

8. Household Welfare Impacts of China's Accession to the WTO

Shaohua Chen and Martin Ravallion, World Bank[†]

China's accession to the World Trade Organization brings a sharp reduction in import tariffs, quantitative restrictions, and export subsidies, with implications for the domestic structure of prices and wages and hence for the welfare of Chinese households. Even if the trade reforms have little effect on poverty and income distribution in the aggregate, the impacts may vary across household types and regions, with implications for the design of compensatory policy responses.

In China, the economic geography of poverty, and its interaction with the geographic diversity in the impact of policy reforms, is high on the domestic policy agenda. A policy analysis that simply averaged such differences would miss a great deal of what matters to the policy debate. In this chapter, data from national household surveys for rural and urban areas are used to measure and explain the welfare impacts on households of changes in goods and factor prices stemming from the accession. The approach respects the richness of detail that is available from a modern integrated household survey, allowing us to go well beyond the highly aggregative types of analysis one often finds. The expected impacts across the distribution of initial levels of living are measured, but the way that the impacts vary by other household characteristics, including location and demographic characteristics, are examined. A reasonably detailed "map" of the predicted welfare impacts by location and socioeconomic characteristics emerges.

The first section briefly reviews the approaches that have typically been used for analyzing welfare impacts of trade reform, followed by a summary of the approach taken in this chapter. The following section describes the results, followed by a concluding section.

Measuring the welfare impacts of trade reform

The literature contains much debate about the welfare impacts of greater openness to trade. Some authors argue that external trade liberalizations benefit the poor in developing countries, while others argue that the benefits are captured more by the nonpoor. Assessments have focused particularly on the expected impacts on relative wages (notably between skilled and unskilled labor) and relative prices (such as between food staples and luxury imports).

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Cross-country studies

One might hope to provide a conclusive answer by comparing changes over time in measures of inequality or poverty between countries that are open to external trade and countries that are not. Thus, several studies have combined levels of measured inequality, or changes over time in measured inequality or poverty, with data on trade openness and other control variables, using aggregate cross-country data sets.¹

One should be cautious in drawing policy inferences from such studies, however. First, there are concerns about data and econometric specification. Differences in survey design and processing between countries, and over time within countries, can distort the measured levels and the apparent differences in inequality. Second, it is unclear how much power cross-country data sets have for detecting any underlying effects of greater openness or other covariates. There is also an issue as to whether the volume of trade should be treated as exogenous in these cross-country regressions; it is clearly not a policy variable as such, and it may well be highly correlated with other (latent) attributes of country performance independently of trade policy. The attribution of inequality impacts to trade policy reforms per se is clearly problematic.

Further, starting conditions vary widely among reforming countries, and averaging across this diversity can readily hide systematic effects of relevance to policy. For example, countries differ in their initial levels of economic development. It has been argued that greater openness to external trade will have very different effects on inequality depending on the level of economic development—raising inequality in rich countries and reducing it in poor ones.² But the opposite outcome is possible when economic reforms, including trade liberalization, increase the demand for relatively skilled labor, which may well be less equally distributed in poor countries than in rich ones. Regressions for inequality across countries show some evidence of a *negative* interaction effect between openness to trade and initial GDP per capita.³

These problems can be dealt with by introducing suitable nonlinearities (including interaction effects) into the regressions based on compilations of country aggregates.

For policymakers, however, the concern remains that the reasons for differences in welfare impacts go much deeper than those captured by country aggregate data. For example, though aggregate inequality or poverty may not change with trade reform, there may be both gainers and losers at all levels of living. Indeed, in cases in which survey data have tracked the same families over time, it is quite common to find that many people have escaped from poverty, while others have fallen into poverty, even though the overall poverty rate may have moved rather little.⁴ As another example, geographic disparities in access to human and physical infrastructure, between and within developing countries, affect the prospects for participating

¹ For example, see Bourguignon and Morisson (1990), Edwards (1997), Li et al. (1998), Lundberg and Squire (1999), Barro (2000), Dollar and Kray (2002), and Milanovic (2002).

² Wood (1994) makes a qualified argument along these lines.

³ Barro (2000), Ravallion (2001), and Milanovic (2002).

⁴ Jalan and Ravallion (1998) report evidence of such churning using panel data for rural China. Baulch and Hoddinott (2000) review evidence for a number of countries.

in the growth generated by reform, and these disparities tend to be correlated with incomes.⁵ A reform may well entail sizable redistributions between the poor and the rich, but in opposite directions in different regions within countries. One should not be surprised to find no correlation between growth and changes in inequality, or that, on average, a policy reform has virtually no impact on inequality. Yet there could well be nonrandom distributional changes going on under the surface of the average impact statistics.

We conclude that claims made about the distributional impacts of trade reform using cross-country comparisons are of questionable relevance for policymaking in any specific country.

Studies of welfare effects of specific trade reforms

Past approaches to studying the welfare impacts of specific trade reforms have tended to be either *partial equilibrium analyses*, in which the welfare impacts of the direct price changes resulting from tariff changes are measured at the household level, and *general equilibrium analyses*, in which second-round responses are captured in a theoretically consistent way but with considerable aggregation across household types.⁶ In general terms, the economics involved in both approaches is well known, and both approaches have found numerous applications.

Our approach in this chapter

Here we combine the partial and the general equilibrium approaches, so that the attribution of welfare effects to trade policy changes is unambiguous and the diversity of welfare impacts among households is not lost. We make use of past estimates of the direct and indirect impacts of China's WTO accession on prices for both commodities and factors of production, as reported in Ianchovichina and Martin (2002), and apply standard methods of first-order welfare analysis to measure the gains and losses at the household level.⁷

The price changes induced by the trade policy change are simulated from the computable general equilibrium (CGE) model used by Ianchovichina and Martin (2002). This is a competitive market-clearing model from the Global Trade Analysis Project (GTAP).⁸ In this model, the revenue implications of the trade policy change are reflected in changes in indirect tax rates.

The CGE model is applied to the data from large national sample surveys of households in urban and rural areas of China, carried out by the National Bureau of Statistics. The general equilibrium analysis generates a set of price and wage changes; these embody both the direct price effects of the trade policy change and "second-round" indirect effects on the prices of

⁵ In the context of China's lagging poor areas, see Jalan and Ravallion (2002).

⁶ For an overview of alternative approaches to accessing the welfare impacts of trade policies and examples, see McCulloch et al. (2001).

⁷ Details of the methodology and data treatment are given in Appendix 1 to this chapter, at <http://www.worldbank.org/eaptrade>.

⁸ Papers describing the standard GTAP with applications can be found in Hertel (1997). A full discussion of the assumptions of the general equilibrium model and the results of its application to China's accession to the WTO can be found in Ianchovichina and Martin (2002).

nontraded goods and on factor returns, including effects that make themselves felt through the government's budget constraint. Since the price changes are based on an explicit model, their attribution to the trade policy reform is unambiguous, thus avoiding the identification problems common to past attempts to estimate distributional effects of trade policy reform using cross-country comparisons.

The welfare impacts are derived from a household model that incorporates own-production activities. The CGE and household-level analyses are not integrated—with 85,000 households in the survey, doing so would require an extraordinarily large CGE model. The micro simulations are built on economic assumptions that are consistent with the CGE model—notably that households take prices as given and that those prices clear all markets—but no attempt was made to assure full consistency between the micro analysis and the predictions of the CGE model.

The survey data come from the 1999 Rural Household Survey (RHS) and the 1999 Urban Household Survey (UHS), both carried out by China's National Bureau of Statistics (NBS). The RHS sample covers 67,900 households, and the UHS, 16,900.^{9,10} NBS also kindly provided with the micro data for three provinces (Liaoning, Guangdong, and Sichuan), which we term the "test provinces." The computer program to implement the estimation method was written for these data, after which NBS staff ran the program on the entire national data set.

Before China's WTO accession in 2001, the economy had already started to adapt to the expected change. The trade reform can thus be considered as having two stages, a lead-up period, in which tariffs started to fall in anticipation of WTO accession, and the period from 2001 onward. Ianchovichina and Martin (2002) argue that one can take 1995 as a plausible beginning of the lead-up period, and we used their estimates of the price changes induced by WTO accession for the periods 1995-2001 and 2001-07. The discussion that follows focuses mainly on the latter period, though estimates of the welfare impacts for the lead-up period are also provided.

Welfare impacts to the survey data for 1999 are calculated. This year was chosen partly for data reasons; it was the most recent year for which access to the micro data could be

⁹ The full sample of the UHS in 1999 was about 40,000 households. However, the central office only keeps the individual record data for 16,900 households. Starting in 2002, the central office keeps all 40,000 households' data.

