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Revenue-Neutral Tariff Reform: The Welfare Effects of Uniform Tariffs in 13 Developing Countries

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Abstract

This paper examines the welfare effects of replacing the existing tariff structure with uniform tariff in the context of a multi-country study that comprises thirteen developing countries from Asia and Latin America. For each country, static policy simulations are performed using a computable general equilibrium (CGE) world model with seven regions, nineteen sectors and five primary factors. Constant returns to scale and perfect competition are assumed in production. Trade reform in the simulation scenarios is revenue-neutral; i.e. the uniform tariff rate is endogenously determined in the model subject to the public budget constraint. Thus, in each country the uniform rate is close to the weighted average tariff of the benchmark situation. The model estimates show that replacing the benchmark differential tariff structure with a uniform rate is welfare improving in all selected countries. The size of the gains depends on the initial tariff dispersion and on the role of trade in the economy. Welfare gains are larger in countries where the range of dispersion was larger and/or with significant trade. Within a country, welfare gains are larger in the scenario with the broader tax-base to apply the uniform rate. Further, a positive welfare effect arises even though the level of the uniform rate is generally somewhat higher than the benchmark average tariff. The results of positive welfare effects are robust to alternative regional aggregations, as well as to different values of the elasticity of substitution between domestic and imported goods and to heterogeneous elasticities across goods.

I. Introduction

In developing countries import tariffs have been used for both to protect domestic industries and to raise revenue. Because of the later, free trade that is theoretically optimal for a small open economy with no world market power, is in practice not an attainable goal for developing countries. In these countries the removal of tariffs could derive strong implications in public finance, as tariffs are major source of government revenue and at the same time the tariff revenue loss can not be easily replaced in the short run (Mitra 1992b and Dahl et al. 1994). Estimates of the International Monetary Fund illustrate the significant role of tariffs to raise revenue in developing countries compared with that in developed countries. During the period 1986-92 tariffs accounted for more than 20 percent of total tax revenue in developing countries, while tariffs accounted for 2 percent in developed (OECD) countries¹.

The role of tariffs as revenue source in developing countries suggests that the second-best optimum tariff structure must be nonzero, regardless of the size of the country relative to the world economy. In this context the determination of the optimum or less costly tariffs becomes an important issue, which has been the subject of analysis in recent years². The two alternative approaches that have been discussed in the related literature are the uniform rate and a differential tariff structure based on Ramsey's optimum taxation theory. In theoretical studies the relative performance in terms of

¹ International Monetary Fund (1995).

² See, for example, Shantaynan et al. (1994) that present a summary of the "Symposium on the Economics of Uniform Tariffs" where different authors discuss the performance of uniform versus differentiated tariffs in a revenue-constrained economy.

welfare of these structures depends on the assumption about substitutability or complementary among goods. If substitution dominates the uniform rate is superior, while the opposite is true if goods are complements. At the empirical level, the welfare effects of these alternative tariff structures have been examined by performing static simulations of trade reforms in the context of one single country. Results depend upon the underlying assumptions and if trade reform is combined with tax reform, albeit the difference between the uniform and the differential tariff structure has been found rather small (see, for example Dahl et al., 1994 and Mitra, 1992a).

This paper illustrates the quantitative significance of the idea of a uniform tariff in the context of a revenue-constrained economy, using computable general equilibrium (CGE) multi-region models to simulate unilateral trade reforms in a sample of thirteen developing countries of Asia and Latin America³. The model is static with constant returns to scale and perfect competition in production. The objective is to provide new evidence based on a multi-country comparison of general equilibrium estimates of the welfare effects of a revenue-neutral uniform tariff. This paper does not consider the alternative differential structure suggested in the literature as optimum by analogy with Ramsey's taxes. Thus, the analysis does not pretend to rank different tariff structures, rather the purpose is to provide insights of the effects of a tariff reform aimed to remove tariff dispersion. The fundamental effect is that post-reform domestic relative prices are closer to relative world prices. Although distortion persists between domestic and world prices because the uniform tariff is nonzero, the distortion due to differential tariffs is

³ Korea, Indonesia, Philippines, Singapore, Thailand, China, Taiwan, India, Central America and Caribbean (CAM), Argentina, Brazil, Chile and Venezuela.

removed. This in turn induces an improvement in resources allocation that is the classical source of a gain from freer trade.

The policy simulations consist of replacing the differential tariff structure of the initial situation with a uniform rate, while maintaining unaltered government revenues. The CGE model is used to calculate the uniform tariff, subject to the public budget constraint. Thus, in each country the requirement of government revenue determines the tariff rate. Revenue-neutrality can be attained because the reduction of the highest tariffs to the level of the uniform is compensated by the increase in the lowest ones. In the general equilibrium context of this analysis there is also a change in revenue from the rest of taxes as the trade reform induces a reallocation of resources, though the tax rate of these taxes is exogenously fixed at the benchmark level. The rationale of this formulation is twofold. The first objective is to isolate the welfare effects of changing the structure of tariffs from fiscal effects of changing government revenues⁴; and the second is to illustrate that a trade reform can be welfare improving and at the same time consistent with a revenue-neutral objective.

All variables used in the CGE model are aggregations from the database GTAP Version 4⁵, base year 1995. The selection of countries is on the basis of having a sample of economies with different degree of tariff dispersion across sectors in the benchmark equilibrium. The first step in this research is to make aggregations of the database for

⁴ When taxes are altered to replace tariff revenue, the model estimates reflect the effects of both trade and fiscal reforms.

⁵ Global Trade Analysis Project (GTAP). This database contains information of trade flows among 45 country/regions, 50 sectors and 5 factors of production (see "Global Trade Analysis. Modeling and Applications" edited by Hertel (1997), and "GTAPinGAMS" by T.Rutherford (1998)) .

each selected country. Countries are aggregated in seven regions, of which one is the 'home'⁶ country. The rest of the world is aggregated in six regions, as follows: USA, Japan, Rest of Asia, Latin America, Europe and the Rest of the World. Countries were aggregated by geographical location, except in the case of Japan and USA because these two countries are individually important trade partners of the selected countries in the sample. Production activities are aggregated in nineteen sectors and there are five primary factors. The policy analysis considers four simulation scenarios that differ on the tax-base to apply the uniform rate. The purpose is to examine the effects of maintaining the zero and negative tariffs of the initial situation⁷.

The main results can be summarized in five points: First, starting from an initial situation with differential tariff structure, a revenue-neutral trade reform aimed to tariff uniformity leads to welfare gains. Second, it is more likely to have sizable welfare gains from replacing the actual tariff structure with a uniform rate when the range of tariff dispersion in the initial situation is large and/or the role of trade in the economy is large. Third, the gains are larger in the scenario that applies the uniform tariff to the broader tax-base, in which all imports are taxed regardless of the tariff exemptions or subsidies of the initial situation. Fourth, the uniform rate in the simulation scenarios is generally higher than the benchmark average weighted tariff rate. Still, there are welfare gains in all scenarios. These results suggest that although the policy simulation in this paper implies the reduction of the highest tariffs, lowering the level of the weighted average tariff is not

⁶ 'home' is one of the selected countries in which trade policy reform is performed.

⁷ Zero tariffs are typically applied on imports of services, and negative tariffs on imports of basic food products and oil.

a necessary condition for welfare gains, as long as the reform entails tariff uniformity. Nevertheless, within a country the lower the level of the uniform tariff, the larger the gains. Fifth, the tariff reform objective of improving welfare can be compatible with revenue-neutrality without altering domestic taxes.

The rest of the paper unfolds as follows: Section II cites some issues related with the discussion of optimum tariff structures. Section III presents an overview of the economic structure of the countries in the sample. Section IV describes the analytical framework that includes the main characteristics of the database, the model and the scenarios. Results are presented in Section V. Section VI contains the conclusions.

II. Issues in the Literature of Uniform versus Differential Tariffs

The problem of the revenue-constrained optimum tariff structure has been studied along two main approaches: (1) differential rates and (2) uniform rate. The proponents of differential tariffs base their arguments on the optimum taxation theory of Ramsey (1927) and Diamond and Mirrlees (1971). According to this theory optimum taxes are those that are set at a rate inversely proportional to the elasticity of demand, so that the whole system of taxes should not distort consumption. The fundamental underlying assumption of this theory is that goods are not substitutes but complements. Otherwise, consumers can avoid paying the higher tax substituting away for goods with lower tax rate, thereby distorting consumption.

The application of the optimum taxation theory to import tariffs is based on the demonstration of certain analogies between optimum tariffs necessary to raise revenue and the Ramsey taxes. Some recent studies in this line include Panagariya (1994) and Dahl et al. (1994). They argue that unless all imports have the same elasticity in demand,

the optimum structure of tariffs is non-uniform. With the assumption of zero cross-substitution effects among goods, their results support the view that the optimal tariff structure is non-uniform. Panagariya emphasized that rather the focus of uniform tariff rates should be on political-economy considerations as well as on administrative convenience and transparency. Hatta (1994) questioned the conclusions based on assumptions of complementary or no substitution. He argued that in the real economy high cross elasticities and substitutability among commodities dominates, which “*pulls the optimal commodity tax rates toward uniformity*” (Hatta 1994, page 205, 2nd paragraph). Hatta pointed out that divergences among tariff rates cause their own distortions in production. Thus, the application of the optimum taxation theory to import tariffs is not straightforward because tariffs act as both consumption tax and production subsidy.

Bertrand and Vanek (1971) and Hatta (1977) provide the theoretical basis for uniform tariffs as a means to obtain efficiency gains. These authors showed that as long as substitution among goods dominates welfare increases when extreme tariffs are eliminated, because it induces a more efficient resource allocation. Mitra (1994) pointed out that there should be no divergence between relative world prices and relative producer prices to attain production efficiency in the import-competing sectors protected with tariffs. Chambers (1994) noted that in a revenue-constrained economy, a uniform tariff is the best feasible tariff policy under certain conditions, which he called ‘*sufficient*’ conditions. While on the contrary, Lopez and Panagariya (1992) found that in the case of a pure imported input that is neither consumed in final demand or produced domestically, the substitutability condition for efficiency gains is impossible to satisfy. Panagariya

(1994) pointed out that the tariff on intermediate goods in general should be lower than that of final goods, though if the objective is protection and distortions in consumption can be ignored, a uniform rate could be justified as an optimal instrument.

