An Economy-wide Analysis of Impacts of WTO Tiered Formula for Tariff Reduction on Taiwan

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Abstract

In this study we use Taiwan as a case study to provide an economy-wide analysis of impacts on Taiwan of WTO tariff reduction schemes with different combinations of thresholds and reduction rates. The model we utilized in this study is <u>Tai</u>wan <u>G</u>eneral <u>E</u>quilibrium <u>M</u>odel with a WTO module (TAIGEM-WTO, hereafter) that is a multi-sectoral computable general equilibrium (CGE) model of the Taiwan's economy derived from Australian ORANI model (Dixon, Parmenter, Sutton and Vincent, 1982). Simulation results show that results are more sensitive to the scheme of tariff-reduction (i.e., Category 1, 2, and 3) than the tiered levels (i.e., A, B, C, and D) and as a strategy we should pay more attention to the arguments related to the amounts of tariff-reduction. Moreover, changes in nominal average tariff rates are more sensitive and shocks to the economy are more severe when we change the tariff reduction categories rather than the tiered levels. This conclusion also applies to the tiered reduction case when only sensitive products are considered. Finally, simulations with sector's bound rate calculated using arithmetic means have bigger effects than those using import values as weights. Therefore, sector's bound rate using import values as weights would be preferred.

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I. Motivation

After the setback in Cancun, agricultural trade negotiations made a significant

progress on 1 August, 2004 with the Framework Agreement to the July Package.

Although the Framework does not spell out all the details, it sets the principles for the

next stage of negotiations. On tariff reduction, in order to meet the "substantial

improvements" objectives, the Framework states that the formula must be made through

a tiered approach and takes account of members' different tariff structures. So the

tiered reduction formula will be developed to ensure that tariffs in higher tiers have

steeper cuts than those in the lower ones.

Furthermore, the next task will be to forge a compromise of the components of the

tiered reduction formula such as number of bands, thresholds, reduction formula within

bands and reduction rate. Actually, there are two main opposing positions, one from

net food imported countries including EU and G-10 that argue for flexibilities like

UR-type formula within bands and the other from agricultural products exporters

including US, Cairns group and G-20 that request the slash in tariff peaks like

non-linear formula.

Beyond the conflict, we are unsure what the appropriate design of the tiered

reduction formula should be, and which one of the components is more important than others, and how far the impact level that we can endure with. For resolving these questions, especially the optimal choice between thresholds and reduction rates, empirical simulations for different proposals are indispensable for a consistent economic assessment. In this study we use Taiwan as a case study to provide an economy-wide analysis of impacts on Taiwan of WTO tariff reduction schemes with different combinations of thresholds and reduction rates.

II. Analytical Framework

The model we utilized in this study is <u>Tai</u>wan <u>G</u>eneral <u>E</u>quilibrium <u>M</u>odel with a WTO module (TAIGEM-WTO, hereafter) that is a multi-sectoral computable general equilibrium (CGE) model of the Taiwan's economy derived from Australian ORANI model (Dixon, Parmenter, Sutton and Vincent, 1982). The input-output database was compiled from the 160-sector Input-Output tables of 1999. The model distinguishes 160 sectors, 6 types of labor, 8 types of margins and 160 commodities. It is designed for conducting comparative static analysis, i.e., for projecting the impact of an external shock on the economy at a point in time.

The tariff structure of Taiwan's agriculture-related commodities is shown in Table 1 where 1,387 commodities are listed according to the HS 8 Code and Taiwan's

schedules of tariff-rate concessions in 2001.   About 25.38% of these commodities have

0% tariff, 44.84% of them with tariff below 10%, and   88.25% of these

agriculture-related commodities have tariff below 30%.   The frequency distribution is

skewed towards to the left with the lower tail thicker than the upper tail.   Most of tariff

rates are centered on the range between 20 and 30%.

Table 2 shows the bound rates for agriculture-related sectors in TAIGEM-WTO

database.   We calculated the bound rates based on Taiwan's schedules of tariff-rate

concessions in 2001.   To better approximate the current state of Taiwan's agricultural

sector, we calculates the bound rate for each sector with two weighting methods, one is

with arithmetic means, and the other with import value in 2004 as weights.   For TRQ

(Tariff Rate Quota) commodities in the agricultural sector, we use their Out-Quota

Tariff Rate to calculate their bound rates.   Moreover, we transform the specific tariffs

to Ad Valorem Equivalents (AVE) using the average import unit values from 1999 to

2003.   For those commodities with missing data or with the import value less than

US$2500 for one year, we replaced them with c.i.f. price data of Japan or Hong Kong.