¹⁰ Over the past 15 years, NBS has made a great effort to improve both the RHS and UHS, focusing on sample coverage, questionnaire design, survey methodology, and data processing. The number of variables in the surveys has increased dramatically with additional details on income, expenditure, savings, housing, and productivity, among other things. However, a number of problems still remain in the 1999 RHS and UHS. For its sample frame, the RHS relies on its sampled counties from 1985. The UHS excludes the rural migrants, since the base of the UHS sample frame is the legal registration system (*Hukou*). As in other countries, the RHS gives data on the remittances of migrant workers, but does not provide information about the migrant workers themselves, who (unlike in other countries) are not sampled in the urban survey either. This makes it difficult to measure impacts through labor mobility and rural-urban transfers in the present study. Comparisons between the RHS and UHS also pose problems. For example, income in the RHS includes income in-kind (such as from own-farm production and other household enterprises), but income in the UHS ignores some in-kind components, notably subsidies received from the government. For further discussion in the context of the RHS, see Chen and Ravallion (1996).

obtained. Also, choosing a year near the middle of the lead-up period, rather than at the beginning or end, might diminish possible biases caused by any nonlinearity in the welfare impacts of price and wage changes.

Results

Appendix table 5.1 and Appendix table 5.2¹¹ show the predicted changes in relative prices and wages in China during 1995-2001 and 2001-07, respectively, as obtained from the China GTAP model of Ianchovichina and Martin (2002). The tables also show the mean net revenue per capita for urban and rural areas, based on the 1999 rural and urban household surveys.

Measured welfare impacts of WTO accession

Based on the relative price changes from the China GTAP model and production/consumption shares from the 1999 rural/urban household survey data, the net gain (or loss) for each household can be computed.¹² Table 8.1 summarizes the results. The first panel gives the mean gains for each of the periods 1995-2001 and 2001-07, split by urban and rural areas.

The second panel of Table 8.1 shows the impacts on income inequality, both actual (for the baseline year, 1999) and simulated for the two stages of the trade reform. The simulated income distribution is obtained, for the first stage, by subtracting the estimated gains over 1995-2001 from the 1999 incomes at household level, and, for the second stage, by adding the household-specific gains from 2001-07 to the 1999 incomes. Thus, the first simulation gives the distributional impact of the price changes during the first stage of the reform—that is, what the baseline distribution would have looked like without the reforms—while the second shows the impact of the post-2001 price changes—that is, how those changes are expected to affect the baseline distribution, looking forward.

The third panel of Table 8.1 gives the headcount index of poverty as measured by various poverty lines; the “official poverty line” gives estimates based on the poverty lines used by the National Bureau of Statistics, while the “\$1/day” and “\$2/day” lines are those from Chen and Ravallion (2001).

There was an overall gain of about 1.5 percent in mean income, all in the period leading up to WTO accession. There was almost no impact on inequality, either in the period leading up to WTO accession or predicting forward. The aggregate Gini index increases slightly, from 39.3 percent without WTO accession to 39.5 percent post-WTO.

¹¹ At <http://www.worldbank.org/eaptrade>.

¹² Using equation 3, as explained in Appendix 1.

Table 8.1: Predicted aggregate impacts on welfare of rural and urban households

	<i>Rural</i>	<i>Urban</i>	<i>National</i>
1. Mean gains (Yuan/capita)			
1995-2001	34.47	94.94	55.49 (1.54%)*
2001-07	-18.07	29.45	-1.54 (-0.04%)*
2. Inequality impacts (Gini index as %)			
Baseline (1999)	33.95	29.72	39.31
Simulated: Less gains 1995-2001	33.90	29.68	39.27
Simulated: Plus gains 2001-07	34.06	29.65	39.53
3. Poverty impacts (headcount index, %)			
A. Official poverty line			
Baseline (1999)	4.38	0.08	2.92
Simulated: Less gains 1995-2001	4.56	0.08	3.04
Simulated: Plus gains 2001-07	4.57	0.07	3.04
\$1/day (1993 PPP)			
Baseline (1999)	10.51	0.29	7.04
Simulated: Less gains 1995-2001	10.88	0.28	7.28
Simulated: Plus gains 2001-07	10.81	0.28	7.23
\$2/day (1993 PPP)			
Baseline (1999)	45.18	4.07	31.20
Simulated: Less gains 1995-2001	46.10	4.27	31.88
Simulated: Plus gains 2001-07	45.83	3.97	31.60

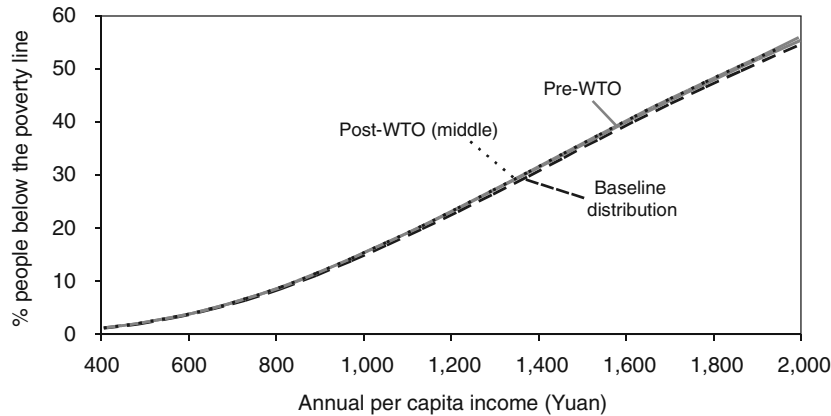
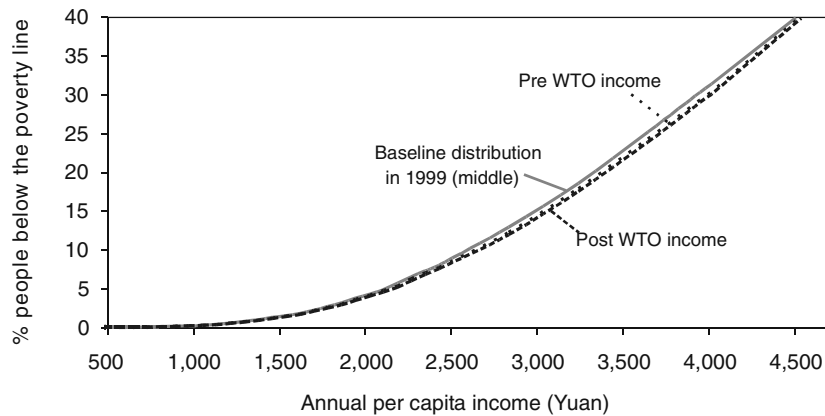
Note: * gives percentage of mean income. PPP is purchasing power parity.

In 1999, the incidence of poverty would have been slightly higher if not for the trade policy changes over the lead-up period to WTO accession, but that from 2001 to 2007 poverty will increase very slightly as a result of the price changes expected to be induced by the remaining tariff changes.

The impacts on poverty as measured by a wide range of poverty lines can be seen from Figure 8.1 and Figure 8.2, which give the cumulative distributions of income for both the baseline and the two simulated distributions, for the poorest 60 percent in rural areas and the poorest 40 percent in urban areas.

In the aggregate, then, WTO accession has virtually no predicted impact on poverty and inequality. Disaggregating the results, predicting forward from WTO accession, we focused on three indicators of impact at the household level: the absolute gain or loss in yuan, the percentage gain or loss, and whether the change is a gain or a loss. Interest in the first two measures is obvious enough; we included the third to help determine where there might be high concentrations of losses, whether in specific geographic areas or socioeconomic groups.

About three-fourths of rural households and one-tenth of urban residents are predicted to lose real income in the period 2001-07. Farm income is predicted to drop by 18 yuan per person, while urban per capita income rises by 29 yuan (Appendix table 5.3 and Appendix table 5.4). The drop in rural income is caused by the drop in the wholesale prices of most farm products, plus higher prices for education and health care (Appendix table 5.2). On the other hand, farmers will benefit from the drop in some consumer prices, and from the increase in nonfarm labor wages. Urban residents will enjoy lower prices for most farm products, and higher wages, but they will also be hit by higher fees for education and health care.

Figure 8.1: Poverty incidence curves: Rural**Figure 8.2: Poverty incidence curves: Urban**

Impacts differ widely across regions, as evident in Figure 8.3, Figure 8.4, and Figure 8.5, which plot the results by provinces ranked by mean income per person.¹³ The mean absolute gains tend to be highest in the richest provinces in both urban and rural areas (Figure 8.3), though there is no correlation between proportionate gains and the mean income of the province (Figure 8.4).

One spatially contiguous region stands out as losing the most from the reform: namely, the northeast provinces of Heilongjiang, Jilin, Inner Mongolia, and Liaoning (Appendix table 5.3). Both the absolute and proportionate impacts are highest in this region—indeed, more than 90 percent of farmers in Heilongjiang and Jilin are predicted to experience a net loss in income.

¹³ For the province rankings, see Table 5.5.

