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Economic and Poverty Impacts of Agricultural, Trade and Factor Market Reforms in China

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Abstract

Capitalizing on the most recent estimates of agricultural price distortions in China and in other countries, this paper assesses the economic and poverty impact of global and domestic trade reform in China. It also examines the interplay between the trade reforms and factor market reforms aimed at improving the allocation of labor within the Chinese economy. The results suggest that trade reforms in the rest of the world, land reform and *hukou* reform all serve to reduce poverty, while unilateral trade reforms result in a small poverty increase. Agricultural distortions are important factors in determining the distributional and poverty effects of trade reform packages, although their impacts on aggregate trade and welfare appear to be small. A comprehensive reform package which bundles the reforms in commodity and factor markets together may benefit all broad household groups in China.

JEL codes: D30, D58, D63, F13, O53, Q18

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Fan Zhai and Thomas Hertel

As the most populous nation in the world, China plays a critical role in the determination of the global poverty headcount. Indeed a considerable portion of the reduction in the latter can be attributable to the remarkable reduction in poverty incidence in China over the past two decades. Chen and Ravallion (2004) find that, in 1981, 65 percent of the population in China was in extreme ($1/day) poverty, whereas by 2001, this figure had fallen to nearly 12 percent. These authors show that much of this poverty reduction was driven by reforms in the agricultural sector. These advances notwithstanding, rural poverty continues to dominate the national poverty headcount in China, and the headcount is highest among households which are specialized in farming. Furthermore, there is evidence that, despite rapid economic growth, the rural-urban wage gap is widening (Sicular et al. 2007). And within the rural sector, rapid non-agricultural income growth and slow agricultural income growth since the 1990s is contributing to increased rural inequality (Benjamin et al. 2007). Therefore, the agricultural sector continues to play an important role in the determination of national poverty and inequality in China. In this chapter, we focus on the impact of agricultural, trade and rural policy reforms – both at home and abroad – on poverty and inequality in China.

The impact of trade reforms on poverty and inequality in China has been a topic of intense research over the past decade, culminating in a number of studies focusing on the impact of China's accession to the WTO on poverty (e.g., see Bhattasali, Li and Martin 2004). Chen and Ravallion (2004) examine these impacts at a highly disaggregate level using earnings and price estimates from another study, and estimate that WTO accession will benefit urban households – particularly poor urban households. However, their prediction of the impact of WTO accession on rural households is that falling rural wages and increases in consumer prices for these households are likely to hurt the rural poor. In a companion study, Hertel, Zhai and Wang (2004) aggregate households to a greater degree, but incorporate them

directly into their CGE model of China. They, too, conclude that WTO accession would be relatively more favorable for urban households, but they argue that whether or not rural households will lose from these reforms depends critically on the degree of off-farm labor mobility. At low (or zero) mobility, as assumed by Chen and Ravallion, the poorest rural households lose from reform but, as the off-farm labor supply elasticity rises, the potential for farm households to gain increases.

In closely related work, Hertel and Zhai (2006) contrast the impacts of commodity market reforms, such as those initiated under China's WTO accession, with factor market reforms aimed at facilitating an improved flow of labor out of agriculture and between the rural and urban markets. They find that the latter can result in significant gains for rural households. Specifically, those authors explore the implications of (a) reforming agricultural land markets to permit arms-length land rental in all rural areas, thereby facilitating the permanent movement of labor out of farming, (b) enhancing off-farm labor mobility, and (c) abolishing the *hukou* system, thereby reducing the transaction costs imposed on rural–urban migrants. When combined, these reforms reduce the estimated 2007 urban-rural income ratio from 2.58 (in the absence of WTO accession) to 2.09. When WTO accession is additionally added to this mix of policy reforms, the 2007 urban-rural income ratio is still reduced – but not quite as much – to 2.12. Given the importance of the labor market distortions for poverty and inequality in China, we pay special attention to their presence in this study as well.

In this chapter we update the model used in earlier studies (to reflect the most recent Chinese Social Accounting Matrix) and capitalize on the most recent estimates of agricultural price distortions which have changed significantly since China's accession to the WTO. We also bring to bear new farm price distortions estimates for other developing countries,[1] in order to make an assessment of the impact of global trade reform on poverty and inequality in China. Unlike our earlier work, which focused solely on China's own reforms associated with WTO accession, here we explore the impacts of reforms in the rest of the world as well as in China. Additionally, we decompose these impacts in two ways: first by region (China versus the rest of the world), and secondly by sector (agriculture versus non-agriculture). We also examine the interplay between these commodity market reforms and factor market reforms aimed at improving the allocation of labor within the Chinese economy.

[1] Estimates of agricultural protection/assistance for China, based on Huang et al. (2009), are incorporated in the World Bank's global agricultural distortions database (Anderson and Valenzuela 2008). Those estimates cover five decades, but the representative values for developing country agriculture as of 2004 that are used in the global CGE modeling for this study are summarized in Valenzuela and Anderson (2008).

This chapter is organized as follows: the next section describes the specification of the CGE model used in this study. We then assess the impact of eliminating agricultural price distortions in rest of the world, as well as reducing China's own distortions in commodity and factor markets, on China's macro-economy, agricultural production and poverty. The final section offers conclusions.

The model and data

The Chinese model used in this study is an updated version of the household-disaggregated CGE model which we used to study the economic and poverty effects of WTO accession and Doha round trade liberalization on China (Hertel, Zhai and Wang 2004, Hertel and Zhai 2006, Zhai and Hertel 2006). The model has its intellectual roots in the group of single-country, applied general equilibrium models used over the past two decades to analyze the impact of trade policy reform. The updated version in this chapter has a more recent benchmark dataset based on 2002 Chinese Input/Output table and a very detailed sectoral disaggregation for agriculture and food. In this section we describe the main features of the model.

Household behavior

Following our previous work, we disaggregate rural and urban households into 40 rural and 60 urban representative households according to their primary source of income and relative income level. In light of the fact that the focus here is on agricultural incentives, we seek to highlight those households that depend exclusively on farming for their incomes. Accordingly, we stratify the rural households by agriculture-specialized (more than 95 percent of household income from farming) and diversified (all other). We are also interested in the impacts of restrictions on rural-urban labor mobility, so we separately identify urban households and group them into three strata: transfer-specialized, labor-specialized and diversified. Within each stratum, we order households from poorest to richest, based on per capita income, and then group them into 20 vingtiles, each containing 5 percent of the stratum population.

Household income derives from labor income, profits from family-owned agricultural and non-agricultural enterprises, property income and transfers. Households consume goods and services according to a preference structure determined by the Extended Linear Expenditure System (ELES). Through specification of a subsistence quantity of each good or service, this expenditure function generates non-homothetic demands, whereby the larger the relative importance of subsistence consumption (e.g., it would be high for rice, and low for automobiles) the more income-inelastic the household's demand for that good.

The other important dimension of household behavior is the supply of labor to off-farm activities. In China, the off-farm labor supply decision is complicated by institutional factors which have been built into the system in order to keep the agricultural population in place, among which the rural land tenure system is one of most widely-discussed (Zhao 1999b). The absence of well-defined land tenure has served to raise the opportunity cost of leaving the farm (Yang 1997). Households that cease to farm the land may lose the rights to it, so they have a strong incentive to continue some level of agricultural activity, even when profitability is quite low (Zhao 1999a). With only modest growth in rural, non-farm activities, this seriously limits the ability of households to obtain off-farm work (Zhao 1999b).[2] Although an active land rental market has emerged in some regions in recent years, the overall level of land rental transactions is still low, with around 10-15 percent of rural households renting land in/out (Deininger and Jin 2005, 2007, Wang, Herzfel and Glauben 2007). Empirical studies have found that the transaction costs associated with land rental are significant, and the absence of an efficient land rental market remains a substantial barrier to the facilitation of off-farm participation of rural labors (Deininger and Jin 2005, Wang, Herzfel and Glauben 2007).

In this study we model rural households as maximizing the total return to their labor supply, which is offered in both the on-farm and off-farm labor markets. However, the ability of households to shift labor between these two labor markets is constrained by a number of factors including education, experience, and simple geography, which can serve to isolate farm households from the non-farm labor market. We proxy the combined impact of these factors with a single, finite, constant elasticity of transformation (CET). The labor allocation between farm and off-farm jobs is determined by the ratio of the shadow value of labor in agriculture, relative to the off-farm wage rate, and this elasticity of transformation.[3] The CET

[2] However, as noted by Parish, Zhe and Li (1995), the rural labor market is looking more like an open market all the time.
[3] See Hertel and Zhai (2006) for details of off-farm labor supply behavior in the model.

parameter governs the off-farm labor supply elasticity, for which we adopt the estimate of 2.67 by Sicular and Zhao (2004) as the overall farm/off-farm transformation elasticity for the total rural labor force. The empirical study by Zhang, Huang and Rozelle (2002) suggests that this elasticity increases by 0.58 for an additional year of schooling. This is translated into the farm/off-farm transformation elasticity of 0.68 for unskilled labor and 4.01 for semi-skilled labor.[4]

Owing to the absence of an effectively functioning land market, the shadow value of labor in agriculture in this function takes into account the potential impact which reducing agricultural employment will have on the household's claim to farm land. This incremental factor is calculated as the marginal value product of land, multiplied by the probability that the household will lose its land as a result of off-farm migration. In order to make this amenable to use in a model of the representative farm household, with continuously variable labor and land use, we translate this probability into a simple elasticity of land income with respect to on-farm labor. The higher this elasticity, the greater the probability that the farmer will lose his land if he shifts to an off-farm job. The benchmark elasticity in our model is 0.5, that is, a ten percent reduction in on-farm work results in a 5 percent loss of land income. However, for purposes of sensitivity analysis we also report results from two extreme simulations. In the first, the elasticity of land income with respect to off-farm work is zero. This is the case of a perfectly functioning land rental market with no chance of land loss. In the second sensitivity analysis, the elasticity is set equal to one, such that the farmer leaving his farm to work in the city is virtually guaranteed of losing his land. By comparing these two extremes, we gain an appreciation for how important land market reform might be for inequality.

Rural-urban migration

Migration is a key part of the rural economy in China. According to rural household survey data collected in 2003 and compiled by Liu, Park and Zhao (2006), 19.4 percent of all rural workers participated in migratory work in that year, and more than 40 percent of all households had at least one member who was a migrant in 2003. More than half of the migrants left their province, and most of these migrated to the coastal provinces where

[4] Given the very small number of skilled farm workers in China, this segment is ignored in our analysis. See Zhai and Hertel (2006) for details of the derivation of the off-farm labor supply elasticity.

manufacturing activity and exports have been booming. The 2000 census estimated that the total number of migrants in China was 131 million, of which nearly two-thirds were non-*hukou* migrants. (Households without the *hukou* urban registration face limited access to many of urban amenities, including housing and education.) Rural-urban migration was the largest form of migration and amounted to more than 50 million in the 2000 census (Cai, Park and Zhao 2007). This massive migration is a rational response to the enormous rural-urban wage gap that exists in China, which Sicular et al. (2007) recently placed at 2.27 (the ratio of urban to rural per capita disposable income in 2002) after adjusting for housing subsidies and spatial price differences. Remarkably, they find no evidence of this gap declining. Indeed, if anything, the ratio of urban to rural incomes appears to have risen slightly between 1997 and 2002. This is hardly the outcome that a standard, general equilibrium model with perfect labor mobility would predict! Clearly there are some important barriers to labor movement in China that need to be considered if one hopes to accurately assess the impact of commodity market reforms on rural and urban employment, wages and household income.

