen with the increased abundance of commodities, barriers to employment, urban housing, education and medical services have become the major deterrents to potential rural migrants. Although there is increasing migration from rural to urban areas, the policy renders imperfect mobility of labour. Except in the construction and some service industries, rural migrants are largely excluded from urban industries. Given this transitional stage of labour market policy, we have grouped labour into two categories: rural and urban. Rural labour is further split into farm and non-farm labour.

China's capital market is also segmented, especially between rural and urban sectors. There are few formal channels for capital to flow from one sector to another. For this reason, we separate rural and urban capital markets. Capital in the rural sector meets demand from agriculture and rural industries, while urban capital is used in urban industries. However, limited mobility of capital is allowed across the two capital markets.

Rural households earn their incomes mainly from the employment of their factors of production (land, labour and capital) in farming and rural industrial activities, although a small proportion of their incomes is from labour services provided to urban construction and service industries. On the other hand, urban households earn their income exclusively from the possession of labour and capital which are all employed in urban industries.

Commodity demand

There are five types of commodity demand in the model: intermediate inputs, investment, household consumption, government consumption, and exports. Intermediate demand is modelled with Leontief technology. That is, intermediate inputs are combined in fixed proportions with an aggregate of primary factors to produce gross output. There is no substitution between various intermediate inputs

or between the intermediates and the aggregate of primary factors. Similarly, investment and government demand by commodity is assumed to be proportional to total final absorption.

Household demand is non-homothetic, characterised by the linear expenditure system. Under this specification, change in household demand varies from commodity to commodity when income changes. In other words, income elasticities of demand differ among commodities, although they sum to unity when weighted by marginal shares of consumption, thus satisfying Engel's aggregation constraint.

Export demand is modelled with the constant elasticity of substitution (CES) function. Essentially, we assume that goods produced by China and the rest of the world are imperfect substitutes. The ease with which the goods substitute depends on a constant elasticity of substitution. Thus, the higher the price of Chinese goods relative to those of the goods from the rest of the world, the lower the demand for Chinese goods.[1] The advantage of using the CES specification is that market shares are taken into account, and that the elasticities of substitution are the only explicitly specified parameters which determine demand response. Global demand for exports is endogenous and determined by the price of the commodity concerned relative to the average price of all commodities. Since there is nothing to determine prices in the rest of the world in this model, we set them exogenous. Thus, the change in the world price of a particular commodity is the change in the price of the Chinese export multiplied by China's share of that commodity in the world market, and the change in the average world price of all commodities is the average of individual commodities weighted by these commodities' shares in world total exports, when there is no change in the prices of exports from the rest of the world.

Commodity supply

Import supply by the rest of the world is specified as an upward-sloping function. The higher the price, the greater the supply is. The impact of China's imports on the price it pays to the rest of the world depends on the elasticity of supply. When the elasticity is large, China is effectively a 'small' country; when the elasticity is small, China is a 'large' country and has the power of influencing border prices it pays. The elasticity of supply varies from commodity to commodity. For commodities that China has a large share of world imports—such as rice—the elasticity is small.

There are two agricultural sectors producing all the agricultural commodities in the model. The crops sector produces all grain and cash crops, while the livestock sector produces all livestock products, including meat, diary products and wool. How much each commodity is produced by an agricultural sector is governed by a

constant elasticity of transformation (CET) function. The output of each commodity depends on the relative prices of various commodities produced by the sector and the level of activity of that sector. Perfect competition and constant returns to scale are assumed for all industries. Thus, all industries earn zero economic profits.

The same commodity produced by the same rural and urban industries are assumed to be heterogenous. These heterogenous products are combined using a CES aggregation function to form a composite commodity. This essentially assumes that products produced by rural and urban industries are imperfect substitutes. The composition of national output can change in response to changes in relative competitiveness of rural and urban industries. Such a feature is particularly useful in modelling structural change in national output composition. Each of the composite commodities can be sold either in the domestic market or in the overseas market, depending on the prices prevailing in the domestic or overseas markets. Again, a CET function governs the transformation between domestic and overseas sales.

Primary factor markets

On the demand side, primary factors substitute one for another according to the CES function. The farm and forestry sectors use all three primary factors: land, labour and capital, while all other sectors use only labour and capital. The farm sectors only use farm labour, rural industries use only non-farm rural labour, and urban industries only use urban labour. Farm labour is perfectly mobile across farm sectors, non-farm rural labour is perfectly mobile across rural industries, and urban labour is perfectly mobile across urban industries. Rural capital is perfectly mobile across all rural sectors, and urban capital is perfectly mobile across all urban sectors. Land is a 'sluggish' factor, only partially mobile between the crop and forestry sectors.

On the supply side, rural and urban labour can be converted from one to another according to a CET process. Farm and non-farm rural labour can be transformed in the same way. Capital moves between rural and urban sectors in response to relative returns in the two sectors. The conversion of land use from one type to another is also modelled by a CET function. However, the cost of converting primary factors from one type to another is not taken into account in the model.

Factor markets are cleared by equating demand and supply for each of them. For labour, this means that total demand for farm labour by all farm sectors equals the total supply of farm labour. Similarly, total demand for non-farm rural labour by rural industries is equal to total supply of this category of labour, and the aggregate demand for urban labour by all urban industries is balanced by the supply of urban labour. Rural and urban capital markets are cleared in the same way. For land, demand for each type of land is matched by its supply.

Macroeconomic constraints

Gross household incomes come from factor returns. These incomes are taxed at different rates by the government, depending on the level of per capita income of each category of households. Disposable incomes, which are the difference between gross incomes and income taxes, are either used for consumption or saving. Wealthier households save a larger proportion of their disposable incomes than less wealthier households. The consumption expenditure is in turn the sum of spending on all commodities. It is assumed that households save a fixed proportion of their disposable incomes. However, this proportion can be altered through exogenous changes in the propensities to save. The budget for each and every household category is balanced.

Government revenues are from taxes. Current expenditure by the government is for purchase of various commodities, while government savings join household savings to form a national savings pool. Since government consumption of individual commodities changes proportionally with real domestic absorption of these commodities, government savings becomes a residual of total government spending, as we impose a balanced government budget. The difference between national savings and aggregate investment is the net inflow of capital, or trade balance since capital accounts are not explicitly incorporated in the model. With this external sector closure, budget constraints for government and each and every household category must hold, making one of the budget constraints redundant. As a result, we have chosen to introduce a 'slack' variable in the budget equation for the six household category. This variable is endogenous, but should be zero in any simulations as a test of Walra's law.

