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Welfare Impacts of China's Accession to the World Trade Organization

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Data from China's national rural and urban household surveys are used to measure and explain the welfare impacts of changes in goods and factor prices attributable to accession to the World Trade Organization. The price changes are estimated separately using a general equilibrium model to capture both direct and indirect effects of the initial tariff changes. The welfare impacts are first-order approximations based on a household model incorporating own-production activities calibrated to household-level data and imposing minimum aggregation. The results show negligible impacts on inequality and poverty in the aggregate. However, diverse impacts emerge across household types and regions, associated with heterogeneity in consumption behavior and income sources, with possible implications for compensatory policy responses.

There has been much debate about the welfare impacts of greater trade openness. Some argue that external trade liberalization is beneficial to the poor in developing economies, whereas others argue that the benefits will be captured by people who are not poor. Expected impacts on relative wages (notably between skilled and unskilled labor) and relative prices (such as between food staples and luxury imports) have figured prominently in debates about the welfare impacts.

What does the evidence suggest? 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 those that are not. A number of attempts to throw empirical light on the welfare effects of trade liberalization have been made using aggregate cross-country data sets that combine survey-based measures of inequality or poverty with data on trade

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openness and other control variables (see Bourguignon and Morisson 1990; Edwards 1997; Barro 2000; Dollar and Kraay 2002; Lundberg and Squire 2003).

However, there are reasons to be cautious in drawing implications from such cross-country comparisons. There are concerns about data and econometric specifications. Differences in survey design and processing between countries and over time within countries can add considerable noise to the measured levels and changes in poverty and inequality. 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 the issue of whether trade volume can be treated as exogenous in these cross-country regressions; it is clearly not a policy variable and 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 themselves is clearly problematic. The correlations (or their absence) found in cross-country studies can also be deceptive because starting conditions can vary so much between reforming countries. Averaging across this diversity in initial conditions can readily hide systematic effects of relevance to policy (Ravallion 2001).

In principle, such problems in cross-country comparative work can be dealt with by better data and methods. However, the concerns go deeper. Aggregate inequality or poverty may not change with trade reform even though there are both gainers and losers at all levels of living. Survey data tracking the same families over time commonly show considerable churning under the surface.[1] The data show that many people have escaped poverty, whereas others have fallen into poverty, even though the overall poverty rate is unchanged.

Numerous sources of such diverse impacts can be found in developing economy settings. For example, geographic disparities in access to human and physical infrastructure affect prospects for participating in economic growth.[2] For China, the economic geography of poverty and how this interacts with geographic diversity in the impacts of policy reforms are high on the domestic policy agenda. A policy analysis that simply averaged over such differences would miss a great deal of what matters to the debate on policy.

This article follows a different approach, in which the attribution to trade policy changes is unambiguous and the diversity of welfare impacts is not lost. The article examines the welfare impacts at the household level of the changes in commodity and factor prices attributed to a specific trade policy reform, namely, China's accession in 2001 to the World Trade Organization (WTO). For China, this meant a sharp reduction in tariffs, quantitative restrictions, and export subsidies, with implications for the domestic structure of prices and wages and thus for household welfare. Drawing on estimates by Ianchovichina and Martin

1. 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.

2. For China's lagging poor areas see Jalan and Ravallion (2002).

(2002) of the impacts of reform on prices (for both commodities and factors of production), the following analysis applies standard methods of first-order welfare analysis to measure the gains and losses at the household level using large sample surveys collected by China's National Bureau of Statistics (NBS).

I. Measuring the Welfare Impacts of Trade Reform

Previous approaches to studying the welfare impacts of specific trade reforms have tended to be either partial equilibrium analyses, which measure household-level welfare impacts of the direct price changes due to tariff changes using survey data (typically) covering many thousands of randomly chosen households, or general equilibrium analyses, which use a computable general equilibrium (CGE) model to capture second-round responses.[3] Although partial equilibrium analysis requires little or no aggregation of the primary household data, it misses potentially important indirect effects on prices and wages. General equilibrium analysis has the power to capture these effects by simulating economywide impacts on markets. However, standard CGE models entail considerable aggregation across household types, with rarely more than six or so representative households. Such models are crude tools for welfare-distributional analysis.

The challenge for applied work is to find an approach that respects the richness of detail available from modern integrated household surveys while ensuring that the price changes attributed to reform are internally consistent with economywide equilibrium conditions. In principle, the CGE model could be built onto the household survey, so that the number of households in the model is the number sampled in the survey.[4] For this study, that degree of integration would require an extraordinarily high dimensional CGE model, with 85,000 households. This is currently not a feasible route.

The intermediate approach used here carries the reform-induced commodity and factor price changes simulated from a general equilibrium model to the level of all the sampled households in the survey.[5] The welfare impacts are measured using standard tools of analysis familiar from prior work on the welfare effects of price changes associated with tax and trade policy reform. This approach imposes minimal aggregation conditions on the survey data within unavoidable

3. Examples of partial equilibrium analysis of the welfare distributional effects of price changes include King (1983), Deaton (1989), Ravallion (1990), Ravallion and van de Walle (1991), and Friedman and Levinsohn (2002). On applications to tax policy reform, also see Newbery and Stern (1987). On CGE models see Decaluwe and Martens (1988) and Hertel (1997).

4. The only known example of this full integration is Cockburn (2002), who built a classic trade-focused CGE model onto the Nepal Living Standards Survey covering about 3,000 households.

5. In an antecedent to the approach take here, Bourguignon and others (2003) also take price changes generated by a CGE model to survey data (for Indonesia). Methodologically, the main difference is that they generate income impacts at the household level from a microeconometric model of income determination, whereas this study derives first-order welfare impacts analytically from a standard competitive farm-household model.

data limitations. In addition to calculating the trade reform's overall effects on poverty and inequality, this approach provides a detailed socioeconomic map of impact, showing how it varies with other nonincome characteristics, such as location. This generates better insights to the questions policymakers ask about who gains and who loses from reform.