While the rural-urban per capita income gap is an indication of a potential labor market distortion, what we really want to know is the hourly wage differential for workers of comparable skill and ability. If there were no barriers to the movement of labor between rural and urban areas, we would expect real wages to be equalized for an individual worker with given characteristics. Shi, Sicular and Zhao (2002) explore the question of rural-urban inequality in greater detail for nine different provinces using the China Health and Nutrition Survey (CHNS). The authors conclude that the apparent labor market distortion is about 42 percent of the rural-urban labor income differential and 48 percent of the hourly earnings differential.[5] When applied to their estimated average wage differential, this amounts to an ad valorem rate of apparent transactions "tax" on rural wages of 81 percent.[6]

We model these transactions costs as real costs that are assumed by the temporary rural migrants who move to the urban areas without *hukou* urban registration. Of course these migrants are heterogeneous and the extent of the burden varies widely. Those individuals who are single and live close to the urban area in which they are working are likely to

[5] There are likely other, unobserved factors inducing this rural-urban wage differential, in which case estimation of the labor market distortion via subtraction of known factors is biased in the direction of overstating the *hukou*-related distortion. Therefore, it is useful to also estimate the direct impact of household registration status on the observed wage difference among households. Shi (2002) takes this approach to the problem, using the same CHNS data set. He finds that only 28 percent of the rural-urban wage difference can be explained directly via the coefficient on the *hukou* registration variable. This is quite a bit less than the 48 percent left unexplained via the subtraction approach of Shi, Sicular and Zhao (2002).

[6] See Hertel and Zhai (2006) for a detailed description of how this ad valorem distortion is obtained.

experience minor inconvenience as a result of this temporary migration. We expect them to be the first to migrate (*ceteris paribus)* in response to higher urban wages. On the other hand, some migrants have large families and come from a great distance. Their urban living conditions are often very poor and it is not uncommon for them to be robbed on the train when they are returning home after their work. For such individuals, the decision to migrate temporarily is likely to be a marginal one – and one which they may or may not choose to repeat. With this heterogeneous population in mind, we postulate a transactions cost function that is increasing in the proportion of the rural population engaged in temporary work. This transactions cost function has a simple, constant elasticity functional form, which begins at the origin, reflecting those migrants for whom there is essentially no cost due to their proximity to urban areas, and reaches the observed wage gap (adjusted for transport and living costs) at the current level of temporary migration (about 70 million workers). We assume that further increases in temporary migration have only a modest impact on these transactions costs.[7] Finally, it is important to note that only a portion of these observed transactions costs can be attributed to the government's formal policy of migration restriction – the *hukou* system. Indeed, Shi (2002) finds that only 28 percent of the rural-urban wage difference can be explained directly via the coefficient on the *hukou* registration variable. We will take this into account later in our study, when we investigate the implications of the Chinese government undertaking labor market reforms.

Production and trade

Production in each of the sectors of the economy is modeled using nested constant elasticity of substitution (CES) functions, and constant returns to scale is assumed. In the top level of the nest, value-added and a composite of intermediate inputs produce outputs. Then a further CES function disaggregates the value-added into capital-labor composite and agricultural land. Capital-labor composite is further split into the capital-skilled labor composite and the aggregated less-skilled labor. The capital-skilled labor composite consists of capital and skilled labor, while aggregated less-skilled labor is composed of semi-skilled labor and unskilled labor. A low substitution elasticity of 0.3 between capital and skilled labor is assumed here to introduce the capital-skill complementarity. The elasticity of substitution between semi-skilled labor and unskilled labor is set to 1.5, based on estimates for the United

[7] We assume that a doubling of temporary migration would only increase the marginal cost of migration by 10 percent.

States by Katz and Murphy (1992) and Heckman and Lochner (1998).

Each sector employs a labor composite comprising both rural and urban labor that substitute imperfectly. This is an indirect means of building into the model a geographic flavor, since some sectors will be located largely in urban areas while others will be predominantly in rural areas. By limiting the substitutability of rural and urban labor in each sector, we are able to proxy the economic effect of geographically distributed activity. Ideally we would model the geographic distribution of industrial activity, but unfortunately the data do not exist to support this split.

All commodity and factor markets are assumed to clear through prices. In the case of rural labor markets, there is a segmentation between agricultural and non-agricultural labor: these two markets are linked imperfectly through the CET parameter discussed previously. Once transactions costs associated with temporary migration are accounted for, rural wages are equated with urban wages. Capital is assumed to be fully mobile across sectors. Import demand is modeled using the Armington assumption, i.e. domestic products are assumed to be differentiated from foreign products. On the export side, it is assumed that the firms treat domestic and export markets equally. Thus the law of one price holds, that is, the export price is identical to that of domestic supply. The small country assumption is assumed for imports and so world import prices are exogenous in terms of foreign currency. Exports are demanded according to constant-elasticity demand curves. Therefore the terms of trade for China are endogenous in the simulations. The value of export demand and Armington elasticities are based on the elasticities used in the global CGE model LINKAGE (van der Mensbrugghe 2005).

The benchmark data

A Chinese social accounting matrix (SAM) is estimated for the year 2002 to serve as the benchmark data set for model calibration. The SAM contains 48 sectors of production and 100 representative households, based on the 2000 household survey data for three provinces (Guangdong, Sichuan, and Liaoning) and the most recent 2002 Input-Output table. Since the 2002 Input-Output table has only one crop sector and one livestock sector, we disaggregate these two sectors into eight crop sectors and four livestock sectors according to the corresponding GTAP sector classification (Hertel 1997). The information about the structure of production, demand, inputs and trade from GTAP database version 7.0 are used for the

sectoral disaggregation and we employ the cross-entropy method to balance the SAM (see Robinson, Cattaneo, and El-Said 2001).

The base year tariffs and export subsidies/taxes are reported Table 1. Protection rates for lightly processed food and agricultural products are obtained from Huang et al. (2009) and from the GTAP database, version 7.0. For other primary goods and manufacturing products, tariffs are estimated based on collected revenue of import tariffs and base year imports by commodities. As shown in Table 1, China's tariff structure provides more protection for food and agricultural products than non-food manufacturing goods. Moreover, the import tariff rates show considerable cross-sector variation within agriculture: vegetables and fruits, oilseeds and sugar cane and beet have high tariff rates of around 15 percent, while imports of plant-based fibers appear to be effectively subsidized.

Columns 3-5 of Table 1 present China's sectoral shares of GDP, exports and imports. Despite the diminishing importance of the agricultural sector in the Chinese economy over the last two decades, agriculture still accounts for 13.4 percent of GDP. Vegetables, fruits and livestock are key sources for agricultural value-added. Manufacturing value-added is 32 percent of the economy-wide total. Chemicals, metals and machinery lead the way, followed by sectors related to electronics, textiles and apparel. Non-food manufacturing is very export intensive, accounting for 75 percent of Chinese exports. Electronics, textiles, apparel, chemicals and machinery are the major exporting sectors. These sectors also represent a relatively large share of imports, reflecting the significant presence of processing trade in China. On the other hand, China's agricultural and food manufacturing sectors have very limited trade exposure. Agriculture accounts for only 1.6 percent of exports and 2.5 percent of imports. Vegetables and fruits are major agricultural exports while agricultural imports are concentrated in oilseeds, cotton and forestry products.

Simulation design

To explore the implications of agricultural distortions at home and abroad for the Chinese economy, we consider six policy reform scenarios that eliminate various distortions in global trade and in China's domestic commodity and factor markets. These scenarios are summarized in Table 2. The first two scenarios examine the effects of trade liberalization in

the Rest of the World. *ROW-Ag*, considers the impact of agricultural liberalization in the form of elimination of import tariffs and export subsidies, as well as subsidies for domestic production, in agriculture and lightly processed food sectors in rest of the world. The second scenario involving Rest of World policies across all merchandise commodities (*ROW*) looks at a broader-based trade liberalization. It combines the removal of policy distortions in agricultural and lightly processed food sectors in Scenario 1 with tariff elimination for non-agricultural goods in the rest of the world.

We incorporate the impacts of trade reforms in the rest of the world in the Chinese CGE model through exogenous changes in import prices and export demands. The sizes of these exogenous trade shocks are obtained from the global CGE model *Linkage*, omitting China's reforms in the process. Table 3 lists the external shocks imposed in the *ROW* and *ROW-Ag* scenarios.[8] It shows there are some enormous percentage increases in China's agricultural and food export volumes ("export demand") generated by the elimination of very high rates of protection elsewhere in Asia. Rice, other grain, vegetable and fruits, and refined sugar all show very large proportionate increases. Of course the associated output volume changes are often quite modest, as China is not a large exporter of most of these products (recall Table 1). China's export volume declines in most livestock sectors, reflecting relatively smaller ROW barriers faced by its exporters in these sectors.

China's average export price increases by 2.4 percent while average import price increases by just 0.6 percent (both relative to the price of OECD manufacturing exports) in the case of a broad-based trade reform, indicating a gain in its terms of trade when other countries liberalize and China does not. However, given the relatively greater importance of manufacturing exports to China, if liberalization is confined to the agricultural sectors, the terms of trade improvement diminishes, with a 0.6 percent increase in average export price and 0.4 percent increase in average import price. The increase in sector export prices range from 1.8 to 4.5 percent in the case of broad-based trade liberalization and from 0.3 to 2.0 percent in the case of agricultural liberalization only, with food and agricultural prices rising relative to non-food prices in both cases.

The changes in China's import prices show much greater sector variation. The import prices of most food and agricultural products rise more than non-food products, reflecting the elimination of agricultural subsidies in OECD countries. However, the world price of China's oilseed imports declines by 2.8 and 2.3 percent, respectively, in these two scenarios, largely

[8] Annex Table A.1 provides the mapping between 48 sectors in Chinese CGE model and 23 sectors in *Linkage* model.

due to the elimination of the very high export taxes for soybean exports from Argentina which becomes a dominant source for oilseed imports into China in the wake of their elimination.

The next two scenarios focus on the impacts of China's own trade liberalization. Scenario 3 (*DOM-Ag*) eliminates the import tariffs and export taxes and subsidies for China's agricultural goods and lightly-processed foods. In Scenario 4, *DOM*, the tariff elimination is extended to non-agricultural sectors. These two scenarios are intended to show the effects of distortions in China's factor markets. Scenario 5 (*LABOR*) examines the impact of a relaxation of the *hukou* system such that the ad valorem tax equivalent of the indirect transaction costs are reduced from 81 to 34 percent (when evaluated at current levels of migration). As noted above, this is the portion of the observed differential in wages that has been directly attributed to possession of a *hukou* certificate. In scenario 6 (*LAND*), we consider the impact of relaxing one of the important barriers to off-farm labor mobility, namely, the absence of well-defined property rights for agricultural land. As noted previously, this leads to the retention of additional labor in the farm sector. The reason for this is that farm households presently tend to include the returns to communal land in their decision to work on- or off-farm, since leaving the farm means potentially forgoing rights to their farm land. This scenario introduces a land reform such that farm households migrating to the city can keep full land returns by renting their land out, and thereby only need consider the ratio of the marginal value products of their labor in agriculture and non-farm rural wages in deciding where to work.

In all six scenarios, government real spending and real saving (deflated by the GDP deflator) are fixed at their base year levels. Thus the policy reforms are assumed to be revenue neutral, with a unified, endogenous factor income tax designed to replace lost government tariff revenue. The goal of this tax replacement closure is to avoid unrealistic macro-economic effects of tariff removal, while having a relatively neutral impact on inequality. Foreign saving is also fixed in foreign currency terms and the real exchange rate adjusts endogenously in order to maintain current account balance. Total investment is endogenously adjusted, driven by the changes in households and enterprises savings.