Welfare measurements

Equivalent variation is the measurement of welfare change in the model. It is a metric measure of household and government utility at the initial prices. For each category of households and the government, utility is a Cobb-Douglas function of consumption and savings. An alternative welfare measure would be real consumption. To make this a meaningful welfare indicator, the trade balance needs to be held constant, so that any change in real consumption does not result merely from changes from lending to, or borrowing from, overseas. The advantage of using real household consumption as an indicator of welfare change is that it is easier to interpret. In addition, for households who have little savings it is a very direct and precise measure of the change in their living standards. The disadvantage is that if

policy change can lead to significant changes in external accounts, fixing the trade balance will suppress adjustment to policy changes. This is particularly relevant when governments do not respond to changes in external balances arising from specific policy changes.

Model closure

How the model is 'closed' has fundamental implications for simulation results. In the previous section, we discussed some of the microeconomic issues relating to model closure, such as the mobility of factors of production. Here we focus on macroeconomic closure. An important macroeconomic assumption is that China can borrow from overseas or run down its foreign reserves if current account surplus declines, or China can 'export' capital if its trade surplus increases—in the base year 1992, China had a trade surplus of 131 billion yuan. In other words, we allow the trade balance to adjust endogenously to policy changes. The adjustment is made through change in the real exchange rate, with the nominal exchange rate being held constant. In fact, the nominal exchange rate is the numeraire. This macroeconomic setup is the key to the understanding of changes in government savings. As private savings are fixed proportions of household incomes and government savings are residual of total government revenues after government consumption, any change in the trade balance will affect government savings directly. When the trade surplus increases, government savings increases. When the trade surplus declines, government savings fall accordingly. The introduction of the government utility index is to capture the impact on national economic welfare of changes in government consumption and savings.

As the model is a comparative static one, there are no mechanisms for the determination of accumulation of endowments. In comparative static simulations, these endowments are held constant. This essentially assumes that while investment responds to policy changes, capital stock will not be altered by changes in investment. Thus, investment in the model only plays a role on the demand side. In projection exercises, endowment accumulation will have to be determined exogenously. In the case of capital accumulation, these exogenous forecasts are not necessarily the same as the endogenously determined growth of investment, if any lag between investment and its transformation into capital stock is assumed. In any experiment, returns to investment do not determine the magnitude of savings, as savings are driven by household incomes and government revenues.

Trade liberalisation and income distribution

In this section, we assess the impact of trade liberalisation on income distribution in China. The starting point for the experiment is the 1992 Chinese economy. In the first experiment, tariff rates *ad valorem* are cut by 30 per cent across the board. This of course leads to different degrees of impact on domestic prices as the 1992 tariff rates vary greatly among commodities. The impact is expected to be greater for commodities which are subject to higher initial tariffs. Depending on the composition of output of various industries and the consumption pattern of different households, the effect of trade liberalisation on individual household groups can vary significantly.

The 30 per cent tariff cut improves China's economic welfare considerably, and all household categories benefit from the cut (Table 4).[2] The most salient result from the simulation is an improvement in rural-urban equality. Real consumption and savings for rural households increase much more than urban households. Measured by equivalent variation, rural households benefit three times as much as urban households.

By the same equivalent variation measure, wealthier households generally benefit more from trade liberalisation than less wealthier households. However, the money measure of welfare change captures the effect of the size of initial household incomes, as well as the extent of tariff change. The larger benefits to wealthier households are mainly a result of the higher initial levels of their incomes. If these benefits are measured relative to initial incomes, poorer rural households benefit more than wealthier households. In the urban sector, however, the welfare of wealthier households improves proportionally more than poorer households. These results are more clearly shown by changes in real household consumption and savings (Table 4).The larger gain to rural households results primarily from the expansion of rural output (Table 5).

Much of this has to do with China's tariff structure and the uniform tariff cut formula we have chosen. China's current tariff structure tends to discriminate against agriculture, and within the industrial sector, higher tariff levels are accorded to heavy industries which tend to produce capital-intensive goods. Moreover, heavy industries are concentrated in urban areas, whereas labour-intensive goods form a large part of the output for rural industries. As initial tariffs on industrial commodities are higher than those on agricultural commodities and those capital-intensive goods are generally higher than on labour-intensive goods, uniform tariff cuts have a greater contracting effect on urban and heavy industries.

As the income of poorer rural households relies on agriculture to a greater extent than wealthier rural households, the favourable effect of trade liberalisation on

agriculture tends to improve rural income distribution. Similarly, the expansion of rural output in contrast with the contraction of urban output reduces rural-urban income inequalities.

Table 4 **Income distribution effects of 30 per cent across the board tariff cut, 1992** (per cent)

	Equivalent variation (billion yuan)	Real consumption (per cent)	Real savings (per cent)
Rural household 1	10.95	1.48	1.73
Rural household 2	7.44	1.61	2.13
Rural household 3	2.20	1.72	2.29
Urban household 1	4.37	0.79	0.81
Urban household 2	1.77	0.49	0.60
Urban household 3	0.70	0.23	0.44
Government	-8.26	0.95	-14.4
Total	19.17	1.06	0.15

Source: The simulation of the China model.

Table 5 **Macroeconomic effects of 30 per cent tariff cuts** (per cent)

Variable	Percentage change / Billions of yuan
Real GDP	0.87
Equivalent variation (billions of yuan)	19.17
GDP deflator	-2.55
CPI	-2.72
Real savings	0.15
Government revenue (nominal)	-3.89
Farm output	0.52
Rural output	0.17
Urban output	-0.38
Real exports	15.38
Real imports	18.2
Terms of trade	-0.87
Change in trade balance (billions of yuan)	5.95

Source: The simulation of the China model.

For urban households, the story is different. Given our assumption of Leontief technology, the contraction of urban output means that demand for factors of production falls. However, real urban household incomes still increase as a result of rises in real factor returns. As the sectoral composition of factor incomes for the three urban household categories are similar, normal incomes for them increase similarly in the wake of trade liberalisation. However, as poorer urban households consume more agricultural commodities, whose prices have risen relative to industrial commodities, they benefit less than wealthier households. In comparison with rural households, the impact of trade liberalisation on the welfare of urban households is felt more in their consumption.

