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Impacts of the Doha Development Agenda on China: The Role of Labor Markets and Complementary Education Reforms *

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Abstract

This paper offers an assessment of the implications of multilateral trade reforms for poverty in China. We do so by combining results from a global modeling exercise with a national CGE (Computable General Equilibrium) model that features disaggregated households in both the rural and urban sectors. We examine two trade reform scenarios: one involving global trade liberalization, and one involving possible Doha Development Agenda reforms. Using the World Bank's $2/day poverty line, we find that multilateral trade reforms do in fact reduce poverty in China. The biggest reductions occur in the rural areas – largely as a result of higher prices for farm products.

Introduction

With its rapid economic growth and integration into the world economy over the last two decades, China has emerged as a global economic force. Now it is the fourth-largest trader and the largest foreign direct investment (FDI) recipient in the world. China's foreign trade and investment are expected to be further boosted by WTO accession, including recent elimination of textile and apparel quotas, as well as prospective multilateral trade liberalization in the context of the Doha Development Agenda. However, against the background of rapid economic growth and openness, the income distribution has deteriorated sharply in China. The ratio of urban to rural incomes has increased from 2.2 in 1990 to 3.1 in 2002, which is extremely high by international standards. In the mean time, income inequality within rural areas, as measured by the Gini coefficient, has risen from 0.31 in 1990 to 0.36 in 2001, and it has increased from 0.23 to 0.32 in urban areas over the same period (Li and Yue, 2004).

This widening income disparity is the result of profound structural changes in the Chinese economy. The experience of the last decade suggests that trade liberalization might contribute to the increased inequality (Kanbur and Zhang, 2001). China's WTO accession has further heightened the concern about the increasing rural-urban disparity, as most analyses suggest that accession will exacerbate inequality, by lowering barriers to grain imports and increasing opportunities for manufacturing exports as well as foreign investment in urban-based services. (Ianchovichina and Martin, 2004). Hertel, Zhai and Wang (2004) find that the poorest rural, agriculture-specialized households that have limited labor mobility out of farming might lose from WTO accession. How will these outcomes be affected by a potential Doha reform package? Do complementary reforms exist that might lessen adverse impacts on the poor? This paper focuses on the potential for rural education reforms to enhance the poverty outcomes under a potential Doha Development Agenda.

It has been widely recognized that education plays a critical role in creating human capital, and subsequently prompting economic development and reducing poverty. However, investment in education is often inadequate relative to other investments, due to the presence of associated externalities, labor market distortions that depress private returns to education, and the generally low level of public support for education (Heckman, 2002). Moreover, disparities in funding for education have resulted in non-uniform access to education across regions and between urban and rural areas. In China, education spending has been disproportionately directed toward urban areas at the cost of rural areas. In 2001, per capita spending on compulsory education in urban area was a 16% higher than in rural areas (Wang, 2003).

In this paper, we utilize a household-disaggregated applied general equilibrium model to assess the differential household effects of mutlilateral trade liberalization under the Doha Development Agenda of the WTO, as well as the additional impacts of increasing rural education spending. We explicitly model the linkages between education and labor productivity improvement as well as off-farm labor mobility – which we see as a critical vehicle for poverty reduction in rural China.

The paper is organized as follows: the next section describes the specification of the CGE model used in this study. We then elaborate how we model the educational expenditures and output – in terms of the supply of labor force by skill and associated efficiency. Section 3 assesses the impact of Doha Round trade liberalization, as well as increasing rural educational expenditures, on rural-urban inequality. The final section offers conclusions.

1. The CGE Model

The CGE model of China used in this study is the latest in a long line of model developments based at the Development Research Center of State Council in Beijing. 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 (Dervis, de Melo and Robinson, 1982; de Melo, 1988; Shoven and Whalley, 1992). Here, we focus on the main features of the model.

Household Behavior: In order to come to grips with the poverty question, it is critical that that we disaggregate households to the maximum extent possible, subject to the limitations posed by survey sampling, computational constraints, and human capacity for analysis. Following our previous work (Hertel, Zhai and Wang, 2004; Hertel and Zhai, 2004), 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. Recent analysis of trade and poverty by Hertel et al. (2004) suggests the merit of distinguishing those households that are specialized (95% or more of their income from one source) in transfer payments, labor wages and salaries, or self-employment income. According to the available survey data, we stratify the rural households by agriculture-specialized and diversified (all other), and the urban households by 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% of the stratum population.

Household income derives from labor income, profits from family-owned agriculture and non-agriculture 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 (Zhao, 1999b). During earlier years, the Chinese government sought to make it costly for individuals to leave the rural areas by tying incomes to daily participation in collective work. More recently, the absence of well-defined land tenure has raised 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).[1]

We use a constant elasticity of transformation function to model the off-farm labor supply of rural households. 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 the elasticity of transformation[2], which reflects imperfect labor mobility. There are many reasons for this imperfect mobility of labor, including education, experience, and simple geography which can serve to isolate farm households from the non-farm labor market. Owing to the absence of an effectively functioning land market, the shadow value of labor in agriculture in this function

[1] However, as noted by Parish, Zhe and Li (1995), the rural labor market is looking more like a market all the time.

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 rate at which decreased on-farm labor reduces the household's land endowment.[3]

Rural-urban Migration: Despite the large income and poverty differential between rural and urban households, permanent migration in China has been limited. This is due to a combination of both direct and indirect measures. First and foremost, households must have an appropriate registration (*hukou*) in order to legally reside in an urban area. Without this registration, access to many of the urban amenities, including housing and education, is limited and quite expensive. In light of these barriers to moving the entire household to an urban area, rural-urban migration is largely a transitory phenomenon.

For our modeling exercise, it is important to obtain an estimate of the wage gap motivating the temporary migration of workers from the rural to the urban sector in China. Yaohui Zhao (1999a) documents an average annual wage gap between rural and urban work of 2,387.6 ¥uan for unskilled rural workers of comparable background and ability in Sichuan Province in 1995. The majority of the wage gap is due to social costs associated with migration – including: the disutility of being away from family, poor quality of housing, limited social services for migrants, and the general uncertainty associated with being a non-registered worker in an urban area (Zhao, 1999a, 1999b). While these transactions costs are unobservable, they clearly represent a very significant burden on the migrants and their families.

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,

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[2] See Hertel and Zhai (2004) for the details of the off-farm labor supply behavior in the model.

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% of the rural-urban labor income differential and 48% of the hourly earnings differential.[4] When applied to the average wage differential, this amounts to an *ad valorem* rate of apparent transactions "tax" on rural wages of 81%.[5]

We model these transactions costs as real costs that are assumed by the temporary migrants. 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 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 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 and reaches the observed wage gap (adjusted for transport and living costs) at the current level of

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[3] In this model we assume that the elasticity of land with respect to on-farm labor is unitary

[4] 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% 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% left unexplained via the subtraction approach of Shi, Sicular and Zhao (2002).

[5] See Hertel and Zhai (2004) for a detailed description of how this *ad valorem* distortion is obtained.

temporary migration (about 70 million workers). We assume that further increases in temporary migration have only a modest impact on these transactions costs.[6]

Production, Exports and Imports: Since the 1990s, processing exports have grown rapidly as a result of their preferential treatment, which includes duty-free imports. This sector now accounts for more than half of China's total exports. This is captured in our CGE model explicitly by incorporating two separate foreign trading regimes. One is the export processing regime, which receives duty-free imports and is therefore extremely open, with considerable foreign investment. Under this regime, firms process and assemble the imported goods, turning them into finished goods for export; these imported intermediate goods are exempted from tariffs and value-added taxes. Therefore, export processing firms are more intensive in their use of imported intermediate inputs, and all of their output is exported. The other sector is the ordinary trade regime, which is carried out under traditional taxes and regulations. The firms under the ordinary trade regime sell products on the domestic market or export to rest of the world, according to a constant elasticity of transformation (CET) function. Therefore, the ordinary exports are treated as differentiated products from those sold on the domestic market. We also assume the buyers of rest of the world choose a mix between the ordinary exports and the processing exports to minimize their costs.

There are two types of imports in the model. The imports of duty-free processing goods are used by export processing firms as their intermediate inputs. Ordinary imports are modeled using the Armington assumption, i.e. they are assumed to be differentiated from Chinese products produced by ordinary firms. The small country assumption is assumed for imports and so world import prices are exogenous in terms of foreign currency. Exports are demanded

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

according to constant-elasticity demand curves. Therefore the terms of trade for China are endogenous in our simulation. The values of export demand and Armington elasticities, which are reported in Table 1, are based on the estimation by Hertel et al (2003). Table 1 also lists some a variety of useful information on production and trade patterns of the Chinese economy, based on the 1997 Chinese social accounting matrix (SAM).

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 a capital-labor composite and agricultural land. The 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. The values of substitution elasticities in production functions are listed in Table 2. A low substitution elasticity of 0.3 between capital and skilled labor is assumed here to introduce capital-skill complementarity. The elasticity of substitution between semi-skilled labor and unskilled labor is set to 1.5, based on estimates for the U.S. by Katz and Murphy (1992) and Heckman and Lochner (1998).

