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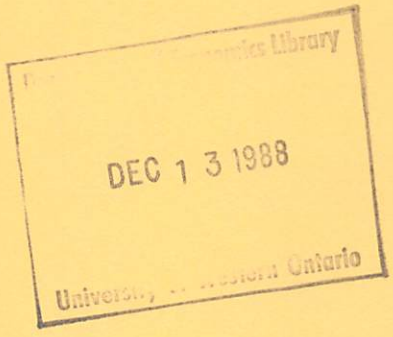

This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the authors.

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THE WELFARE EFFECTS OF CUSTOMS UNION ACCESSION

by

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1. THE ISSUES

There is a wealth of literature on customs unions. A large part of this focuses on the impact of the formation of a customs union, or the expansion of an existing one, on the welfare of the participating nations. The major drawback of the early papers was their tendency to use partial-equilibrium analysis and build models with very few goods (generally, two). These handicaps have been overcome and we have now *n*-good, general-equilibrium models of these preferential trading relations [see, for example, Berglas (1979) and Wooton (1986)].

Serious shortcomings nonetheless remain. Almost all of the literature examines the formation of a customs union by considering the effects of *marginal* changes in trade barriers whereas large, *discrete* tax changes are central to the creation of the union. The use of marginal techniques is dictated in large part by the analytical intractability of doing anything else. However, this is not without cost. The experience gained from study of optimal tariffs has taught us that marginal and discrete tariff changes do not always have the same implications: while a large country will benefit from reducing, say, a prohibitive tariff it is not in its best interests to eliminate the tariff entirely. Similarly, especially with models of three or more countries, we must expect qualitative (as well as quantitative) differences in the effects of marginal and discrete tax adjustments.

The technique that we adopt in solving for discrete tariff changes is to construct a numerical version of the theoretical model where specific functional forms for production and consumption are selected as well as the countries' endowments of the factors of production. We solve this using Rutherford's (1988) MPS/GE software, yielding production and consumption levels as well as the impact on the welfare of the various nations. Several examples are discussed and the misleading nature of the marginal analysis is exposed. The marginal analysis is shown to be by no means worthless in yielding insight into the economic mechanisms at work.

The next section quickly reviews Wooton's (1986) analytic framework and provides a disaggregation of the welfare effects. The following section presents the numerical model and discusses several examples of the formation of a customs union. The final section is a summary.

2. THE THEORETICAL MODEL

We first introduce the general theoretical model adopted in our analysis.[1] We then examine the equilibrium that emerges in the model with a customs union. Finally we consider the expansion of the CU by the marginal reduction of trade barriers between the CU and the new member.

2.1 The Model

Let the set of countries in the world be J, each country being composed of a single representative household. Each has v factors of production, all in fixed supply. There are n commodities all of which are final goods consumed in every country.[2] It is assumed that there is no "cross-hauling", that is, no country both exports a commodity to one country and imports it from another. Within this structure a good can be traded in any one of $m(m-1)$ patterns of production, export, and consumption. The model therefore allows all possible patterns of trade, *although we do assume that the pattern does not change with the formation of the CU or with accession.* This assumption can be evaluated with the numerical model developed later.

In its initial trading equilibrium, each country has imposed taxes or subsidies on its international trade. An import tariff raises the domestic price of a good above the international

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[1]For a complete discussion of the theoretical framework, see Wooton (1986). The version presented here incorporates many countries.

[2]Intermediate goods can easily be incorporated in this framework but only primary inputs and final products are discussed in the examples in this paper.

price as does a subsidy on the export of a commodity.[3]

In equilibrium a country's consumption expenditure equals the value of production together with the net revenues from trade taxes. Thus,

$$e^j(p^j,u^j) = r^j(p^j,v^j) + t^j \cdot m^j. \tag{2.1}$$

The scalar $e^j(p^j,u^j)$ is the minimum expenditure necessary by country j to achieve utility level u^j when the vector of domestic prices of the n goods is p^j. The scalar $r^j(p^j,v^j)$ is the maximum attainable revenue at domestic prices, given the vector of domestically employed factors, v^j. t^j is the vector of specific import tariffs (positive terms) and export taxes (negative terms) and m^j is the vector of net imports of the n goods. Thus the inner product $t^j \cdot m^j$ is the total tax revenue on trade in commodities.

The domestic supply and consumption demand for goods are obtained by differentiating with respect to their prices the revenue function and the expenditure function, respectively. Import demand for a particular good is the difference between its domestic demand and domestic supply. Thus the vector of net compensated import demand is:

$$m^j = e_p^j - r_p^j, \tag{2.2}$$

where e_p^j and r_p^j are, respectively, the vectors of country j's compensated demands for and production of the final commodities.

Consumers and producers in country j face domestic prices that have been distorted from the international terms of trade by the trade taxes. Let p be the vector international terms of trade (for final and intermediate goods) and hence:

$$p = p^j - t^j. \tag{2.3}$$

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[3]Import taxes and export taxes may be positive, negative, or zero. Import tariffs and export subsidies are specifically mentioned (without loss of generality) because of the prevalence of their use in actual customs unions.

World equilibrium is characterized by the total international excess demand for each traded and intermediate good being zero:

$$\sum_j m^j = 0. \tag{2.4}$$

2.2 A Customs Union

Of the countries in the world, let C be the subset that are members of a customs union (CU). As such, each country will have two trade policies: free trade for *intra-union* exchange (i.e., trade conducted with other member countries); and a set of common external tariffs (CETs) imposed by all members of the CU on their trade with the rest of the world.[4] The national income-expenditure relation for country c, a member of the CU, becomes:

$$e^c(p^*,u^c) = r^c(p^*,v^c) + t^* \cdot m^{cn}, \tag{2.5}$$

where the superscript letter "n" refers to that part of a nation's trade that is conducted with N, the set of non-member countries, and the superscript asterisks refer to variables common to the CU as a whole. In particular, t^* is the vector of CETs.

2.3 Expansion of the Customs Union

Let the existing members of the CU be designated by $c \in C$, the newly acceding members be labeled $a \in A$, and the remaining countries (with non-discriminatory tariffs) be designated by N. It is convenient to consider the case where A is a singleton.

The CU members will *marginally* lower their taxes on trade with A to less than the CET levels, while A will make preferential concessions to the CU by *marginally* lowering its tariffs and taxes on trade with its new partners. In addition, A will adjust its tariffs with the rest of the world towards CET levels and CU members will *marginally* adjust their external tariffs (if the accession negotiations have led to a change in the set of CETs). For simplicity,

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[4]This ignores, for simplicity, the possibility of additional preferential trading agreements that may have been made with other countries or groups of countries. Examples include the United Kingdom's Commonwealth preferences, and the European Communities' agreements with less-developed nations and with EFTA.

it is assumed that the non-union members do not respond to the accession by changing any of their taxes. Differentiating equation (2.1) for a country that remains outside the customs union, we obtain:

$$e_u^n \, du^n = -m^n \cdot dp + t^n \cdot dm^n. \tag{2.6}$$

The welfare of such a country can be affected in two ways, each corresponding to a term on the right-hand side of equation (2.6).

Firstly, the accession may cause changes in the international terms of trade (p), the relative prices at which countries exchange commodities. A rise in the price of an imported commodity (m^n positive) is detrimental to a country through raising the costs either of consumption or of production, while a rise in the price of exported commodities (m^n negative) benefits the country through higher export revenues. The overall impact of this term shall be called the "terms-of-trade" effect.

Secondly, the accession may cause some reorientation of world trade, with the result that different quantities of goods end up being traded. This change in a nation's trade has consequences for its tax revenues: a decline in the volume of trade results in less tax being collected at the border on imports and exports. A country will therefore experience a positive "volume-of-trade" effect if the accession results in an expansion of trade of those goods whose trade is impeded by tariff or tax barriers. This result is fairly intuitive: the trade tax has reduced the quantity of the good that is internationally traded, lowering welfare. If trade expands, the deleterious impact of the tariff is, to some degree, offset and welfare increases. On the other hand, artificially high exports resulting from export subsidies are also generally harmful to a country, which will benefit from a reduced volume of trade in such goods.

