Asymmetries and Tariff-Tax Reforms in the
Asia-Pacific Economic Cooperation:
A Quantitative Assessment

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Abstract. Many asymmetries among member countries in the Asia-Pacific Economic Cooperation may cause conflicting interests, or may offer opportunities for collaboration. This paper investigates an optimal coordinated tariff-tax reform, and examines the factors which significantly affect the level of welfare. Through the examinations, we see whether fiscal policy issues are affected by those asymmetries. An optimal coordinated tariff-tax reform keeps up with the current global trend of domestic tax reform, directed towards increasing consumption taxes. Sensitivity analyses imply that tariff-tax reforms are not likely to favor developed countries which have a lower degree of dependence upon foreign trade and lower tariff rates.

JEL Classification: F13, H30.
Keywords: Tariff-tax reforms, Asymmetries, Asia-Pacific Economic Cooperation, Computational General Equilibrium

1. Introduction
The economic cooperation agenda within the Asia-Pacific Economic Cooperation has been primarily focused on free and open trade and investment. However, the APEC may have some difficulties in reaching internal consensus among member countries, due to asymmetries which are attributes of the APEC. These asymmetries may cause conflicting interests, and eventually create potential tension, or may offer opportunities for collaboration.

There has been growing interest in Free Trade Agreements among member countries. As the United States and Korea currently negotiate a bilateral FTA, several sensitive issues draw the attention of both countries’ officials. Under the asymmetries between two countries, each country set its own objective in the FTA negotiations. In the negotiations, do those asymmetries finally work for conflict or collaboration?

This paper investigates an optimal coordinated tariff-tax reform, and examines the factors which significantly affect the level of welfare. Through the examinations, we will see whether fiscal policy issues are affected by those asymmetries. This paper is organized as follows. The second section gives a brief overview of asymmetries within the APEC. Section 3 introduces an outline of
previous studies on coordinated tariff-tax reforms. A simulation model and calibration issues are presented in section 4. Section 5 provides simulation results and interpretation. Finally, the last section summarizes this study and suggests policy implications.

2. Asymmetries in the Asia-Pacific Economic Cooperation

The Asia-Pacific Economic Cooperation economy represents 56 percent of the world GDP and 48 percent of the world trade. More than 2.6 million people from twenty one member countries are involved in the APEC economy. Developed countries and developing countries are all intertwined. There are dissimilarities or asymmetries in trade patterns and tax structures.

Table 1 shows the GDP per capita of the APEC member countries. In Table 2, the countries are listed by the order of the degree of interdependence upon foreign trade (especially upon imports). Trade patterns are different among member countries. Many developed countries, including the U.S., Japan, and Australia, have a lower degree of interdependence upon foreign trade, whereas many developing countries, including Malaysia, Thailand, the Philippines, and China, heavily rely on foreign trade.

Table 1: Gross Domestic Product per Capita

<table>
<thead>
<tr>
<th>Tiers</th>
<th>GDP per capita</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Over $30,000</td>
<td>U.S., Japan, Canada, Australia</td>
</tr>
<tr>
<td>Tier II</td>
<td>$29,999-$10,000</td>
<td>Singapore, New Zealand, Hong Kong, Korea, Taipei</td>
</tr>
<tr>
<td>Tier III</td>
<td>$9,999-$5,000</td>
<td>Mexico, Chile, Russia, Malaysia</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Under $4,999</td>
<td>Peru, Thailand, China, Indonesia, Philippines</td>
</tr>
</tbody>
</table>

Source: Asia-Pacific Economic Cooperation (2005)

Table 2: Degree of Interdependence upon Foreign Trade

<table>
<thead>
<tr>
<th>Tiers</th>
<th>Imports/GDP</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Over 50%</td>
<td>Hong Kong, Singapore, Malaysia, Thailand, Taipei</td>
</tr>
<tr>
<td>Tier II</td>
<td>49%-25%</td>
<td>Philippines, China, Korea, Canada</td>
</tr>
<tr>
<td>Tier III</td>
<td>24%-15%</td>
<td>Chile, Mexico, New Zealand, Indonesia, Australia</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Under 14%</td>
<td>Russia, U.S., Peru, Japan</td>
</tr>
</tbody>
</table>

Source: Author’s calculations, based on Asia-Pacific Economic Cooperation (2005)