Within each labor category (i.e., unskilled, semi-skilled and skilled), we distinguish rural and urban workers. These two categories of workers substitute imperfectly in production. 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. This is particularly important in China where significant barriers to rural and urban mobility remain (see above). Ideally we would model the geographic distribution of industrial activity, but unfortunately the data do not exist to support this split.

All commodity and non-labor factor markets are assumed to clear through prices. With the exception of the farm/non-farm labor supply decision, labor is assumed to be perfectly mobile across sectors. Capital is assumed to be partially mobile, reflecting differences in the marketability of capital goods across sectors.

Recursive Dynamic and Comparative Static-Steady State Closures: The CGE model is benchmarked to China's 1997 Social Accounting Matrix (SAM) and it incorporates dynamics in two alternative ways. The recursive dynamic version of the model is used to update the SAM to 2005 and assess the impact of intervening events on China's patterns of trade, production and consumption. In this version of the model, the classical savings-investment mechanism determines the capital stock in the medium- and long-term. Dynamics originate from the accumulation of productive factors and productivity changes. The steady–state, comparative static version is used to assess the impact of trade and educational reforms, starting from the 2005 base. Here, the longer-term accumulation effects are taken into account by introducing a different capital market closure following Harrison *et al* (1997) and Francois *et al* (1996). The aggregate capital stock is allowed to adjust to its long-term equilibrium based on an exogenous capital rental rate (fixed at the benchmark level). The theoretical underpinnings of this closure are based on the concept of an invariant capital stock equilibrium as proposed by Hansen and Koopmans (1972).

2. Modeling Education

Education affects the economy in several important ways. Education improves the skills of workers, thereby enhancing their productivity and garnering them a higher wage. In the context of rural China, education is also a key determinant of an individual's potential suitability for off-farm work (Yang 2002; Zhang, Huang and Rozelle, 2002). Since the farm – off-farm labor market linkage has proven key to the transmission of trade reform benefits to the rural poor (Hertel, Zhai and Wang, 2004), this mechanism will receive special attention here. This section describes the framework through which education expenditure affects the production of human capital and its distribution among different household groups, as well as the linkage between schooling attainment and off-farm mobility of labor in rural areas.

In the CGE model each household is endowed with 17 groups of workers, distinguished by their total years of schooling, ranging from 0 to 16. Based on this level of educational attainment, we infer the skill level of household members in the workforce. Unskilled labor refers to workers with 0 to 6 years of educational attainment. Semi-skilled workers have 7 to 12 years of educational attainment, and skilled workers have an educational attainment from 12 to 16 years. For each household, the labor endowment by skill is determined by its age-specific school participation rates and labor force participation rates.

The age-specific school participation rates are determined by the education costs per pupil-year and the total educational expenditure. We assume that a change in total education expenditure induces a proportional change in school participation rates across all ages. The education expenditure comprises private expenditure and government expenditure, which we assume are fully fungible. Government and private education expenditures enter the budget constraints of government and households, respectively. However, private decisions are not the result of household investment choices. Rather, throughout the analysis, private and public expenditures are assumed to be made in equal proportions.

In the model, education enhances labor productivity through two channels. First, more education improves the skill composition of the labor force, resulting in a greater supply of skilled labor and lesser supply of unskilled labor. Second, for each skill level, more education yields a higher level of average schooling attainment, thereby improving its average labor productivity. The second channel is captured by linear increasing functions between labor efficiency and the average years of schooling for the three types of labor.

As noted above, we model the off-farm labor supply decision of rural households as a CET function of the ratio of the shadow value of labor in agriculture, relative to the off-farm wage rate. We assume that the elasticity of transformation is a linear, increasing function of average years of schooling within the labor skill groups. This specification, which implies that rural households with higher educational attainment respond more effectively to farm/non-farm wage gaps, is based on recent empirical evidence (Zhang, Huang and Rozelle, 2002).

2.1 Model Calibration and Choice of Parameters

Detailed data on the population and labor force is necessary to calibrate the education block of the model. We calculate the age distribution of the rural and urban populations, respectively, according to their mortality tables from the 2000 national population census, under the assumption of a stationary population, i.e. no change in the age structure. The age distribution of each of the 40 rural household groups is assumed to be the same, and similarly with the 60 urban household groups. Age-specific labor participation rates by urban and rural classifications are also obtained from the 2000 national population census. We scaled them up/down to the aggregated labor force participation rate of each representative household to obtain the age-specific labor participation rates by household.

National average school participation rates by age are calculated from official enrollment and drop-out rates for primary school, middle school, high school and university or college. Then we estimate the age-specific school participation rates of each household by solving a quadratic program, which minimizes the difference between the school participation rates of each household and the national average school participation rates, subject to the constraints implied by the base year skill composition of each household's labor endowment.

The productivity increments associated with educational attainment enhancement are derived from the study by Shi, Sicular and Zhao (2002). These authors estimate wage (or shadow wage) equations for agricultural and rural, non-farm workers. These equations include educational attainment as an explanatory variable. Their estimates suggest that additional education has the greatest impact on rural non-farm wages, with one additional year of schooling boosting hourly wages (and, we presume, productivity) by 15%. Additional schooling also has an impact on agricultural productivity, with an additional year of schooling boosting total factor productivity on the farm by 2%. When adjusted for the share of labor in agricultural output, this is equivalent to a 2.5% increase in labor productivity. Specification of the values of the off-farm labor supply elasticity draws on the econometric work of Sicular and Zhao (2004) and Zhang, Huang and Rozelle (2002). Sicular and Zhao report results from a household labor supply model estimated using labor survey data from the 1997 CHNS data set for nine central provinces. From their labor supply equations for self-employed agricultural labor and self-employed non-agricultural labor, it is possible to calculate elasticities of labor transfer from farm to non-farm activities. They report a variety of elasticities in their paper.[7] We adopt their estimate of 2.67 for use in this work as the overall farm/off-farm transformation elasticity for the total rural labor force.

To obtain separate estimates of the farm/off-farm transformation elasticity for three skill levels of labor, we utilized the rate at which increased schooling attainment enhances the transformation elasticity, ε_l, based on the study by Zhang, Huang and Rozelle (2002). These authors explore the labor-supply behavior of a panel of 310 individuals in 109 families observed in four villages of Jiangsu province in the years 1988, 1992, and 1996. They find that for every additional year of education, farmers had a 14% greater chance of finding an off-farm job in 1996, *ceteris paribus*. Using the base year ratio of the shadow value of labor in agriculture relative to the off-farm wage rate, as well as the total farm and off-farm labor supplies, this increasing opportunity to access off-farm jobs associated with higher educational attainment translates into an increment of 0.58 in transformation elasticity for each additional year of schooling. This is used to calculate the farm/off-farm transformation elasticities by skill level, according to the average years of schooling for each skill level of the rural labor force. The resulting values for this elasticity are 0.68 for unskilled labor, 4.01 for semi-skilled labor and 7.49 for skilled labor.

[7] Due to the variety of labor supply elasticities in response to the three different wages in their model, the authors obtain a variety of labor transfer elasticities, depending on the "thought experiment" being conducted. These are asymmetric, with the response to a change in shadow wages differing from the response of labor supply to a change in the market wage. However, this response is treated as symmetric in our model. This makes it difficult to choose the correct parameter for our analysis. We focus on the transfer of labor from agriculture to market wage employment in response to a change in returns to agriculture, since this transfer accounts for the bulk of the labor flow in our analysis.

3. Simulations

Simulation Design

The baseline scenario from 1998-2005 is constructed by utilizing the recursive dynamic version of the model. The baseline scenario establishes a plausible growth trajectory for the Chinese economy, which takes into account events such as China's WTO accession and its recent dramatic surge in exports, which have doubled in the last four years. We then utilize the updated 2005 data base as the new benchmark equilibrium from which we employ the comparative steady-state model to conduct the policy simulations. A series of trade reform scenarios are then considered, followed by a final scenario that is designed to capture the added impact of rural education reform.

In the first trade reform scenario (*ROW*) we consider the impacts of global trade liberalization excluding China. In particular, this entails elimination of all import tariffs in the rest of the world. In addition, agricultural export subsidies are eliminated, as are subsidies for domestic agricultural production in the OECD. The second scenario (*Uni*) focuses on China's unilateral liberalization. All import tariffs and non-tariff barriers of China are eliminated in this scenario. The third scenario (*Full-Lib*) considers the impact of global free trade by combining the first and the second scenarios. The fourth scenario is the standard *Doha* scenario.

To reflect the impacts of multilateral trade liberalization in the single country model, we incorporate external market impacts into the Chinese CGE model through exogenous shifts in import prices and export demand schedules. The sizes of these exogenous trade shocks are obtained from global simulations. The tariff reduction in China is excluded in this GTAP simulation but is included in the simulation of the single country model.

Table 3 reports the results provided by the global analysis for the *Full-Lib* and *Doha* scenario impacts on China (with China's own reforms excluded). In the case of *Full-Lib*, there are some enormous percentage increases in China's export volumes generated by the elimination of very high rates of protection elsewhere in Asia. Rice, corn, grain milling and other food products all show very large proportionate increases. Of course the associated volume changes are often quite modest, as China is not a large exporter of most of these products. Moreover, after our China CGE model is solved with implied shifts in export demands and import prices, the resulting equilibrium change in export volumes predicted by the national model are much smaller than that suggested by the GTAP simulations.

