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EXACT WELFARE MEASUREMENT OF CUSTOMS UNIONS FORMATION IN THE CARIBBEAN COMMUNITY: AN HICKSIAN ALTERNATIVE

by

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ABSTRACT

This paper derives expressions for welfare change in a Caribbean Customs Union based on the popular Hicksian notions of Compensating and Equivalent Variation (CV, EV). Preliminary results utilizing these concepts indicate that CARICOM has had a miniscule impact on the welfare of citizens of the three MDC territories of Trinidad and Tobago, Barbados and Jamaica. The results point, more importantly, to wide variations in welfare effects from the various product categories as well as differential welfare impacts on the individual member states.

KEYWORDS: COMPENSATING AND EQUIVALENT VARIATION, CUSTOMS UNION, PATH DEPENDENCE, WELFARE EFFECTS, ECONOMETRIC MODELLING.

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INTRODUCTION

Although numerous attempts have been made to quantify the Static Welfare effects of Economic Integration for other Integration movements in the Developed and Developing World[1], little or no such analysis has been undertaken for CARICOM. Indeed much of what has been attempted on this issue for CARICOM has bordered, almost exclusively, on qualitative speculation based on the experiences of other Developing Countries[2]. With the further attempt to deepen the Integration process via the single market in CARICOM, questions are being asked about CARICOM's impact on the welfare of citizens of the various member states.

This paper is an attempt, therefore, to measure the Static Welfare Gains or Losses which have resulted from the formation of

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CARICOM using Hicksian notions. Section 1 outlines the main static concepts of Trade Creation and Trade Diversion and indicates the Welfare implications that traditional Customs Union Theory posit for small developing countries using General Equilibrium (GE) and PartHxl Equilibrium formulations. Section 2 explores briefly how the concept of welfare change in Customs Union theorizing can be analyzed in terms of Consumer Surplus triangles and evaluated by utilizing Marshallian-based formulations. An analysis of the strengths and limitations of this approach is also examined drawing specifically from the early partial equilibrium studies. Section 3 presents the alternative Hicksian-based concepts of Welfare Change - Compensating and Equivalent Variation (CV, EV) - and illustrates how welfare comparisons can be undertaken using the formulation of Hausman (1981). In the final section, Section 4, an attempt is made to calculate and compare the welfare effects of Economic Integration for various commodity groupings in the Caribbean Common Market using the notion of Compensating Variation.

SECTION 1 : WELFARE EFFECTS OF CUSTOM UNION FORMATION: GENERAL EQUILIBRIUM AND PARTIAL EQUILIBRIUM NOTIONS.

Any useful starting point for the elaboration of welfare effects of Customs Union formation must commence with some broad appreciation of the traditional Vinerian orthodoxy[3] [see Viner (1950)]. This orthodoxy identifies three important considerations which largely determine welfare effects. These considerations relate to Trade

Creation, Trade Diversion and Terms of Trade effects. In the specific context of the Small Economy Model, however, the traditional effects collapse to the former two, only. The general equilibrium format chosen for the exposition of these static effects draws heavily from the work of Michaely (1977) whose analysis utilizes a 3-country-2-good model. For the sake of completeness the countries in this model can be defined as Country A - the Home Country, Country B - the Partner Country and Country C - the Rest of the World. It may in fact be more useful in the specific context of the Caribbean Common Market to think of Country A as one of the More Developed Caribbean member territories (MDCs) - for example Trinidad, Jamaica, Barbados or Jamaica - which forms a union with a composite of the remaining MDCs (Country B) against the Rest of the World[4]. This Home Country A which produces two commodities, Good X and Good M, is assumed to be small relative to its partner and the outside world so that Trade Creation and Trade Diversion are the only relevant variables that determine welfare.

General Equilibrium Formulation.

Following Michaely (1977), the arc segment PQ represents the concave Production Possibility or Transformation Curve of the Home Country facing fixed foreign prices[5] (see Diagram 1a). Imports of Commodity M from the outside world (Country C) are assumed to be cheaper either than imports from Country B or from the Production

price of commodity M in the Home country under autarchy. The free-trade Home Production Equilibrium occurs at point F where the budget restraint line or consumption possibility curve, cc^6, is tangential to the transformation surface, PQ. Consumption occurs at any point along the locus cc. With the formation of the Customs Union between the Home country, A and the partner country, B the home country ceases trade with the rest of the world (country C) and conducts trade, instead, with the union partner. The new production point occurs therefore at G where the marginal cost of Good M in home production is equal to its price in trade with country B. This shift from free trade, point F, to the union (imposition of tariff on imports from the rest of the world) - point G - involves a Production loss, RS units of commodity X, valued at free trade prices, c_1c_1. At point G the economy's budget is, however, no longer c_1c_1 but rather lies along the budget restraint surface, bb. With point H, for instance, representing Home consumption, if the Home country had been trading with country C at country C prices, a quantity OU units of Good X would have been sufficient to allow country A to secure consumption basket H at prices prevailing in country C. SU thus represents the trade shift loss due to the move from free trade to the union. Had the economy been on budget line c_2c_2, a consumption basket to the left of H would have been selected which would have yielded the same welfare. The distance UV is thus an added loss - the consumption loss - which is a result of the shift from free trade to the union. The general equilibrium framework thus allows a detailed

identification of the welfare gains and losses from Customs Union Formation. This framework, however, from a geometric standpoint, is quite cumbersome as a tractable tool for analyzing the welfare effects of Customs Union formation even for the simple three-country-two good case. Fortunately, in a linear world, the information in the general equilibrium format can be re-expressed in partial equilibrium format utilizing the familiar one-to-one correspondence between the commodity-commodity space of the GE world and the commodity-price space of partial equilibrium analysis. This results allows the use of the more tractable partial equilibrium format in the exposition of welfare effects of Customs Union Formation.

Partial Equilibrium Formulation

Diagram 1b displays static welfare effects in the context of the partial equilibrium model. The curve DD^7 represents the compensated demand curve for the imported Good M and shows how with each price change the consumer's income is adjusted so that his welfare remains unchanged (i.e the pure substitution effect). At the tariff included price OP_w+t, OQ_1 units of Good M are produced while OQ_2 units are demanded by the consumer. The remainder (OQ_2-OQ_1) is imported from Country C. With the elimination of the tariff between the Home and and Partner countries because of union formation, OQ_0 units of Good M are produced while OQ_3 units are demanded at the Customs Union price, OP_b. The shaded area DEF in

diagram 1b represents the consumption gain and is quivalent to LT in the general equilibrium diagram while the production gain, ABC, is equivalent to TR units. The shift from free trade to the union also involves losses. These are the production (ALK) and consumption (FIJ) losses which are the equivalent analogues of RS and UV in the general equilibrium setting; and the trade shift loss (AFIK) which is equivalent to SU in the general equilibrium world. In the partial equilibrium framework welfare gains are derived from the trade creating triangles ABC and DEF whilst welfare losses are due to the trade diversion rectangle, CEGH. The net sum of these two effects gives the Vinerian net welfare effect of union formation.