Impacts of reforms on China's economy

In this section we examine the impacts of the above scenarios in turn on the macroeconomy, on poverty and inequality, and then on households and sectors.

Macroeconomic effects

The macro-economic results from these simulations are reported in Table 4. We begin by focusing on the two scenarios of broad-based commodity trade liberalization (*ROW* and *DOM* , reported in the first two columns). The elimination of trade distortions in all commodity sectors gives a substantial boost to trade in China, with both exports and imports rising by more than 5 percent in the unilateral liberalization scenario and by 2-4 percent in the scenario of trade liberalization in rest of the world (first two columns of Table 4).

Aggregate welfare effects, which we proxy by the summation of equivalent variation (EV) of individual households and the representative firm,[9] are generally quite small, as one would expect in a model with fixed endowments, perfect competition and constant returns to scale. Composite EV is projected to increase by 0.5 percent of GDP in the case of trade liberalization in rest of the world, due to improved terms of trade. By contrast, there is a small deterioration in welfare under unilateral liberalization due to a deterioration in China's terms of trade. This reflects China's relatively low import protection following WTO accession, as well as her growing influence in world export markets where trade expansion tends to depress export prices.

With fixed labor endowments and capital stocks, and assuming fixed unemployment and no productivity changes, real GDP changes little under both trade liberalization scenarios. The small decrease under *ROW* is driven by the ensuing labor reallocation from non-agriculture to agriculture. The stronger demand in China's agricultural exports following elimination of trade barriers in the rest of the world diverts the labor force from high-productivity manufacturing sectors to lower productivity agricultural sectors.[10] As a consequence, real GDP declines slightly. This contrasts with China's unilateral trade liberalization, where the elimination of the relatively higher import protection in agricultural sectors encourages the movement of the labor force from rural, agricultural sectors to urban, non-agricultural activities, leading to an increase in GDP.

[9] The EV of the representative firm is calculated based on its utility derived from the part of investment financed by the firm's retained earnings.

[10] In reality, this is likely to be evidenced in the form of slower rates of outmigration from agriculture.

As the bottom section of Table 4 indicates, temporary migration from the rural to urban sectors slows down as a result of the trade liberalization in rest of the world, which boosts economic prospects in agriculture. Under *ROW,* there are about 5.9 million fewer rural-urban migrants in the new equilibrium, as compared to the base year. The larger rural labor force is mainly due to the retention of additional on-farm labor (increased by 6.4 million) under the ROW scenario. In contrast, China's unilateral trade liberalization accelerates off-farm migration, with about 1.5-1.6 million workers leaving agriculture and migrating to the urban areas, relative to the baseline.

Table 4 also reports changes in factor prices, from which it is clear that trade liberalization in rest of the world favors unskilled and semi-skilled labor over skilled labor, and rural labor over urban labor. This is due to the relative increase in demand for agricultural exports and the rise in the price of competing agricultural imports. Agricultural profitability in China is also boosted by the trade reforms in rest of the world, as reflected in the rise in returns to agricultural land under ROW. Both returns to capital and skilled wages increase less than CPI, which rises by 2.9 percent under ROW. This pattern of changes in factor prices contrasts sharply with that obtained under China's unilateral liberalization, wherein returns to capital and skilled wages increase most relative to the CPI while returns to agricultural land decrease most.

Next we turn to the third and fourth columns of macro-economic results reported in Table 4, namely, those stemming from the liberalization of agriculture and lightly processed food sectors only. Here we see that agricultural liberalization has only modest impacts on aggregate exports and imports, reflecting the minor role of agricultural and food sectors in China's total trade (recall Table 1). Consequently, China's welfare gains from agricultural liberalization are trivial, ranging from 0.01 to 0.04 percent of its GDP. In contrast to unilateral trade liberalization in all sectors, China's unilateral agricultural liberalization leads to an aggregate EV gain of 0.01 percent of GDP, mainly due to much smaller losses in terms of trade. The changes in factor prices induced by agricultural liberalization show similar patterns to those of broad-based commodity trade liberalization, i.e. agricultural liberalization in the rest of the world would favor unskilled and semi-skilled labor as well as agricultural land in China, while China's unilateral agricultural reforms would favor capital and skilled labor which are intensively employed in the relatively lightly protected manufacturing sectors. The changes in off-farm employment and rural-urban migration under the two agricultural liberalization scenarios are comparable to their corresponding broad-based trade

liberalization scenarios, indicating the dominant role played by distortions in agricultural sectors in determining the mobility of the rural labor forces in China.

Compared to the reduction of China's trade distortions, the labor market reforms investigated in scenarios *LABOR* and *LAND* generally have larger impacts on welfare, GDP and other macroeconomic aggregates. This reflects the large, and persistent, rural-urban distortions in China's labor markets. It is evident from the last two columns of Table 4 that both of the factor market reforms serve to increase migration out of the relatively low productivity agricultural sector, into the higher productivity non-agricultural sectors, and from the rural to urban economy. In the case of land reform, 13.2 million additional workers leave agriculture when they are assured of retaining land ownership in the wake of migration (*LAND* scenario, final column, row Farm Labor, in Table 4). These individuals migrate initially to the off-farm rural labor market, which in turn releases an additional 12.1 million temporary rural migrants to the urban sector in order to restore equality in rural and urban wages, net of transactions costs. The release of workers from agriculture tends to depress wages in the rural, non-farm economy, where wages fall by 3.9 percent in the case of land reform. This wage drop plays a role in dampening out-migration from agriculture.

While the *LAND* reform scenario focuses on the barriers to off-farm mobility of labor, the *LABOR* scenario focuses on rural-urban migration. When the transactions costs associated with temporary migration are reduced, due to elimination of the *hukou* system, rural-urban migration expands by 35.7 million workers. Since the transactions costs associated with temporary rural-urban migration operate like a tax on rural labor, the first effect of their reduction is to increase the supply of rural labor to the urban economy, thereby boosting rural wages and depressing urban wages. This represents a redistribution of the rents associated with the *hukou* system from urban to rural households. In addition, by raising rural wages, this *hukou* reform scenario also draws 27.9 million additional workers out of agriculture.

Poverty and inequality impacts

Since poverty and income distribution are central to our study, we provide several related measures of inequality and poverty in Table 5. The first column in this table simply reports the initial level of each indicator in our data base, while subsequent columns report changes, or percentage changes, in these indicators. The initial urban/rural income ratio, at 3.5, is higher than in some of the household survey-based studies cited previously. This is largely

due to our inability to adjust for spatial price variation which, if fully taken into account, would reduce this ratio considerably. The initial Gini coefficient in our model, 0.442, is heavily influenced by rural-urban income disparity. This estimate is also consistent with the recent work of Benjamin et al. (2007), who identify limitations with many of the existing estimates of inequality and place the Gini in the 0.4-0.5 range.

Using the $2/day poverty line and 1993 PPP exchange rate, the World Bank estimates that 58.11 percent of the rural population in China was in poverty and 2.51 percent of the urban population was in poverty in 2004.[11] We start with these target rates of poverty and compute the poverty line in our data set which reproduces this same poverty headcount. This yields a poverty line of 3520 Yuan/person for urban and 2591 Yuan/person for rural areas. By assuming a uniform distribution of the population within each of the income vingtiles in our source data from NBS, we are able to estimate the poverty headcounts in each stratum. This information is also reported in Table 5. As can be seen there, the national poverty picture in China is largely driven by rural poverty, with 455 million poor residing in rural areas. The poverty headcount rate is highest in the agriculture-dependent household group, where nearly two thirds (63.7 percent) of the population is poor.

Turning to the reform scenarios, the two scenarios that do not reduce the rural-urban income disparity are *DOM* and *DOM-Ag* (China's unilateral liberalization), as rural households generally lose from declining agricultural factor returns. Although the magnitude of the change in the rural-urban income ratio is very small in the cases of trade liberalization, it is very substantial in the factor market reform scenarios. In the case where the *hukou* registration system is abolished *(LABOR)*, for example, this ratio declines from 3.54 to 3.23. The decline for the land reform scenario (*LAND)* is also large (0.17 points).

Table 5 also reports the absolute changes in several Gini coefficients. As income inequality in China is dominated by urban-rural inequality, the narrowed urban-rural income gaps under scenarios of trade liberalization in the rest of the world and reforms in factor markets are reflected in an improvement in overall inequality, as measured by the national Gini coefficient. There are no discernible changes in inequality within the urban and rural areas under the scenarios of unilateral liberalization. However, under the two factor market reform scenarios, the Gini coefficients show a slight increase in inequality within urban areas and a slight decline within rural areas. This is because the low-income, unskilled labor dependent urban households are hurt most by the increase in rural-urban migration of

[11] The World Bank's poverty estimates are available at http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

unskilled workers under labor market reforms, whereas low-income, diversified rural households gain more from the resulting increase in rural unskilled wages than those at high income levels.

Next we turn to the changes in poverty as a consequence of the reform scenarios. In the scenario of broad-based trade liberalization in the rest of the world (*ROW)*, the monetary poverty line increases by 2.9 percent, following the change in CPI (Table 4). Nevertheless, higher factor earnings mean that the poverty headcount ratio declines for all household groups with significant poverty. Urban poverty decreases by 0.3 million (bottom panel reports poverty change in millions) while rural households enjoy a 1.9 percentage point reduction in the poverty headcount (the middle panel reports percentage point change in poverty). Given the large population base in rural China, this translates into a rural poverty reduction of 14.6 million. In the case of agricultural liberalization in the rest of the world, the poverty reduction is smaller but still significant, with the rural poverty headcount declining by 10.8 million.

Given the adverse impacts of China's unilateral liberalization on agricultural sectors, rural poverty increases slightly, by 3.5 million, in the *DOM* scenario and 2.4 million in the scenario of *DOM-Ag*. Given the predominance of rural poverty in China, these rises in rural poverty, in turn, translate into comparable changes in total poverty. On the other hand, labor market reforms would significantly reduce rural poverty, but slightly increase urban poverty. The rural poverty headcount ratio declines from 58.1 percent in the base year to 51.0 percent in the *LABOR* scenario and 56.2 percent in the *LAND* scenario, while the urban headcount ratio rises slightly, from 2.5 percent to 2.8-3.2 percent. Overall, the share of the national population that is impoverished falls quite sharply in the case of *hukou* reforms, from 36.4 percent of the total population to 32.3 percent under the *LABOR* scenario (*hukou* reforms) and to 35.4 percent under the *LAND* reform scenario. When combined, these two scenarios together generate a poverty reduction of 65.5 million. Thus it is clear that, if a poverty reduction and greater income equality are the objectives of the next round of reforms in China, then factor market reforms will need to be part of the package.

Household impacts

It is important to dig down below the aggregate indicators of poverty and inequality and consider the disaggregated, household incidence curves reported in Figures 1a - 1f. These

report the percentage change in welfare (EV as a percentage of initial income), by stratum, across the income-vingtile spectrum. The largest increases in welfare following both trade and agricultural liberalization in ROW (on the order to 2 percent) accrue to the agriculture-specialized households (Figure 1a and Figure 1b). These households benefit from the fact that returns to agricultural land increase relative to other factor prices. Real incomes rise less for rural diversified households due to the dominance of non-farm wage earnings in their income portfolio. Amongst the urban households, the largest welfare increases in Figure 1a are associated with labor-specialized households, followed by urban diversified households. This is consistent with the larger increases in wage rates than in returns to capital. Because the transfers are held constant in real terms, and transfers make up most of their income, the real income of the transfer group is little affected by the agricultural reform. However, as households at low income levels tend to have a larger proportion of food consumption in their total expenditure, the relative increase of food prices leads to a higher household-specific CPI for these low-income households relative to the national average CPI, causing the modest welfare losses of the lowest income transfer groups.