Figure 8.3: Mean gains by provinces: Absolute gains in yuan per capita

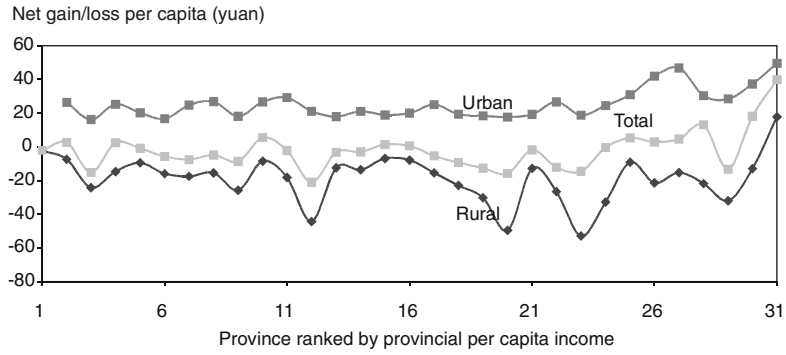


Figure 8.4: Mean gains by provinces: Proportionate gains in percent

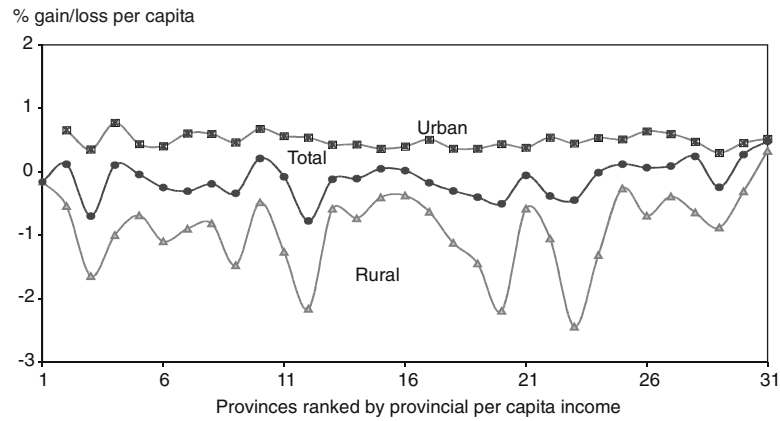


Figure 8.5: Mean gains by provinces: Percentage of gainers

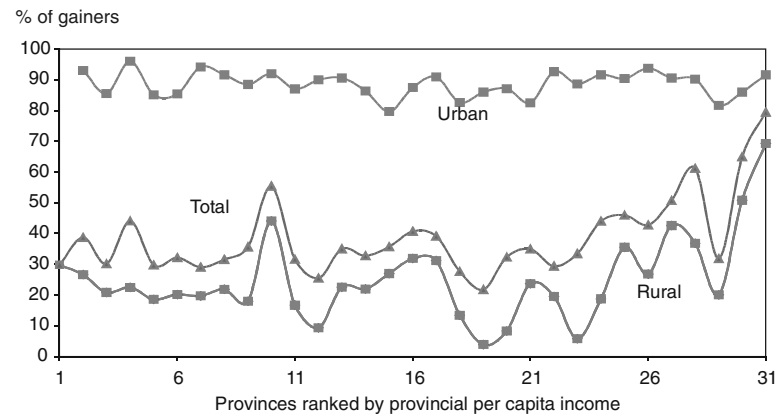
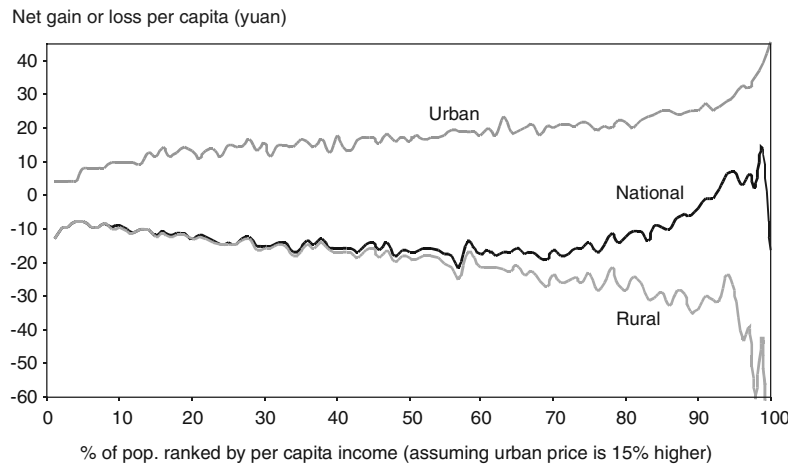


Figure 8.6: Mean gains in yuan, by income percentile

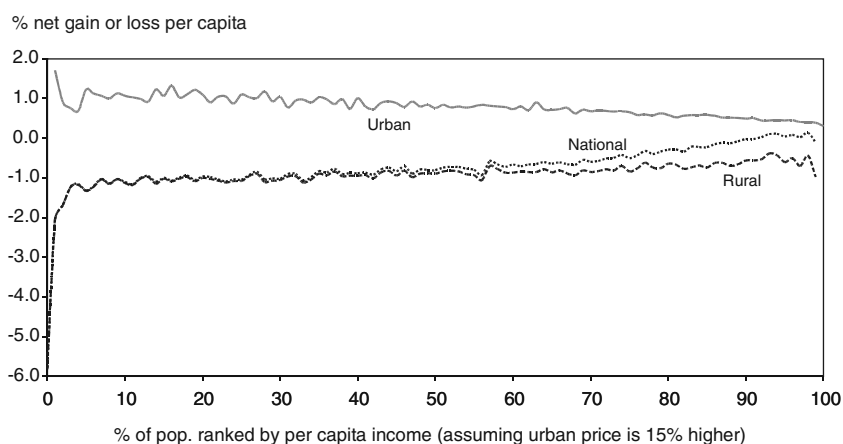
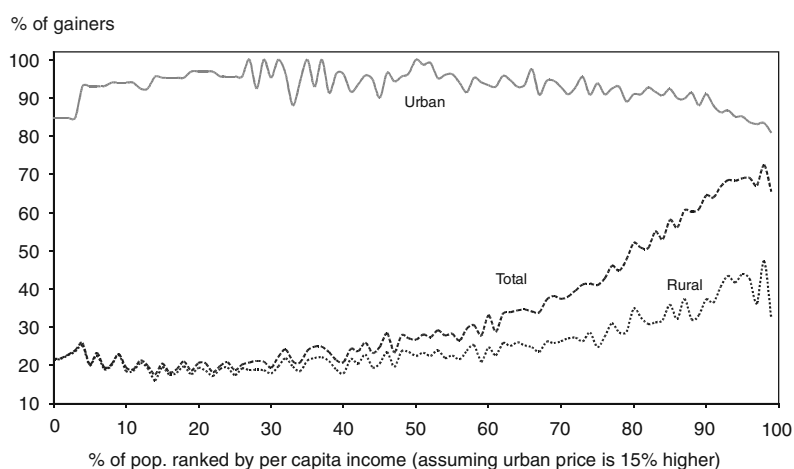
When households were ranked by initial income, there was a notable difference between urban and rural households. Figure 5.6 through Figure 5.8 plot the results given above against percentiles of the income distribution. For example, to see the mean impact in yuan per capita at the median income level, one looks at the 50th percentile in Figure 5.6. (Figure 5.6 gives the horizontal differences in Figure 5.1 and Figure 5.2 plotted against the point on the vertical axis.)

The absolute gains tend to be higher for higher-income households in urban areas and lower for low-income households in rural areas. Nationally (combining urban and rural areas using the weights described in Appendix 1), there is a hint of a U-shaped relationship, though still with the highest absolute gains for the rich.

This pattern flips when looking at the proportionate gains (Figure 8.7) In urban areas, the proportionate gains tend to fall as income rises, but in rural areas and nationally, they rise with income. In the aggregate, one finds a higher proportion of gainers as one moves up the income ladder, which is driven by the rise in the number of gainers as income increases within rural areas (Figure 8.8).

Incidence of gains and losses

Which types of households gain and which lose? Appendix 1 describes in formal terms the model for explaining the incidence of gains and losses as a function of household characteristics. We estimated the model for the three test provinces, Liaoning, Guangdong, and Sichuan, for which complete micro data were available. The key characteristics considered include the age of the household head, education and demographic characteristics, and land (interpreted as a fixed factor of production, since it is allocated largely by administrative means in rural China). We considered rural and urban areas separately; there are some differences in the explanatory variables between them.

Figure 8.7: Mean percentage gain, by income percentile**Figure 8.8: Percentage of gainers, by income percentile**

The results are given in Appendix tables 5.6 and 5.7 for rural areas and Appendix tables 5.8 and 5.9 for urban. Because these results are averages across the impacts of these characteristics on the consumption and production choices that determine the welfare impact of given price and wage changes, they are difficult to interpret. We view them as being mainly of descriptive interest, to help isolate covariates of potential relevance in thinking about compensatory policy responses.