While household welfare improves, benefits derived from government activities decline considerably. This largely results from the model closure we have chosen. Tariff revenue declines in the wake of the tariff cut, despite considerable increases in import volumes. Output taxes (mainly the consolidated industrial and commerce taxes) form the bulk of government revenue. The tariff cut also leads to a decline in the value of gross output and hence to a reduction in output tax revenues. Income tax revenues, although only a small proportion of total government revenue, also declines as a result of the tariff cut. Altogether, these lead to a nearly 4 per cent decline in total government revenue. Given a 2.6 per cent decline in the GDP deflator, real government revenue declines by about 1.3 per cent. At the same time, government expenditure on consumption falls by only 1.3 per cent, forcing government savings to decline by 17 per cent (or 14 per cent in real terms, as shown in Table 4) in order to balance the budget.

Despite this large fall in nominal government savings, aggregate nominal savings fall by only 2.4 per cent in nominal terms, a marginal increase in real terms if deflated by the GDP price. Increases in real household savings contribute to this slight increase in aggregate savings.

While total real aggregate savings increase, real investment declines by 0.8 per cent. The decline in real investment is largely the result of declines in the absorption of capital goods whose output contracts more than that of other goods. The resulting excess savings translate into a nearly 6 billion yuan increase in trade surplus. Due to a large initial trade surplus (131 billion yuan) in 1992 the trade surplus increases despite that imports increase more than exports (both in real and nominal terms).

Nevertheless, the large decline in government savings results in a substantial decline in welfare derived from government activities, despite a significant increase in real government consumption. However, with the large welfare gain to households, overall national welfare improves substantially.

How the decline in government revenue resulting from the tariff cut affects income distribution is an important issue. In particular, how this affects income transfers to poor households needs further examination. In the present model, welfare payments to households are absent from the database because of the lack of such information. Income taxes built into the database are in fact net taxes (taxes minus transfer payments to households). By fixing the income tax rates in the simulation, we have in effect assumed that the net tax burden is maintained by the trade-off between taxes and transfers. In other words, if taxes increase, offsetting transfer would occur, and vice versa. It is conceivable that a uniform increase in value added taxes, or a progressive increase in income taxes, can be used to compensate for the lost tariff revenue, without adversely affecting income distribution. This tax replacement issue, however, deserves separate research.

Table 6 **Income distribution effects of a 30 per cent tariff cut on agricultural imports**, 1992 (per cent)

	Equivalent variation (billion yuan)	Real consumption (per cent)	Real savings (per cent)
Rural household 1	0.31	0.09	-0.01
Rural household 2	-1.11	-0.23	-0.34
Rural household 3	-0.49	-0.39	-0.51
Urban household 1	1.69	0.34	0.19
Urban household 2	1.02	0.34	0.18
Urban household 3	0.66	0.35	0.17
Government	-0.08	0.14	-0.82
Total	2.01	0.13	-0.01

Source: The simulation of the China model.

In the second experiment, we simulate a 30 per cent tariff cut on all agricultural imports, leaving tariffs on all other commodities unchanged. Given the mild protection for the agricultural sector, this 30 per cent tariff cut on agricultural imports has a rather small impact on overall economic welfare (Table 6). The country as a whole benefits by about 2 billion yuan, and real GDP increases by 0.06 per cent.

The impact of this policy change on income distribution is, however, quite significant (Table 6). Rural-urban inequality increases, and most of the gain from

agricultural liberalisation accrues to urban households. However, it is important to note that while the two poorer groups of rural households are worse off, the wealthiest rural household group actually gains from agricultural liberalisation. This seemingly paradoxical outcome results from the varying composition of income sources for three rural household groups. While the poor households rely to a great extent on agricultural incomes, the wealthy households obtain a large portion of their income from non-agricultural activities. When agricultural protection is reduced, farm incomes fall as agricultural production contracts, but non-farm incomes from rural industries rise as resources are drawn from farming to industrial activities. In addition, the prices of agricultural commodities decline as tariffs fall, raising real income levels for households. The difference between the wealthiest group of rural households and the other two groups of rural households is that for the former the benefit from the increases in non-farm incomes and from the decreases in agricultural prices more than offset its loss of farm income. This is not the case for the other two categories of households.

All urban households benefit from agricultural liberalisation, but income distribution is hardly affected. Because of the size effect, measured by equivalent variation, wealthier households benefit more. In fact, in terms of real consumption, poorer urban households tend to benefit more from agricultural liberalisation than wealthier urban households, but their real savings tend to increase marginally less due to their slightly smaller increases in normal incomes.

Table 7 **Income distribution effects of a 30 per cent tariff cut on industrial imports**, 1992 (per cent)

	Equivalent variation (billion yuan)	Real consumption (per cent)	Real savings (per cent)
Rural household 1	10.62	1.39	1.73
Rural household 2	8.51	1.84	2.45
Rural household 3	2.67	2.10	2.77
Urban household 1	2.73	0.46	0.54
Urban household 2	0.79	0.16	0.34
Urban household 3	0.06	-0.10	0.19
Government	-8.12	0.81	-13.59
Total	17.25	0.93	0.16

Source: The simulation of the China model.

In the third experiment, tariffs on all industrial goods are cut by 30 per cent while leaving tariffs on all agricultural commodities unchanged. Measured by equivalent variation, all household categories benefit, and rural households benefit the most. Even the poorest rural household group gains almost as much as the wealthiest urban household group. However, in comparison with the results of the first experiment where an across-the-board tariff reduction was carried out, the wealthiest rural household category is worse off, indicating that agricultural liberalisation actually benefit households in this category. This is consistent with the result from the second experiment. On the other hand, the two less wealthy household groups benefit from maintaining current agricultural protection, as shown by the results in Table 4 in comparison with those in Table 1.

If current agricultural protection remains while those on industrial commodities are cut 30 per cent, the benefits to urban households are much smaller than if agricultural tariffs are reduced as well. The welfare gain for the wealthiest urban group is 38 per cent less, for the middle group 55 per cent less, and for the poorest group 91 per cent less. In fact, real consumption has to decline slightly if the poorest urban households are to maintain their savings as a proportion of their total income. Quite unlike agricultural liberalisation, industrial liberalisation makes urban income distribution less equitable and rural income distribution more equitable.

