

**WELFARE EFFECTS OF ECONOMIC INTEGRATION IN
THE CARIBBEAN COMMUNITY (CARICOM)**

by

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CHAPTER 6

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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 World⁸⁰, 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 Countries⁸¹. 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 chapter is an attempt, therefore, to measure the Static Welfare Gains or Losses which have resulted from the formation of CARICOM using Hicksian notions. Section 6.1 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 Partial Equilibrium formulations. Section 6.2 explores briefly how the concept of welfare change in Customs

⁸⁰ See for instance Cline and Delgado (1978) and Leith (1992).

⁸¹ A few of the notable exceptions include the studies by Bennett (1982), Gondwe and Griffith (1989), Housty (1985), Ramcharan (1978) and the World Bank (1990).

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 6.3 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 formulations of Hausman (1981). In the final section, Section 6.4, an attempt is made to calculate and compare the welfare effects of Economic Integration for various commodity groupings in the Caribbean Common Market using both the marshallian and hicksian approaches.

6.1 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. 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 World⁸². 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.

6.1.1 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 prices⁸³ (see Figure 6.2). 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, cc⁸⁴, 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 point G where the marginal cost of Good M in

⁸² See Figure 6.1 for a graphical illustration of this point.

⁸³ The fixity of foreign prices reflects the small country assumption.

⁸⁴ The slope of this line is simply $-(P_x/P_m)$, the price of imports in terms of exports.

Figure 6.1 Graphical Illustration of Customs Union Formation in CARICOM [3_Country-2_Good Model]

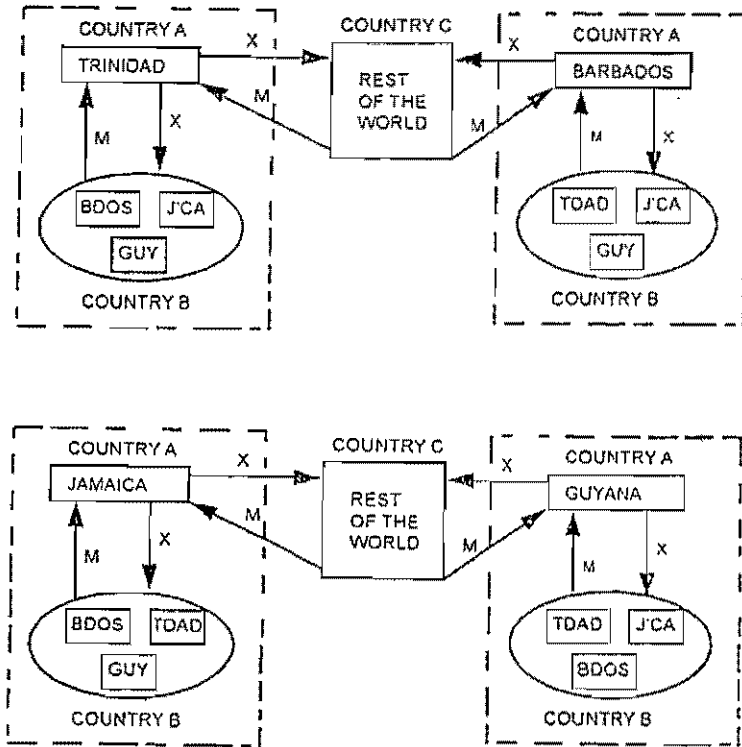
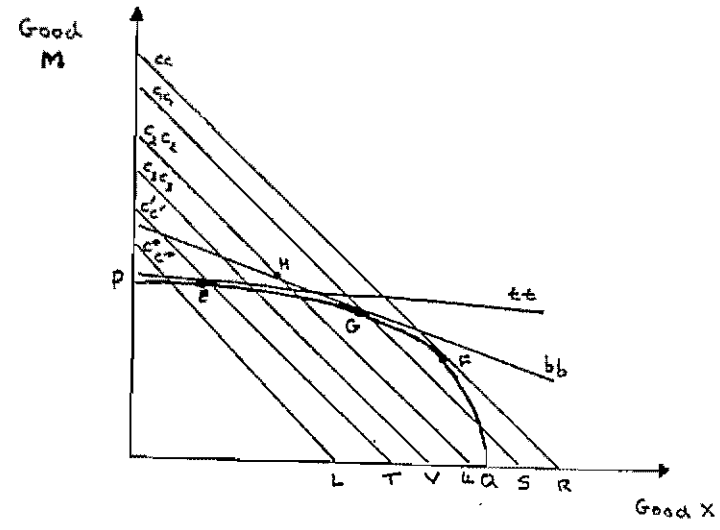


Figure 6.2 General Equilibrium Diagram of Customs Union Formation



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, however, equilibrium 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.

6.1.2 Partial Equilibrium Model

Figure 6.3 displays static welfare effects in the context of the partial equilibrium model. The curve DD⁸⁵ 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 $OP_w(1+t)$, 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 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_u . The shaded area DEF in Figure 6.3 represents the consumption gain and is equivalent 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, CEHG. The net sum of these two effects gives the Vinerian net welfare effect of union formation.

⁸⁵ This curve is usually derived from the consumer's preference function

commodity at the free trade price (OP_w), the customs union price, OP_b and the tariff distorted price,

$OP_w(1+t)$. 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)]. Figure 6.4 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 $A^2B^2C^2$ on the import demand curve while the trade diverting rectangle CEHG is equivalent to $D^2C^2G^2H^2$. The areas are in fact portions of the consumer surplus triangle. Quite a number of the empirical trade studies⁸⁷ have concentrated on the measurement of welfare using this Marshallian import demand schedule as a basic reference frame. The trade creation area under the ordinary marshallian demand curve can be re-expressed as follows:-

$$TC=0.5*(OP_b-OP_w(1+t))*\{OM_2-OM_1\} \quad (6.4)$$

$$=0.5*dP_b*dM \quad (6.5)$$

where $dP_b=\{OP_b-OP_w(1+t)\}$ ⁸⁸ and $dM=\{OM_2-OM_1\}$

⁸⁷ See for instance Corden (1957), Johnson (1960), Harberger (1954, 1959), Stern (1964), Balassa and Kreinin (1967), Magee (1974), Baldwin and Mutti (1975), Cline et al. (1978), Cline and Delgado (1978) and more recently Yeaboah (1993).

⁸⁸ The change can be written in this format since one is moving down the demand curve.

OM_1	Quantity of imported commodity before Customs Union Formation.
OM_2 -	Quantity of imported commodity after Customs Union Formation.
$OP_w(1+t)$	Tariff-inclusive import price before Customs Union Formation.
OP_b -	Tariff exclusive import price with the partner country after customs Union Formation.
TC -	Trade Creation.

