"Trade Taxes Are Better ?!?"

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Abstract: The main purpose of this paper is to find out more about welfare implications of trade reforms with a government budget constraint by expanding the study of Anderson (1999). A simple general equilibrium model with distortionary indirect taxes and an "active" government budget constraint is employed to analyze the welfare implications of a trade reform. Unlike the conventional trade theory, the tariff revenue cuts due to the tariff reform must be compensated with increases in indirect taxes and not simply assuming lump sum transfers. The concept of "Marginal Cost of Funds" (MCF) from the public finance literature is utilized to find out whether the prospective change is welfare improving or not. The empirical part of the paper generates MCF figures, which answer the question; "is replacing trade taxes with indirect taxes always beneficial?" The results are of special interest to developing countries, which rely on trade taxes as a significant source of their government revenue, as well as for organizations such as the WTO, World Bank or the IMF.

I. Introduction

This paper focuses on the welfare implications of trade reforms and various kinds of compensating taxation. Trade taxes constitute an important part of government revenue in developing countries[1] and can also be substantial in some cases for developed countries.

In recent years, many countries have followed the path of trade liberalization by eliminating or lowering their trade barriers, and opening their economies to international competition. The trade theory provides us with the insight that this liberalization enhances economic efficiency, promotes growth and helps correct domestic market failures in imperfectly competitive markets. However, does freer trade come without any costs? If so, why are the trade barriers still widespread?[2] There are many different and sophisticated explanations why nations trade so little[3] [4]. This study focuses on a direct cost: loss of tax revenue as tariffs and elimination or lowering of other trade taxes. Since this loss can be substantial for developing countries, the welfare implications of trade liberalization becomes an important issue.

In an environment where the prominent international organizations such as the World Trade Organization (WTO), the World Bank and the International Monetary Fund (IMF) strongly advocate for trade liberalization, some important questions emerge. What are the consequences of compensating for the revenue loss due to the liberalization, and will the whole operation, including recapturing the foregone tariff revenue, be welfare improving?

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[1] Trade taxes account for approximately a quarter of the total tax revenues in low income countries (from Government Finance Statistics, 1997). Also, in a group of selected developing countries in Africa, trade taxes accounted about 5.5% of GDP on average in 1995, Ebrill, Stotsky and Gropp (1999).

[2] Uruguay Round 1994, from WTO sources.

[3] Anderson (1999), "Why Do Nations Trade (so little)?"

Recently, research in this area, especially among the economists of the World Bank and the IMF, gained momentum[5]. Findings in outcome of of these studies hint to the necessity for further investigation.

The starting point of this paper is a study by Anderson (1999) ,where he finds out that a revenue neutral trade reform may not always improve welfare. He introduces a government budget constraint where a change in tariff revenue due to trade reforms is offset by public good decreases or other tax increases. To measure welfare effects, Anderson uses the concept of the Marginal Cost of Funds (MCF) from the public finance literature and generates sufficient conditions for the welfare increasing revenue neutral trade reform. According to Hatta (1977), uniform radial tariff cuts with lump sum taxes are always welfare improving. Anderson analyzes the case of uniform radial tariff reductions financed by uniform radial increases in consumption taxes. He asks the basic question which brings us one step closer to the real life analysis[6]: Is replacing trade taxes with distortionary consumption taxes always beneficial? His results show that no presumption obtains. Anderson provides an example of welfare-decreasing replacement for Korea in 1963, despite higher average trade taxes than consumption taxes.

How pervasive might this phenomenon be? Under what circumstances is it likely to occur? There is a need to study welfare implications for further cases of compensation with distortionary taxation. The results of this paper might be of special interest for developing countries and for organizations like the WTO, the World Bank and IMF which advise developing countries on their economic policies. The empirical part of this paper proves operationality of the model by generating MCF values for Turkey in 1990. The second section of the empirical

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[4] According to Kubota (1999), there are three main reasons that explain why trade barriers are so prevalent: 1) restricting trade can be an optimal policy (infant industry, strategic trade policy, etc...), 2) interest group politics to intervene in trade, 3) revenue-raising aspect of trade barriers.

[5] Greenaway and Milner (1991), Mitra (1992), Datta-Mitra (1997), Rajaram (1994), Kubota (1999), Ebrill et al (1999).

study includes MCF values and welfare comparisons for 15 countries. The data set is also used to identify the determinants of MCF, and to provide insight into the likelihood of welfare decreasing tariff cuts.

MCF for any tax increase is given by the ratio of the required compensation, at the margin, to maintain real income to the collected tax revenue, at the margin. After finding the MCF, comparing it to the marginal benefit of the revenue raised indicates whether the prospective change is welfare improving or not. Devarajan, Squire and Suthiwart-Narueput (1995) stress the usefulness of MCF, especially for projects that are characterized by public costs and private benefits. A more detailed intuition of MCF will follow in section II.