In terms of political economy there is an agreement of the advantage of the uniform relative to differential tariff structure. Panagariya and Rodrik (1993) showed that tariff uniformity could increase efficiency by lowering the value of implicit rents captured by rent-seekers, so that resources can be reallocated into productive activities. For example in the case of the endogenous determination of the entire tariff structure, there is a "free-rider" effect of lobbying in one sector as protection spreads to all sectors in the context of uniform tariff. Additional advantages of the uniform rate cited in the literature include the administrative simplicity and transparency that lead to increase revenue collection and to reduce evasion problems (Dahl et al., 1994 and Subramanian (1994). From revenue perspective, Subramanian (1994) emphasized that the uniform rate is less harmful than other alternative trade reforms, since the reduction of the highest tariffs may be offset by the increase in the minimum ones.

At the empirical level, the welfare incidence of the uniform is compared with that of a differential tariff structure constructed based on the Ramsey rule, which has been labeled as the "optimum" tariff structure. Dahl et al. (1994) in a computable general equilibrium model of the case of Cameroon found that a uniform tariff is a close approximation to the 'optimum' differential tariffs if the rest of taxes in the economy are set optimal. Otherwise, the uniform rate can lead to welfare losses. Mitra (1992a) using a general equilibrium model of India found that although the "optimum" performs better than the uniform structure, the difference was rather small. Mitra noted that tariff

uniformity is likely to be a reasonably good policy in particular when the objective is non-discriminatory protection.

In terms of implementing a trade reform in the real world, if it were the case of analogy between revenue-raising tariffs and Ramsey taxes, the determination of the ‘true optimum’ differential tariff structure demands exhaustive knowledge of demand and cross-price elasticities, which typically does not exist. In practice, governments use the differential tariffs to fulfill different policy objectives, like protection to specific domestic industries, incentive to 'infant' industries, to raise revenue, or to fix balance of payment difficulties. However, it has been recognized that high and widely dispersed tariffs are part of the problem of low competitiveness and productivity in developing countries, as the comparative advantage may be hidden by the distorted cost-price signals to producers. Additional indirect costs of differential tariffs include higher possibility of smuggling and misclassification of products (Subramanian 1994 and Mitra 1992a).

In line with the recognition of problems that could stem from the practice of differential tariff structure in developing countries, the reforms supported by the World Bank⁸ through structural adjustment programs have been directed toward tariff uniformity. Rajaram (1994) in a review of the reforms undertaken during the 1980's found that the explicit recommendation of uniform rate as a goal was present in 45 percent of the programs. Nevertheless, the notion of tariff uniformity was present in all reforms via the recommendation of reducing the range of tariff dispersion, though some confusion existed regarding the tariff treatment of intermediate inputs. More recently,

⁸ The World Bank has contributed to the surge of trade liberalization since the 1980s (see Rajaram 1994).

Edwards (1997) pointed out that the design of new trade reforms supported by the World Bank incorporates the lessons of previous experiences. Even though each reform contains country-specific features, a common recommendation is the uniform import tariff, as well as the anticipation of fiscal impacts of trade reform.

III. Overview of the Economic Structure of the Selected Countries

This section presents some statistics that provide an overview of the economic structure and international trade of the selected countries. The source is the database of GTAP Version 4⁹ with base year 1995, which is used to implement the CGE models.

1. GDP and Trade

As can be seen in Table 1 column (1), the selected countries comprise a sample of economies of different size, as given by the share of their GDP in the world GDP. The significance of international trade in each country, measured with imports as the percentage of GDP, is given in column (2) (or percentage of exports in column (3)). These figures provide some indication of the expected magnitude of the static welfare effects of trade reform. The effects should be more important in countries where trade plays a significant role in the economy, like the Asian countries compared with that role in the Latin American countries. In some countries, as in Singapore, imports (or exports) are greater than GDP, which may be explained by the importance of assembling activities. In Brazil and Argentina imports (or exports) represented around ten percent of the GDP

⁹ Global Trade Analysis Project. The database is documented in “Global Trade Analysis. Modeling and Applications”, edited by Hertel (1997), and in GTAPinGAMS (Rutherford, 1998).

in the base year 1995. In contrast, in Asian countries of similar size of that of Brazil and Argentina, like China and Taiwan, trade represented more than thirty percent of GDP.

Columns (4) to (6) of Table 1 give the composition of imports by end-use. In the base year 1995 the bulk of imports in all selected countries was destined to intermediate use in production. The importance of intermediate inputs in total imports ranges from 65 percent in Thailand to 93 percent in Korea. In the rest of countries the proportion of intermediate imports is around 80 percent of total imports.

2. Tariff Revenue

Table 2 gives the structure of government revenue by main taxes in the selected countries. The figures in columns (3) to (5) give an idea of the existence of other distortions in the economy due to domestic taxes. Since the rates of these taxes are not altered in the policy examined in this paper, we focus on column (1) that shows the significance of import tariffs as revenue source in the selected countries. Tariffs accounted for more than 20 percent of total government revenue net of subsidies (except in Brazil and Argentina where tariffs represented less than ten percent). In particular, in Central America and Caribbean (CAM) and most of the Asian countries in the sample, tariffs contributed with more than 40 percent of revenues. In contrast, as can be seen in column (2), the role of export taxes is very small and in some countries the revenue from export taxes is negative, which represents a subsidy. To this regard, the policy analyzed in this paper is not aimed to change export taxes; rather the reform is on tariffs only¹⁰.

¹⁰ A more comprehensive trade reform would be to include a uniform subsidy on exports at the same level of the uniform rate, so that eliminating export bias in production, but in this case revenue raising could not be a policy objective, rather uniform protection.

3. Dispersion of Tariffs

In Table 3, the data correspond to collected tariffs defined as the ratio of tariff revenue to the value of imports CIF (cost, insurance and freight) of each good¹¹. It is important to note that the range of tariff dispersion depends upon the aggregation of sectors and regions. Table 3 gives the dispersion of nineteen goods and the rest of the world aggregated in six regions.

As is shown in column (1), there is an asymmetry in the level of the average weighted tariff in the selected countries. For example, the average rate was at a very low level in Singapore (1.4 percent) and Taiwan (6.2 percent). In contrast, the average tariff in India was 35.2 percent, Thailand 29.3 percent and in China 23.9 percent. A notable feature in the data is that the average tariff in the Latin American countries was relatively small (around 10 percent). This asymmetry allows the analysis of the implications of the level of the tariff on welfare effects of trade reform, since the revenue-neutral uniform rate remains close to the level of the average rate prior to the reform.

Columns (2) and (3) of Table 3 present the dispersion of tariffs given by the minimum and maximum tariffs across sectors. Tariffs range from negative and zero to very high values, like the upper limit of 195 in the case of Korea, Philippines, Thailand and Taiwan. In contrast, the upper limit of the tariffs in the Latin American countries is around 20 percent. Column (4) gives the dispersion in percentage points. Based on the figures of this column, the lower dispersion appears in the Latin American countries. In the case of the Asian countries the high dispersion is given by the extreme highest tariff

¹¹ See “Global Trade Analysis. Modeling and Applications”, edited by Hertel (1997), Chapter 3.

that is usually applied on imports of *grains*, which seems to be a strategic sector in those economies. In the case of the selected countries of Latin America, a characteristic of the data is that some imports, typically basic food products and oil, are subsidized. So that the lower bound with negative tariffs contribute to widen the range of tariff dispersion given in column (4), while this fact appears only in two of the Asian countries.

Columns (5) to (9) provide an indication of the dispersion of tariffs in terms of the proportion of imports under extreme low or high rates. In particular, column (6) gives the percentage of imports that were admitted duty-free in the base year. The case of Singapore is interesting as 79.7 percent of imports were exempted of tariff payments. Column (8) gives the percentage of imports with tariffs close to the average rate (the average plus and less 5 percentage points). In the case of countries with the highest extreme tariffs like Korea and Taiwan, 74.1 and 93.9 percent of imports, respectively, have tariffs close to the average rate. Consequently, the proportion of imports in the high tariff range (column (9)) was very small.

Table 4 contains some indicators of the 45 country/regions of the full database to provide an insight of import tariffs in a more global context. In this table tariff dispersion corresponds to the 50 sectors of the database. As can be seen in column (1), tariff revenue represents a significant source of revenue in the groups of developing countries, like Rest of Asia, Latin America, Africa and the Asian NICs. This contrast with the role of tariffs to raise revenue in developed countries, like USA, Canada and the countries of the European Union. Some exceptions of raising-revenue tariffs are Honk Kong that in the database appears with zero import tariffs, as well as 'Rest of Middle East' (RME) and 'Rest of South-Saharan Africa' (RSS) that have net import subsidies instead of positive

tariff revenue. Overall, the figures in column (1) confirm that in developing countries the tariff revenue loss becomes a critical issue when planning a trade reform.

In column (2) of Table 4, the average import tariff rate is lower in developed country/regions and in the Asian NICs, compared with that of the rest of countries, in particular in the group of Rest of Asia.

The range of tariffs given in columns (3) to (5) of Table 4, suggest that in general tariff dispersion is a feature of the tariff system at the world level. A high upper limit appears even in developed countries with relatively low average tariff. The larger tariff dispersion appears in the Asian countries. This contrast with the Latin American countries where the range of tariff dispersion is relatively small and a considerable proportion of the dispersion is explained by the extreme tariffs in the lower limit that in all cases are negative. Another feature of the tariffs in Latin America is that there are no extreme high tariffs compared with the rest of the countries. In fact, the upper limit is the lower of the countries in the database.