Conclusion

Several characteristics of the Chinese economy are important to the analysis of income distribution in China. These include the ever increasing importance of non-agricultural incomes in rural China, the large regional differences in the source of household incomes and the segmentation of rural and urban factor markets. Careful consideration of these factors can substantially improve the usefulness of conventional CGE models in the analysis of income distribution issues.

The simulation results show that comprehensive trade liberalisation leads to a pareto improvement in China. For rural households, this means not only their incomes improve relative to their urban counterparts, but also among themselves. Although income distribution among urban households becomes less equitable, every household group benefits. In contrast, if agricultural liberalisation is undertaken alone, poorer rural households would be worse off, although overall economic efficiency improves. If industrial liberalisation is carried out alone, all households benefit and both rural-urban equality and rural income distribution improve, but urban income distribution deteriorates. On balance, comprehensive tariff cuts are

probably most desirable as it provides the greatest overall welfare gain, improves rural-urban income distribution, and benefits urban residents more than alternative approaches of partial liberalisation, even though income disparities among them would not be reduced.

The simulation results highlight the complex general equilibrium effects of trade policy. It may appear that rural households do not have much to benefit from tariff cuts on industrial commodities. Our results show that there is a considerable economy-wide effect on rural incomes of such trade liberalisation. This is the case despite strict control over mobility of factors of production between the rural and urban sectors. The key to understanding this is that when tariffs are cut on industrial commodities, more resources will be available for the expansion of agricultural and rural industries, and rural income will rise as a result.

In the longer term, if the current rapid economic growth continues, structural change in the Chinese economy will continue to favour rural industry. When incomes from rural industries become sufficiently important for poorer rural households, tariff cuts on agricultural commodities may not result in any losses for them, let alone for wealthy households.

These results have an important implication for China's WTO entry. If China reduces its tariffs as a condition of entry, it will likely improve income distribution between rural and urban households, as well as benefiting both rural and urban residents. If such a cut is to phase in over a period of time, the adverse impact of agricultural liberalisation on rural households will be diminishing, as these households become increasingly dependent on non-agricultural incomes. Even if the WTO-conditioned trade liberalisation occurs in the near future, the adverse impact of tariff cuts on agriculture will be more than compensated for by concomitant industrial tariff cuts of a similar extent.

These results do depend on a number of assumptions about the model and the simulations, including macroeconomic behaviour such as household and government savings. The assets market is important for household incomes and wealth, but it is not taken into account in the model. Nevertheless, the consistent framework and database of the model means that we can explore these assumptions and improve our understanding of income distribution issues in China.

Endnotes

[1] An alternative apprach to modelling export demand is a partial equilibrium framework, where demand for a Chinese good is a function of the price of the good. Such specification is widely used but it ignores the across-price effects on export demand. With the partial equilibrium specification, the elasticity of demand reflects not only the substitutability between home and overseas goods, but also the share of home goods in the world market / The larger the share is, the more inelastic the demand.

[2] In this and subsequent tables, the first group of rural households is the wealthiest among the rural households while the third group is the poorest. Similarly, the first group of urban households is the wealthiest while the third group is the poorest.

Appendix A: The CGE model of the Chinese economy

Equations

Commodity demand

Demand for intermediate inputs *ij*

$$q^1_{i,j} = x_j + ai_{i,j}$$

Demand for investment goods *i*

$$q^2_i = q_i + ff_i$$

Household consumption demand *ih*

$$q^3_{i,h} = \varepsilon_{i,h} n^*_h + \sum_k \eta_{i,k,h} p^q_k$$

Export demand *i*

$$q^4_i = qw^4_i - \sigma^w_i \left(p^e_{i,"\exp"} - \sum_s S^e_{i,s} p^e_{i,s} \right)$$

Global demand for exports *i*

$$qw^4_i = \beta_i \left(\sum_s S^e_{i,s} p^e_{i,s} - \sum_i \sum_s S^{we}_{i,s} p^e_{i,s} \right)$$

Government consumption demand *i*

$$q^5_i = q_i + gd_i$$

Domestic absorption of good *i* from all sources *i*

$$q_i = \sum_j SI_{i,j} q^1_{i,j} + SV_i q^2_i + \sum_h SC_{i,h} q^3_{i,h} + SG_i q^5_i$$