It is important to point out that the MCF used in this study is a compensated concept. The main reason behind choosing the compensated MCF concept is that it is comparable across economies, model specifications and parameterizations. Its use in this research stands in contrast to prevailing usage in the public economics and relevant trade or tax reform literature (Snow and Warren, 1996) where the uncompensated, or money metric utility, version of MCF is widely employed. The uncompensated MCF is non-comparable across models or countries. Further comparisons of compensated versus uncompensated MCF can be found in the study of Anderson and Martin (1995).

The MCF concept provides a decomposition of the welfare change of uniform radial replacement. This decomposition is essential for deeper understanding of the likelihood of undesirable trade liberalization.

Ahmad and Stern (1990) also contribute to the public finance literature by using comparison of "marginal social costs" to evaluate "shadow" revenue neutral marginal shifts from one tax to another. The difference between this study and their approach is that they focus on the role of shadow prices and

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[6] Note that although it is extremely convenient to implement, there is no application of "lump sum" taxation into the real economy.

distributional values.

Falvey (1994), in his paper “Revenue Enhancing Tariff Reform”, considers the importance of trade taxes as a source of government revenue in many developing countries and investigates a tariff reform package that is both welfare improving and revenue enhancing (WIRE reform). Our study differs from Falvey (1994), in that our focus is on the comparison of simultaneous tariff and tax reforms which maybe welfare improving or welfare decreasing.

In his paper, Anderson (1999) presents a small scale CGE model of the Korean economy in 1963. It constitutes an example of a simple efficient tax by using a uniform radial change in the consumer tax vector to compensate uniform radial reductions in tariffs, in other words, taxing all the consumption at the same rate.

The main purpose of this paper is to build on Anderson’s (1999) study by investigating more indepth the MCF calculations for distortionary taxation. It aims to shed light on the questions; “What is the MCF for various kinds of taxations?” and “Are revenue neutral trade reforms welfare improving for the case of distortionary taxes?” The application to real life follows through the “marginal cost of funds - marginal benefit of revenue” analysis which indicates the welfare implications of the compensating taxation.

The layout of the paper is as follows. Section II sets out the intuition of the employed concepts and the basic theoretic framework. Sections III lays out the model. Section IV is devoted to the empirical work and the mechanics of the CGE model. Section V reports the results and Section VI concludes the paper. Section VII discusses some potential extensions and further research areas.

II. Basic Intuition and Theoretic Framework

Marginal Cost of Funds (MCF) – Intuition and Derivation

An increase in taxes will decrease the real income of the consumer and raise a tax revenue for the government at the same time. The Marginal Cost of Funds (MCF) for any tax increase gives the relationship between the marginal compensation required to maintain real income and the marginal tax revenue raised by this tax increase. In other words, it is the marginal cost of raising another dollar of tax revenue.

Consider an imported good with an international price of p^*, which is selling domestically for p due to a tariff. Denoting the quantity by m, MCF after a small perturbation in the tariff can be defined as follows:

$$MCF = \frac{mdp}{[m + (p - p^*)m_p]dp}, \qquad (2.1)$$

where mdp is the marginal compensation and $[m + (p - p^*)m_p]dp$ is the marginal tax revenue change.

The framework of the model is built on the representative consumer's expenditure function, $e(p,u)$, and the gross domestic product function, $g(p,v)$.

The expenditure function, $e(p,u)$ gives the minimum expenditure on private goods needed to reach a utility of u, where p is the price vector for private goods.

The gross domestic product function, $g(p,v)$ gives the maximized value of private production at prices p, where v represents the vector of primary factors of production in a convex technology. In other words, the gross domestic product function measures the total payments to factors.

The following set up gives the simplest case where the public goods are not included in the equations to simplify the analysis[7]. The net expenditure on private goods at domestic prices can be defined as

$$E(p,u,v) = \bar{e}(p,u) - \bar{g}(p,v)\,, \tag{2.2}$$

where

$$\bar{e}(p,u) = \max_{\pi}\{e(p,u)\} \tag{2.3}$$

and

$$\bar{g}(p,v) = \min_{\pi^*}\{g(p,v)\}\,. \tag{2.4}$$

Once we have the net expenditure function, we can set up the private and government budget constraints.

The private budget constraint is as follows:

$$E(p,u,v) - \theta = 0 \tag{2.5}$$

The first term is the net expenditure on the private goods. The second term presents the lump sum transfer from the government to the private sector. In other words, net private consumption, $E(p,u,v)$, is covered by the transfers to the private sector, θ.

The government budget constraint is:

$$(p - p^*)' E_p(p,u,v) - \theta = 0 \tag{2.6}$$

The first term gives the tariff revenue of the government where $(p - p^*)$ denotes the tariff and E_p gives the vector of excess demands. The second term, θ, denotes transfers from the government to the private sector. In other words, the tariff (or tax) revenue of the government is transferred to the private sector.