China's unilateral trade liberalization hurts all households except urban transfer specialized households, as shown in Figure 1c, although the magnitude of their welfare losses is small. Rural agriculture-specialized households experience the largest welfare losses, followed by rural diversified households, as they suffer from depressed returns to agricultural activity. The welfare losses of urban households are very small, amounting to only around 0.1-0.2 percent of household income for both diversified households and labor-specialized households. The increased income tax rate to replace tariff revenue loss is the major factor contributing to the welfare losses of urban households. In the case of China's unilateral agricultural liberalization, rural households are still the major losers, but all urban households gain slightly because of the smaller tax replacement effects associated with a lower loss in tariff revenue (Figure 1d).

Recall from the preceding discussion that the largest poverty and inequality impacts stem from the *hukou* reform. Figure 1e shows why this is true. The population stratum with the highest poverty headcount, the agriculture-specialized households, is also the one to reap the largest proportionate gains under this labor market reform scenario. They benefit from the significant increase in agricultural wages. The diversified rural households also benefit from the rise in rural wages, although their welfare gains are somewhat less. These households supply less of the temporary migrant labor to urban areas. And it is these migrants who bear

the direct burden of the heightened transactions costs owing to the *hukou* system. When this is eliminated, they are the ones who benefit most directly from their absence. While the benefits from *hukou* reform are spread relatively evenly across income levels within each of the rural strata, the higher income households within the diversified strata – which have more capital earnings in their income – tend to experience smaller proportionate gains, thereby contributing to the decrease in the Gini coefficient within the rural sector.

Most urban households suffer from the influx of additional unskilled and semi-skilled rural migrants, the presence of which drags down the wage rates in the urban areas. Almost all urban households experience welfare losses, with the minor exception of the richest transfer specialized households. Overall, the urban index of income inequality worsens slightly. However, this is overwhelmed by the reduction in between-sector, rural-urban inequality, and, when coupled with the decline in rural inequality, this leads to a decline in the national Gini inequality index of 0.021 (from 0.442 to 0.421). This is a substantial movement in an index which is generally quite robust to policy reforms.

Similar to the *hukou* reform, the largest gains from land reform accrue to the agriculture-specialized, rural households (Figure 1f). These are the households that are currently constrained to remain active on the farm if they wish to retain rights to their land. By permitting some of these households to rent the land and migrate to the city if they wish to do so, land market reform raises the shadow value of the labor remaining in agriculture very substantially across all income levels. The diversified rural households also gain, with some of the highest gains coming at the lowest income levels, where households are more heavily reliant on income from agriculture. Urban household welfare falls across the board in this experiment and it falls most for the poorest households. This is due to the large boost to rural-urban migration of unskilled and semi-skilled labor as well as the increase in food prices following the reduction in the agricultural labor force. As a consequence, the urban Gini index rises. However, from the point of view of overall inequality in China, the main consequence of this experiment is to redistribute income from urban to rural households, which lowers the Gini index by 0.008.

Sectoral impacts

The effects of the investigated policy reforms on six aggregated sectors' output, exports and imports are reported in Table 6. The first row of Table 6 shows that the highly processed food

products are the major gainers from the elimination of market distortions in rest of the world, with an average output expansion of 5.4 percent. The agriculture and lightly processed food sector expands production by 1.7 percent. Strong increases in exports are the key drivers of the expansion of China's food and agricultural sectors, flowing from the strong increase in international demand. Exports of China's agricultural products, lightly processed food and highly processed food increase by 72 percent, 31 percent and 65 percent, respectively, under the scenario *ROW*. Despite the absence of any cut in protection for agriculture under the *ROW* scenario, China's agricultural and food imports increase by around 10 percent following the agricultural liberalization in rest of the world, because of the decline in the world prices of some of China's major agricultural importing goods such as oilseeds and vegetable oils. In addition, there is a real appreciation of China's currency which tends to boost the demand for imports across the board.

If ROW liberalization is confined to the agriculture and lightly-processed food sectors, they are the only two aggregate sectors with expanding exports and output. All the other aggregate sectors experience declining output and exports. The impact of agricultural liberalization in the rest of the world on China's imports is modest in comparison with the broad-based trade liberalization, as the decline in total exports, and a depreciation of real exchange rate, both serve to dampen the expansion of imports in this ROW-Agr scenario.

The sectoral impacts of China's own reforms suggest that the current distortions arising from China's tariff protection and the labor market barriers generally support the size of agriculture relative to other industries. Under all four scenarios involving China's own reforms, agriculture experiences output losses while both the non-food manufacturing sector and services expand. The impacts of reducing China's distortions in commodity and factor markets on highly processed food sectors are mixed: this sector benefits from the elimination of import tariffs, but loses from reforms in factor markets.

In the two scenarios involving liberalization in the rest of the world, the disaggregated changes in sectoral output (not shown) generally follow that of changes in export demand reported in Table 3: the sectors with larger increases (decreases) in export demand and higher export dependence, such as prepared fish products, sugar, textiles, and apparel and leather, experience relatively large increases (decreases) in output. But imports also play a role in determining sectoral output changes in the oilseeds sector, where output shrinks by 7.4 percent in the *ROW* scenario as a result of the 2.8 percent decline in import prices which spurs the growth of its imports.

Under China's unilateral trade liberalization (*DOM*), instruments, electronics, textiles, apparel and leather are major manufacturing sectors with rapid output expansion. As the most export oriented sectors, they benefit from the real depreciation of Chinese currency in the wake of China's unilateral trade liberalization. At the other end of the spectrum, the most heavily protected sectors, with sizable trade exposure, experience declining output, including: oilseeds, sugar, transportation equipment, other grains and vegetable oil. In the case of China's unilateral agricultural liberalization, there are large output contractions in the agricultural sectors with high levels of protection.

In the scenarios of *hukou* reform (reduced transactions costs) and land reform, agricultural output falls sharply, as the farm labor force is diverted to off-farm rural activities as well as urban-based manufacturing sectors. Within manufacturing, the consumption goods sectors experience declining output but most capital goods sectors expand, because the changes in final demand favor investment over consumption in these two scenarios.

Sensitivity of results to the land rental market assumption

As noted previously, China's rural land markets have been undergoing reform and a nascent market for land is emerging in many areas. In principle, this should facilitate off-farm migration, as migrants may no longer risk losing control of this asset when they leave the farm. However, to date these reforms have been restricted to certain regions, and it is not clear how efficiently this market is functioning – even in those special cases. Therefore, in our base case results, we assumed that the transfer of rural labor from farm to off-farm activities would diminish earnings from land rents by 50 percent, on average (that is, there is a 50 percent probability that migrants will lose control of their land). Since this parameter choice is somewhat arbitrary, we contrast the base case results with those from the two extreme assumptions about the functioning of rural land rental market: one in which there is zero loss in land returns following off-farm employment, and the other in which there is no land rental market (100 percent loss in land returns if farmers switch to off-farm jobs). Thereupon we repeat the two trade liberalization scenarios, *ROW* and *DOM*. The key simulation results are presented in Table 7. Since the macro aggregate results are essentially unchanged from our base line results, only revised results on factor prices and labor migration are reported.

The first pair of columns in Table 7 report the results when the land market is fully

absent, so that migration results in the loss of all land farmed by the migrant. The second pair of columns reports the results when the opposite assumption is made, namely, a fully functioning land market. Consider first the case of trade reforms in the rest of the world (*ROW*). Here, both the returns to land and wage rates in agriculture rise. Furthermore, the rise in land returns is greater than the rise in wages. Therefore, households that had hitherto been considering leaving agriculture due to depressed factor returns have an even stronger incentive to continue do devote their labor to agriculture than do those who, at the margin, had been indifferent to the wage differential between the farm and non-farm sectors (fully functioning land market). Thus the movement of labor into agriculture in the *ROW* scenario is greater when the land market is not functioning than when it is, provided there is no change in the underlying structure of the land market.

The same situation applies, but in reverse, in the case of unilateral trade reforms when labor is leaving agriculture. Here, by including returns to land in the off-farm migration decision(since these fall by more than wages), the incentive to work off-farm is accentuated in the absence of a land market. As we saw above, moving from no land market to a fully functioning land market (experiment *LAND*) generates a much larger flow of workers from agriculture to the rest of the economy (more than 13 million), and a significant poverty reduction. So we are not concluding that a poorly functioning land market is good for poverty reduction. Since the impact of land reforms dominates the trade reform impacts on labor markets, it is the former that rules the day if both are undertaken together. However, this sensitivity analysis does show that our predictions about the impact of trade reforms on intersectoral labor mobility depend importantly on the extent to which farmers are able to lease their land when migrating to the city for work.

Conclusions and policy implications

Absolute poverty in China is now largely a rural problem and, within the rural sector, the intensity of poverty is greatest on the farm. Thus policy reforms that either boost returns to farming or enhance off-farm opportunities for those presently working in agriculture offer the best prospects for reducing poverty and inequality in China. Of the reforms considered, trade reforms in the rest of the world, land reform and *hukou* reform all serve to reduce poverty in

China, while unilateral trade reforms result in a small poverty increase. Domestic agricultural distortions are important factors in determining the distributional and poverty effects of trade reform packages, although their impacts on aggregate trade and welfare are small. Furthermore, the ROW trade reforms as well as the land and *hukou* reforms tend to favor rural over urban households, while the opposite is true of the unilateral tariff reforms. So it would seem desirable to bundle these reforms together in such a way that all of these broad household groups stand to benefit from the reform package. For example, by combining the ROW and domestic trade reforms, a policy package is obtained that would reduce both poverty and inequality while benefitting all of the household groups in our study.

Turning to domestic policies, both the land reform and the *hukou* reform scenarios benefit rural areas much more strongly than urban ones. In the case of land reform, these may hurt lower income urban households who currently benefit from the artificial restriction of rural-urban labor mobility. That may be avoided though if these reforms are phased in over time: in the context of continued rapid economic growth in urban and coastal regions, those urban losses are likely to be more than offset by ongoing income growth. Indeed, this is what appears to be happening in many regions of China, where restrictions on labor mobility are being eroded and land markets are emerging. This study suggests that such labor and land market reforms are particularly impressive in their potential for reducing inequality and rural poverty in China, as well as their scope for allowing China to better realize the potential of her vast rural labor force.

References

Anderson K. and E. Valenzuela (2008),'Estimates of Global Distortions to Agricultural Incentives, 1955 to 2007', World Bank, Washington DC, October, accessible at www.worldbank.org/agdistortions.

Anderson, K., E. Valenzuela and D. van der Mensbrugghe (2010), "Global Poverty Effects of Agricultural and Trade Policies Using the Linkage Model", Ch. 2 in K. Anderson, J. Cockburn and W. Martin (eds.), *Agricultural Price Distortions, Inequality and Poverty*, London: Palgrave Macmillan and Washington DC: World Bank.

Benjamin, D., L. Brandt, J. Giles and S. Wang (2007), "Inequality and Poverty in China

During Reform", PEP-PMMA Working Paper 2007-07, March.