The trade diverting area can be obtained from the following expression:-

$$TD=\{OP_b-OP_w\}*OM_1$$

$$= \{(OP_w(1+t)-OP_w)-(OP_w(1+t)-OP_b)\}*OM_1 \quad (6.6)$$

$$=dP_w*OM_1 \quad (6.7)$$

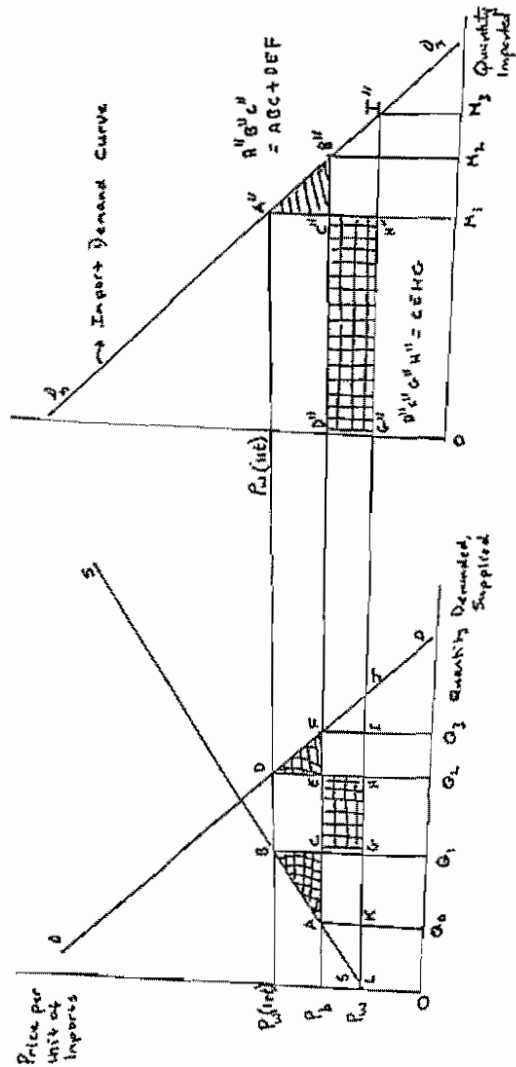
where $dP_w=\{OP_b-OP_w\}$ and

OP_w Tariff-exclusive import price with the rest of the world.

The Net Welfare effect of Customs Union Formation can be expressed as follows:-

$$NWE=\{TC - TD\} \quad (6.8)$$

Figure 6.4 Mapping From Linear Supply-Demand Schedules to Import Demand Curve



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

If dM is unknown, ex-ante estimates of the trade creating area would require use of estimates of the price elasticity of demand. The arc elasticity of demand can be expressed as follows:-

$$E_p^m = (dM/M)/(dP/P) \quad (6.9)$$

$$\text{where } dM/M = (OM_2 - OM_1)/(OM_1)$$

$$\text{and } dP/P = (OP_b - OP_w(1+t))/(OP_w(1+t))$$

which implies that:-

$$dM = E_p^m \cdot (dP/P) \cdot M \quad (6.10)$$

Substituting for dM in the trade creating expression (and noting that $P = OP_w(1+t)$, $dP = dP_b$ and $M = OM_1$) yields the following:-

$$TC = 0.5 \cdot dP_b \cdot E_p^m \cdot (dP_b / OP_w(1+t)) \cdot OM_1 \quad (6.11)$$

$$= 0.5 \cdot E_p^m \cdot (dP_b)^2 \cdot (OM_1 / OP_w(1+t)) \quad (6.12)$$

$$NWE = \{0.5 \cdot E_p^m \cdot (dP_b)^2 \cdot (OM_1 / OP_w(1+t))\} - \{dP_w \cdot OM_1\} \quad (6.13)$$

The Marshallian triangle approach to measuring welfare has been criticized, however, on two major fronts. The first criticism concerns 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 is critical in ensuring that changes in

incomes have no effect on how the consumer allocates his total expenditure among the various commodities. In the real world context, 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:-

$$x_i = x_i(p, M) \quad (6.14)$$

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:-

$$du = \lambda \sum_{i=1}^n p_i dx_i \quad (6.15)$$

or simply

$$u = \lambda \int_C \sum_{i=1}^n p_i dx_i \quad (6.16)^5$$

where $\lambda = u'/p^i$ is the marginal utility of money income 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 :-

$$\phi = \int_C p dx \quad (6.17)$$

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 identical⁸⁹. Thus when p_i changes, the import demand curve for the other commodities (j*≠*i) also change but at the rate, dx_j/dp_i . In a similar fashion when p_j changes the import demand curve for commodity i shifts at the rate dx_i/dp_j . Unless these rates are equal, i.e $(dx_j/dp_i = dx_i/dp_j)$ ⁹⁰ 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 indicator⁹¹.

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

⁸⁹ See Jeon and Von Furstenberg (1985) and Appendix C on consumer surplus in Takayama (1994, pp 621-647) for fuller explanations.

⁹⁰ This condition is the path independence condition.

⁹¹ A fairly common restriction imposed is the condition of homotheticity.

appropriate to attempt to estimate the welfare implication of Customs Union formation using Hicksian notions. These notions are explored in the ensuing section.

6.3 HICKSIAN MEASURES OF WELFARE EFFECTS

Hicksian notions⁹² 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:-

$$CV = e^m(p^1, U^0) - e^m(p^0, U^0) \quad (6.18)$$

$$= e^m(p^1, U^0) - y^0 \quad (6.19)$$

Equivalent Variation (EV) on the other hand measures the amount of income needed to keep the consumer at the new utility level, U^1 , when faced with original prices.

$$EV = e^m(p^1, U^1) - e(p^0, U^1) \quad (6.20)$$

⁹² These methods derive their names from the contributions by Hicks (1946a,b, 1956).

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 authors⁹³ they have not been extensively applied in the context of Customs Union formation⁹⁴. The main strength of the Hicksian measures of welfare is the fact that they are based on a compensated demand curve. Although Leamer and Stern (1970) recognized the value of the compensated curve there was no method at the time to transform the ordinary Marshallian demand curve into a compensated demand function. These authors noted that:-

"We would require for this purpose that a compensating variation of income be made that in turn would require a knowledge of the unknown utility structure. What is observed, however, is the ordinary demand curve indicating purchases of importables as a function of prices and income. If the compensated and ordinary demand curves are related in some known way, the compensated curve could be reconstructed from the observable demand function". [Leamer and Stern (1970), p.189].

⁹³ See for instance Bhagwati and Johnson (1960), Anderson (1974), Leamer and Stern (1977), Helpman (1978), Jeon and Von Furstenberg (1986) and Winters (1990).