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 nontraded goods and on factor returns, including effects operating through the government's budget constraint. Ianchovichina and Martin (2002) use a competitive market-clearing model from the Global Trade Analysis Project (GTAP).[6] The revenue implications of the trade policy change are reflected in changes in indirect tax rates.[7] Because 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 previous attempts to estimate distributional effects of trade policy reform using cross-country comparisons.

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

The indirect utility function of household i is given by

$$(1) \qquad \nu_i[p_i^d, w_i, \pi_i] = \max_{(q_i^d, L_i)}[u_i(q_i^d, L_i)\Big| p_i^d q_i^d = w_i L_i + \pi_i]$$

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

$$(2) \qquad \pi_i(p_i^s, p_i^d, w_i) = \max_{(z_i, L_i^o)}[p_i^s q_i^s - p_i^d z_i - w_i L_i^o \Big| q_{ij}^s \le f_{ij}(z_{ij}, L_{ij}^o), \quad j = 1, .., m; \sum_j z_{ij} \le z_i, \sum_j L_{ij}^o \le L_i^o]$$

where p_i^s is the m-vector of supply prices, q_i^s is the corresponding vector of quantities supplied, L_i^o is the labor input to own-production activities, of which L_{ij}^o is used in producing good j, f_{ij} is the household-specific production function

6. Hertel (1997) contains descriptions of the standard GTAP model with applications.

7. 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).

for good j (embodying fixed factors), and the z_i terms are the commodities used as production inputs, of which z_{ij} is used in producing good j.

Measurement of the welfare impacts is of course constrained by the data, which do not include initial price and wage levels.[8] However, this data limitation does not matter in 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 treating the quantity choices as given), the monetary value of the change in utility for household i is given by

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

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.)

Equation 3 is the key formula used in calculating the household-level welfare impacts of the price changes implied by the general equilibrium analysis of the trade policy reform. 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 jth 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. The term $p_{ij}^s q_{ij}^s - p_{ij}^d (q_{ij}^d + z_{ij})$ is referred to as *net revenue*, which (to a first-order approximation) gives the welfare impact of an equiproportionate increase in the price of commodity j.

With the gain (or loss) to each household calculated based on equation 3, the covariates of those gains can now be examined. One covariate of obvious interest is income, needed to assess impacts on aggregate poverty and inequality. Ideally, one would use a money metric of utility based on equation 1. However, that would require an explicit model of the demand and supply system (that can be integrated back to obtain the indirect utility function). Again, feasibility becomes an issue because of the absence of complete data on price and wage levels. Thus there is little choice but to use income as the money metric of utility, in effect ignoring all geographic differences in the prices faced or in the extent to which border price changes are passed on locally. However, we make a seemingly plausible allowance for urban–rural cost of living differences in this setting.

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

Two further limitations of this approach should be noted. First, applying the calculus in deriving equation 3 implicitly assumes small changes in prices. Relaxing this requires more information on price levels and the structure of the demand and supply system.[9] This would entail considerable further effort, and the reliability of the results will be questionable given the problem of incomplete price and wage data.

Second, as already noted and consistent with the general equilibrium analysis, this approach also rules out rationing in commodity or factor markets or nonconvexities in consumption or production. In principle, these problems can also be handled through a completely specified demand model (which can be used to estimate the virtual prices at which the rationed demand or supply would be chosen). This is not feasible without data on price and wage level.

II. Setting and Data

Although the official date of China's WTO accession is 2001, it is clear that the Chinese economy had already started to adapt to this expected change well before that time. The trade reform can thus be thought of 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 for 1995 as a plausible beginning of the lead-up period. Their estimates of the price changes induced by WTO accession for the periods 1995–2001 and 2001–07 are used in this analysis. Although the primary focus is on the second period, welfare impacts are also estimated for the lead-up period.

The measure of welfare impacts given by equation 3 is calibrated to survey data for 1999, two years before official WTO accession and a few years after the likely beginning of the lead-up period. The choice of 1999 was partly made for data reasons, because it was the most recent year for which the micro-data were available. Choosing a year near the middle of the lead-up period (rather than a survey at the beginning or end) should also diminish biases due to any non-linearity in the welfare impacts of price and wage changes.

Survey Data

The survey data used in this study are from the 1999 Urban Household Survey and the 1999 Rural Household Survey by China's NBS. The sample size is 67,900 households for the rural survey and 16,900 households (out of the survey total of 40,000 households) for the urban survey.[10] Over the past 15 years, the NBS has worked to improve both surveys, focusing on sample coverage, questionnaire

9. Examples of this approach can be found in King (1983) and Ravallion and van de Walle (1991).

10. The full sample of the urban survey was about 40,000 households, but until 2002 the central NBS office kept individual record data for only 16,900 households.

design, methodology, and data processing.[11] The number of variables in the surveys has increased dramatically, with additional details on income, expenditure, savings, housing, and productivity, among others. The NBS also provided micro-data for three provinces (Liaoning, Guangdong, and Sichuan—the test provinces). A computer program to implement the estimation method was written for these data, after which the program was run by NBS staff on the entire national data set.

A number of problems remain in the 1999 surveys. For a sample frame, the rural survey relies on its sampled counties from 1985, which may no longer be representative. The urban survey excludes rural migrants, because the base of the sample frame is the legal registration system (*hukou*). As in other countries, the rural survey gives data on the remittances of migrant workers, but it 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.

Comparisons between the rural and urban surveys also present problems. For example, income in the rural survey includes in-kind income (such as from own-farm production and other household enterprises), but income in the urban survey ignores some in-kind components, notably subsidies from the government.

Sampling Weights

The population census puts the 1999 urban population share at 34 percent, whereas the sample-based urban population share is 20 percent. To correct the rural and urban sampling weights, the urban population share from the *China Statistical Yearbook* (NBS 2000) was used to replace the survey sample weights to form the national figures.

Matching the Global Trade Analysis Project Model and the Surveys

There are 57 sectors in the GTAP model. The China GTAP model used in this study regroups these 57 sectors into 25: rice, wheat, feed grains, vegetables and fruits, oilseeds, sugar, plant-based fibers, livestock and meat, dairy, processed food, beverages and tobacco, extractive industries, textiles, apparel, light manufactures, petrochemicals, metals, automobiles, electronics, other manufactures, trade and transport, construction, communications, commercial services, and other services. To these are added land, capital, and three types of labor (see later discussion).