[7] Including an exogenously determined G, and hence using dG=0 would bring us to the same result.

The social budget constraint can is defined by solving for the transfer θ, and substituting (2.5) into (2.6):

$$B(p,u,v) = E(p,u,v) - (p - p^*)' E_p(p,u,v) \tag{2.7}$$

Now we can introduce a package of tariff changes by perturbing the domestic price vector p. Changes in domestic prices can be denoted as $dp^i = W^i p d\tau$, where W^i is a diagonal matrix of weights (i standing for a member of an index set) and $d\tau$ is a scalar.

Next step is discussing the effect of an exogenous change in dp solved for the endogenous change in the redistribution, $d\theta$, and in welfare du. Totally differentiating the government budget constraint:

$$E_p' W^i p d\tau + (p - p^*)' E_{pp} W^i p d\tau + (p - p^*)' E_{pu} du - d\theta = 0 \tag{2.8}$$

and the private budget constraint:

$$E_p' W^i p d\tau + E_u du - d\theta = 0 \tag{2.9}$$

solving for $d\theta$, substituting the differentials into each other and gathering terms in du on the left hand side we obtain;

$$(1 - (p - p^*)' \frac{E_{pu}}{E_u}) E_u \frac{du}{d\tau} = (p - p^*)' E_{pp} W^i d\tau \tag{2.10}$$

Equation (2.10) gives us the “classical case”, where $d\theta$ from (2.8) and (2.9) is the lump-sum transfer from the government to the private sector. In the conventional trade theory, it is conveniently used to balance the social balance budget function. Note that (2.10) also gives the relationship between the change in money metric measures (left hand side) and compensation measures (right hand side). We will come back to this equation in section IV while explaining the mechanics of the CGE model.

In this study, the differential of the government budget constraint is equal to an external transfer, $d\beta$, instead of zero:

$$d\beta = -E_p{}'W^i p d\tau - (p-p^*)'E_{pp}W^i p d\tau - (p-p^*)'E_{pu}du \qquad (2.11)$$

The endogenous tax reduction, $dp^i = W^i p d\tau$, is financed by this external transfer, while no additional transfers from the government to the private sector are allowed, $d\theta$ =0. In other words, government budget constraint is first altered by an external transfer, then balanced by an endogenous change in taxes, $d\tau$, where is given by (2.12):

$$d\tau = -\frac{1}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p} d\beta - \frac{1}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p}(p-p^*)E_{pu}du$$

(2.12) is obtained using the government budget constraint only. Solving for $d\tau$ from the private budget constraint (2.9), we obtain:

$$\frac{-E_u du}{E_p p} = d\tau \qquad (2.13)$$

Substituting (2.12) into (2.13) we end up with (2.14):

$$\frac{E_u du}{E_p p} = \frac{1}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p} d\beta + \frac{1}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p}(p-p^*)E_{pu}du$$

Multiplying both sides by $\frac{E_p p}{d\beta}$, and rearranging terms, we find (2.15):

$$\frac{E_u du}{d\beta} = \frac{E_p p}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p} + \frac{E_p p}{E_p{}'W^i p + (p-p^*)'E_{pp}W^i p}(p-p^*)\frac{E_{pu}}{E_u}\frac{E_u du}{d\beta}$$

Rewriting this impression we end up with a term that includes MCF;

$$\frac{E_u du}{d\beta}(1 - MCF(p-p^*)\frac{E_{pu}}{E_u}) = MCF \qquad (2.16)$$

where $MCF \equiv \dfrac{E_p p}{E_p' W^i p + (p - p^*)' E_{pp} W^i p}$ (2.17)

The intuition behind (2.17) is straightforward; the nominator stands for the private marginal cost of the tariff change or in other words, it is the magnitude effect of a unit tariff change on the representative agent. The denominator gives the net revenue raised by the tariff change. All changes are at constant utility(u).

This experiment can be extended to two sets of taxes[8]. One group of taxes is altered exogenously, and another group of taxes change endogenously to maintain the tax revenue at a constant level. For this analysis, we need to calculate MCF_i and MCF_j for two group of goods i and j, respectively. Partitioning the domestic price vector p into the vectors p_i and p_j and defining the exogenous change in taxes for the j set of goods as $dp_j = W^j p_j d\tau_j$, we solve the differential of the government budget constraint for the endogenous change, $dp_i = W^i p_i d\tau_i$ at constant θ.