⁹⁴ Recently, there have been attempts to utilize these methods in Computable General Equilibrium Trade Models (see for instance Francois and Shiells (1994) and Shoven and Whalley (1992) and Whalley (1985)).

The Direct Differential method developed by Hausman (1981) will be utilized, therefore, to compute exact welfare measures in the context of Customs Union Formation in the Caribbean Community.

6.3.1 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 Imports⁹⁵ 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.

⁹⁵ 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.

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

$$x = \frac{\partial v(p, y)}{\partial p} / \frac{\partial v(p, y)}{\partial y} \quad (6.21)$$

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:-

$$\frac{\partial v(p(t), y(t))}{\partial p(t)} \cdot \frac{dp(t)}{dt} + \frac{\partial v(p(t), y(t))}{\partial y(t)} \cdot \frac{dy(t)}{dt} = 0 \quad (6.22)$$

Combining equations 6.21 and 6.22 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 only handle single price changes⁹⁶.

6.3.2 AN "HICKSIAN-BASED" 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 :-

$$X_1(P_{m1}, Y) = P_{m1}^{-\alpha} \cdot Y^{\beta} \quad (6.23)$$

where X_1 is the quantity imported of commodity 1 from CARICOM, P_{m1} is the price of the imported commodity 1 and Y is the disposable income of the consumer in the MDC. Given Roy's identity and the implicit function theorem, where $v(P_{m1}(\cdot), Y(\cdot))$ is the Indirect Utility Function,

$$\frac{dY(t)/dt}{dP_{m1}(t)/dt} = \frac{-\partial v(P_{m1}(t), Y(t)) / \partial P_{m1}}{\partial v(P_{m1}(t), Y(t)) / \partial Y} = X_1 \quad (6.24)$$

one obtains :-

⁹⁶ Numerical methods utilized by McKenzie and Ulph (1983) and Vartia (1983) have improved on these inherent weaknesses of Hausman's approach.

$$\frac{dY}{dP_m} = X_1 = P_m^{-\alpha} \cdot Y^\beta \quad (6.25)$$

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

$$\frac{1}{1-\beta} \cdot Y^{1-\beta} = \frac{1}{\alpha+1} \cdot P_m^{-\alpha+1} + C \quad (6.26)$$

where C is a constant. The Indirect Utility Function⁹⁷ is obtained by setting C=U⁰, so that:-

$$v(P_m, Y) = C = U^0 = \frac{Y^{1-\beta}}{1-\beta} - \frac{P_m^{-\alpha+1}}{\alpha+1} \quad (6.27)$$

Utilizing the dual relationship between the Indirect Utility Function, v(P_m, Y) and the expenditure function for imports one obtains⁹⁸

$$e^\alpha(P_m, U^0) = \left[(1-\beta) \cdot \left(U^0 + \frac{P_m^{-\alpha+1}}{\alpha+1} \right) \right]^{\frac{1}{1-\beta}} \quad (6.28)$$

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

$$h_1(P_m, U^0) = \frac{\partial e^\alpha(P_m, U^0)}{\partial P_m} \quad (6.29)$$

where h(P_m, U⁰) is the compensated import demand curve. This operation yields the following expression:-

$$h_1(P_m, U^0) = \left(P_m^{-\alpha} \cdot \left[(1-\beta) \cdot \left(U^0 + \frac{P_m^{-\alpha+1}}{\alpha+1} \right) \right]^{\frac{\beta}{1-\beta}} \right) \quad (6.30)$$

The application of Hausman's method presumes that the trade creating and trade diverting effects can be measured by the areas of the relevant trapezoids. This in effect means that the trade creating area can be represented by the trapezoid P₀(1+t)A²B²P₁ while the trade diverting area can be proxied by the trapezoid P₀B²I²G². The net welfare effect of Customs Union formation measured in terms of compensating variation (or equivalent variation) can be represented as follows:-

$$\begin{aligned} \text{NWE} &= \text{Area of Trapezoid } P_0(1+t)A^2B^2P_1 \\ &\quad - \text{Area of Trapezoid } P_0B^2I^2G^2 \end{aligned} \quad (6.31)$$

⁹⁷ The constant of integration depends on the initial utility level.

⁹⁸ This is achieved by interchanging Income and Base Utility.

The trapezoid $P_w(1+t)A^2B^2P_b$ is likely to over-estimate the trade creating gain since its area exceeds that of the triangle while a similar result can be inferred from the trade diverting trapezoid.

The Compensating trade creating gain can be obtained by integrating the compensated import demand curve over the range $P_{m1w}(1+t)$ to P_{m1b} with the appropriate values of $U^0, (P_{m1w}(1+t) > P_{m1b})$.

$$CV_{TC} = \int_{P_{m1b}}^{P_{m1w}(1+t)} h_I(P_{m1}, U^0) dP_{m1} \quad (6.32)$$

where CV_{TC} - Trade creating gain measured by compensating variation

$P_{m1w}(1+t)$ - Import Price before Customs Union Formation (Base Period Price)

P_{m1b} - Import Price following Formation of Customs Union (New Period Price)

$$CV_{TC} = \int_{P_{m1b}}^{P_{m1w}(1+t)} P_{m1}^{-\alpha} \left[(1-\beta) \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] dP_{m1} = e^m(P_{m1}, U^0) \Big|_{P_{m1b}}^{P_{m1w}(1+t)} \quad (6.33)$$

$$e^m(P_{m1}, U^0) = \left[(1-\beta) \left(U^0 + \frac{P_{m1}^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] \Big|_{P_{m1b}}^{P_{m1w}(1+t)} \quad (6.34)$$

where

$$U^0 = \frac{(Y^0)^{1-\beta}}{1-\beta} - \frac{(P_{m1w}(1+t))^{\alpha+1}}{\alpha+1} \quad (6.35)$$

The calculation of CV_{TC} involves the evaluation of the following expression:-

$$CV_{TC} = \left[(1-\beta) \left(U^0 + \frac{(P_{m1w}(1+t))^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] - \left[(1-\beta) \left(U^0 + \frac{(P_{m1b})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] \quad (6.36)$$

This expression for CV measures the compensation that has to be taken away⁹⁹ from the CARICOM consumer if he is to maintain his original Pre-Customs Union utility level, U^0 , given a fall in prices from $P_{m1w}(1+t)$ to P_{m1b} on account of the tariff reduction induced by union formation.

Likewise Equivalent Variation (EV)¹⁰⁰ can be obtained in a similar fashion using appropriate values for U^1 :-

$$EV_{TC} = \left[(1-\beta) \left(U^1 + \frac{(P_{m1w}(1+t))^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] - \left[(1-\beta) \left(U^1 + \frac{(P_{m1b})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] \quad (6.37)$$

⁹⁹ The critical assumption here is that the removal of tariffs between partners causes a fall in price which allows the consumer in the home country to buy more of the commodity from the partner country.