China's rural and urban surveys have about 2,000 categories for consumption and production. The variables from the household surveys are matched to the closest category in the GTAP model. For example, corn, millet, and potatoes

11. For further discussion in the context of the Rural Household Survey, see Chen and Ravallion (1996).

are placed in the category feed grains and cotton and fiber crops are placed in the category plant-based fibers. (The working paper version of this article, Chen and Ravallion 2003, gives details on how the variables from the surveys are matched to the GTAP model sectors.)

Definitions of Labor and Labor Earnings

The China GTAP model defines three types of labor: unskilled farm labor, unskilled nonfarm labor, and skilled nonfarm labor.[12] Because the rural and urban surveys have different questionnaires, rural and urban labor earnings are treated differently. In the urban survey three variables—sector, occupation, and education—are used to determine labor types. But sector or occupation alone cannot indicate whether a person should be classified as skilled labor. For example, the financial sector may hire some unskilled labor and the services sector may hire some skilled labor. Similarly, a train driver in the occupation category "workers and staff-members in production and transportation" counts as skilled labor. Therefore, education is also taken into account. Workers who have received education at the senior high school level or higher are considered skilled labor. Others are classified as unskilled labor.

It is more difficult to determine the type of labor income for rural areas. There is no information on how much each person earns and from what work. Consequently, labor earnings can be classified only roughly by income source. For instance, all labor remuneration from agriculture is considered income from unskilled farm labor; earnings from industry or construction, grain processing, and the like are considered income from unskilled nonfarm labor; earnings from the services sector, transportation and trade, and the like are considered income from skilled nonfarm labor.

Land

Under China's economic reforms, which began in 1978, all farmers have land-use rights but not the right to sell, although they can subcontract the allocated land to other farmers. Therefore, the change in land prices from the GTAP model affects only the value of land rentals paid and received.

Household Income

For assessing the overall impacts on poverty and inequality, rural and urban households are combined. There is no cost of living index between urban and rural areas of China. (Urban and rural consumer price indexes are both indexed to 100 at the base date.) The urban price level is assumed to be 15 percent higher than the rural price level. This differential is less than that for other

12. By the International Labour Organization's definitions, *skilled labor* consists of managers and administrators, professionals, and para-professionals, and *unskilled labor* consists of tradespeople, clerks, salespeople and personal service workers, plant and machine operators and drivers, laborers, and related workers and farm workers.

developing economies because subsidies to urban households in China help compensate for higher housing and food costs than in rural areas.

Income per person is used as the welfare indicator (so that all households are ranked by per capita income, from the poorest to the richest). This is termed "net income" in the rural survey and "disposable income" in the urban survey. Postreform income is then income plus the estimated gain defined by equation 3.

III. Measured Welfare Impacts of WTO Accession

Based on the predicted relative price and wage changes from the GTAP model for 1995–2000 (table 1) and 2001–07 (table 2) and production and consumption shares from the 1999 rural and urban household survey data, equation 3 can be used to compute the net gain for each household. The first panel in table 3 gives the mean gains for 1995–2001 and 2001–07, split by urban and rural areas. The second panel gives the Gini indices, both actual (for the baseline year, 1999) and simulated. The two simulated income distributions are obtained by subtracting the estimated gains over 1995–2001 from the 1999 incomes at the household level and by adding the household-specific gains from 2001–07 to the 1999 incomes. Thus the first simulation shows the distributional impact of the price changes during the first stage of the trade reform (what the baseline distribution would have looked like without the reforms) and the second shows the impact of the post-2001 price changes (how the changes are expected to affect the baseline distribution, looking forward). The third panel gives the headcount index of poverty for the official poverty line based on the poverty lines used by China's NBS and for the \$1/day and \$2/day poverty lines from Chen and Ravallion (2001).

There is an overall gain of about 1.5 percent of mean income. All of this gain is in the period leading up to WTO accession. There is almost no impact on inequality, either in the period leading up to WTO accession or predicting forward. The aggregate Gini index increased slightly, from 39.3 percent without WTO accession to 39.5 percent after accession.

The incidence of poverty would have been slightly higher in 1999 if not for the trade policy changes in the lead-up to WTO accession, whereas poverty is predicted to increase slightly during 2001–07 due to the expected price changes induced by the remaining tariff changes during that period. The impacts on rural and urban poverty for a wide range of poverty lines can be seen in figure 1, which gives the cumulative distributions of income for both the baseline and the two simulated distributions for the poorest 60 percent in rural areas and 40 percent in urban areas.

Although there is virtually zero aggregate impact when predicting forward from WTO accession, the disaggregated results show a more nuanced picture. The analysis focuses on three measures of impact at the household level: the absolute gain or loss, g_i; the proportionate gain or loss, g_i/y_i; and whether there is a gain or not, $I(g_i)$, where I is the indicator function. This third measure helps determine where there might be high concentrations of losers in specific areas or socioeconomic groups.

TABLE 1. Predicted Price Changes from GTAP Model and per Capita Net Gain or Loss for Rural and Urban Households, 1995–2001

			Rural		Urban	
Expenditures and income sources	Wholesale prices (%)	Consumer prices (%)	Net revenue (yuan)	Mean welfare change (yuan)	Net revenue (yuan)	Mean welfare change (yuan)
Expenditures						
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 and 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 and 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 and 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
Income sources						
Farm unskilled labor	1.7	1.7	313.58	5.22		0.00
Nonfarm unskilled	1.7	1.7	287.19	4.78	1,227.51	20.44
Skilled labor	2.0	2.0	360.87	7.09	3,391.11	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

Source: Ianchovichina and Martin (2002) and author's computations based on China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

TABLE 2. Predicted Price Changes from GTAP Model and per Capita Net Gain or Loss for Rural and Urban Households, 2001–07

