WTO Impacts on US Rice Producing Households

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Abstract: We investigate distributional impacts of WTO reforms on US rice producers. Model results show that rice producer's household income is very sensitive to the amount of market access achieved in export markets and the depth of subsidy cuts in the US, largely explaining the US negotiating position in the WTO.

Introduction

Estimating the potential gains from Doha Round agricultural trade reforms in developing and least developed countries has been the primary focus of numerous analyses of the current WTO round. Following on the limited performance of the Uruguay Round Agreement on Agriculture (URAA) for improving the plight of the poorest countries, the Doha round has an explicit mandate to foster development that is well represented in the published research, most notably in two World Bank volumes published in 2006 (Anderson and Martin; Hertel and Winters). The Anderson and Martin (2006) volume looks closely at agricultural protection, how reform is to be implemented, where reform will have the biggest impacts, and the potential for long term economic gains for developing countries. Building on this, the Hertel and Winters (2006) volume investigates distributional issues in developing countries, focusing particularly on the poverty and distributional impacts of different scenarios of agricultural reform.

While the welfare impacts for developing countries have been found to be a mixed-bag, depending importantly on the net trade position of particular countries, their dominant trading partners, and the composition of their export and import flows, the results for developed countries have been reported to be nearly a uniform welfare gain. This is because at the country or region level, the consumers and taxpayers in these economies reap significant benefits of reduced subsidies and cheaper imports. Even studies which derive separately the aggregate farm household welfare change from agricultural reform (e.g. Hertel and Keeney, 2006; Hertel, Keeney, Ivanic, and Winters, 2007) show only slight losses to the farm population, particularly for countries where the farm population is heavily dependent on non-farm earnings for household income. These aggregate net farm income or farm household income changes mask the considerable diversity in the farm population of a

wealthy country. In particular, we know that the farms most likely to experience large income declines are the set of large farms that are most dependent on farm income for household well-being. These farms are in turn the most vocal advocates of strong farm support in the political process. Therefore it is of great interest to investigate the distributional outcomes for wealthy countries when analyzing proposed agricultural reforms under the WTO, as these outcomes will speak to both the political feasibility of negotiating positions and the potential impacts on the structure of the farm population.

With this in mind, the analysis here extends a global model of trade subjected to multilateral agricultural reform experiments to look at distributional impacts on the welfare of a set of US farm households. To narrow the focus of the research, we focus specifically on rice producing households in the United States, defined as those households for whom the rice share of agricultural sales is largest and is at least one-third of the total value of production. Aside from narrowing the focus of the paper, the case of rice is quite interesting for a number of reasons including the heavy protection and support it receives in the developed countries and the importance of rice as a staple grain and cash commodity for developing country consumers and farmers.

The importance of protection and support on world rice markets is seen in Figures 1 and 2. In Figure 1, Producer Support Estimate[1] data are used to track the support to rice relative to all other crops in the United States for the period 1995-2004. The first thing to note is the relatively high level of support as measured by the percent PSE (the PSE as a percentage of the value of production) for the rice sector relative to all agricultural production over the period, with only three years of relatively high rice prices being below

[1] The Producer Support Estimate (PSE) is an aggregate measure of support to a particular agricultural sector. It includes direct transfers from treasury funds to producers as well as the value of price differentials arising from market interventions.

the US average for percent PSE. From 1999 to 2004, support to rice has been extremely high reaching a peak over fifty for the percent PSE (i.e. over half of the value of the rice crop arose from some agricultural policy) in 2001. The second comparison between rice and all agriculture in this figure concerns the share of the PSE that is delivered via an output subsidy (OS) (e.g. a payment to units of output such as an LDP or marketing loan gain). Figure 1 shows that nearly all of the increases in support over the period have come from output subsidy increases.