As can be seen in columns (6) to (8), in developed countries the share of imports subject to high tariffs is relatively small compared with that of developing countries. As an illustration, in the case of Japan with a relatively low average tariff and a large range of tariff dispersion (535.1 percentage points), more than 90 percent of imports have a tariff rate lower or close to the average of 8.5 percent. Similar situation appears for the USA, the European Free Trade Area (EFT) and all the European countries, as well as in the case of the Asian NICs. In the rest of groups of developing countries more than 20 percent of imports were subject to relatively high tariffs compared to their average tariff rate.

IV. Analytical Framework

The quantitative analysis of a tariff reform aimed to uniformity in a revenue-constrained economy is made using multi-region computable general equilibrium (CGE) models to calculate the uniform rate in the selected countries. In each country, the policy simulations consist of unilateral trade reforms aimed to replace the existing tariff structure with a uniform tariff, while maintaining government revenue unchanged at the benchmark level. The rest of taxes are left unaltered at the initial level and protection is not an objective of policy. Thus, in each country the wedge between domestic and imports prices reflects only the need of revenues to maintain the benchmark level of public expenditures.

The estimation of the CGE model is made using the General Algebraic Modeling System (GAMS) software with the MPSGE non-linear complementarity subsystem developed by Rutherford (1999).

1. Data

(a) Database:

All variables are aggregations from the GTAP version 4 database¹², with base year 1995. The full database contains 45 country/regions with the typical information of a social accounting matrix (SAM). That is, the input-output linkages of 50 sectors of production, 5 primary factors, and domestic and trade taxes. There is one representative agent in each country/region. In the database domestic tax rates are distinguished by taxes on output, on intermediate and on final private and public consumption. However, for the

¹² Global Trade Analysis Project (GTAP), Hertel (1997). For aggregation procedure see Rutherford (1998).

rest of taxes, including income tax, the information is aggregated in one single variable. Thus, in the CGE model revenue from these 'rest' of taxes is treated as a fixed exogenous parameter, which implies that it does not change with changes in production activities. In regard to import tariff rates, as was already mentioned, tariffs are collected bilateral rates. The implication for the analysis of a uniform tariff reform is that the dispersion of collected rates may be lower than the dispersion of nominal or official rates¹³.

(b) Data Aggregations:

The sample includes thirteen countries, of which eight are from Asia and five from Latin America, as follows: Korea, Indonesia, Philippines, Singapore, China, Taiwan, India, Central America and Caribbean, Argentina, Brazil, Chile and Venezuela. The rationale to select those countries, besides data availability, is to include in the analysis countries with a wide range of tariff dispersion in the benchmark equilibrium. For example, in 1995 the tariff structure of Chile was virtually uniform with an upper limit of 19.4 percent, while in Korea tariffs ranged from 0 to 195.3 percent. In some countries there are negative tariffs, i.e. subsidies to imports. The sample thus allows policy simulations under different scenarios that differ on the tax-base definition.

Production sectors were aggregated in nineteen sectors, while the CGE model retains the five primary factors of the full database. For each country in the sample (namely 'home'), the rest of the world is aggregated in six country/regions.

The aggregation of the rest of the world was made on basis of geographical location, except in the case of USA and Japan that are not grouped with other countries,

¹³ See Pritchett and Sethi (1994) for a detailed comparison of official and collected tariff rates.

because they are individually important trade partners of the selected countries. As can be seen in Table 5, imports from Japan represented more than 20 percent of total imports in the Asian countries except in the case of India where the most important trade partner was Europe with 35 percent of total imports. Imports from USA ranged from 8 to 23 percent of total imports in the Asian countries. In the selected Latin American countries the share of imports from USA ranged from 21 to 32 percent, while imports from Japan accounted for less than 10 percent of total imports. Europe, as a single region, is an important trade partner for both Asian and Latin American countries.

The list of regions, sectors and factors of the CGE model is presented in Table 6.

2. The Model

The model is a modified version of the core multi-region static model of the documentation of GTAP to use the database in applied economic analysis¹⁴. The GTAP model is formulated in the MPSGE code developed by Rutherford (1999), which correspond to the mixed complementary problem (MCP) formulation.

To examine the importance of revenue-constrained uniform tariff, the model is used to determine the tariff rate that generates the same level of revenue as before. This permits trade policy simulation without altering government revenues or restructuring the entire tax system. Accordingly, a modification in the model is the introduction of a constraint to maintain government revenues (or expenditures) of the 'home' country at the benchmark level in real terms. This is implemented as follows: First, the initial import tariff structure is replaced with an arbitrary uniform rate (say ten percent) along with a

¹⁴ See Rutherford (1998) that includes an algebraic description of the model.

tariff multiplier. Second, we let the model to endogenously determine the value of the multiplier that scales the uniform tariff. Thus, the level of this tariff is directly associated with the revenue requirement to meet benchmark government expenditures. It is important to note that the constraint is in terms of total government revenue, so that in the general equilibrium context of this analysis, revenue from the rest of taxes can change as response of changes in economic activity, though tax rates are fixed at the benchmark level. The constraint can be written as:

$$PG_h * \bar{G}_h = TOTAX_h$$

where PG_h is the shadow price of public expenditure, \bar{G}_h is the benchmark level of public expenditure, and $TOTAX_h$ is the level of tax revenue in the counterfactual scenarios. The subscript h stands for 'home country'.

The main assumptions of the model are:

(a) *Goods:*

All regions ' r ' (home and the rest of the world) can produce and trade the same set of goods, which though broadly similar are imperfect substitutes in demand, as they are distinguished from one another according to the country of origin (the Armington assumption¹⁵). Each composite of domestic and imported varieties of good type ' i ', namely the Armington composite, is formed via a nested CES function. In the first stage, domestic and an aggregate of imported varieties of the good are selected. Then, further substitution takes place by choosing varieties from different countries ' r ' to form the aggregate of imports of good ' i '.

¹⁵ Armington (1969).

(b) Production:

The production side of the model distinguishes nineteen sectors as listed in Table 6, of which five are agricultural and primary activities, nine manufacturing, four services sectors, and one savings/investment good. Firms behave competitively and technology is characterized by constant returns to scale. Domestic output consists of goods produced for domestic and exports markets. It is assumed that these two types of goods are not perfect substitutes in production and firms can move along a constant-elasticity transformation frontier (with elasticity of transformation ' η_{DX} ' defined in table 7) in supplying the domestic and foreign markets.

Inputs to production comprise primary factors and intermediate inputs. The production function is assumed to have a nested Leontief-CES form. At the top level, intermediate inputs and the value added are used in fixed proportion to output (Leontief function). At the second level, value added is formed by a Cobb-Douglas production function using the five primary factors that include two types of labor (skilled and unskilled), capital, land and resources. All factors are mobile across sectors but immobile across country/regions. At the same level of the nested production function, demand of an intermediate input is represented as an aggregate of domestic and imported goods (Armington composites), which in turn is formed by a CES function as above described.

The Leontief formulation of the top level of the function implies that in a counterfactual equilibrium the composition of intermediate inputs is not responsive to relative prices. However, the nested structure allows the proportion of domestic and imported intermediate goods to be responsive to relative prices gross of applicable taxes.

(c) Consumption:

The representative agent in each country/region maximizes utility subject to a budget constraint. Consumers are assumed to have a Cobb-Douglas utility function defined over Armington composites of the nineteen goods. In the second stage of the utility function the representative agent determines the allocation of private demand of each type of good between imports and domestically produced varieties. Then, imports are selected from different country of origin.

(d) Government:

The level of public expenditure is exogenously fixed due to the revenue-neutral constraint. Public expenditure is formed with goods of the domestic/imports composite using a Cobb-Douglas functional form. Thus, although at the aggregate level Government demand is fixed, its composition is responsive to relative prices gross of taxes.

Note that this model utilizes the usual assumption of same CES function for different types of demands --intermediate, private consumption and government-- of the domestic/imports aggregate. Likewise, following the conventional use of the Armington assumption in trade models, domestic and imported varieties are assumed more differentiated in demand than are the imported varieties from different foreign countries. Consequently, the elasticity of substitution between domestic and imported goods is lower than the elasticity of imports from different sources¹⁶.

¹⁶ In general the elasticity between domestic/imports is around the half the elasticity among different import sources. See Global Trade Analysis Project (GTAP), ed. Hertel, 1997, Chapter 4

(e) Terms of Trade:

The trade side of the model contains price-responsive exports and import relationships, which is given by the Armington elasticity of substitution between domestic and imported varieties of a good as well as the substitution among imports from different source. One consequence of this assumption is that even small countries can have market power on world markets, so that affecting the terms of trade. The terms of trade effect depends on the value of the Armington elasticities. The lower the elasticity the higher the potential terms of trade effect, as goods are highly differentiated by country of origin.

(g) Equilibrium Conditions:

The model estimates correspond to the equilibrium solution of an Arrow-Debreu economy, which is described in a set of non-linear equations that relates the interaction between producers and consumers. Equilibrium is defined by three sets of equations or conditions that follow the representation of an Arrow-Debreu economy presented by Mathiesen (1985)¹⁷. These conditions can be summarized as follows:

Income Balance: The model distinguishes between private and government budget constraints and allows for saving and investment. Consumer expenditure of the representative agent is equated to income, which is the sum of factor earnings net of taxes and government transfers. The representative agent uses total income to purchase consumption goods and savings. Given the static setting of this analysis, the level of savings is exogenously fixed at the base year level. To close the model, net international

¹⁷ Also see Rutherford (1998 and 1999).

capital inflows (deficit or surplus in trade balance) are allocated to the representative agent. This variable is also treated as an exogenous parameter fixed at its benchmark level. The balance of public expenditure with government revenue is given by the revenue-neutral constraint.