The solution for $d\tau_i / d\tau_j$ is (2.18)

$$\frac{d\tau_i}{d\tau_j} = \frac{-1}{E_{p_i}' W^i p_i + (p - p^*)' E_{\bullet i} W^i p_i} + \frac{-1}{E_{p_i}' W^i p_i + (p - p^*)' E_{\bullet i} W^i p_i} (p - p^*)' E_{pu} \frac{du}{d\tau_j}$$

where $E_{\bullet i}$ is the matrix $\begin{pmatrix} E_{ii} \\ E_{ji} \end{pmatrix}$, which captures the substitution effect.

Solving $d\tau_i / d\tau_j$ together with the differential of the private budget constraint we obtain:

$$(1 - MCF_i (p - p^*)' X_I) E_u \frac{du}{d\tau_j} = \left(\frac{MCF_i}{MCF_j} - 1 \right) E_{p_j}' p_j \tag{2.19}$$

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[8] This section follows closely the set up of differential tax case by Anderson and Martin (1995).

where $X_I = E_{pu} / E_u$ and MCF_i is defined as:

$$MCF_i = \frac{E_{p_i}' W^i p_i d\tau_i}{E_{p_i}' W^i p_i d\tau_i + (p - p^*)' E_{\bullet i} W^i p_i d\tau_i}$$ and MCF_j is also defined similarly.

$(1 - MCF_i (p - p^*)' X_I)$ is the fiscal multiplier for endogenous consumption taxes.

The intuition tells us if the consumption taxes for group i goods are more costly, in other words if $MCF_i > MCF_j$ (which indicates that the term in the brackets, $\left(\frac{MCF_i}{MCF_j} - 1\right)$, is positive), an increase in consumption taxes for group j goods accompanied by a revenue neutral cut in consumption taxes for group j goods will be welfare improving.

Same approach holds for trade taxes versus consumption taxes. In the model employed in this study, the two different kind of taxes are, trade taxes and indirect taxes. While the intuition behind the MCF calculations are as illustrated above, the mechanics of the CGE application will be explained in detail in Section IV.

III. The Model

The simple CGE model used in this paper simulates the working of a small open market economy. It is static and assumes constant returns to scale (CRTS). There are three sectors; agriculture, manufacturing and services. The Armington specification between imports and domestic goods indicates imperfect substitution in demand via a CES (constant elasticity of substitution) preference structure. Each sector produces exports and domestic products according to a CET (constant returns to transformation) joint production function, which makes them imperfect substitutes in supply. There is CES specification between labor and capital. The model evolves around a representative consumer with a Cobb-Douglas utility function. Expenditure functions arise from these Cobb-Douglas preferences. Government consumption equals revenue from different types of taxation (including trade taxes) and foreign transfers. In this simple model, the government does not supply a public good. The world price of exports and imports is assumed to be constant due to the small country assumption. Trade is taxed via tariffs on imports. The other distortion is the indirect taxes that apply to all domestic transactions. The model is Walrasian in that only relative prices matter.

The flow chart below demonstrates the important linkages of the model. It is a simplified version of the model, and some parts are subsumed for the sake of clarity.

INSERT CHART

Production Block and Factor Markets

The domestic production process combines labor and capital to produce goods and services on a sectoral basis according to a constant elasticity of substitution (CES) production function:

$$Y_i = AD_i[\gamma_i L_i^{\frac{\sigma_i - 1}{\sigma_i}} + (1-\gamma_i)K_i^{\frac{\sigma_i - 1}{\sigma_i}}]^{\frac{\sigma_i}{\sigma_i - 1}}, \text{ where} \qquad (3.1)$$

- Y denotes the sectoral output,
- AD is the production function shift parameter, also known as the efficiency parameter or the parameter indicating the state of technology. It is calibrated from the benchmark data and stays constant throughout the analysis due to the static nature of the study,
- is the production function share parameter (also known as the distribution parameter) which gives the relative factor shares in the production,
- L and K are the two factors of production, labor and capital,

- and σ_i is the elasticity of substitution between labor and capital in the production of good i. The production elasticity is assumed to be constant across sectors, and its value is equal to 1.2.

The price for value added is derived from the production function:

$$PV_i = \frac{[\gamma_i^{\sigma_i}(WAGE_i)^{1-\sigma} + (1-\gamma_i)^{\sigma_i}(RENT_i)^{1-\sigma}]^{\frac{1}{1-\sigma_i}}}{AD_i}, \tag{3.2}$$

and the marginal products of factors of production, wage and rent, are also derived from the production function using the MV=MP principle of perfect competition:

$$WAGE_i = (\frac{1}{AD^{\frac{\sigma_i-1}{\sigma_i}}})\gamma_i PV_i (Y_i / L_i)^{1/\sigma_i} \tag{3.3}$$

$$RENT_i = (\frac{1}{AD^{\frac{\sigma_i-1}{\sigma_i}}})(1-\gamma)_i PV_i (Y_i / K_i)^{1/\sigma_i} \tag{3.4}$$