¹⁰⁰ The main difference between the two concepts CV_{TC} and EV_{TC} is the level of utility at which the difference in import expenditure due to the price change is measured.

where

$$U^1 = \frac{(Y^0)^{1-\beta} (P_{mlb})^{\alpha+1}}{1-\beta} \quad (6.38)$$

Given the new utility level, U^1 , under Customs Union formation the expression for EV_{TC} 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.

The trade diverting loss in terms of compensation variation can be obtained by integrating the compensated import demand curve over the range P_{mlb} to P_{mlw} with the appropriate value of U^0 . It is important to note in this context that P_{mlw} is the domestic price that consumers in the home country would be willing to pay to the rest of the world for the commodity if trade barriers were absent (i.e. export free on board price of the respective commodity charged by the rest of the world).

$$CV_{TD} = \int_{P_{mlw}}^{P_{mlb}} h_l(P_{ml}, U^0) dP_{ml} \quad (6.39)$$

where CV_{TD} - Trade Diverting loss measured in terms of Compensating variation

$$CV_{TD} = \int_{P_{mlw}}^{P_{mlb}} \left[(1-\beta) \left(U^0 + \frac{P_{ml}^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] dP_{ml} = e^{\eta} (P_{ml}, U^0)_{P_{mlw}}^{P_{mlb}} \quad (6.40)$$

The calculation of CV_{TD} involves evaluation of the following expression:-

$$CV_{TD} = \left[(1-\beta) \left(U^0 + \frac{(P_{mlb})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] - \left[(1-\beta) \left(U^0 + \frac{(P_{mlw})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] \quad (6.41)$$

$$U^0 = \frac{(Y^0)^{1-\beta} (P_{mlb})^{\alpha+1}}{1-\beta} \quad (6.42)$$

If the consumer in the home country were able to purchase the imported commodity at the world price P_{mlw} rather than at the new customs union price P_{mlb} ($P_{mlb} > P_{mlw}$) then his welfare would improve¹⁰¹. CV_{TD} therefore measures the compensation that would have had to be taken away from the CARICOM consumer in the home country if he were to maintain his utility level under the customs union if prices fell from P_{mlb} to P_{mlw} . It is critical to realize that this trapezoidal area represents a loss in terms of consumer surplus under the customs union since the consumer is forced to purchase more expensive imports at price P_{mlb} from the partner country rather than cheaper goods from the rest of the world.

Trade diverting equivalent variation can also be obtained in a similar manner using appropriate values for U^1 .

$$EV_{TD} = \left[(1-\beta) \left(U^1 + \frac{(P_{mlb})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] - \left[(1-\beta) \left(U^1 + \frac{(P_{mlw})^{\alpha+1}}{\alpha+1} \right)^{\frac{1}{1-\beta}} \right] \quad (6.43)$$

¹⁰¹ The base period in this case is the period of customs union formation whereas the current period represents a situation in which trade barriers against the rest of the world are completely dismantled.

$$U^0 = \frac{(Y^0)^{1-\beta}}{1-\beta} - \frac{(P_{m,w})^{\alpha+1}}{\alpha+1} \quad (6.44)$$

Given a new utility level, U^1 , under free trade, the expression measures the compensation that is to be paid to the consumer to maintain the new utility level, U^1 , under free trade when faced with import prices under the customs union. The Net welfare consequence of Integration for the home country depends on the difference between trade creation and trade diversion measured in terms of either compensating variation or equivalent variation. In short,

$$NWE_{CV} = \{CV_{TC} - CV_{TD}\} \quad (6.45)$$

where NWE_{CV} - Net Welfare Effect in terms of Compensating Variation

or

$$NWE_{EV} = \{EV_{TC} - EV_{TD}\} \quad (6.46)$$

where NWE_{EV} - Net Welfare Effect in terms of Equivalent Variation

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 using both the Hicksian and Marshallian import demand curves.

6.4 MEASUREMENT OF WELFARE EFFECTS IN CARICOM

The calculation of the trade creation triangle and trade diversion rectangle requires data on tariffs, the price elasticities of import demand for the various commodities and the quantity imported of each commodity before and after the formation of the Customs Union in CARICOM. For the Hicksian based formulae, data on base period utility which is a function of base period incomes and prices, values for the α and β parameters and base and terminal period import prices are required.

A major issue in the computation of the welfare effects in both approaches revolves around the determination of (a) the base period (pre-customs union) or tariff-inclusive price of imported items bought from the rest of the world before customs union formation [i.e $OP_{m,w}(1+t)$ for the Hicksian formulae and $OP_w(1+t)$ for the Marshallian approach]; (b) the terminal price or tariff-exclusive import price of items bought from CARICOM partners [i.e $OP_{m,b}$ for the Hicksian case and OP_b for the Marshallian approach] and (c) the world price before any import duties or taxes are imposed [$OP_{m,w}$ for the Hicksian case and OP_w for the Marshallian approach]. The practical analogues of these theoretical prices are not as straightforward as one presupposes from an empirical standpoint. The world price (i.e the free trade price) in this analysis is measured by the implicit unit price of imports¹⁰² of each of the MDC territories with the rest of the world before taxes or import charges are applied. The tariff-exclusive price of imports from CARICOM (Customs Union price) is proxied by the unit price of imports from CARICOM countries. It should be noted that although CARICOM envisaged the removal

¹⁰² This price is simply the value of imports from the specific region divided by the respective quantity.

of barriers between member countries since its establishment in 1973, this liberalisation of intra-regional trade has not been truly realised and most countries have utilized various forms of restrictions (e.g. quotas) to protect their individual home markets¹⁰³. The unit price of imports may therefore, significantly under-estimate the "true import prices" which prevailed among the CARICOM member states.

The pre-customs import price was determined on an ad-valorem basis. Implicit unit prices for each MDC's trade with the rest of the world were computed and these were added to the estimates of the product of the average nominal tariff rate and the implicit unit prices for imports, i.e. $P_{mlw}(1+t) = (P_{mlw} + (t * P_{mlw}))$.

The nominal tariff rates, t , can be determined in several ways. They can be based either on "scheduled rates" applied by each of the member states against imports from the rest of the world or determined by an implicit formula. The latter approach, for instance, has been recommended by Greenaway and Milner (1993, 1994). These authors have suggested that the implicit or ex-post tariff rate can be calculated as follows:

$$t = \frac{TR_i}{M_i} \quad (6.47)$$

where TR_i - Total customs collections of the commodity

M_i - Total value of imports in sector i .