This stands in contrast to the pattern of protection for rice in east Asia, and is illustrated by Figure 2. Here we again observe the PSE information specific to the rice sector and for aggregate agriculture, but in this case for Japan. First we note that the PSE for Japan has consistently been high for both rice and agriculture, as the percent PSE is consistently around sixty percent for all agriculture and above eighty percent for rice. In contrast to the United States where rice stands apart from other commodities due to its reliance on output subsidies, almost all support for agriculture in Japan is provided by border protection. These two figures preview the two most important factors for rice farmers arising from WTO agricultural reform. The loss of support in terms of value of the rice crop will have strong negative effects for rice producers in the United States yet the opening of a nearly closed large market in Japan should have a positive effect on the world price and demand for US rice. These competing factors in the different scenarios of agricultural reform provide the primary basis for analysis of potential impacts of WTO reforms on US rice farmers.

The next section presents the modeling framework and data used for the analysis, and this is followed by discussion of the liberalization experiments considered. The final two sections report the results of these experiments and discuss the implications of and potential for extensions to the analysis offered here.

Methods

The analysis here depends on two fundamental sources of data: household survey data from the US and the GTAP data base on global trade, production, and policy. The starting point for the modeling is the GTAP version 6.1 data base (Dimaranan, 2006). Virtually all contemporary analyses of the Doha Development Agenda employ this database. Data availability is easily the most limiting resource for global analysis and GTAP version 6 represents the only data base covering global economic activities with bilateral trade and protection data that reflects tariff regimes inclusive of preferential arrangements. Beyond this, using this database permits us to draw on the carefully constructed Doha reform scenarios developed and utilized in the recent books by Anderson and Martin (2006), and Hertel and Winters (2006).[2]

Modifications to the standard GTAP model are made here to focus on features that enhance analysis of agricultural reforms and simulation of distributional impacts. Retained are the simplistic yet empirically robust assumptions of constant returns to scale and perfect competition typically featured in agricultural trade studies. Modifications are aimed at permitting us to shed new light on the distributional consequences of WTO reforms – focusing particularly on agricultural liberalization in the industrial countries and impacts at the farm household level through changes in factor returns.

The primary changes to the standard GTAP modeling structure are those included in the GTAP-AGR special purpose version of the model, documented in Keeney and Hertel (2005). In brief, we modify the factor supply and substitution parameters of the model using different estimates for different regions of the world to control these important parameters

[2] These tariff cutting scenarios are available on the GTAP web site.

determining supply response and rewards to farm owned factors. On the factor supply side, we specify a constant elasticity of transformation function which "transforms" farm-labor into non-farm labor and vice-versa. This transformation function permits wages to diverge between the farm and non-farm sectors, a key driver in our distributional analysis. With segmented labor markets, the impact of reduced subsidies to agriculture in the rich economies will not be shared equally between the farm and non-farm labor forces. We employ a similar segmented market for agricultural capital.

The extent of burden shifting between farm and non-farm labor and capital will depend on the size of the associated factor supply elasticities. In order to calibrate these key parameters, we draw on the OECD's (2001) parameterization of agricultural factor markets which derive from comprehensive econometric reviews for the EU (Salhofer, 2001) and for North America (Abler, 2001) as well as a modeling panel's assumptions for the Japanese economy. These elasticities are intended to represent medium term adjustment possibilities (i.e., 2 – 3 years). Thus we gear our analysis around medium term outcomes from trade reform. (This is appropriate, since our CGE model does not take into account the impact of trade reforms on investment, productivity and economic growth.)

The potential for adverse impacts on rich country farm household incomes has received far less attention than the distributional impacts in poor countries, yet it represents a key component of the political economy of WTO trade reform. A primary factor in determining the impact of agricultural reforms on farm household welfare in rich countries is the share of their income that currently comes from the farm sector. If farm income is only 10% of total household income, then a 10% drop in farm income translates into just a 1% drop in overall household income (for constant non-farm income). Recent OECD (2003) statistics report the on and off-farm income split for farm households in numerous

member countries. Farm income provides only 8% of the total income of US farm households and 10% and 12% in Canada and Japan respectively. In Europe the share is larger, in 60%-70% range.