			Rural		Urban	
Expenditures and income sources	Wholesale prices (%)	Consumer prices (%)	Net revenue (yuan)	Mean welfare change (yuan)	Net revenue (yuan)	Mean welfare change (yuan)
Expenditures						
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 and 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 and 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 and 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
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Income sources						
Farm unskilled labor	−0.3	−0.3	313.58	−0.85		
Nonfarm unskilled	1.0	1.0	287.19	2.96	1,227.51	12.64
Skilled labor	0.4	0.4	360.87	1.55	3,391.11	14.58
Land	−4.7	−4.7	17.08	−0.80		
Capital	0.6	0.6	21.14	0.13	126.01	0.80

Source: Ianchovichina and Martin (2002) and authors' computations based on China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

TABLE 3. Summary Statistics on Aggregate Welfare Impacts, 1995–2001 and 2001–07

Item	Rural	Urban	National
Mean gains (yuan per capita)			
1995–2001	34.47	94.94	55.49 (1.54%)[a]
2001–07	−18.07	29.45	−1.54 (−0.04%)[a]
Inequality impacts (Gini index as percentage)			
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
Poverty impacts (headcount index, percentage)[b]			
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 purchasing power parity)			
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 purchasing power parity)			
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

[a]Percentage of mean income.

[b]Official poverty line is from China NBS; $1/day and $2/day poverty lines are from Chen and Ravallion (2001).

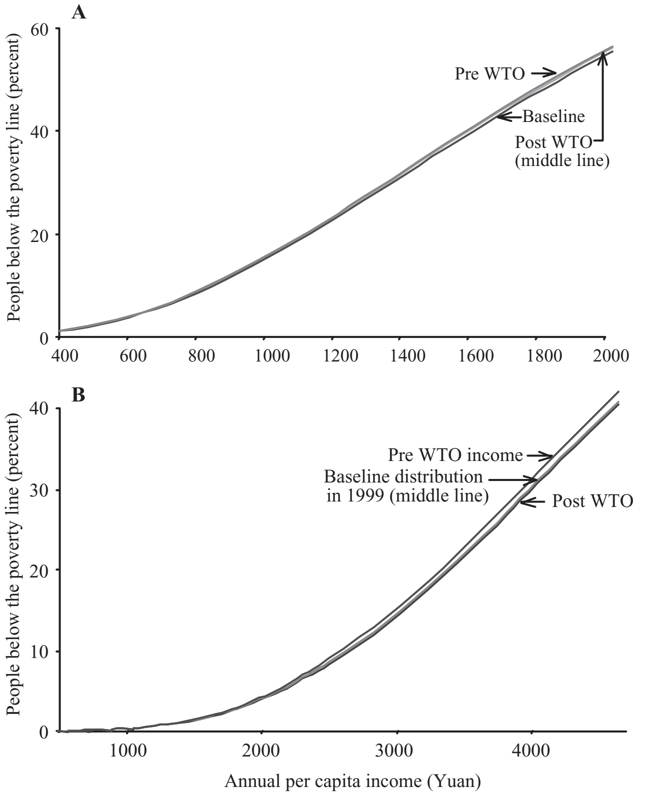
Source: Authors' computations based on China National Bureau of Statistics 1999 Rural Household Survey and 1999 Urban Household Survey.

The results by provinces ranked by mean income per person are plotted in figure 2a for mean absolute gains (g_i in yuan per capita), in figure 2b for proportionate gains (g_i/y_i, as a percentage), and in figure 2c for the proportion of households that registered positive gains. (The average gain or loss by province for urban and rural areas and the number of gainers in each case are shown in appendix tables A.1 and A.2; Chen and Ravallion 2003 gives the province rankings.)

The same results are also plotted in figure 3 against percentiles of the income distribution. So, for example, to see the mean impact in yuan per capita at the median income, one looks at the 50th percentile of figure 3a. (Notice that figure 3a gives the horizontal differences in figures 1a and 1b plotted against the point on the vertical axis.)

In the aggregate, about three-quarters of rural households and one-tenth of urban households will experience a real income loss. Farm income is predicted to drop by 18 yuan per person, whereas urban income rises by 29 yuan per person. The breakdown by sectors in table 2 shows that the decline in rural

FIGURE 1. (a) Rural and (b) Urban Poverty Incidence Curves

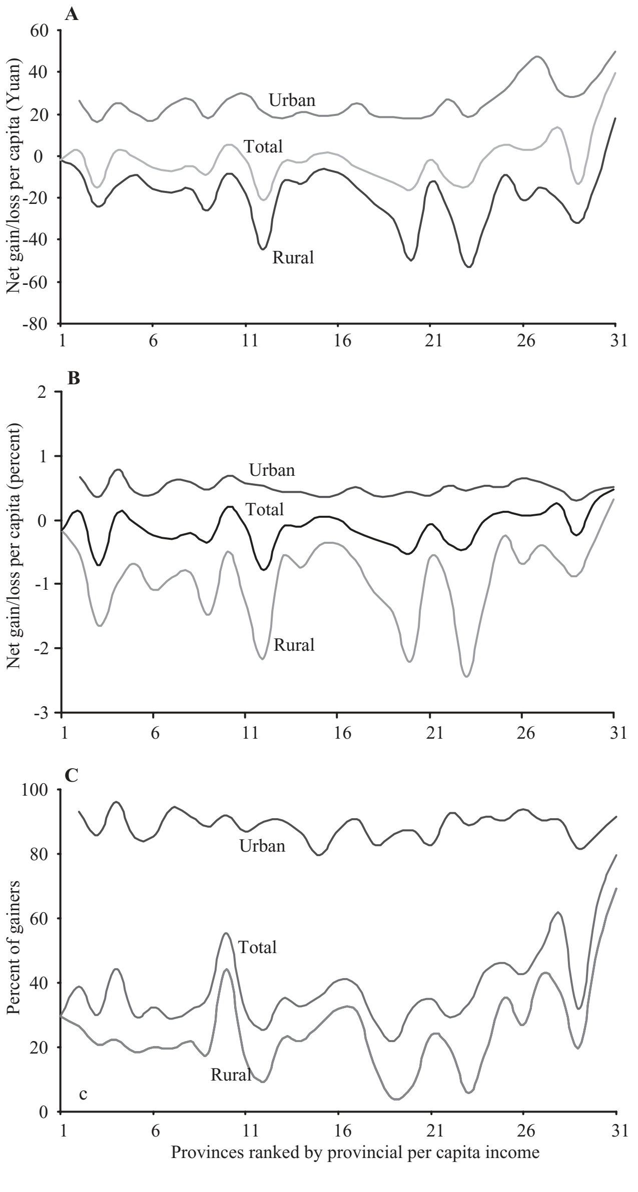


Source: China National Bureau of Statistics and Chen and Ravallion 2001.

income is due to the drop in wholesale prices for most farm products, plus higher prices for education and health care. Farmers will also benefit from the drop in some consumer prices and from the increase in nonfarm labor wages. In urban areas residents will enjoy lower prices for most farm products and higher wages, but they will also be hit by increases in service fees for education and health care.