World food and agricultural prices facing China rise relative to non-food prices, based on the global modeling exercise, with the increases ranging from 4% to 12% in the case of full liberalization, but considerably smaller for the Doha scenario. These are reported in the second and third sets of columns in Table 3. The final set of columns in Table 3 reports the percentage cut in the tariff rates in China under each scenario. In the case of Doha, they are in the range of one-quarter to one-third of Full-Lib (-100%).

In the final scenario of this paper, we explore the potential poverty impacts of investing in rural education. In this scenario we equalize the urban-rural imbalance in per capita government spending on education by increasing government spending on rural education by 16% in order to bring per capita rural spending in line with that in urban areas.[8] Since we are interested in the impact of this reform in the context of multilateral trade liberalization, we treat

[8] A caveat should been mentioned here. In the scenario of education reform, we assume the private education spending of rural households increase proportionally to the public spending. It implies that the education demand in rural area is constrained by the supply side factors. This seems reasonable, given the low level of rural education in China, the potential benefits from education investment as well as the long-term nature of the simulation.

it as a combined scenario, with the rural educational reforms *added to* the global liberalization scenario (*Full-Lib*). The shorthand for this combined scenario is *Edu-Lib*.

Economy-wide Impacts of Multilateral Trade Liberalization

The macro-economic results from the trade reform scenarios are reported in the first four columns of Table 4. The reported values are deviations from the baseline in 2005. The reduction in global trade barriers gives a substantial boost to trade in China, with both exports and imports rising by about 2-3% in the Doha Round trade liberalization and 5-6% in the scenario of global free trade (Full-Lib). Aggregate welfare, which is measured by the summation of individual household equivalent variation (EV) and reported as a percentage of GDP, would increase by about 0.4% under the Doha trade reforms and 0.8% in the scenario of global free trade, due to improved terms of trade and reduced distortions between world prices and domestic prices. China's welfare gain from global trade liberalization comes entirely from the liberalization of other countries. Actually, in the scenario of unilateral trade liberalization, China experiences a welfare loss of 0.3% of its GDP, due to a deterioration in its terms of trade, which are endogenous in this model. This reflects China's relatively low level import protection after its WTO accession and its growing influence in world export markets, which in turn tends to reduce its export demand elasticities.

With fixed labor endowments, full employment and no productivity changes, China’s GDP is little changed under trade reform. The small increase under Full-Lib is driven by the effects on labor reallocation and capital accumulation. In the case of Doha Round trade liberalization as well as global free trade, stronger export demand in agricultural products and larger cuts in tariff rates for manufacturing goods divert the labor force from high productivity, manufacturing sectors to lower productivity, agricultural sectors, when compared to the baseline outcome.[9] Although capital stock rises slightly -- spurred by the trade liberalization, the increased capital stock is largely offset by the productivity loss associated with more labor employed in agriculture and the rural sector, resulting in minimal gains in real GDP. On the other hand, in the scenario of China's unilateral liberalization, the deterioration in terms of trade reduces the profits of exports, which consequently discourages the capital accumulation, resulting in a lower level of steady-state capital stock. Although some of the agricultural labor force is diverted to non-agricultural activities, this does not offset the adverse effect of less capital stock. As a consequence, GDP slightly declines in the scenario of China's unilateral liberalization.

Turning to the changes in factor prices, we see that the effects of global free trade and Doha Round trade liberalization on wages are largely neutral across skill levels and between rural and urban sectors. The increase in agricultural profitability, which is reflected in the rise of returns to agricultural land, increased the on-farm demand for labor and therefore reduces off-farm labor supply by about 0.8 million in the Doha Round trade liberalization and 2.2 million in the scenario of global free trade, relative to baseline. Urban and rural non-farm wages are linked through the temporary migration of individuals to urban areas. In the multilateral trade liberalization scenarios, temporary migration from the rural to the urban sector is slowed, with about 1.5 million fewer migrants under *Full-Lib* than would be the case in the baseline.

Since poverty and income distribution are central to this paper, we provide several such measures for China as a whole in Table 5. The urban-rural income ratio declines in all three global trade liberalization scenarios, although the magnitude of this change is very small – 0.01 points in the case of global free trade. This is also reflected in a small improvement in urban-

[9] In this model, there are exogenous differences in labor productivity across sectors, inferred from observed wage rates.

rural inequality, as measured by the Gini coefficient. However, there are no discernible changes in inequality within the urban and rural areas.

Using the $2/day poverty line, Chen and Ravallion (2004) estimate that 45.2% of the rural population in China and 4.1% of the urban population are in poverty. Applying these figures to our benchmark data for the year 2005, we obtain the poverty line of 4730 ¥uan (1997 prices) for urban and 3580 ¥uan (1997 prices) for rural households. By assuming a uniform distribution of the population within each of the vingtiles, we are able to estimate how the poverty headcount changes in the wake of these reforms. This information is also reported in Table 5. In the *Full-Lib* scenario, the monetary poverty line increases by 2.4%, following the change in the CPI (Table 4). Nevertheless, higher factor earnings mean that the poverty headcount ratio declines for all household groups.

Since transfer incomes are assumed to be constant in real terms and are indexed by the consumer price index, the urban transfer specialized household group experiences only a modest decline in its poverty headcount, reflecting a decline in non-transfer income, which comprises less than 5 percent of this group's total income. The aggregate urban poverty headcount decreases by about 2.1 percent. Rural households enjoy a 2.7 percent reduction in poverty headcount, which amounts to a 1.2 *percentage point* reduction in rural poverty (i.e., the proportion of the entire rural population in poverty falls by 1.2 percent). Given the large population base in rural China, this translates into a rural poverty reduction of 10.6 million people. The Doha scenario shows a similar pattern of poverty reduction across households, but with lesser absolute reductions. Overall, the impoverished share of the national population falls from 31.3 percent of total population to 30.5 percent in the scenario of global free trade, and to 30.9 percent under the Doha Round scenarios.

Sector Impacts

Figures 1 and 2 report a subset of the changes in sector output, in descending order, omitting the changes that are less than 2% for global free trade and less than 0.7% in absolute value for the Doha Round trade liberalization. In both scenarios, the largest increases in output are due to the expansion of textiles and apparel exports, with these products, as well as the production of synthetic fibers, increasing by substantial amounts in the wake of tariff cuts in overseas markets. Some agricultural sectors, such as wool, corn and grain milling and feedstuffs, also enjoy a boost in output – particularly under the *Full-Lib* scenario. On the other end of the spectrum, the most heavily protected sectors, with sizable trade exposure, experience declining output, including: automobiles, machinery, special equipment, non-ferrous metal products and vegetable oil. In the case of global free trade, wheat production shows the largest reduction in output, due to the very large reduction in China's tariff under that scenario.

Trade volume changes associated with each of the trade reform experiments are reported in Table 6. With the exception of a few mining products and transport services -- for which there is no cut in protection, import volumes increase for all sectors in the economy in the scenarios of Doha Round trade liberalization. The largest increases are for automobiles, as well as textiles, apparel and leather products - where the demand for intermediate inputs increases strongly. Export volumes for most products also increase, especially for rice, corn, grain milling and feedstuff, textile and apparel, fueled by increased demand in the global market. Those sectors with slight or negative increments in exogenous export demand, such as vegetable oil, non-ferrous metals, some mining products, machinery, special equipment and automobiles, experience reductions in export volumes under the Doha scenario.

In the case of global free trade, the changes in both imports and exports are much more significant. Despite relatively large increases in the world price of imports into China, import volumes grow by 20% to 50% in most crops and food sectors, because of their large reduction in import protection. One exception is imports of rice which would decline due to the low initial protection and large increment in the import price. Similar to the cases of Doha Round trade liberalization, the rise of imports in automobile, textile and apparel are also large. Agricultural and food sectors, textiles and apparel, as well as the other transportation equipment sector, are the major gainers in terms of export volume. However, there are also manufacturing sectors that would experience reductions in export volume.

The large expansion in China's agricultural exports under the global free trade scenario can be better understood against the backdrop of the significant cuts in agricultural protection in Korea and Japan. Given its close geographic proximity to (and strong trade linkage with) these countries, China would benefit from the strong agricultural import growth in these markets following global trade liberalization. However, as mentioned in the previous section, due to its small export volumes in most agricultural products, China is still a small agricultural exporter in the world market. In the case of grains, our baseline scenario predicts that China's exports of rice and corn will be 2.0 and 4.8 billion ¥uan (1997 prices), respectively, in 2005. Even under the scenario of global free trade, its exports of rice and corn are only 7.9 and 7.5 billion yuan (1997 prices). These changes are no larger than recent annual fluctuations in exports of these commodities.[10]

[10] In the case or rice exports, this increase is comparable in size to that observed between 1997 and 1998, which rice exports increased from about 2 billion yuan to nearly 9 billion yuan, after which is steadily declined, returning to about 2 billion yuan by 2004. In the case of maize, the projected change is smaller than recent annual export fluctuations.