¹⁰³ No effective conclusion was reached on the CET until 1991. Only eight of the thirteen member states, including Trinidad and Tobago, Jamaica and Barbados, implemented national customs tariffs based on the agreement reached at the Special Meeting of the Common Market Council held in July 1990.

It should be noted that although a concordance between the BTN, CCCN, HS and the SITC is available in each of the member states of CARICOM at the SITC 3-Digit level, the customs collections corresponding to the requisite 3-digit aggregations are, however, not readily accessible (or even published) in the various CARICOM member states. Averages of the nominal "scheduled" tariff rates had to be utilized in place of estimates based on the implicit tariff rate.

Exclusive reliance on these "scheduled" tariffs may, however, misrepresent the extent of protection among the MDC territories in the respective Caribbean territories unless some consideration is also given to the use of non-tariff barriers against imports from the rest of the world. Such barriers, for instance, were actively applied by Trinidad and Tobago, Jamaica and Barbados (through the use of negative listing and exchange control practices) throughout the period of the late seventies and the first half of the eighties¹⁰⁴. The indirect price raising effect of quantitative restrictions above the known direct price raising influence of the tariffs also needs to be ascertained. Unfortunately, data to allow computation of the net tariff equivalences (i.e. quantitative estimates of non-tariff barriers) are not produced by any of the Statistical Agencies in CARICOM although some preliminary "estimates" are available for Trinidad and Tobago, Barbados¹⁰⁵ and Jamaica based on reports of various consultants¹⁰⁶.

Tables 6.1, 6.2 and 6.3 present estimates of average scheduled nominal tariffs, average net tariff equivalences and overall average nominal rates for selected 3-digit

¹⁰⁴ See Hilaire (1991) for an analysis of the Trinidad situation.

¹⁰⁵ Milner (1993) has compiled broad estimates for Barbados.

¹⁰⁶ An attempt was made to obtain comparable estimates of net tariff equivalences from the Maxwell Stamp Trade Policy Report (1992) for Trinidad and Tobago. The report, however, is a classified document.

Table 6.1
Estimates of Nominal Tariffs and Net Tariff Equivalences
of Selected SITC 3-Digit (Rev 1) Commodities:
Trinidad & Tobago

SITC 3-Digit	Commodity	Average Nominal Scheduled Tariff Rate (%)	Average Net ¹ Tariff Equivalence (%)	Average Overall ¹ Nominal Tariff Rate (%)
042	Rice	30	130	160
081	Feeding Stuff	5	-	5
091	Margarine & Shortening	10	78	88
099	Food Preparations	35	50	85
122	Tobacco Manufactures	40	25	65
533	Pigments, Paints	25	49	74
541	Medicinal & Pharmaceutical Products	15	-	15
554	Soaps & Other Preparations	35	146	181
642	Articles of Paper Pulp	25	140	165
821	Furniture	25	90	115
893	Articles of Plastics	25	130	155

Table 6.2
Estimates of Nominal Tariffs and Net Tariff Equivalences
of Selected SITC 3-Digit (Rev 1) Commodities:
Jamaica

SITC 3-Digit	Commodity	Average Nominal Scheduled Tariff Rate (%)	Average Net ¹ Tariff Equivalence (%)	Average Overall ¹ Nominal Tariff Rate (%)	
042	Rice	30	45	75	100
048	General Preparations	30	30	60	80
099	Food Preparations	35	40	75	100
243	Wood (shaped)	20	-	20	20
332	Petroleum Products	10	-	10	10
422	Other Vegetable Oils	40	20	60	120
533	Pigments, Paints	25	38	63	100
541	Medicinal & Pharmaceutical Products	15	-	15	100
554	Soaps & Polish Preparations	35	45	80	100
581	Plastic Materials	25	35	60	100
642	Article of Paper Pulp	25	60	85	100
					790
					100

¹ Figures presented in the Table represent estimates of tariff rates based on consultations with officials at the C.S.O., Central Bank and the Ministry of Planning and Development. The values utilized were unweighted averages.

¹ Figures presented in the Table represent estimates of tariff rates based on consultations with officials at the C.S.O., Central Bank. The values utilized were unweighted averages.

Table 6.3
Estimates of Nominal Tariffs and Net Tariff Equivalences
of Selected SITC 3-Digit (Rev 1) Commodities:
Barbados

SITC 3-Digit	Commodity	Average Nominal Scheduled Tariff Rate (%)	Average Net ¹ Tariff Equivalence (%)	Average Overall ¹ Nominal Tariff Rate (%)
042	Rice	30	25	55
048	Cereal Preparation	30	20	50
091	Margarine & Shortening	10	20	30
099	Food Preparations	35	40	75
112	Alcohol Beverages	35	50	85
332	Petroleum Products	10	-	10
341	Gas, Natural & Manufactured	5	-	5
541	Medicinal & Pharmaceutical Products	15	-	15
554	Soaps & Polish Preparation	35	-	35
642	Article of Paper Pulp	25	41	66
692	Metal Containers	25	50	75
821	Furniture	25	80	105

(Rev 1) commodities imported by Trinidad and Tobago, Barbados and Jamaica, respectively from the rest of the world¹⁰⁷. The "overall" average nominal tariff rates are crude approximations of the extent of protection in the various territories and were derived following consultations with trade officials in the Central Statistical Offices, Customs Divisions and Central Banks of the various member states. Table 6.1 indicates relatively high levels of protection in Trinidad and Tobago for furniture, articles of plastic, articles of paper pulp, rice, margarine and food preparations. In Barbados, high levels of protection (Table 6.2) were recorded for furniture, alcoholic beverages, food preparations and metal containers while in Jamaica (Table 6.3), rice, food preparations, soaps and polish preparations and articles of paper pulp accounted for the highest levels among the selected commodities.

Estimates of 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

¹⁰⁷ This includes all developed and developing countries but excludes members of CARICOM.

Figures presented in the Table represent estimates of tariff rates based on consultations with officials at the C.S.O., Central Bank. The values utilized were unweighted averages.

were exported in a format which allowed easy portability to the TSP¹⁰⁸ processing environment.

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

$$\ln X_t = \alpha_0 + \alpha_1 \ln P_{m1} + \beta \ln Y \quad (6.48)$$

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

Once reliable estimates for α_1 and β are obtained these are substituted into the required Marshallian and Hicksian formulae 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 studies mentioned earlier relied on assumed elasticities and "guesstimates" of parameters to inform welfare evaluation. An attempt is made to avoid this pitfall as far as possible.

6.4.1 Estimation of Ordinary Marshallian Import Demand Curve

The log-linear versions of the import demand equation were estimated by Ordinary Least Squares (OLS) for Trinidad and Tobago, Jamaica and Barbados over the period,

¹⁰⁸ All econometric estimations were undertaken with the Time Series Processor (TSP), version 4.2B, 1993.