In the global CGE model, we model a representative farm household for each region and explicitly track the allocation of its labor and capital between the farm and non-farm sectors (recall the factor supply elasticities above) and the allocation of its land across agricultural uses (only agricultural land is included in the data). As returns in agriculture fall when subsidies are removed, farm households reallocate some farm-owned resources to the non-farm sector as well adjusting the output composition to changes in relative land returns. Total farm household income in the model is then determined as the sum of returns on their endowments employed in agriculture, plus the returns on those employed in non-agriculture.

While the average farm household's welfare change is an important component in assessing WTO outcomes for any given country, greater detail on the distribution around this average is required to develop insight into the political economy of agricultural reform. For instance, using the representative farm household provides little to no insight about the impacts on rice producers due to their minimal share in the farm population, yet the history of strong protection and support in this sector identifies the rice producer as one of considerable interest. This requires more disaggregate data. We have obtained these data for the US, and we use a "micro-simulation" approach in which the general equilibrium changes in product and factor prices are combined with disaggregated household data to evaluate the income impact on rice producing farm households in this country similar to the process used for determining the representative farm household's income change.

The group of specialized rice households (those with at least one-third of their agricultural sales from rice with rice being the largest sales component) are differentiated

using a wealth distribution. Each decile of the wealth distribution is separated and a farm welfare change is modeled for each subgroup. These households and their initial income sourcing are benchmarked using the ARMS annual survey data of the United States farm household population for 2004.

Table 1 identifies the US farm households in this study and their differential reliance on income from farming and from off-farm sources. The farm income shares for rice households range from around a fifty-fifty on/off farm income split for the least wealthy rice households, to a strong reliance on farm income for the wealthiest fifty percent of rice producers. From this we see that all rice producers are much more reliant on farm income than the average farm household (where around eight percent of income is from the farm), and that in general the wealthier the household group is the more reliant on farm income they become. As such, we can expect the losses from reduced support to increase with the increased wealth of the particular farm household. Further, while wealthier households tend to be less diversified into off-farm income, all of these specialized producers tend to be less diversified into other agricultural sources of income as on average over forty percent of acreage is planted to rice (see Table 1).

There is significant reason to believe that the high levels of support enjoyed by producers of heavily supported products tends to foster the kind of income specialization observed here. Following that, specialization enhances interest group formation and lobbying around a specific agricultural product (Babcock and Hart, 2005), making the kind of distributional analysis conducted here on producers invested in a particular product primary to understanding the potential impacts and negotiating troubles of multilateral agricultural reform.

Liberalization Experiments

Due to their prominence in agricultural support and protection, the liberalization scenarios conducted here focus exclusively on the reforms to be undertaken by wealth countries (USA, Europe, Canada, Japan, Australia, and New Zealand). The OECD annual estimates of the PSE for its member countries show that rice is far and away the most protected commodity by this measure with on average OECD rice producers receiving eighty-plus percent of their revenue as a result of some policy intervention.

The OECD producer support estimate is a combined measure of all support to producers capturing the transfer of treasury monies paid to farmers as well as the transfers from commodity sales at prices supported above world market levels. Thus this subsidy measure can be broadly decomposed into market price support (i.e. border policies) and farm policy transfers including output and input subsidies, area- and livestock headage-based payments, and the various payments tied to land use, farm income, and historical payments. The relative importance of these differs across countries but in most instances the division between market price and other support is roughly equal. The primary exception is in east Asia (Japan and Korea) where producer support is provided nearly entirely as market price support.

In contrast to the encompassing PSE measure, the WTO separates support policies into three groups, with separate negotiating modalities for each of them. Transitioning from the OECD producer support measure to the WTO's aggregate measure of support framework is difficult. This complexity of moving from the OECD's comprehensive domestic support data base to the WTO negotiating pillars is the reason we draw on the published study by Jensen and Zobbe (2006) for our Doha agricultural scenarios. These authors consider in detail not only the WTO designations of support and what they imply for reduction commitments, but also the associated binding overhang created by the

difference between actual support levels and WTO agreed upon bindings on support that can not be evaluated by the PSE information in isolation.