Tax structures are also different among member countries. Import tariff rates are much differentiated between developed countries and developing countries. Since developing countries, in general, mostly rely on tariffs as sources of tax revenue, they have relatively higher tariff rates. The ratio of consumption taxes to income taxes in developing countries has consistently remained more than double the ratio in developed countries.² It is true that developing countries rely more on indirect taxes, such as consumption taxes and import tariffs.
3. Coordinated Tariff-Tax Reforms
In 1994, when the economic leaders of the Asia-Pacific Economic Cooperation came together at Bogor, Indonesia, they agreed to adopt long term goals of free and open trade and investment in Asia-Pacific regions. In 2005, the economic leaders gathered in Busan, Korea and declared a firm support for the WTO Doha Development Agenda negotiations by reiterating the importance of the Bogor Goals. Under the pledge for freer trade, the APEC is now trying to achieve the long term goals by 2010 for developed member countries and by 2020 for developing countries. Therefore, lowering tariff rates and reducing quantitative restrictions are unavoidable issues to the APEC member countries.

Domestic tax reform is moving toward lowering capital taxes and increasing consumption taxes. There are many previous studies that quantitatively dealt with domestic tax reform. Goulder, Shoven and Whalley (1983) analyzed the capital flow effect with a very cursory treatment of the foreign sector. Thalmann, Goulder and Delorme (1996) employed an infinite-horizon formulation which may overstate intertemporal effects, since it yields very high responses of savings to changes in tax rates. Mendoza and Tesar (1998) assumed a fully integrated world capital market which may overstate the degree of international capital mobility. Ballard and Kang (2003) used a static model, in which capital is internationally mobile, but with incomplete adjustment in the world capital market. They found that unilateral elimination of U.S. capital taxes generates welfare gains for the U.S., and estimated 1.4 percent of the GDP as annual static gains.

Tariffs are major sources of tax revenues, especially for developing countries. So these countries need to find alternative taxes to preserve revenue loss from tariff cuts. This is the why tariff policy should be coordinated with domestic tax policy. Studies on coordinated tariff-tax reforms include: Anderson (1999), Keen and Ligthart (2002), and Emran and Stiglitz (2005). They all analyzed coordinated reforms theoretically. Even though some details differ, they all concluded that a cut in tariffs combined with an increase in consumption taxes can increase welfare levels. A few papers have dealt quantitatively with coordinated tariff-tax reforms. Rutherford and Tarr (2002) assessed the welfare effect of trade liberalization, and showed that complementary reforms were crucial for determining gains from the trade reform.

4. Simulation Model and Parameter Calibration
I used a standard small open economy (SOE) model, which was formulated using the GAMS/MPSGE computational general equilibrium modeling. MPSGE constructs production and utility functions based on reference prices, quantities and elasticities. A brief description of functional forms is as follows. I consider three sectors in production: agriculture, industry, and services. Each production sector produces domestic goods and exports which are assumed to be imperfect substitutes. For production, each sector uses capital, labor, and intermediate goods. Intermediate
input is an Armington aggregate of domestic outputs and imports which are assumed to have a constant elasticity of substitution. An Armington aggregate is also used for private consumption, government consumption, and investment. A representative agent maximizes her private consumption, given an endowment of labor and capital, and an exogenously fixed investment and the government sector’s output.

On the top of the standard SOE model, labor/leisure choice was incorporated in the utility function. With an endogenous labor-supply decision, we can fully capture the distortionary effect of income taxes, and also grasp the fact that the effect of consumption taxes on real wage rate leads to changes in the labor supply. If there is no labor-supply decision in the model, then income taxes are equivalent to lump-sum taxes, so it is not possible to precisely evaluate trade reform with realistic distortionary income taxation.

There are important parameters in this model. In general, a time-endowment ratio chosen arbitrarily leads to an exceptionally large value of total-income elasticity. Therefore, a better strategy is to choose the desired value of the total-income elasticity of labor supply and to solve for the value of the time-endowment ratio that is consistent with that elasticity. Based on the econometric literature, a value of -0.1 for the total-income elasticity would be reasonable.