We determine the welfare impact on members of the CU and on a by differentiating equations (2.6) and (2.1), respectively:

$$e_u^c \, du^c = -m^c \cdot dp^* + t^{*a} \cdot dm^{ca} + t^* \cdot dm^{cn} + m^{ca} \cdot dt^{*a} + m^{cn} \cdot dt^*, \tag{2.7}$$

$$e_u^a \, du^a = -m^a \cdot dp^a + t^{a*} \cdot dm^{a*} + t^{an} \cdot dm^{an} + m^{a*} \cdot dt^{a*} + m^{an} \cdot dt^{an}, \tag{2.8}$$

where terms with superscripts "$a*$" refer to a's aggregate trade with the CU, those terms with superscripts "cn" and "an" refer to the respective country's aggregate trade with the rest of the world, and t^{*a} is the common tax vector imposed by all members of the customs union on trade with country a.

There are five terms on the right-hand-side of these welfare decompositions. Firstly, note that the welfare of a and the welfare of the customs-union member, c, are both subject to terms-of-trade and volume-of-trade effects (as were extra-union countries). Consequently any country, irrespective of its membership of a CU, may benefit both from an improvement in its international terms of trade, from an expansion in the trade of its protected goods, and a reduction in exports of subsidized commodities. The first terms on the right-hand-side of (2.7) and (2.8) are the changes in domestic prices in the respective countries. The second and third terms are, respectively, the volume-of-trade effects for trade with the country's new partner(s) and for trade with the rest of the world.

There are two additional effects on the welfare of the CU members and their new partner. The fourth term captures the impact of the countries reducing their tariffs on mutual trade, diminishing their tax revenues, while at the same time giving their trading partner improved terms of trade. The final term takes account of the adjustments in the external tariffs to the levels negotiated for the CET.

The particular welfare impact of these last two changes depends on the *pattern* in which each good is traded. Goods may be exchanged between the three groups (country a, the CU, and the rest of the world) in one of six patterns—in each case one of the groups trades with the two others, either exporting the good to both or importing it from both. The trade patterns are categorized as: A-N-C, N-A-C, and N-C-A, where the middle group trades the good in question with the other two. It is, of course, assumed that the pattern of trade is not

affected by the accession of country *a*. Discrete changes in tariffs may well result in alterations in the pattern of trade, causing goods to switch from one category to another.

For trade pattern A-N-C the CU members and the acceding country do not trade directly with each other, the two groups both either exporting the goods to non-member countries or importing the goods from them. The direct impact on trade in such goods results from the CU's adjustments in, and the acceding member's movements towards, the CET. For the other two trade patterns, namely N-A-C and N-C-A, domestic prices for the new partners will be affected both by the adjustments in extra-union tariffs of the country (or countries in the CU) that trade(s) with the rest of the world and by the easing of tax impediments on trade between themselves.

Wooton (1986) discusses the analytic solution to this model. The expressions are extremely complicated and are very difficult to interpret with any generality. An additional shortcoming of this theoretical model has been the concentration only on *marginal* tax changes and the associated assumption that the pattern of trade is unperturbed by the accession of a new country as a member of a customs union. In reality, of course, the formation of these economic coalitions involves discrete, not marginal, changes in countries' tariff levels which may well result in dramatic reorientations in production and world trade. The question immediately arises as to whether, say, the initially beneficial impact to a country of CU accession resulting from small tax-rate changes (and predicted by the marginal analysis) will continue throughout the accession process until the country is fully integrated into the customs union.

The next section presents an approach to analyzing these questions.

3. A NUMERICAL MODEL

In order to resolve the problems of intractability and marginal analysis, we adopt a different approach to address the impact of CU formation. We construct a computable general-equilibrium (CGE) model that is identical in structure to the theoretical model but, for tractability, we adopt specific functional forms for production and consumption activities. We then choose parameter values for endowments and tax/subsidy rates and solve this numerical model for the regions' welfare levels *and* for the endogenously determined trade pattern during the accession of a country to membership in a customs union.

Additionally, we can look at the relationship between the marginal technique and this numerical technique by considering a *series* of equilibria resulting from small, successive changes in the countries' tax and subsidy rates through the period of accession. In particular, we shall be interested in cases where initial gains for a country turn into eventual losses (and *vice versa*). That is, we wish to examine situations in which the marginal analysis indicates a different welfare outcome than actually arises from the discrete changes in tax/subsidy rates involved in the formation or expansion of a customs union. Thus our numerical modelling can provide some indication of the limitations of the theoretical approach used in the previous section.

3.1 The Model

For present purposes it is sufficient to assume that each of the three regions (C, A, and N) consist of a single country.[5]

Each region has an inelastically supplied endowment of factors of production. National preferences are represented by a concave and homothetic utility function. Goods of a particular type, irrespective of country of origin, are perfect substitutes. Thus there need not be trade in a particular product between two countries and, further, a regime change (such as

[5]This allows us to ignore the problem of the distribution of tariff revenues amongst member countries in the CU. This problem is addressed explicitly in our empirical model of the European Communities [see Harrison, Rutherford, and Wooton (1988a,b,c)].

customs union accession) may result in a new pattern of trade such that some trade flows cease and new ones arise.

Let p_x^j be the price of domestically produced good x in region $j \in \{A, B, C\}$ and let π_x^{ij} be the buyer price (inclusive of any trade taxes and subsidies) of the same good imported into country i from j. In equilibrium the landed price of an imported good must equal that of the (identical) domestically produced good; that is, $\pi_x^{ij} = p_x^i$. Discrete changes in tariff levels may break this equality, forcing trade to cease.

The experiment that we consider is, again, the mutual reduction in trade barriers (import taxes and export subsidies) by a CU and an acceding member, while the latter also adjusts its taxes on trade with the rest of the world to conform to those of the CU.[6]

Given our concern with the theoretical model's appropriateness for the analysis of discrete tax changes, we examine the path of equilibria for incremental moves towards full accession. Let α $(0 < \alpha < 1)$ be the scalar parameter representing the degree of integration: for $\alpha = 1$, the acceding country is a fully integrated member of the CU.

Let s_x^i and t_x^i be the non-discriminatory export subsidy and import tariff, respectively, charged by country I on its trade in good x. Let s_x^* and t_x^* be, respectively, the common external subsidies and taxes on trade by the CU with non-member countries. In the process of accession, the CU progressively removes its taxes/subsidies on trade with A, and the acceding member gradually eliminates its taxes on trade with C while adjusting it taxes to the CU levels for trade with N. It is arbitrarily assumed that the tax rates are adjusted linearly with α. If good x is imported by country i from country j then $p_x^i = \pi_x^{ij}$. Because of the pattern of discrimination in international trade, this implies the following equalities (depending on the trading countries).

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[6]We assume that the CET is not changed during the accession.

Acceding country A and non–member N. (3.1.1)

i. $A \longrightarrow N$: $p_x^N = \pi_x^{NA}(\alpha) = [\,1 - \alpha s_x^* - (1-\alpha)s_x^A\,](\,1 + t_x^N\,)\,p_x^A$

ii. $A \longleftarrow N$: $p_x^A = \pi_x^{AN}(\alpha) = (\,1 - s_x^N\,)[\,1 + \alpha t_x^* + (1-\alpha)t_x^A\,]\,p_x^N$

Acceding country A and customs union C. (3.1.2)

iii. $A \longrightarrow C$: $p_x^C = \pi_x^{CA}(\alpha) = [\,1 - (1-\alpha)s_x^A\,][\,1 + (1-\alpha)t_x^*\,]\,p_x^A$

iv. $A \longleftarrow C$: $p_x^A = \pi_x^{AC}(\alpha) = [\,1 - (1-\alpha)s_x^*\,][\,1 + (1-\alpha)t_x^A\,]\,p_x^C$

Customs union C and non–member N. (3.1.3)

v. $C \longrightarrow N$: $p_x^N = \pi_x^{NC} = (\,1 - s_x^*\,)(\,1 + t_x^N\,)\,p_x^C$

vi. $C \longleftarrow N$: $p_x^C = \pi_x^{CN} = (\,1 - s_x^N\,)(\,1 + t_x^*\,)\,p_x^N$

The arrow indicates the direction of trade in the good. Notice that as $\alpha \to 1$ prices in the acceding country and the CU are equalized for traded goods. Trade in any good x will conform to *at most* two of the above relations. We assume that there is no cross-hauling of goods and so there are six different patterns in which a good may be traded by all countries.