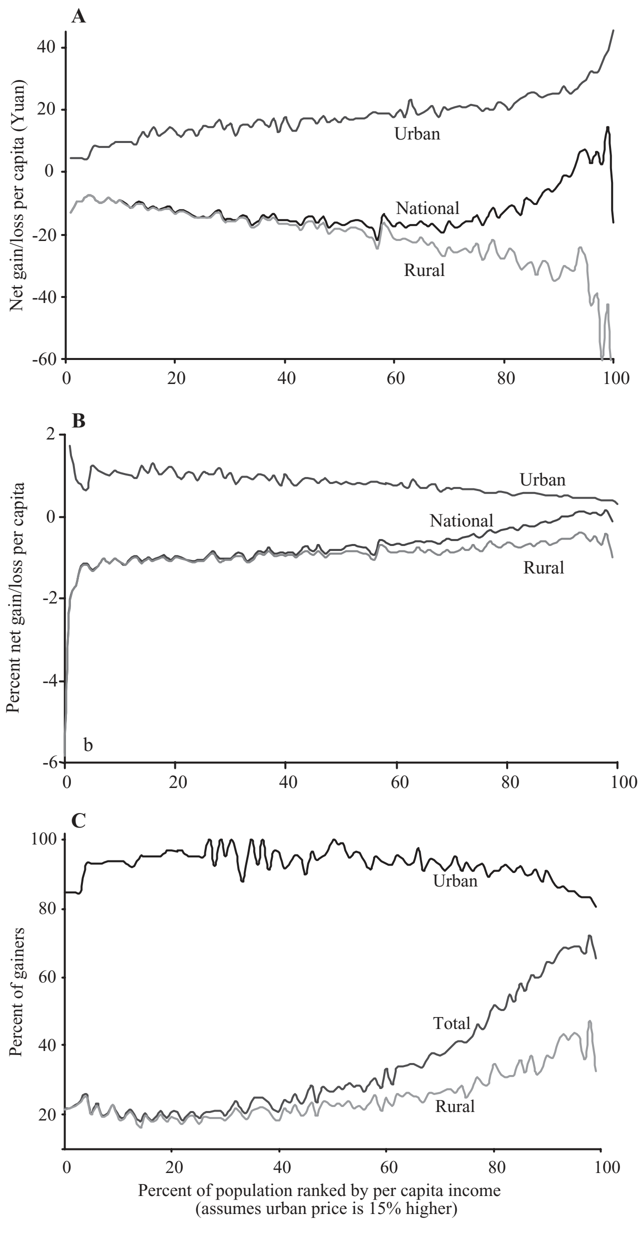
Impacts differ considerably across regions (see figure 2 and appendix tables A.1 and A.2). The mean absolute gains tend to be highest in the richest provinces in both urban and rural areas (figure 2a), though there is no correlation between the proportionate gains and mean income of provinces (figure 2b). One spatially contiguous region—the northeast provinces of Inner Mongolia, Liaoning, Jilin, and Heilongjiang—stands out as having the largest loss from the reform. Both absolute and proportionate impacts are highest in this region—more than 90 percent of farmers in Heilongjiang and Jilin are predicted to experience a net loss.

FIGURE 2. (a) Mean Absolute Gain or Loss by Province Ranked by per Capita Income. (b) Mean Proportionate Gain or Loss by Province Ranked by per Capita Income. (c) Mean Percentage of Gainers by Province Ranked by per Capita Income



Source: Authors' computations based on data from China National Bureau of Statistics 1999 Rural Household Survey and 1999 Urban Household Survey.

FIGURE 3. (a) Mean Gain or Loss by Population Ranked by per Capita Income Percentile (Yuan). (b) Mean Percentage Gain or Loss Ranked by per Capita Income Percentile. (c) Percentage of Gainers by Income Percentile



Note: Urban prices are assumed to be 15 percent higher than rural prices.

Source: Authors' compilation based on China National Bureau of Statistics 1999 Rural Household Survey and 1999 Urban Household Survey.

Notice that these geographic differences in welfare impacts arise entirely from differences in consumption and production behavior. In reality, there are also likely to be differential impacts on local prices due to transport or other impediments to internal trade. The analysis here does not incorporate such differences, and doing so would pose a number of data and analytic problems. This might, however, be a fruitful direction for future work where the necessary data on prices and wage levels are available by geographic area.

When households are ranked by initial income, there is a notable difference between urban and rural households, with absolute gains tending to be higher for higher-income households in urban areas but lower for higher-income households in rural areas (see figure 3a). Nationally (combining urban and rural areas with the corrected weights), there is the hint of a U-shaped relationship, but still with the highest absolute gains for the rich.

This picture is reversed for proportionate gains, which tend to fall as income rises in urban areas, but to rise with income in rural areas and nationally (see figure 3b). In the aggregate the proportion of gainers rises with income, a result that is driven by the rise in the number of gainers as income increases in rural areas (see figure 3c).