1973-1992. Estimation results for these countries are reported in Tables 6.4, 6.5 and 6.6, respectively. 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 complementarity 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.

Table 6.3 reports estimation results for Trinidad's imports from CARICOM. The results from these preliminary estimations are quite modest. In four of the selected product categories - 042, 081, 122 and 541 - the adjusted coefficients of determination are under sixty-five (65) per cent. In one specific case, product category 541, the adjusted coefficient of determination equals 0.28, indicating that import prices and disposable income explain only twenty-five per cent of the variation in the quantity of the commodity imported from CARICOM countries. 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 are less than unity suggesting that the quantities imported from CARICOM into Trinidad and Tobago are not responsive to changes in disposable income. The Durbin-Watson (DW) statistic which is a measure of serial correlation is generally satisfactory for the estimated equations. For commodities 042, 091, 122, 554 and 642 the DW statistic exceeds 2.0 and is indicative of the absence of autocorrelation in the estimated equations. For the remaining product group equations, the value of the DW statistic lies in the inconclusive region.

Estimation results for Jamaica are reported in Table 6.5. The adjusted coefficients of determination are relatively low especially for product categories 048, 099, 541 and 642 lying generally below 65 per cent in these cases. Like the Trinidad and Tobago case, the adjusted coefficient of determination 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 were relatively small for all the commodity groupings indicating an inelastic response in quantities imported from CARICOM to changes in disposable income. The t-statistics on the price and income variables were generally significant for most of the product categories.

The estimation results for Barbados (Table 6.4) are generally more satisfactory than 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. All 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 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 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 ,

$$X_i(P_{m1}, Y) = (\lambda P_{m1})^\alpha (\lambda Y)^\beta \quad (6.49)$$

$$X_i(P_{m1}, Y) = (P_{m1})^\alpha Y^\beta \lambda^{\alpha+\beta} \quad (6.50)$$

the zero homogeneity condition is violated unless α_1 and $\beta = 0$.

6.4.3 Welfare Estimates of Trade Creation and Trade Diversion: Results based on the Ordinary Marshallian Import Demand Curve.

Estimates of trade creation and trade diversion using the ordinary marshallian import demand curve are presented in Tables 6.7, 6.8 and 6.9 for Barbados, Jamaica and Trinidad and Tobago, respectively. The computation of these trade creating and trade

diverting effects were based on equations 6.12 and 6.7, respectively. The sub-period 1973-1990 was taken as representative of the pre-customs union era. This may appear, at first blush, to be surprising especially since the sub-period corresponded to a period of economic integration in CARICOM. It should be noted, however, that in the strictest possible sense, customs union formation requires the removal of barriers to trade between member states and the establishment of a common external tariff against the rest of the world. The decade of the 1980s in CARICOM witnessed an intensification of non-tariff barriers in both intra-regional and extra-regional trade. It was not until 1991 and 1992 that the member states made definitive attempts to liberalize intra- and extra-regional trade and to arrive at some consensus over the common external tariff. The years 1991 and 1992 were therefore chosen as the terminal years or the years of Customs Union Formation.

Table 6.7 presents welfare estimates for Barbados based on the static marshallian formulae. The results indicate that the trade creation gains, in the aggregate, amounted to US\$ 165.5 thousand and represented about 6.2% of average Gross Domestic Product (1980-1990). Although all the selected import categories registered gains, the main contributions to increased trade creation came from petroleum products, gas (natural and manufactured), articles of paper pulp and food preparation. These gains were, however, negated by substantial trade diverting losses of US\$265.9 thousand resulting in an overall net welfare loss for Barbados of US\$100.4 thousand.

For Jamaica (Table 6.8), the overall trade creating gains amounted to US\$370 thousand, approximately 9.2% of average Gross Domestic Product (1980-1990) while the trade diverting losses amounted to US\$576.4 thousand, about 14.4 per cent of average Gross Domestic Product (1980-1990). The largest contributions to the trade diverting losses were from petroleum products, rice, plastic materials and articles of paper pulp. The net overall effect of customs union formation for Jamaica was a welfare loss of US\$206 thousand.

The results for Trinidad and Tobago (Table 6.9) are quite similar to those for both Barbados and Jamaica although the overall net welfare loss from integration is larger for Trinidad and Tobago. The trade creating gains for Trinidad and Tobago were estimated at US\$184.99 thousand, about 2.8% of average Gross Domestic product (1980-1990) while the losses from trade diversion amounted to US\$ 431.8 thousand. The overall net welfare loss for Trinidad and Tobago was estimated at US\$ 247.3 thousand.

Two important results surface from the static welfare calculations based on the ordinary marshallian import demand curve. Firstly, the trade diverting effects dominate the trade creating effects such that the union results in an overall welfare loss for each of the three member states of CARICOM. Secondly, the welfare gains and losses, as proportions of Gross Domestic product, are relatively small for each of the MDC territories.

6.4.4 Welfare Estimates of Trade Creation and Trade Diversion: Results based on the Compensated (Hicksian) Import Demand Curve.

To facilitate comparisons, welfare estimates were also computed using the "hicksian" or compensated demand curve. Estimates of trade creation and trade diversion

were calculated in this framework using the notion of compensating variation. In the case of Barbados (Table 6.10), the overall trade creation gains measured by compensating variation amounted to US\$274.1 thousand while overall trade diversion was estimated at US\$430.3 thousand. The net overall loss from union formation amounted to US\$ 156.2 thousand. On a commodity by commodity basis, the smallest net welfare losses were registered for rice, and alcoholic beverages whereas the largest loss occurred in the petroleum products sub-group. This result is not the least surprising, since Barbados imports a relatively large proportion of petroleum products from Trinidad and Tobago - the largest producer in CARICOM.

Amongst the three MDC territories, Jamaica registered the largest trade creating gains measured in terms of compensating variation (Table 6.11). Overall gains from trade creation were estimated at US\$458.8 thousand while trade diverting losses amounted to US\$739.1 thousand. The overall net welfare loss for Jamaica was US\$280.6 thousand. As regards individual commodities, the largest losses were recorded for petroleum products, rice and food preparations while soap and cereal preparations had the smallest net welfare losses.

In the case of Trinidad and Tobago, the overall gains (compensating variation) from trade creation were estimated at US\$281.7 thousand while the losses from trade diversion amounted to US\$765.9 thousand. The resultant overall net welfare loss amounted to US\$484.2 thousand, the largest among the three member states of CARICOM. The largest net welfare losses for Trinidad and Tobago were recorded for articles of paper pulp, soap and other preparations, articles of plastic and pigments and paints.