Bhattasali, D., S. Li and W.J. Martin (2004), *China and the WTO: Accession, Policy Reform, and Poverty Strategies*, London: Oxford University Press and Washington DC: World Bank.

Cai, F., A. Park and Y. Zhao (2007), "The Chinese Labor Market in the Reform Era", Ch. 6 in L. Brandt and T. Rawski (eds.), *China's Great Economic Transformation*, Cambridge and New York: Cambridge University Press.

Chen, S. and M. Ravallion (2004), "Welfare Impacts of China's Accession to the WTO", Ch. 15 in D. Bhattasali, S. Li and W. Martin (eds.), *China and the WTO: Accession, Policy Reform, and Poverty Reduction Strategies*, London: Oxford University Press and Washington DC: World Bank.

Deininger, K. and S. Jin (2005), "The Potential of Land Rental Markets in the Process of Economic Development: Evidence from China," *Journal of Development Economics* 78(1): 241-70.

Deininger, K. and S. Jin (2007), "Land Rental Markets in the Process of Rural Structural Transformation: Productivity and Equity Impacts in China," Policy Research Working Paper 4454, The World Bank, Washington DC.

Heckman, J. J. and L. Lochner (1998), "Explaining Rising Wage Inequality: Explorations with a Dynamic General Equilibrium Model of Labor Earnings with Heterogeneous Agents", *Review of Economic Dynamics* 1: 1-58.

Hertel, T.W. (ed.) (1997), *Global Trade Analysis: Modeling and Applications*, Cambridge and New York: Cambridge University Press.

Hertel, T.W., P.V. Preckel, J. Cranfield and M. Ivanic (2004), "Poverty Impacts of Multilateral Trade Liberalization", *World Bank Economic Review* 18(2): 205-36.

Hertel, T.W. and F. Zhai (2006), "Labor Market Distortions, Rural-Urban Inequality and the Opening of China's Economy," *Economic Modeling* 23: 76–109.

Hertel, T., F. Zhai and Z. Wang (2004), "Implications of WTO Accession for Poverty in China", Ch. 16 in D. Bhattasali, S. Li and W. Martin (eds.), *China and the WTO: Accession, Policy Reform, and Poverty Strategies*, London: Oxford University Press and Washington DC: World Bank.

Huang, J., S. Rozelle, W. Martin and Y. Liu (2009), "China", Ch. 3 in Anderson, K. and W. Martin (eds.), *Distortions to Agricultural Incentives in Asia*, Washington DC: World Bank.

Katz, L. and K. Murphy, (1992), "Changes in Relative Wages, 1963-1987: Supply and Demand Factors", *Quarterly Journal of Economics* 107: 35-78.

Liu, X., A. Park and Y. Zhao (2006), “Determinants of Labor Migration: Recent Evidence from Rural China”, mimeo, Beijing University, Beijing.

Parish, W.L., X. Zhe and F. Li (1995), "Nonfarm Work and Marketization of the Chinese Countryside", *China Quarterly* 143: 697-730.

Robinson, S., A. Cattaneo and M. El-Said (2001), “Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods”, *Economic Systems Research* 13(1): 47-64.

Shi, X. (2002), “Empirical research on Urban-Rural Income Differentials: The Case of China, mimeo, China Center for Economic Research, Beijing University, Beijing.

Shi, X., T. Sicular and Y. Zhao (2002), “Analyzing Urban-Rural Income Inequality in China”, paper presented at the International Symposium on Equity and Social Justice in Transitional China, Beijing, 11-12 July.

Sicular, T. and Y. Zhao (2004), “Earnings and Labor Mobility in Rural China: Implications for China’s Accession to the WTO”, Ch. 14 in D. Bhattasali, S. Li and W. Martin (eds.), *China and the WTO: Accession, Policy Reform, and Poverty Reduction Strategies*, London: Oxford University Press and Washington DC: World Bank.

Sicular, T., Y. Ximing, B. Gustafsson and S. Li (2007), “The Urban-Rural Income Gap and Inequality in China”, *Review of Income and Wealth* 53(1): 93-126.

Valenzuela, E. and K. Anderson (2008), ‘Alternative Agricultural Price Distortions for CGE Analysis of Developing Countries, 2004 and 1980-84’, Research Memorandum No. 13, Center for Global Trade Analysis, Purdue University, West Lafayette IN, December, see https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2925

van der Mensbrugghe, D. (2005), ‘LINKAGE Technical Reference Document: Version 6.0’, Unpublished, World Bank, Washington DC, January, accessible at www.worldbank.org/prospects/linkagemodel

Wang, X., T. Herzfeld and T. Glauben (2007), “Labor Allocation in Transition: Evidence from Chinese Rural Households,” *China Economic Review* 18(3): 287-308.

Yang, D.T. (1997), “China’s Land Arrangements and Rural Labor Mobility,” *China Economic Review* 8(2): 101-16.

Zhai, F. and T.W. Hertel (2006), “Impacts of the Doha Development Agenda on China: The Role of Labor Markets and Complementary Education Reforms”, Ch. 10 in T.W. Hertel

and L.A. Winters (eds.), *Poverty and the WTO: Impacts of the Doha Development Agenda*, London: Palgrave Macmillan and Washington DC: World Bank.

Zhang, L., J. Huang and S. Rozelle (2002), "Employment, Emerging labor markets, and the Role of Education in Rural China", *China Economic Review* 13(2-3): 313-28.

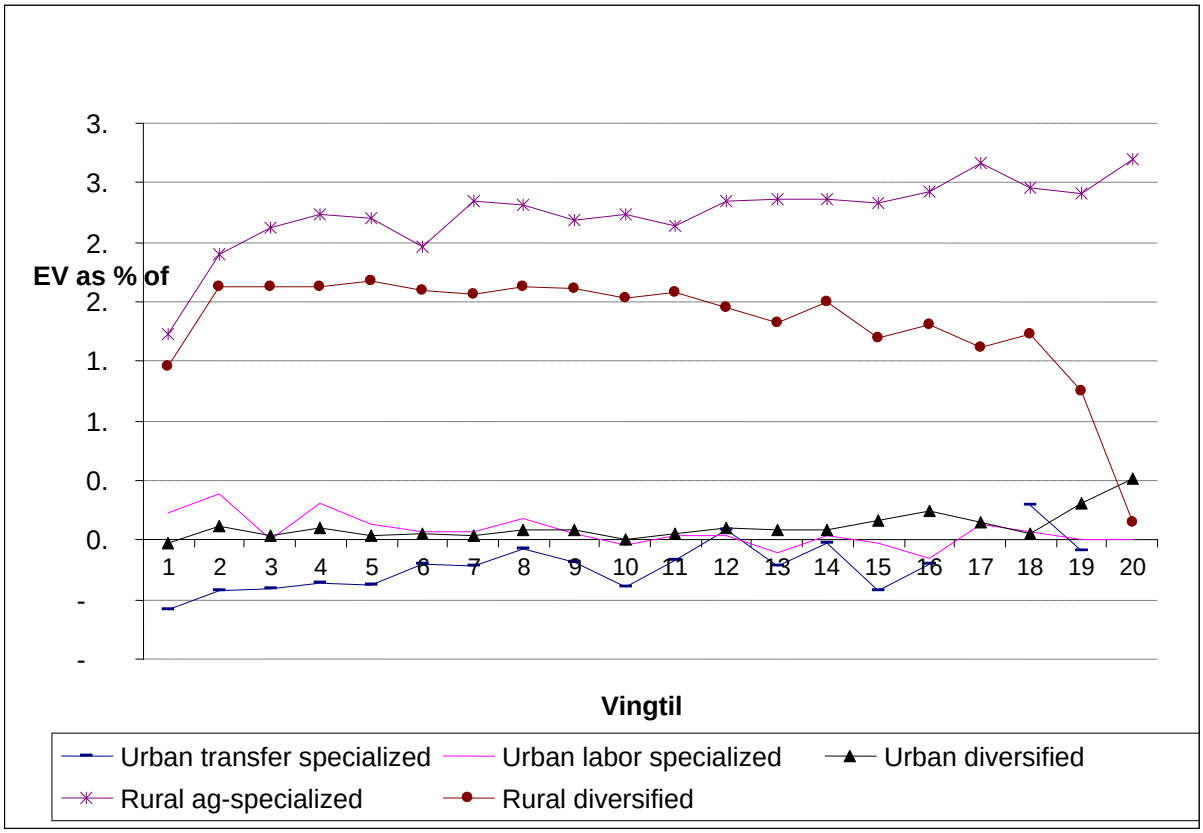
Zhao, Y. (1999a), “Labor Migration and Earnings Differences: The Case of Rural China,” *Economic Development and Cultural Change* 47: 767-82.

Zhao, Y. (1999b), “Leaving the Countryside: Rural-to-Urban Migration Decisions in China,” *American Economic Review* 89(2): 281-86.

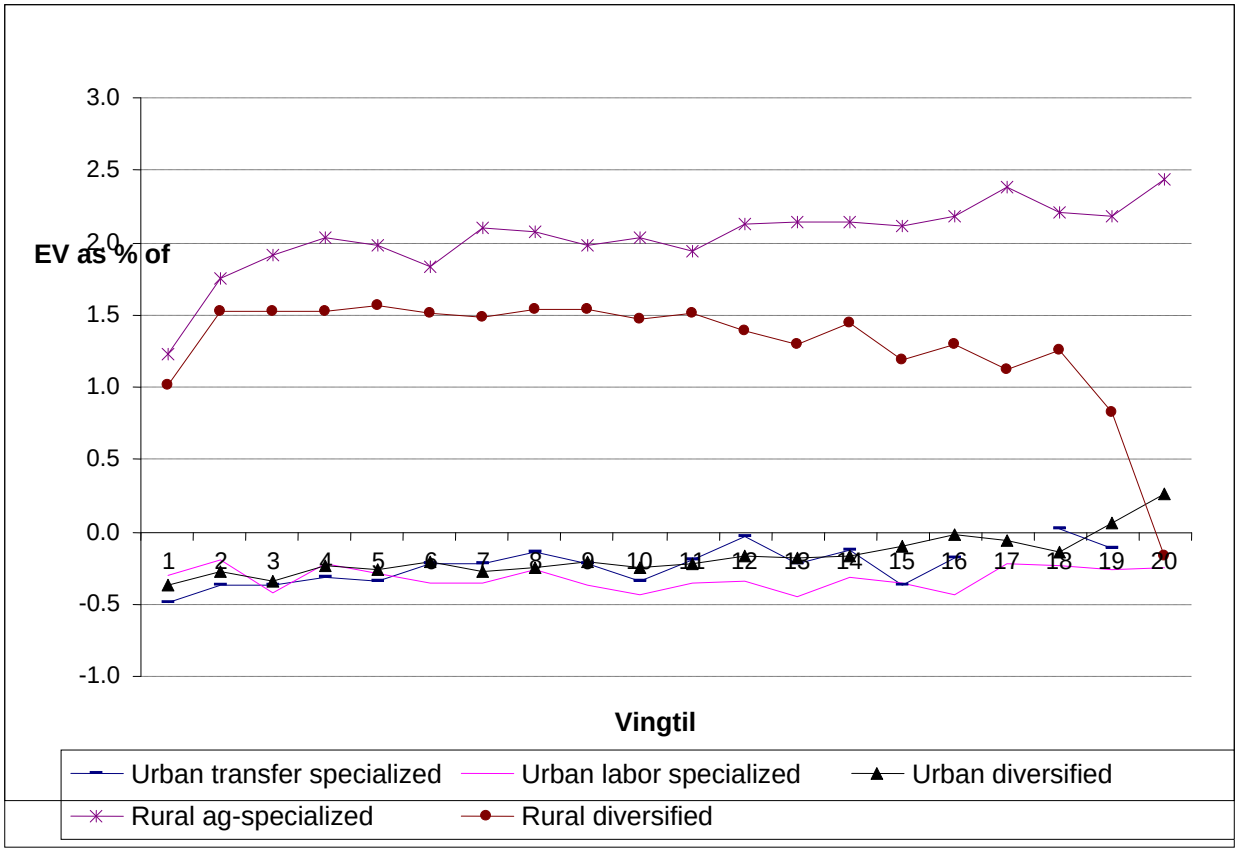
Figure 1: Impacts of prospective liberalizations on five types of Chinese households