Household Impacts

We now turn to Figures 3a and 3b, which report the household impacts of trade liberalization, by stratum, across the income spectrum. The first point to note from Figure 3a is that global trade liberalization benefits all households, except those reliant on transfers. Since the transfers are held constant in real terms, and transfers comprise most of their income, the transfer group is little affected by the trade liberalization.

Among the other urban households, the smallest welfare increases in Figure 4a are associated with urban diversified households. This contrasts with the relatively larger gains by the urban, labor-specialized households. The difference is attributable to the fact that the urban diversified households have significant income from capital earnings – particularly the wealthiest households. Since the increases in rates of return to other factors are larger than the increases in capital stock, the highest income, diversified households benefit proportionately less than the other, labor-specialized urban household groups. The largest increases in welfare following global trade liberalization accrue to the rural households – especially the wealthier, agriculture-specialized households. They benefit from the fact that returns to agricultural land increase relative to other factor prices. Real income rises less for rural diversified households due to the dominance of non-farm wage earnings. Similar patterns of household incidence emerge from the Doha scenarios.

Impact of Investing in Rural Education

As noted previously, one of the keys to enhancing the welfare of the rural poor – particularly those reliant on agriculture for their income – is to enhance their off-farm employment opportunities. As noted previously, econometric evidence suggests that education has proven to be one of the key determinants of off-farm employment. Therefore, we now consider the impact of improved access to education for the rural households, in conjunction with the experiment of global free trade implemented previously. The incremental aggregate effects of rural education reform are reported in the sixth column of Table 4. Real GDP and welfare rise by 1.3% and 1.2%, respectively, as a result of increasing the rural education spending by 16%. Clearly from an economy-wide point of view, rural education is a favorable investment, given our assumptions about productivity differentials, education costs and financing mechanisms (a mix of public and private funding).

Three factors contribute to the observed GDP growth following investment in rural education: (1) Due to improved access to education, average schooling attainment of unskilled rural labor increases by 1.7 years[11]. It results in higher productivity, which largely offsets the decline in the amount of unskilled labor supply. (2) As a result of improved rural education, the supply of rural semi-skilled and skilled labor increase by 16% and unskilled labor declines by 23%. This favorable change in skill composition induces an economy-wide productivity gain. On the other hand, the forgone working hours from higher school participation rates is quite modest – the supply of aggregate rural labor force declines by only 0.29%.[12] (3) Higher educational attainment also improves off-farm labor mobility. Due to the improved rural education, 4.9 million additional workers leave agriculture and an additional 2.0 million temporal migrants move to urban areas. This movement of labor from relatively low productivity sectors

[11] The model predicts that only the unskilled labor force will experience an increment in schooling attainment because we assume same proportional increase in the school participation rates across grades Thus the increase in semi-skilled labor at the low end is offset by a reduction at the high end as more semi-skilled become skilled. However, at the low end, the increase in unskilled labor is fueled by a decline in the share of illiterate people in unskilled labor force.

[12] The relatively small reduction in rural labor force is perhaps somewhat surprising. However, this is the consequence of several factors. Firstly, the 1.7 increment to schooling years applies only to the unskilled rural labor force. Secondly, the ages of labor force in this model are from 15-70. While the ages of pupils are from 7-25. So increasing enrollment rates of primary school (0-6 schooling years, for pupils at 7-12 years old) and middle school (7-9 schooling years, for pupils at 13-15 years old) has no direct impact on total labor supply.

(agriculture, and rural non-farm employment) into higher productivity activities (rural non-farm work, and urban employment, respectively) also boosts overall productivity.

With an increase in the pool of semi-skilled rural workers of 42.4 million, migration among this group out of agriculture increases by 13.3 million workers. Temporary migration of semi-skilled workers to urban areas also rises by 10.5 million workers, contributing to a decline in urban semi-skilled wage rates. Since we abstract from any transactions costs associated with the temporary rural-urban migration of skilled labor, the bulk of the increased supply of rural skilled workers (around 1.9 million, or 82% of the supply increment) migrates to urban areas. However, its impact on the urban skilled wage is very limited, given the small size of temporary skilled migration compared to the stock of urban skilled workers. On the other hand, with the combination of a diminished supply and an enhanced schooling attainment of unskilled workers in the rural areas, wages for this group rise sharply. As a consequence, both off-farm employment and temporary migration of unskilled labor to urban areas actually decline.

The distributional impacts of improved rural education may be seen in Figure 4a, which reports the *incremental* welfare change of disaggregated household groups in urban and rural China. Most urban households lose under this scenario, as they face more intense competition from increasingly well-educated and mobile rural workers. Furthermore, given the closure rules used in our model, the additional government expenditure on rural education is financed via a direct tax on household income. Therefore, urban households pay part of the costs of increased rural education[13]. Lower income households in the urban area experience bigger losses because they rely more heavily on semi-skilled labor income. As a consequence the urban Gini index rises by 0.003 (Table 5). On the other hand, household welfare rises for all rural households. The

[13] As we assume that the income tax is levied on the non-transfer incomes, urban transfer specialized households do not bear the

largest proportional increase in welfare is for the agriculture-specialized rural households which benefit from the strong increase in rural unskilled wages. Overall, the benefits from rural educational reform are spread relatively evenly across income levels, and the rural Gini index is hardly changed. The educational reform induces a 0.23 point decline in the urban-rural income ratio and a 0.015 decline in national Gini coefficient – indicating an improvement in urban-rural income distribution in China. Returning to Table 5, we see that the rural poverty headcount falls significantly, by 11.8%, following the investment in rural education. The largest fall is ascribed to diversified rural households. The poverty headcounts of urban labor specialized and diversified urban household groups increase by 8.5% and 12.0%, respectively. However, given the share of urban poverty in the overall population, the deterioration of urban poverty is more than offset by the alleviation of rural poverty, and national poverty headcount falls by 44.3 million.

The combined aggregate impact of both global free trade and improvement in rural education is reported in the final columns of Tables 4 and 5. The results show that these reforms are potentially significant for Chinese economy. As a major indicator of overall efficiency, GDP increases by 1.2%, and aggregate welfare rises by 2.0%.

Figure 4b shows the cumulative effect of global free trade and educational reform on disaggregate urban and rural household welfare. Here, the potential urban-rural redistribution of welfare is striking. The equivalent variation for agriculture-specialized rural households is around 7-9% of initial income. Other rural households also benefit from these reforms. In contrast, urban household welfare falls by as much as 2% of initial income for the poorest urban households. Clearly the reforms aiming at global free trade and promoting rural education would

costs of additional rural education.

boost rural household welfare, however, this does come at the expense of urban household 0 – particularly those lower income groups. However, when viewed in an historical context, this redistribution is quite modest. It does little more than undo the worsening of the urban-rural income disparity that has arisen since 1998.

The combined education and trade reforms also contribute significantly to rural poverty reduction. The rural poverty headcount ratio declines by 14.2 percent, or 6.4 percentage points, from 45.2% in the base case to 38.8% in the *EduLib* scenario, while the urban headcount ratio rises slightly from 4.07% to 4.27%. Overall, the national number of people in poverty nationwide declines by 55 million when rural education reforms are combined with global trade liberalization.

Of course an important question remains: How much interaction is there between the rural education reforms and multilateral trade liberalization? In order to isolate this interaction, we repeated the Full-Lib scenario using the database and parameters that result from implementation of the education reforms. The results of the Full-Lib experiment in the wake of the education reform were nearly identical, suggesting that there is little interaction between the two policies. In other words, the cumulative impact of undertaking both sets of reforms is essentially the sum of the two individual impacts.

4. Conclusions and Policy Implications

The goal of this paper has been to assess the implications of multilateral trade reforms for poverty in China. We do so by combining results from a global modeling exercise with a national CGE model that features disaggregated households in both the rural and urban sectors. We examine three different scenarios: one involving global trade liberalization, and two involving possible Doha Development Agenda reforms. Using the World Bank's $2/day poverty line, we find that multilateral trade reforms do in fact reduce poverty in China. The biggest reductions occur in the rural areas – largely as a result of higher prices for farm products. Since this is where the bulk of the poor in China reside, an overall reduction in poverty follows.

Urban poverty falls in two of the three household groups considered in this analysis, since the increased demand for China's products in world markets boosts factor earnings sufficiently to offset the impact of higher food prices. For the remaining group – which is heavily dependent on transfer payments -- we assume that indexation of these payments will largely offset the adverse consequences of higher prices. However, a decline in other income sources is sufficient to cause an increase in poverty, and this increase is large enough to boost the overall urban poverty headcount. However, the urban poor only represent 5% of the total poor in China and thus the national poverty headcount falls.

We also explore the implications of complementary reforms in China – in particular increased investments in rural education aimed at equalizing per capita spending between rural and urban areas. This boosts rural enrollments by 16% which has the twin benefits of increasing labor productivity, as well as enhancing the mobility of the rural labor force, thereby putting these workers in a better position to benefit from trade reforms. Our analysis takes account of the cost of funding these additional students, as well as the reduction in the workforce that results from having more pupils in school. Nevertheless, these reforms generate very substantial gains for China's economy. They also serve to boost rural incomes and reduce the incidence of rural poverty. Indeed, when combined with global trade liberalization, poverty in China is estimated to drop by about 55 million people.