TABLE 1

Case	Relations	Pattern
1.	*i.* and *iii.*	$C \longleftarrow A \longrightarrow N$
2.	*ii.* and *iv.*	$C \longrightarrow A \longleftarrow N$
3.	*iv.* and *v.*	$A \longleftarrow C \longrightarrow N$
4.	*iii.* and *vi.*	$A \longrightarrow C \longleftarrow N$
5.	*ii.* and *vi.*	$A \longleftarrow N \longrightarrow C$
6.	*i.* and *v.*	$A \longrightarrow N \longleftarrow C$

3.2 Numerical Examples

The structures of the models (listed in the appendix) are chosen to closely approximate those of the familiar neoclassical trade models. Countries have access to the same constant-returns-to-scale production technology for each good, while consumers have identical tastes in all countries. In order that there might be trade in all possible patterns, there are six goods produced in the world economy. Labour and capital are essential to production and are freely mobile between sectors, but not internationally. In addition, in the first three examples each good is produced using the services of a sector-specific factor of production, ensuring that each good is produced in every region. To ensure that each good is produced and consumed in every region, each country is endowed with stocks of the fixed factors necessary for the goods' production. Each country has the same physical endowments of the intersectorally mobile factors of production, but the allocation of the sector-specific factors differs from country to country. The model therefore most closely resembles the Ricardo-Viner trade model.

Having sector–specific factors prevents extreme levels of specialization within countries. Their presence is by no means essential to the analysis, but merely make the interpretation of the results easier. To illustrate this point, Example 4 adopts the same production technology but permits the third factor, *f*, in each industry to be intersectorally mobile as well. In this example countries differ only in their endowments of the three mobile factors and thus the model is a higher dimensional variant of the Heckscher-Ohlin framework.

In each example all countries initially impose non-discriminatory tariffs on their trade at a common rate of 15%, and the customs union is created by countries A and C removing these taxes on their bilateral trade, leaving a common external tariff of 15% in place against N (which also maintains its tax rate). We compute the impact of the tariff reductions on the countries' trade patterns and welfare along a path from zero integration ($\alpha = 0$) to the establishment of the complete CU ($\alpha = 1$). We calculate the welfare decompositions for each step along the path by measuring the differences between adjacent equilibria. This yields the

approximate changes in the components of the countries' welfare. The figures for each country show the integrals of these changes.[7]

We then compare these results with those of two alternate policy regimes. The first alternative, referred to as "MFN" in our figures, involves A and C removing their tariffs on imports from all countries, not just from each other (i.e., giving N "most favored nation" status). The second alternative regime, referred to as "GFT", involves global free trade (all countries eliminating their trade barriers). Our discussion focuses on salient aspects of the results—the complete output tables are available from the authors.

3.2.1 Example 1

The endowments of the sector-specific factors in each country (see the appendix) were chosen such that each of the six pattern of trade are represented in free trade. Specifically, country A was chosen to have a relatively high endowment of factor 1 and a relatively low endowment of factor 2 such that it would be the sole exporter of good 1 and the sole importer of good 2 if there were no trade restrictions in the world economy. Similar relationships hold for factors 3 and 4 for country C and for factors 5 and 6 for country N, such that the free-trade pattern of goods corresponds directly to the six cases listed in the previous section. The results of the tariff changes are illustrated in Figures 1.1, 1.2, and 1.3.

As country C makes its tariff concessions on imports of good 1 from A, their trade expands. However, country N (which maintains its tariff at 15%) imports decreasing quantities and eventually stops trading good 1 entirely. Both N and C have a comparative advantage in producing good 2 and consequently both export it to A in the initial non-discriminatory equilibrium. A's tariff concessions to C divert its imports from N, which loses its export market entirely. The reduction of country A's prohibitive tariff on imports of good 3 from C results in an increasing volume of trade between the two countries. Country N, which does not

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[7]As a check on our calculations, we compare the change in the welfare indices as a result of complete accession with the sums of the integrands of the components. Our grid size is chosen so that the discrepancies between these is maintained below 0.1% of the equivalent variation.

lower its tariff barrier, continues to consume only domestically produced output. Country N has the majority of the export market of good 4 to country C, but the latter's preferential treatment of imports from country A lead to traditional trade diversion, where N loses a share of its export market to country A.

Good 5 exhibits a particularly extreme case of trade diversion, as is shown in Figure 1.4. The pattern of endowments would predict that both country A and country C would import good 5 from country N (and this is indeed the case in the free trade regime). Initially tariffs are sufficiently high that only A wishes to import from N. The tax concessions being made by the countries do not directly affect their trade in good 5 (as the countries' import taxes from country N continue to be taxed at 15%). However, the formation of the CU has affected the terms of trade and has benefited the partner countries such that A increases its imports of good 5 and C starts to import the good. The discriminatory aspect of the tariff plays an increasing role such that C's concessions on imports from A relative to N lead to A choosing to reverse its pattern of trade and become a *net exporter* of good 5, contrary to its comparative advantage. Good 6 is imported only by country N, whose welfare is diminished by the formation of the CU. As a result the volume of trade in this good declines as the CU becomes established.

Figure 1.5 illustrates the Equivalent Variations for each country for the accession to a CU between A and C as well as for the non-discriminatory elimination of tariffs by A and C and for global free trade. We can see that A and C monotonically benefit from the accession while N loses. Extending the tariff concessions to N would greatly benefit that country at a significantly greater cost to C than to A. N would be almost indifferent between this and reciprocating by eliminating its own tariffs, but both A and C would benefit from a move to global free trade. Notice that, while both A and C benefit from both a CU *and* free trade, their rankings of the alternative policies differ. C would be in favour of multilateral negotiations to eliminate all tariff barriers while A would oppose the extension of tariff concessions to country N.

We now use the decompositions derived in section 2.3 (and illustrated in Figures 1.1, 1.2, and 1.3) to provide some understanding of the sources of these welfare changes.

Firstly consider the impact on country N. Equation (2.6) indicated two welfare terms, the terms-of-trade change and the volume-of-trade effect. N's imports of goods 1 and 6 decline (good 3, its other import, is not traded at initial tariff levels) while its exports of goods 2 and 4 also diminish. Only good 5 experiences an expansion of trade by N but, as there are no export taxes in this example, this cannot prevent the volume-of-trade effect from being unambiguously negative. Additionally, country N suffers from a deterioration in its terms of trade. Its imports (goods 1 and 6) become more expensive, while two of its exports (2 and 4) face a decline in their relative prices. Again, only good 5 can yield any benefit as the domestic price of that import falls. However, the trade volume in the good is too small to prevent the terms-of-trade effect from being negative.

Conversely, the terms-of-trade and volume-of-trade effects are positive for both partners in the CU. Good 5 does generate a negative terms-of-trade effect for country A, but it is too small to be significant. Also, country A loses some of its export market in good 6 and hence, were export taxes in use, this would reduce that country's volume-of-trade benefit. The CET is not changed and so term 5 in equations (2.7) and (2.8) are zero. Term 4 in the same welfare expressions must be negative, being the loss in tariff revenue on mutual trade. Our calculations indicate that both of the partner countries have higher welfare from the reduction in mutual tariffs, and so the volume-of-trade and terms-of-trade effects dominate this implicit revenue transfer.

Notice that marginal analysis yields the same predictions as the numerical model for changes in welfare and the volume of trade. The only difference is that the marginal analysis is unable to predict the change in the pattern of trade in good 5 when the customs union is formed.

3.3.2 Example 2

The endowments of the model are changed such that country A has a strong comparative advantage in goods 1, 2, and 3 relative to the other countries while country C has a relatively strong comparative advantage in goods 4, 5, and 6. This is reflected in the free-trade pattern in Figure 2.1, where A is the exclusive exporter of goods 1, 2, and 3 while C exports 4, 5, and 6. Country N imports 1, 2, 3, and 5 and exports relatively small quantities (given its size) of goods 4 and 6. In addition, countries A and N are relatively large, in terms of their absolute endowments, as compared to C.

In this example the accession to a CU does not have any significant implications for the pattern of world trading—all goods continue to be traded in their initial patterns except good 4, where country N stops exporting. Indeed, the volume of N's trade in all goods declines (or remains at zero). The other countries (CU partners A and C) experience expansions in their trade in all goods and the volume of world trade in all goods rises. Trade in good 1 for a fully established CU is actually marginally higher than it would be for global free trade (GFT).

The marginal analysis predicts substantially the same changes, but yields an entirely misleading prediction of the impact on nations' welfare. Figures 2.1, 2.2, and 2.3 show that, while C monotonically gains (and N loses) along the accession path, country A experiences short-lived gains that quickly diminish. Once the CU is fully established C is the sole beneficiary, with countries A and N both being worse off. Thus a purely marginal analysis of this case may recommend the wrong policy for country A.