SECTION 2: MEASUREMENT OF WELFARE EFFECTS - MARSHALLIAN APPROACH

The marshallian approach to analyzing welfare effects is based on the evaluation of welfare gains (losses) which accrue from the consumption and production triangles. These triangles essentially reflect the Dupuit-Marshall conceptualization of consumer surplus. Dupuit (1844) introduced the notion of consumer surplus as a monetary measure of welfare change and proposed that it was measurable using the triangle-like area below the demand curve. Marshall (1920) popularized this notion as a measure of satisfaction by showing that there was a one-to-one numerical correspondence between utility (satisfaction) and areas to the left

of the demand curve when the marginal utility of income was constant[8].

In the specific context of linear marshallian supply and demand curves, the welfare effects of CU formation involves the calculation of the areas of the shaded triangles ABC and DEF and the shaded rectangle CEGH. Standard mensuration analysis of classical geometry suggests the following computations:-

1(a) Triangle ABC = $(1/2)*bh=(1/2)*(OQ_0-OQ_1)*(OP_w+t - OP_b)$.

1(b) Triangle DEF = $(1/2)*bh=(1/2)*(OQ_3-OQ_2)*(OP_w+t - OP_b)$.

1(c) Rectangle CEGH = $l*b = (OP_b - OP_w)*(OQ_2 - OQ_1)$.

where l,b and h represent length, breadth and height, respectively. These calculations are predicated on the assumptions of perfect competition, linear supply and demand schedules and the existence of data on home production and home consumption of the particular commodity at the free trade price (OP_w), the customs union price, OP_b and the tariff distorted price, $OP_w + t$. In order to make the welfare effects of tariff liberalization more accessible to quantification, particularly in the context of scarce data on home production and consumption, a popular alternative adopted in the literature involves the mapping of the supply and demand schedules onto an ordinary marshallian demand curve for imports [see for instance, Greenaway (1983) and Marques-Mendes(1986)]. Diagram 1c outlines the basic structure of this mapping. In this diagram the trade creating areas ABC and DEF on the linear marshallian supply-

demand schedules are equivalent to the area A"B"C" on the import demand curve while the trade diverting rectangle CEGH is equivalent to D"C"G"H". These areas are, in fact, portions of the consumer surplus triangle. Quite a number of the empirical trade studies[9] have concentrated on the measurement of welfare using the marshallian import demand schedule as a basic reference frame.

The Marshallian triangle approach to measuring welfare has been criticized, however, on two major fronts. The first criticism pertains to the assumption that the marginal utility of money is constant or independent of variations in income and all prices [Samuelson (1966) and Chipman and Moore (1976)]. This assumption ensures that changes in incomes have no effect on how the consumer allocates his total expenditure among the various commodities. In the real world context, however, changes in income may cause the consumer to spend large amounts of his income on one or a few commodities.

The second criticism is related to the ceteris paribus assumption of price changes. In the partial equilibrium marshallian framework a change in the price of a particular commodity is assumed to be the major factor influencing the change in quantity demanded and hence any variation in utility defined by consumer surplus. The prices of other commodities are assumed to be neutral. In reality, though, there are likely to be several interactions in price changes between different commodities. As a consequence the use of the marshallian ordinary demand curve for imports introduces the critical problem of path dependence. This

problem refers to the fact the sum of the area segments under the demand curve for imports is not independent of the adjustment process in prices and income. To be more formal, consider the following demand function for good i:-

$$x_i = x_i(p, M) \tag{1}$$

where p is the price vector and M is money income. The change in utility resulting from a small change in the consumption vector, to a first order approximation, is:-

$$du = \lambda \sum_{i=1}^{n} p_i dx_i \tag{2}$$

or simply

$$u = \lambda \int_C \sum_{i=1}^{n} p_i dx_i \tag{3}$$

where C is a certain path. The expression for du or u involves complicated line integrals taken over the interval between the initial price-income vector (p^0, m^0) and the terminal vector (p^1, m^1) along some specified path C. If ϕ is defined as follows :-

$$\phi = \int_{c} p \, dx \qquad (4)$$

the value of ϕ, the sum of the area segments, depends on the adjustment process of income and prices. In fact, different series of price-income change can yield different money valuations of the same gain in utility even if the initial and terminal price-income vectors are identical[10]. Thus when p_i changes, the import demand curve for the other commodities ($j \neq i$) also change but at the rate, $\delta x_j/\delta p_i$. In a similar fashion when p_j changes the import demand curve for commodity i shifts at the rate $\delta x_i/\delta p_j$. Unless these rates are equal, i.e ($\delta x_j/\delta p_i = \delta x_i/\delta p_j$[11]) the way in which p_i and p_j are changed will affect the value of ϕ. Several restrictions, therefore, have to be imposed on the preference set to make the marshallian consumer surplus triangle serve as an exact welfare indicator[12].

In summary therefore, the marshallian approach to consumer surplus is defective as a welfare measure if firstly, price changes are substantial and secondly, a large segment of the consumer's budget is spent on a particular good. Given these apparent difficulties with the calculation of welfare based on the Dupuit-Marshall formulation, it seems more appropriate to attempt to estimate the welfare implication of Customs Union formation using Hicksian notions. These notions are explored in the ensuing section.

SECTION 3 HICKSIAN MEASURES OF WELFARE EFFECTS

Hicksian notions of welfare are based on the familiar concepts of compensating and equivalent variation. Compensating Variation (CV) refers to the minimum amount by which a consumer would have to be compensated after a price change to be as well off as before. This is the amount necessary to keep the individual at the original level of utility, U^0, after a price change from p^0 to p^1 holding income constant at y^0. If CV is defined in terms of an expenditure function for imports $e^m(p,U)$ then it can be written as follows:-

$$CV = e^m(p^1, U^0) - e(p^0, U^0)$$
$$= e^m(p^0, U^0) - y^0$$

Equivalent Variation (EV) on the other hand measures the amount of income needed to keep the consumer at the new utility level when faced with original prices.

$$EV = e^m(p^1, U^1) - e(p^0, U^1)$$

These hicksian notions allow an "exact" measure of welfare gain or loss as opposed to the marshallian formulation which provides only an approximation to the true welfare gain or loss. Recently, theoretical and empirical interest in the use of these hicksian notions has intensified as evidenced by the work of Hausman(1981),

Vartia(1983), McKenzie (1982), McKenzie and Ulph (1983), Hayes and Porter-Hudak(1987a, 1987b) and Porter-Hudak and Hayes(1986, 1991). Although these notions of welfare have been recommended by several authors[13] they have not been extensively applied in the context of Customs Union formation. The Direct Differential method developed by Hausman(1981) will be utilized to compute exact welfare measures in the context of Customs Union Formation in the Caribbean Community.

A. HAUSMAN'S DIRECT DIFFERENTIAL APPROACH

Hausman(1981) demonstrated, using numerical examples, that it was not solely the deadweight gains or losses that should be measured but, also, the complete change in consumer surplus which is a trapezoid to the left of the demand curve. This approach to obtaining exact hicksian measures of welfare from the marshallian demand curve involves the following steps :-

(1) Estimation of the Ordinary Demand Curve for Imports[14] of a Commodity by the usual econometric methods.