The Doha scenario considered in this paper derive from the so-called July 2004 Framework Agreement (WTO, 2004) as embodied in the core scenario from the Hertel and Winters volume (2006) and is summarized in Table 2. The first column of this table highlights the implications for cuts in support in the rich countries' agricultural sectors. This Doha scenario assumes that industrial countries with domestic support in excess of 20 percent of production cut their bound commitments by 75 percent, while others cut by 60 percent. However, even with these ambitious reductions, the gap between bindings and applied policies, as well as the inclusion of market price support concepts mean that effectively only five WTO members would be required to reduce actual support, based on 2001 notifications: Australia, EU, Iceland, Norway, and US (Jensen and Zobbe, 2006).

Export subsidies are the one area where bold cuts (full elimination) are on the table, and we assume this outcome in our Doha scenario. Agricultural tariffs in the rich countries are reduced using a tiered formula, with marginal cuts changing at 15 and 90 percent initial bound tariff rates. The marginal cuts are 45 percent on the first 15 percentage points of the tariff, 70 percent for the range between 15 and 90 percent, and 75 percent on the remainder.[3]

These detailed scenarios offer a significant advantage over the stylized representations of policy reform previously conducted. CGE analyses of trade reforms have been much criticized for missing these fine points and these scenarios remedy some of the most egregious simplifications (e.g. imposing reductions at the tariff line to counter the binding overhang problem). Where CGE models have found their advantage are in investigations of the total cost of agricultural protection, estimating the benefits accrued to

[3] For example, a tariff of, say, 100% is cut by 66.95%: = [15%*0.45 + (90-15)%*0.70 + (100-90)%*0.75]. By applying the cuts at the margin we avoid the discontinuities implied by the July Framework.

different countries when all support is removed. These investigations typically represent estimates of the possible gains from entering into negotiations for significant reforms, or benchmarks to compare the gains estimated from partial liberalization experiments.

In keeping with this we simulate a full agricultural reform (in rich countries) scenario as well, whereby all of the Doha reform instruments are eliminated. This provides an important measure for the rice households we are interested in. The full reform scenario allows us to investigate the necessity of rice support for maintaining the welfare of rice households when other countries remove their interventions into the global rice market. This full reform scenario is shown in Table 2, where all Doha impacted instruments are reduced to zero distortion levels.

As a final course of investigation, we examine the (highly likely) possibility of the declaration of sensitive products by countries to allow them to protect important domestic sectors of the economy. This sensitive product scenario merely extends the Doha scenario given in Table 2, by exempting from tariff reduction the one percent of tariff lines which generate the most tariff revenue to the importing country. Table 3 provides the information on the average (trade weighted) tariff cut for Japan, the United States, and the European Union under each of the three scenarios. For the United States, we see as mentioned earlier that border protection is minimal for rice as evidenced by the low tariff reduction under the full scenario. The identical tariff cut for Doha and Sensitive indicates that the US is not expected to declare rice as a sensitive product along any bilateral route. More importantly, looking at the simulated tariff reductions for Japan and the European Union, we see that nearly all of the tariff reduction of the Doha scenario from these two regions is lost when countries are allowed to declare rice a sensitive product. This will have important

implications for US rice producers since the primary source of gains they need to offset lost subsidy income derives from access to these export markets.

Results

The variable result we focus on is the change in farm household income (inclusive of off-farm income changes) for rice households differentiated by their place in the wealth distribution. The most interesting result that arises from this table is that all of the representative rice households realize an increase in farm household income under the Doha scenario. The income change for all rice households becomes negative (and of similar magnitude) when we allow sensitive products as part of the Doha agreement, and full reform entails large negative income changes that are roughly three times larger than the income losses under the sensitive products scenario. We next turn to a decomposition of each of these scenario results to better understand the differences in these scenarios for income changes. The decompositions are aimed at investigating the hypothesis that when farm household income increases for US rice producers that the increase in market access in export markets contributes strongly enough to world prices and by extension factor returns in rice production to overcome the lost subsidy income.

The decomposition method employed is that of Harrison, Horridge, and Pearson (2001) which allows for the calculation of partial changes in model variables that can be attributed to a particular shock to the model. The method calculates the movement along the solution path and allocates the total movement to each shock in the model, allowing for a full decomposition of total model results to the individual shocks giving rise to the new equilibrium.