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Figure 1: Change in Sector Output – Full-Lib

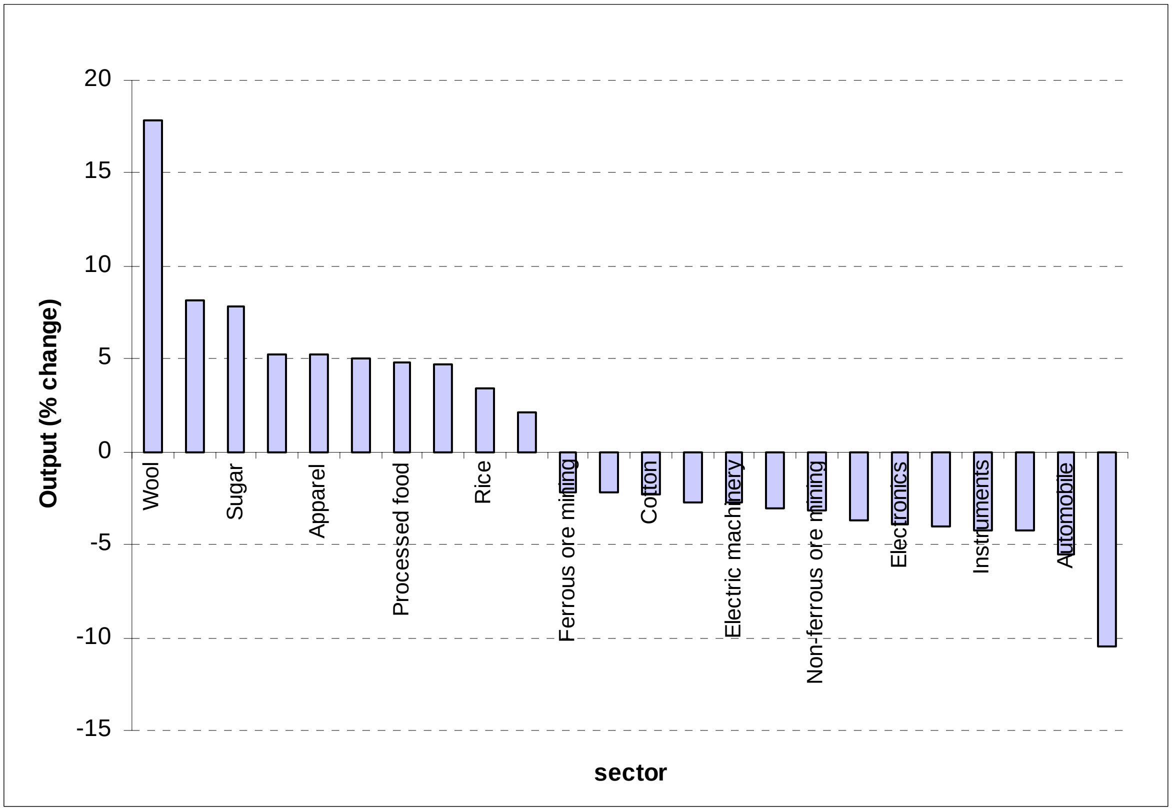

Figure 2: Change in Sector Output - Doha

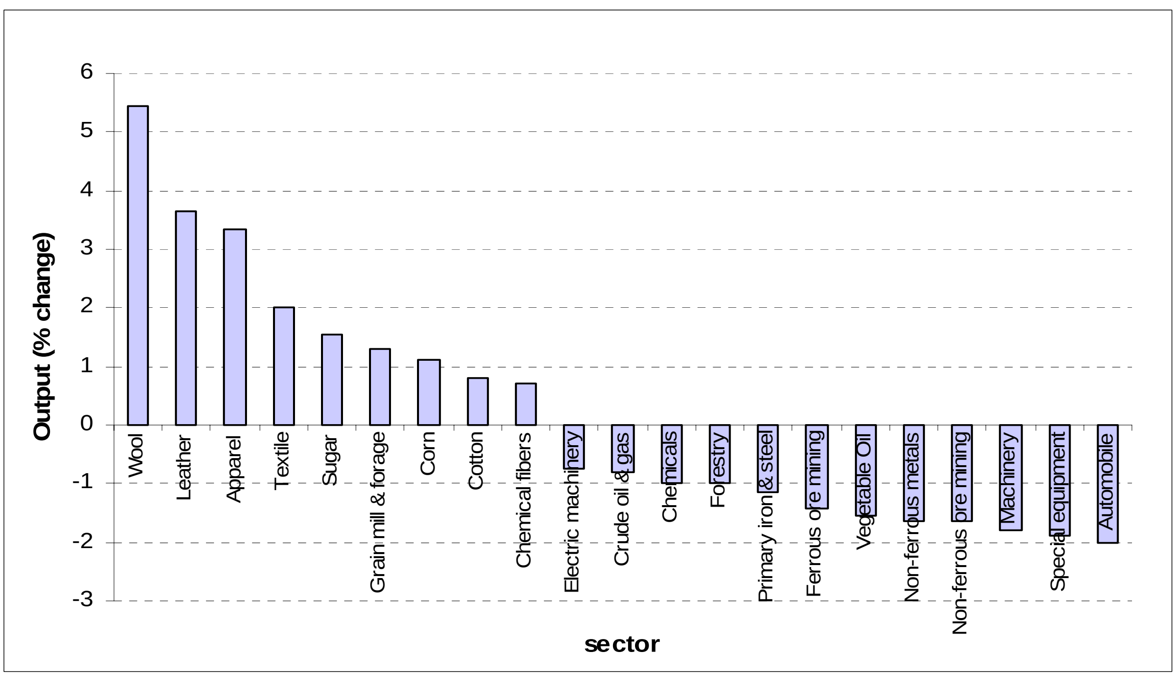

Figure 3a: Impacts on Households – Full Lib

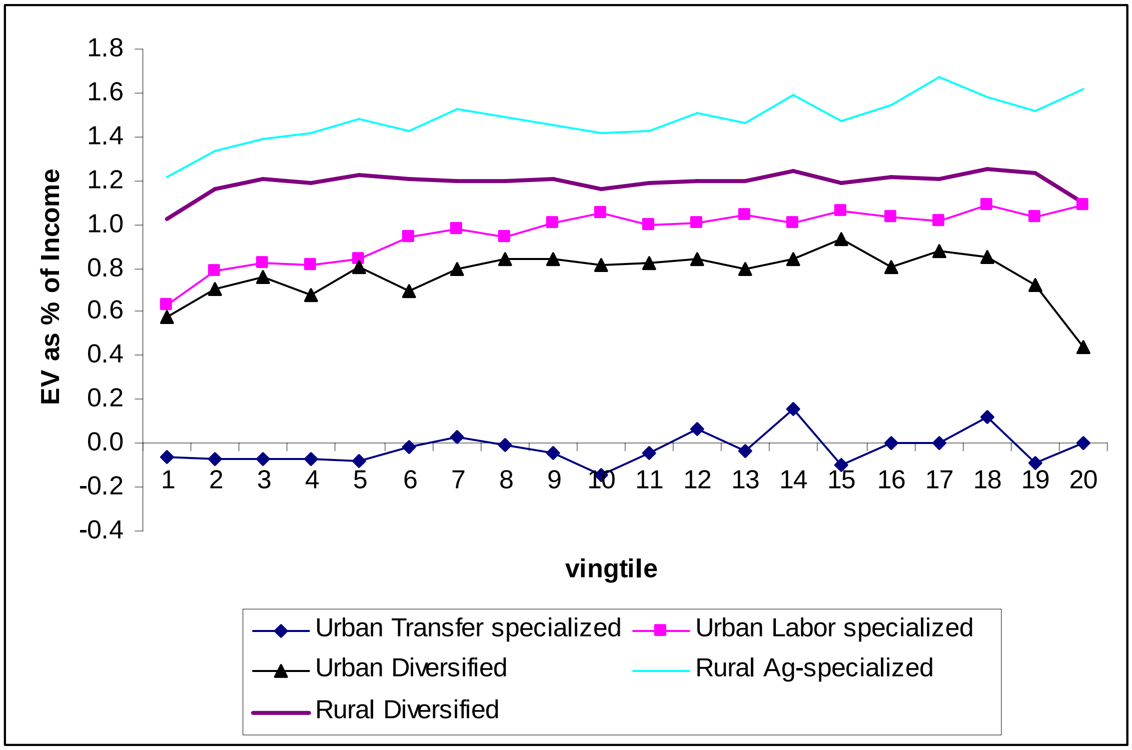

Figure 3b: Impacts on Households - Doha