While this marginal analysis may be ill-suited to examining the overall impact of CU formation, it comes into its own for determining the *sources* of gains and losses. What has caused this initially beneficial agreement to reduce the welfare of one of the partners?

Consider an initial preferential tariff cut and evaluate the terms in the decompositions of section 2.3. Country C is relatively smaller than A and both N and C import the same goods (1, 2, and 3) from A whereas A is the only destination for C's exports. Thus it would be expected that country A would have considerably more monopoly power in trade than would

country C. Consequently, C would be more likely to benefit from mutual reductions in tariffs as the gains from trade generally accrue to the smaller country. This is indeed the case: the sum of terms 1 and 4 in equation (2.7) (the overall terms-of-trade effect for country C) is positive while it is negative in equation (2.8) (for country A). Rising volumes of trade benefit both countries (terms 2 and 3, with tariff rates identical at the initial equilibrium). As both countries do gain from the first steps towards a CU, we know that the volume-of-trade gain must offset terms-of-trade losses for A.

What causes the gains to reverse for A? This can be determined through checking the decompositions for tariff concessions once the accession process is fairly advanced. Country C continues to benefit from both the volume-of-trade and terms-of-trade effects while A suffers from losses through the terms of trade. What is most significant is the change in the volume-of-trade terms (2 and 3). While A's trade volume in all goods continues to expand, it makes a large switch in the source of its imports of good 6. Thus it reduces its imports from N (facing a 15% tariff) and increases its imports from C (at a lower, preferential tax rate). Tariff revenues decline significantly, reducing the magnitude of the (still positive) volume-of-trade gains.

Thus, being the larger country in a CU partnership and the effects of strong trade diversion combine to reduce the welfare of country A.

3.2.3 Example 3

This example was constructed to demonstrate that the non-monotonicity of the changes in country A's welfare in the previous example is not a result of the limited pattern of trade. With these factor endowments (listed in the appendix), country A again benefits from an initial reduction in the mutual tariffs on trade with C yet loses from complete accession to the CU. (The loss is small, only 0.003% of the equivalent variation.) This loss occurs even though all six patterns of trade occur along the accession path and there are no reversals in the pattern of trade.

3.2.4 Example 4

It is by no means necessary to have sector-specific factors in these models. In this example each country is endowed with stocks of three freely mobile factors of production. The remarkable result is that, while A and C both gain from initial marginal tariff cuts, in the final stages of the accession *all three countries face declines in their welfare.* The partner countries do benefit from the formation of the CU (as compared with the initial trading regime), yet both would do better from retaining non–zero tariffs on their *intra-union* trade. This implies that the continued presence of the tariffs on trade with N more than offsets the benefits to the union of freer bilateral trade.

As might be expected, given the free mobility of all of the factors of production there are dramatic switches in the patterns of production and trade. For example, country A imports good 1 at all times. Initially the sole source of its imports is country N. As the accession becomes more complete country C begins to take over N's export market. In the CU country C provides all of A's imports yet, were GFT to be adopted, C would also import good 1 from N. Thus we have a striking example of *trade diversion* with a complete re-orientation in the trade pattern. *Trade creation* arises for good 2. In this case there is no trade whatsoever at the initial tariff levels, and the mutual reduction of tariffs between A and C leads to A's exporting the good to C, as it would in GFT. A similar story can be told for good 3 with the difference that the trade level in good 3 in the CU is significantly (about 40%) larger than it would be in GFT. Goods 4 and 5 are not traded in the initial equilibrium and the formation of the CU leads to trade between the partners (A importing good 4 and C importing good 5). Though we now find trade where previously there was none, this is not "true" trade creation as the pattern of trade is contrary to what it should be in GFT—in both cases the source of the exports would then be country N, not the partner. Country C has a comparative advantage in good 6 and would export it to both N and A in free trade. The formation of the CU leads to increased trade between A and C but at the cost of trade between N and C such that C's export market declines over the accession process.

4. SUMMARY

The numerical implementation of the theoretical structure demonstrates that the marginal analysis that has readily been used in examining preferential trading arrangements may not only yield *quantitatively* inaccurate predictions of the effects on countries' welfare but may suggest outcomes that are *qualitatively* incorrect, suggesting gains for a potential-member nation that in fact loses from joining the CU. The models used to generate this result are quite "conventional", which leads us to suspect that such outcomes might often arise.

This does not mean that marginal analysis is worthless. As has been shown, the value of the marginal analysis is in "signing" the various components of the welfare changes, thereby illuminating the economic forces at work during the formation of the customs union.

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APPENDIX

3 regions: j = C, N, A

6 goods: $i = 1,...,6$

(a) Consumption technology

All countries have identical tastes represented by constant-elasticity-of-substitution utility (CES) functions:

$$u^j = \left\{ \sum_{i=1}^{6} \delta_i (c_i^j)^{-\rho} \right\}^{-\frac{1}{\rho}},$$

where the elasticity of substitution $\sigma \equiv \frac{1}{1+\rho} = 0.5$, and

Good	1	2	3	4	5	6
δ_i	0.082	0.021	0.330	0.186	0.129	0.253

(b) Production technology

Identical technology in all countries characterized by Cobb-Douglas production functions:

$$x_i^j = A_i (f_i^j)^{\alpha_i} (l_i^j)^{\beta_i} (k_i^j)^{\gamma_i}$$

where $\sum_{i=1}^{6} l_i^j = \bar{l}^j$, $\sum_{i=1}^{6} k_i^j = \bar{k}^j$, for all of these examples and $f_i^j = \bar{f}_i^j$, for examples 1, 2, and 3, while $\sum_{i=1}^{6} f_i^j = \bar{f}^j$, for example 4.

The production parameters are the same in all examples:

Good	A_i	α_i	β_i	γ_i
1	2.971	0.3	0.4	0.3
2	2.586	0.2	0.2	0.6
3	2.455	0.1	0.3	0.6
4	2.800	0.3	0.2	0.5
5	2.455	0.1	0.3	0.6
6	2.569	0.5	0.1	0.4

(c) Factor Endowments

Example 1

	Country		
Factor	C	N	A
$\bar{f}_1$	3.0	3.0	5.0
$\bar{f}_2$	3.0	3.0	1.0
$\bar{f}_3$	6.0	2.0	2.0
$\bar{f}_4$	2.0	6.0	5.0
$\bar{f}_5$	1.0	4.0	1.0
$\bar{f}_6$	6.0	3.0	5.0
$\bar{l}$	20.0	20.0	20.0
$\bar{k}$	10.0	10.0	10.0

Example 2

Factor	Country C	N	A
$\bar{f}_1$	1.0	6.5	15.0
$\bar{f}_2$	1.0	6.5	15.0
$\bar{f}_3$	1.0	6.5	15.0
$\bar{f}_4$	6.0	6.0	1.0
$\bar{f}_5$	6.0	6.0	1.0
$\bar{f}_6$	6.0	6.0	1.0
$\bar{l}$	20.0	20.0	20.0
$\bar{k}$	10.0	10.0	10.0

Example 3

Factor	Country C	N	A
$\bar{f}_1$	3.0	3.0	20.0
$\bar{f}_2$	3.0	3.0	1.0
$\bar{f}_3$	6.0	1.0	2.0
$\bar{f}_4$	2.0	6.0	9.0
$\bar{f}_5$	1.0	4.0	1.0
$\bar{f}_6$	4.5	2.95	4.5
$\bar{l}$	20.0	20.0	20.0
$\bar{k}$	10.0	10.0	10.0

Example 4

Factor	Country C	N	A
$\bar{f}$	20.0	10.0	10.0
$\bar{l}$	10.0	20.0	10.0
$\bar{k}$	10.0	10.0	20.0