Table 5 presents the decomposed results of the Doha scenario. The first column reproduces the Doha scenario result from Table 4, while the remaining columns decompose

this result into the partial income changes arising from US reforms to rice subsidies, Japanese reforms to rice tariffs, and the remainder comprised primarily of other reductions in support to US producers (rice producers have other crops and other crops impact factor rewards to rice production) and changes in tariffs leading to increased access to other export markets. The farm household income changes from the Doha experiment range from a little over one percent for the poorest households to around five percent for the wealthiest households. This result is generated from a loss in income due to US rice reforms which are roughly equal in magnitude and with opposite sign to the overall income change across households. Contrasted with this is the large positive component arising from Japanese tariff reforms, that tends toward double the resultant income change for the group of US rice farm households. The residual change in the additive components is small relative to the total income change for all of the households.

The results of Table 5 arise due to the relatively aggressive reform position on high tariffs in the Doha framework agreement. Agricultural subsidies have aggressive proposed cuts as well, but the maintenance of high bindings on agricultural subsidies limits the impact of these somewhat as the proposed cuts in domestic support of the Doha scenario amounts to around a twenty-eight percent reduction in domestic subsidies.

Table 6 offers the results for the Doha scenario when countries are allowed to designate sensitive products as exempt from tariff reductions. As noted before, the farm income results for rice households change from increases to losses of roughly the same size as predicted for the Doha scenario excluding sensitive product provisions. The decomposition of the income change is identical to that of Table 5, and we see that the strong positive impact on US rice farmer income from Japanese tariff reforms disappears. With the income change from US rice reforms roughly holding the same value as in the

Doha scenario, the sign change can be entirely attributed to the lost market access arising from sensitive product provisions, primarily in Japan. The difficulty of the multilateral agricultural negotiations becomes clear comparing Tables 5 and 6 as we see that the income change of US rice producers is extremely sensitive to the market access reforms entailed. The situation is clearly magnified for rice given the heavy dependence on subsidies in the US and tariffs in Japan, and stories similar to this play out throughout the many commodities and instrumentations involved in the agricultural negotiations.

The final table of results is Table 7, which again shows the total and decomposed results for US rice farm household income changes, in this instance for full agricultural reforms. Moving to a full reform scenario restores the income impact of Japanese border reforms in rice, but the impact of full subsidy removal now dominates among the additive components generating large income losses across the distribution of rice producing households. The US rice subsidy removal is accompanied by elimination of subsidies for other commodities benefiting from support, and the other category now contributes strongly to income loss. The across the board subsidy removal has strong impacts on all agricultural factors of production with the relatively immobile land input providing the largest change in factor returns. These results highlight why large movement in subsidy removal is so difficult, as across the board income declines are large, with nearly twenty percent income declines for the wealthiest farm households. While it can be argued that these households can most afford the income losses predicted, clearly they have incentive to organize with other producers of the commodity and try to influence the policy process to avoid these losses. Considering the accompanying land value decline (wealth loss) that occurs with the income decline, the purchase of influence through the lobbying process becomes even more attractive to this set of wealthy producers.

Conclusions and Further Work

In summary, investigating the income impacts on US rice farm households, we get a pretty clear picture of why the aggregate analyses of agricultural reform are incomplete for the industrialized countries if they fail to assess the distributional impacts. The push for more market access from other countries on the part of the US is obvious a benefit to rice producers in the US as it generates income gains that in the case of the Doha scenario considered here more than offset the income losses from subsidy removal. The lack of movement by the US on deepening subsidy cuts in their own domestic programs is also easily explained as these have large direct impacts on farm household income, and in the case of rice farmers who tend to be specialized in farm income and in agricultural earnings from rice production, full subsidy removal is shown to generate large losses that fully opening export markets can not overcome.