(EV as a percent of income)

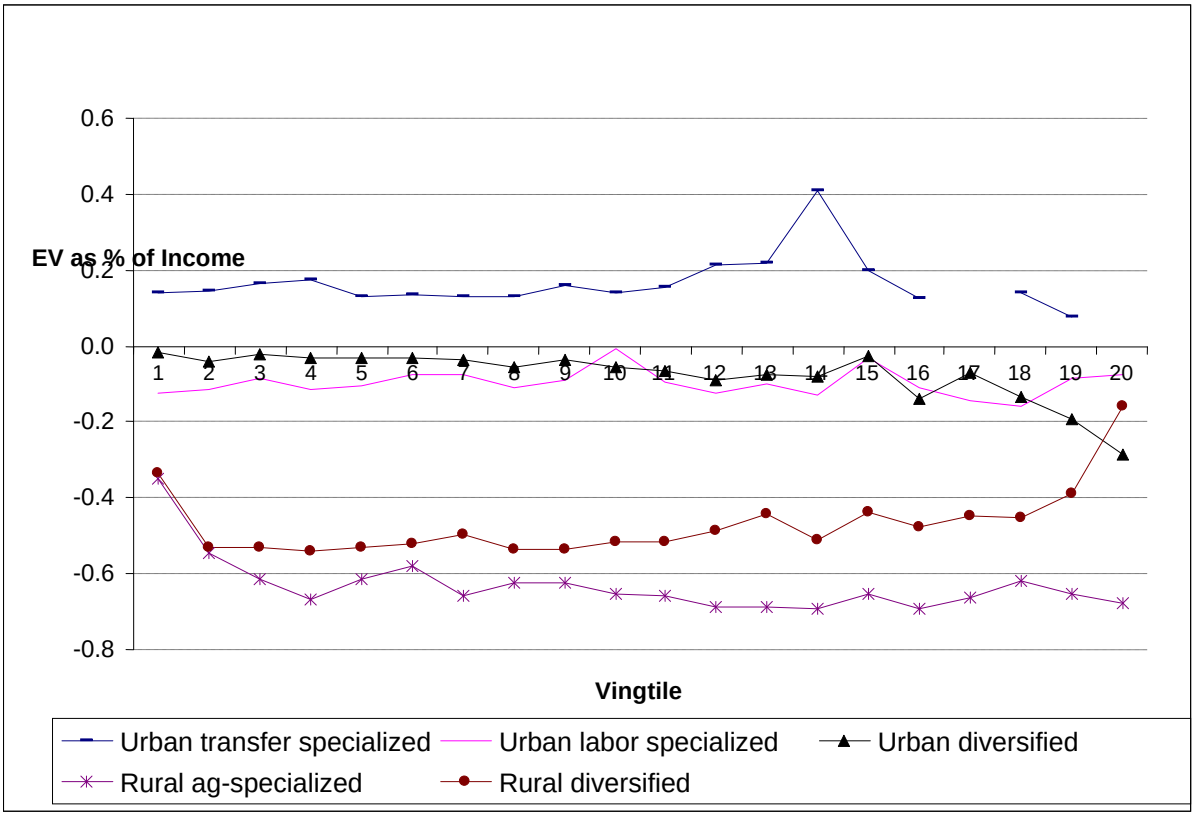
(a) All goods liberalization in rest of the world (ROW)



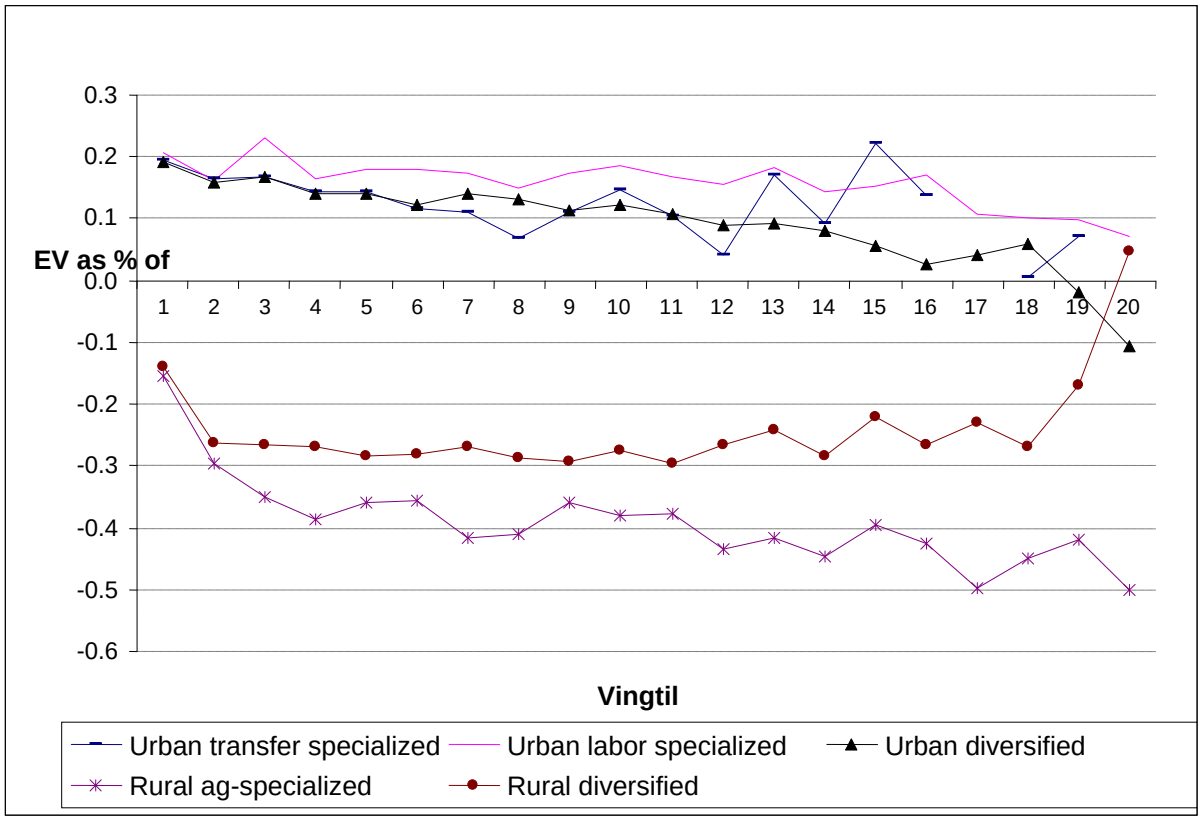
(b) Agricultural liberalization in rest of the world (ROWag)



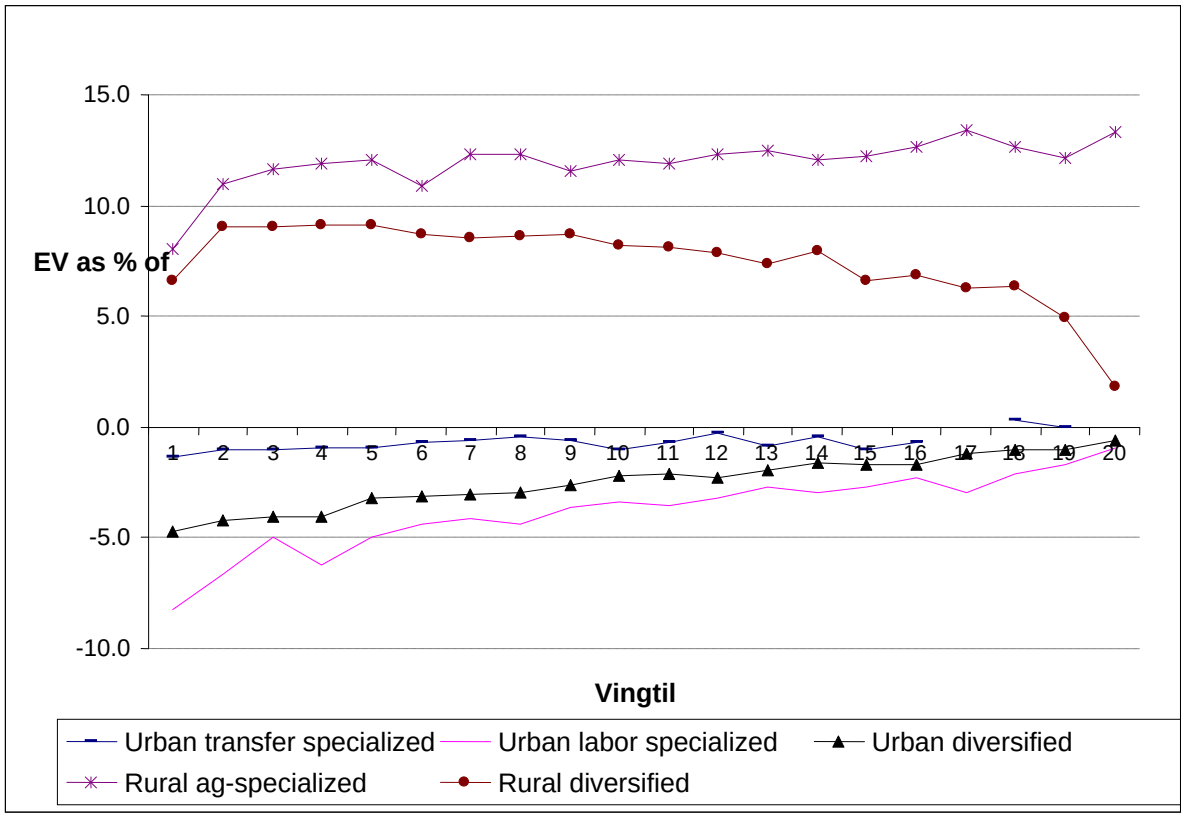
(c) Unilateral liberalization of all goods trade (TRA)