Because of uncertainties with the current WTO negotiation on the tiered reduction

formula, several different simulation scenarios consistent with Agriculture Framework

of "July Package" and "Harbinson Draft" were assumed in this study.   As shown in

Table 3, on the "tier" dimension, we have four scenarios, i.e., tariff above 90%, tariff

between 90% and 15%, and tariff below 15% (Scenario A); tariff above 60%, tariff

between 60% and 10%, and tariff below 10% (Scenario B); tariff above 100%, tariff

between 100% and 30%, and tariff below 30% (Scenario C); tariff above 120%, tariff

between 120% and 60%, and tariff below 60% (Scenario D).   On the "tariff-reduction"

dimension, we have three scenarios, i.e., 40%, 50%, and 60% (Category 1); 30%, 40%,

and 50% (Category 2), 25%, 35%, and 45% (Category 3). Therefore, there are twelve

experiments in total.

III. Simulations Results

Simulation results consist of two parts, i.e., impacts on macro-economy and

impacts on agriculture-related sectors.   As shown in Table 4, positive gains from

tariff-cutting were found in real GDP, employment, total import value, and total export

value. These results are consistent with the efficiency improvement argument for free

trade.   We found that Scenario B (with tariff above 60%, tariff between 60% and 10%,

and tariff below 10%) brings more impacts on macro-economy than other scenarios.

Scenario A (with tariff above 90%, tariff between 90% and 15%, and tariff below 15%)

is the next.

Two major reasons might be used to explain the simulation results.   One is related

to the coverage of the middle tier.   The more the middel tier covers, the more severe

the impacts on the economy.   Compared to other scenarios, the middle tier of Scenario

B (tariff between 60% and 10%) covers the most items as shown in Table 1.   The other

is related to the threshold of the top tier.   The lower the threshold of the top tier is, the

more the items with high tariff reduction, and the more the impacts on the economy.

Scenario B has the lowest threshold in the top tier (i.e., 60%) and accordingly, it has the

largest impacts on Taiwan's economy.   Next to Scenario B is Scenario A.

Comparing the impacts from different schemes of tariff-reduction in table 4, we

found that the higher the tariff cuts, the bigger the impacts.   The scenario with tariff

cuts of 40%, 50%, and 60% (i.e., Category 1) has the largest impacts on Taiwan's

economy and the scenario with tariff cuts of 25%, 35%, and 45% (i.e., Category 3) incur

smallest effects.   Moreover, simulation results clearly show that compared to the tiered

dimension significantly different impacts were observed along the tariff-reduction

dimension.   It seems that more attention paid to the tariff-reduction negotiation is

warranted.

Furthermore, comparing simulation results with different weighting calculation, we

found that simulation with sector's bound rate calculated using arithmetic means will

have bigger effects than that using import value as weights.   The major reason is that

most commodities with small import values have high tariff rates.   As a result, if

import values in 2004 were used as weights to calculate the bound rates, then

commodities with less import value, although with high tariff rate, will incur smaller shocks and thus smaller impacts as a whole.

Table 5 shows the output changes of agriculture-related sectors. As expected, outputs of almost all agriculture-related sectors decrease. For those non-agriculture sectors that use agricultural commodities as inputs, their outputs increase due to cost reduction. Sectors of sugar, sugarcane, and flour incur more damages than other sectors. The reason is that in our simulations sugar and sugarcane sectors, once heavily protected sectors in Taiwan, have more tariff reduction than other sectors. For the rice sector, however, since the tariff rate is still high after tariff reduction, the impacts on rice production seems to be not significant.

Like the simulation results on macro-economy, Scenario B (with tariff above 60%, tariff between 60% and 10%, and tariff below 10%) will have the largest impacts on agriculture-related sectors. The next one is Scenario A (with tariff above 90%, tariff between 90% and 15%, and tariff below 15%). These results seem reasonable because current bound rates of most commodities (around 88.25%) are below 30%. The middle tier of both Scenarios B and A covers more commodities than other scenarios. As a result, tariff rates of agriculture-related sectors in both Scenarios B and A were reduced with shocks more than those of the other two scenarios.

For sectoral results with different scheme of tariff reduction, the higher the tariff rates were reduced, the greater the impacts. The simulation with 40%, 50%, 60% tariff cuts (i.e., Category 1) incurs the largest impacts and the simulation with 25%, 35%, 45% tariff cuts (i.e., Category 3) will have smaller sectoral impacts.