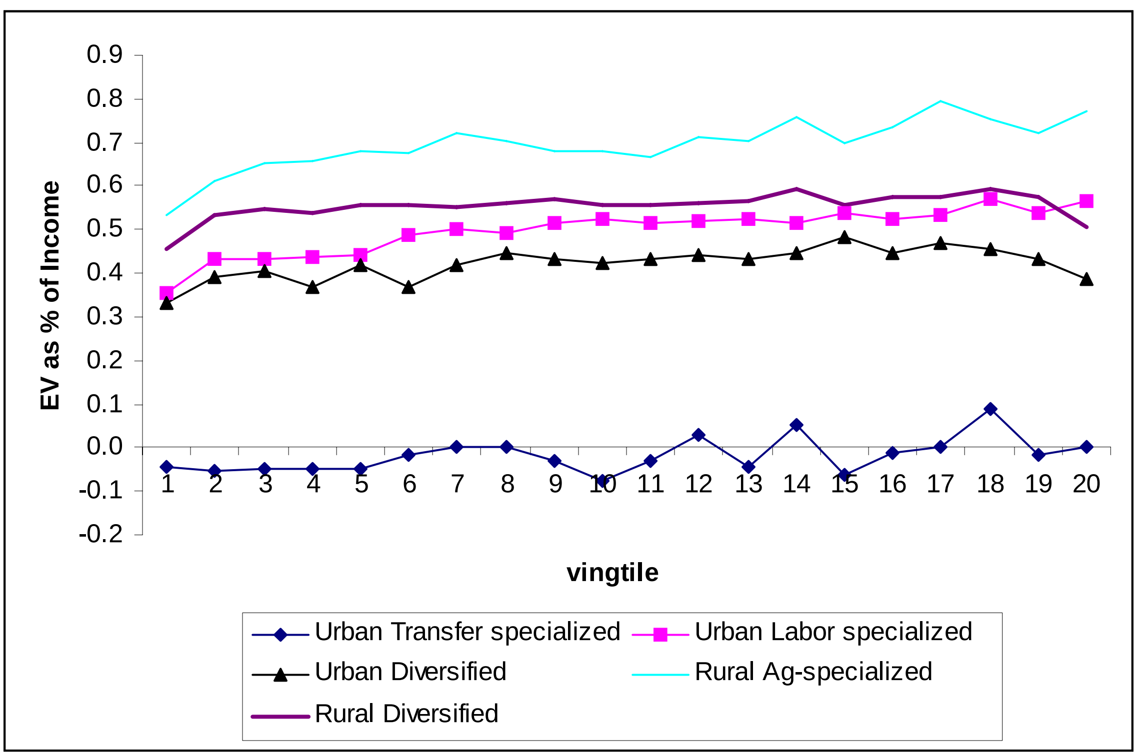

Figure 4a: Incremental Impacts on Households - EduLib

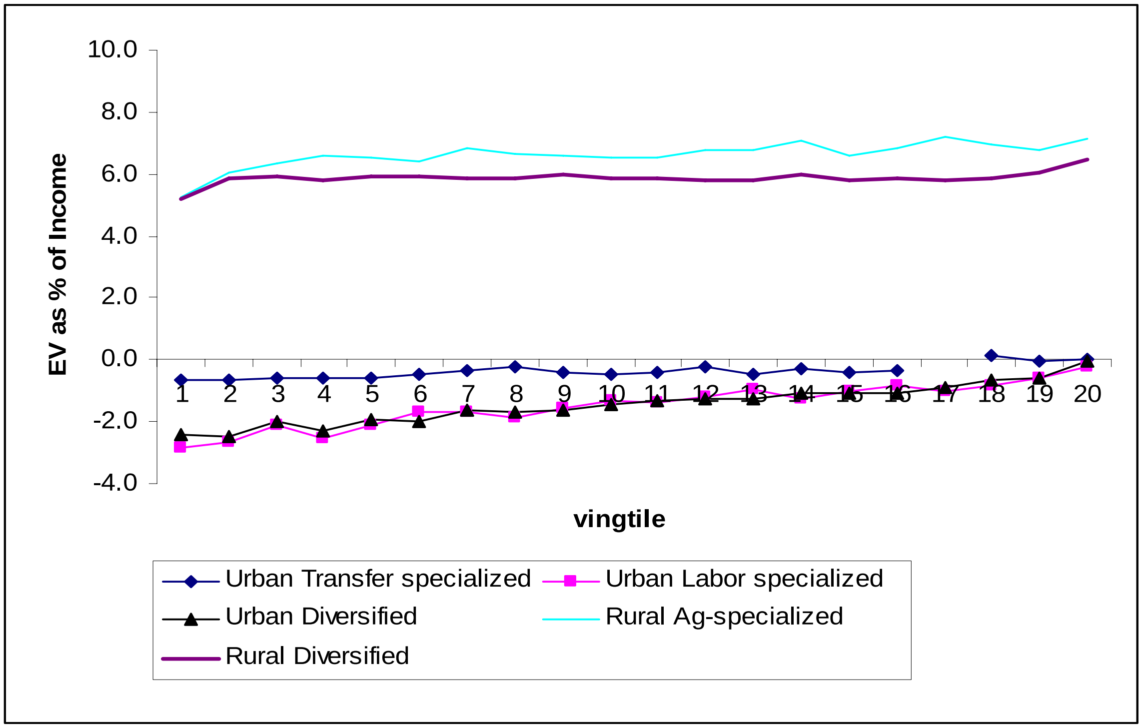

Figure 4b: Cumulative Impacts on Households - EduLib

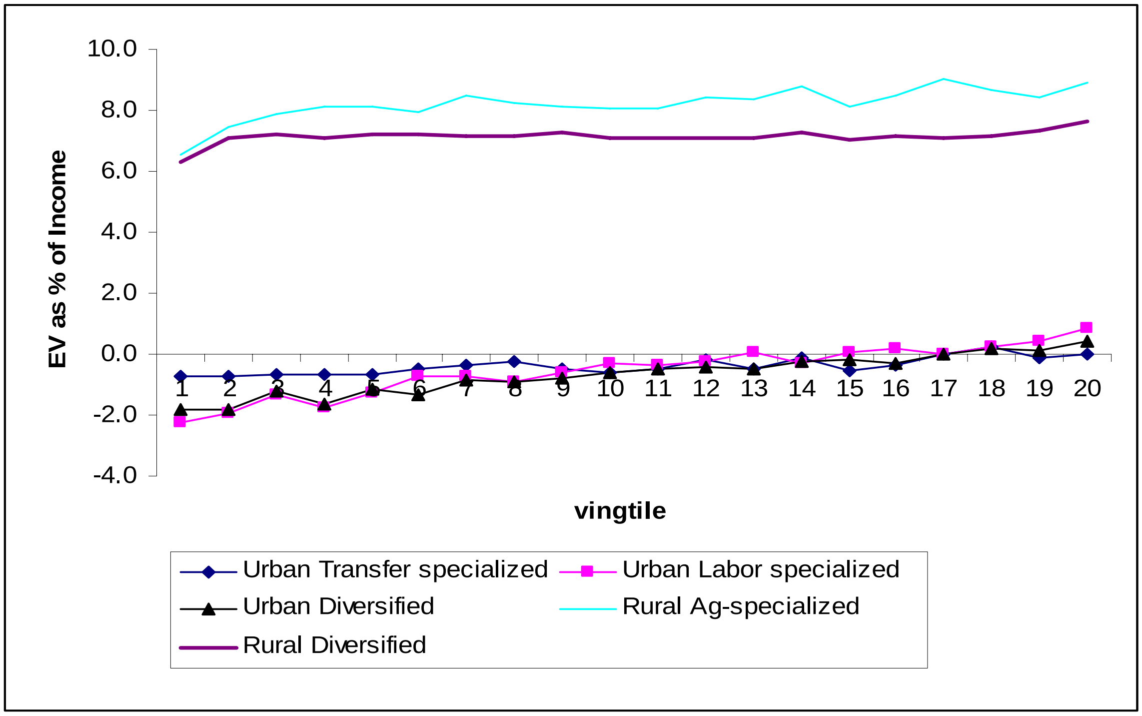

Table 1: Elasticity Parameters for Trade and Sectoral Structure of Production and Trade