Deflator for absorption of good *i* *i*

$$p^q_i = \sum_s SA_{i,s} p^u_{i,s}$$

Substitution in demand between domestically produced and imported goods *i*

$$q^s_{i,s} = q_i - \sigma^m_i \left(p^u_{i,s} - p^q_i \right)$$

Commodity supply

Supply of imports *i*

$$q^s_{i,"imp"} = \Phi_i p^m_i$$

Output transformation by sector *ij*

$$com^i_{i,j} = x_j + \sigma^c_j \left(p^x_i - p^{xa}_j \right) + ac_j$$

Aggregate price by industry *j*

$$p_j^{xa} = \sum_i SO_{i,j}^I p_{i,j}^{xs}$$

Aggregate price by commodity *i*

$$p_i^{xt} = \sum_j SO_{i,j}^J p_{i,j}^{xs}$$

Substitution among commodities from different sectors

$$com_{i,j}^i = com_i - \sigma_i^s \left(p_{i,j}^{xs} - p_i^x \right)$$

Deflator for production of good *i* *i*

$$p_i^x = \sum_d SP_{i,d} p_{i,d}^p$$

Transformation in production between domestic and export 2*i*

$$c_{i,d}^d = com_i + \sigma_i^t \left(p_{i,d}^p - p_i^x \right)$$

Price links

$$p_i^{xt} = p_i^x$$

Demand for primary factors

Effective price of value added *j*

$$p_j^{vad} = \sum_v SF_{v,j} \left(pf_{v,j} - af_{v,j} \right)$$

Demand for primary factors *vj*

$$qf_{v,j} = x_j - \sigma_j^p \left(pf_{v,j} - p_j^{vad} \right) - af_{v,j}$$

Demand for factors by sector and household *vjh*

$$qfh_{v,j,h} = qf_{v,j}$$

Supply of primary factors

Transformation between rural and urban labour 2

$$ql_m = qlab + \delta^1 \left(pl_m - plab \right)$$

Price of aggregate labour supply 1

$$plab = \sum_m SL_m^1 pl_m$$

Transformation of labour between farm and non-farm 2

$$ql_n = ql_{"labr"} + \delta^2 \left(pl_n - pl_{"labr"} \right)$$

Aggregate price of rural labour supply 1

$$pl_{"labr"} = \sum_{n} SL_n^2 pl_n$$

Transformation of capital between rural and urban sectors 2

$$qk_m = qcap + \delta^3 \left(pk_m - pcap \right)$$

Economy-wide price for capital 1

$$pcap = \sum_{m} SK_m pk_m$$

Supply for land by industry *j*

$$qa_j = qland + \delta^4 \left(pa_j - pland \right)$$

Aggregate price for land 1

$$pland = \sum_{j} ST_j pa_j$$

Supply prices of farm labour *f*

$$pfs_{"labour",j} = pl_{"labf"}$$

Supply prices of on-farm labour *n*

$$pfs_{"labour",j} = pl_{"labn"}$$

Supply prices of urban labour *j-f-n*

$$pfs_{"labour",j} = pl_{"labu"}$$

Supply prices of rural capital *f+n*

$$pfs_{"capital",j} = pk_{"rural"}$$

Supply prices of urban capital *j-f-n*

$$pfs_{"capital",j} = pk_{"urban"}$$

Market clearing conditions

Domestic goods market clearing *i*

$$q^s_{i,"dom"} = c^d_{i,"dom"}$$

Export market clearing *i*

$$q^4_i = c^d_{i,"imp"}$$

Urban labour market clearing 1

$$ql_{"labu"} = \sum_{u} SU_u^{lab} qf_{"labour",j}$$

Rural labour market clearing 1

$$ql_{"labr"} = \sum_r SR_r^{lab} qf_{"labour",j}$$

Urban capital market clearing 1

$$qk_{"urban"} = \sum_u SU_u^{cap} qf_{"capital",j}$$

Rural labour market clearing 1

$$qk_{"rural"} = \sum_r SR_r^{cap} qf_{"capital",j}$$

Land market clearing *j*

$$qa_j = q^f_{"land",j}$$

Zero pure profit

Zero profits in production *j*

$$p_j^{ps} + ac_j = \sum_i P_{i,j}^{PI}\left(p_i^q - ai_{i,j}\right) + \sum_v P_{v,j}^{F}\left(pf_{v,j} - af_{v,j}\right) + slack_j^{profit}$$

Indirect taxes on production *j*

$$p_j^{xa} = p_j^{ps} + ti_j$$

Zero profits in domestic sales *i*

$$p^u_{i,"dom"} = p^p_{i,"dom"} + tc_i$$

Zero profits in importing *i*

$$p_i^{bm} = p_i^m + tm_i + phi$$

Zero profits in sales of imported goods *i*

$$p^u_{i,"imp"} = p_i^{bm} + tc_i$$

Zero profits in exporting *i*

$$p^p_{i,"\exp"} = p^e_{i,"\exp"} - tx_i + phi$$

Zero profits in factor markets *vj*

$$pfs_{v,j} = pf_{v,j} + tf_{v,j}$$

Consumer and government budget constraints

Gross household income *h*

$$hrev_h^b = \sum_v \sum_j HY^B_{v,j,h}\left(pfs_{v,j} + qfh_{v,j,h}\right)$$

Disposable household income h

$$hrev_h^a = hrev_h^b - ty_h$$

Household savings h

$$hsav_h = hrev_h^a + hhp_h$$

Household budget constraint h

$$hrev_h^a + slack_h^{hb} = SY_h^c n_h^* + SY_h^s hsav_h$$

Government revenue 1

$$\begin{aligned} grev = & \sum_i GR_i^{ma}\left(p_i^{bm} + q_{i,"imp"}^s\right) - \sum_i GR_i^{mb}\left(p_i^m + phi + q_{i,"imp"}^s\right) \\ & + \sum_i GR_i^{xp}\left(p_{i,"\exp"}^p + c_{i,"\exp"}^d\right) - \sum_i GR_i^{xb}\left(p_{i,"\exp"}^e + phi + c_{i,"\exp"}^d\right) \\ & + \sum_i GR_i^{du}\left(p_{i,"dom"}^u + q_{i,"dom"}^s\right) - \sum_i GR_i^{dp}\left(p_{i,"dom"}^u + q_{i,"dom"}^s\right) \\ & + \sum_j GR_j^{pa}\left(p_j^{xa} + x_j\right) - \sum_j GR_j^{pb}\left(p_j^{ps} + x_j\right) \\ & + \sum_h GR_h^{hb} hrev_h^b - \sum_h GR_h^{ha} hrev_h^a \end{aligned}$$

Government budget constraint 1

$$grev + slack^{gb} = \sum_i GC_i^g\left(q_i^5 + p_i^q\right) + GS^g gsav$$

Total savings by households and government 1

$$tsav = \sum_h SS_h^{hhd} hsav_h + SS^{gov} gsav$$

Balancing net saving with trade account

$$\begin{aligned} & \sum_h HDS_h hsav_h + GVSgsav - \sum_i SIN_i\left(p_i^q + q_i^2\right) \\ & \quad = \sum_i XB_i vex - \sum_i MB_i vim + slack^{bot} \end{aligned}$$

Identities

Total export value 1

$$vex = \sum_i \left(SXB_i\left(p_{i,"\exp"}^e + phi + c_{i,"\exp"}^d\right)\right)$$

Total import value 1

$$vim = \sum_i \left(SMB_i \left(p_i^m + phi + q^s_{i,"imp"} \right) \right)$$

Total export volume 1

$$qex = \sum_i \left(SXB_i c^d_{i,"\exp"} \right)$$

Total import volume 1

$$qim = \sum_i \left(SMB_i q^s_{i,"imp"} \right)$$

Trade balance as a proportion of GDP 1

$$bt = vex - vim$$

Dollar change in trade balance 1

$$100 * \Delta bot = \sum_i XB_i vex - \sum_i MB_i vim$$

Real gross domestic product definition 1

$$gdpr = \sum_i \sum_h GPR^{hdc}_{i,h} q^3_{i,h} + \sum_i GPR^{gvc}_i q^5_i + \sum_i GPR^{inv}_i q^2_i + \sum_i GPR^x_i{}_i qex - \sum_i GPR^m_i qim$$