(2) Integration of the Demand Schedule using Roy's Identity to obtain the Indirect Utility Function.

(3) Inversion of the Indirect Utility Function to obtain the expenditure function for imports utilizing the duality relationship between maximization of utility and expenditure minimization.

(4) Differentiation of the expenditure function to obtain the unobservable compensated demand curve.

(5) Estimation of the relevant area under the compensated

demand curve between the initial and new prices to obtain exact welfare estimates of CV and EV.

The basis of Hausman's method is the direct evaluation of differential equations. In Step 2, based on Roy's identity, observed demand can be expressed as a partial differential equation

$$x = -\frac{\partial v(p,y)}{\partial p} / \frac{\partial v(p,y)}{\partial y} \qquad (5)$$

Since CV and EV requires that one stays on a given indifference surface, $U^0 = v(p(t), y(t))$, v can be totally differentiated to yield

$$\frac{\partial v(p(t),y(t))}{\partial p(t)} \cdot \frac{dp(t)}{dt} + \frac{\partial v(p(t),y(t))}{\partial y(t)} \cdot \frac{dy(t)}{dt} = 0 \qquad (6)$$

Combining equations 5 and 6 results in an ordinary differential equation whose solution yields an expression for income as a function of prices which should be integrable. If the constant of integration is defined as the base utility level then solving for U^0 gives the indirect utility function. The corresponding expenditure function can be obtained by inverting U^0 and income. The usefulness of this method is predicated on the existence of closed form solutions to the specified differential equations. In reality, however, Hausman's approach suffers from two major limitations. Firstly, not every conceivable demand function is likely to have a closed form solution and secondly, the technique

was devised to handle single price changes[15], only.

B. DERIVATION OF EXACT WELFARE INDICATOR FOR CARICOM

The mapping of the supply-demand schedule onto an equivalent import demand curve allows one to focus explicitly on a specified functional representation of import demand to evaluate welfare effects in CARICOM. Consider, therefore, the following import demand curve for each MDC's trade with CARICOM :-

$$X_1 (P_{m1}, Y) = P_{m1}^{\alpha} . Y^{\beta} \qquad (7)$$

where X_1 - Quantity Imported of Commodity 1 from CARICOM.
P_{m1} - Price of Imported Commodity 1.
Y - Disposable Income of Consumer in MDC.

Given Roy's identity and the implicit function theorem, where $v(P_{m1}(.),Y(.))$ is the Indirect Utility Function,

$$\frac{dY(t)/dt}{dP_{m1}(t)/dt} = \frac{-\partial v(P_{m1}(t), Y(t))/\partial P_{m1}}{\partial v(P_{m1}(t), Y(t))/\partial Y} = X_1 \qquad (8)$$

one obtains :-

$$\frac{dY}{dP_{m1}} = X_1 = P_{m1}^{\alpha} . Y^{\beta} \qquad (9)$$

The above equation is a first order ordinary differential equation whose solution by the method of separation of variables yields the following expression:-

$$\frac{1}{1-\beta} \cdot Y^{1-\beta} = \frac{1}{\alpha+1} \cdot P_{m1}^{\alpha+1} + C \qquad (10)$$

where C is a constant. The Indirect Utility Function[16] is obtained by setting $C=U_0$, so that :-

$$v(P_{m1}, Y) = C = U^0 = \frac{Y^{1-\beta}}{1-\beta} - \frac{P_{m1}^{\alpha+1}}{\alpha+1} \qquad (11)$$

Utilizing the dual relationship between the Indirect Utility Function, $v(P_{m1},Y)$ and the expenditure function for imports one obtains[17]:-

$$e^m(P_{m1}, U^0) = \left[(1-\beta) \cdot \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1} \right) \right]^{\frac{1}{1-\beta}} \qquad (12)$$

The compensated import demand function is obtained by differentiating the expenditure function with respect to the price of imported commodity 1 (Shephard's Lemma) :-

$$h_1(P_{m1}, U^0) = \frac{\partial e^m(P_{m1}, U^0)}{\partial P_{m1}} \qquad (13)$$

where $h(P_{m1}, U^0)$ is the compensated import demand curve. This operation yields the following expression:-

$$h_1(P_{m1}, U^0) = \left(P_{m1}^{\alpha} \cdot \left[(1-\beta) \cdot \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{\beta}{1-\beta}}\right) \qquad (14)$$

Compensating variation can be obtained by integrating the compensated import demand curve over the range P^1_{m1} to P^0_{m1} with the appropriate values of U^0, $(P^0_{m1} > P^1_{m1})$.

$$CV = \int_{P^1_{m1}}^{P^0_{m1}} \left(P_{m1}^{\alpha} \cdot \left[(1-\beta) \cdot \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{\beta}{1-\beta}}\right) dP_{m1} = e(P_{m1}, U^0)_{P^1_{m1}}^{P^0_{m1}} \qquad (15)$$

$$e(P_{m1}, U^0) = \left[\left[(1-\beta) \cdot \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{1}{1-\beta}}\right]_{P^1_{m1}}^{P^0_{m1}} \qquad (16)$$

where

$$U^0 = \frac{(Y^0)^{1-\beta}}{1-\beta} - \frac{P_{m1}^{0\,\alpha+1}}{\alpha+1} \qquad (17)$$

The calculation of CV involves the evaluation of the following expression:-

$$CV=\left[(1-\beta).\left(U^0+\frac{(P^0_{m1})^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{1}{1-\beta}}-\left[(1-\beta).\left(U^0+\frac{(P^1_{m1})^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{1}{1-\beta}} \qquad (18)$$

This expression for CV measures the compensation that has to be taken away from the CARICOM consumer if he is to maintain his original Pre-Customs Union utility level, U^0, given a fall in prices from P^0_{m1} to P^1_{m1} on account of the tariff reduction induced by union formation.

Likewise Equivalent Variation (EV) can be obtained in a similar fashion using appropriate values for U^1 :-

$$EV=\left[(1-\beta).\left(U^1+\frac{(P^0_{m1})^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{1}{1-\beta}}-\left[(1-\beta).\left(U^1+\frac{(P^1_{m1})^{\alpha+1}}{\alpha+1}\right)\right]^{\frac{1}{1-\beta}} \qquad (19)$$

where

$$U^1=\frac{(Y^0)^{1-\beta}}{1-\beta}-\frac{P^{1\,\alpha+1}_{m1}}{\alpha+1} \qquad (20)$$

Given the new utility level, U^1, under Customs Union formation the expression for EV measures the compensation that is to be paid to the consumer to maintain his new utility level under the union when faced with Pre-Customs Union import prices.

In attempting to calculate the above-mentioned expressions for CV and EV it is critical to have estimates of the α and β parameters. The next section reports estimates for parameters using standard econometric methods and summarizes the welfare effects for particular commodities in the Caribbean Community.