Interpretation of the twelve simulation results may be facilitated using Table 6 where the nominal average rates after tiered reduction are shown along the "tier" dimension (column) and the "tariff reduction" dimension (row), respectively. The bottom row shows the variations along the "tier" dimension and the last column shows the variations along the "tariff reduction" dimension.

Given a tariff reduction category, Scenario B has the lowest tariff rate after the tariff reduction. Scenario A is the second. On the other hand, given a tiered scheme, Category 1 with largest tariff reduction has the lowest tariff rate after the tariff reduction. Accordingly Scenario B1 has the lowest after-reduction tariff rate among all twelve scenarios and has the most impacts on Taiwan's economy as shown in Table 4 and Table 5.

Moreover, the magnitudes of the variations in the last column are more than those in the bottom row. That is, changes in nominal average tariff rates are more sensitive and shocks to the economy are more severe when we change the tariff reduction

categories rather than the tiered levels. Hypothesis testing with F statistic strongly rejects the null hypothesis that there is no difference in variances of the bottom row and the last column. Our conclusion also applies to the tiered reduction case when only sensitive products are considered.

IV. Conclusions

To sum up, the following concluding remarks may be drawn from our simulation with Taiwan as a case study:

1. Simulation results are more sensitive to the scheme of tariff-reduction (i.e., Category 1, 2, and 3) than the tiered levels (i.e., A, B, C, and D) and as a strategy we should pay more attention to the arguments related to the amounts of tariff-reduction.

2. Changes in nominal average tariff rates are more sensitive and shocks to the economy are more severe when we change the tariff reduction categories rather than the tiered levels. This conclusion also applies to the tiered reduction case when only sensitive products are considered.

3. Simulations with sector's bound rate calculated using arithmetic means have bigger effects than those using import values as weights. Therefore, sector's bound rate using import values as weights would be preferred.

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Table 1 Tariff Structure of Taiwan's Agriculture-related Commodities

Tariff Rate	Number of Commodities	cumulative frequency	cumulative percentage	Sensitive products	cumulative frequency	cumulative percentage
0	352	352	25.38%	1	1	0.31%
0-5	116	468	33.74%	6	7	2.19%
5-10	154	622	44.84%	20	27	8.46%
10-15	144	766	55.23%	43	70	21.94%
15-20	127	893	64.38%	77	147	46.08%
20-25	224	1,117	80.53%	43	190	59.56%
25-30	107	1,224	88.25%	41	231	72.41%
30-35	64	1,288	92.86%	11	242	75.86%
35-40	17	1,305	94.09%	9	251	78.68%
40-45	12	1,317	94.95%	3	254	79.62%
45-50	7	1,324	95.46%	6	260	81.50%
50-60	3	1,327	95.67%	3	263	82.45%
60-70	3	1,330	95.89%	2	265	83.07%
70-80	7	1,337	96.40%	7	272	85.27%
80-90	2	1,339	96.54%	2	274	85.89%
90-100	2	1,341	96.68%	2	276	86.52%
100-110	2	1,343	96.83%	2	278	87.15%
110-120	1	1,344	96.90%	1	279	87.46%
120-130	43	1,387	100.00%	40	319	100.00%
total	1,387	1,387	100.00%	319	319	100.00%

Data Source：Authors' calculation based on Taiwan's schedules of tariff-rate concessions in

2001.

Table 2 Bound Rates of Agriculture-related Sectors in TAIGEM-WTO

The sector code in the model	Name of agriculture-related sectors	Bound rate（calculated using arithmetic means）	Bound rate（calculated using weighted*）
1	Paddy Rice	104.46	0.00
2	Other common Crops	2.52	0.86
3	Sugarcane	8.00	6.00
4	Other Special Crops	13.01	2.53
5	Fruits	35.44	24.39
6	Vegetables	26.05	23.41
7	Other Horticultural Crops	27.63	10.42
8	Hogs	4.17	2.50
9	Other poultry& Livestock	9.96	4.49
18	Slaughtering & By-Products	30.03	68.86
19	Edible Oil & Fat By-Products	14.53	1.72
20	Flour	61.14	9.78
21	Rice	324.00	412.05
22	Sugar	79.15	110.97
23	Animal Feeds	1.20	0.33
24	Canned Foods	21.98	15.60
25	Frozen Foods	38.71	34.86
27	Seasonings	14.93	13.30
28	Dairy Products	18.65	9.27
29	Sugar Confectionery & Bakery Products	19.86	17.81
30	Misc. Food Products	29.41	16.45
31	Non-Alcoholic Beverages	19.90	12.91
32	Alcoholic Beverages	13.70	3.71
33	Tobacco	16.85	26.25

Data source：Authors' calculation based on Taiwan's schedules of tariff-rate concessions.

