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TRADE REFORM, HOUSEHOLD EFFECTS, AND POVERTY IN RURAL CHINA

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In the way that the forces of development have generated progress and problems, the nation's efforts at pushing ambitious market liberalization policies have had both positive and negative consequences (Yao). Surprisingly, despite the importance to both world trade and China's domestic food economy of the nation's move to join the World Trade Organization (WTO), little empirical work has sought to answer basic questions about the expected effects of China's entry in the WTO, especially the effects on the poor. In our previous work (Huang, Rozelle, and Chang), we showed that, on balance, the nation's accession to WTO will help rural residents and improve incomes. Huang, Rozelle, and Chang also demonstrated that since households in most parts of China are fairly well integrated into national markets, the effects of trade liberalization that start at China's ports—both those that raise and lower domestic prices—are transmitted rapidly throughout the economy.

Unfortunately, in previous modeling efforts, researchers rarely tried to track closely the way that different types of households have been affected. Specifically, almost no research has tried to measure the effects of trade liberalization on a commodity-by-commodity basis. Similarly, few have tried to assess the effects of the trade policy changes on the different types of households in the different regions of the country that produce them. Without this type of analysis, it is difficult to assess household impacts, since different types of

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farmers (e.g., poorer or richer ones) that live and farm in different regions produce different types of crops. If the crop mix produced by one type of farmer that lives in one region of the nation is relatively competitive (and they are better able to take advantage of trade liberalization-induced shifts into the more competitive crops) and the crop mix of another is less competitive, the benefits will vary. Finally, it is often implicitly assumed that if a wheat producer that earns half of his income from wheat suffers a 50% fall in the price of wheat, his household's income falls by 25% (e.g., Ravallion and Chen). We know, however, profit-oriented farmers that are producing in a market environment (even when markets are imperfect), in fact, will respond to trade liberalization-induced price changes by shifting cropping patterns and adjusting the household's consumption-side expenditures.

In this paper our overall goal is to examine the effect of WTO in China and measure its effect on poverty. To meet this goal, we briefly describe poverty in China and seek to understand the nature of the economic activities of the poor and their vulnerability to changes in prices triggered by the nation's accession to WTO. Second, we analyze the responses of households that are affected by WTO-related changes, although in our analysis we allow households to shift their resources from those activities that are hurt by trade policy changes to those that are helped. In doing so, we are able to assess what types of farmers that live in which areas in China will benefit most from WTO.

To meet these objectives, we build on our previous work that used the China Agricultural Policy Simulation (CAPSIM) modeling framework, a partial equilibrium policy analysis framework that has been used for a number of previous analyses (e.g., Huang and Chen). To achieve our objective for this paper, however, we make one major change in the typical approach used for macro-policy analysis. We disaggregate our data into thirty-three groups, based on eleven income categories in three

regions of the nation. With our new framework, we illustrate several key features of how poor households respond to trade policy shifts and why they may benefit lesser than richer households.

Trade Liberalization, WTO, and China's Farming Population

Price and market reforms are key components of China's policy shift from a socialist to a market-oriented economy. The early reforms included increases in the levels of procurement prices, reductions in quotas, and the introduction of negotiated procurement of surplus production. Later, private traders were encouraged to enter markets. Reformers also gave more flexibility to farmers marketing of most agricultural products.

As a result of the liberalization reforms, the level of protection of China's own markets has fallen sharply during the reform era. Huang, Rozelle, and Chang show that the estimates of nominal protection rates (NPRs) have fallen sharply between 1980 and 2000. Although China's domestic prices have moved toward world market prices, on the eve of China's accession to the WTO, there are still some distortions. Not surprisingly, given China's historic bias toward food security-first policies, the most heavily taxed commodities are the exportable ones, especially rice and livestock products (i.e., China's prices have always been below world market prices). Wheat, cotton, and soybean, China's main imported commodities, have been more protected.

Changes in trade and other policies over the past two decades have affected both the overall volume and composition of China's trade. Despite the share of agricultural trade in China's total trade declining, China's agricultural trade has increased in absolute terms during the past two decades. Annual agricultural trade value increased from US$9 billion in the early 1980s to US$26 billion during 1995–97, an annual growth rate of 6.0%. During this time, exports outpaced imports and since 1983 China's agricultural trade balance has been in a surplus position.