This paper has analyzed the distributional impacts on US rice farm households under differential reform scenarios of the WTO negotiating framework. The importance of carrying the market impacts of trade reform experiments to the distributional level has been highlighted as aggregate measures will mask the diversity of impacts faced by individuals in the farm population. In particular, the more concentrated the losses are in the wealthiest farm households the less likely we can expect movement toward considerable reform as those households have the ability to organize with producers with similar interests and influence the policy process.

Extensions to the analysis here should be done for the full set of US households to investigate cases of farm producers that are less extreme than that of rice. As mentioned, rice is the most protected agricultural product OECD-wide and in many industrialized countries like the US rice producers tend to be more income specialized in rice income than other

producers due to the benefits of the program and the limited mobility of land and capital used in rice production. The distributional analysis could be improved by estimating the income changes for every observation in the ARMS dataset for a particular year giving a more complete distributional picture. Finally, the base year for commodity support in the experiments conducted here with the GTAP database is 2001. This year stands out among the recent period having the highest output subsidies for rice in the United States, which magnifies the quantitative results, although the decomposition picture should remain valid. This could be corrected by adjusting the base year of the database to better reflect average subsidy levels over the period following the URAA or the period of the most recent US farm bill for rice, rather than taking the subsidy level for the year 2001.

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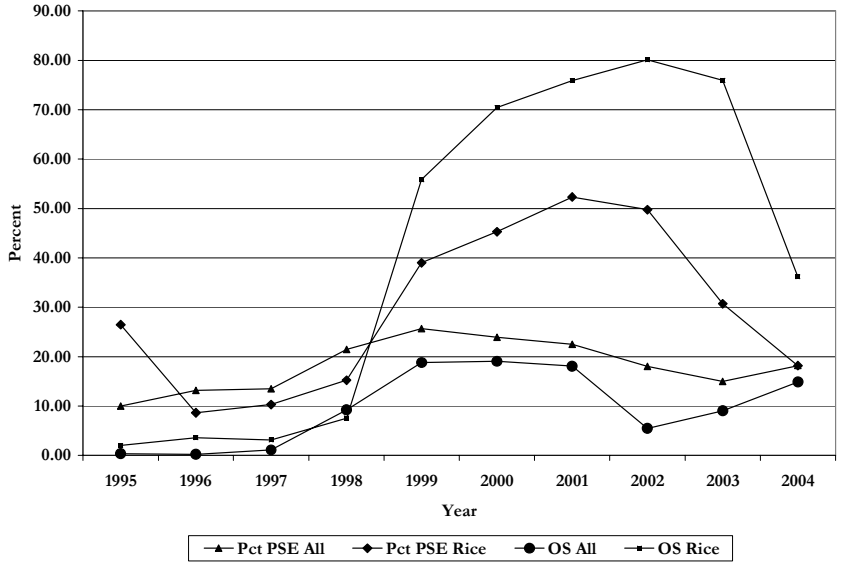
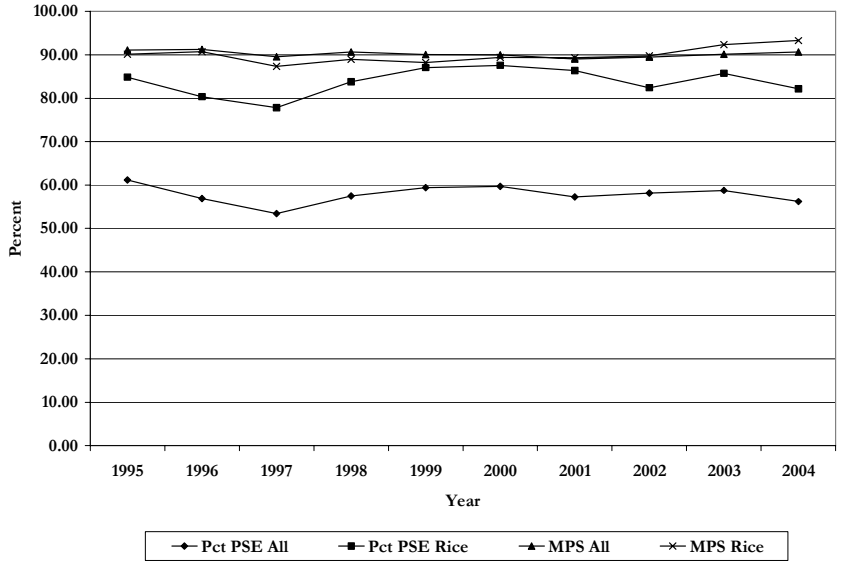
Figure 1. US Support for Rice and All Agriculture