IV. Explaining the Incidence of Gains and Losses

The way the problem of measuring welfare impacts was formulated in section II allows utility and profit functions to vary between households at given prices. To explain the heterogeneity in measured welfare impacts, these functions can instead be supposed to vary with observed household characteristics. The indirect utility function becomes

$$(1') \qquad \nu_i\left(p_i^d, w_i, \pi_i\right) = \nu\left(p_i^d, w_i, \pi_i, x_{1i}\right)$$

where

$$(2') \qquad \pi_i = \pi\left(p_i^s, p_i^d, w_i, x_{2i}\right)$$

for vectors of characteristics x_{1i} and x_{2i} that shift the utility functions in equation 1 and the profit functions in equation 2. Note that the characteristics that influence preferences over consumption (x_{1i}) are allowed 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 household's consumption, labor supply, and production choices, which in turn depend 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, 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, the gain can be written as

$$(4)\quad g_i = g\left(p_i^d, p_i^s, w_i, x_{1i}, x_{2i}\right)$$

$$= \sum_{j=1}^{m}\left[p_{ij}^s q^s\left(p_i^d, p_i^s, w_i, x_{2i}\right)\frac{dp_{ij}^s}{p_{ij}^s} - p_{ij}^d\left[q^d\left(p_i^d, w_i, \pi_i, x_{1i}\right) + z_{ij}\left(p_i^d, p_i^s, w_i, x_{2i}\right)\right]\frac{dp_{ij}^d}{p_{ij}^d}\right]$$

$$+ \sum_{k=1}^{n} w_k\left[L_{ik}\left(p_i^d, w_i, \pi_i, x_{1i}\right) - L_{ik}^o\left(p_i^d, p_i^s, w_i, x_{2i}\right)\right]\frac{dw_k}{w_k}\Big)$$

Notice that the gain from reform is inherently nonseparable, in that it cannot be written as a function solely of p_i^d, x_{1i}, and π_i because the gain also depends on production choices.

However, as noted in section II, household-specific wages and prices are not observed, so further assumptions are required. In explaining variations across households in the predicted gains from trade reform, wage rates are assumed to be a function of prices and characteristics as $w_i = w(p_i^d, p_i^s, x_{1i}, x_{2i})$, and differences in prices faced are assumed to be adequately captured by a complete set of county-level dummy variables.

Under these assumptions, and the linearization of equation 4 with an additive innovation error term, the following regression model applies for the gains:

$$(5)\qquad g_i = \beta_1 x_{1i} + \beta_2 x_{2i} + \sum_k \gamma_k D_{ki} + \varepsilon_i$$

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

The characteristics considered include age and age squared of the household head, education and demographic characteristics, and land (interpreted as a fixed factor of production because it is allocated largely by administrative means in rural China). Also included are 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 there is wage employment, whether there is state-sector employment, and whether there is participation in a township and village enterprise. There are endogeneity concerns about these variables, but they appear to be 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, equation 5 is estimated by ordinary least squares. The model is estimated separately for urban and rural areas in each of the three test provinces (Liaoning, Guangdong, and Sichuan) for which complete micro-data are available.

There are some differences in the explanatory variables between urban (tables 4 and 5) and rural areas (tables 6 and 7). Results are presented for both absolute

TABLE 4. Regression Results for Level of Gain (Yuan) in Rural Areas of Three Provinces, 2001–07

Variable	Liaoning	Guangdong	Sichuan
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)
Age of household head squared	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)
Number employees/household size	12.665 (4.10)	−6.932 (−0.29)	12.652 (3.02)
Number township and village enterprise workers/household size	10.768 (3.13)	29.466 (3.06)	15.327 (4.26)
Number of migrant workers/household 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			
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)			
Labor force/household size	0.576 (0.08)	2.877 (0.15)	−4.995 (−1.16)
Children under 6//household size	46.999 (2.71)	8.109 (0.35)	−2.291 (−0.45)
Children 6–11/household size	1.414 (0.11)	2.247 (0.10)	−9.011 (−1.50)
Children 12–14/household size	−0.155 (−0.01)	−24.489 (−1.20)	−9.606 (−1.51)
Children 15–17/household size	−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^2	0.278	0.116	0.116

Note: Numbers in parentheses are *t*-statistics.

Source: Authors' computations based on China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

gains (g_i) and proportionate gains (g_i/y_i). Recall that these 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. This makes interpretation difficult. These regressions are mainly of descriptive interest to help isolate covariates of potential relevance in thinking about compensatory policy responses.

For rural areas, the results show that the predicted gain from trade reform tends to be larger for larger households in all three provinces. There is also a U-shaped relationship with age of the household head: The gains reach a minimum around 50 years of age (47 in Liaoning, 52 in Guangdong, 55 in Sichuan). The gains are lower for agricultural households and higher for households with more employees and more township and village enterprise workers, with more migrant workers, and with less cultivated land (though significant only in Liaoning). The only strong demographic effect is that younger households

TABLE 5. Regression Results for Percentage Gains in Rural Areas of Three Provinces, 2001–07

Variable	Liaoning	Guangdong	Sichuan
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)
Age of household head squared	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)
No. employees/household size	0.630 (2.76)	0.271 (2.57)	0.444 (3.61)
No. township and village enterprise workers/household size	0.669 (4.27)	0.585 (4.47)	0.548 (6.11)
No. migrant workers/household 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			
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)			
Labor force/household size	0.456 (0.85)	0.323 (1.81)	−0.099 (−0.71)
Children under 6/household size	3.730 (3.61)	0.461 (1.49)	−0.169 (−0.78)
Children 6–11/household size	1.557 (1.41)	0.173 (0.72)	−0.275 (−1.48)
Children 12–14/household size	1.625 (1.54)	−0.477 (−1.60)	−0.343 (−1.85)
Children 15–17/household size	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^2	0.108	0.217	0.171

Note: Numbers in parentheses are *t*-statistics.

Source: Authors' computations based on China nbs 1999 Rural Household Survey and 1999 Urban Household Survey.

(with a higher proportion of children under age six) tend to be gainers in Liaoning. Although the results for the county dummy variables are not shown (to save space), losses were significantly higher than average in six counties in Liaoning, seven in Guangdong, and six in Sichuan. table 8 gives the mean losses in these counties for agricultural households.

In urban areas the gains tend to be higher for smaller households (except in Guangdong). As in rural areas there is a U-shaped pattern (except for Liaoning), with lowest gains at 66 years of age in Guangdong and 51 in Sichuan. Although there is no pattern in the relationship between education and welfare gains in rural areas, the gains in urban areas tend to be larger for less well-educated households. However, this may be biased by the fact that education was used in identifying skilled labor (noting that unskilled nonfarm wages are predicted to increase relative to skilled labor; see table 2). There are some signs of sectoral effects, though only significantly so in Liaoning, with higher gains for those with government jobs. Retirees tend to have lower gains than others.