	Trade Elasticity			SectoralStructure				
	Armington	CET	Export demand	Output share (%)	VA/Output (%)	K/L (rental/wage ratio)	Exports/ Outputs (%)	Imports/ Domestic use (%)
Rice	5.1	3.6	10.1	1.2	63.0	0.1	0.9	0.9
Wheat	4.5	3.6	8.9	0.7	62.9	0.1	0.0	7.9
Corn	1.3	3.6	2.6	0.4	63.0	0.1	7.9	1.1
Cotton	2.5	3.6	5.0	0.3	62.7	0.1	0.0	10.7
Other non-grain crops	2.5	3.6	4.9	3.8	62.9	0.1	2.3	0.8
Forestry	2.5	3.6	5.0	0.4	70.6	0.1	3.6	6.7
Wool	6.5	3.6	12.9	0.0	47.3	0.1	8.9	55.5
Other livestock	1.5	3.6	3.1	3.8	48.2	0.1	0.9	0.1
Fishing	1.3	3.6	2.5	1.1	59.0	0.2	1.2	0.2
Other agriculture	2.5	3.6	5.0	0.6	54.9	0.2	1.2	0.0
Coal mining	3.1	4.6	6.1	1.1	49.3	0.4	3.1	0.4
Crude oil & natural gas	7.4	4.6	14.9	0.8	64.6	3.8	14.4	23.9
Ferrous ore mining	3.0	4.6	5.9	0.2	27.2	0.7	0.0	29.6
Non-ferrous ore mining	4.2	4.6	8.4	0.4	31.7	0.7	1.1	6.5
Other mining	0.9	4.6	1.8	0.9	36.5	0.5	4.3	5.5
Vegetable Oil	3.3	4.5	6.6	0.6	15.4	2.4	4.3	12.1
Grain mill and forage	2.6	4.5	5.2	1.6	15.7	2.4	1.6	4.0
Sugar	2.7	4.7	5.4	0.2	10.1	0.3	3.3	6.0
Processed food	2.8	4.5	5.6	2.6	21.9	1.1	9.7	2.5
Beverage	1.2	4.7	2.3	1.3	19.7	1.1	3.1	0.5
Tobacco	1.2	4.7	2.3	0.7	12.1	1.7	3.2	1.3
Textile	3.8	5.4	7.5	4.6	22.8	1.0	18.4	10.1
Apparel	3.7	5.8	7.4	1.9	31.8	0.6	37.0	3.6
Leather	4.1	4.6	8.1	1.1	18.9	0.5	32.6	13.2
Sawmills and furniture	3.4	4.6	6.8	1.1	23.2	0.7	13.1	5.6
Paper & printing	3.0	4.6	5.9	1.7	27.4	0.6	2.0	9.9
Social articles	3.8	5.6	7.5	1.1	25.9	0.9	40.0	8.9
Petroleum refining	2.1	3.8	4.2	1.6	12.5	1.7	5.7	11.6
Chemicals	3.3	3.8	6.6	4.1	20.1	1.0	8.3	16.5
Medicine	3.3	3.8	6.6	0.9	28.1	1.8	5.9	1.7
Chemical fibers	3.3	3.8	6.6	0.6	17.1	1.4	6.6	18.2
Rubber and plastics	3.3	3.8	6.6	2.1	19.2	0.9	15.7	6.9
Build materials	2.9	3.8	5.8	4.4	26.2	0.7	3.4	1.2
Primary iron and steel	3.0	4.6	5.9	2.7	16.3	0.6	5.5	8.6
Non-ferrous metals	4.2	4.6	8.4	1.2	13.4	0.7	8.0	13.0
Metal products	3.8	4.6	7.5	2.5	19.3	0.7	13.1	7.0
Machinery	2.8	4.6	5.6	2.5	31.0	1.1	5.9	13.2
Special equipment	2.8	4.6	5.6	1.8	24.3	0.8	5.6	23.3
Automobile	2.8	4.6	5.6	1.7	21.2	1.0	1.9	4.1
Oth. Transport equipment	4.3	4.6	8.6	1.3	24.2	0.8	9.7	12.1
Electric machinery	4.1	4.6	8.1	2.8	18.1	0.9	15.9	9.5
Electronics	4.4	4.6	8.8	2.5	21.2	1.1	36.3	34.1
Instruments	4.1	4.6	8.1	0.4	27.3	0.9	49.5	43.2

	Trade Elasticity			SectoralStructure				
	Armington	CET	Export demand	Output share (%)	VA/Output (%)	K/L (rental/wage ratio)	Exports/ Outputs (%)	Imports/ Domestic use (%)
Other manufacturing	3.8	3.8	7.5	0.8	53.3	1.0	8.1	3.1
Utilities	2.8	3.8	5.6	2.2	36.1	2.0	0.9	0.0
Construction	1.9	3.8	3.8	8.7	26.4	0.3	0.1	0.3
Transportation	1.9	2.8	3.8	2.5	50.4	1.0	9.4	1.8
Post & Comm.	1.9	2.8	3.8	1.0	53.5	3.5	5.7	1.3
Commerce	1.9	2.8	3.8	6.5	37.2	0.5	0.9	1.3
Finance	1.9	2.8	3.8	1.8	37.9	1.1	0.5	1.2
Social services	1.9	2.8	3.8	3.7	45.0	1.2	10.1	5.3
Education & health	1.9	2.8	3.8	3.3	46.4	0.3	0.7	0.5
Public adminis.	1.9	2.8	3.8	2.2	45.0	0.2	0.1	0.6

Source: Hertel et al (2003), 1997 Chinese Social Accounting Matrix

Table 2: Substitution Elasticities in Production

	Agriculture	Non-Agriculture
VA – Aggregated intermediate Input	0.10	0.10
Capital-labor composite – Land	0.30	-
Capital-skilled labor composite – Aggregate less-skill labor		
Old vintage	0.45	0.65
New vintage	0.95	1.10
Capital – Skilled labor	0.30	0.30
Unskilled labor – Semiskilled labor	1.50	1.50
Urban labor – Rural labor	2.20	2.20

Table 3: Inputs* from the Global Model (% change)

	Export volume		Export price		Import price		Tariff	
	Full-Lib	Doha	Full-Lib	Doha	Full-Lib	Doha	Full-Lib	Doha
Rice	7574.5	454.4	12.2	2.1	12.2	1.3	-100	0
Wheat	43.2	7.6	5.4	1.4	5.4	1.3	-100	0
Corn	88.8	21.3	7.6	1.9	7.6	5.5	-100	-28
Cotton	71.9	28.5	5.7	1.7	5.7	5.0	-100	-20
Other crops	37.9	14.9	6.7	1.6	6.1	3.6	-100	-21
Forestry	0.9	-1.4	2.5	0.7	2.5	0.1	-100	-24
Wool	3.0	-6.3	7.7	2.2	7.7	2.4	-100	-2
Other livestock	-3.1	-1.3	7.1	1.8	7.1	0.7	-100	-23
Fishing	9.8	2.8	5.0	1.2	5.0	0.2	-100	-29
Other agriculture	71.9	28.5	5.7	1.7	5.7	5.0	-100	-20
Coal mining	1.9	0.5	2.0	0.5	2.0	0.3	-100	-30
Crude oil & gas	-1.9	-0.3	1.0	0.1	0.7	0.1	-100	-
Ferrous ore mining	-2.4	-1.4	2.4	0.7	2.4	0.2	-100	-30
Non-ferrous ore mining	-3.6	-1.8	2.3	0.7	2.3	0.2	-100	-31
Other mining	0.8	0.2	1.9	0.5	1.9	0.5	-100	-29
Vegetable Oil	-18.8	-9.2	5.7	1.7	5.7	0.4	-100	-22
Grain mill & forage	525.3	53.2	6.9	1.4	6.9	2.6	-100	0

	Export volume		Export price		Import price		Tariff	
	Full-Lib	Doha	Full-Lib	Doha	Full-Lib	Doha	Full-Lib	Doha
Sugar	83.4	25.0	5.0	1.4	5.0	1.5	-100	-1
Processed food	36.6	-0.5	5.9	1.4	5.5	0.9	-100	-25
Beverage	19.9	2.2	4.5	1.2	4.5	0.2	-100	-22
Tobacco	19.9	2.2	4.5	1.2	4.5	0.2	-100	-22
Textile	13.7	5.5	3.3	1.0	3.3	0.2	-100	-33
Apparel	17.0	9.0	2.9	0.9	2.9	0.4	-100	-32
Leather	15.2	7.0	3.7	1.1	3.7	-0.3	-100	-32
Sawmills and furniture	-4.7	-2.8	2.8	0.8	2.8	0.2	-100	-32
Paper & printing	-5.1	-3.1	3.0	0.9	3.0	0.3	-100	-33
Social articles	-4.3	-2.0	2.9	0.9	2.9	0.0	-100	-28
Petroleum refining	3.8	-0.5	1.2	0.3	1.2	0.1	-100	-30
Chemicals	0.6	-0.7	2.5	0.7	2.5	0.1	-100	-28
Medicine	0.6	-0.7	2.5	0.7	2.5	0.1	-100	-28
Chemical fibers	0.6	-0.7	2.5	0.7	2.5	0.1	-100	-28
Rubber and plastics	0.6	-0.7	2.5	0.7	2.5	0.1	-100	-28
Build materials	8.8	2.1	2.6	0.8	2.6	0.2	-100	-32
Primary iron & steel	-2.4	-1.4	2.4	0.7	2.4	0.2	-100	-30
Non-ferrous metals	-3.6	-1.8	2.3	0.7	2.3	0.2	-100	-31
Metal products	4.4	0.9	2.5	0.7	2.5	0.1	-100	-33
Machinery	-18.3	-5.6	2.3	0.7	2.3	0.0	-100	-33
Special equipment	-18.3	-5.6	2.3	0.7	2.3	0.0	-100	-33
Automobile	-18.3	-5.6	2.3	0.7	2.3	0.0	-100	-33
Oth. transport equipment	15.7	-1.3	2.4	0.7	2.4	0.0	-100	-32
Electric machinery	-4.1	-2.3	2.4	0.7	2.4	0.0	-100	-33
Electronics	-4.8	-2.8	1.8	0.5	1.8	0.1	-100	-33
Instruments	-4.1	-2.3	2.4	0.7	2.4	0.0	-100	-33
Oth. manufacturing	-4.3	-2.0	2.9	0.9	2.9	0.0	-100	-28
Utilities	-2.4	-1.3	2.4	0.7	2.4	0.0	0	0
Construction	-6.3	-2.6	2.7	0.8	2.7	-0.1	0	0
Transportation	-5.5	-2.3	3.0	0.9	2.9	0.2	0	0
Post & Comm.	-5.4	-2.2	2.6	0.8	2.6	0.0	0	0
Commerce	-5.6	-2.5	3.1	0.9	3.1	0.3	0	0
Finance	-5.6	-2.3	2.7	0.8	2.7	-0.1	0	0
Social services	-6.2	-2.4	2.8	0.8	2.8	-0.1	0	0
Education & health	-6.5	-2.3	2.8	0.8	2.8	0.0	0	0
Public adminis.	-6.5	-2.3	2.8	0.8	2.8	0.0	0	0

Source: GTAP simulations

* These results are obtained by solving the global model with China's shocks omitted. The export price and volume changes are used, along with the export demand elasticity, to compute the shift in the export demand schedule.