SECTION 4: MEASUREMENT OF WELFARE EFFECTS IN CARICOM

The econometric estimates of the welfare effects in CARICOM were undertaken for three of the More Developed Countries (MDCs) of CARICOM, namely Trinidad and Tobago, Barbados and Jamaica. It was not possible to consider Guyana since disaggregated trade data at the SITC 3-Digit level was unavailable for most of the 1980s. Data on the volume and value of imports were obtained from UNCTAD's COMTRADE database. Broad 3-Digit (Rev 1) import categories were chosen based on the availability of data with the proviso that the selected series account for approximately fifty to seventy per cent of imports from intra-regional sources. Programs were written using Dbase4 and SAS to extract the value and quantity data, on a historical basis, for each MDC's trade with CARICOM. These data were exported in a format which allowed easy portability to the TSP[18] processing environment.

The time series data provide the basis for the estimation of the following log-linear version of the import demand equation :-

$$\ln X_1 = \alpha_0 + \alpha_1 . Ln P_{m1} + \beta . \ln Y \qquad (21)$$

$$\alpha_1 \leq 0, \ \beta \geq 0.$$

Once reliable estimates for α_1 and β are obtained these are substituted into the expression for CV (and EV) to arrive at welfare change estimates. It is useful, at this juncture, to stress that a major problem with applied Customs Union welfare studies relates to the unavailability of reliable parametric estimates and elasticities to allow proper evaluation of welfare effects. Indeed, quite a few of the above-mentioned studies relied on assumed elasticities and "guesstimates" of parameters to inform welfare evaluation. A special attempt is made in our analysis to avoid this pitfall.

Estimation Methodology

The log-linear versions of the import demand equation were estimated by Ordinary Least Squares (OLS) for Trinidad and Tobago and Barbados over the Integration period (1973-1990) and for Jamaica over the period 1973-1988. Estimation results for these countries are reported in Tables 1, 2 and 3. One important caveat that should be stated at the outset is the fact that the estimations were undertaken on a product by product basis with no consideration given to possible complimentarity and/or substitutability among the broad product categories. In the event that these relationships exist between the various groups, the

error terms in individual equations may actually be cross-correlated violating one of the important assumptions on which OLS estimation is based.

Estimation Results

Table 1 reports estimation results for Trinidad's imports from CARICOM. The results from these preliminary estimations are quite modest. In seven of the selected product categories - 042, 081, 099, 541, 554, 642 and 893 - the adjusted coefficients of determination are under sixty-nine (69) per cent. In one specific case, product category 541, the adjusted coefficient of determination is only 0.30 indicating that import prices and disposable income explain only thirty per cent of the variation in the quantity of the commodity imported from CARICOM. Generally, though, the coefficients on the price and income variables carry the correct sign. For the import price variable, the coefficients exceed unity in magnitude implying that quantities of the various products imported from CARICOM are quite responsive to changes in import prices. In the case of the disposable income variable all the product coefficients with the exception of 821 are less than unity suggesting that the quantities imported from CARICOM into Trinidad are not responsive to changes in disposable income.

Estimation results for Jamaica are reported in Table 2. The adjusted coefficients of determination are relatively low especially for product categories 048, 099, 332, and 541 lying

generally below 60 per cent in these cases. Like the Trinidad case, the adjusted coefficient for Medicinal and Pharmaceutical products (541), is particularly low indicating that only a small percentage of the variation in the quantity imported from CARICOM of this product is determined by price and income considerations. The coefficients on import prices generally have the correct signs except for Product Group 243 (Wood shaped or simply worked), where the sign was positive and the t-statistic insignificant. As regards the coefficients on disposable income, these exceeded unity in five of the commodity groupings - 042, 099, 332, 554 and 581 - indicating some responsiveness in the quantities imported of these products from CARICOM to changes in disposable income. For product groups 048, 533, 541 and 641 the β coefficients indicate an inelastic response of quantity imported from CARICOM to changes in income. Both the income coefficients for product groups 243 and 422 were incorrectly signed.

The estimation results for Barbados are generally more satisfactory when compared with those for Trinidad and Tobago and Jamaica. In most cases the adjusted coefficients of determination are quite high with the sole exception being the Metal Containers product group where the coefficient is barely above fifty per cent. The majority of the import price coefficients are correctly signed and are at least significant at the 10 per cent level. These coefficients which represent elasticities suggest a high degree of responsiveness of quantity imported from CARICOM to changes in import prices. In the context of the income variable all the

coefficients carry the correct sign although for three product categories - 042, 642 and 692 - the coefficients are statistically insignificant. The majority of the coefficients on income are less than unity indicating a general non-responsiveness of quantity imported from CARICOM to changes in income.

Several criticisms can be made about these preliminary empirical results. Firstly no detailed attempt was made to examine possible non-stationarities in the trade data. This issue is an important consideration since it can affect the reliability of the OLS estimates. The literature involving tests for unit roots and cointegration is particularly relevant if any great amount of confidence is to be placed in these results. Secondly, the issue of zero homogeneity or the absence of "money illusion" was not strictly imposed or tested in our framework. This condition requires that the coefficients on prices and income must sum to zero if quantity demanded of the commodity is not to change when prices and incomes are increased by the same proportion, λ.
In short, given the proportionality factor, λ

$$X_1 (P_{m1}, Y) = (\lambda P_{m1})^{\alpha} . (\lambda Y)^{\beta} \qquad (22)$$

$$X_1 (P_{m1}, Y) = (P_{m1}^{\alpha} . Y^{\beta}) . \lambda^{\alpha+\beta} \qquad (23)$$

the zero homogeneity condition is violated unless $\alpha + \beta=0$.

Welfare Considerations

In evaluating the welfare effects in CARICOM it is critical to define the base and terminal periods over which welfare change can be evaluated. The base period in our analysis is taken to be the period before the formation of the Customs Union while the terminal period represents the period of Customs Union Formation. In the specific context of our CV measure, the year 1968 was chosen as the base period for Trinidad and Tobago and Barbados while the year 1972 was chosen for Jamaica. These years represent periods prior to the establishment CARICOM. The terminal period chosen for Trinidad and Tobago and Barbados, respectively was the year 1990 while the year 1988 was selected as the terminal year for Jamaica. These terminal years are used to proxy the period of Customs Union formation.

The Welfare effects for CARICOM were calculated from the expression for CV defined in equation 18. This expression requires data on base utility which is a function of base period income and prices, values for the α and β parameters, and base and terminal period import prices. Critical to the interpretation of the welfare effect is the method adopted for deciding on the relevant import price in the terminal period. In this analysis the terminal import price is defined as a 20 per cent unilateral reduction in the base period or pre-customs union import price. In short, $P^1_{m1}=$

$P^0_{m1} - \phi P^0_{m1}$.