To calibrate the time-endowment ratio, I begin with the expenditure function, and derive the compensated labor-supply elasticity.

\[
E = \left\{ \beta \sigma \epsilon_{ct} P_c^{1-\sigma} + (1 - \beta)^{\gamma_{ct}} P_t^{1-\gamma_{ct}} \right\}^{\frac{1}{1-\sigma_{ct}}},
\]

where \( V \) is the indirect utility function, \( P_c \) is price of consumption, \( P_t \) is wage rate, and \( \sigma_{ct} \) is the elasticity of substitution between consumption and leisure. Shephard’s Lemma tells us that the compensated leisure-demand function is the derivative of the expenditure function with respect to the wage rate.

\[
\frac{\partial E}{\partial P_t} = \epsilon' = V(1 - \beta)^{\gamma_{ct}} P_t^{\gamma_{ct}} \left\{ \beta^{\sigma_{ct}} P_c^{1-\sigma_{ct}} + (1 - \beta)^{\gamma_{ct}} P_t^{1-\gamma_{ct}} \right\}^{\frac{\sigma_{ct}}{1-\sigma_{ct}}}
\]

Then, the compensated leisure-demand elasticity is

\[
\eta' = \frac{\partial \epsilon'}{\partial P_t} \cdot \epsilon' = \frac{\sigma_{ct} P_t^{\sigma_{ct} + 1} \left\{ (1 - \beta)^{\gamma_{ct}} P_t^{2}\frac{\sigma_{ct}^{2}}{2\gamma_{ct}^{\gamma_{ct} - 1}} - P_t^{1-\gamma_{ct}^{\gamma_{ct} - 1}} \frac{\gamma_{ct}^{\gamma_{ct} - 1}}{2} \right\}}{\Omega^{\gamma_{ct} - 1}} ,
\]
where $\Omega = (1-\beta)^{\sigma_{c}} P_{i}^{\sigma_{c}} + (1-\beta)^{\sigma_{c}} P_{i}^{\sigma_{c}} \sigma_{c}^{\sigma_{c}}$. This equation can be converted to the compensated labor-supply elasticity which is represented as a function of time-endowment ratio, $\Phi$. 

$$\eta^{*} = (1-\Phi)\sigma_{c} \left( \frac{P_{i}}{Y_{i}} - 1 \right)$$

Finally, equation (4) can be used to calibrate the time-endowment ratio that is consistent with the desired value of the compensated labor-supply elasticity. As you see in Table 3, I calibrated the time-endowment ratio as 1.3, and this value is much lower than the values researchers previously used. I also calibrated the elasticity of substitution between domestic goods and imports which depends on the price elasticity of import demand and expenditure share of imports and domestic goods.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Calibrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total-income elasticity of labor supply</td>
<td>-0.1</td>
<td></td>
</tr>
<tr>
<td>Uncompensated labor supply elasticity</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Time-endowment ratio ($\Phi$)</td>
<td>1.3</td>
<td>Yes</td>
</tr>
<tr>
<td>Elasticity of substitution b/w domestic good &amp; imports</td>
<td>1.5</td>
<td>Yes</td>
</tr>
</tbody>
</table>

5. Simulation Results and Interpretation
An extreme case of zero tariffs is considered for the simulation. The lost revenues are replaced by higher rates of consumption taxes and labor taxes, respectively. The changes in consumer welfare are calculated by equivalent variations, along with marginal excess burden (MEB) of new tax policies. The negative values of MEB mean that tariff cuts generate negative efficient cost. In other words, tariff cuts generate, so called “efficient benefit”. Higher absolute value means more benefit.

Based on the results in Table 4, we can interpret that zero tariff improves production efficiency. This is partly due to the fact that tariffs, in general, impose higher distortion costs than other taxes because it favors domestic production over imports. The results are consistent with the findings from a theoretical approach on coordinated tariff-tax reforms. Compared with the result of labor tax replacement, consumption tax replacement is shown to produce larger welfare gains. Tariff cuts with higher rates of consumption tax generate the welfare gains amount to 2.15 percent of GDP, whereas tariff cuts with higher rates of labor tax generate the gains amount to 1.83 percent of GDP. An efficient benefit from consumption tax replacement is shown to be larger than that from labor tax replacement. This is partly due to the attribute of labor taxes which distorts labor/leisure choice. I also analyzed the case of tariff reduced by the same proportion in all sectors, and then compare it...
with the case of tariff cut only in one sector. The results are in Table 5. I find that if the tariff is reduced by the same proportion in all sectors, it brings more efficiency by keeping relative prices constant across sectors.