COUNTRY N
Welfare Decompositions

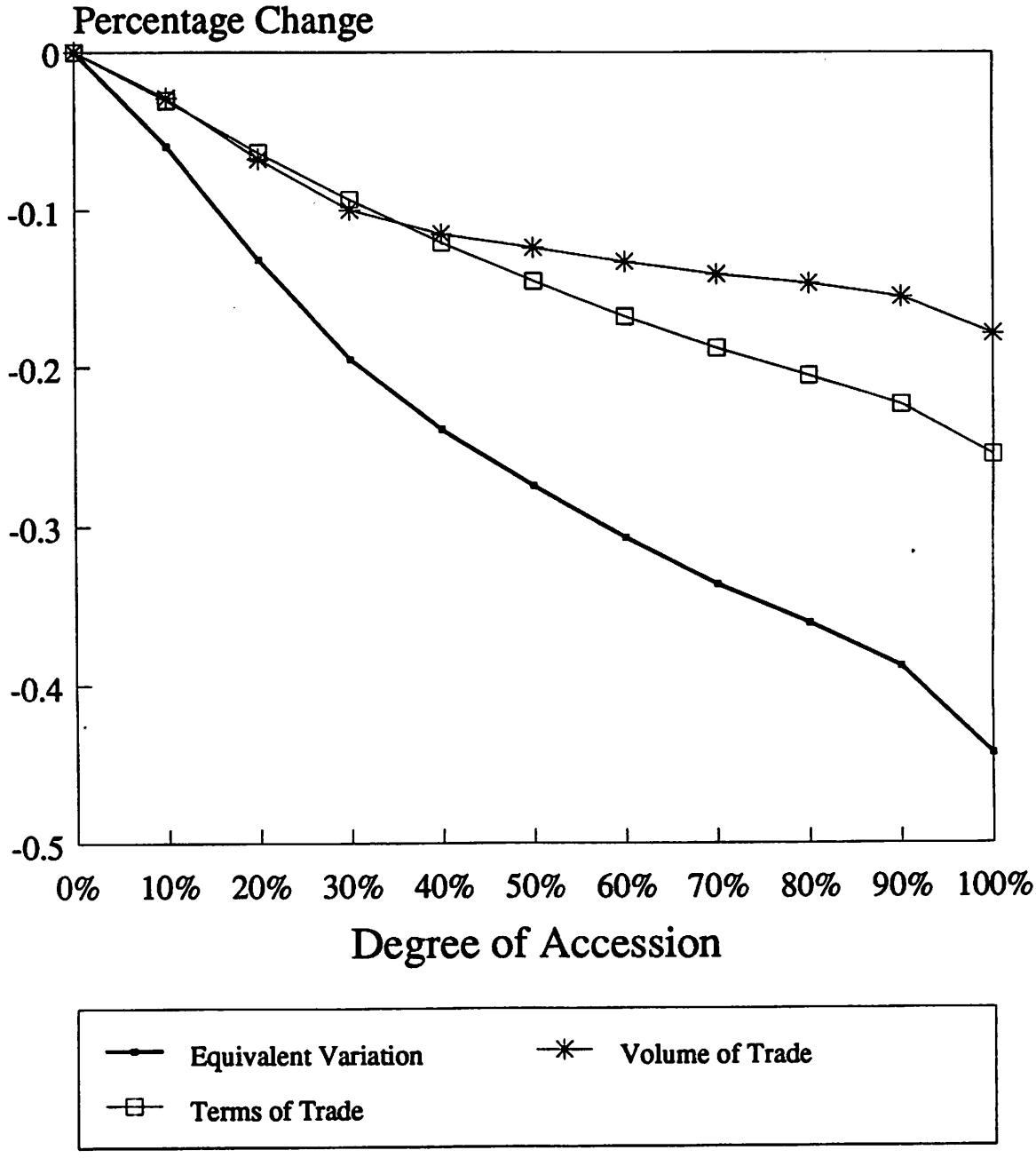


FIGURE 1.1

COUNTRY A
Welfare Decompositions

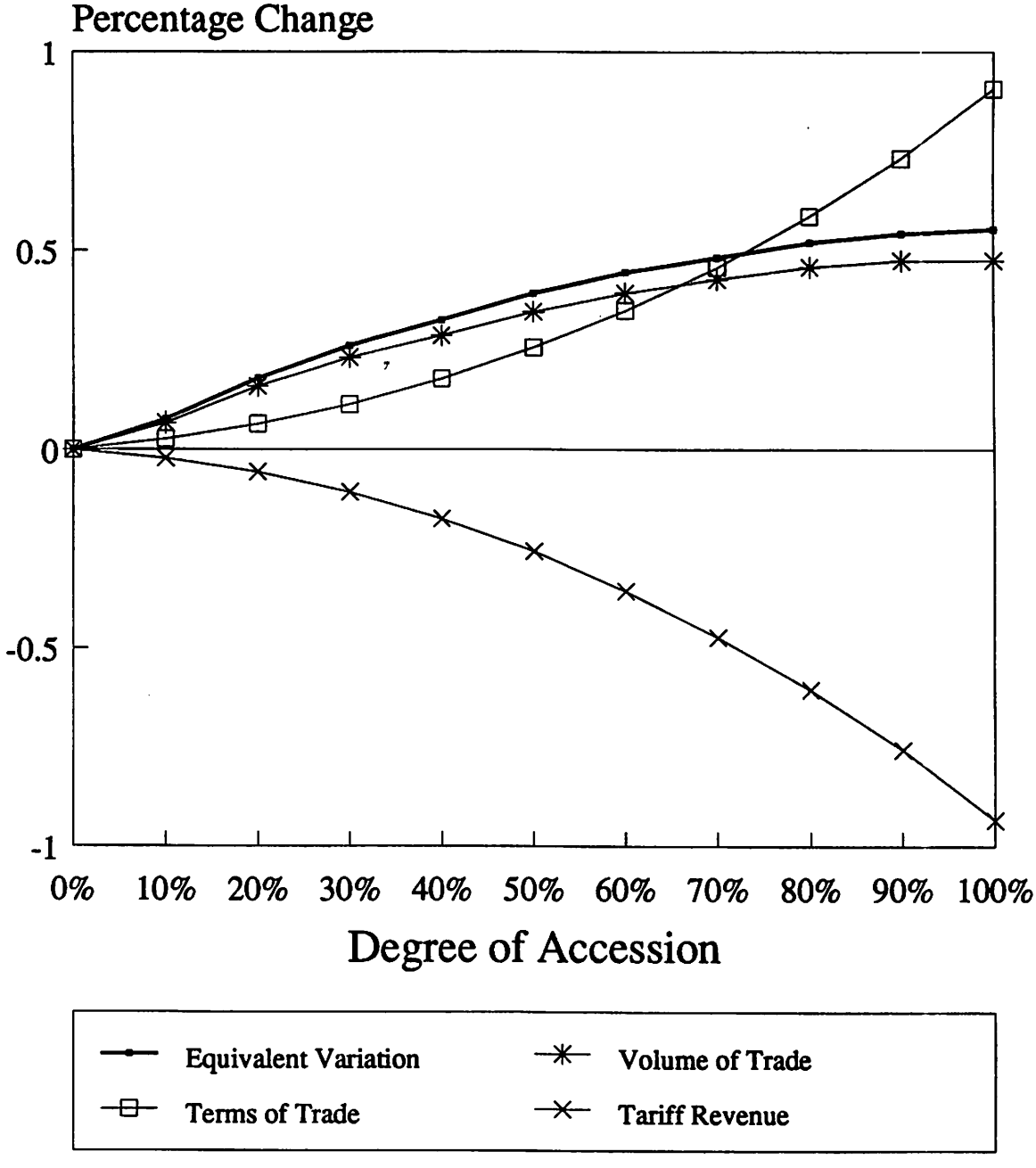


FIGURE 1.2

COUNTRY C