Market Clearance: In all goods and factors markets prices are flexible, so that supply equals demand. Demand is distinguished into private consumption, public sector use and intermediate demand in production. Aggregate demand plus domestic investment equates aggregate supply.

Zero Profits: As was already mentioned, production is characterized by perfect competition and constant-returns technology. Consequently, producers earn zero profit in equilibrium.

3. Benchmark Replication

The data above described are employed to calibrate the CGE model. Therefore, the benchmark replication corresponds to the situation of the selected countries in the base year 1995. A characteristic of the benchmark equilibrium is that by choice of units, world prices are set equal to unity.

To calibrate the model, the value of the elasticities of transformation and substitution are picked from the core multi-regional static model of the ‘GTAPinGAMS’ documentation (Rutherford, 1998), which are the standard values used in trade models¹⁸. In the case of the Armington elasticity, as was already mentioned, assuming values not equal to infinite leads to terms of trade effects in all regions considered in the model.

¹⁸ These values come from econometric estimates (Harrison et al. (1997)). Also see Chapter 4 of “Global Trade Analysis, Modeling and Applications” (1997) edited by T. Hertel.

From the domestic equilibrium perspective, a high elasticity value implies more homogeneous goods and more specialization in 'home' country when opening up to trade.

Table 7 gives the 'basic' elasticity values used to replicate the benchmark and to perform policy simulations.

Table 7: Basic Elasticities of Transformation and Substitution

Symbol	Name	Value
η_{DX}	Elasticity of transformation --domestic and exports	2
σ_{DM}	Elasticity of substitution --domestic and imports	15
σ_{MM}	Elasticity of substitution --imports from different country	30
σ_Y	Elasticity of substitution in production --intermed inputs and value added	0
σ_{VA}	Elasticity of substitution in value added	1
σ_{PC}	Elasticity of substitution in private consumption	1
σ_{GOV}	Elasticity of substitution in government consumption	1

The value of the Armington elasticities, σ_{DM} and σ_{MM} , corresponds to the “central” elasticities used by Harrison et al. (1997) in a quantitative evaluation of trade policy in Chile. Although some econometric studies suggest lower elasticity values, Harrison et al. argued that high Armington elasticity reflects the situation of small open economies as they are characterized by low or no world market power. Nevertheless, since the elasticity of substitution between domestic and imported goods is critical for the effects of trade policy, the sensitivity of the results to the value of these parameters is examined using lower values to perform policy simulations. Two alternative sets are considered, $\sigma_{DM} = 4$, $\sigma_{MM} = 8$ referred as low elasticities, and $\sigma_{DM} = 8$, $\sigma_{MM} = 15$ referred as medium elasticities.

4. Simulation Scenarios

The calibration of the model to the database constitutes the benchmark scenario. Then, analysis of trade policy proceeds by comparing the results of the counterfactual scenarios with this benchmark situation. Four scenarios are considered that differ by the tax-base to apply the uniform rate. To this aim imports are distinguished according to the tariff treatment received in the benchmark situation, as follows (a summary is presented in table 8):

1. UNIF: In this scenario the uniform tariff is levied on imports of all goods and services, regardless of their treatment in the initial situation.
2. UNIF_EXS: In this scenario there are two tariff levels: (1) Uniform tariff levied on imports of all goods, and (2) zero tariff on imports of services that were duty free in the benchmark situation. Services with nonzero tariff in the initial situation are taxed with the uniform rate.
3. UNIF_EXSG: In this scenario, as in the UNIF_EXS scenario, there are two tariff levels. (1) Uniform tariff levied on goods and services that were taxed with a positive rate in the benchmark, and (2) zero tariff on imports of goods and services that were admitted duty free or subsidized in the base year. Thus, in this scenario the tariff is zero on goods or services with zero or negative tariffs in the base year.
4. UNIF_EXSU: This scenario is estimated in the case of countries with negative tariffs at the level of sector aggregation considered in the CGE model. In this scenario there are multiple tariff levels. Uniform tariff is levied on goods and

services that were taxed in the benchmark with a positive rate, while benchmark zero and negative tariffs are retained.

V. Results

This section reports the main results of the counterfactual scenarios focussing on welfare effects. Welfare change is the Hicksian equivalent variation, defined as the variation in the value of the expenditure function in the simulation scenarios, with respect to its value in the benchmark equilibrium. Thus, a positive figure indicates welfare improvement.

It is important to note that welfare changes in this analysis refer to the traditional effects from reallocation of resources due to trade reform. The model does not capture other gains associated with uniform tariffs, such as minimization of rent-seeking activities and administrative costs, or the reduction of evasion problems.

1. Welfare Effects

Graph 1 presents the estimates of welfare effects of the UNIF scenario using the 'basic' Armington elasticities. The selected countries were arranged in ascending order of welfare changes. As can be seen in this graph, in all countries the policy of uniform rate has positive welfare effects compared with the initial situation. These results suggest that in fact there is a cost associated with tariff dispersion and, consequently, there is an efficiency gain when this distortion is removed.

Although the uniform tariff reform leads to positive welfare effects in all selected countries, there is an asymmetry in the magnitude of the gains across countries. A notable feature is that the Latin American countries obtain lower welfare gains compared with the gains in the Asian countries. The outcome of the size of the gains is associated with the

initial tariff dispersion and role of trade. As can be seen in Graphs 2 and 3, the Latin American countries appear with relatively low tariff dispersion and role of trade. This explains the relatively low welfare gains in this group of countries, ranging from 0.3 percent in Argentina to 1.5 percent in CAM. In the case of CAM the gains are larger than the gains of the other Latin American countries because although it has low tariff dispersion (similar to that of Brazil), imports represent a significant proportion of GDP. In the group of Asian countries, one interesting result is the case of Singapore that has the lowest tariff dispersion of the selected countries and at the same time it has the largest role of trade. Thus, in this country welfare gains of the uniform tariff rate are of a sizable magnitude (3.1 percent in the UNIF scenario). In most of the Asian countries characterized by highly dispersed tariff structure combined with important role of trade, the tariff reform leads to huge welfare gains, ranging from 1.5 percent in Indonesia to 8.9 percent in Thailand. In particular, the gains of Thailand, Philippines, China and Korea are more than six times the gains of the Latin American countries.

Table 9 presents the model estimates of welfare change by scenario. The results in Graph 1 above commented are robust to the alternative scenarios that differ by the tax-base definition. In general, within a country welfare gains are larger in the UNIF scenario, where the uniform rate is applied on the broader tax-base. In this scenario all imports are taxed regardless of the tariff treatment of the initial situation; that is, the uniform rate is universally applied. The welfare effects in the scenarios UNIF_EXS and UNIF_EXGS are basically the same because in the database zero tariffs are mainly applied on imports of services, which are already considered in the UNIF_EXS scenario. The exception is the case of Singapore, with a large share of imported goods subject to zero tariffs. In this

country welfare gains in the UNIF_EXGS are lower than in the scenario UNIF_EXS. In countries with negative tariffs in the benchmark data, the gains of the scenario that retains both zero and negative tariffs (UNIF_EXSU) are smaller than those of the rest of scenarios.

It is important to note that the rest of taxes were unaltered. Thus, welfare gains in this analysis arise in spite of the structure of the rest of taxes. These results contrast with those of Dahl et al. (1994) for the case of Cameroon as they obtained welfare gains in the uniform-rate scenario only if the rest of taxes were modified and set optimal. Otherwise, in their estimates the uniform tariff resulted in losses with respect to the initial situation. Even so, there are some differences in the CGE model of Dahl et al. and the model in this analysis that could explain the difference of the results. The most important are: (i) the difference in sectors aggregation that include 7 goods in the model of Dahl et al. compared with 19 in this model; and (ii) the assumption about factors mobility. Dahl et al. treat capital as sector-specific, while here capital is mobile across sectors¹⁹.

2. Level of the Revenue-Neutral Uniform Rate

As can be seen in table 10, the level of the revenue-neutral uniform rate is close to that of the initial weighted average rate. This similarity stems from the constraint to maintain unchanged the benchmark level of government revenues. Thus, the tariff reform analyzed in this paper does not lead in general to a lower uniform tariff rate relative to the level of the benchmark average tariff. Moreover, in most cases the uniform tariff is larger

¹⁹ The treatment of capital as sector-specific introduces rigidities in the model that makes the economy less responsive to policy changes, so that the results are more likely to reflect short-run effects, compared with the effects in the long run when all substitution possibilities can take place. (For more details of the consequences of sector-specific factors in general equilibrium models see, for example, Mayer (1974)).

than the benchmark average. Nevertheless, depending on the tax-base there are some differences in the level of the uniform rate across scenarios. As expected, the lower tariff rate is generally that of the UNIF scenario with the broader tax-base. The larger uniform tariff appears in the scenario UNIF_EXSU.

Combining the results of tables 9 and 10 provides an interesting illustration about the level of the uniform tariff rate and the welfare implications of the policy of eliminating the distortion of relative prices associated with tariff dispersion. For example, in the case of Thailand and India the uniform rate is around 33 and 28 percent, respectively, which can be considered a relatively high tariff (relative to standard recommendations of 10 percent or less than 15 percent²⁰). Yet, in both countries the results show welfare gains of a sizable magnitude from replacing the initial tariff structure with a revenue-neutral uniform tariff. Another special case is given by the results of Singapore, where the level of the benchmark average tariff was very low (1.38 percent). In the counterfactual scenarios the uniform rate is larger than the benchmark average, especially in the UNIF_EXGS scenario. Nevertheless, there is a positive welfare effect from tariff uniformity, even in the UNIF_EXGS scenario in which the tax-base for the uniform rate covers only 20 percent of imports, while the benchmark zero tariffs on 80 percent of imports are retained.