These unilateral reductions were meant to mimic recent decisions taken by Heads of Government in CARICOM to reduce the Common External Tariff (CET) to a maximum of twenty (20) per cent by January 1, 1988. There is of course a problem in utilizing this rate of 20 per cent unilaterally across all broad commodity groups. The new harmonized Common External tariff schedule published by CARICOM has identified at the eight-digit item level the requisite CET to be charged on commodities depending on whether they are competing or non-competing inputs or final goods[19]. These rates differ markedly across the various items imported into the common market. Ideally, in the context of the present study, it would be more appropriate to reflect these differential CET rate charges in the calculation of welfare derived from our CV measure. However this was not possible for two reasons. Firstly, the data used in this analysis were based on SITC (Revision 1) categories. There is at present no correlation table[20] available at CARICOM which maps the new Harmonized item codes into their respective SITC (Rev 1) counterparts. Secondly, the import data in our study are based on SITC 3-Digit aggregations whereas CARICOM has prepared its tariff rates at the finer eight-digit level. No 3-digit aggregations, to our present knowledge, have been prepared by the Secretariat.

Welfare results for CARICOM are reported in Table 4. These results are based on CV expressed as a percentage of the income spent on importing the particular product category from CARICOM. A casual perusal of the Table indicates that the welfare gains

identified from union formation are **extremely small** for the selected product categories. Only in the case of the imports of Margarine and Shortening (Trinidad) and Medicinal and Pharmaceutical Products (Barbados) were the welfare effects in the vicinity of 1.0 per cent of disposable income. These results tend to concur with speculative beliefs that the regional integration movement has had little impact on the economic welfare of citizens of the MDC territories.

Total welfare effects were obtained by aggregating the welfare gains from each of the individual product categories for the various MDCs. These aggregate effects as a percentage of disposable income amount to 0.093, 0.911 and 1.269 per cent, respectively for Jamaica, Trinidad and Tobago and Barbados. These tentative results indicate, more importantly, that the overall impact of CARICOM on the welfare of citizens in the three MDC territories is unevenly distributed. Barbados, for instance, seems to have benefitted more from regional association than either Trinidad and Tobago or Jamaica. Moreover our results indicate that citizens in Jamaica have benefitted the least from union formation in CARICOM. Another important finding in our present study is that the small impact of CARICOM may actually mask great variation in the distribution of welfare effects across the various commodity groupings. In the context of our present findings, for instance, both Medicinal/Pharmaceutical Products and Natural Gas have made the largest contributions to welfare in Barbados, with a combined compensating variation to disposable income ratio of 1.19 percent.

Conclusion

Results based on "exact" hicksian notions have confirmed a priori speculation that CARICOM has had little effect on the economic welfare of citizens in the More Developed territories of Trinidad and Tobago, Barbados and Jamaica. These results need to be interpreted however with care since they are essentially static in design and are based on a rather narrow conceptualization of economic welfare, i.e consumer surplus. In refining this study it is our intention to attempt to incorporate differential tariff rates based on the new Harmonized System developed for CARICOM as well as to experiment with richer econometric specifications, in particular the newer flexible functional forms (e.g Translog, Generalized McFadden and Almost Ideal Demand Systems). These specifications would allow some analysis of complimentarity and substitutability between products groups and would enable the employment of recent developments in econometric estimation and testing.

TABLE 1: REGRESSION RESULTS FOR TRINIDAD AND TOBAGO

LQM(.)	CONST	LP(.)	LINC	$RBAR^2$	D.W.
	(α_0)	(α_1)	(β)		
(042)	1.87	-3.86	0.582	0.52	1.50
	(0.44)	(-1.37)	(1.48)		
(081)	-6.19	-1.68	0.68	0.62	2.14
	(-0.87)	(-1.23)	(1.84)		
(091)	1.21	-1.93	0.21	0.83	2.23
	(0.22)	(-1.97)	(1.92)		
(099)	3.52	-5.32	0.79	0.61	1.63
	(2.40)	(-4.65)	(4.26)		
(122)	-2.36	-1.18	0.69	0.81	1.84
	(-0.91)	(-3.45)	(2.06)		
(533)	1.24	-4.56	0.85	0.72	1.51
	(1.08)	(-3.01)	(3.81)		
(541)	7.85	-3.54	0.15	0.30	1.45
	(3.22)	(-1.20)	(0.75)		
(554)	2.82	-6.33	0.80	0.61	1.65
	(1.22)	(-2.79)	(2.75)		
(642)	2.17	-4.36	0.58	0.68	1.64
	(0.86)	(-1.83)	(2.33)		
(821)	-1.47	-5.25	1.23	0.85	1.39
	(-0.43)	(-3.96)	(2.79)		
(893)	1.11	-5.78	0.98	0.68	1.99
	(0.54)	(-1.83)	(2.64)		

Note: Figures in ( ) represent t-statistics.

TABLE 2: REGRESSION RESULTS FOR JAMAICA

LQM(.)	CONST	LP(.)	LINC	$RBAR^2$	D.W.
	(α_0)	(α_1)	(β)		
(042)	13.42	-18.47	1.25	0.78	1.70
	(2.56)	(-3.01)	(2.76)		
(048)	1.01	-4.02	0.92	0.54	1.44
	(0.19)	(-0.97)	(1.81)		
(099)	-4.72	-3.69	1.40	0.56	1.83
	(-1.23)	(-2.12)	(4.01)		
(243)	15.10	2.13	-0.83	0.68	1.74
	(1.83)	(-1.08)	(-0.96)		
(332)	4.42	-7.42	1.30	0.60	1.77
	(1.15)	(-1.99)	(4.05)		
(422)	13.81	-4.74	-0.13	0.75	1.78
	(3.85)	(-2.42)	(-0.37)		
(533)	9.66	-8.28	0.44	0.63	1.89
	(2.53)	(-5.47)	(1.22)		
(541)	-1.42	-9.42	0.76	0.35	1.59
	(-0.31)	(-1.52)	(1.93)		
(554)	13.06	-16.42	1.04	0.76	1.26
	(2.21)	(-5.16)	(2.25)		
(581)	-2.29	-3.43	1.01	0.65	1.82
	(-0.47)	(-4.80)	(2.10)		
(642)	1.35	-2.70	0.73	0.66	1.79
	(0.32)	(-3.96)	(1.84)		

Note: Figures in ( ) represent t-statistics.

TABLE 3: REGRESSION RESULTS FOR BARBADOS

LQM(.)	CONST	LP(.)	LINC	$RBAR^2$	D.W.
	(α_0)	(α_1)	(β)		
(042)	3.99	-5.25	0.011	0.84	1.94
	(1.78)	(-1.63)	(0.05)		
(048)	-1.99	-1.92	0.31	0.87	1.58
	(-1.36)	(-1.79)	(1.90)		
(091)	4.06	-10.48	0.92	0.85	1.54
	(2.73)	(-5.21)	(3.33)		
(112)	3.51	-4.31	0.49	0.94	2.22
	(1.58)	(-2.95)	(1.97)		
(322)	7.38	-14.99	1.45	0.95	1.78
	(10.44)	(-7.57)	(9.38)		
(341)	5.09	-1.44	0.039	0.89	1.98
	(2.97)	(-1.82)	(2.11)		
(541)	1.53	-2.92	0.212	0.71	2.60
	(0.83)	(-1.74)	(1.59)		
(554)	4.07	-5.56	0.45	0.92	1.45
	(5.08)	(-3.31)	(3.55)		
(642)	1.86	-2.90	0.11	0.91	2.19
	(3.17)	(-1.87)	(0.97)		
(692)	7.46	-4.87	0.04	0.56	1.44
	(3.72)	(-5.03)	(1.22)		
(821)	2.17	-6.27	0.87	0.88	1.83
	(2.64)	(-7.49)	(6.76)		

Note: Figures in ( ) represent t-statistics.