Disaggregating trade trends by crops also demonstrates the changing composition of trade and suggests imports and exports are shifting toward products that are more consistent with China's comparative advantages (Huang and Chen). The import of land-intensive commodities, such as grains and

oilseeds, has risen. At the same time, exports of more labor-intensive products, such as horticultural and livestock products, have risen.

Given the shift in trade trends over the past two decades, when assessing who has benefited by trade liberalization, it is important to consider a region's production structure. During the 1990s, farmers living in coastal areas may have benefited the most, at least relative to those in poorer areas. Coastal farmers produce a higher proportion of China's rice, livestock, and horticulture crops, crops that have driven the nation's rising exports (CNSB). The yields of these crops in the coastal areas also are higher. In contrast, inland farmers have put a higher proportion of their sown area into crops such as wheat, soybean, and cotton, the crops with the largest rise in imports (and largest falls in NPRs). Although we have no hard evidence, it would be logical to conjecture that, at least in the recent past, coastal farmers have been the primary beneficiaries of trade and marketing liberalization.

Average incomes for households in the lowest income quantiles and poverty incidences show clearly that China's poor live in the inland areas that are producing the least competitive commodities. The average per capita income of the poorest 3.5% of the population (henceforth, the "group I poor" or "poorest of the poor") in China's western provinces is only 356 yuan, less than 60% of the average income of the poorest farm households in the coastal provinces (598 yuan). The average income of the group with the population containing those that fall between the 3.5 and 10 quantiles (henceforth, the "group II poor") in western China is 596, only 55% of the income of their counterpart group in the coastal provinces (1,074 yuan). With such low average incomes for groups I and II poor, it is not surprising that the incidence of poverty (measured using China's poverty line in western provinces (7.3%) is more than five times the incidence in coastal China (1.3%). Assuming the poor grow the same crop mix as the rest of the farmers in the region, trade liberalization may be expected to have favored the rich over the poor mainly because better-off farmers produced more of the crops that have benefited from trade liberalization and poorer farmers produced those that have seen protection fall the most.

The projected changes in NPRs that will occur as a result of China's WTO promises show that the changes will not be new (table 1). Although the NPRs of commodities will not go

Table 1. Nominal Rates of Protection (Tariffs of Tariff Equivalents) of Agricultural Commodities in 2001 and Assumed Rates in 2005 and 2010

Commodities	2001	2005	2010	Remarks
Rice	−3.3	−1.6	0.0	Weighted
Indica rice	−8.0	−4.0	0.0	Cif (importable)
Japonica rice	17.0	8.5	0.0	Fob (exportable)
Wheat	12.0	6.0	0.0	Cif
Maize	32.0	16.0	0.0	Fob
Other course grain	5.0	2.5	0.0	Cif
Soybean	15.0	7.5	0.0	Cif
Cotton	17.0	8.5	0.0	Cif
Edible oil crops	47.0	23.5	0.0	Cif
Sugar	40.0	20.0	0.0	Cif
Vegetable	−10.0	−6.0	−2.0	Fob
Fresh Fruit	−15.0	−9.0	−3.0	Fob
Pork	−20.0	−12.0	−4.0	Fob
Beef	−10.0	−6.0	−2.0	Fob
Mutton	−5.0	−3.0	−1.0	Fob
Poultry	−15.0	−9.0	−3.0	Fob
Milk	30.0	15.0	0.0	Cif
Fish	−15.0	−9.0	−3.0	Cif

Note: Assumes NPRs decline by 50% from 2001 to 2005 and to zero by 2010 except for commodities in the horticulture and animal sectors. Because we assume that China will continue to face Sanitary and Phytosanitary (SPS) restrictions, we assume that the access to other markets will be limited in some cases and so we multiply the scheduled NPR falls by 0.8.

to zero immediately, between 2000 and 2010 the NPRs on most importable crops (such as, wheat) will fall in line with the trends from the past. As formal tariff rates fall, Tariff Rate Quotas (TRQs) are filled and imports rise, domestic prices and NPRs should be expected to fall for these commodities. The opposite is true for a number of exportables (e.g., vegetables). In short, we believe that the changes in agriculture that will be caused by WTO are more of a continuation of past trends rather than a radical policy change. If so, as in the past, farmers that produce exportable crops and those with higher yields when producing these crops will be the beneficiaries of WTO; those that produce less competitive crops will lose their protection during the next decade and will be hurt.