Nominal gross domestic product 1

$$gdpv = \sum_i \sum_h GPR^{hdc}_{i,h} \left(q^3_{i,h} + p^q_i \right) + \sum_i GPR^{gvc}_i \left(q^5_i + p^q_i \right) + \sum_i GPR^{inv}_i \left(q^2_i + p^q_i \right) + \sum_i GPR^x_i vex - \sum_i GPR^m_i vim$$

Gross domestic product deflator 1

$$pdgp = gdpv - gdpr$$

Farm output 1

$$fout = \sum_i \sum_r OF_{i,r} com^i_{i,r}$$

Rural output 1

$$rout = \sum_i \sum_r OR_{i,r} com^i_{i,r}$$

Urban output 1

$$uout = \sum_i \sum_u OU_{i,u} com^i_{i,u}$$

Real final absorption 1

$$aR = \sum_i \sum_h ABS^{hdc}_{i,h} q^3_{i,h} + \sum_i ABS^{gvc}_i q^5_i + \sum_i ABS^{inv}_i q^2_i$$

Welfare measures

Household utility function $u^h = \sum_i SCN_{i,h} q_{i,h}^3 + SV_h \left(hsav_h - pgdp \right)$	h
Government utility function $u^g = \sum_i SCN_{i,g} q_i^5 + SV_g \left(gsav - pgdp \right)$	1
Household equivalent variation $EV^h = \left(HYA_h / 100 \right) u^h$	h
Government equivalent variation $EV^g = \left(GY / 100 \right) u^g$	1
Total equivalent variation $EVT = \sum_h EV^h + EV^g$	1
Total number of equations	$vjh+2ij+2vj+8h+18i+7j+ih+32$

Variables

x_j	j	Industry activity level
$q^1_{i,j}$	ij	Demand for intermediate
$ai_{i,j}$	ij	Technical shifter for use of intermediate input
q^2_i	i	Demand for investment goods
q_i	i	Domestic absorption
ff_i	i	Technical shifter for demand for investment goods
$q^3_{i,h}$	ih	Household consumption demand
n^*_h	h	Households' total consumption expenditure
p^q_i	i	Deflator for absorption of goods
q^4_i	i	Demand for export from China
qw^4_i	i	Global demand for exports
$p^e_{i,s}$	$2i$	Export price by China and the rest of the world
q^5_i	i	Government consumption demand
gd_i	i	Technical shifter for government demand
$p^u_{i,s}$	$2i$	User prices for domestic and imported goods
$q^s_{i,s}$	$2i$	Total demand for domestic and imported goods
p^m_i	i	Price of import in foreign currency
$com^i_{i,j}$	ij	Outputs of commodity by industry
p^x_i	i	Aggregate price for production of commodity
p^{xt}_i	i	Aggregate price of commodities from different sectors
$p^{xs}_{i,j}$	ij	Price by commodity and by sector
p^{xa}_j	j	Aggregate price for industry
com_i	i	Total supply of commodity
ac_j	j	Technical shifter in multi-output transformation
$p^p_{i,d}$	$2i$	Producer prices by destinations: domestic market and export
$c^d_{i,d}$	$2i$	Supply of goods by destinations: domestic market and export

$q^{f}_{v,j}$	3*j*	Demand for primary factors by industry
$pf_{v,j}$	3*j*	Prices of primary factors by industry
p^{vad}_{j}	*j*	Effective price of value-added by industry
$af_{v,j}$	*vj*	Technical shifter in demand for primary factors
$qfh_{v,j,h}$	*vjh*	Demand for factors by sectors and households
qlab	1	Total supply of labour
plab	1	Aggregate price for labour
ql_{m}	4	Labour supplies: urban, rural, farm and non-farm
pl_{m}	4	Prices of labour: urban, rural, farm and non-farm
qcap	1	Total supply of capital
pcap	1	Aggregate price of capital
qk_{m}	2	Supply of capital: urban and rural
pk_{m}	2	Price of capital: urban and rural
qland	1	Total supply of land
pland	1	Aggregate price of land
qa_{j}	*j*	Supply of land by industry
pa_{j}	*j*	Supply price of land by industry
$pfs_{v,j}$	*vj*	Price of factor supplies
p^{ps}_{j}	*j*	Aggregate producer prices by industry
$slack^{profit}_{j}$	*j*	Slack variable for profit in production
ti_{j}	*j*	Production tax by industry
tc_{i}	*i*	Domestic sales tax
p^{bm}_{i}	*i*	Border price of imports in domestic currency
tm_{i}	*i*	Import tariff
phi	1	Exchange rate

tx_i	i	Export tax
$hrev_h^b$	h	Households' gross income
$hrev_h^a$	h	Households' disposable income
ty_h	h	Income tax by households
$hsav_h$	h	Household savings
hhp_h	h	Households' propensity to save
$slack_h^{hb}$	h	Slack variable for households' budget constraints
$tsav$	1	Total savings by households and government
$gsav$	1	Government savings
$grev$	1	Government revenue
$slack_h^{gb}$	1	Slack variable for government budget constrain
vex	1	Total export in foreign currency
vim	1	Total import in foreign currency
qex	1	Total export in volume
qim	1	Total import in volume
bt	1	Trade balance as a proportion of GDP
Δbot	1	Dollar change in trade balance
$gdpr$	1	Real gross domestic product
$gdpv$	1	Nominal gross domestic product
$pgdp$	1	Gross domestic product deflator
$fout$	1	Farm output
$rout$	1	Rural output
$uout$	1	Urban output
aR	1	Real final absorption
u^h	h	Household utility

u^g	h	Government utility
EV^h	h	Household equivalent variation
EV^g	1	Government equivalent variation
EVT	1	Total equivalent variation