Several interesting conclusions can be made from both sets of results. Firstly, both the hicksian and marshallian results demonstrate that the trade diverting effects tended to

predominate, resulting in overall welfare losses in the three member states of CARICOM. Secondly, the welfare effects based on compensating variation tended to be larger than those calculated from the more popular marshallian based formulae. Thirdly, both results pointed to large variations in net welfare effects among the various product groups. Finally, the 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 suffered the smallest loss from regional association than either Trinidad and Tobago or Jamaica. Among the MDC territories the citizens in Trinidad and Tobago have benefitted the least from customs union formation in CARICOM.

CONCLUSION

This chapter attempted to analyze the welfare consequences of economic integration for three of the larger territories in CARICOM. The majority of empirical studies which measure the effects of customs union formation employ the areas of triangles and rectangles derived from a marshallian ordinary import demand function. In this study we have also derived alternative Hicksian measures of Welfare utilizing the popular notions of compensating and equivalent variation. These notions allow an "exact" measure of welfare since they incorporate the path independence condition. It is evident from both the hicksian and marshallian results that the attempt at integration in CARICOM has been largely trade-diverting. In addition, the results point to large variations in the welfare impact across the various commodity groups and among the member countries. Barbados seemed to have incurred the smallest welfare losses among the three MDC territories of CARICOM.

The 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. Indeed these results depict only the "first round" effects of integration and completely ignore second round effects (e.g. productivity) that a change in the pattern^{trade} can bring. It may be useful in future extensions of this study to experiment with richer econometric specifications especially the newer flexible functional forms (e.g. Translog, Generalized McFadden and Almost Ideal Demand Systems) to gauge the sensitivity of the results to varying functional specifications.

Table 6.4

Estimation Results for Trinidad & Tobago¹

LQM(.)	CONST α_0	LP(.) α_1	LINC β	RBAR ²	D.W.
[042]	-11.34 (-1.12)	-1.72 (-3.16)	0.203 (2.66)	0.64	2.24
[081]	4.27 (0.41)	-1.44 (-1.59)	0.01 (1.23)	0.55	1.74
[091]	-14.48 (-3.18)	-2.78 (-2.13)	0.32 (1.96)	0.76	2.07
[099]	11.77 (4.28)	-1.18 (-3.21)	0.49 (1.56)	0.84	1.71
[122]	-4.12 (-1.08)	-1.96 (-4.74)	0.028 (2.65)	0.64	2.16
[533]	4.85 (2.43)	-1.06 (-2.62)	0.46 (3.56)	0.69	1.46
[541]	14.03 (10.43)	-3.83 (-1.35)	0.134 (0.91)	0.28	1.47
[554]	16.09 (5.88)	-2.92 (-3.41)	0.30 (9.23)	0.93	1.96
[642]	16.81 (3.29)	-2.18 (-2.03)	0.22 (3.55)	0.76	2.20
[821]	-0.65 (-0.21)	-1.53 (-4.31)	0.05 (4.76)	0.90	1.71
[893]	1.21 (0.82)	-1.13 (-1.93)	0.35 (1.96)	0.83	1.76

¹ The figures in square brackets [] and parentheses () represent SITC 3-digit commodity and t-statistics, respectively.

Table 6.5

Estimation Results for Barbados¹

LQM(.)	CONST α_0	LP(.) α_1	LDNC β	RBAR ²	D.W.
[042]	-22.78 (-4.18)	-3.92 (-2.19)	0.07 (1.24)	0.91	1.92
[048]	-21.24 (-3.12)	-2.28 (-2.01)	0.04 (2.76)	0.78	1.84
[091]	6.40 (2.71)	-1.09 (-4.13)	0.29 (1.68)	0.69	1.75
[099]	-3.18 (-2.46)	-1.43 (-1.72)	0.61 (2.80)	0.69	1.82
[112]	19.45 (3.87)	-2.49 (-6.91)	0.18 (4.58)	0.94	1.65
[322]	15.84 (4.35)	-4.67 (-2.85)	0.41 (3.17)	0.74	1.85
[341]	12.76 (2.15)	-1.01 (-2.09)	0.30 (2.09)	0.52	1.90
[541]	5.43 (1.67)	-2.06 (-1.81)	0.21 (1.04)	0.73	2.21
[554]	14.32 (5.33)	-1.65 (-2.91)	0.19 (2.60)	0.91	2.13
[642]	6.26 (1.04)	-1.91 (-2.31)	0.53 (1.29)	0.82	1.92
[821]	-25.7 (-10.80)	-2.06 (-2.27)	0.44 (4.89)	0.94	1.98

¹ The figures in square brackets [] and parentheses () represent SITC 3-digit commodity and t-statistics, respectively.

Table 6.6

Estimation Results for Jamaica¹

LQM(.)	CONST α_0	LP(.) α_1	LDNC β	RBAR ²	D.W.
[042]	12.11 (1.76)	-1.13 (-2.04)	0.08 (2.34)	0.66	1.64
[048]	3.12 (0.47)	-2.54 (-1.94)	0.32 (1.67)	0.59	1.26
[099]	3.24 (0.39)	-2.68 (-1.85)	0.48 (2.32)	0.51	1.64
[243]	12.12 (3.03)	2.33 (1.20)	0.51 (0.58)	0.65	1.72
[332]	4.65 (3.06)	-3.72 (-4.17)	0.21 (2.99)	0.71	1.90
[422]	10.26 (3.48)	-2.78 (-2.05)	0.02 (1.97)	0.79	1.82
[533]	9.71 (3.67)	-3.07 (-4.76)	0.42 (1.99)	0.72	1.86
[541]	-1.31 (-0.32)	-3.81 (-1.75)	0.41 (2.06)	0.33	1.54
[554]	12.33 (4.21)	-3.57 (-3.37)	0.12 (2.19)	0.69	2.06
[581]	7.91 (2.08)	-2.47 (-4.45)	0.13 (1.87)	0.68	1.89
[642]	3.17 (2.14)	-2.03 (-3.79)	0.43 (2.24)	0.63	1.71

¹ The figures in square brackets [] and parentheses () represent SITC 3-digit commodity and t-statistics, respectively.