In other words, at the sectoral level, value added consists of payments to both labor and capital. $PV_i Y_i = WAGE_i L_i + RENT_i K_i$ (3.5)

The sectoral demand for labor and capital are determined by equations 3.3 and 3.4 respectively:

$$L_i = Y_i[(\frac{1}{AD^{\frac{\sigma_i-1}{\sigma_i}}})\gamma_i PV_i / WAGE_i)]^{\sigma_i} \tag{3.6}$$

$$K_i = Y_i[(\frac{1}{AD^{\frac{\sigma_i-1}{\sigma_i}}})(1-\gamma_i)PV_i / RENT_i)]^{\sigma_i} \tag{3.7}$$

However, due to the static nature of the model, the supply of labor and capital are assumed to be invariant with respect to the wage rate and rent. Both of the factors of production are assumed to be perfectly mobile across all three sectors[9], therefore their returns are same across all sectors, and the labor market and capital market equilibrium conditions are given by:

$\sum_i L_i = L$ and $\sum_i K_i = K$, (3.8) and (3.9)

where L and K represent the fixed amounts of endowments.

Price Equations

The absorption equation sets the value of the composite commodity (final goods) equal to the sum of the value of imports and the value of domestic sales:

$P_i Q_i = PM_i IMP_i + PD_i DO_i$, where (3.10)

- IMP_i is the sectoral import,
- DO_i is the domestic sales,
- $Q_i = IMP_i + DO_i$ is the composite commodity and
- $PM_i = PWM_i(1 + PROPTM_i)$ (3.11)

is the domestic price of imported goods. PWM_i stands for the world price of imports which is fixed to the numeraire and remains constant due to the small country assumption.

$PROPTM_i = TM_i DTM$ (3.12)

gives the change in the tariff rate, where

$TM_i = TARIFF_i / (IMP_i - TARIFF_i)$ is the tariff rate, (3.13)

and DTM depicts the radial cut (same across the three sectors) in the tariff rate.

The next price identity indicates that value of aggregate output is equal to the value of domestic sales plus the value of exports.

$PY_i Y_i = PD_i DO_i + PWE_i E_i$,where (3.14)

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[9] Alternatively, capital could be assumed sector specific $K_i = \overline{K_i}$, where $\overline{K_i}$ is the fixed stock of capital by sector. In that case, the return of capital (RENT) would be determined as a residual from equation (3.5) after labor is paid the value of its marginal product.

PWE_i stands for the world price of exports (fixed to the numeraire and constant due to the small country assumption) and PY_i is the price of the aggregate output.

Consumption Block

The Marshallian consumer demand functions are given below:

$HC_i = HBS_i * HR / P_i$, where (3.15)

- HC_i is the household consumption,
- $HR = \sum_i HC_i$ is the household revenue, and
- $HBS_i = HC_i / HR$ is the household budget share,

The consumer demand functions are derived from the utility function of the consumer with Cobb-Douglas preferences:

$$UTILIYTY = \prod_i HC_i^{\ HBS_i} \quad (3.16)$$

The expenditure function:

$$EFCT = \prod_i \frac{P_i^{HBS_i}}{HBS_i^{HBS_i}} * UTILITY \quad (3.17)$$

is used to determine the money metric version of MCF:

$MMCF = ECOEFF_0 * [UTILITY_1 - UTILITY_0]$,where (3.18)

$ECOEFF = \prod_i \frac{P_i^{HBS_i}}{HBS_i^{HBS_i}}$ is the price part of the expenditure function (3.19)

Equation 3.20 calculates the familiar money metric utility (using old prices as base): $MO = E(p^0, U^0) - E(p^0, U_1)$, and it is equal to $\frac{E_u du}{d\beta}$ in equation (2.15).

Government Revenue and Consumption

The model has two tax instruments; tariffs on imports and output taxes on domestically produced goods. Government revenues are determined by:

$$GR = INTAX + TARIFF + REMIT \quad , \qquad (3.20)$$

where INTAX is the for indirect tax revenue, TARIFF stands for the tariff revenue and REMIT for remittances from abroad.

The market clearing condition in the government sector is:

$$GR = \sum_i GC_i + THG \, , \qquad (3.21)$$

where GC represents the government consumption and THG is the a lump-sum transfer from government to the households (or vice versa), determined residually to clear the market.

IV. Empirical Work

To understand the mechanics of the empirical work, it is essential to mention once again that the MCF figures calculated here stem from a “compensated equilibrium”. In CGE models, such as the one employed in this study, more than one step is required to obtain the compensated MCF.