Looking first at rural areas, in all three provinces the predicted gain from trade reform tends to be larger for larger households. There is also a U-shaped relationship with the age of the household head, such that the gains reach a minimum around 50 years of age (47 in Liaoning, 52 in Guangdong, and 55 in Sichuan). The gains are smaller for agricultural households. They are larger for households with more employees, more workers in township and village enterprises, more migrant workers, and less cultivated land (though the last finding is only significant in Liaoning). The only strong demographic effect is that younger households (those with a higher proportion of children under six) tend to be gainers in Liaoning.

For agricultural households, predicted losses are significantly higher than average in six counties in Liaoning (losses of 3 to 5.6 percent, versus the provincial average of 1.3 percent), seven in Guangdong (2.5 to 5.3 percent, versus the provincial average of 0.8 percent), and six in Sichuan (2.8 to 5.7 percent, versus the provincial average of 0.7 percent) (Appendix table 5.10).

In urban areas, the gains tend to be larger for smaller households (except in Guangdong). As in rural areas, there is a U-shaped pattern (except in Liaoning), with the smallest gains for households whose heads were 66 years of age in Guangdong and 51 years in Sichuan. By contrast with rural areas, where we find no relationship between education levels and welfare gains, in urban areas the gains tend to be larger for less well educated households.¹⁴ There are signs of some sectoral effects, though only significantly so in Liaoning, with higher gains for those in government jobs. There are signs of larger gains among those whose employer is the government. Retirees tend to gain less than others.

Conclusions

In the aggregate, the finding is that China's accession to the WTO has only a small impact on mean household income, inequality, and incidence of poverty.

However, there is a sizable, and at least partly explicable, variance in impacts across households of different characteristics. Rural families tend to lose; urban households tend to gain. Impacts are larger in some provinces than others, and largest in the geographically contiguous northeast region of Heilongjiang, Jilin, Liaoning, and Inner Mongolia. This is a region in which rural households depend more on feed grain production (for which falling prices are expected from WTO accession) than elsewhere in China.

Within rural or urban areas of a given province, the gains from WTO accession vary with observable household characteristics. The most vulnerable households tend to be rural, dependent on agriculture, with relatively few workers, and with weak economic links to the outside economy through migration. There are also some strong geographic concentrations of adverse impacts. For example, agricultural households in certain counties of Liaoning, Guangdong, and Sichuan incur predicted welfare losses of 3-5 percent of their incomes.

Naturally, this approach had limitations. A case in point is that there may well be dynamic gains from trade liberalization that are not captured by the model used to generate the relative price impacts. For example, trade may well facilitate learning about new technologies and innovation that brings longer-term gains in productivity. These effects may be revealed better by studying time-series evidence, combined with cross-country comparisons.

The geographic differences identified in welfare impacts arise entirely from differences in household consumption and production behavior. In reality, trade reform is likely to have differential impacts on local prices as a result of transport or other impediments to internal

¹⁴ This finding may be biased by the fact that, as explained in Appendix 1, we had to use educational levels to identify skilled labor (noting that wages of unskilled non-farm workers are predicted to increase relative to those of skilled labor, as shown in Appendix Table 3).

trade. Our approach does not incorporate such differences, and doing so would pose a number of data and analytical problems. This might, however, be a fruitful direction for future work in settings in which one has the necessary data on prices and wage levels by geographic area.

Another limitation of the approach is that, as explained in Appendix 1, it was necessary to make linear approximations in the neighborhood of an initial optimum for each household. In other applications using this method, doing so may be deceptive if the price or wage changes are large, or if a household is initially out of equilibrium, perhaps because of rationing (including involuntary unemployment). In principle, there are ways to deal with these problems by estimating complete demand and supply systems, allowing for rationing. This may prove a fruitful avenue for future research, though it should be noted that such methods generate their own problems, such as those arising from incomplete data on price and wage levels at the household level.

While acknowledging these limitations, we believe that the type of approach offered here can still illuminate the likely short-term distributional impacts of economy-wide reforms, with minimum aggregation. Thus, the tools used can offer insights for the sorts of policy responses that might be called for to compensate losers from reform.

Appendix to Chapter 8: Household Welfare Impacts of China's Accession to the WTO

1. Methodology and data treatment

The specifics of our approach can be outlined as follows. Each household has preferences for consumption and work effort represented by the utility function $u_i(q_i^d, L_i)$ where q_i^d is a vector of the quantities of commodities demanded by household i and L_i is a vector of labor supplies by activity, including supply to the household's own production activities. (Commodities have positive marginal utilities while labor supplies have negative marginal utilities.) The household is assumed to be free to choose its preferred combinations of q_i^d and L_i subject to its budget constraint. Consistently with the general equilibrium model that generated the price and wage changes, we assume that there is no rationing at household level; for example, involuntary unemployment is ruled out.

To calculate the monetary value of the welfare impact of price and wage changes, we work with the standard indirect utility function of household i as given by:

$$v_i[p_i^d, w_i, \pi_i] = \max_{(q_i^d, L_i)} [u_i(q_i^d, L_i) \mid p_i^d q_i^d = w_i L_i + \pi_i] \quad (1)$$

where p_i^d is the price vector for consumption, w_i is the vector of wage rates and π_i is the profit obtained from all household enterprises as given by:

$$\pi_i(p_i^s, p_i^d, w_i) = \max_{(z_i, L_i^o)} [p_i^s q_i^s - p_i^d z_i - w_i L_i^o \mid q_i^s = f_i(z_i, L_i^o)] \quad (2)$$

where p_i^d is the vector of supply prices, q_i^s is the vector of quantities supplied, L_i^o is the labor input to the own production activities, f_i is the household-specific production function (embodying fixed factors) and z_i are quantities of commodities used as production inputs.

To analyze household-level welfare impacts, we take the predicted price and wage impacts from the China GTAP model (Ianchovichina and Martin (2002)) as given. We are constrained of course by the data, which do not include initial price and wage levels.¹ However, this data limitation does not preclude our calculating a first-order approximation to the welfare impact in a neighborhood of the household's optimum. Taking the differentials of equations (1) and (2) and using the envelope property (whereby the welfare impacts in a neighborhood of an optimum can be evaluated by

¹ For food items, we can calculate unit values (expenditure divided by quantity) from the survey data, but there is no such option for food inputs to production, non-food commodities consumed or used in production, or wages (given that the survey data do not include labor supplies or quantities consumed of nonfood goods including production inputs).

treating the quantity choices as given), the gain to household i (denoted g_i) is given by the money metric of the change in utility:

$$g_i \equiv \frac{du_i}{v_{\pi i}} = \sum_{j=1}^m [p_{ij}^s q_{ij}^s \frac{dp_{ij}^s}{p_{ij}^s} - p_{ij}^d (q_{ij}^d + z_{ij}) \frac{dp_{ij}^d}{p_{ij}^d}] + \sum_{k=1}^n (w_k L_{ik}^s \frac{dw_k}{w_k}) \quad (3)$$

where $v_{\pi i}$ is the marginal utility of income for household i (the multiplier on the budget constraint in equation 1) and $L_{ik}^s = L_{ik} - L_{ik}^o$ is the household's "external" labor supply to activity k . (Notice that gains in earnings from labor used in own production are exactly matched by the higher cost of this input to own-production.) The proportionate changes in all prices and wages are weighted by their corresponding expenditure and income shares; the weight for the proportionate change in the j 'th selling price is $p_{ij}^s q_{ij}^s$, the revenue (selling value) from household production activities in sector j ; similarly $-p_{ij}^d (q_{ij}^d + z_{ij})$ is the (negative) weight for demand price changes and $w_k L_{ik}^s$ is the weight for changes in the wage rate for activity k . We will refer to the term $p_{ij}^s q_{ij}^s - p_{ij}^d (q_{ij}^d + z_{ij})$ as "net revenue" which (to a first-order approximation) gives the welfare impact of an equi-proportionate increase in the price of commodity j .

Equation (3) is the key formula we use for calculating the welfare impacts at household level. Notice that by applying the calculus in deriving (3) we are implicitly assuming small changes in prices and earnings. To relax this assumption would require more information on the structure of the demand and supply system.² Getting such information would entail considerable further effort, and the reliability of the results would be questionable because we do not have complete price and wage data.

For the same reason, we have little choice but to largely ignore geographic differences in the prices faced, or in the extent to which border price changes are passed on locally. The exception is that we make a seemingly plausible allowance for urban-rural cost-of-living differences in this setting.

Sampling weights

According to the population census, the 1999 urban population share is 34 percent. As already noted, we only have part of the urban sample and the sample-based urban population share is 20 percent. To correct the rural and urban sampling weights, we use the urban population share from the China Statistical Yearbook to replace the survey sample weights in forming the national figures in this study.

² See, for example, Ravallion and van de Walle (1991).

Matching between the GTAP model and the survey data

Sectors

The GTAP model has 57 sectors. The China GTAP model used in this study regroups these 57 sectors into 25 categories, listed in Appendix Table A1 below. China's Rural Household Survey (RHS) and Urban Household Survey (UHS) have about 2,000 categories for consumption and production. We match the variables from the household surveys into the closest category in GTAP. For example, corn, millet, and potatoes are placed in category 3 (feed grains), and cotton and fiber crops in category 7 (plant-based fibers); Appendix Table 8.11 gives details.