Coefficients

$\varepsilon_{i,h}$	Income elasticity of consumption demand
$\eta_{i,k,h}$ iih	Price elasticity of consumption demand
σ_i^w	Elasticity of demand substitution for exports from China and the rest of the world
$S_{i,s}^e$	Share of exports from China and the rest of the world in world's export of a commodity
$S_{i,s}^{we}$	Share of exports from China and the rest of the world by commodities in world's total exports
$SI_{i,j}$	Share of intermediate inputs in domestic absorption of a commodity
SV_i	Share of investment demand in domestic absorption of a commodity
$SC_{i,h}$	Share of households' consumption in domestic absorption of a commodity
SG_i	Share of government consumption in domestic absorption of a commodity
$SA_{i,s}$	Share of domestically produced and imported goods in total domestic absorption of a commodity
σ_i^m	Armington elasticity of substitution between demands for domestically produced and imported goods
Φ_i	Supply elasticity for China's imports by commodities
σ_j^c	Elasticity of transformation between commodities by sectors
$SO_{i,j}^I$	Share of commodities in an industry's total output
$SO_{i,j}^J$	Share of commodity output by industries in total output of that commodity

$SP_{i,d}$	Share of goods produced for domestic market and for exporting in total output by commodities
σ_i^t	Elasticity of transformation of produced goods between domestic market and exporting
$SF_{v,j}$	Share of returns to individual factors in total value-added by industries
σ_j^p	Substitution elasticity of demand for individual factors by industries
δ^1	Transformation elasticity between urban and rural labour
SL_m^1	Share of urban and rural labour in the economy's total labour supply
δ^2	Transformation elasticity between farm and non-farm labour
SL_n^2	Share of farm and non-farm labour in total rural labour supply
δ^3	Transformation elasticity between urban and rural capital
SK_m	Share of urban and rural capital in the economy's total supply of capital
ST_j	Share of industries in the economy's total supply of agricultural land
SU_u^{lab}	Share of urban industries in total supply of urban labour
SR_r^{lab}	Share of rural industries in total supply of rural labour
SU_u^{cap}	Share of urban industries in total supply of urban capital
SR_r^{cap}	Share of rural industries in total supply of rural capital
$P_{i,j}^{PI}$	Share of individual intermediate inputs in an industry's output
$P_{v,j}^{F}$	Share of returns to individual primary factors in an industry's output
$HY_{v,j,h}^{B}$	Share of return to individual factors from individual industries in households' gross income (before income tax)
SY_h^c	Share of consumption expenditure in households' total disposable income (after income tax)
SY_h^s	Share of savings in households' total disposable income (after income tax)

SS_h^{hhd}	Share of households' saving in the economy's total saving
SS^{gov}	Share of government's saving in the economy's total saving
GR_i^{ma}	Proportion of after tariff value of imports to total government revenue
GR_i^{mb}	Proportion of before tariff value of imports to total government revenue
GR_i^{xp}	Proportion of post tax value of export to total government revenue
GR_i^{xb}	Proportion of before tax value of export to total government revenue
GR_i^{du}	Proportion of post tax value of product for domestic market to total government revenue
GR_i^{dp}	Proportion of before tax value of product for domestic market to total government revenue
GR_j^{pa}	Proportion of individual sectors' total payment including tax to total government revenue
GR_j^{pb}	Proportion of individual sectors' total payment excluding tax to total government revenue
GR_h^{hb}	Proportion of households' gross income in total government revenue
GR_h^{ha}	Proportion of households' disposable income in total government revenue
GC^g	Share of consumption in government's total expenditure
GS^g	Share of saving in government's total expenditure
HDS_h	Households' savings
GVS	Government's saving
SIN_i	Investment value by commodities
XB_i	Export value by commodities
MB_i	Import value by commodities
SXB_i	Share of commodities in the economy's total exports
SMB_i	Share of commodities in the economy's total imports
$GPR_{i,h}^{hdc}$	Share of consumption by commodities and households in total GDP
GPR_i^{gvc}	Share of government consumption by commodities in total GDP
GPR_i^{inv}	Share of investment by commodities in total GDP

GPR_i^x	Share of exports by commodities in total GDP
GPR_i^m	Share of imports by commodities in total GDP
$OU_{i,u}$	Share of output by commodities and industries in total urban output
$OR_{i,r}$	Share of output by commodities and industries in total rural output
$ABS_{i,h}^{hdc}$	Share of consumption by commodities and households in real final absorption
ABS_i^{gov}	Share of government consumption by commodities in real final absorption
ABS_i^{inv}	Share of investment by commodities in real final absorption
$MBS_{i,h}$	Marginal budge share by household and commodity
HYA_h	Total disposable income by households
$SCN_{i,h}$	Share of consumption of good *i* in disposable household income
SV_h	Share of household savings in disposable household income
$SCN_{i,g}$	Share of consumption of good *i* in government revenue
SV_g	Share of savings in disposable government revenue

Appendix B: Database of the China model

The database of the China model contains two important parts: one social accounting matrix (SAM) and the behavioural parameters.

Construction of the SAM

The model includes 59 industries: 5 agricultural sectors, 27 rural non-agricultural industries and 27 urban industries. Two of the agricultural sectors, crop and livestock industries, are multi-product industries. There are 44 commodities, 17 of them are agricultural products and 27 non-agricultural products (Table B1).

There are six households in the model, three rural and three urban. Three rural households represent the households in the Eastern, Central and Western regions of rural China, while the three urban households are separated according to their per capita household income (rich, middle and poor).

The SAM table was constructed based on the 119 sector Input-Output Table of China 1992 (SSB 1996). The large number of the non-agricultural sectors was first aggregated into 27 industries. Each of the non-agricultural industries was then split into rural and urban sectors in two steps. The intermediate inputs of the rural and urban industries were separated according to their output proportions (in other words, the same input-output coefficients were assumed for the same industry in rural and urban areas). Total value-added was split in the same manner. The proportions between returns to capital and labour, however, were assumed to be different between rural and urban industries. Capital-labour ratios in the individual rural and urban industries were used to adjust the proportion of returns to capital and labour in total value-added (State Statistical Bureau 1993). In general, the rural industries are more labour-intensive, and the shares of labour in total value-added are higher than their urban counterparts.

For the agricultural sectors, returns to land, labour and capital were split using existing econometric estimation results in the literature. In the original table, there were only five agricultural products (crop, forestry, livestock, fish and other agriculture). The commodity groups for the crop and livestock industries were thus disaggregated applying mainly the output proportions.

The original input-output table has only 'net exports'—the difference between exports and imports. Export and import data for the current 44 commodities were compiled from the United Nations Trade Statistics using the 3 and 4 digit levels of SITC trade statistics (International Economic Databank, ANU). Export and import duties were calculated using information made available by the World Bank (1993).