Table 6.7
Estimates of Trade Creation and Trade Diversion
based on the Ordinary Marshallian Import Demand Curve:
Barbados (US\$'000)

SITC 3-Digit	Commodity	TC	TD	NWE	(TC/GDP)	(TD/GDP)
042	Rice	7.0	15.2	-8.20	0.003	0.006
048	Cereal Preparation	8.6	17.8	-9.20	0.003	0.007
091	Margarine & Shortening	12.8	16.1	-3.30	0.005	0.006
099	Food Preparations	9.2	18.7	-9.50	0.003	0.007
112	Alcohol Beverages	1.9	3.4	-1.50	0.001	0.001
332	Petroleum Products	80.2	115.9	-35.70	0.030	0.043
341	Gas, Natural & Manufactured	19.3	31.7	-12.40	0.007	0.012
541	Medicinal & Pharmaceutical Products	1.3	6.9	-5.60	0.000	0.003
554	Soaps & Polish Preparation	2.6	5.3	-2.70	0.001	0.002
642	Article of Paper Pulp	18.3	25.2	-6.90	0.007	0.009
692	Metal Containers	4.3	9.7	-5.40	0.002	0.004
821	Furniture	7.1	16.5	-9.40	0.003	0.006
	TOTAL	165.5	265.9	-100.4	0.062	0.099

Notes: TC - Trade Creation
TD - Trade Diversion
NWE - Net Welfare Effect; Gain (+)/Loss (-)

Table 6.8
Estimates of Trade Creation and Trade Diversion
based on the Ordinary Marshallian Import Demand Curve:
Jamaica (US\$'000)

SITC 3-Digit	Commodity	TC	TD	NWE	(TC/GDP)	(TD/GDP)
042	Rice	33.1	60.6	-27.5	0.008	0.015
048	Cereal Preparation	18.9	28.7	-9.80	0.005	0.007
099	Food Preparations	22.3	42.3	-20.0	0.006	0.011
243	Wood (Shaped)	6.7	9.3	-2.6	0.002	0.002
332	Petroleum Products	201.3	26.5	-63.7	0.050	0.066
422	Other Vegetable Oils	9.8	17.8	-8.0	0.002	0.004
533	Pigments, Paints	15.3	23.5	-8.2	0.004	0.006
541	Medicinal & Pharmaceutical Products	4.2	16.2	-12.0	0.001	0.004
554	Soaps & Polish Preparation	6.1	10.9	-4.8	0.002	0.003
581	Plastic Materials	17.7	53.4	-35.7	0.004	0.013
642	Article of Paper Pulp	34.6	48.7	-14.1	0.009	0.012
	TOTAL	370.0	576.4	-206.4	0.092	0.144

Notes: TC - Trade Creation
TD - Trade Diversion
NWE - Net Welfare Effect; Gain (+)/Loss (-)

Table 6.9
Estimates of Trade Creation and Trade Diversion
based on the Ordinary Marshallian Import Demand Curve:
Trinidad & Tobago (US\$'000)

SITC 3-Digit	Commodity	TC	TD	NWE	(TC/GDP)	(TD/GDP)
042	Rice	37.6	62.62	-24.66	0.006	0.010
081	Feeding Stuff	2.43	6.60	-4.17	0.004	0.001
091	Margarine & Shortening	14.8	26.9	-12.1	0.002	0.004
099	Food Preparations	24.7	34.9	-10.2	0.004	0.005
122	Tobacco Manufactures	8.9	19.8	-10.9	0.001	0.003
533	Pigments, Paints	13.4	39.2	-25.8	0.002	0.006
541	Medicinal & Pharmaceutical Products	6.7	19.4	-12.7	0.001	0.003
554	Soaps & Polish Preparation	9.3	30.5	-21.2	0.001	0.005
642	Article of Paper Pulp	35.4	120.3	-84.9	0.005	0.019
821	Furniture	16.3	24.0	-7.7	0.003	0.004
893	Articles of Plastic	14.1	47.8	-33.7	0.002	0.007
	TOTAL	184.99	431.8	-247.82	0.028	0.067

Notes: TC - Trade Creation
 TD - Trade Diversion
 NWE - Net Welfare Effect: Gain (+)/Loss (-)

Table 6.10
Estimates of Trade Creation and Trade Diversion based
on the "Hicksian" or Compensated Import Demand Curve:
Barbados (US\$'000)

SITC 3-Digit	Commodity	CVTC	CVTD	NWE	(CVTC/ GDP)	(CVTD/ GDP)
042	Rice	14.4	17.7	-3.30	0.005	0.007
048	Cereal Preparation	9.8	18.3	-8.50	0.004	0.007
091	Margarine & Shortening	17.0	26.1	-9.10	0.006	0.010
099	Food Preparations	15.2	25.7	-10.50	0.006	0.010
112	Alcohol Beverages	8.9	13.1	-4.20	0.003	0.005
332	Petroleum Products	120.8	195.4	-74.60	0.045	0.073
341	Gas, Natural & Manufactured	40.2	53.7	-13.50	0.015	0.020
541	Medicinal & Pharmaceutical Products	5.1	14.4	-9.30	0.002	0.005
554	Soaps & Polish Preparation	4.8	7.8	-3.00	0.002	0.003
642	Article of Paper Pulp	28.7	42.3	-13.60	0.011	0.016
692	Metal Containers	9.2	15.8	-6.60	0.003	0.006
821	Furniture	10.4	19.7	-9.30	0.004	0.007
	TOTAL	274.1	430.3	-156.2	0.102	0.161

Notes: CVTC - Compensating Variation (Trade Creation)
 CVTD - Compensating Variation (Trade Diversion)
 NWE - Net Welfare Effect: Gain (+)/Loss (-)

Table 6.11
Estimates of Trade Creation and Trade Diversion based
on the "Hicksian" or Compensated Import Demand Curve:
Jamaica (US\$'000)

SITC 3-Digit	Commodity	CVTC	CVTD	NWE	(CVTC/ GDP)	(CVTD/ GDP)
042	Rice	49.0	85.2	-36.2	0.012	0.021
048	Cereal Preparation	29.0	35.0	-6.0	0.007	0.009
099	Food Preparations	28.7	58.1	-29.4	0.007	0.014
243	Wood (Shaped)	10.5	30.7	-20.2	0.003	0.008
332	Petroleum Products	215.9	315.1	-99.1	0.054	0.079
422	Other Vegetable Oils	14.2	27.5	-13.3	0.004	0.007
533	Pigments, Paints	20.7	29.3	-8.6	0.005	0.007
541	Medicinal & Pharmaceutical Products	10.3	21.7	-11.4	0.003	0.005
554	Soaps & Polish Preparation	9.2	12.5	-3.3	0.002	0.003
581	Plastic Materials	30.7	71.8	-41.1	0.008	0.018
642	Article of Paper Pulp	40.3	52.3	-12.0	0.010	0.013
	TOTAL	458.5	739.1	-280.6	0.114	0.0184

Notes: CVTC - Compensating Variation (Trade Creation)
CVTD - Compensating Variation (Trade Diversion)
NWE - Net Welfare Effect; Gain (+)/Loss (-)