Occupations and labor income

The China GTAP model defines three types of labor: unskilled farm labor, unskilled non-farm labor, and skilled non-farm labor.³ Since the RHS and UHS use different questionnaires, they treat rural and urban labor earnings differently.

In the UHS, three variables—sector, occupation, or education—are used to determine labor types. Table 8.11 gives the codes used by the UHS. “Sector” or “occupation” alone cannot tell us whether a person should be classified as skilled labor. For example, the financial sector may hire unskilled labor while the services sector may hire skilled labor. (A janitor who works at a bank will be classified as in the financial sector even though his is an unskilled job, while a train driver in the occupational category “workers and staff-members in production and transport” will be classified as a skilled worker.) Therefore, we also take account of education. If a worker has received education at the senior high school level or above, he or she is considered skilled. Otherwise, he is classified as unskilled.

For rural areas, it is more difficult to determine the type of labor income since the RHS does not record individual income. Although we have every household member's education record, we have no information on how much each person earns from what work. Consequently, labor earnings can only be classified roughly by income source. For instance, all labor remuneration from agriculture is considered income from unskilled farm labor; earnings from industry and/or construction, grain processing etc., are considered as income from unskilled non-farm labor; and earnings from the tertiary sector, transport and trade etc. are considered as income from skilled non-farm labor.

Land and capital

Since China's economic reforms started in 1978, every farmer has rights to use land but not to sell it, although she/he can subcontract the allocated land to another farmer. Thus

³ By the International Labor Organization's definitions, “skilled labor” consists of managers and administrators, professionals, and para-professionals, while “unskilled labor” comprises trades-persons, clerks, salespersons and personal service workers, plant and machine operators and drivers, laborers and related workers and farm workers.

the changes in land prices derived from the GTAP model pertain to the value of land rentals paid and received, not to sale prices.

We end up with 25 groups of production and consumption activities, plus “land” and “capital” and three types of labor—farm unskilled, non-farm unskilled, and skilled.

Treatment of own production

In the urban household survey, own production is zero for all households and every category. For rural areas, the calculation is more complicated. We use category 3, “other grain”, as an example. For every household i , $p_3^s q_{i3}^s$ relates to the cash income from the production of corn, millet, potato etc.; $p_3^d q_{i3}^d$ relates to the cash expenditures on these items. (We can exclude the impacts on consumption from own production since the gains and losses automatically cancel out for this part of family consumption.) $p_3^d z_{i3}$ is the production cost related to category 3. The production cost includes seeds, fertilizer etc., but only seeds count in this category; fertilizer is considered in the category “petrochemical industry”.

In four cases, we could not distinguish the cash expenditure for an individual item from the total cash consumption. In those cases we assigned a cost to each item proportionally. (For example, if millet consumption is 10 percent of grain consumption, we assume that the cash expenditure on millet is also 10 percent of the cash expenditure on grain.)

Urban-rural price differential

To assess the overall impacts on poverty and inequality, we combine rural and urban households. There is no cost-of-living index between urban and rural areas of China (the urban and rural CPIs are both indexed to 100 at the base date). We assume that the urban price level is 15 percent higher than the rural one. We assume a smaller rural-urban price differential than in other developing countries, since China’s subsidies to urban households help to compensate for higher urban housing and food costs. We then rank all households by their per capita income from the poorest to the richest.

Welfare indicator

To assess impacts on inequality and poverty, we use income per person as the welfare indicator; this is what is termed “net income” in the RHS and “disposable income” in the UHS. Post-reform income is then income plus the estimated gain defined by equation (3).

Distinguishing gainers and losers

The way we have formulated the problem of measuring welfare impacts allows utility and profit functions to vary between households at given prices. To try to explain the heterogeneity in measured welfare impacts, we can suppose instead that these functions vary with observed household characteristics. The indirect utility function becomes:

$$v_i(p_i^d, w_i, \pi_i) = v(p_i^d, w_i, \pi_i, x_{1i}) = \max[u(q_i^d, L_i, x_{1i}) | p_i^d q_i^d - w_i L_i = \pi_i] \quad (4)$$

where

$$\pi_i = \pi(p_i^s, p_i^d, w_i, x_{2i}) = \max[p_i^s f(z_i, L_i^o, x_{2i}) - p_i^d z_i - w_i L_i^o] \quad (5)$$

Note that we allow the characteristics that influence preferences over consumption (x_{1i}) to differ from those that influence the outputs from own-production activities (x_{2i}).

The gain from the price changes induced by trade reform, as given by equation (3), depends on the consumption, labor supply, and production choices of the household, which depend in turn on prices and characteristics, x_{1i} and x_{2i} . For example, households with a higher proportion of children will naturally spend more on food, so if the relative price of food changes then the welfare impacts will be correlated with this aspect of household demographics. Similarly, there may be differences in tastes associated with stage of the life cycle and education. There are also likely to be systematic covariates of the composition of income.

Generically, we can now write the gain as:

$$g_i = g(p_i^d, p_i^s, w_i, x_{1i}, x_{2i}) = \sum_{j=1}^m [p_{ij}^s q^s(p_i^d, p_i^s, w_i, x_{2i}) \frac{dp_{ij}^s}{p_{ij}^s} - p_{ij}^d [q^d(p_i^d, w_i, \pi_i, x_{1i}) + z_{ij}(p_i^d, p_i^s, w_i, x_{2i})] \frac{dp_{ij}^d}{p_{ij}^d}] + \sum_{k=1}^n w_k [L_{ik}(p_i^d, w_i, \pi_i, x_{1i}) - L_{ik}^o(p_i^d, p_i^s, w_i, x_{2i})] \frac{dw_k}{w_k} \quad (6)$$

Notice that equations (4) and (5) imply that the gain from reform is inherently non-separable, in that one cannot write it as a function solely of p_i^d, x_{1i} and π_i . This is because the gains also depend on production choices.

However, since we do not have data on household-specific wages and prices, we must make further assumptions. In explaining the variation across households in the predicted gains from trade reform we assume that: (i) the wage rates are a function of prices and characteristics as $w_i = w(p_i^d, p_i^s, x_{1i}, x_{2i})$ and (ii) differences in prices faced can be adequately captured by a complete set of county-level dummy variables.

Under these assumptions, and linearizing (6) with an additive innovation error term, we can write the following regression model for the gains:

$$g_i = \beta_1 x_{1i} + \beta_2 x_{2i} + \sum_k \gamma_k D_{ki} + \varepsilon_i \quad (7)$$

where $D_{ki} = 1$ if household i lives in county k and $D_{ki} = 0$ otherwise and ε_i is the error term.

The household characteristics we consider include age and age-squared of the household head, education and demographic characteristics, and land (interpreted as a fixed factor of production, since it is allocated largely by administrative means in rural China). We also include dummy variables describing some key aspects of the occupation and principle sector of employment, such as whether the household is a registered agricultural household, whether its members engage in wage employment, are employed by the state, or participate in township and village enterprises. We recognize that there are endogeneity concerns about these variables, though we think those concerns are minor in this context, especially when weighed against the concerns about omitted variable bias in estimates that exclude these characteristics. Under the usual assumption that the error term is orthogonal to these regressors, we estimate (6) by Ordinary Least Squares.

We estimate the model for urban and rural areas separately in each of the three test provinces for the study (Liaoning, Guangdong, and Sichuan) for which we have the complete micro data.

II. The General Equilibrium Analysis

The model used in the analysis is based on the GTAP model (Hertel, 1997) widely used for trade policy analysis. It is a standard global applied general equilibrium model that assumes perfectly competitive markets and constant returns to scale technology. The model has a sophisticated representation of consumer demands via a constant difference of elasticities (CDE) functional form and a supply side that emphasizes the role of intersectoral factor mobility in the determination of sectoral output. Product differentiation between imports and domestic goods, and imports by region of origin allows for two-way trade in each product category, depending on the ease of substitution between products from different regions.

At the macroeconomic level, each region's final demand is governed by a representative, regional household, which allocates regional income across private consumption, government expenditure and savings according to a Cobb Douglas utility function. Land, labor, capital and the natural resources in a region are unchanged and fully employed. The returns to these factor inputs accrue to the households in the region in which they are employed. Global savings must equal global investment, which is allocated across regions in order to equate expected rates of return. The numeraire is the price of the global investment good.

Because of the importance to China of the duty exemption arrangements for inputs used in the production of exports, a major adaptation was made to allow exporting activities to have access to duty-free intermediate inputs. This was done comprehensively, by creating distinct export-oriented activities able to purchase their inputs duty-free, and able to

substitute towards greater use of these inputs. See Ianchovichina (2003) for details of the methodology and implementation. Ianchovichina (2003, Table 5) shows that ignoring this important feature of China's trade regime leads to serious biases in the effects of China's WTO accession—simply because the resulting analysis assumes that tariffs on inputs are being removed where none existed.