TABLE 4: WELFARE EFFECTS IN THE MDCS OF CARICOM: COMPENSATING VARIATION.

SITC (REV 1) PRODUCT GROUPS	TRINIDAD & TOBAGO	BARBADOS	JAMAICA
	CV/INC	CV/INC	CV/INC
042 Rice	0.00094	0.0057	0.0*
048 Cereal Prep.	-	0.066	0.00039
081 Feeding stuff	0.0077	-	-
091 Margarine & Short.	0.86	0.0*	-
099 Food Preparations	0.000047	-	0.00064
112 Alcoholic Beverages	-	0.00059	-
122 Tobacco Manuf.	0.042	-	-
243 Wood (Shaped)	-	-	0.082
332 Petroleum Products	-	0.0*	0.0*
341 Gas, Nat & Manuf.	-	0.41	-
422 Oth. Veg. Oils	-	-	0.00019
533 Pigments, Paints	0.00022	-	0.0*
541 Med. & Phar. Prod.	0.00012	0.78	0.0*
554 Soaps & Pol. Prep	0.0*	0.0*	0.0*
581 Plastic Materials	-	-	0.00015
642 Art. of Paper Pulp	0.000038	0.00091	0.0082
692 Metal Containers	-	0.00015	-
821 Furniture	0.0*	0.0*	-
893 Art. of Plastic	0.0*	-	-
Total Welfare Effect	**0.911**	**1.269**	**0.093**

Notes: 1. -: Not Applicable.
2. *: Values are less than E-06.

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ENDNOTES

1. See for instance Cline and Delgado (1978) and Leith (1992).

2. A few of the notable exceptions include the studies by Bennett (1982), Gondwe and Griffith (1989), Housty (1985), Ramcharran (1978) and the World Bank (1990).

3. See Nicholls (1993) for a more complete discussion on Vinerian thought.

4. See figure 1 for a graphical illustration of this point.

5. The fixity of foreign prices reflects the small country assumption.

6. The slope of this line is simply $-(P_x/P_m)$, the price of imports in terms of exports.

7. This curve is usually derived from the consumer's preference function.

8. See Burns (1973) for a formal statement of marshallian consumer surplus.

9. See for instance Corden (1957), Johnson (1960), Harberger (1959, 1964), Stern (1964), Balassa and Kreinin (1967), Magee (1974), Baldwin and Mutti (1973), Cline et al. (1978), Cline and Delgado (1978) and more recently, Yeaboah (1993).

10. See Jeon and Von Furstenberg (1986) for a complete explanation.

11. This is the path independence condition.

12. A fairly common restriction imposed is the condition of homotheticity.

13. See for instance Bhagwati and Johnson (1960), Anderson (1974), Leamer and Stern (1977), Helpman (1978), Jeon and Von Furstenberg (1986) and Winters (1990).

14. Hausman discusses, in his original paper, the method in terms of ordinary demand curves. Import demand curves are utilized in this context with the implicit assumption that consumers in CARICOM derive much of their utility from the consumption of imported commodities.

15. Numerical methods utilized by Mckenzie and Ulph (1983) and Vartia (1983) have improved on these inherent weaknesses of Hausman's approach.

16. The constant of integration depends on the initial utility level.

17. This is achieved by interchanging Income and Base Utility.

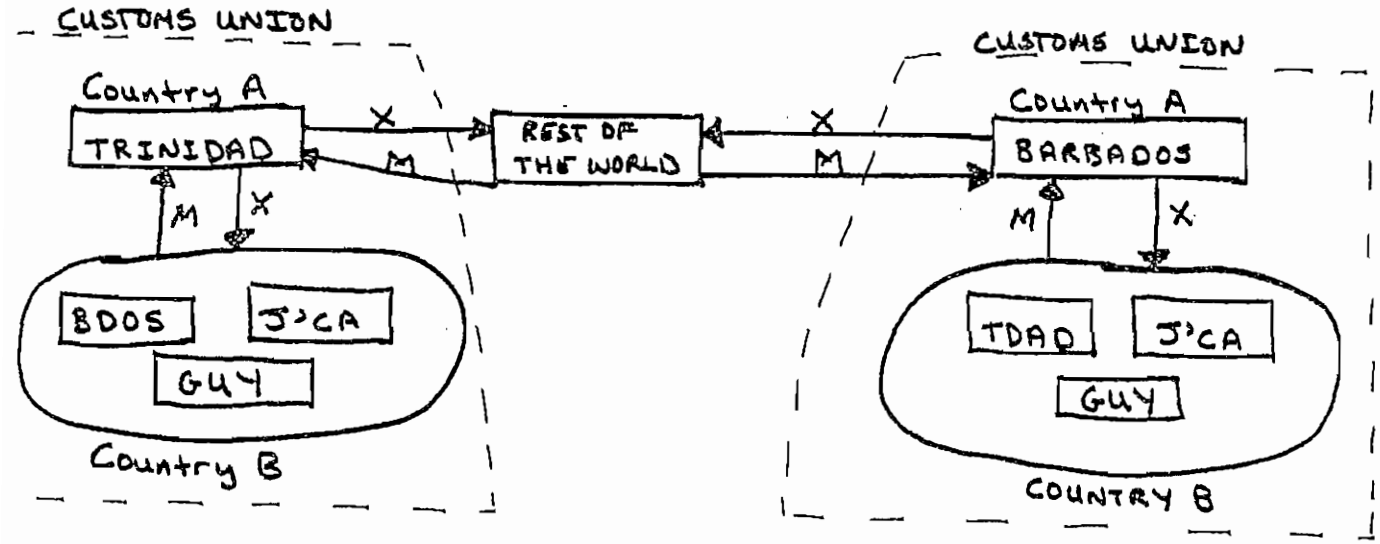
18. All econometric estimations were undertaken with the Time Series Processor (TSP), version 4.2B, 1993.