Additionally, the results by scenarios within a country suggest an inverse relationship between the size of welfare gains and the level of the uniform tariff, which is associated with the tax-base definition. In general, the lowest uniform tariff and the

²⁰ Mitra (1992b) refers to a tariff of no more than 15 percent, Rajaram (1994) points out that high uniform rates, say 30 percent, are not recommended.

largest welfare gain appear in the UNIF scenario (except in the case of Philippines where the higher uniform rate is in the UNIF scenario). This can be explained because in the UNIF scenario the tariff rate is universal (no exemptions). In contrast, the highest uniform tariff and lowest welfare gain are in the UNIF_EXSU scenario.

3. Sensitivity Analysis of the Results

(a) To the Elasticity of Substitution

In this section we investigate how sensitive are the results to the value of the key parameters in the CGE model, which in this analysis are the Armington elasticities. To this end the simulation scenarios also are performed with two sets of elasticity values (low and medium elasticities). As before, we assume that all changes in tariffs are revenue-neutral.

Without exceptions the results in Table 11 confirm the previous results. In each of the thirteen selected countries and in the four policy simulations the direction of positive welfare change is maintained in the low and medium elasticity scenarios. Thus, a positive welfare effect of the revenue-neutral uniform tariff is robust to different elasticity values.

However, the magnitude of the gains is sensitive to alternative elasticity values. The model estimates in Table 11 indicate that the higher the elasticity the higher the welfare gains. This can be explained because higher substitution possibilities between domestic and imported goods provide a wider scope for the trade reform to affect the economy. Thus, under the 'basic' elasticity values, welfare gains of sizable magnitude are more generalized in the selected countries, especially in the case of the Asian countries. In the scenarios with low elasticity values the gains are relatively low in some countries, especially in the selected countries of Latin America, though the size of the gains in these

countries does not vary in a large extent with different elasticity values, except in the case of CAM.

(b) *To Heterogeneous Elasticity of Substitution*

As was described in Section IV of this paper, the CGE model assumes the same value of the elasticity of substitution between imported and domestic varieties for all goods. The implication of this assumption is that the import demand elasticity is homogenous across different types of goods. Since heterogeneity of the import demand elasticity is the basis to argue against the uniform tariff, the sensitivity of the results to the assumption of homogenous elasticity was also tested. To this end, the Armington elasticity of substitution between imported and domestic varieties is redefined as $\sigma_{DM(i)}$, so that each good can have a different elasticity value. Then, we let the model to randomly generate these elasticities between certain range of values. In the case of the elasticity among imports from different sources, $\sigma_{MM(i)}$, we maintain the assumption that it is the double of $\sigma_{DM(i)}$. Subsequently, the model is solved with the new set of elasticity values, repeating the procedure one hundred times. This analysis was performed for the tariff reform of the UNIF scenario and for two countries of the sample: CAM and Thailand. The rationale to select these countries is to include one country with relatively small welfare gains (CAM) and the other one with larger gains (Thailand).

Graphs 4 and 5 present the frequency distribution of welfare changes (EV) using three ranges of elasticity values: (i) from 0 to 15.0, (ii) from 1.5 to 15.0, and (iii) from 0.75 to 22.5. Results are arranged by frequency of EV values.

As can be seen in both graphs the probability of a positive welfare change is 100 percent. In Graph 4, the range of EV values (in percent terms) in the case of CAM goes

from 0.4 to 1.7. There are no negative or zero values. In the lower tail, welfare changes between 0.4 to 0.6 percent have a 3 percent of probability, while high EV values, ranging from 1.5 to 1.7 occur with a probability of 5 percent. The probability of getting welfare gains ranging from 25 percent less and plus the EV obtained with the homogenous Basic elasticity (EV equal to 1.5 percent) is 66 percent. In the case of Thailand with a welfare gain of 8.9 percent in the UNIF scenario using the homogeneous 'Basic' elasticity values, the results in Graph 5 show that EV values range from 2.5 to 10.0. In the lower tail the probability of getting EV between 2.5 to 3.5 is 2 percent and in the tail of upper values the probability of EV values between 9 to 10 is 5 percent. The probability of welfare gains between 25 percent less and plus the EV using the Basic homogenous elasticity is 51 percent.

The results in these graphs show that a positive welfare effect of the uniform rate in this analysis does not depend on the assumption of homogenous import demand elasticity. However, the magnitude of the gains does depend on the elasticity value in a similar pattern to that of different values of the homogeneous elasticity analyzed in the previous subsection. In both graphs the EV frequency distribution using elasticities between the range of 0.75 to 22.5 is skewed to the right, which contains the larger EV values. The opposite comes about with the estimates using elasticity values ranging from 0 to 15.

(c) *To Region Aggregation*

Since different regional aggregations could imply different range of tariff dispersion, the sensitivity of the results to this data handling is examined for six countries of the sample, three from Asian and three from Latin America. To this aim, the results of

the model with 7 regions (home and the rest of the world in six regions) are compared with the estimates of a two-region model where the rest of the world is aggregated in one single region.

As can be seen in Table 12, the positive welfare effect of the uniform tariff also is robust to region aggregation. In regard to the magnitude of the effect, welfare gains are larger in the seven-region model because in this case the model estimates account for differential tariffs across both sectors and countries of origin of the import. This is more evident in the case of China where the tariff dispersion in the seven-region aggregation is 105.1 percentage points compared with 77.2 percentage points in the two-region aggregation. This augmented tariff dispersion combined with a significant trade leads to much larger welfare gains than those of the two-region model. In the case of Singapore with a tariff dispersion of 38.4 percentage points in the seven-region aggregation compared with 27.0 percentage points in the two-region aggregation, combined with a highly significant trade, welfare gains of the seven-region model more than double those of the two-region model. In the case of Taiwan, trade plays an important role in the economy but tariff dispersion in the seven-region aggregation is not far from that in the two-region aggregation. Consequently, welfare gains though larger in the seven-region model are rather similar to those in the two-region model. In the Latin American countries, the tariff dispersion of CAM in the seven-region aggregation (56.9 percentage points) almost double that of the two-region aggregation (33.7 percentage points). This combined with significant trade leads to welfare gains in the seven-region model that almost double those of the two-region model. In Brazil and Venezuela, although the tariff dispersion is larger in the seven-region aggregation, the difference is basically explained

by a widening in the lower limit that corresponds to negative tariffs applied on a very small proportion of imports (see Table 3). Thus, welfare gains in both two- and seven-region aggregations are quite similar.

By scenario, the larger welfare gains appear in the UNIF scenario in the two-region model estimates, which is the same situation in the estimates using the seven-region aggregation.

VI. Conclusions

1. The results show that starting with a dispersed tariff structure the 'home' country can benefit by eliminating the distortion created by differential tariffs across sectors. The welfare gains are larger in the scenario that entails more uniformity (UNIF) compared with the gains in the scenarios where the benchmark zero and negative tariffs are retained.
2. There is more likely to have sizable welfare gains if the initial tariff structure is highly dispersed combined with a significant role of trade in the economy. The later measured with imports as the percentage of GDP. This result is on line with the argument that the elimination of extreme tariff distortions is a condition for welfare-improving piece-meal tariff reforms presented by Bertrand and Vanek (1971) and Hatta (1977).
3. Lowering the level of the weighted average tariff rate is not a necessary condition for welfare improving trade reform as long as the reform is aimed to tariff uniformity, because the uniform rate policy entails lowering the level of the highest tariffs. Nevertheless, within a country the lower the uniform tariff the larger the magnitude of welfare gains.

4. Taking into account that in the database the intermediate inputs represent the bulk of imports in the selected countries, the results also illustrate that welfare gains can be obtained by imposing the uniform rate without discriminating by end-use.
5. The results of a positive welfare effect from the uniform tariff policy are robust to different values of the elasticity of substitution between domestic and imported goods, as well as to the assumption of homogeneous or heterogeneous import demand elasticity across goods. Nevertheless, the magnitude of the gains does depend to some extent on the substitution possibilities. The higher the value of the Armington elasticity, the larger the welfare gains.
6. The positive welfare effect of the uniform rate is robust to alternative regional aggregations. Additionally, the sensitivity analysis of the results to region aggregation points up that the magnitude of welfare gains in the context of a trade reform aimed to tariff uniformity might be sensitive to region aggregation if it implies changing the range of tariff dispersion of the initial situation. This also suggest that if tariffs are discriminated across sources of the import, the 'home' country can obtain additional welfare gains when the uniform rate is applied without discrimination across countries of origin of the imports.

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Table 1: Main Economic Indicators of Selected Countries in 1995

Country	GDP (as % of World GDP)	International Trade (as % of each country GD		Imports Structure by Demand Market (In % of total Imports)		
		Imports CIF	Exports FOB	Intermediate	Consumption	Government
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Asia</u>						
Korea	1.51	39.86	37.33	93.45	6.46	0.09
Indonesia	0.74	26.98	28.36	77.22	13.55	9.22
Philippines	0.23	62.66	46.95	80.09	19.83	0.08
Singapore	0.21	242.24	232.21	86.19	13.43	0.38
Thailand	0.51	64.83	52.25	64.80	32.92	2.28
China	2.12	31.83	39.65	80.32	17.08	2.60
Taiwan	0.96	44.68	53.19	85.22	14.54	0.24
India	1.07	14.93	14.30	79.17	19.16	1.67
<u>Latin America</u>						
CAM *	0.30	58.80	47.17	74.86	18.98	6.16
Argentina	0.98	9.67	9.40	81.17	14.94	3.89
Brazil	2.42	10.85	8.45	85.43	14.23	0.35
Chile	0.21	34.29	35.04	81.13	18.83	0.04
Venezuela	0.27	23.88	28.20	67.35	31.61	1.05

CAM: Central American and Caribbean

Source: Global Trade Analysis Project (GTAP) Version 4.