The model is solved in order to determine the endogenous changes in output and trade flows as a result of the proposed trade policy changes. The model maintains all of the restrictions imposed by economic+ theory: changes in consumer demand add up to changes in total spending; each region's total exports equal total imports of these goods by other regions, less shipping costs; each region's income is determined by spending on its output and tax revenues. Key results are given in Appendix Tables 8.1 and 8.2

REFERENCES

- Ianchovichina, E. (2003), 'GTAP-DD: a model for analyzing trade reforms in the presence of duty drawbacks' GTAP Technical Paper No 21, Global Trade Analysis Project, Purdue University, West Lafayette, www.gtap.org
- Ianchovichina, E. and Martin, W. (2003), Economic Impacts of China's Accession to the WTO, Mimeo, World Bank. www.worldbank.org/trade

2. Detailed results

Appendix Table 8.1: Predicted price changes from GTAP model, 1995-2001, and per capita net gain or loss for rural and urban households

	Wholesale prices % change	Consumer prices % change	Rural		Urban	
			Net revenue	Mean welfare change	Net revenue	Mean welfare change
			Yuan	Yuan	Yuan	Yuan
<i>Expenditures</i>						
Rice	0.5	1.5	73.66	0.15	-109.33	-1.64
Wheat	-1.7	-1.5	40.86	-0.74	0.00	0.00
Feedgrains	2.6	10.7	117.04	2.15	0.00	0.00
Vegetables & fruits	0.5	1.5	123.41	0.13	-378.69	-5.68
Oilseeds	-0.6	-0.8	37.05	-0.24	-1.04	0.01
Sugar	0.7	1.4	13.74	0.05	-174.06	-2.44
Plant-based fibers	-3.6	-1.9	36.84	-1.34	0.00	0.00
Livestock & meat	2.0	3.1	194.62	2.59	-500.65	-15.52
Dairy	1.5	2.5	2.50	0.02	0.00	0.00
Other food	1.2	3.1	-81.60	-3.39	-343.13	-10.64
Beverages & tobacco	-4.6	-7.2	-72.98	5.25	-197.20	14.20
Extractive industries	-0.2	0.8	17.99	-0.44	-173.03	-1.38
Textiles	-5.0	-8.9	-11.08	0.99	-53.50	4.76
Apparel	-2.7	-7.4	-64.13	4.75	-394.30	29.18
Light manufacturing	-0.3	-2.5	-16.15	0.40	-82.96	2.07
Petrochemical industry	-0.7	-0.1	-325.39	0.33	-398.23	0.40
Metals	-0.7	-0.1	-15.30	0.02	-24.02	0.02
Autos	-17.7	-20.4	-52.27	10.66	-37.76	7.70
Electronics	-1.5	-4.0	-24.27	0.97	-162.69	6.51
Other manufactures	-0.6	-0.3	-264.61	0.79	-431.16	1.29
Trade and transport	0.2	1.3	-18.70	-0.24	-110.53	-1.44
Construction	0.1	1.1	0.00	0.00	-31.11	-0.34
Communication	0.9	1.9	-16.72	-0.32	-152.04	-2.89
Commercial services	0.8	1.8	-61.37	-1.10	-533.33	-9.60
Other services	0.1	1.1	-414.45	-4.56	-680.99	-7.49
<i>Income sources</i>						
Farm unskilled labor	1.7	1.7	313.58	5.22		0.00
Nonfarm unskilled	1.7	1.7	287.19	4.78	1227.51	20.44
Skilled labor	2.0	2.0	360.87	7.09	3391.11	66.64
Land	1.3	1.3	17.08	0.22		0.00
Capital	1.3	1.3	21.14	0.27	126.01	0.77

Appendix Table 8.2: Predicted price changes from GTAP model, 2001-07, and per capita net gain or loss for rural and urban households

	Wholesale prices % change	Consumer prices % change	Rural		Urban	
			Net revenue Yuan	Mean welfare change Yuan	Net revenue Yuan	Mean welfare change Yuan
<i>Expenditures</i>						
Rice	-1.4	0.7	73.66	-1.39	-109.33	-0.75
Wheat	-1.5	0.7	40.86	-0.92	0.00	0.00
Feedgrains	-3.7	2.1	117.04	-4.90	0.00	0.00
Vegetables & fruits	-2.6	-0.6	123.41	-4.02	-378.69	2.24
Oilseeds	-5.7	-5.9	37.05	-2.10	-1.04	0.06
Sugar	-2.8	-3.5	13.74	-0.34	-174.06	6.01
Plant based fibers	1.6	4.1	36.84	0.56	0.00	0.00
Livestock & meat	-1.5	0.7	194.62	-5.21	-500.65	-3.40
Dairy	-2.4	-0.5	2.50	-0.09	0.00	0.00
Other food	-3.1	-2.7	-81.60	2.04	-343.13	9.32
Beverages & tobacco	-5.6	-7.7	-72.98	5.62	-197.20	15.09
Extractive industries	-0.4	1.7	17.99	-0.86	-173.03	-2.92
Textiles	-0.2	-1.5	-11.08	0.17	-53.50	0.82
Apparel	2.6	0.8	-64.13	-0.51	-394.30	-2.98
Light manufacturing	-0.6	0.5	-16.15	-0.08	-82.96	-0.43
Petrochemical industry	-1.1	0.8	-325.39	-2.60	-398.23	-3.19
Metals	-0.6	1.3	-15.30	-0.20	-24.02	-0.31
Autos	-3.8	-4.0	-52.27	2.09	-37.76	1.52
Electronics	-1.2	-1.4	-24.27	0.34	-162.69	2.20
Other manufactures	-0.8	0.8	-264.61	-2.12	-431.16	-3.46
Trade and transport	-0.4	1.7	-18.70	-0.32	-110.53	-1.85
Construction	-0.4	1.7	0.00	0.00	-31.11	-0.52
Communication	-0.4	1.7	-16.72	-0.28	-152.04	-2.54
Commercial services	-1.1	0.9	-61.37	-0.55	-533.33	-4.72
Other services	-0.7	1.3	-414.45	-5.39	-680.99	-8.76
<i>Income sources</i>						
Farm unskilled labor	-0.3	-0.3	313.58	-0.85		
Nonfarm unskilled	1.0	1.0	287.19	2.96	1227.51	12.64
Skilled labor	0.4	0.4	360.87	1.55	3391.11	14.58
Land	-4.7	-4.7	17.08	-0.80		
Capital	0.6	0.6	21.14	0.13	126.01	0.80

Appendix Table 8.3: Gain or loss by province; rural areas

	Sampled h'holds	Number of gainers	Original income	Post- WTO income	Gain or loss	Change (%)	% losers
Beijing	750	381	4221.05	4210.08	-10.96	-0.26	49.20
Tianjin	595	219	3401.71	3380.48	-21.22	-0.62	63.19
Hebei	4200	1310	2441.50	2426.82	-14.68	-0.60	68.81
Shanxi	2100	926	1772.62	1765.13	-7.49	-0.42	55.90
Inner Mongolia	2198	206	2055.49	2011.26	-44.22	-2.15	90.63
Liaoning	1886	353	2501.98	2469.64	-32.34	-1.29	81.28
Jilin	1598	132	2260.12	2210.46	-49.66	-2.20	91.74
Heilongjiang	1997	115	2166.59	2114.18	-52.41	-2.42	94.24
Shanghai	600	416	5409.11	5428.79	19.68	0.36	30.67
Jiangsu	3400	1209	3495.20	3486.78	-8.42	-0.24	64.44
Zhejiang	2693	1148	3946.44	3934.92	-11.52	-0.29	57.37
Anhui	3095	676	1900.76	1885.79	-14.97	-0.79	78.16
Fujian	1750	469	3091.39	3071.40	-19.99	-0.65	73.20
Jiangxi	2450	553	2129.45	2117.26	-12.19	-0.57	77.43
Shandong	4200	822	2520.76	2494.89	-25.87	-1.03	80.43
Henan	4200	828	1948.36	1931.70	-16.66	-0.86	80.29
Hubei	3188	755	2212.71	2200.04	-12.68	-0.57	76.32
Hunan	3700	1181	2102.98	2095.39	-7.60	-0.36	68.08
Guangdong	2560	514	3628.95	3599.61	-29.34	-0.81	79.92
Guangxi	2310	309	2048.33	2025.75	-22.58	-1.10	86.62
Hainan	718	28	2086.40	2057.85	-28.55	-1.37	96.10
Chongqing	1500	404	1736.63	1730.20	-6.43	-0.37	73.07
Sichuan	3998	879	1843.23	1830.92	-12.31	-0.67	78.01
Guizhou	2240	417	1363.07	1354.03	-9.04	-0.66	81.38
Yunnan	2397	399	1438.34	1421.34	-17.00	-1.18	83.35
Tibet	480	143	1309.46	1307.41	-2.05	-0.16	70.21
Shaanxi	2217	446	1456.48	1442.09	-14.39	-0.99	79.88
Gansu	1800	479	1357.28	1350.34	-6.95	-0.51	73.39
Qinghai	600	135	1466.67	1452.61	-14.06	-0.96	77.50
Ningxia	600	108	1754.15	1729.05	-25.11	-1.43	82.00
Xinjiang	1495	312	1471.11	1447.57	-23.55	-1.60	79.13
Rural China	67515	16272	2257.15	2239.08	-18.07	-0.80	75.90