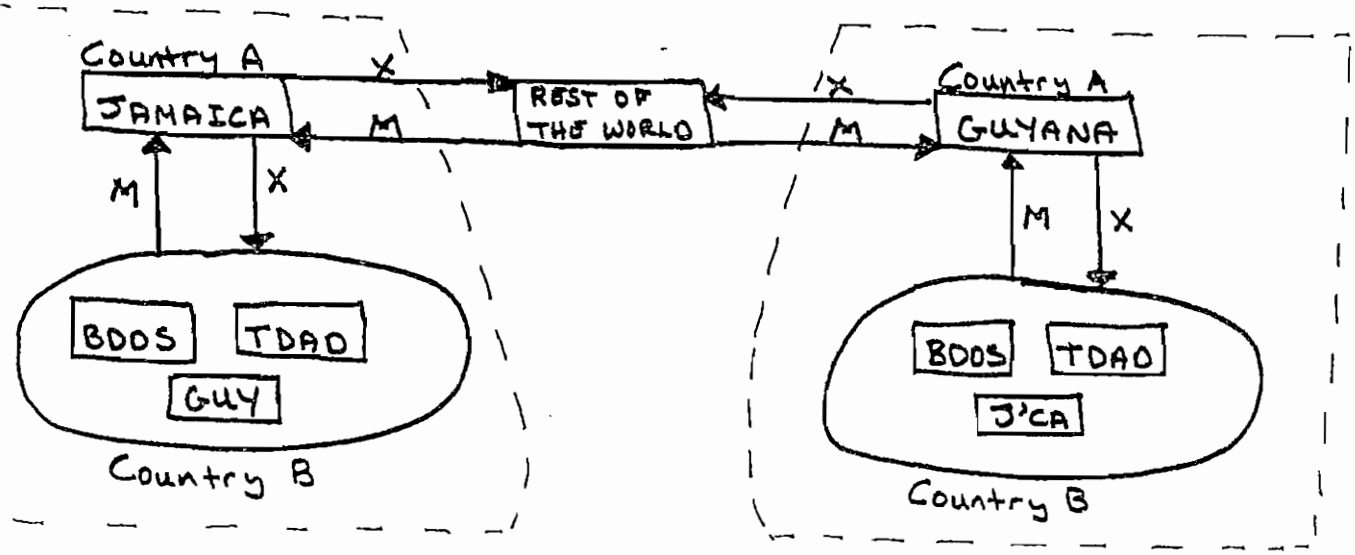
19. See Caribbean Community Secretariat (1993a,b)

20. The CARICOM Secretariat has prepared correlation tables which allow item mappings from the Harmonized Scheme (HS) to the SITC Rev 2 and Rev 3 categories.

Diagram I

GRAPHICAL ILLUSTRATION OF CUSTOMS UNION FORMATION IN CARICOM [3-Country-2 Good Model]

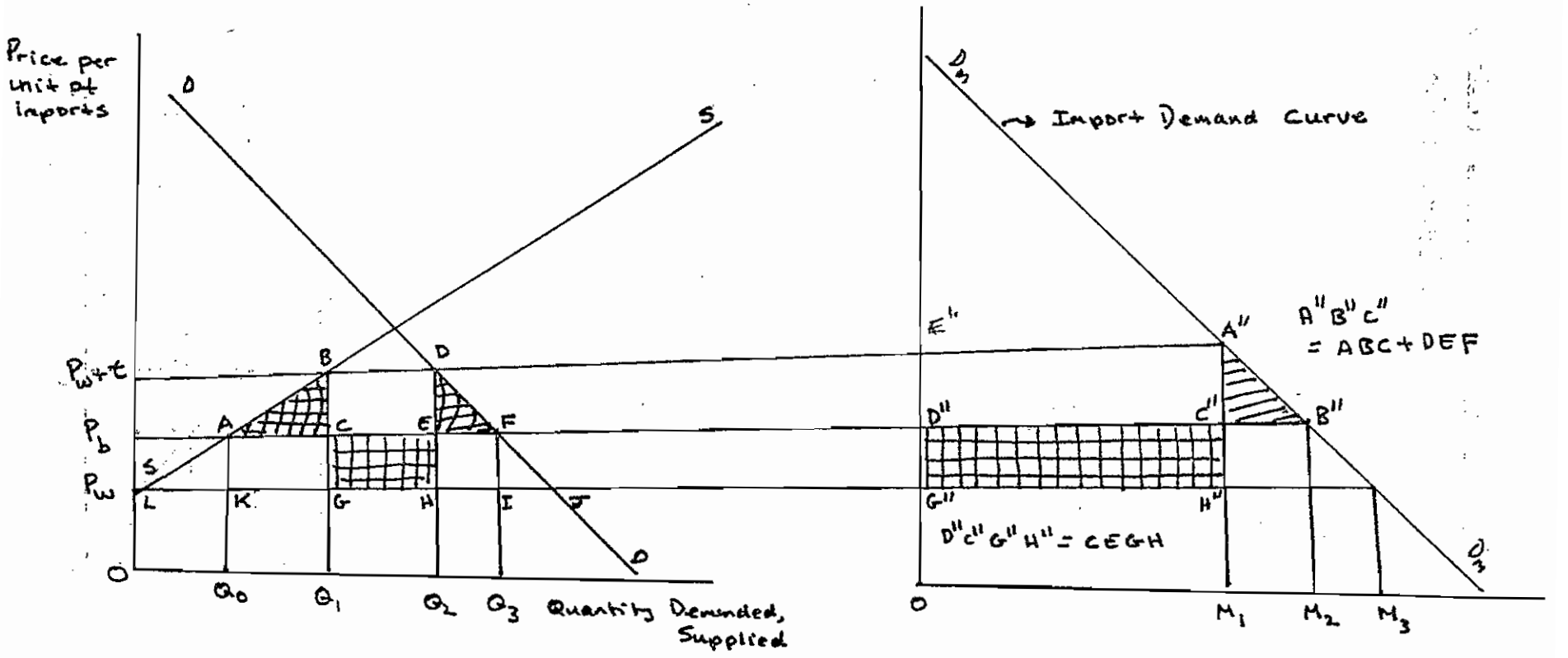




X - Exports.

M - Imports.

Diagram 1C :- MAPPING FROM LINEAR SUPPLY - DEMAND SCHEDULES TO IMPORT DEMAND CURVE



Sources: Greenaway (1983) and Marques-Mendes (1986).

Diagram 1a: General Equilibrium Analysis (Customs Union Formation)

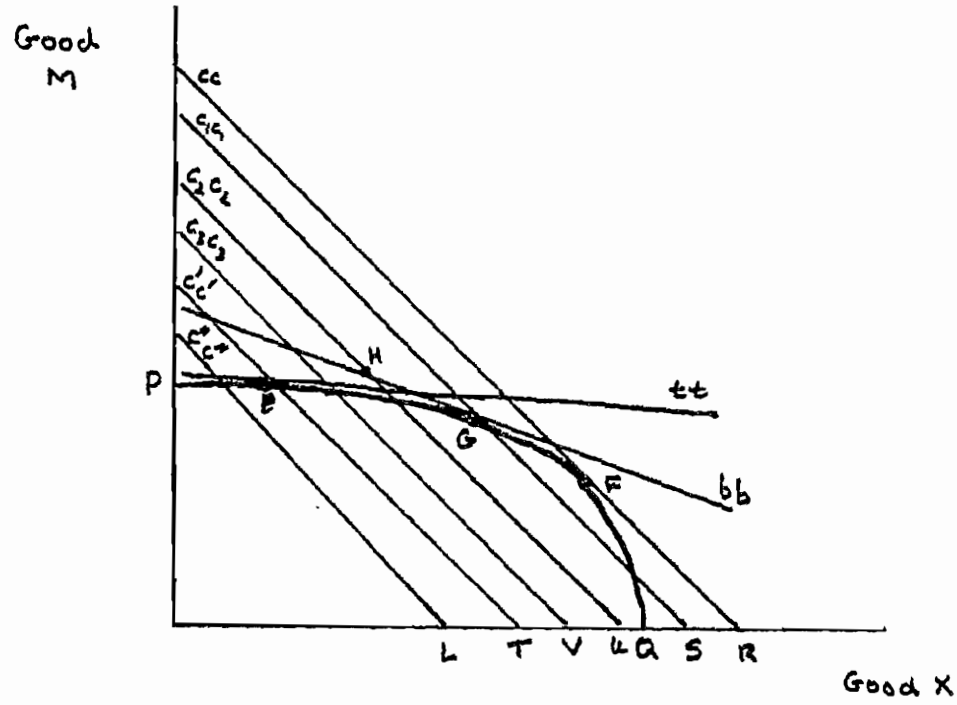


Diagram 1b: Partial Equilibrium Analysis (Customs Union Formation)