Table B1 **Industry (commodity) classifications in the China model**

Crop (Rice, Wheat, Corn, Other grain, Vegetables and fruits, Cotton, Other natural fibre, Other crops)
Forestry (Forestry)
Livestock (Pork, Beef and mutton, Poultry, Egg, Wool, Other livestock)
Fishing (Fish)
Other agriculture (Other agricultural products)
Energy mining, rural / urban (Energy mining)
Ore mining, rural / urban (Ore mining)
Other mining, rural / urban (Other mining)
Food processing, rural / urban (Food processing)
Beverage, rural / urban (Beverage)
Tobacco, rural / urban (Tobacco)
Forage, rural / urban (Forage)
Textiles, rural / urban (Textiles)
Clothing, rural / urban (Clothing)
Leather and fur products, rural / urban (Leather and fur products)
Wood and prod, rural / urban (Wood and products)
Cultural products, rural / urban (Cultural products)
Electricity and water, rural / urban (Electricity and water)
Mineral refineries, rural / urban (Mineral refineries)
Chemicals, rural / urban (Chemicals)
Chemical fertiliser, rural / urban (Chemical fertiliser)
Chemical fibres, rural / urban (Chemical fibres)
Building materials, rural / urban (Building materials)
Metals, rural / urban (Metals)
Machinery, rural / urban (Machinery)
Agricultural machinery, rural / urban (Agric machinery)
Electrical machinery, rural / urban (Electrical machinery)
Transport equipment, rural / urban (Transport equipment)
Electronic equipment, rural / urban (Electronic equipment)
Other manufacture, rural / urban (Other manufactured products)
Construction, rural / urban (Construction)
Service, rural / urban (Service)

Matching of income sources for three rural households was relatively easy because information about income sources (by type of activities and broad industries) for rural residents in the three regions are publicly available (State Statistical Bureau 1993). The matching for the urban households was less precise, mainly using income proportions. But certain adjustments were made considering the fact that usually the poor households own more labour than capital while the rich households have the opposite pattern.

A summary of the SAM table used in the China model is shown in Table B2.

Table B2 **Income elasticities of household consumption**

	Rural households			Urban households		
	East	Central	West	Rich	Middle	Poor
Rice	0.05	0.26	0.38	0.02	0.09	0.21
Wheat	0.21	0.53	0.64	0.17	0.26	0.42
Corn	0.10	0.13	0.13	0.08	0.09	0.11
Other grain	0.05	0.30	0.39	0.01	0.04	0.05
Vegetables and fruits	0.56	1.25	1.35	0.51	0.74	1.01
Cotton	0.00	0.13	0.25	0.00	0.00	0.10
Other natural fibres	0.00	0.00	0.00	0.00	0.00	0.00
Other crops	0.41	0.50	0.55	0.34	0.37	0.45
Forestry	0.00	0.00	0.00	0.00	0.00	0.00
Pork	0.51	1.26	1.36	0.42	0.75	1.02
Beef & mutton	1.12	1.64	1.72	0.89	0.99	1.32
Poultry	0.62	1.05	1.15	0.38	0.61	0.85
Egg	0.41	0.93	1.03	0.25	0.53	0.75
Wool	0.21	0.71	0.69	0.17	0.47	0.57
Other livestock	0.98	1.41	1.47	0.93	0.99	1.22
Fishing	1.08	1.61	1.78	0.85	1.05	1.29
Other agriculture	0.30	0.28	0.27	0.34	0.26	0.22
Energy mining	0.62	0.70	0.79	0.68	0.79	0.87
Ore mining	0.00	0.00	0.00	0.00	0.00	0.00
Other mining	0.62	0.70	0.79	0.76	0.79	0.97
Food processing	0.72	1.17	1.13	0.51	0.76	0.94
Beverage	1.11	1.50	1.46	0.51	0.98	1.21
Tobacco	0.49	0.67	0.65	0.08	0.44	0.54
Forage	0.00	0.00	0.00	0.00	0.00	0.00
Textiles	0.69	0.94	0.91	0.51	0.61	0.76
Clothing	1.07	1.45	1.40	0.93	0.95	1.17
Leather and fur products	1.85	1.64	1.31	1.02	1.47	1.32
Wood and products	1.59	1.42	1.17	1.44	1.23	1.14
Cultural products	1.95	1.86	1.69	1.95	1.72	1.50
Electricity and water	1.85	1.75	1.53	1.63	1.41	1.41
Mineral refineries	2.57	2.19	1.64	2.04	1.80	1.76
Chemicals	2.30	2.11	2.04	2.29	2.05	1.69
Chemical fertiliser	0.00	0.00	0.00	0.00	0.00	0.00
Chemical fibres	0.00	0.00	0.00	0.00	0.00	0.00
Building materials	0.00	0.00	0.00	0.00	0.00	0.00
Metals	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural machinery	0.00	0.00	0.00	0.00	0.00	0.00

Electrical machinery	1.95	1.74	1.69	1.61	1.39	1.40
Transport equipment	2.58	2.19	1.64	2.54	2.29	1.76
Electronic and telephone equipment	2.00	1.75	1.53	1.78	1.56	1.41
Other manufactures	1.90	1.64	1.31	1.70	1.47	1.32
Construction	0.00	0.00	0.00	0.00	0.00	0.00
Service	1.54	1.31	1.20	1.53	1.31	1.06

Behavioural parameters

The behavioural parameters of the model are mostly drawn from the existing computable general equilibrium models, especially the GTAP model (Hertel 1997), the models of the Chinese economy by Martin (1990) and Huang (1993) and the vast literature on the Chinese economy. Income elasticities for agricultural commodities are drawn extensively from Wu and Findlay (1997), and those for other commodities are adopted from the GTAP data base (Table B3). These income elasticities are generally in the range of those adopted by most other studies, such as Hertel (1997) and Tyers and Anderson (1992).

Price elasticities for consumption are calibrated in the model using the SAM data. The Armington elasticities, output transformation elasticities and substitution elasticities between inputs are constructed based on the data sets of the GTAP database and the Martin model (1990).

The transformation elasticity between rural and urban labour is set to 0.01, while that between farm and non-farm labour within the rural economy is set to 2.0. The difference in the scale of the two elasticities reflect the degree of labour mobility between different categories. The transformation elasticity between rural and urban capital is set to 0.5. The transformation elasticity of land between sectors is set to 0.1.

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