Table 4: Aggregated Results (% change)

	ROWLib	Uni-Lib	Full-Lib	Doha	*EduLib* Incremental	*EduLib* Cumulative
<u>Macroeconomic Variables</u>						
Welfare(EV)	1.0	-0.3	0.8	0.4	1.2	2.0
GDP	0.1	-0.1	0.1	0.0	1.2	1.2
Exports	0.2	4.4	4.8	2.2	1.0	5.8
Imports	1.9	3.8	5.9	2.9	0.8	6.7
Terms of trade	1.4	-0.8	0.5	0.5	-0.3	0.3
CPI	4.6	-2.1	2.4	0.7	0.9	3.3
Capital stock	1.7	-0.6	1.1	0.3	1.1	2.2
<u>Factor Prices</u>						
Returns to agr land	23.2	-7.2	15.5	5.2	7.0	23.5
Unskilled wages						
Urban	5.2	-1.9	3.3	1.0	14.8	18.6
Rural non-agri	5.3	-1.9	3.3	1.0	16.7	20.6
Agricultural	6.1	-2.3	3.9	1.3	28.3	33.3
Semi-skilled wages						
Urban	5.4	-1.9	3.4	1.1	-4.0	-0.7
Rural non-agri	5.8	-2.0	3.7	1.2	-4.9	-1.4
Agricultural	5.2	-1.9	3.3	1.0	-4.2	-1.0
Skilled wages						
Urban	5.6	-1.7	3.8	1.2	-0.5	3.3
Rural non-agri	5.6	-1.7	3.8	1.2	-0.5	3.3
Agricultural	5.9	-1.8	4.0	1.2	-3.9	-0.1
<u>Labor Migration (millions)</u>						
Off-farm labor	-3.3	1.2	-2.2	-0.8	4.9	2.8
Unskilled	-0.5	0.2	-0.4	-0.1	-10.2	-10.6
Semi-skill	-2.6	1.0	-1.7	-0.6	13.3	11.6
Skilled	-0.2	0.1	-0.1	0.0	1.9	1.8
Rural-Urban	-2.4	0.9	-1.5	-0.6	2.0	0.4
Unskilled	-0.3	0.1	-0.2	-0.1	-10.4	-10.6
Semi-skill	-1.9	0.7	-1.2	-0.5	10.5	9.2
Skilled	-0.2	0.1	-0.1	0.0	1.9	1.8
<u>Labor Migration (%)</u>						
Off-farm labor	-2.5	0.9	-1.6	-0.6	3.8	2.1
Unskilled	-0.9	0.3	-0.6	-0.2	-18.4	-18.9
Semi-skill	-3.8	1.4	-2.5	-0.9	19.7	16.7
Skilled	-2.3	1.0	-1.4	-0.5	27.9	26.1
Rural-Urban	-3.7	1.4	-2.3	-0.9	3.1	0.7
Unskilled	-1.0	0.4	-0.7	-0.2	-38.2	-38.6
Semi-skill	-6.1	2.4	-3.9	-1.4	34.2	29.0
Skilled	-3.0	1.2	-1.8	-0.7	35.9	33.5

Data Source: Simulation results.

Table 5: Effects on Inequality and Poverty

	Base	Full-Lib	Doha	*EduLib* Incremental	*EduLib* Cumulative
<u>Inequality</u>					
Urban/rural income ratio	3.213	-0.012	-0.005	-0.230	-0.242
Gini	0.438	-0.001	-0.001	-0.015	-0.016
Urban	0.291	0.000	0.000	0.003	0.003
Rural	0.298	0.000	0.000	0.001	0.001
<u>Poverty Headcount</u>	(ratio,%)	Changes (percentage point)			
<u>Total</u>	31.3	-0.8	-0.4	-3.3	-4.2
Urban	4.1	-0.1	0.0	0.3	0.2
Transfer specialized	24.7	0.0	0.0	0.1	0.1
Labor specialized	3.8	-0.1	-0.1	0.3	0.2
Diversified	2.5	-0.1	0.0	0.3	0.2
Rural	45.2	-1.2	-0.6	-5.2	-6.4
Ag-specialized	54.3	-1.2	-0.5	-4.7	-5.8
Diversified	44.1	-1.2	-0.6	-5.3	-6.5
	(mn. person)	(% change)			
<u>Total</u>	413.7	-2.7	-1.3	-11.0	-13.4
Urban	18.2	-2.1	-1.2	7.3	5.0
Transfer specialized	5.3	-0.1	-0.1	0.5	0.4
Labor specialized	6.7	-2.5	-1.4	8.5	5.8
Diversified	6.1	-3.5	-2.0	12.0	8.1
Rural	395.5	-2.7	-1.3	-11.8	-14.2
Ag-specialized	49.8	-2.1	-1.0	-8.8	-10.7
Diversified	345.7	-2.8	-1.3	-12.3	-14.7

Data Source: Simulation results.

Table 6: Sector Volume Impacts of Trade Liberalization: Percentage deviation from baseline

	Full-Lib		Doha	
	Import	*Export*	*Import*	*Export*
Rice	-29.3	290.5	-0.6	60.7
Wheat	83.7	-	0.6	-
Corn	55.2	54.4	6.6	13.4
Cotton	54.5	28.8	5.6	12.3
Other non-grain crops	33.6	22.1	2.9	7.0
Forestry	16.9	-2.5	5.2	-1.7
Wool	2.7	27.9	2.9	5.8
Other livestock	2.2	4.3	3.1	0.3
Fishing	5.8	9.7	1.5	2.2
Other agriculture	17.3	34.9	2.5	13.5
Coal mining	15.2	-0.9	4.9	-0.6
Crude oil and natural gas	1.0	-1.8	0.1	-0.8
Ferrous ore mining	-2.5	-1.0	0.1	-1.0

	Full-Lib		Doha	
	Import	*Export*	*Import*	*Export*
Non-ferrous ore mining	-3.6	-3.1	0.0	-1.4
Other mining	1.6	0.1	0.6	0.0
Vegetable Oil	29.0	20.1	5.2	-4.8
Grain mill and forage	-2.2	247.4	-3.2	29.5
Sugar	38.1	162.7	0.9	22.7
Processed food	18.1	32.8	7.7	1.7
Beverage	17.1	18.4	3.4	2.3
Tobacco	7.3	17.3	2.8	2.3
Textile	12.9	15.6	7.4	5.6
Apparel	15.2	13.0	7.1	8.5
Leather	13.1	12.9	9.8	9.5
Sawmills and furniture	4.5	-1.6	3.0	-0.5
Paper & printing	4.0	-1.7	2.6	-0.7
Social articles	0.7	-1.6	2.7	1.1
Petroleum refining	7.9	1.8	2.5	-0.2
Chemicals	6.6	0.8	3.2	0.1
Medicine	12.3	1.4	5.1	0.2
Chemical fibers	10.5	1.9	5.6	2.0
Rubber and plastics	6.1	0.2	3.4	1.5
Build materials	11.7	5.0	4.9	1.6
Primary iron and steel	3.2	-1.7	2.0	0.6
Non-ferrous metals	1.2	-3.4	1.6	-0.4
Metal products	8.2	2.6	4.2	1.6
Machinery	7.1	-12.1	3.4	-3.0
Special equipment	4.5	-12.0	2.4	-3.0
Automobile	26.8	-11.1	9.4	-2.6
Oth. Transport equipment	6.9	11.5	3.8	1.9
Electric machinery	9.7	-3.3	4.9	0.8
Electronics	-1.6	-5.8	0.9	-0.2
Instruments	3.0	-3.7	1.9	0.6
Other manufacturing	5.9	-2.2	3.6	0.3
Utilities	-1.4	-0.2	1.1	-0.3
Construction	-0.8	-2.4	1.4	-1.0
Transportation	-1.2	-1.1	0.7	-0.7
Post and communication	-1.7	-0.7	0.8	-0.3
Commerce	-0.5	-1.5	1.0	-0.8
Finance	-0.5	-1.8	1.4	-0.7
Social services	-0.5	-1.6	1.4	-0.7
Education & health	0.2	-2.7	1.7	-0.9
Public administration	0.0	-2.8	1.6	-1.0

Data Source: Simulation results.