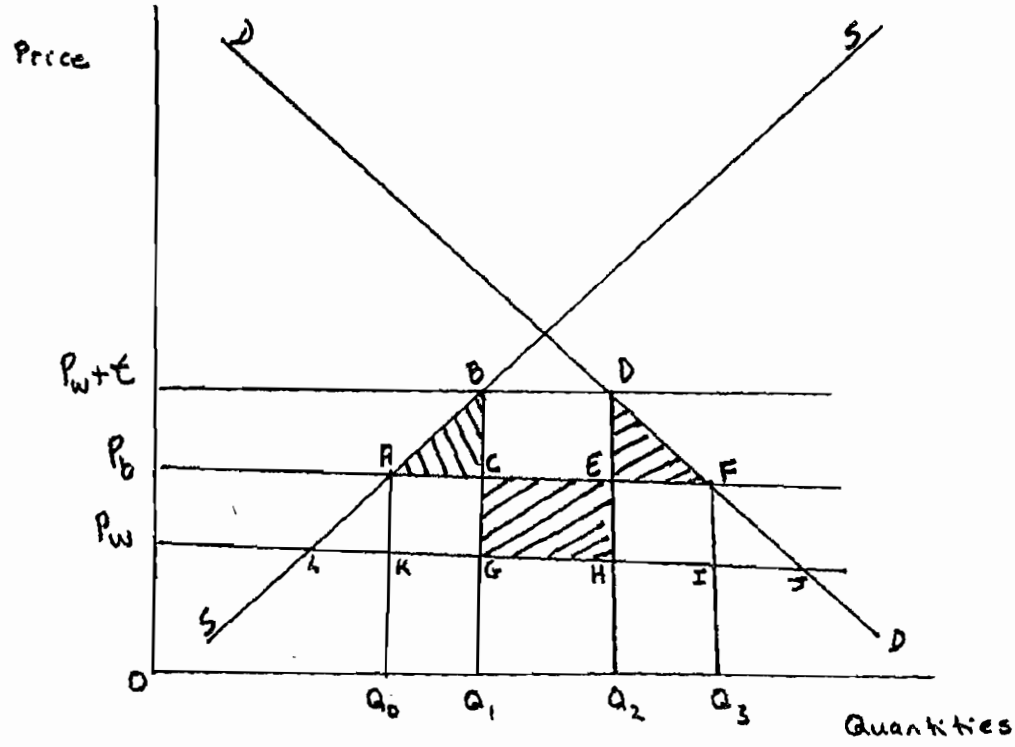
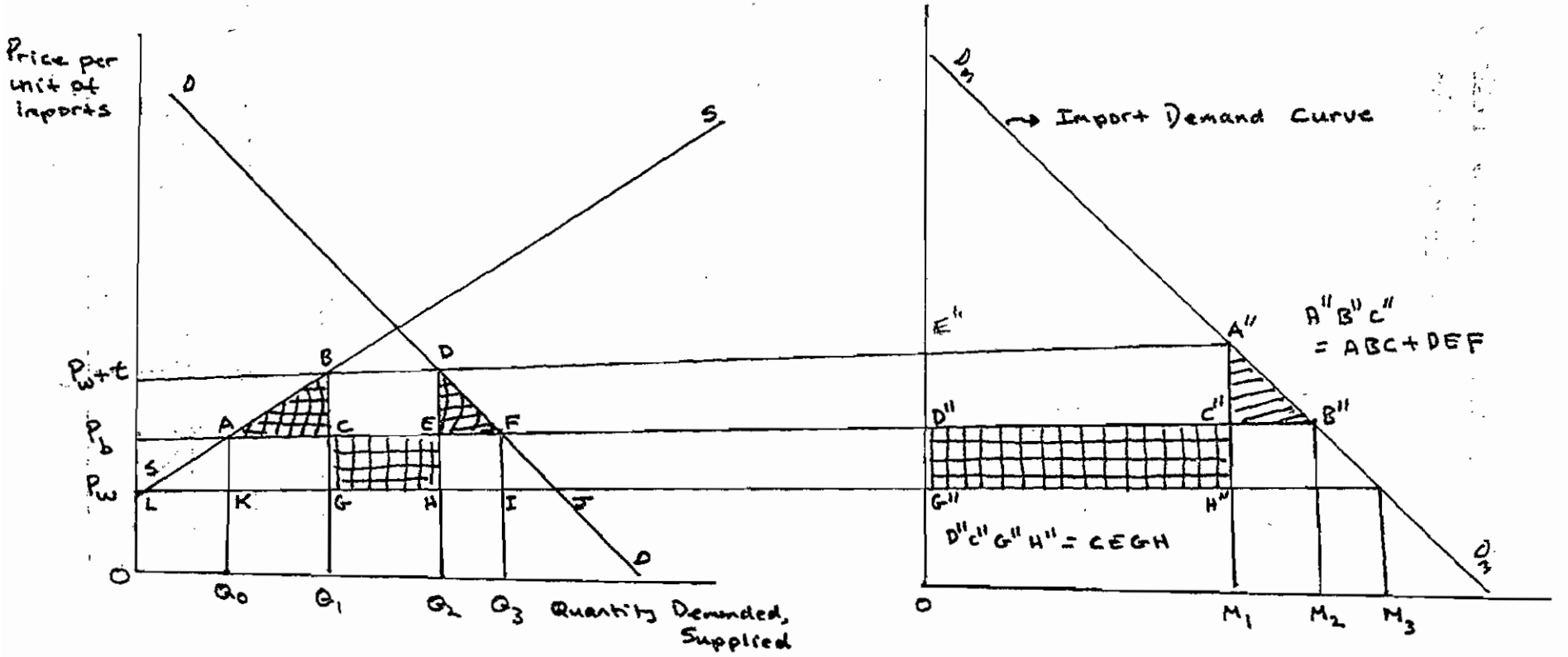


Diagram 1C :- MAPPING FROM LINEAR SUPPLY - DEMAND SCHEDULES TO IMPORT DEMAND CURVE



Sources: Greenaway (1983) and Marques-Mendes (1986).