Methods

The commodities selected include eleven crops and seven major livestock products. The crops include rice, wheat, maize, sweet potato, potato, other coarse grains, soybean, cotton, all edible oils, sugar crops, and horticulture crops. Farmers cultivate the eleven crops on around 90% of China's total sown area. The livestock commodities include pork, beef, mutton, poultry, eggs, milk, and fish.

To evaluate the impacts of WTO accession on rural poverty, we used our CAPSIM mod-

eling framework. CAPSIM was developed out of the need to have a framework for analyzing policies affecting agricultural production, consumption, price, and trade at the national level. CAPSIM is a partial equilibrium model. We econometrically estimated most of the elasticities and parameters, imposing almost all of the commonly acknowledged theoretical constraints. In the projection or policy simulation, prices of all commodities can be determined endogenously or exogenously except for cotton. In addition to price effects, CAPSIM explicitly accounts for a number of demand- and supply-side effects (e.g., urbanization and agricultural investment). Details of the model can be found in Huang and Chen.

To simulate the impact of WTO on production, consumption, or price (henceforth known as Y), we begin by assuming that any change in Y from time $t - 1$ to time t, which we define as ΔY_t, can be decomposed into the impacts of WTO's accession and other factors:

$$(1) \quad Y_t = Y_{t-1} + \Delta Y_{At} + \Delta Y_{Bt}$$

or $\Delta Y_t = \Delta Y_{At} + \Delta Y_{Bt}$ where subscript B refers to all factors that affect the economy except for the policy changes related to China's WTO accession (subscript A). We then let NPR_{WTO-t} be the level of protection under WTO and NPR_{Base-t} be the level that China would enjoy under the scenario if there was no WTO agreement.

With these assumptions and definitions, we build our simulation by constructing two scenarios that vary only by the nation's future NPRs. In scenario I, we have:

$$(2) \quad \Delta NPR_t^I = NPR_t - NPR_{t-1} \neq 0.$$

In scenario II, we have:

$$(3) \quad \Delta NPR_t^{II} = 0 \text{ and } NPR_t \neq 0$$

where ΔNPR is the change in the NPR associated with either scenario I or scenario II.

In scenario I, China's NPR moves over the next ten years levels that are consistent with its WTO accession agreement (table 1). In scenario II, China's economy continues to operate during the next ten years as if there were no trade reform; as shown in equation (3), China's NPRs remain constant. If CAPSIM is used to simulate the two scenarios, once with the conditions in equation (2) imposed and once with those in equation (3) imposed, the impact of WTO can be isolated by taking the difference between the two scenarios:

$$(4)$$
$$\Delta Y_{At} = (Y_{At} \mid \Delta NPR_t = NRP_t - NPR_{t-1} \neq 0)$$
$$- (\Delta Y_{At} \mid NPR_t = NPR_{t-1} \neq 0).$$

In other words, equation (4) produces a measure of the impacts of WTO accession on China's agricultural production, consumption, and prices (or Y_t) between $t-1$ and t relative to a scenario in which there is no additional trade reform.

In implementing both the WTO and baseline scenarios, we make a number of assumptions. First, we assume that producers and consumers in all regions and all income categories have the same demand and supply elasticities. While somewhat restrictive, we believe that since our interest in this paper is in poor areas, that our assumption can be considered "conservative." Since poor areas likely have relatively more farmers that are only engaged in subsistence production (although even in the poorest areas in China farmers market a part of their crop) and face somewhat less robust markets, demand and supply elasticities are likely somewhat lower (in absolute value terms) than those of producers and consumers in coastal areas.