*calculated using import value in 2004 as weights

Note：Ad Valorem Equivalents（AVE) is calculated as follows:

AVE = (sp/uv)*100, where uv = v/q, sp is specific tariff, and uv is import unit value（the average of 1999-2003）.

Table 3 Scenario Designs for Tiered Reduction Formula Simulation

Tariff Reduction / Tier		Scenario A-1～A-3		Scenario B-1～B-3		Scenario C-1～C-3		Scenario D-1～D-3	
		tiers	Tariff cut	tiers	tariff cut	tiers	Tariff cut	tiers	Tariff cut
Market access	tariff	above 90%	1.average -60% 2. average -50% 3. average -45%	above 60%	1. average -60% 2. average -50% 3. average -45%	above 100%	1. average -60% 2. average -50% 3. average -45%	above 120%	1. average -60% 2. average -50% 3. average -45%
		15-90 %	1. average -50% 2. average -40% 3. average -35%	10-60 %	1.average -50% 2.average -40% 3.average -35%	30-100 %	1.average -50% 2.average -40% 3.average -35%	60-120 %	1.average -50% 2.average -40% 3.average -35%
		below 15％	1.average -40% 2.average -30% 3.average- -25%	below 10％	1.average -40% 2.average -30% 3.average -25%	below 30％	1.average -40% 2.average -30% 3.average -25%	below 60%	1.average -40% 2.average -30% 3.average -25%

Table 4 Impacts on Macro-economy of Taiwan

unit：％

scenario \ term	Bound rate* （to calculate by arithmetic means）			Bound rate* （to calculate by weighted**）		
	Scenario A-1	Scenario A-2	Scenario A-3	Scenario A-1	Scenario A-2	Scenario A-3
Real GDP	0.207	0.167	0.148	0.172	0.139	0.123
employment	0.326	0.263	0.233	0.269	0.217	0.192
import	0.545	0.442	0.393	0.515	0.419	0.371
export	0.920	0.746	0.661	0.822	0.667	0.590
Scenario	Scenario B-1	Scenario B-2	Scenario B-3	Scenario B-1	Scenario B-2	Scenario B-3
Real GDP	0.211	0.173	0.153	0.177	0.144	0.128
employment	0.332	0.272	0.241	0.277	0.225	0.199
import	0.554	0.454	0.404	0.527	0.431	0.383
export	0.936	0.768	0.681	0.843	0.688	0.610
Scenario	Scenario C-1	Scenario C-2	Scenario C-3	Scenario C-1	Scenario C-2	Scenario C-3
Real GDP	0.194	0.159	0.136	0.162	0.129	0.113
employment	0.304	0.249	0.213	0.252	0.201	0.175
import	0.512	0.421	0.361	0.490	0.393	0.345
export	0.863	0.708	0.607	0.779	0.623	0.546
Scenario	Scenario D-1	Scenario D-2	Scenario D-3	Scenario D-1	Scenario D-2	Scenario D-3
Real GDP	0.189	0.149	0.130	0.160	0.127	0.110
employment	0.296	0.234	0.203	0.249	0.197	0.171
import	0.498	0.396	0.345	0.483	0.387	0.339
export	0.840	0.666	0.580	0.768	0.613	0.535

Source: Simulation results from TAIGEM-WTO.