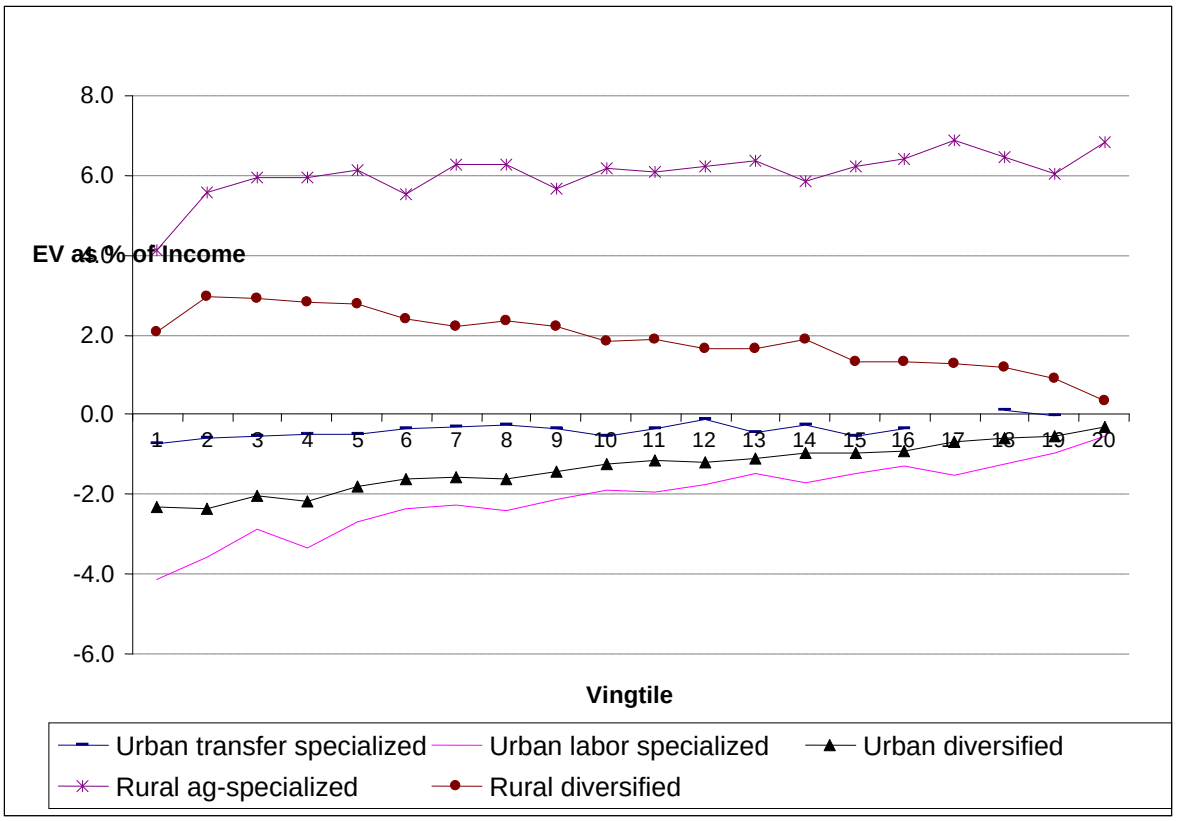
(d) Unilateral liberalization of agricultural trade (TRA-ag)



(e) Hukou reform (LABOR)



(f) Land reform (LAND)



Source: Authors' simulations

Table 1: Sectoral structure of GDP, trade, import tariffs and export subsidies, China, circa 2004

(percent)

	Tariff rate	Export subsidy rate[a]	GDP share	Exports share	Imports share
Agriculture	**6.5**	**0.8**	**13.4**	**1.6**	**2.5**
Paddy rice	0.0	-1.0	0.8	0.0	0.0
Wheat	4.0	0.0	0.3	0.0	0.1
Other grains	3.4	13.0	0.3	0.1	0.0
Vegetables and fruits	14.8	0.0	5.5	0.7	0.1
Oilseeds	15.9	0.0	0.4	0.1	0.7
Sugar cane and beet	15.3	0.0	0.0	0.0	0.0
Plant-based fibers	-5.3	0.0	0.2	0.0	0.3
Other crops	9.4	0.0	0.1	0.3	0.0
Cattle sheep etc	3.9	0.0	0.3	0.0	0.0
Other livestock	0.0	0.0	2.7	0.1	0.2
Raw milk	0.0	0.0	0.1	0.0	0.0
Wool	7.0	0.0	0.1	0.0	0.1
Forestry	2.8	0.0	1.3	0.0	0.9
Fishing	5.2	0.0	1.3	0.1	0.0
Mining	**0.7**	**0.0**	**4.9**	**1.5**	**6.2**
Coal mining	3.1	0.0	1.9	0.5	0.1
Crude oil and natural gas	0.9	0.0	1.9	0.4	4.1
Ore mining	0.0	0.0	0.5	0.1	1.4
Other mining	0.5	0.0	0.6	0.5	0.7
Food manufacturing	**5.0**	**-0.0**	**3.8**	**3.0**	**2.0**
Meat Products	10.5	0.0	0.2	0.5	0.3
Vegetable oils	12.5	0.0	0.3	0.1	0.5
Grain, milled	0.0	-1.0	0.2	0.0	0.0
Sugar, refined	17.3	0.0	0.1	0.0	0.1
Forage	11.5	0.0	0.2	0.0	0.0
Prepared fish products	0.9	0.0	0.2	1.0	0.7
Other processed food	9.4	0.0	0.8	1.1	0.3
Beverages	12.7	0.0	0.6	0.2	0.1
Tobacco products	8.9	0.0	1.1	0.1	0.1
Non-food manufacturing	**2.9**	**0.0**	**28.6**	**74.9**	**80.5**
Textiles	0.2	0.0	2.0	9.1	4.5
Apparel and leather	0.2	0.0	1.5	9.3	1.6
Sawmills and furniture	1.9	0.0	0.9	2.2	0.7
Paper, printing, etc.	3.0	0.0	2.0	3.3	2.0
Petroleum refining	3.6	0.0	0.9	0.9	1.5
Chemicals	3.3	0.0	4.9	7.3	13.0
Build materials	2.7	0.0	1.6	1.4	0.7
Metals	1.7	0.0	3.1	1.5	5.9
Metal products	2.1	0.0	1.2	3.6	2.0
Machinery	3.3	0.0	3.1	4.4	11.6
Transport equipment	16.4	0.0	2.1	2.2	3.7

Electric machinery	2.9	0.0	1.5	6.8	6.2
Electronics	1.4	0.0	2.3	16.6	20.7
Instruments	2.1	0.0	0.4	5.0	6.0
Other manufacturing goods	0.7	0.0	1.2	1.4	0.4
Utilities, construct., services	**0.0**	**0.0**	**49.3**	**19.0**	**8.8**

[a] Negative figures indicate an export tax.

Source: Huang, Rozelle and Martin (2009), drawing on the GTAP database v7.0 and China's 2002 Social Accounting Matrix.

Table 2: Modeled liberalization scenarios for China

Scenario	*Description*
ROW-Ag	Agricultural liberalization in the rest of the world - Elimination of production taxes and subsidies in agricultural and lightly processed food sectors - Elimination of export taxes and subsidies in agricultural and lightly processed food sectors - Elimination of import tariffs in agricultural and lightly processed food sector sectors
ROW	All merchandise trade liberalization in the rest of the world - Elimination of production taxes and subsidies in agricultural and lightly processed food sectors - Elimination of export taxes and subsidies in agricultural and lightly processed food sectors - Elimination of import tariffs in all sectors
DOM-Ag	Agricultural liberalization in China - Elimination of export taxes and subsidies in agricultural and lightly processed food sectors - Elimination of import tariffs in agricultural and lightly processed food sectors
DOM	All merchandise trade liberalization in China - Elimination of export taxes and subsidies in agricultural and lightly processed food sector - Elimination of import tariffs in all sectors
LABOR	Relaxation of the *hukou* system - Cut the indirect transactions costs from 81 to 34 percent of the non-farm rural wage
LAND	Introduction of land reform - Farm households do not include the returns to land in their temporal migration decision

Source: Authors' specifications.

Table 3: Exogenous demand and price shocks due to liberalization in the rest of the world

(percent change)

	Elimination of all trade distortions in ROW			Elimination of agricultural distortions in ROW		
	Export demand	Export price	Import price	Export demand	Export price	Import price
Agriculture:						
Paddy rice	94.9	4.2	..	123.6	1.8	
Wheat	15.5	3.5	2.8	45.8	1.4	3.6
Other grains	105.1	3.9	6.5	157.7	1.6	6.5
Vegetables and fruits	185.5	4.2	1.9	232.9	1.8	1.6
Oilseeds	10.3	4.0	-2.8	42.9	1.7	-2.3
Sugar cane and beet	..	..	..	..	..	..
Plant-based fibers	30.0	3.3	10.0	51.4	1.3	11.5
Other crops	-12.7	4.5	1.3	8.4	2.0	1.5
Cattle sheep etc	-18.6	4.4	6.5	-3.1	1.9	6.6
Other livestock	-20.8	3.8	0.7	-0.2	1.6	1.6
Raw milk	-48.3	4.1	-1.8	-31.7	1.7	-0.7
Wool	-13.1	3.8	4.9	10.1	1.6	4.9
Other primary products	-7.8	2.7	0.5	2.0	0.6	1.1
Lightly processed food:						
Meat products	29.2	3.5	4.9	56.3	1.3	5.6
Vegetable oils	-6.4	1.8	-0.2	5.7	0.3	-0.9
Grain, milled	148.8	3.0	4.2	192.1	0.9	3.4
Sugar, refined	410.2	3.0	1.4	560.4	0.8	2.0
Highly processed food	67.3	2.9	0.8	-14.1	0.8	-0.2
Non-food manufacturing:						
Textiles; apparel and leather	13.7	2.6	-0.2	-2.1	0.8	0.4
Other manufacturing sectors	-3.3	2.2	0.7	-1.6	0.5	0.3
Services	-10.5	2.5	0.1	-0.9	0.5	0.2
Total	2.2	2.4	0.6	-0.3	0.6	0.4

Source: Linkage model simulations (see van der Mensbrugghe, Valenzuela and Anderson 2009).

Table 4: Aggregate simulation results of prospective liberalizations for China

	ROW	*DOM*	*ROW-Ag*	*DOM-Ag*	*LABOR*	*LAND*
Macroeconomy (percent change)						
Welfare (EV)	0.5	-0.1	0.04	0.01	1.0	0.1
Real GDP	-0.1	0.2	-0.2	0.1	0.8	0.3
Exports	1.9	5.8	-0.3	0.7	1.6	0.6
Imports	4.3	5.5	0.1	0.7	1.4	0.6
Terms of trade	1.8	-0.8	0.3	-0.1	-0.3	-0.1
CPI	2.9	-0.9	1.0	-0.3	1.4	0.7
Factor prices (percent)						
Return to agric land	16.3	-3.5	13.5	-3.1	-7.3	-2.5
Return to capital	2.2	-0.8	0.0	0.0	1.5	0.6
Unskilled wages:						
Urban	3.7	-1.1	1.2	-0.3	-17.7	-3.1
Rural non-agric	3.9	-1.3	1.3	-0.4	6.9	-3.9
Agricultural	4.4	-1.8	1.3	-0.4	23.7	8.8
Semi-skilled wages:						
Urban	3.9	-1.2	1.3	-0.3	-5.4	-3.1
Rural non-agric	4.9	-1.1	2.2	-0.4	25.5	-4.5
Agricultural	2.7	-1.1	0.0	0.0	20.1	11.7
Skilled wages:						
Urban	1.9	-0.9	0.0	0.0	0.9	0.3
Rural non-agric	1.9	-1.0	-0.1	0.0	0.9	0.2
Labor force (millions)						
Farm labor:	6.4	-1.6	5.7	-1.5	-27.9	-13.2
Unskilled	0.7	-0.2	0.6	-0.2	-15.6	-1.8
Semi-skill	5.7	-1.4	5.1	-1.3	-12.3	-11.3
Rural-urban temporary migration:	-5.9	1.5	-5.3	1.4	35.7	12.1
Unskilled	-0.6	0.1	-0.5	0.1	18.2	1.5
Semi-skill	-5.3	1.3	-4.8	1.3	17.6	10.6
Skilled	0.0	0.0	0.0	0.0	0.0	0.0
Labor force (percent)						
Farm labor:	1.7	-0.4	1.6	-0.4	-7.6	-3.6
Unskilled	0.4	-0.1	0.4	-0.1	-9.8	-1.2
Semi-skill	2.7	-0.7	2.4	-0.6	-5.9	-5.4
Rural-urban temporary migration:	-6.0	1.5	-5.4	1.4	36.5	12.3
Unskilled	-1.5	0.4	-1.4	0.4	46.7	3.9
Semi-skill	-10.4	2.6	-9.3	2.5	34.3	20.6
Skilled	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' Chinese CGE model simulations.