Our model also assumes that the transmission of price shifts at the national level (e.g., changes at the border due to increased imports) to households in rural areas is 0.75. Ac-

cording to Huang, Rozelle, and Chang, transmission coefficients of this size are consistent with the development of China's agricultural markets. Although markets are well integrated, there are still some imperfections (and domestic trade is still subject to substantial transaction costs) that keep all of the price change at the border from being experienced by inland producers. Based on the work, when both producer and consumer prices at the national level change by 1%, CAPSIM assumes that 0.75% of the shift is transmitted to households.

In both scenarios I and II, we assume per capita income grows equally fast in all regions, which may not be a bad assumption if remittances are counted in income gains in poor areas and subtracted from income gains in richer areas. Urban real income growth declines from 8% in 2002–2005 to 6% in 2006–2007 and falls to 4% in 2008–2010. The corresponding growth rates in rural areas are 5%, 3.5%, and 3.2%. Since these figures are the same in both scenarios I and II, they will not affect our results. The only shortcoming of our analysis is that we do not account for the impacts on consumption of changes in income due to WTO price changes. That is, if farmers receive a higher price due to increased exports under WTO, although we account for both lower consumption and higher production due to the price rise, we do not account for the fact that the profits (or income) of farmers, as producers, rise and this will affect consumption. As a result, to the extent that overall prices in China's rise (fall) due to WTO, the consumption effects will be under- (over-) estimated.

As in all projection models of this genre, the impacts of trade reforms on different types of farmers that live in different regions depend on the initial levels of per capita consumption and production (or yields and sown area) in the base year (i.e., at the time China joined WTO in 2001). The baseline for beginning the projections for both scenarios I and II use household data from 1999 that come from the China National Statistics Bureau (CNSB). Since we want to begin our projections from 2000, the year prior to the nation's accession to WTO, we use trends from published data on the nation's per capita production and consumption growth rates between 1999 and 2000 to generate per capita production and consumption for each group of farmers in 2000. Domestic price changes that we use in the first year of the simulation (2001 over 2000) are those actually experienced during 2000.

Table 2. Impacts of China's WTO Accession on Agriculture Output Value and Food Expenditure in 2000 Real Prices from CAPSIM Projections Model

Income	China		West		Central		East	
Categories[a]	2005	2005	2005	2010	2005	2010	2005	2010
Output								
Changes in per capita agricultural output value (yuan)								
Group 1	5.50	25.27	2.95	13.63	6.17	28.35	6.45	29.56
Group 2	6.59	30.26	4.03	18.52	6.37	29.23	8.31	38.16
Group 6	10.51	48.29	8.19	37.64	10.20	46.95	12.16	55.79
Changes per capita agricultural output value as percent of per capita income								
Group 1	1.11	5.10	0.83	3.83	1.34	6.18	1.08	4.94
Group 2	0.74	3.42	0.68	3.13	0.76	3.48	0.77	3.55
Group 6	0.58	2.67	0.63	2.89	0.64	2.96	0.50	2.30
Expenditures								
Changes in per capita food expenditure (yuan)								
Group 1	−1.36	−6.80	−1.28	−6.47	−1.45	−7.19	−1.34	−6.65
Group 2	−1.50	−7.48	−1.45	−7.24	−1.65	−8.28	−1.40	−6.94
Group 6	−2.08	−10.34	−2.11	−10.41	−2.05	−10.28	−2.09	−10.35
Changes in per capita food expenditure as percent of per capita income								
Group 1	−0.29	−1.44	−0.36	−1.82	−0.32	−1.57	−0.22	−1.11
Group 2	−0.18	−0.91	−0.24	−1.22	−0.20	−0.99	−0.13	−0.65
Group 6	−0.12	−0.60	−0.16	−0.80	−0.13	−0.65	−0.09	−0.43

Note: Reported impacts calculated as the differences in projection outputs and expenditures between the WTO (Scenario I) and Baseline (Scenario II) scenarios.
[a] Group 1 includes poorest of the poor. They are those with incomes between the 0% and 3.5% quantiles. Group 2 includes group II poor and are those with income between 3.5% and 10% quantiles. Group 6 includes those households with income between the 40% and 50% quanitles.