Below, the procedure of calculating MCF of trade taxes is laid out:

- In the first step, the model is perturbed with a transfer of a small external exogenous amount, $d\beta$, into the government budget. This amount is offset by an endogenous proportionate change in the trade tax vector, $dp_i = W^i p_i d\tau_i$, where $d\tau_i$, is the endogenous scalar. The simulation calculates the change in money metric utility, $\frac{E_u du}{d\beta}$, in equation (2.15). This is the uncompensated MCF (MMCF) for trade taxes.
- Second step starts with the injection of the same small external exogenous amount, $d\beta$, into the government budget. However, this time it is offset by a lump sum transfer, $d\theta$, from the government to the private sector. Running the CGE model, the change in money metric utility, μ, is calculated. μ, the shadow price of foreign exchange, is equal to:

$$\mu = \frac{1}{1-(p-p^*)\frac{E_{pu}}{E_u}} \qquad (4.1)^{10}$$

- Third step, in our experience, is simply dividing the result of step1 by the result of step2; $\dfrac{\frac{E_u du}{d\beta}(= step1)}{\mu(= step2)}$.

The calculation of MCF of indirect taxes follows the same structure.

GAMS (General Algebraic Modeling System) system is employed to solve the CGE model and to calculate the MCFs. The main technical problem is modifying the model to permit taxation of the non-traded good. Defining a price index for non-traded goods, h, and introducing taxes on non-traded goods $dh = (h - h^*)d\vartheta$ (where h^* stays for producer price of non-traded goods) we can replicate the procedure at the end of section II to find

$$(1 - MCF_{\vartheta}(p-p^*)' X_I)E_u \frac{du}{d\tau} = \left(\frac{MCF_{\vartheta}}{MCF_{\tau}} - 1\right)\{e_p'(p-p^*) + G\bar{g}'_{Gh^*} h_p^*(p-p^*)\}. \qquad (4.2)$$

See Anderson (1999) for details of the derivation.

The data set used in the next chapter comes primarily from GTAP database and TRAINS sources, which is mostly assembled from the UNCTAD data.

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[10] μ is derived by subbing $\frac{d\theta}{d\beta} = \tau + (p-p^*)' E_{pu} / d\beta$ (government budget constraint) into the private government budget constraint, and solving for the rate of change in money metric utility.

V. Results of the Empirical Analysis

i) Testing Operationality: Case of Turkey, 1990

The CGE model has proved useful for studying the welfare effects of trade reforms in the presence of an active government budget constraint. This section reports estimates of MCF^{φ} and MCF^{τ}, the marginal cost of funds, of indirect taxes, and tariffs, respectively. The results are obtained from the simple CGE model of the Turkish economy in 1990, explained in Section III above. The simulation of the model runs following the procedure explained in Section IV, and produces the MCF for tariffs of around 1.53, and the MCF for indirect taxes of around 1.13. These estimates are in their magnitudes similar to the figures announced in the literature[11].

The results show that the MCF for indirect taxes is significantly lower than the MCF for tariffs. These findings are in the expected direction, since the indirect taxes in the model are low (between zero and 5.8%), whereas the tariffs are relatively higher (they go up to 21%). The comparison of MCF^{φ} and MCF^{τ} gives us the answer of the original question. In the simplest sense, we can say that to raise $1, while keeping the government budget constraint constant, one has to spend $1.53 when using tariffs as the policy tool, and only $1.13 when using the indirect taxes. Hence, indirect taxes are the "cheaper" distortion, and therefore replacing trade taxes with indirect taxes is beneficial.

Due to the three-step calculation procedure of the CGE experiment, explained in Section IV, we also obtain some "side results" along the way to compute MCF:

- Step 1, in Section IV, generates uncompensated MCF (MMCF) figures

[11] Devarajan et al (1995): 1.32-1.47 US, 2.2 for Sweden,
Ballard, Shoven and Whalley (1985): 1.17-1.57 for US
Anderson (1997): 1.57-1.74

for trade and indirect taxes. For the Turkish economy of 1990, MMCF for tariffs is 1.67, and MMCF for indirect taxes is 1.23.

- The shadow price of foreign exchange, μ, is 1.09.

It is important to look at the sensitivity of these results for changes in elasticity of substitution between home and imported goods. The table below shows how the MCF figures are affected by the change in substitution elasticity.

Table 5.1:

% increase in substitution elasticity	$MMCF^{TM}$ Tariffs	$MMCF^{TY}$ Indirect Taxes	MU Shadow Price	MCF^{TM}	MCF^{TY}
0%	1.669	1.230	1.092	1.528	1.126
10%	1.689	1.259	1.101	1.534	1.144
20%	1.706	1.287	1.109	1.538	1.161
30%	1.721	1.312	1.116	1.542	1.176
40%	1.733	1.336	1.122	1.545	1.191
50%	1.744	1.359	1.128	1.546	1.205

The results stated above are not sensitive to changes in substitution elasticity. The MCF for indirect taxes is still smaller than MCF for trade taxes, indicating that the indirect taxes are still the cheaper distortion for a wide range elasticity of substitution between domestic and imported goods.