TABLE 6. Regression Results for Level of Gain (Yuan) in Urban Areas of Three Provinces, 2001–07

Variable	Liaoning	Guangdong	Sichuan
Log of household size	−5.627 (−1.81)	5.289 (0.27)	−19.441 (−4.09)
Single household head	−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)
Age of household head squared	−0.001 (−0.24)	−0.040 (−1.8)	−0.015 (−2.22)
Highest education level (default is college)			
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 government)			
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 and water conservancy	−27.422 (−2.62)	20.089 (0.92)	−16.585 (−0.83)
Transportation and telecommunications	6.368 (1.52)	16.525 (1.24)	1.644 (0.25)
Wholesale and retail	−3.184 (−0.61)	5.664 (0.45)	−1.983 (−0.4)
Banking and 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	−9.260 (−1.93)	0.683 (0.04)	−1.049 (−0.17)
Education	−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)
Other	−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)
Self-employed	4.278 (0.6)	9.448 (0.64)	10.582 (2.08)
Privately owned business	−9.587 (−1.41)	−14.823 (−0.99)	−4.601 (−0.57)
Retirees reemployed	−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)
Other	−10.350 (−1.36)	−6.568 (−0.34)	−16.796 (−2.06)
Occupation (default is retiree)			
Engineer and 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 manufacturing	17.484 (2.02)	13.151 (0.47)	13.810 (1.86)
Worker in transportation and telecommunication	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^2	0.265	0.131	0.181

Note: Numbers in parentheses are *t*-statistics.

Source: Authors' computations based on China nbs 1999 Rural Household Survey and 1999 Urban Household Survey.

TABLE 7. Regression Results for Percentage Gains in Urban Areas of Three Provinces, 2110–07

Variable	Liaoning	Guangdong	Sichuan
Log of household size	0.175 (3.54)	−0.038 (−0.4)	0.036 (0.46)
Single household head	−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)
Age of household head squared	0.000 (0.1)	0.000 (−2.12)	0.000 (−1.46)
Highest education level (default is college)			
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 government)			
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 and water conservancy	−0.407 (−3.06)	0.178 (1.03)	−0.228 (−0.53)
Transport and telecommunications	0.206 (2.93)	0.060 (0.79)	−0.036 (−0.4)
Wholesale and retail	0.060 (0.78)	0.081 (0.99)	−0.015 (−0.18)
Banking and 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	−0.088 (−1.1)	0.007 (0.06)	−0.124 (−1.49)
Education	−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)
Other	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)
Self-employed	−0.069 (−0.59)	−0.051 (−0.39)	0.317 (2.46)
Privately owned business	−0.182 (−1.65)	−0.231 (−1.96)	−0.037 (−0.22)
Retirees reemployed	−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)
Other	−0.124 (−1.13)	−0.187 (−1.24)	−0.338 (−1.2)
Occupation (default is retiree)			
Engineer and 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 manufacturing	0.118 (0.82)	0.025 (0.12)	0.091 (0.56)
Worker in transport and telecommunications	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^2	0.401	0.290	0.359

Note: Numbers in the parentheses are *t*-statistics.

Source: Authors' computations based on China nbs 1999 Rural Household Survey and 1999 Urban Household Survey.

TABLE 8. Average Impacts for Agriculture Households in Selected Counties, 2001–07

	Gain			Provincial mean	
Province	County identifier	Yuan	%	Yuan	%
Liaoning				−32.34	−1.29
	210181	−73.72	−3.07		
	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				−29.34	−0.81
	440111	−107.31	−2.74		
	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				−12.31	−0.67
	510121	−130.46	−2.86		
	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: A negative sign means a net loss. Agriculture household means that more than 75 percent of income is from agriculture.

Source: Authors' computations based on China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

V. CONCLUSIONS

In the aggregate, the analysis finds that China's trade reforms have had only a small impact on mean household income, inequality, and poverty incidence. There is, however, a sizable (and at least partly explicable) variance in impacts across household characteristics. Rural families tend to lose; urban households tend to gain. There are larger impacts in some provinces than in others, with the highest impacts in the northeast region of Inner Mongolia, Liaoning, Jilin, and Heilongjiang, where rural households are more dependent 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 trade reform vary with observable household characteristics. The most vulnerable households tend to be in rural areas, dependent on agriculture, with relatively fewer 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 some counties incur welfare losses of 3–5 percent of their incomes.

Naturally, the approach taken here has limitations. For example, there may well be dynamic gains from greater trade openness that are not captured by the model used to generate the relative price impacts. Trade may facilitate learning about new technologies and innovation, bringing longer-term gains in productivity. Trade reform may also come with (and possibly help induce) other policy reforms, such as in factor markets. The approach here has attempted to capture only the static welfare effects of WTO accession.

A further limitation was the need to make linear approximations in the neighborhood of an initial optimum for each household. In other applications this could be deceptive if price or wage changes are large or if the household was initially out of equilibrium, due to rationing (including involuntary unemployment), for example. In principle, there are ways of dealing with these problems by estimating complete demand and supply systems that allow for rationing. This may prove a fruitful avenue for future research, though it should be noted that these methods generate their own problems, such as those arising from incomplete data on price and wage levels at household level.

Despite these limitations, the type of approach followed here can usefully illuminate the range of welfare impacts to be expected from economywide reforms. By avoiding unnecessary aggregation of the primary household-level data, these relatively simple tools can also offer insights into the sorts of policy responses that might be called for to compensate losers from reform.