Results: The Effects of WTO Accession

According to the analysis, if China implements its promises for the WTO agreement, the changes in domestic prices will affect both production and consumption (table 2, column 1). Examining the effect on the median group (i.e., those with incomes that fall in the fifth decile or group 6), our simulation analysis predicts that after five years per capita agricultural output value will rise about 10 yuan, or 0.6% of per capita income (rows 3 and 6). During the same period, expenditures will fall (2 yuan or 0.1%), albeit at a rate less than production (rows 9 and 13).

The importance of accounting for household responses to changing prices can be seen by noting that the rise in overall production occurs even as prices "on average" for China's major agricultural commodities fall as a result of WTO. Although some prices rise (e.g., the price of pork will rise by about 20% between 2001 and 2010) and others fall (e.g., the price of wheat will fall by 11%), using a Stone price index (where prices of individual commodities are aggregated using weights constructed with value shares) the overall price level falls by 0.95% between 2001 and 2010. Facing the price

shifts, producers in China according to our simulation respond by moving into the production of crops that experience price rises and out of crops that experience price falls. At the end of the period we forecast that enough structural change has occurred so that overall agricultural output ends up rising.

In contrast aggregate expenditures fall, even though the aggregate price index falls. The reason that this can happen is that in responding to price changes consumers also cause a structural change in China's demand structure like producers create in agriculture. Apparently, the response of consumers to commodities that experience a price rise (resulting in a fall in expenditures) is greater than the response to those that experience a price fall. In fact, the projected structural changes in production and consumption are an extension of the changes that trade and domestic market liberalization policies have caused in China over the past two decades (Huang et al.).

Between 2005 and 2010, the fifth and tenth year after the implementation of WTO, the rate of rise of output and expenditure accelerates (table 1, column 2). Because liberalization continues for both those crops that are protected (especially for maize and sugar crops)

and those that are exportable (e.g., livestock, fish, vegetables, and rice), the median farm household gains more than 40 yuan per capita by year 10, an increase in per capita of more than 2.5% (rows 3 and 6). The fall in expenditures also accelerates. However, because we have not accounted for the increased consumption that occurs due to the higher profits that agricultural households earn from their decisions to shift to more profitable crops, we overstate the expenditure falls. It could be that expenditures hardly fall or may even rise fractionally. When comparing our results with those of other trade models that have simulated the impact of the accession to WTO on China's economy, our results (which are only for agricultural goods and are couched in terms of output rather than income) are fairly consistent (around 2%; if one takes a fraction of output—say 50%—as increased profits and multiplies the gains by five, since agriculture is only about 20% of China's economy).

Not all farm households, however, benefit equally from China's accession to the WTO. Our results show that in 2005 and 2010, eastern and central farmers in the median group and those in the two poor categories (the poorest of the poor and group II poor) increase their output from 20% to 100% more than western farmers (table 2, columns 3–8, rows 1–3). In absolute value terms the amount of increase rises for the richer income categories in all regions (i.e., moving from row 1 to 3 down each column). Since average incomes are higher in the richer income categories, in percentage terms the benefit actually falls within a region (rows 4–6). For example, output as a percent of per capita income falls from 4.94% for the poorest of the poor to 2.30% for the median farmers in the east region in 2010 (column 8, rows 4–6). Despite this trend, eastern and central farmers in the two poorest income categories still benefit more on a percentage basis than western farmers.

Similarly, food expenditure responses also benefit the better-off farm households in the east. Food expenditures fall in all regions and in all categories. And, while in absolute levels the amounts are relatively equal (rows 7–9), in percentage terms the rate of fall rises from west to east and from poor to rich. Hence, it is clear in the case of both production and consumption that WTO, while benefiting all types of households—rich and poor; coastal and inland—in an absolute sense, benefits the richer farm households living in the eastern coastal areas more.

Sources of the Advantages for the Rich

Given the design of our simulations, the main advantage of WTO for one type of farmer over another has to be one of two factors. Farmers benefit when they allocate more sown area to crops that have rising terms of trade. They also benefit when they achieve higher yields of crops that have rising terms of trade. Hence, when explaining the sources of the benefits for certain groups of farmers, one only needs to examine their crop mixes and match them to whether or not the prices of the crops rose over the period or fell, and if farmers are moving into the production of those crops.