Notes: Source is the OECD-PSE Database (2005). Pct PSE is one hundred times the annual producer support estimate (PSE) divided by the total value of production for all agriculture and rice respectively. OS is the *output subsidy* PSE component divided by the total PSE for all agriculture and rice respectively, i.e. it is the percentage of the PSE that is delivered via an output subsidy.

Figure 2. Japanese Support for Rice and All Agriculture



Notes: Source is the OECD-PSE Database (2005). Pct PSE is one hundred times the annual producer support estimate (PSE) divided by the total value of production for all agriculture and rice respectively. MPS is the *market price support* PSE component divided by the total PSE for all agriculture and rice respectively, i.e. it is the percentage of the PSE that is delivered via a border measure.

Table 1. Income and Planting Shares for Rice Households

Wealth Group	On Farm Income	Rice Planting
10%ile	0.52	0.44
20%ile	0.53	0.44
30%ile	0.67	0.43
40%ile	0.67	0.43
50%ile	0.88	0.59
60%ile	0.65	0.36
70%ile	0.81	0.42
80%ile	0.84	0.44
90%ile	0.81	0.44
95%ile	0.81	0.36
100%ile	0.80	0.36

Notes: Source for calculations is USDA-Agricultural Resource Management Survey data for 2004. Wealth groups are averages for weighted survey observations between listed percentiles of the wealth distribution of all specialized rice households. On farm income is the share of household income earned from farm activity. Rice planting is the share of acreage planted to the rice crop.

Table 2. Overview of Multilateral Liberalization Scenarios

Instrument	Doha	Full
Agr. Tariffs Rich	-45 %, -70 %, -75 %[c]	-100 %
Agr. Tariffs Poor (Non-LDC[a])	n.a.	n.a.
Agr. Export Subsidies	-100 %	-100 %
Amber Box Subsidies[b]	-75 % Group 1 -60 % Group 2	-100 %
Non-Agr. Tariffs Rich	n.a.	n.a.
Non-Agr. Tariffs Poor (Non-LDC[a])	n.a.	n.a.
Green Box Subsidies	n.a.	n.a.

Notes: Instruments represent different negotiating pillars of the Doha framework. Only liberalization for rich countries (USA, Europe, Japan, Australia, New Zealand, Canada) and for agricultural support and protection are considered here (note the n.a.'s). Green box subsidies are assumed to be unaffected. Under the Doha scenario, rich country agricultural tariffs feature tiered reductions with the depth of liberalization increasing at tariffs of ten percent and ninety percent. Amber box subsidy reductions are similarly tiered with group 1 deeper reductions occurring where producer subsidies constitute over 20 percent of producer revenue. Full liberalization increases Doha reductions in agricultural to be completely removed. The intermediate Doha with special products is identical to the Doha scenario, with countries allowed to protect 1 percent of tariff lines (those generating the most tariff revenue) from reductions.

Table 3. Trade Weighted Average Tariff Reductions for Rice

Region	Sensitive	Doha	Full
Japan	-6.94	-58.45	-87.12
United States	-0.92	-0.92	-4.31
European Union	-3.85	-13.63	-22.36

Notes: Tariff reductions are average reductions across all bilateral flows for rice. Sensitive products scenario allows for 1 percent of tariff lines to be exempted. Sensitive products are assumed to be chosen on the basis of tariff revenue generated. Doha and Full scenarios tariff reductions are the result of trade weighted averaging of the formulaic cuts given in Table 2.