Table 5: Effects of prospective liberalizations on inequality and poverty in China

	Base	*ROW*	*DOM*	*ROW-Ag*	*DOM-Ag*	*LABOR*	*LAND*
Inequality							
Urban/rural income ratio	3.538	-0.052	0.009	-0.042	0.010	-0.303	-0.167
Gini coefficient	0.442	-0.005	0.001	-0.004	0.001	-0.021	-0.008
Urban	0.259	0.000	0.000	0.001	0.000	0.006	0.003
Rural	0.315	-0.002	0.000	-0.002	0.000	-0.008	-0.003
Poverty headcount ($2/day)							
	(ratio, %)	Changes (percentage point)					
Total	36.4	-1.2	0.3	-0.8	0.2	-4.1	-1.0
Urban	2.5	-0.1	0.0	0.0	0.0	0.7	0.3
-- transfer specialized	0.5	0.0	0.0	0.0	0.0	0.0	0.0
-- labor specialized	4.0	-0.1	0.0	0.0	0.0	0.9	0.4
-- diversified	1.6	0.0	0.0	0.0	0.0	0.6	0.3
Rural	58.1	-1.9	0.5	-1.4	0.3	-7.1	-1.9
--ag-specialized	63.6	-1.8	0.4	-1.4	0.3	-6.8	-3.5
-- diversified	57.5	-1.9	0.5	-1.4	0.3	-7.1	-1.7
	(million persons)	Changes (million persons)					
Total	467.3	-14.9	3.6	-10.8	2.3	-52.1	-13.4
Urban	12.6	-0.3	0.1	0.0	0.0	3.3	1.6
-- transfer specialized	0.1	0.0	0.0	0.0	0.0	0.0	0.0
-- labor specialized	8.1	-0.2	0.1	0.0	0.0	1.7	0.9
-- diversified	4.4	-0.1	0.0	0.0	0.0	1.6	0.8
Rural	454.7	-14.6	3.5	-10.8	2.4	-55.5	-15.0
--ag-specialized	52.2	-1.5	0.4	-1.1	0.3	-5.6	-2.9
-- diversified	402.5	-13.1	3.2	-9.7	2.1	-49.9	-12.1

Source: Authors' Chinese CGE model simulations.

Table 6: Effects of prospective liberalizations on sectoral outputs and trade of China

(percent)

	ROW	*DOM*	*ROW-Ag*	*DOM-Ag*	*LABOR*	*LAND*
Output						
Agriculture	1.7	-0.3	1.6	-0.4	-2.9	-1.3
Other primary goods	-0.8	-0.1	-0.2	0.1	-0.8	-0.5
Lightly processed food	1.7	-2.0	1.7	-2.2	-2.6	-1.1
Highly processed food	5.4	0.03	-1.6	0.44	-2.3	-1.1
Non-food manufacturing	-0.5	0.4	-0.9	0.3	2.0	0.9
Services	-0.4	0.2	-0.2	0.1	1.3	0.5
Exports						
Agriculture	71.5	5.7	100.2	3.0	-39.2	-23.6
Other primary goods	-6.0	5.6	1.7	0.6	3.7	1.3
Lightly processed food	31.2	11.0	58.3	7.7	-25.0	-14.4
Highly processed food	64.8	7.0	-14.8	2.8	-17.4	-9.6
Non-food manufacturing	1.6	6.4	-2.1	0.7	3.0	1.4
Services	-10.2	2.7	-1.2	0.3	2.1	1.1
Imports						
Agriculture	11.6	21.0	1.2	22.1	18.6	9.8
Other primary goods	5.5	1.2	-2.4	-0.1	6.9	3.0
Lightly processed food	8.8	46.4	-0.1	48.6	10.3	5.8
Highly processed food	8.8	16.3	3.5	-0.9	8.0	4.3
Non-food manufacturing	3.9	5.7	0.2	0.0	0.5	0.1
Services	4.8	-1.2	0.3	-0.1	0.4	0.1

Source: Authors' Chinese CGE model simulations.

Table 7: Sensitivity analysis of simulation results for China

	No land rental market		*Fully functioning land market*	
	ROW	*DOM*	*ROW*	*DOM*
Factor prices (percent)				
Return to agric land	16.8	-3.6	15.8	-3.4
Return to capital	2.1	-0.7	2.2	-0.8
Unskilled wages:				
Urban	4.0	-1.1	3.4	-1.0
Rural non-agric	4.3	-1.3	3.5	-1.3
Agricultural	3.5	-1.3	5.3	-1.8
Semi-skilled wages:				
Urban	4.4	-1.3	3.5	-1.1
Rural non-agric	5.6	-1.1	4.1	-1.1
Agricultural	1.5	-0.8	4.2	-1.5
Skilled wages:				
Urban	1.8	-0.9	1.9	-0.9
Rural non-agric	1.7	-1.0	1.9	-1.0
Labor force (millions)				
Farm labor:	8.0	-1.9	4.7	-1.3
Unskilled	0.8	-0.2	0.5	-0.1
Semi-skill	7.2	-1.7	4.2	-1.1
Rural-urban temporary migration:	-7.4	1.7	-4.4	1.2
Unskilled	-0.7	0.2	-0.4	0.1
Semi-skill	-6.7	1.6	-4.0	1.1
Skilled	0.0	0.0	0.0	0.0

Source: Authors' Chinese CGE model simulations.

Appendix Table A.1: Sectoral concordance between Chinese CGE model and Linkage model

Chinese model	Linkage model
Agriculture	
Paddy rice	Paddy rice
Wheat	Wheat
Other grains	Other grains
Vegetables and fruits	Vegetables and fruits
Oilseeds	Oilseeds
Sugar cane and beet	Sugar cane and beet
Plant-based fibers	Plant-based fibers
Other crops	Other crops
Cattle sheep etc	Cattle sheep etc
Other livestock	Other livestock
Raw milk	Raw milk
Wool	Wool
Lightly processed food	
Meat Products	Beef and sheep meat; Other meats
Vegetable oils	Vegetable oils and fats
Grain, milled	Processed rice
Sugar, refined	Refined sugar
Highly processed food	
Forage; Prepared fish products; Other processed food; Beverages; Tobacco	Dairy products; Other food, beverages and tobacco
Other primary products	
Forestry; Fishing; Coal mining; Crude oil and natural gas; Ore mining; Other mining	Other primary products
Non-food manufacturing	
Textiles, Apparel and leather	Textiles and wearing apparel
Sawmills and furniture; Paper, printing & social articles; Petroleum refining; Chemicals; Build materials; Metals; Metal products; Machinery; Transport equipment; Electric machinery; Electronics; Instruments; Other manufacturing goods	Other manufacturing
Services	
Utility; Construction; Transportation & communication; Commerce; Finance; Other services	Services

Source: Authors' compilation

Table A.2: Impacts on prospective liberalizations on sectoral output, China

(percentage deviation from baseline)

	ROW	*DOM*	*ROW-Ag*	*DOM-Ag*	*LABOR*	*LAND*
Paddy rice	1.3	0.4	0.1	0.4	-1.5	-0.7
Wheat	-0.1	-0.7	0.8	-1.1	-4.6	-2.4
Other grains	5.8	-4.4	6.8	-4.7	-3.4	-2.0
Vegetables and fruits	3.5	0.1	3.6	0.0	-2.2	-0.6
Oilseeds	-7.4	-13.4	-3.4	-14.1	-12.2	-6.5
Sugar cane and beet	6.5	-5.8	6.5	-5.9	-2.2	-0.7
Plant-based fibers	4.7	2.6	2.0	1.0	-3.0	-1.5
Other crops	-6.2	0.8	-0.8	0.0	-19.1	-10.6
Cattle sheep etc	-1.5	-0.9	-0.1	0.2	-5.5	-2.9
Other livestock	1.8	0.3	0.1	0.0	-1.3	-0.7
Raw milk	-0.3	0.3	-0.3	0.4	-2.9	-1.5
Wool	1.4	0.5	-0.8	0.3	-0.9	-0.5
Forestry	3.5	0.6	-0.4	-1.2	-2.8	-1.5
Fishing	3.5	0.3	-1.1	0.2	-6.6	-3.3
Coal mining	-0.9	0.1	-0.2	0.1	1.9	0.8
Crude oil and natural gas	-2.5	-0.7	0.5	0.1	0.4	0.2
Ore mining	-3.5	0.3	-0.2	0.2	3.7	1.6
Other mining	-1.8	0.7	0.0	0.2	3.6	1.5
Meat Products	1.1	0.1	0.2	0.2	-1.5	-0.3
Vegetable oils	0.7	0.2	-0.4	0.4	-3.1	-1.6
Grain, milled	-1.1	-4.3	-2.0	-4.4	-2.4	-0.9
Sugar, refined	8.7	-7.8	8.9	-7.9	-2.2	-0.8
Forage	3.2	-0.5	4.9	-1.1	-4.0	-2.1
Prepared fish products	22.6	1.9	-5.3	0.6	-13.8	-7.4
Other processed food	6.2	0.0	-2.1	0.8	-1.8	-0.8
Beverage	1.7	-0.3	-0.7	0.2	0.3	0.3
Tobacco	2.2	-0.7	-0.6	0.1	0.1	0.3
Textiles	5.1	3.5	-2.2	0.9	0.2	-0.1
Apparel and leather	6.2	2.8	-1.3	0.9	0.7	0.2
Sawmills and furniture	-1.4	1.0	-0.8	0.2	-0.2	-0.3
Paper, printing, etc.	-1.5	0.4	-0.9	0.2	1.6	0.8
Petroleum refining	-0.5	-0.5	-0.4	0.0	0.8	0.3
Chemicals	-1.3	-0.5	-0.7	0.2	1.2	0.6
Build materials	-0.5	0.4	-0.5	0.1	2.6	1.0
Metals	-1.7	-0.5	-0.8	0.2	3.0	1.3
Metal products	-1.6	0.7	-0.9	0.2	3.3	1.5
Machinery	-1.4	-1.2	-0.7	0.1	2.9	1.2
Transport equipment	-0.9	-5.2	-0.5	0.1	2.2	0.9
Electric machinery	-2.3	0.9	-1.0	0.2	3.6	1.7
Electronics	-1.5	3.8	-0.9	0.2	3.0	1.5
Instruments	-1.8	7.1	-1.6	0.4	5.8	2.8
Other manufacturing goods	-1.5	0.6	-0.8	0.2	0.7	0.2
Utility	-0.6	0.1	-0.3	0.1	1.3	0.5
Construction	0.4	0.1	-0.2	0.1	2.1	0.6
Transportation & commun.	-1.0	0.3	-0.4	0.1	1.5	0.7
Commerce	-0.9	0.3	-0.5	0.1	1.3	0.6
Finance	-0.3	0.1	-0.1	0.0	0.6	0.3
Other services	-0.3	0.1	0.0	0.0	0.7	0.4

Source: Authors' Chinese CGE model simulations.