Appendix Table 8.4: Gain or loss by province; urban areas

	Sampled h'holds	Number of gainers	Original income	Post-WTO income	Gain or loss	Change (%)	% losers
Beijing	500	430	9388.88	9431.72	42.84	0.46	14.00
Tianjin	500	451	7323.57	7358.47	34.91	0.48	9.80
Hebei	650	591	5673.46	5702.35	28.89	0.51	9.08
Shanxi	650	598	4519.20	4549.94	30.74	0.68	8.00
Inner Mongolia	550	495	4491.87	4516.19	24.32	0.54	10.00
Liaoning	1000	916	5257.42	5285.65	28.23	0.54	8.40
Jilin	700	610	4630.13	4650.46	20.33	0.44	12.86
Heilongjiang	1000	887	4798.92	4820.50	21.58	0.45	11.30
Shanghai	500	458	10927.18	10984.16	56.98	0.52	8.40
Jiangsu	800	723	6933.07	6968.78	35.71	0.51	9.63
Zhejiang	550	498	9044.40	9098.28	53.87	0.60	9.45
Anhui	500	458	5159.46	5190.37	30.91	0.60	8.40
Fujian	550	516	7521.52	7569.70	48.18	0.64	6.18
Jiangxi	550	498	4762.78	4783.38	20.60	0.43	9.45
Shandong	650	602	5689.90	5720.69	30.78	0.54	7.38
Henan	600	565	4689.43	4717.89	28.46	0.61	5.83
Hubei	750	619	5743.18	5765.29	22.11	0.38	17.47
Hunan	700	612	5727.42	5750.43	23.00	0.40	12.57
Guangdong	600	490	10871.06	10903.85	32.79	0.30	18.33
Guangxi	600	496	6011.10	6033.40	22.30	0.37	17.33
Hainan	200	172	5766.33	5787.64	21.31	0.37	14.00
Chongqing	300	239	5910.18	5931.90	21.72	0.37	20.33
Sichuan	800	691	5610.29	5634.60	24.30	0.43	13.63
Guizhou	450	383	5324.43	5347.71	23.27	0.44	14.89
Yunnan	650	566	5939.69	5973.23	33.54	0.56	12.92
Tibet				n.a.			
Shaanxi	500	427	4768.99	4788.25	19.26	0.40	14.60
Gansu	400	372	4610.86	4641.27	30.41	0.66	7.00
Qinghai	250	240	3759.53	3788.65	29.12	0.77	4.00
Ningxia	200	177	4472.43	4493.27	20.84	0.47	11.50
Xinjiang	250	214	5277.25	5295.94	18.69	0.35	14.40
Urban China	16900	14994	6046.13	6075.60	29.45	0.49	11.28

Appendix Table 8.5: Ranking of provinces (from the poorest to the richest)

	Prov. code	Rank by Prov. income		Rank by Rural inc.
Tibet	54	1	Tibet	1
Gansu	62	2	Gansu	2
Xinjiang	65	3	Guizhou	3
Qinghai	63	4	Yunnan	4
Guizhou	52	5	Shaanxi	5
Shaanxi	61	6	Qinghai	6
Henan	41	7	Xinjiang	7
Anhui	34	8	Chongqing	8
Ningxia	64	9	Ningxia	9
Shanxi	14	10	Shanxi	10
Yunnan	53	11	Sichuan	11
Inner Mongolia	15	12	Anhui	12
Jiangxi	36	13	Henan	13
Sicuan	51	14	Guangxi	14
Chongqing	50	15	Inner Mongolia	15
Hunan	43	16	Hainan	16
Hebei	13	17	Hunan	17
Guangxi	45	18	Jiangxi	18
Hainan	46	19	Heilongjiang	19
Jilin	22	20	Hubei	20
Hubei	42	21	Jilin	21
Shandong	37	22	Hebei	22
Heilongjiang	23	23	Liaoning	23
Liaoning	21	24	Shandong	24
Jiangsu	32	25	Fujian	25
Fujian	35	26	Tianjin	26
Zhejiang	33	27	Jiangsu	27
Tianjin	12	28	Guangdong	28
Guangdong	44	29	Zhejiang	29
Beijing	11	30	Beijing	30
Shanghai	31	31	Shanghai	31

Appendix Table 8.6: Regressions for level (yuan) of gain in rural areas of three provinces

	Liaoning		Guangdong		Sichuan	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Log of household size	37.642	6.42	28.822	2.64	4.958	2.16
Age of household head	-2.425	-3.11	-1.783	-2.60	-0.548	-1.51
Squared age	0.026	3.36	0.017	2.66	0.005	1.30
Agriculture household	-10.942	-3.31	-42.850	-6.45	-37.723	-6.54
# of employee/h'hold size	12.665	4.10	-6.932	-0.29	12.652	3.02
# of TVE workers/hh size	10.768	3.13	29.466	3.06	15.327	4.26
# of migrate workers/hh size	5.399	1.73	7.798	2.35	7.067	3.79
Area of cultivated land	-0.027	-5.73	-0.002	-1.00	-0.001	-0.28
Area of hilly land	0.000	-0.05	-0.001	-0.87	0.002	1.94
Area of fishpond land	-0.001	-0.94	-0.070	-2.85	0.000	0.04
Highest education level is						
... illiterate or semi-illiterate	7.926	1.04	19.016	1.25	8.387	0.92
... primary school	0.071	0.01	-2.148	-0.13	9.694	1.06
... middle school	-0.755	-0.11	-4.261	-0.26	7.669	0.84
... high school	2.125	0.31	2.806	0.18	9.675	1.03
... technical school	-3.096	-0.44	-36.482	-1.09	4.270	0.38
... college (default)						
Ratio of labor force	0.576	0.08	2.877	0.15	-4.995	-1.16
Ratio of children under 6	46.999	2.71	8.109	0.35	-2.291	-0.45
Ratio of children age 6-11	1.414	0.11	2.247	0.10	-9.011	-1.50
Ratio of children age 12-14	-0.155	-0.01	-24.489	-1.20	-9.606	-1.51
Ratio of children age 15-17	-2.592	-0.22	-23.390	-1.02	-5.485	-0.73
Constant	-17.851	-0.82	-17.742	-0.65	-17.220	-1.43
R-square	0.278		0.116		0.116	

Appendix Table 8.7: Regressions for percentage gains in rural areas of three provinces

	Liaoning		Guangdong		Sichuan	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Log of household size	0.768	2.46	0.022	0.20	0.030	0.40
Age of household head	-0.108	-2.17	-0.007	-0.34	-0.004	-0.31
Squared age	0.001	2.19	0.000	0.40	0.000	-0.02
Agriculture household	-0.896	-2.98	-1.365	-14.85	-1.420	-7.58
# of employee/hh size	0.630	2.76	0.271	2.57	0.444	3.61
# of TVE workers/hh size	0.669	4.27	0.585	4.47	0.548	6.11
# of migrate workers/hh size	0.655	3.59	0.187	3.59	0.346	7.08
Area of cultivated land	0.000	-1.77	0.000	-0.73	0.000	-1.61
Area of hilly land	0.000	-0.48	0.000	-0.35	0.000	2.20
Area of fishpond land	0.000	-0.17	-0.001	-2.23	0.000	0.55
Highest education level is						
... illiterate or semi-illiterate	1.393	2.18	0.507	1.26	-0.013	-0.05
... primary school	-0.634	-2.01	-0.154	-0.90	0.069	0.30
... middle school	-0.891	-3.08	-0.023	-0.14	-0.011	-0.05
... high school	-0.660	-2.42	0.010	0.06	0.006	0.02
... technical school	-0.573	-1.87	-0.229	-1.18	0.038	0.14
... college (default)						
Ratio of labor force	0.456	0.85	0.323	1.81	-0.099	-0.71
Ratio of children under 6	3.730	3.61	0.461	1.49	-0.169	-0.78
Ratio of children age 6-11	1.557	1.41	0.173	0.72	-0.275	-1.48
Ratio of children age 12-14	1.625	1.54	-0.477	-1.60	-0.343	-1.85
Ratio of children age 15-17	1.325	1.80	-0.289	-0.91	-0.192	-0.88
Constant	0.788	0.69	-0.709	-1.39	-0.584	-1.68
R-square	0.108		0.217		0.171	