Table 2. Government Revenue from Main Taxes in Selected Countries in 1995

As % of Total Net Taxes (Subsidies are included)

Country	International Trade		Domestic Taxes			Total Taxes
	Import Tariff	Export Tax	Production Tax	Intermediate Consumption	Other Taxes	
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Asia</u>						
Korea	26.61	-0.18	85.53	7.91	-19.87	100.00
Indonesia	38.08	0.00	-8.58	0.00	70.50	100.00
Philippines	76.70	-0.19	54.59	-0.18	-30.92	100.00
Singapore	25.72	0.05	45.19	22.74	6.30	100.00
Thailand	154.01	-18.28	45.21	0.00	-80.94	100.00
China	49.03	-2.89	107.43	32.14	-85.71	100.00
Taiwan	18.30	-0.37	35.68	10.60	35.79	100.00
India	43.61	0.73	57.65	17.51	-19.50	100.00
<u>Latin America</u>						
CAM	45.76	2.18	-5.10	12.00	45.16	100.00
Argentina	9.26	1.33	0.00	-0.04	89.45	100.00
Brazil	6.84	2.06	-13.38	39.31	65.17	100.00
Chile	29.07	1.44	27.51	21.11	20.87	100.00
Venezuela	32.57	2.85	0.00	28.13	36.45	100.00

Source: Global Trade Analysis Project (GTAP) Version 4.

Table 3: Average Tariffs and Rate Dispersion in Selected Countries in 1995

Sample: 7 country/regions, 19 sectors.

Country	Tariff Rate				Percentage of Imports by Range of Tariffs				
	Average	Dispersion			Negative Tariff	0 Tariff	0 to Avg-6	Avg - + 5	Avg +6 to UP limit
		Lower	Upper	Points					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
<u>Asia</u>									
Korea	8.1	0.0	195.3	195.3	0.00	9.29	11.67	74.10	4.94
Indonesia	11.9	0.0	54.7	54.7	0.00	17.26	20.59	47.62	14.53
Philippines	17.1	0.0	195.3	195.3	0.00	17.99	16.28	43.12	22.62
Singapore	1.4	0.0	38.4	38.4	0.00	79.69	0.00	14.92	5.39
Thailand	29.3	0.0	194.6	194.6	0.00	18.92	17.57	23.09	40.42
China	23.9	-12.0	93.1	105.1	1.76	8.83	33.98	39.50	15.93
Taiwan	6.2	0.0	194.5	194.5	0.00	4.44	0.22	93.86	1.48
India	35.2	-15.5	106.3	121.8	0.02	13.64	23.72	1.52	61.10
<u>Latin America</u>									
CAM	7.7	-24.2	32.7	56.9	6.88	11.22	4.63	59.37	17.90
Argentina	8.7	-22.2	26.1	48.3	0.08	17.94	2.56	61.66	17.76
Brazil	11.9	-29.8	29.5	59.2	0.48	18.78	11.79	28.68	40.27
Chile	9.2	-23.5	19.4	42.9	1.20	16.38	0.11	74.23	8.08
Venezuela	9.0	-22.3	19.4	41.6	2.15	25.95	0.00	50.55	21.35

NOTE:

(1) Imports of services are typically duty free.

(2) Negative tariffs are applied mainly on imports of basic food and oil.

Source: Global Trade Analysis Project (GTAP) version 4.

Table 4: Import Tariffs Indicators in 1995

Country/Region	Tariff revenue (as % of total tax revenue)	Import Tariff Rate				% of Imports by Range of Tariff		
		Average	Dispersion		Points	LO Limit to Avg-6	Avg - + 5	Avg +6 to UP Limit
			Lower	Upper				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>OECD* (No Europe)</u>								
JPN Japan	7.7	8.5	0.0	535.1	535.1	84.0	11.9	4.1
USA United States of America	1.8	2.5	0.0	287.8	287.8	36.3	55.0	8.8
CAN Canada	2.7	1.6	0.0	86.1	86.1	74.3	17.0	8.7
AUS Australia	8.2	6.8	0.0	59.0	59.0	35.7	44.6	19.7
NZL New Zealand	5.9	2.9	0.0	44.4	44.4	47.7	39.6	12.7
TUR Turkey	14.0	5.5	0.0	90.3	90.3	16.5	77.7	5.9
<u>EUROPE</u>								
GBR United Kingdom	4.5	3.3	0.0	128.7	128.7	65.3	26.8	7.9
DEU Germany	3.7	3.1	0.0	128.7	128.7	67.1	24.5	8.4
DNK Denmark	3.4	2.9	0.0	128.7	128.7	76.5	14.4	9.1
SWE Sweden	1.9	1.5	0.0	128.7	128.7	75.4	19.1	5.5
FIN Finland	2.5	1.7	0.0	128.7	128.7	69.2	25.2	5.6
REU Rest of EU	6.5	3.8	0.0	128.7	128.7	73.3	20.0	6.7
EFT European Free Trade Area	9.3	4.8	0.0	501.0	501.0	76.7	18.6	4.7
CEA Central European Associates	17.0	6.7	-17.9	61.8	79.7	21.5	65.1	13.3
<u>ASIAN NICs</u>								
KOR Korea	26.6	8.1	0.0	195.3	195.3	24.7	71.7	3.7
HKG Hong Kong	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
SGP Singapore	25.7	1.4	0.0	49.9	49.9	80.5	13.5	6.1
TWN Taiwan	18.3	6.2	0.0	194.5	194.5	13.2	82.7	4.1
<u>REST OF ASIA</u>								
IDN Indonesia	38.1	11.9	0.0	60.0	60.0	43.3	39.4	17.4
MYS Malaysia	69.9	9.1	0.0	195.2	195.2	23.7	65.2	11.1
PHL Philippines	76.7	17.1	0.0	195.3	195.3	35.7	47.7	16.6
THA Thailand	154.0	29.3	0.0	200.0	200.0	33.3	30.9	35.8
VNM Vietnam	114.3	18.7	0.0	150.0	150.0	60.4	11.3	28.3
CHN China	49.0	23.9	-35.4	180.9	216.3	48.2	27.8	24.0
IND India	43.6	35.2	-15.5	355.0	370.5	37.6	3.2	59.2
LKA Sri Lanka	66.8	18.1	-15.5	250.0	265.5	53.5	17.0	29.6
RAS Rest of South Asia	120.9	63.8	-15.5	300.0	315.5	20.9	29.7	49.3
<u>LATIN AMERICA</u>								
MEX Mexico	6.8	2.4	-23.1	20.0	43.1	74.0	4.9	21.1
CAM Central America and Caribbean	45.8	7.7	-97.1	45.0	142.1	20.1	56.9	23.1
VEN Venezuela	32.6	9.0	-25.0	20.0	45.0	28.6	48.7	22.7
COL Colombia	17.2	9.2	-25.0	67.1	92.1	28.2	50.3	21.4
RAP Rest of Andean Pact	20.2	9.5	-98.4	39.8	138.2	21.4	57.4	21.3
ARG Argentina	9.3	8.7	-25.0	34.6	59.6	23.2	55.4	21.4
BRA Brazil	6.8	11.9	-29.7	35.0	64.7	30.5	27.6	41.9
CHL Chile	29.1	9.2	-25.0	21.3	46.3	19.6	73.4	7.1
URY Uruguay	24.1	12.8	-25.0	67.1	92.1	19.9	58.2	21.9
RSM Rest of South America	93.6	9.6	-25.0	20.0	45.0	22.5	55.8	21.7
<u>AFRICA</u>								
MAR Morocco	35.3	14.4	-21.2	45.0	66.2	37.5	34.9	27.6
RNF Rest of North Africa	41.1	16.2	-97.1	186.1	283.2	30.7	47.4	21.9
SAF South Africa	8.6	8.0	-7.5	83.0	90.5	61.0	22.0	17.0
RSA Rest of South Africa	20.0	7.0	-7.5	45.0	52.5	26.1	50.1	23.9
RSS Rest of South-Saharan Africa	-2.0	-0.9	-99.6	50.0	149.6	57.0	5.6	37.4
<u>REST OF REGIONS</u>								
FSU Former Soviet Union	1.0	1.2	-7.0	12.6	19.6	67.4	25.6	7.0
RME Rest of Middle East	-3.3	-2.6	-100.0	37.2	137.2	46.5	10.7	42.8
ROW Rest of the World	76.7	36.0	0.0	196.1	196.1	57.5	17.8	24.7

* Mexico became OECD member in 1994 but in this table it is listed in "Latin America" because of tariffs similarity with this region.

SOURCE: Global Trade Analysis Project (GTAP), Version 4. Full database (45 country/regions and 50 sectors)

Table 5: Imports by Country/Region of Selected Countries in 1995

Country	Imports CIF (In % of 'home' Total Imports)						TOTAL
	Japan	Rest of Asia	USA	Latin America	Europe	Rest of World	
<u>Asia</u>							
Korea	25.9	16.6	23.0	2.7	15.1	16.7	100.0
Indonesia	20.0	26.8	8.3	2.6	29.8	12.4	100.0
Phillipines	20.7	25.9	17.0	2.4	20.0	14.1	100.0
Singapore	20.5	38.2	14.1	1.1	15.9	10.3	100.0
Thailand	20.4	27.0	17.6	2.1	20.5	12.4	100.0
China	19.3	38.5	10.6	2.4	19.4	9.9	100.0
Taiwan	32.2	22.5	20.9	2.1	16.0	6.2	100.0
India	7.7	19.2	12.0	2.4	35.2	23.6	100.0
<u>Latin America</u>							
CAM	3.8	14.9	32.2	14.8	24.0	10.4	100.0
Argentina	3.1	9.5	20.5	28.2	33.9	4.9	100.0
Brasil	5.5	10.6	22.1	18.9	30.4	12.4	100.0
Chile	6.6	13.7	22.6	25.2	24.7	7.2	100.0
Venezuela	3.3	7.7	30.3	19.8	29.1	9.8	100.0

Source: Global Trade Analysis Project (GTAP) version 4.