The main advantage of the richer, coastal farmers in our study has clearly come from the fact that they have been producing commodities that have been in China's competitive sectors (table 3). After dividing the study's commodities into those that were forecast to have higher prices under the WTO scenario relative to the baseline (between 2000 and 2010) and those that were not, as farm households move among income categories from the poorest of the poor (group 1) to the richest of the rich (group 11), they steadily increase the share of crops that are in the competitive sector and decrease the share in the noncompetitive sectors (columns 3 and 4, rows 1–4). Similarly, within income groups (e.g., within the poorest of the poor), as household move from west (row 4) to central (row 7) to east (row 10), the share of crops in competitive sectors rises. In fact, when comparing the richest farmers in the east versus the poorest farmers in the west, the share of competitive crops sown by the richest coastal farmers (74%) is more than twice the percentage of that sown by the poorest western farmer (36%). When these sown area shares are coupled with yields (e.g., coastal rice yields are more than 20% higher than those in western areas), the sources of the advantages are clear.

Conclusion

In this paper, we demonstrate that although the absolute effects of trade liberalization will not be very large, policy makers should be concerned about the poverty and equity effects. We show this through several findings. First, according to the analysis, on average, farmers in all income categories and in all regions will benefit from WTO. Interestingly, the reason is not that the overall agricultural price index rises. It does not. In fact, the aggregate

Table 3.   Share of Agricultural Production by Region and Income Category in China, 1999

Regions	Income Groups	Share of Population (%)	Per Capita Income	Production[a] Sector I (Competitive Sectors)	Production[a] Sector II (Noncompetitive Sector)
China	Group 1	0–3.5	491	42	58
	Group 2	3.5–10	875	46	54
	Group 6	40–50	1,928	53	47
	Group 11	90–100	5,889	64	36
West	Group 1	0–3.5	356	36	64
	Group 2	3.5–10	592	47	53
	Group 6	40–50	1,302	56	44
	Group 11	90–100	3,961	52	48
Central	Group 1	0–3.5	459	40	60
	Group 2	3.5–10	840	47	53
	Group 6	40–50	1,785	56	44
	Group 11	90–100	4,726	65	35
East	Group 1	0–3.5	598	47	53
	Group 2	3.5–10	1,074	45	55
	Group 6	40–50	2,425	50	50
	Group 11	90–100	8,040	74	26

[a]Sector I includes those commodities with prices that are projected to rise when China enters WTO (rice, vegetables, pork, beef, mutton, poultry, eggs, and fish). Sector II includes those commodities with prices that are projected to fall (wheat, maize, other coarse grains, soybeans, cotton, edible oil crops, sugar, and milk).

agricultural price index falls by almost 1% due to WTO policies relative to the baseline. Instead, as some prices rise and others fall, WTO is encouraging farmers to adjust their cropping structure and in doing so producers increase overall output even as aggregate prices fall. In contrast, in response to the overall price falls, consumers decrease consumption. However, with the increased incomes that accompany the shift of farmers to more profitable crops, most of the farming sector likely will be better off (although we do not measure the indirect rise in consumption due to the income effects of higher agricultural profits).

While the farming sector as a whole benefits, we do find that some benefit more than others. And, unfortunately for the sake of poverty alleviation and equity, the richer farmers in coastal areas will benefit more than poorer inland farmers. The main reason for the advantage of coastal farmers is that the farmers have lands that produce higher yields. Moreover, producers that live in coastal regions tend to plant crops in which China has an international comparative advantage. Poorer farmers in western areas, however, do not. As a result when WTO drops protection of crops that China does not have a comparative advantage in and gets better access to foreign markets in crops that it does, richer coastal farmers benefit more. As a consequence, policy makers need to take one of two actions. First, they need to try to encourage farmers in poorer, inland areas to shift their production

decisions (where appropriate) to more competitive crops. Second, officials may also need to take other, nontrade actions to increase the livelihood of farmers in these areas. In many areas, farmers do not have an advantage in any farming activity. In such areas rural education, better communications, and other policies that might facilitate their shift into the nonfarm sector may be the most beneficial policy.

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