Welfare Decompositions

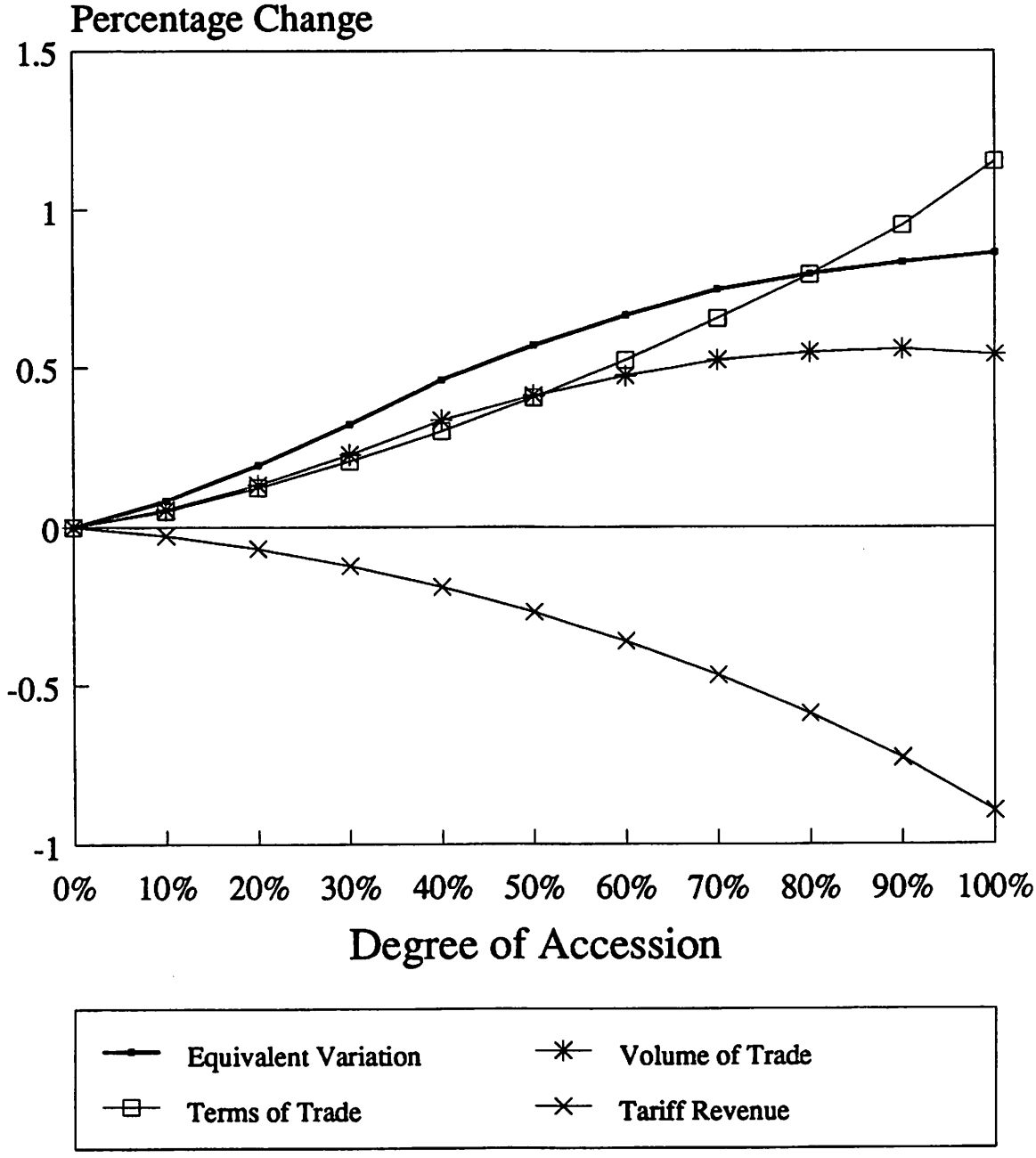


FIGURE 1.3

GOOD 5
Net Exports

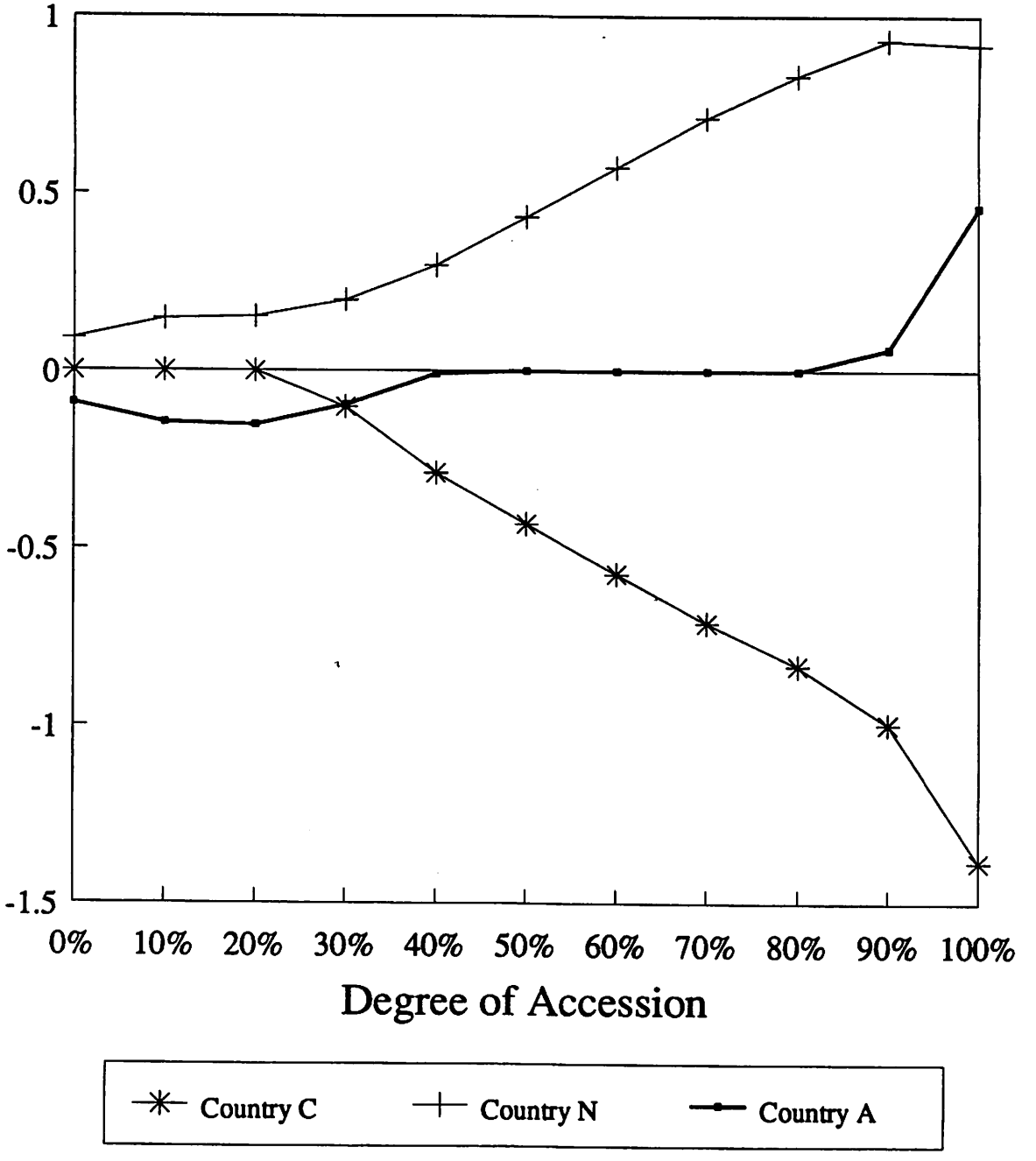
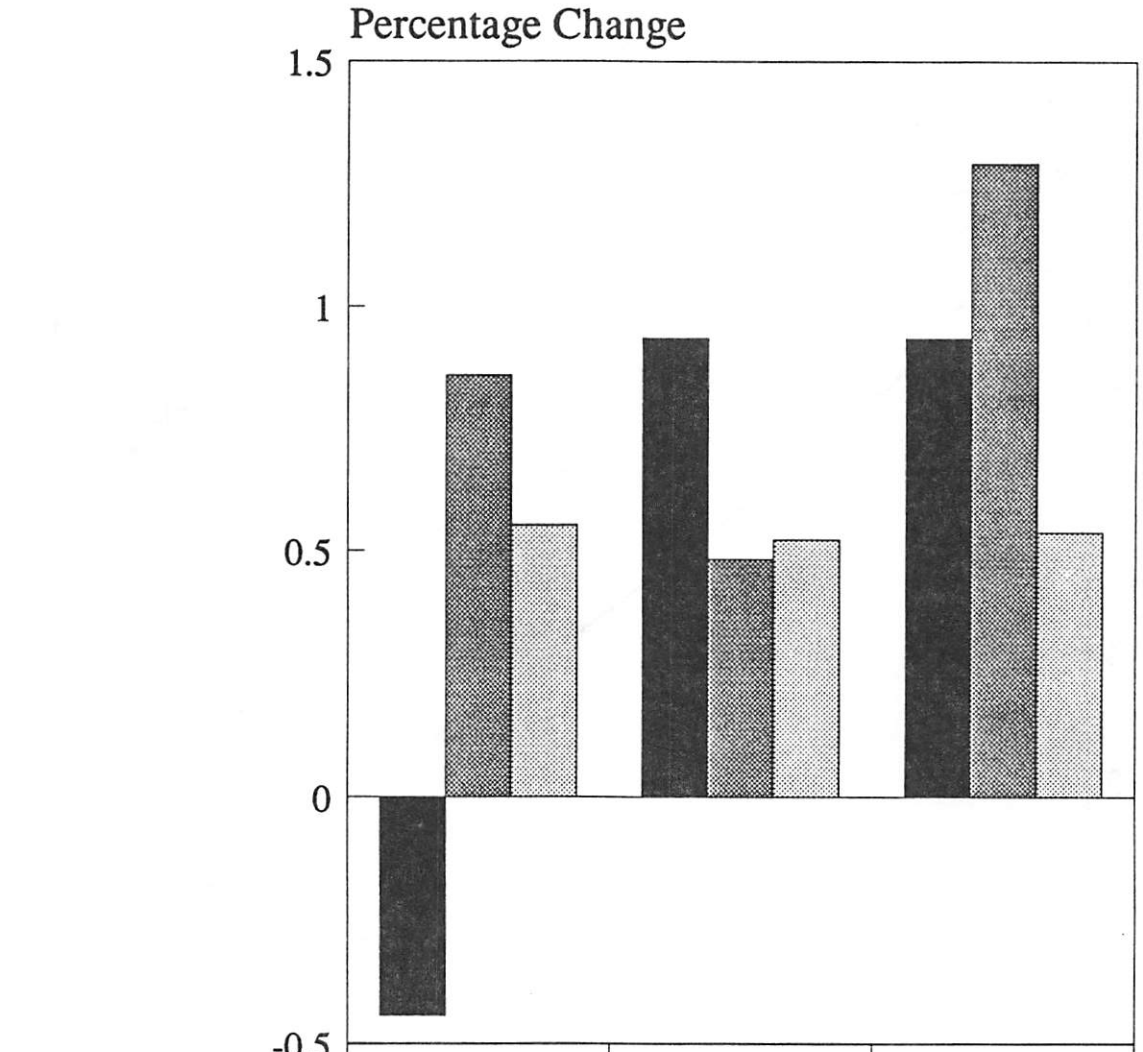