Table 4: Central Case Simulations - Zero Tariffs

<table>
<thead>
<tr>
<th></th>
<th>EV (% of GDP)</th>
<th>MEB</th>
</tr>
</thead>
<tbody>
<tr>
<td>tm=0 (consumption tax replacement)</td>
<td>2.151</td>
<td>-0.405</td>
</tr>
<tr>
<td>tm=0 (labor tax replacement)</td>
<td>1.825</td>
<td>-0.255</td>
</tr>
</tbody>
</table>

Table 5: Tariff Reduction by Same Proportion

<table>
<thead>
<tr>
<th></th>
<th>EV (% of GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>tm=0 in the industrial sectors</td>
<td>1.223</td>
</tr>
<tr>
<td>tm reduced by same proportion in all sectors (*) keep revenue constant</td>
<td>1.505</td>
</tr>
</tbody>
</table>

I have performed sensitivity analyses with respect to two parameters: trade elasticities and initial tariff rates. First, as you see in Figure 1, higher trade elasticities bring more welfare gains. Higher values imply more responsive behavior when taxes are changed. The more consumers are responsive, the greater welfare gains they enjoy by the reduction of tariff rates. Second, Figure 2 shows that a larger initial tariff rate generates higher welfare gains. A lower initial tariff does not enjoy as much production efficiency gains. If the rates are reduced, the gains decrease.

Figure 1: Welfare Changes As a Function of Trade Elasticity

![Figure 1: Welfare Changes As a Function of Trade Elasticity](image)
6. Summary and Policy Implications
Under the regime of the Doha Development Agenda, lowering tariffs is an unavoidable issue. By lowering tariffs, large tax revenue losses are expected in developing countries. To preserve tax revenue, an alternative revenue source should be considered. Based on the simulations, consumption tax replacement would be better than labor tax replacement. This keeps up with the trend of domestic tax reform which is moving toward increasing consumption taxes. It is found that more production efficiency can be achieved through the tariff reduction by the same proportion. Sensitivity analyses tell us that an increase in welfare gains is positively correlated to trade elasticity and initial tariff rates. In this light, a tariff-tax reform is not likely to favor developed countries which have a lower degree of interdependence upon foreign trade and lower tariff rates.

There has been growing interest in Free Trade Agreements among member countries. Some FTA critics believe that the FTA negotiations would be set by the more advanced industrial countries and that the outcomes would reflect their economic power. In the negotiations, do asymmetries between countries cause conflicting interests, or offer new opportunities for collaboration? What are the implications of the simulation results to countries’ officials involved in a bilateral Korea-U.S. Free Trade Agreement? The FTA will be particularly beneficial for the U.S. agricultural producers, since average applied tariff on agriculture products in Korea is four times greater than the U.S. average. It creates new opportunities for U.S. farmers. But the welfare effect on the U.S. will be much smaller, because the United States has lower initial tariffs and its interdependency upon foreign trade is relatively small. On the other hand, Korea expects relatively large overall welfare gains, and the gains will be primarily coming from allocative efficiency effects. From the perspective of efficiency, coordinated tariff-tax reforms are likely to favor Korea, which has relatively large initial tariffs and more heavily relies on foreign trade. However, fiscal policy-makers in Korea should pay attention to equity issues,
since overall gains can be achieved at the expense of losses to one particular sector, agriculture. Therefore, it is suggested that reforming agricultural policies to enhance farmers’ competitiveness should precede, or at least keep pace with market openings.

Notes
1. Kiwon Kang is a Visiting Assistant Professor of International Studies and Programs at Michigan State University. Comments from seminar participants at International University of Japan on October 30, 2006 are gratefully acknowledged. Special thanks are given to Professor Charles L. Ballard in the Economics Department at Michigan State University. Author’s mailing/email addresses: 1 International Academic Center, Michigan State University, East Lansing, Michigan 48824-1035; kangkiw1@msu.edu

2. Compared with developing countries, developed countries derive proportionally twice as much revenue from income tax than from consumption tax. See Tanzi and Zee (2001).

3. In Ballard (1990), the value of the time-endowment ratio, which is consistent with the reasonable value of the total-income elasticity, was calibrated as 1.213. He also showed that the values of the time-endowment ratio chosen arbitrarily, 2.5 and 5.0, produce respectively -0.4414 and -0.6787, which are far larger than the most of the econometric estimates of the total-income elasticity, -0.1.

4. The time-endowment ratio is the ratio of the consumer’s endowment of time and the amount of labor supplied in the base case.

5. A marginal excess burden is defined as a negative value of changes in welfare level over the amount of distortionary tax revenue replaced by consumption tax and labor tax, respectively. It would be a useful tool to evaluate welfare changes under differential analysis. Under balanced budget analysis, the concept of marginal welfare cost, which is defined as a negative value of changes in welfare level over changes in government revenue, is generally used.

6. I considered a trade elasticity as a “proxy” parameter which represents the degree of interdependence upon foreign trade, based on the fact that imports become closer substitutes with domestically produced goods as a country’s consumption relies more on imports.

References