Table 5 Output Changes of Agricultural-related Sectors (value added) unit：％

sectors	Scenario A-1	Scenario A-2	Scenario A-3	Scenario B-1	Scenario B-2	Scenario B-3	Scenario C-1	Scenario C-2	Scenario C-3	Scenario D-1	Scenario D-2	Scenario D-3
Paddy Rice	-0.378	-0.284	-0.316	-0.378	-0.284	-0.315	-0.381	-0.287	-0.317	-0.380	-0.287	-0.318
Other common Crops	-0.624	-0.429	-0.494	-0.636	-0.443	-0.518	-0.584	-0.390	-0.470	-0.589	-0.388	-0.453
Sugarcane	-11.092	-8.266	-9.205	-11.109	-8.297	-9.232	-10.974	-8.176	-9.113	-10.956	-8.150	-9.076
Other Special Crops	-2.050	-1.490	-1.676	-2.100	-1.541	-1.711	-1.949	-1.389	-1.580	-1.903	-1.362	-1.529
Fruits	-1.911	-1.384	-1.560	-1.920	-1.392	-1.566	-1.776	-1.248	-1.422	-1.681	-1.153	-1.329
Vegetables	-0.602	-0.436	-0.490	-0.604	-0.439	-0.490	-0.539	-0.373	-0.434	-0.535	-0.367	-0.426
Other Horticultural Crops	-1.416	-1.028	-1.158	-1.420	-1.031	-1.160	-1.323	-0.914	-1.065	-1.312	-0.903	-1.033
Hogs	-1.047	-0.774	-0.859	-1.045	-0.778	-0.858	-1.012	-0.736	-0.864	-0.973	-0.699	-0.799
Other poultry& Livestock	-0.640	-0.453	-0.514	-0.667	-0.490	-0.554	-0.599	-0.423	-0.497	-0.573	-0.384	-0.446
Slaughtering & By-Products	-0.479	-0.356	-0.397	-0.482	-0.359	-0.396	-0.470	-0.345	-0.395	-0.451	-0.326	-0.370
Edible Oil & Fat By-Products	-1.192	-0.884	-0.986	-1.206	-0.901	-1.001	-1.195	-0.890	-0.998	-1.187	-0.880	-0.983
Flour	-9.188	-6.787	-7.582	-9.240	-6.855	-8.013	-8.945	-6.575	-7.878	-9.076	-6.488	-7.272
Rice	-0.402	-0.300	-0.334	-0.402	-0.301	-0.334	-0.401	-0.301	-0.334	-0.400	-0.300	-0.333
Sugar	-11.325	-8.439	-9.398	-11.342	-8.471	-9.426	-11.204	-8.348	-9.305	-11.187	-8.322	-9.268
Animal Feeds	-0.454	-0.334	-0.371	-0.462	-0.348	-0.380	-0.437	-0.319	-0.375	-0.410	-0.291	-0.335
Canned Foods	-1.120	-0.763	-0.883	-1.146	-0.788	-0.906	-0.959	-0.601	-0.810	-0.968	-0.521	-0.639
Frozen Foods	-3.008	-2.220	-2.450	-2.982	-2.222	-2.449	-2.877	-2.083	-2.500	-2.774	-1.986	-2.284
Seasonings	-0.933	-0.620	-0.724	-1.003	-0.690	-0.783	-0.756	-0.442	-0.534	-0.728	-0.417	-0.524
Dairy Products	-2.864	-1.962	-2.263	-3.059	-2.234	-2.579	-2.608	-1.792	-2.136	-2.509	-1.570	-1.863
Sugar Confectionery & Bakery Products	-1.066	-0.634	-0.748	-1.075	-0.732	-0.832	-0.723	-0.513	-0.590	-0.732	-0.537	-0.516
Misc. Food Products	-1.695	-1.257	-1.403	-1.763	-1.326	-1.426	-1.577	-1.113	-1.284	-1.505	-1.019	-1.210
Non-Alcoholic Beverages	-0.409	-0.268	-0.315	-0.411	-0.270	-0.316	-0.309	-0.168	-0.211	-0.267	-0.128	-0.174
Alcoholic Beverages	-1.362	-0.934	-1.077	-1.397	-0.967	-1.106	-1.213	-0.783	-0.918	-1.083	-0.657	-0.799
Tobacco	-2.145	-1.451	-1.683	-2.293	-1.597	-1.829	-1.801	-1.106	-1.334	-1.809	-1.114	-1.346

Source: Simulation results from TAIGEM-WTO.

Table 6 Average Tariff Rate after Tiered Reduction

Unit: %

Tier level / Tariff Reduction percentage	(Scenario A) Less than 15%; 15%-90%; Greater than 90%;	(Scenario B) Less than 10%; 10%-60%; Greater than 60%;	(Scenario C) Less than 30%; 30%-100%; Greater than 100%;	(Scenario D) Less than 60%; 60%-120%; Greater than 120%;	Nominal Average Rate after Tariff Reduction by the tariff reduction level
(Category 1) Average reduction of lower tier by -40%; Average reduction of middle tier by -50%; Average reduction of top tier by -60%;	13.42	13.30	14.14	14.34	13.80
(Category 2) Average reduction of lower tier by -25%; Average reduction of middle tier by -35%; Average reduction of top tier by -45%;	17.93	17.81	18.66	18.86	18.32
(Category 3) Average reduction of lower tier by -30%; Average reduction of middle tier by -40%; Average reduction of top tier by -50%;	16.42	16.30	17.15	17.35	16.81
Nominal average rate after tariff reduction by the tier level	15.92	15.80	16.65	16.85	Note that the nominal average rate before tariff reduction is 30.09%

Data source：Authors' calculations