FIGURE 1.4

EQUIVALENT VARIATIONS



	CU	MFN	GFT
Country N	-0.443	0.936	0.935
Country C	0.861	0.483	1.292
Country A	0.553	0.523	0.539

Trade Regime

FIGURE 1.5

COUNTRY N
Welfare Decompositions

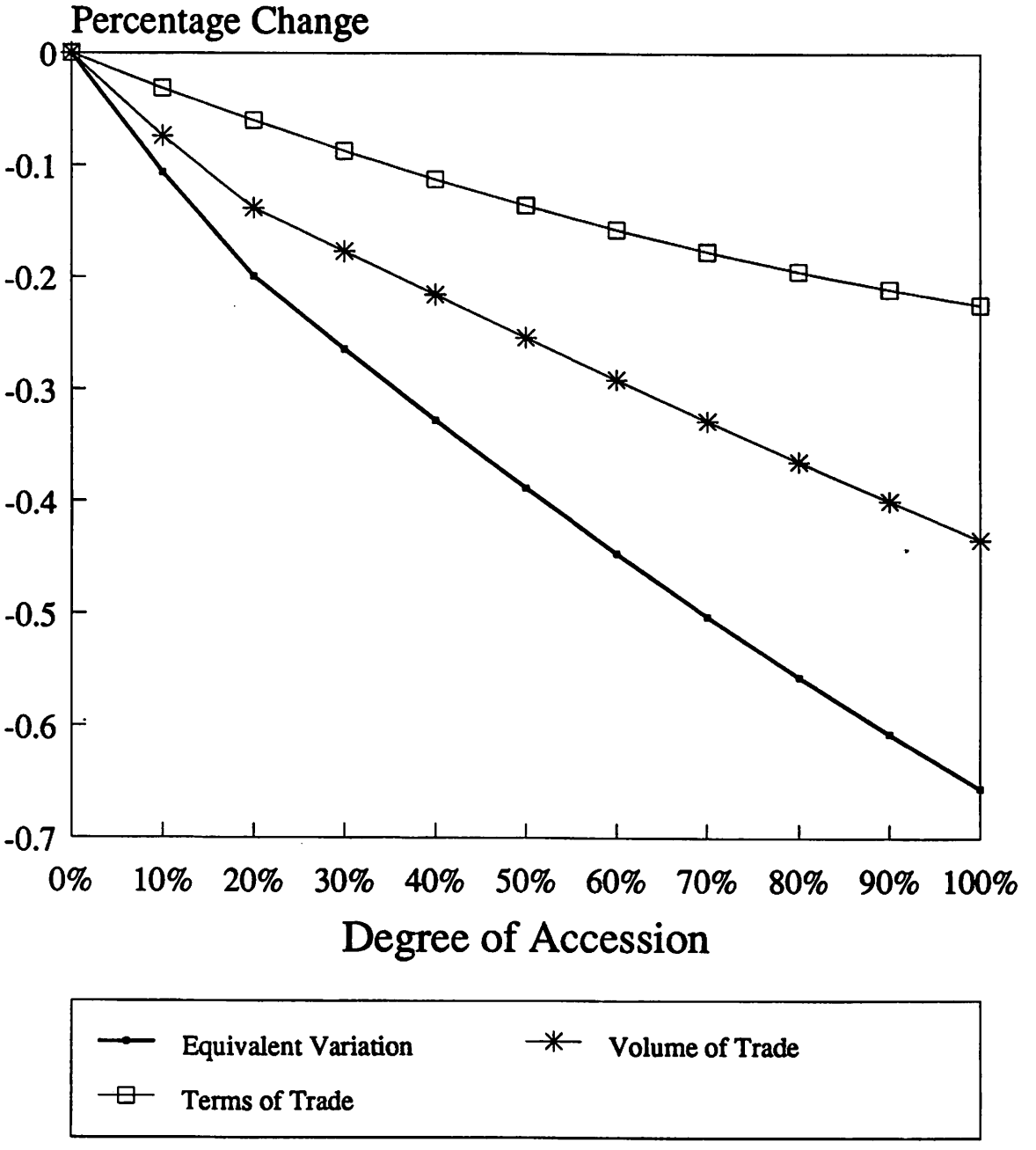


FIGURE 2.1

COUNTRY A
Welfare Decompositions