Appendix

TABLE A-1. Rural Gains and Losses by Province, 2001–07

Province	Number sampled households	Number gainers	Original income (yuan)	Post-WTO income (yuan)	Gain or loss (yuan)	Change (%)	Share of losers (%)
Beijing	750	381	4,221.05	4,210.08	−10.96	−0.26	49.20
Tianjin	595	219	3,401.71	3,380.48	−21.22	−0.62	63.19
Hebei	4,200	1,310	2,441.50	2,426.82	−14.68	−0.60	68.81
Shanxi	2,100	926	1,772.62	1,765.13	−7.49	−0.42	55.90
Inner Mongolia	2,198	206	2,055.49	2,011.26	−44.22	−2.15	90.63
Liaoning	1,886	353	2,501.98	2,469.64	−32.34	−1.29	81.28
Jilin	1,598	132	2,260.12	2,210.46	−49.66	−2.20	91.74
Heilongjiang	1,997	115	2,166.59	2,114.18	−52.41	−2.42	94.24
Shanghai	600	416	5,409.11	5,428.79	19.68	0.36	30.67
Jiangsu	3,400	1,209	3,495.20	3,486.78	−8.42	−0.24	64.44
Zhejiang	2,693	1,148	3,946.44	3,934.92	−11.52	−0.29	57.37
Anhui	3,095	676	1,900.76	1,885.79	−14.97	−0.79	78.16
Fujian	1,750	469	3,091.39	3,071.40	−19.99	−0.65	73.20
Jiangxi	2,450	553	2,129.45	2,117.26	−12.19	−0.57	77.43
Shandong	4,200	822	2,520.76	2,494.89	−25.87	−1.03	80.43
Henan	4,200	828	1,948.36	1,931.70	−16.66	−0.86	80.29

Hubei	3,188	755	2,212.71	2,200.04	−12.68	−0.57	76.32
Hunan	3,700	1,181	2,102.98	2,095.39	−7.60	−0.36	68.08
Guangdong	2,560	514	3,628.95	3,599.61	−29.34	−0.81	79.92
Guangxi	2,310	309	2,048.33	2,025.75	−22.58	−1.10	86.62
Hainan	718	28	2,086.40	2,057.85	−28.55	−1.37	96.10
Chongqing	1,500	404	1,736.63	1,730.20	−6.43	−0.37	73.07
Sichuan	3,998	879	1,843.23	1,830.92	−12.31	−0.67	78.01
Guizhou	2,240	417	1,363.07	1,354.03	−9.04	−0.66	81.38
Yunnan	2,397	399	1,438.34	1,421.34	−17.00	−1.18	83.35
Tibet	480	143	1,309.46	1,307.41	−2.05	−0.16	70.21
Shaanxi	2,217	446	1,456.48	1,442.09	−14.39	−0.99	79.88
Gansu	1,800	479	1,357.28	1,350.34	−6.95	−0.51	73.39
Qinghai	600	135	1,466.67	1,452.61	−14.06	−0.96	77.50
Ningxia	600	108	1,754.15	1,729.05	−25.11	−1.43	82.00
Xinjiang	1,495	312	1,471.11	1,447.57	−23.55	−1.60	79.13
Rural total	67,515	16,272	2,257.15	2,239.08	−18.07	−0.80	75.90

Note: The ordering of provinces is the traditional administrative ordering as used (for example) in *China Statistical Yearbook* (NBS 2000).

Source: Authors' computations based on Ianchovichina and Martin (2002) and China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

TABLE A-2. Urban Gains and Losses by Province, 2001–07

Province	Number sampled households	Number gainers	Original income (yuan)	Post-WTO income (yuan)	Gain or loss (yuan)	Change (%)	Share of losers (%)
Beijing	500	430	9,388.88	9,431.72	42.84	0.46	14.00
Tianjin	500	451	7,323.57	7,358.47	34.91	0.48	9.80
Hebei	650	591	5,673.46	5,702.35	28.89	0.51	9.08
Shanxi	650	598	4,519.20	4,549.94	30.74	0.68	8.00
Inner Mongolia	550	495	4,491.87	4,516.19	24.32	0.54	10.00
Liaoning	1000	916	5,257.42	5,285.65	28.23	0.54	8.40
Jilin	700	610	4,630.13	4,650.46	20.33	0.44	12.86
Heilongjiang	1000	887	4,798.92	4,820.50	21.58	0.45	11.30
Shanghai	500	458	10,927.18	10,984.16	56.98	0.52	8.40
Jiangsu	800	723	6,933.07	6,968.78	35.71	0.51	9.63
Zhejiang	550	498	9,044.40	9,098.28	53.87	0.60	9.45
Anhui	500	458	5,159.46	5,190.37	30.91	0.60	8.40
Fujian	550	516	7,521.52	7,569.70	48.18	0.64	6.18
Jiangxi	550	498	4,762.78	4,783.38	20.60	0.43	9.45
Shandong	650	602	5,689.90	5,720.69	30.78	0.54	7.38
Henan	600	565	4,689.43	4,717.89	28.46	0.61	5.83
Hubei	750	619	5,743.18	5,765.29	22.11	0.38	17.47
Hunan	700	612	5,727.42	5,750.43	23.00	0.40	12.57
Guangdong	600	490	10,871.06	10,903.85	32.79	0.30	18.33
Guangxi	600	496	6,011.10	6,033.40	22.30	0.37	17.33
Hainan	200	172	5,766.33	5,787.64	21.31	0.37	14.00
Chongqing	300	239	5,910.18	5,931.90	21.72	0.37	20.33
Sichuan	800	691	5,610.29	5,634.60	24.30	0.43	13.63
Guizhou	450	383	5,324.43	5,347.71	23.27	0.44	14.89
Yunnan	650	566	5,939.69	5,973.23	33.54	0.56	12.92
Tibet	n.a.						
Shaanxi	500	427	4,768.99	4,788.25	19.26	0.40	14.60
Gansu	400	372	4,610.86	4,641.27	30.41	0.66	7.00
Qinghai	250	240	3,759.53	3,788.65	29.12	0.77	4.00
Ningxia	200	177	4,472.43	4,493.27	20.84	0.47	11.50
Xinjiang	250	214	5,277.25	5,295.94	18.69	0.35	14.40
Urban total	16,900	14,994	6,046.13	6,075.60	29.45	0.49	11.28

Note: The ordering of provinces is the traditional administrative ordering as used (for example) in *China Statistical Yearbook* (NBS 2000).

Source: Authors' computations based on Ianchovichina and Martin (2002) and China NBS 1999 Rural Household Survey and 1999 Urban Household Survey.

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