Table 4. Rice Household Income Impacts across Scenarios

Income Group	Doha	Sensitive	Full
10%ile	1.36	-1.84	-5.08
20%ile	1.37	-1.85	-5.11
30%ile	1.89	-2.34	-6.55
40%ile	1.89	-2.34	-6.55
50%ile	6.32	-6.05	-16.68
60%ile	1.63	-2.76	-7.68
70%ile	4.64	-5.36	-14.92
80%ile	5.53	-6.26	-17.08
90%ile	5.60	-6.43	-17.78
95%ile	5.33	-6.87	-18.91
100%ile	5.31	-6.84	-18.83

Notes: Source of information are authors' simulations. Scenarios are those described in Table 2. Households are specialized in rice production and are differentiated by their place in the wealth distribution. Income changes are real changes in farm household income.

Table 5. Decomposed Doha Impacts on US Rice Households

Income Group	Doha	US Rice	Japan Rice	Other
10%ile	1.36	-1.75	3.44	-0.33
20%ile	1.37	-1.76	3.46	-0.33
30%ile	1.89	-2.33	4.56	-0.34
40%ile	1.89	-2.34	4.58	-0.35
50%ile	6.32	-7.09	13.92	-0.51
60%ile	1.63	-2.38	4.66	-0.65
70%ile	4.64	-5.70	11.19	-0.85
80%ile	5.53	-6.67	13.11	-0.91
90%ile	5.60	-6.87	13.51	-1.04
95%ile	5.33	-6.92	13.61	-1.36
100%ile	5.31	-6.89	13.55	-1.35

Notes: Authors' simulations are the source of information for Table 5. Column Doha gives the total result of farm household income change for each rice household type. US Rice is the component change of farm household income due to US reforms in its own rice policies. Japan Rice is the component change of farm household income due to Japanese reductions in tariffs in rice. Other represents the remainder, primarily the impact of other US policy reforms and increased market access in Europe and east Asia.

Table 6. Decomposed Doha Sensitive Impacts on US Rice Households

Income Group	Sensitive	US Rice	Japan Rice	Other
10%ile	-1.84	-1.38	0.10	-0.56
20%ile	-1.85	-1.38	0.10	-0.56
30%ile	-2.34	-1.83	0.13	-0.64
40%ile	-2.34	-1.84	0.13	-0.63
50%ile	-6.05	-5.55	0.39	-0.89
60%ile	-2.76	-1.87	0.13	-1.03
70%ile	-5.36	-4.46	0.32	-1.22
80%ile	-6.26	-5.22	0.37	-1.41
90%ile	-6.43	-5.38	0.38	-1.43
95%ile	-6.87	-5.42	0.38	-1.84
100%ile	-6.84	-5.39	0.38	-1.83

Notes: Authors' simulations are the source of information for Table 6. Column Sensitive gives the total result of farm household income change for each rice household type. US Rice is the component change of farm household income due to US reforms in its own rice policies. Japan Rice is the component change of farm household income due to Japanese reductions in tariffs in rice. Other represents the remainder, primarily the impact of other US policy reforms and increased market access in Europe and east Asia.

Table 7. Decomposed Doha Sensitive Impacts on US Rice Households

Income Group	Full	US Rice	Japan Rice	Other
10%ile	-5.08	-5.64	2.82	-2.26
20%ile	-5.11	-5.67	2.86	-2.29
30%ile	-6.55	-7.50	3.75	-2.80
40%ile	-6.55	-7.52	3.76	-2.78
50%ile	-16.68	-22.63	11.32	-5.37
60%ile	-7.68	-7.67	3.83	-3.83
70%ile	-14.92	-18.20	9.11	-5.83
80%ile	-17.08	-21.29	10.67	-6.45
90%ile	-17.78	-21.93	10.98	-6.84
95%ile	-18.91	-22.06	11.05	-7.90
100%ile	-18.83	-21.97	11.01	-7.86

Notes: Authors' simulations are the source of information for Table 7. Column Full gives the total result of farm household income change for each rice household type. US Rice is the component change of farm household income due to US reforms in its own rice policies. Japan Rice is the component change of farm household income due to Japanese reductions in tariffs in rice. Other represents the remainder, primarily the impact of other US policy reforms and increased market access in Europe and east Asia.