Appendix Table 8.8: Regressions for level (*yuan*) of gain in urban areas of three provinces

	Liaoning		Guangdong		Sichuan	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Log of household size	-5.627	-1.81	5.289	0.27	-19.441	-4.09
Single head h'hold	-1.366	-0.4	-37.216	-2.06	-17.369	-3.61
Age of household head	0.531	0.92	5.266	2.43	1.542	2.34
Squared age	-0.001	-0.24	-0.040	-1.8	-0.015	-2.22
Highest education level (default is university)						
... primary school or lower	13.240	2.95	50.434	2.4	23.079	3.11
... middle school	19.104	5.99	56.659	3.58	26.096	4.34
... high school	5.123	1.62	12.053	0.95	12.717	2.39
... technical school	11.086	3.23	11.075	0.88	9.552	1.62
... college	3.974	1.26	3.447	0.3	11.013	2.12
Sector (default is govt.)						
... agriculture	-16.310	-1.22	-25.590	-2.23	17.293	1.76
... mining	-14.586	-3.24	19.351	1.13	-3.851	-0.53
...manufacturing	-9.231	-2.59	17.773	1.28	-4.634	-1.2
...utility	-9.387	-1.63	-10.816	-0.42	1.516	0.13
...construction	-6.394	-1.18	8.622	0.63	-4.409	-0.92
...geological prospecting & water conservancy	-27.422	-2.62	20.089	0.92	-16.585	-0.83
...trans. & telecom.	6.368	1.52	16.525	1.24	1.644	0.25
...wholesale & retail etc.	-3.184	-0.61	5.664	0.45	-1.983	-0.4
...banking & finance	-5.278	-0.55	3.888	0.3	9.491	0.85
...real estate	-11.708	-1.71	46.192	1.35	7.670	0.37
...social services	-5.542	-1.02	-4.186	-0.33	0.504	0.1
...health care etc.	-9.260	-1.93	0.683	0.04	-1.049	-0.17
...education etc.	-7.279	-1.64	7.649	0.46	-5.219	-0.87
...scientific research	-20.982	-4.06	17.882	1.14	-7.929	-0.59
...others	-7.784	-1.42	-24.851	-0.75	-7.012	-0.73
Type of employer (default is state owned)						
...collective-owned	-1.927	-0.76	11.882	0.54	-5.946	-2.09
...foreign company	-3.138	-0.72	-10.988	-1.22	2.038	0.31
...private-business owner	4.278	0.6	9.448	0.64	10.582	2.08
...private-owned	-9.587	-1.41	-14.823	-0.99	-4.601	-0.57
...retirees re-employed	-13.333	-2.45	-35.591	-1.82	-6.752	-0.99
...retirees	-15.569	-3.66	-49.442	-1.91	-12.218	-1.95
...others	-10.350	-1.36	-6.568	-0.34	-16.796	-2.06
Occupation (default is retiree)						
Engineer & technician	10.244	1.66	3.479	0.12	10.179	1.49
Officers	12.747	2.07	17.701	0.64	10.564	1.53
staff in commerce	11.742	2.08	18.553	0.65	12.734	1.92
staff in services	19.940	2.54	3.380	0.11	4.057	0.5
worker in manufactory etc.	17.484	2.02	13.151	0.47	13.810	1.86
worker in trans. & telecom. etc.	21.469	3.59	9.637	0.34	16.117	2.35
Other	15.318	2.05	9.810	0.27	-6.141	-0.77
Constant	-10.744	-0.77	-164.442	-2.43	-17.611	-1.1
R-square	0.265		0.131		0.181	

Appendix Table 8.9: Regressions for percentage gains in urban areas of three provinces

	Liaoning		Guangdong		Sichuan	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Log of household size	0.175	3.54	-0.038	-0.4	0.036	0.46
Single head h'hold	-0.022	-0.36	-0.221	-2.21	-0.259	-3.07
Age of household head	0.000	-0.01	0.033	2.55	0.017	1.53
Squared age	0.000	0.1	0.000	-2.12	0.000	-1.46
Highest education level (default is university)						
... primary school or lower	0.524	6.43	0.389	3.7	0.509	5.15
... middle school	0.539	10.41	0.583	7.25	0.591	8.27
... high school	0.180	3.56	0.095	1.46	0.262	3.83
... technical school	0.214	4.04	0.076	1.22	0.120	1.79
... college	0.054	1.04	0.015	0.25	0.125	2.24
Sector (default is govt.)						
... agriculture	-0.079	-0.32	0.166	2.2	0.338	2.64
... mining	0.183	1.11	0.346	3.38	-0.129	-1.01
...manufacturing	-0.015	-0.27	0.114	1.41	-0.021	-0.34
...utility	-0.040	-0.36	-0.144	-1.18	-0.134	-0.84
...construction	0.095	0.91	0.109	1.19	0.036	0.51
...geological prospecting & water conservancy	-0.407	-3.06	0.178	1.03	-0.228	-0.53
...trans. & telecom.	0.206	2.93	0.060	0.79	-0.036	-0.4
...wholesale & retail etc.	0.060	0.78	0.081	0.99	-0.015	-0.18
...banking & finance	-0.088	-0.47	0.049	0.53	0.013	0.12
...real estate	-0.108	-0.91	0.222	1.16	0.106	0.29
...social services	-0.090	-1.09	0.065	0.69	0.148	1.37
...health care etc.	-0.088	-1.1	0.007	0.06	-0.124	-1.49
...education etc.	-0.057	-0.75	0.044	0.44	-0.031	-0.39
...scientific research	-0.454	-4.09	0.126	1.11	-0.082	-0.73
...others	0.012	0.14	0.034	0.25	-0.121	-0.55
Type of employer (default is state owned)						
...collective-owned	0.053	1.16	0.008	0.08	0.137	1.73
...foreign company	-0.046	-0.54	-0.122	-2.3	-0.193	-2.08
...private-business owner	-0.069	-0.59	-0.051	-0.39	0.317	2.46
...private-owned	-0.182	-1.65	-0.231	-1.96	-0.037	-0.22
...retirees re-employed	-0.302	-3.39	-0.242	-1.41	-0.177	-1.32
...retirees	-0.341	-4.2	-0.452	-2.37	-0.359	-3.42
...others	-0.124	-1.13	-0.187	-1.24	-0.338	-1.2
Occupation (default is retiree)						
Engineer & technician	-0.015	-0.14	-0.141	-0.69	-0.036	-0.29
Officers	-0.044	-0.43	-0.063	-0.31	-0.045	-0.36
Staff in commerce	0.012	0.12	-0.036	-0.17	0.029	0.24
Staff in services	0.437	3.08	0.019	0.09	-0.011	-0.08
worker in manufactory etc.	0.118	0.82	0.025	0.12	0.091	0.56
worker in trans. & telecom. etc.	0.209	2.02	-0.018	-0.09	0.130	1.03
Other	0.171	1.33	-0.069	-0.27	-0.636	-4.2
Constant	0.172	0.7	-0.623	-1.68	-0.197	-0.71
R-square	0.401		0.290		0.359	

Appendix Table 8.10: Average losses for agricultural households in selected counties

	NBS county identifier	Loss		Provincial mean	
		in yuan	in %	in yuan	in %
Liaoning	210181	-73.72	-3.07	-32.34	-1.29
	210212	-145.40	-2.99		
	210381	-172.01	-5.57		
	210921	-57.70	-5.21		
	211321	-45.58	-3.78		
	211322	-53.60	-3.23		
Guangdong	440111	-107.31	-2.74	-29.34	-0.81
	440126	-183.63	-2.64		
	440223	-102.33	-3.53		
	440523	-148.90	-2.55		
	440620	-227.23	-3.11		
	440621	-109.59	-2.64		
	441425	-316.49	-5.34		
Sichuan	510121	-130.46	-2.86	-12.31	-0.67
	510125	-63.19	-3.81		
	512425	-138.34	-5.71		
	512610	-52.23	-3.11		
	512825	-40.44	-2.80		
	513021	-93.02	-4.07		

Note: Agricultural households are those for whom agriculture supplies more than 75 % of income.

Appendix Table 8.11: Sectoral classification used in China GTAP model

	China GTAP code	GTAP57 code
Rice	1	1,23
Wheat	2	2
Feed grains	3	3
Vegetables and fruits	4	4
Oilseeds	5	5
Sugar	6	6,24
Plant based fibers	7	7
Livestock & meat	8	9,10,12,19,20
Dairy	9	11,22
Other food	10	8,21,25
Beverages & tobacco	11	26
Extractive industries	12	13,14,15,16,12,18
Textiles	13	27
Apparel	14	28
Light manufacturing	15	29
Petrochemical industry	16	32,16,34
Metals	17	35,36,37
Autos	18	38
Electronics	19	40
Other manufactures	20	30,31,39,41,42
Trade and transport	21	47,48,49,50
Construction	22	46
Communication	23	51
Commercial services	24	52,53,54,57
Other services	25	43,44,45,55,56,