Table 6: List of Country/Regions, Sectors and Factors in the CGE model

Country/Regions

1 Home country:

Asia

KOR	Korea
IDN	Indonesia
PHL	Philippines
SGP	Singapore
THA	Thailand
CHN	China
TWN	Taiwan
IND	India

Latin America

CAM	Central America and Caribbean
ARG	Argentina
BRA	Brazil
CHL	Chile
VEN	Venezuela

2 USA	United States of America
3 JPN	Japan
4 RAS	Rest of Asia
5 LAM	Latin America
6 EUR	Europe
7 ROW	Rest of the World

Production Sectors

1 GRO	Paddy rice, Wheat and Grains
2 OCR	Vegetables, Fruits, Sugar cane, and Crops n.e.c.
3 OAP	Bovine cattle, Milk, Wool and Animal products n.e.c.
4 FFS	Forestry and Fishing
5 ENO	Energy (coal, oil and natural gas) and Other minerals
6 OFP	Manufactured food products, Beverages and Tobacco
7 TWL	Textiles, Wearing apparel and Leather goods
8 LUP	Lumber, Wood, Pulp and Paper
9 P_C	Petroleum and Coal products
10 CRP	Chemicals, Rubber and Plastics
11 NMM	Non-metallic mineral products
12 MET	Metals and Fabricated metal products
13 MVO	Motor vehicles and Other transport equipment
14 EOM	Electronics, Machinery, and Other manufacturing
15 EGW	Electricity, Gas, and Water
16 CNS	Construction
17 T_T	Trade and Transport
18 SER	Other Services (private and public)
19 CGD	Savings good

Primary Factors

1 LND	Land
2 SKL	Skilled Labor
3 LAB	Unskilled Labor
4 CAP	Capital
5 RES	Natural Resources

Table 8. Assumptions on Imports Tariffs in Policy Scenarios

Category of Imports	Scenarios			
	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU
Goods				
BMK (+) tm	uniform tariff	uniform tariff	uniform tariff	uniform tariff
BMK (0) tm	uniform tariff	uniform tariff	0	0
BMK (-) tm	uniform tariff	uniform tariff	0	BMK tariff
Services				
BMK (+) tm	uniform tariff	uniform tariff	uniform tariff	uniform tariff
BMK (0) tm	uniform tariff	0	0	0
BMK (-) tm	uniform tariff	0	0	BMK tariff

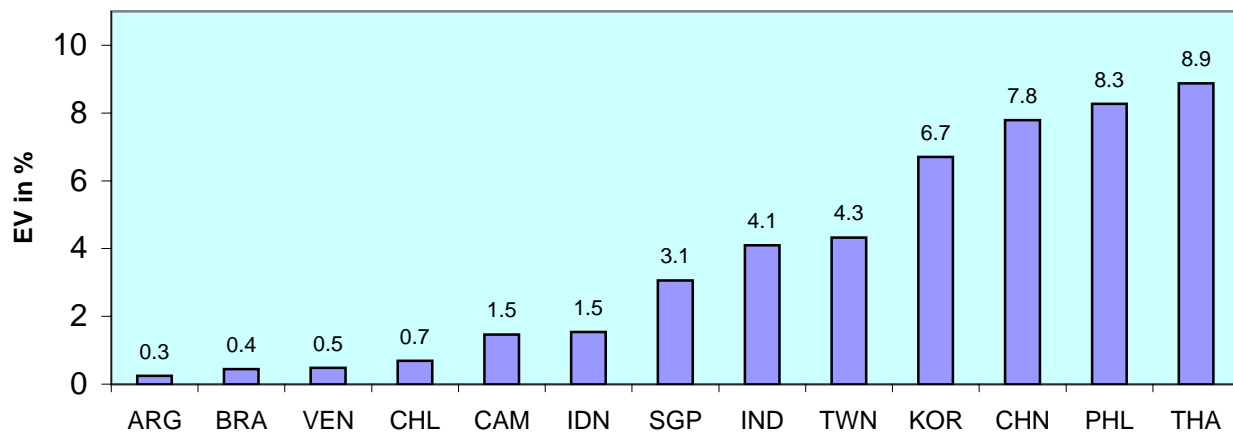
Notation:

BMK (+) tm = Goods and services with positive tariffs in the benchmark (1995)

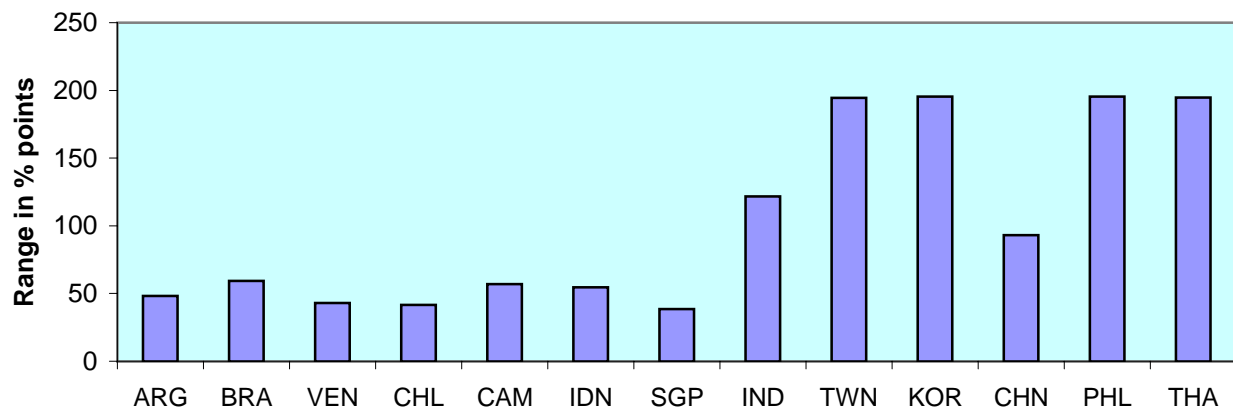
BMK (0) tm = Goods and services with zero tariff in the benchmark (1995)

BMK (-) tm = Goods and services with negative tariff in the benchmark (1995)

Graph 1. Welfare Change
UNIF Scenario



Graph 2. Tariff Dispersion



Graph 3. Role of trade

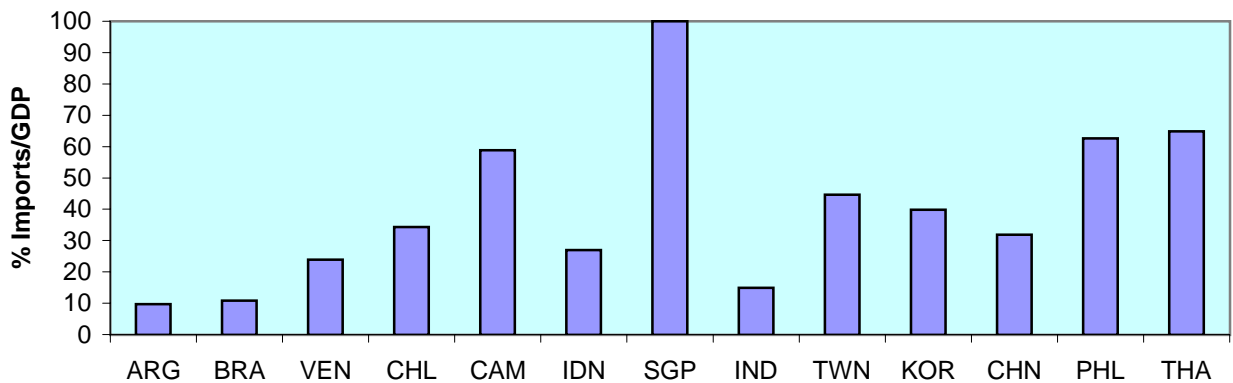


Table 9: Welfare Change (EV in %)

Country	SCENARIOS			
	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU
<u>Asia</u>				
Korea	6.70	6.77	6.77	
Indonesia	1.54	1.01	1.01	
Philippines	8.27	10.36	10.36	
Singapore	3.06	2.86	2.38	
Thailand	8.88	6.74	6.51	
China	7.79	7.79	7.80	7.76
Taiwan	4.32	4.32	4.24	
India	4.10	4.10	4.10	4.10
<u>Latin America</u>				
CAM	1.46	1.26	1.21	0.52
Argentina	0.25	0.18	0.18	0.18
Brazil	0.44	0.34	0.33	0.31
Chile	0.69	0.50	0.50	0.38
Venezuela	0.48	0.34	0.34	0.22

NOTATION OF SCENARIOS:

UNIF	Uniform tariff on all imports of goods and services
UNIF_EXS	Same as UNIF but here the benchmark zero tariffs on services are retained
UNIF_EXGS	Same as UNIF_EXS but here the benchmark zero tariffs on goods are also retained
UNIF_SUBS	Same as UNIF_EXGS but here the benchmark negative tariffs are also retained

Source: Model estimates.