Furthermore, we can observe from the table above that the MCF figures are increasing as the elasticity of substitution rises. The intuition behind this direction is that; the own terms have greater responsiveness with respect to changes in elasticity of substitution than cross-effect terms.

ii) Multi-country Study: 15 Countries

After proving operationality in the previous part, this section expands the empirical analysis to a set of 15 countries. The MCF figures are given in Table 5.2 below:

Table 5.2:

COUNTRY		MCF^{TM}	MCF^{TY}
chl	**Chile**	1.007	1.026
mex	**Mexico**	1.019	1.023
jpn	**Japan**	1.034	2.195
mar	**Morocco**	1.069	1.950
kor	**Korea**	1.088	1.151
ury	**Uruguay**	1.089	1.526
usa	**USA**	1.098	1.232
mys	**Malaysia**	1.159	3.627
chn	**China**	1.254	1.838
vnm	**Viet Nam**	1.307	2.089
col	**Colombia**	1.478	3.109
		$MCF^{TM}<MCF^{TY}$	
tur	**Turkey**	1.169	1.121
ind	**India**	1.232	1.072
tha	**Thailand**	1.296	1.128
phl	**Philippines**	2.008	1.066
		$MCF^{TM}>MCF^{TY}$	

As seen from Table 5.2 above, for the majority of countries (11 out of 15), the MCF for indirect taxes (MCF^{TY}) is significantly higher than the MCF for tariffs (MCF^{TM}). This comparison tells us, that for the first eleven countries reported in Table 5.2, the trade taxes are the "cheaper" distortion, and therefore replacing indirect taxes with trade taxes is beneficial. This finding implies that a trade liberalization package, where the tariff loss will be compensated with an increase in indirect taxes, will be too costly (in welfare terms) for the consumer in the first 11 countries in Table 5.2. The main direction of the results is consistent with

Anderson (1999)'s findings for the Korean economy in 1963, and there is also consistency in the case of Turkey for the two different years, 1990 and 1995.

The main difference between the four countries with higher MCF^{TM} figures and the remaining eleven countries is that the former group is subject to very high tariff taxes (more than 25% on average), whereas the later group has average tariff taxes around 11%. This finding supports the intuition, since in countries with higher trade taxes, a trade liberalization package would be less costly.

However, there are exceptions in both groups: China (32%), Vietnam (21%) and Malaysia (16%) have high trade taxes although they fall in the first group where $MCF^{TM}<MCF^{TY}$, and Turkey (with 8% tariff rate) is in the second group along with three other countries with relatively higher tariffs.

This brings us to the issue that a more detailed look into the CGE model that generates the MCF figures is necessary.

iii) Cross-Country Econometric Analysis

The next step is to try to identify the determinants of MCF, and to provide insight into the likelihood of welfare decreasing tariff cuts. Can we understand from the underlying data (such as data on tariffs and taxes, on the consumption patterns of the economy, on the propensity to import, on the share of the government sector in consumption and production and on elasticities of substitution) and the model specifications which direction the MCF figures will point to? Can we shed light in the black box of the CGE experiment and understand better where these MCF estimates come from?

Cross-country regressions reveal that the import / GNP ratio is the only significant explanatory variable on MCF^{TM} with a positive coefficient. On the other hand, the indirect tax rate is the only significant variable in the cross-country regressions on the MCF^{TY}. The coefficient has a negative sign.

These results are also supported by the intuition: higher volumes of imports imply a higher MCF^{TM} and higher levels of indirect taxes correspond to lower MCF^{TY} figures where a trade reform would be preferable to a domestic tax reform.

iv) Sensitivity Analysis

As seen in Table 5.3 below, the MCF figures are not very sensitive to changes in the elasticity of substitution between imported goods and domestic products in consumption (Armington elasticity). In both countries, elasticities up to 30% above and below the benchmark year elasticity (sigma=2) do not effect the direction of the results. In other words, MCF^{TY} remains higher than MCF^{TM} over the entire range, indicating that replacing indirect taxes with trade taxes would be beneficiary for the economies in question.

Table 5.3:

% increase in substitution elasticity	**Japan**	
	MCF^{TM}	*MCF^{TY}*
-30%	1.046	1.873
-20%	1.044	1.980
-10%	1.041	2.088
0%	**1.034**	**2.195**
10%	1.026	2.302
20%	1.015	2.406
30%	1.004	2.511

% increase in substitution elasticity	Malaysia	
	MCF^{TM}	*MCF*^{TY}
-30%	1.01	4.10
-20%	1.04	3.92
-10%	1.08	3.76
0%	**1.16**	**3.63**
10%	1.18	3.51
20%	1.20	3.41
30%	1.21	3.32

VI. Conclusion

Trade taxes constitute an important source for most developing countries. In theory, the revenue loss of the government could be offset by a hypothetical lump-sum transfer. However, in practice lump-sum transfers do not exist. Recently, the importance of the revenue implications of trade liberalization has been widely acknowledged among economists, especially in international organizations such as the World Bank and the IMF. The new policy recommendation that evolves from their research suggests that for developing countries with binding government budget constraints, it is a priority to implement comprehensive reform packages of the domestic tax system to accompany trade liberalization[12].