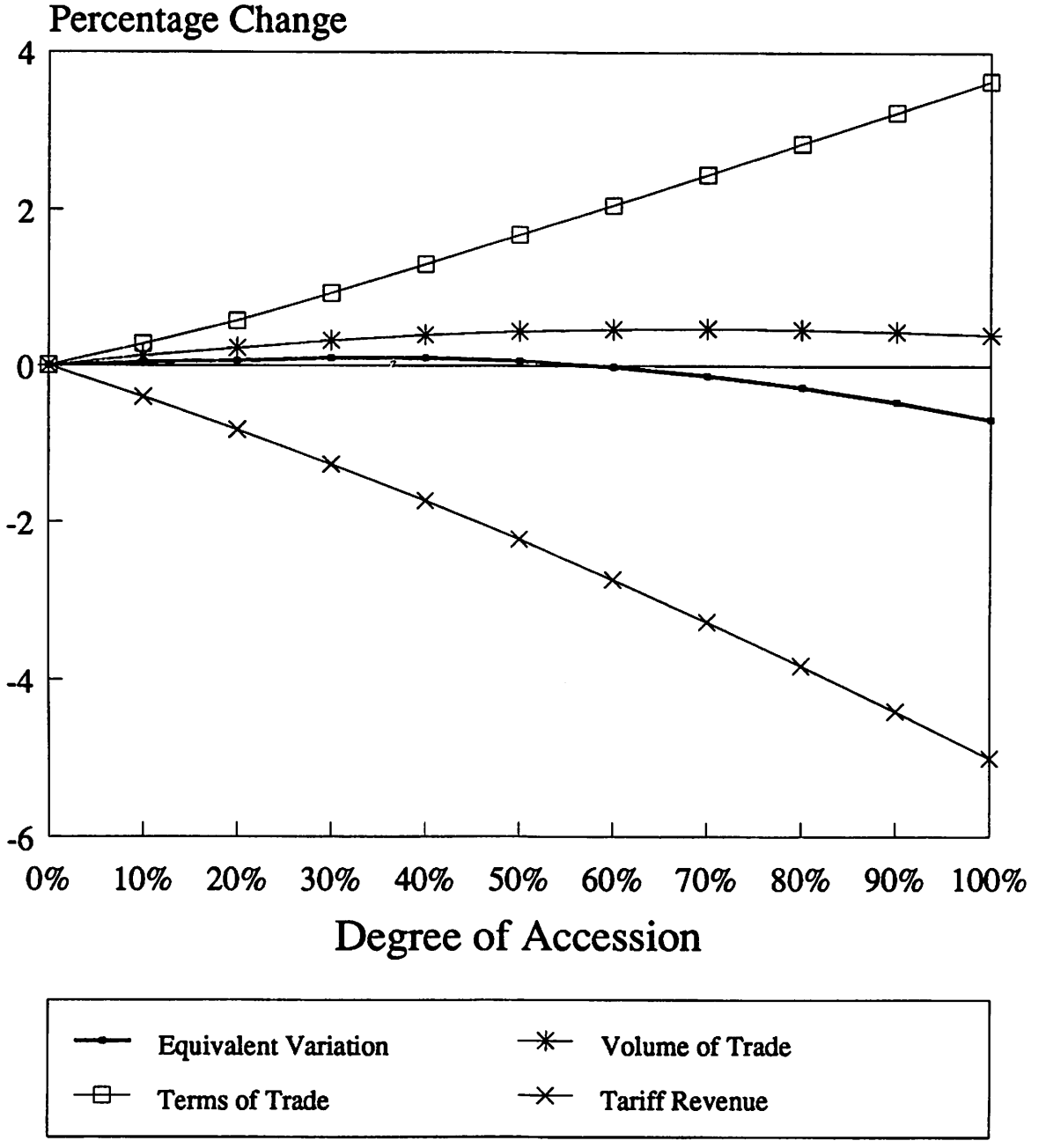


FIGURE 2.2

COUNTRY C
Welfare Decompositions

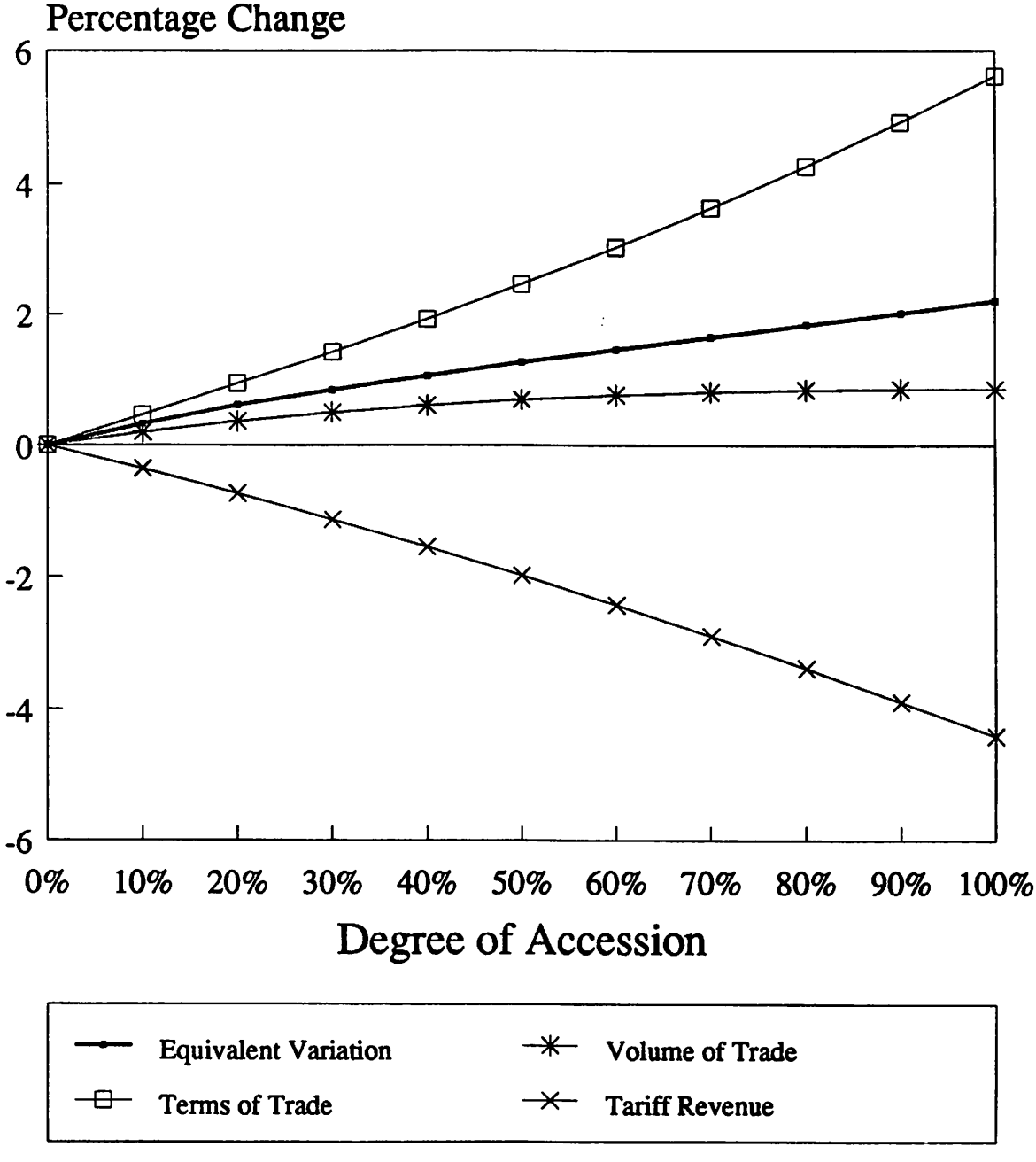
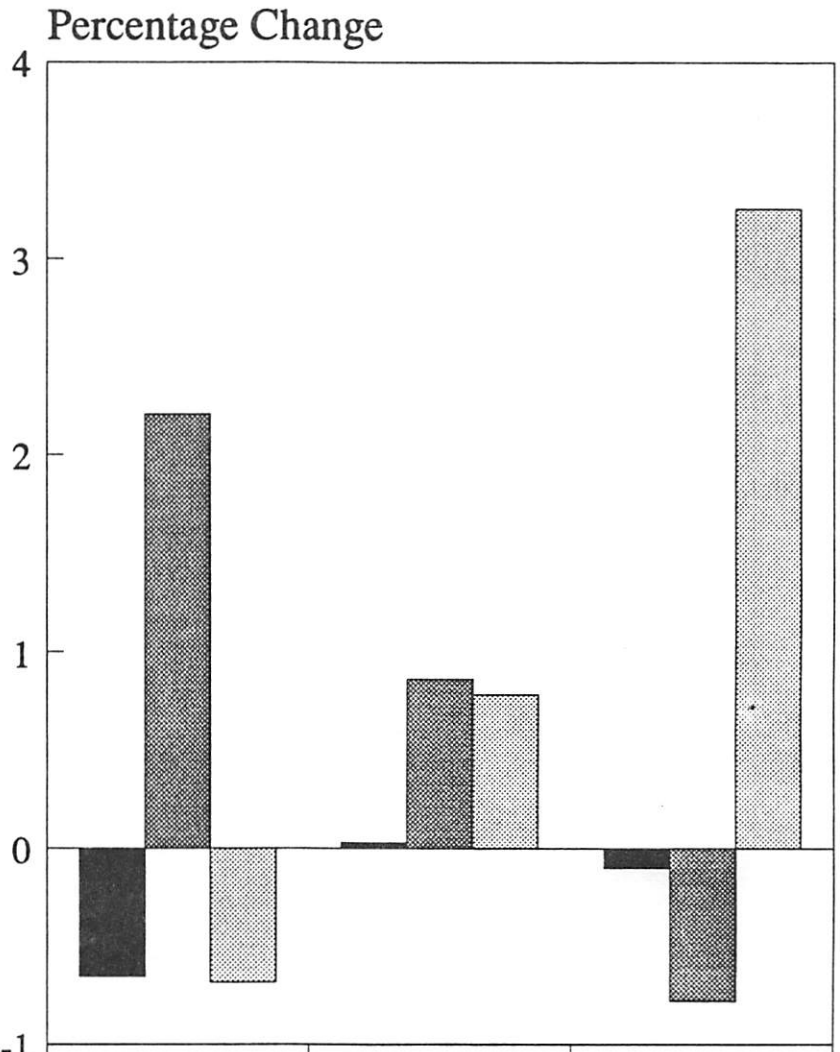


FIGURE 2.3

EQUIVALENT VARIATIONS



	CU	MFN	GFT
Country N	-0.655	0.028	-0.103
Country C	2.206	0.864	-0.777
Country A	-0.685	0.784	3.256

FIGURE 2.4