Table 10: Uniform Tariff Rate in Policy Scenarios

Country	Benchmark Average Tariff rate	SCENARIOS			
		UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU
<u>Asia</u>					
Korea	8.1	8.0	8.3	8.3	
Indonesia	11.9	13.7	16.6	16.6	
Philippines	17.1	14.9	11.9	11.9	
Singapore	1.4	1.4	1.6	2.6	
Thailand	29.3	32.7	34.2	34.5	
China	23.9	25.4	25.4	25.4	25.6
Taiwan	6.2	6.0	6.0	6.2	
India	35.2	28.3	28.4	28.4	28.4
<u>Latin America</u>					
CAM	7.7	8.2	8.7	8.8	10.5
Argentina	8.7	8.4	9.9	9.9	9.9
Brazil	11.9	13.1	14.2	14.3	14.5
Chile	9.2	9.7	10.4	10.4	10.8
Venezuela	9.0	9.7	11.7	11.8	12.5

NOTATION OF SCENARIOS:

UNIF	Uniform tariff on all imports of goods and services
UNIF_EXS	Same as UNIF but here the benchmark zero tariffs on services are retained
UNIF_EXGS	Same as UNIF_EXS but here the benchmark zero tariffs on goods are also retained
UNIF_EXSU	Same as UNIF_EXGS but here the benchmark negative tariffs are also retained

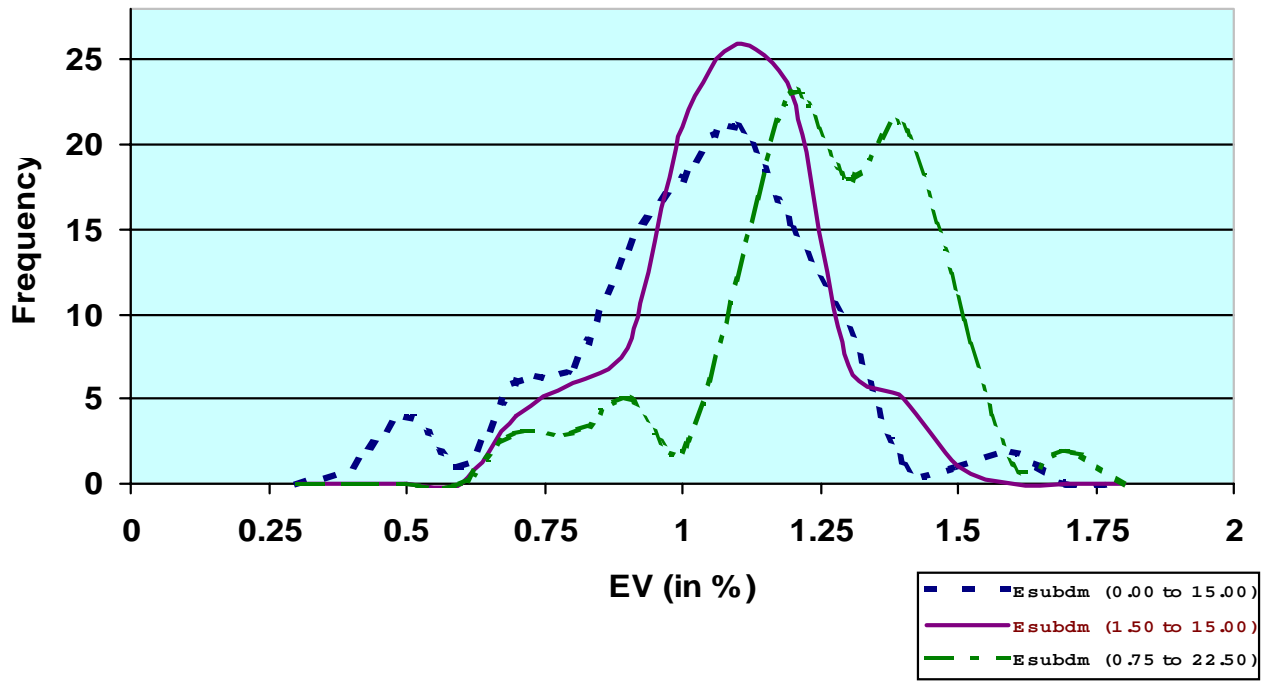
Source: Model estimates.

Table 11: Welfare Change (EV in %) with Different Elasticity Values

Country	Low Elasticity (DM=4, MM=8)				Medium Elasticity (DM=8, MM=15)				Basic Elasticity (DM=15, MM=30)			
	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU
<u>Asia</u>												
Korea	2.74	2.68	2.68		4.93	4.90	4.90		6.70	6.77	6.77	
Indonesia	0.67	0.47	0.47		1.11	0.81	0.81		1.54	1.01	1.01	
Philippines	1.67	0.54	0.54		3.77	3.26	3.26		8.27	10.32	10.32	
Singapore	1.11	0.94	0.91		1.82	1.62	1.47		3.06	2.86	2.38	
Thailand	4.00	1.85	1.65		6.10	4.10	3.88		8.88	6.74	6.51	
China	1.83	1.80	1.83	1.79	3.80	3.82	3.84	3.78	7.79	7.79	7.80	7.76
Taiwan	2.58	2.58	2.54		3.65	3.65	3.60		4.32	4.32	4.24	
India	0.60	0.47	0.47	0.47	1.55	1.45	1.45	1.45	4.11	4.10	4.10	4.10
<u>Latin America</u>												
CAM	0.78	0.58	0.48	0.18	1.03	0.83	0.74	0.30	1.46	1.26	1.21	0.52
Argentina	0.06	0.03	0.03	0.03	0.12	0.08	0.08	0.07	0.25	0.18	0.18	0.18
Brazil	0.19	0.10	0.10	0.10	0.28	0.18	0.18	0.17	0.44	0.34	0.33	0.31
Chile	0.38	0.27	0.27	0.22	0.51	0.37	0.36	0.29	0.69	0.50	0.50	0.38
Venezuela	0.17	0.09	0.09	0.05	0.27	0.17	0.17	0.10	0.48	0.34	0.34	0.22

Source: Model estimates.

Graph 4. CAM: Frequency Distribution of EV with Heterogeneous Import Demand Elasticity



Graph 5. Thailand: Frequency Distribution of EV with Heterogeneous Import Demand Elasticity

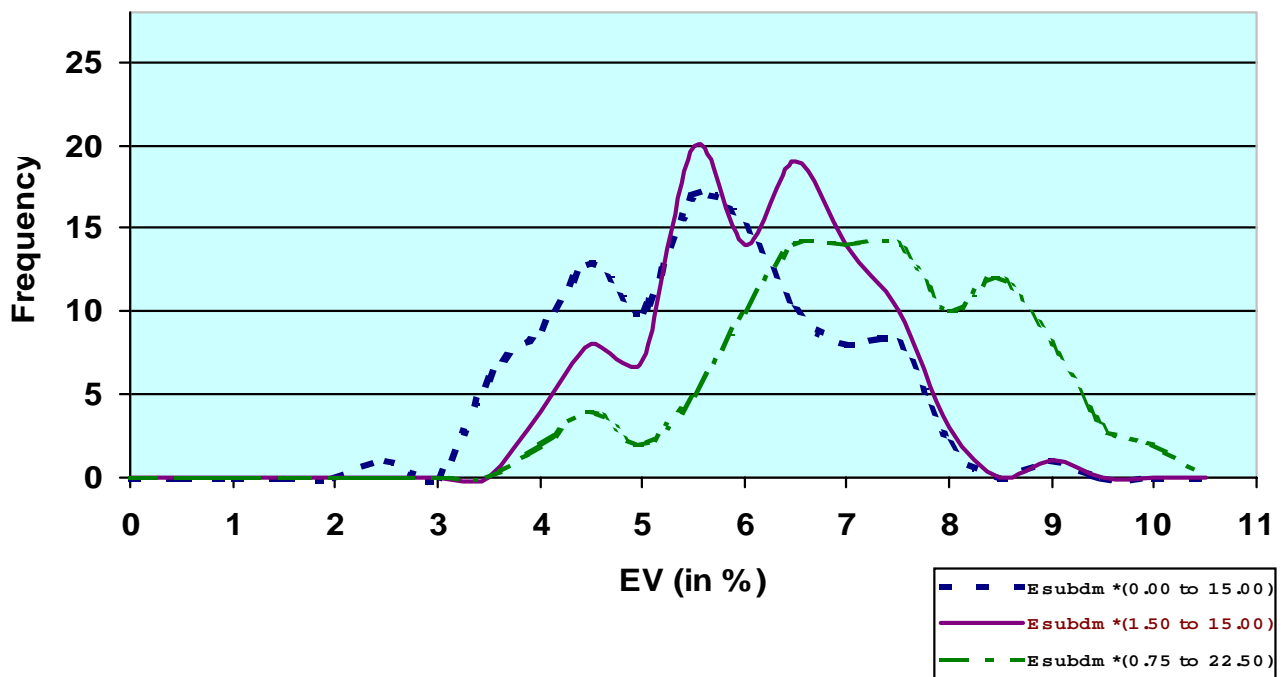


Table 12: Welfare Change (EV in %) with Alternative Regional Aggregation and Elasticity Values

Country	Tariff Dispersion (in % points)	Low Elasticity (DM=4, MM=8)				Medium Elasticity (DM=8, MM=15)				Basic Elasticity (DM=15, MM=30)			
		UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU	UNIF	UNIF_EXS	UNIF_EXGS	UNIF_EXSU
<u>Seven-region</u>													
Singapore	38.4	1.11	0.94	0.91		1.82	1.62	1.47		3.06	2.86	2.38	
China	105.1	1.83	1.80	1.83	1.79	3.80	3.82	3.84	3.78	7.79	7.79	7.80	7.76
Taiwan	194.5	2.58	2.58	2.54		3.65	3.65	3.60		4.32	4.32	4.24	
CAM	56.9	0.78	0.58	0.48	0.18	1.03	0.83	0.74	0.30	1.46	1.26	1.21	0.52
Brazil	49.2	0.19	0.10	0.10	0.10	0.28	0.18	0.18	0.17	0.44	0.34	0.33	0.31
Venezuela	41.6	0.17	0.09	0.09	0.05	0.27	0.17	0.17	0.10	0.48	0.34	0.34	0.22
<u>Two-regions</u>													
Singapore	27.0	0.63	0.31	0.45		0.88	0.56	0.68		1.18	0.86	0.95	
China	77.2	1.09	0.89	0.88	0.85	1.38	1.22	1.23	1.16	1.54	1.21	1.20	1.03
Taiwan	171.6	2.48	2.48	2.48		3.53	3.53	3.53		4.12	4.12	4.12	
CAM	33.7	0.78	0.45	0.34	0.07	0.85	0.55	0.46	0.13	0.98	0.70	0.61	0.16
Brazil	25.7	0.22	0.10	0.10	0.10	0.27	0.15	0.15	0.15	0.39	0.27	0.27	0.27
Venezuela	29.9	0.23	0.07	0.07	0.03	0.30	0.14	0.14	0.07	0.46	0.27	0.26	0.14

Source: Model estimates.