This paper takes the question a step further and asks whether trade taxes or indirect taxes will be more costly in welfare terms. To raise the same amount of revenue for the government, trade taxes and indirect taxes as policy tools generate different amounts of changes in the welfare of the consumer. The results laid out above indicate that for a majority of the countries in this study, trade taxes are the “cheaper” distortion.

Does this imply that trade liberalization is more costly than it is usually

[12] See Ebrill, Stotsky and Gropp (1999).

assumed? Not necessarily. These results provide further incentive to investigate the same question with different types of domestic taxes and for a wider variety of countries. A more thorough investigation of MCF using econometric analysis would also reveal the connection between the characteristics of the economy and the welfare decreasing tariff reforms. Moreover, many simplifying assumptions of the model leave room for improvements in the results. Below are some of the many extensions which would possibly affect the results found in this paper.

VII. Potential Extensions

A. Distortionary Income Taxation

An interesting extension to the paper would be introducing distortionary income taxation. The required substantial change in the model would be including leisure choice into the production function to end up with a non-zero elasticity of labor supply. The elasticity of labor supply varies for different groups of individuals in the society. For example, for non-student males the supply curve is close to vertical, whereas for households and students it is more elastic. Averaging it to the whole population could give an inelastic labor supply curve, rather than a perfectly inelastic one.

B. Sensitivity Analysis in a Broader Sense

Starting from the simple CGE model applied in this paper, we can ask a more general question about the credibility of CGE models. Sensitivity analysis can give a good idea about the usefulness and reliability of a CGE model. A brief literature survey and flowchart of ideas to build up a sensitivity analysis is presented below.

Leamer (1984) runs cross country regressions of net trade divided by domestic consumption in a particular good on the vector of factor endowments. He claims that using the residuals from the cross sectional regression ‘hidden’ trade barriers can be identified. Leamer (1988) also looked at the residuals from Heckscher-Ohlin equations to measure the restrictiveness of trade policy.

Another approach to measure openness is the “Trade Restrictiveness Index (TRI)” of Anderson and Neary (1993), a computable general equilibrium application. It represents the initial protective structure of an economy in terms of a uniform set of trade restrictions (in welfare terms).

The econometric approach of Leamer has the drawback that misspecifications of the model will alter the residuals and hence affect the trade policy.

On the other hand, the question how believable CGE models are, has not been fully answered either.

Canova (1995) mentions the increasing usage of simulation techniques to derive the time series properties of nonlinear general equilibrium models in the applied macroeconomic literature. The “Real Business Cycle” literature has evaluated “goodness of fit measures”, procedures to formally measure the fit of calibrated models (see e.g. Sims (1989) and Canova, Finn, and Pagan (1993)).

The questions of interest are:

Can we find a goodness of fit criteria for CGE models in the international trade literature?

Can we correctly predict the trade flows with the “right” CGE model?

If both, econometric and CGE approaches, are “false”, can we make a comparison and find out which one is worse?

Picking up a benchmark year in the TRI model and generating indexes by going back and forth, would allow us to use the CGE model as an alternative to the econometric approach to engage in forecasts of trade parameters. Using the CGE model for forecasting purposes would not only enable us to compare different approaches in the international trade literature, but also measures of fit of “Real Business Cycle” and “International Trade” CGEs.

Another interesting point would be using the “International Trade” CGE models to answer some other questions. Linking trade and factor prices, income distribution can be investigated exploiting CGE models from the International Trade literature.

C. Political Economy

The structure of tariff reform can be changed to “gradualism” by deciding on the reform endogenously within the model. The political analysis builds on Grossman and Helpman (1994).

An incumbent government maximizes its “political support function”, which depends on the contributions collected from an informed and organized special-interest group presenting the business sector and the welfare of the voters. In other words, government trades off general welfare against political contribution of lobbies. In the case of a tariff reform, the weights of the political support function determine whether the welfare increase is large enough to offset the loss of the special interests.

D. MCF of Quotas

Another attracting extension to the paper is defining the trade reform in terms of reductions in quantitative restrictions, such as quotas, instead of cuts in tariffs. The intuition would remain the same. One interesting aspect of this approach is that the model becomes sensitive to rent sharing between the government and private sector due to the nature of the quantitative restrictions. The results can indicate that quotas might be a better tool for a trade reform. The comparison of

MCF figures between quotas and tariffs can give a new inside for some policy decisions.

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