Trade and interdependence in the economic growth process: a multiplier analysis for Latin America

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RESUMO

Este artigo propõe algumas abordagens alternativas para a análise do papel do comércio internacional e da interdependência econômica no processo de crescimento baseadas em contribuições anteriores de Machlup, Goodwin e Miyazawa. A análise empírica enfoca os países da América Latina: a economia mundial é dividida em dois grupos principais de países (América Latina e uma seleção de países desenvolvidos), com o resto do mundo formando um terceiro bloco agregado. Uma série temporal de matrizes de comércio, para o período 1978-1991, é construída para que se possa explorar a extensão dos impactos do crescimento de um país no resto do mundo e a simetria/assimetria destes impactos. Por meio da utilização do método proposto, revela-se que *insights* importantes acerca da estrutura de comércio internacional podem ser obtidos, propiciando valiosas informações para a análise da evolução dos regimes de comécio e da formação de blocos econômicos.

Palavras-chave: comércio internacional, análise de insumo-produto, decomposição de multiplicador, América Latina.

ABSTRACT

This paper illustrates alternative methodological approaches to the issue of trade and interdependence in the economic growth process with a focus on the countries of Latin America, drawing inspiration from earlier contributions by Machlup, Goodwin and Miyazawa. The world economy is divided into two main blocks of countries (Latin America and a selection of developed economies) with the rest of the world forming an aggregated third block. A time series of trade matrices for the period 1978-1991 has been constructed to explore the degree to which changes in one country spillover to the rest of the world and the degree to which the changes are symmetric or asymmetric. The approaches reveal that important insights into trade structure can be obtained, insights that will prove of value in the rapidly changing trade regimes of the current and next decades.

Key words: international trade, input-output analysis, multiplier decomposition, Latin America.

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Recebido em fevereiro de 1999. Aceito em abril de 1999.

1 Introduction

The relationship between trade and growth has been a familiar topic of discussion in the development literature. More often, the question posed concerns the effects of international trade on economic growth, and thus focuses on trade as an active "agent" of growth. This active role played by international trade can be found in many different models. With the neoclassical free-trade model, in one extreme, trade is regarded as an important stimulator of economic growth. It enlarges a country's consumption capacities, increases world output, and provides access to scarce resources and worldwide markets for products without which poor countries would be unable to grow. (Todaro, 1994) By imposing limits to this theory (fixed resources, full employment, and the international immobility of capital and skilled labor; fixed, freely available technology and consumer sovereignty; internal factor mobility and perfect competition; the absence of national governments in trading relations; balanced trade and international price adjustments; and trade gains accruing to nationals), Todaro (1994) concludes that trade can be an important stimulus to rapid economic growth, although it might not be a desirable strategy for economic and social development. The contribution to development depends on the nature of the export sector, the distribution of its benefits, and the sector's linkages with the rest of the economy. It seems that, to the extent we are only interested in the effects of international trade on pure economic growth, there is a consensus that trade can provide an important stimulus to growth.

One of the central issues to be addreseed in this paper explores the degree to which growth in one country affects growth in other countries. More specifically, the role international trade plays as a mechanism of transfer of income from growing countries is explored with a focus on the degree to which developing countries benefit from the growth of developed countries. Also explored is the asymmetry problem: does the economic growth of developed countries have a higher impact on the developing economies than these economies' growth impact on the richer countries? This paper provides a multiplier analysis of the international economic dependency among Latin American countries and developed countries. In a sense, it contributes to the debate raised by Krugman (1991, 1993), under a new perspective, on regionalism versus multilateralism, by presenting an approach to evaluate the impacts, over time, of the creation of trading blocks on trade patterns within a general equilibrium framework.

Section 2 provides a brief review of the literature on international trade multipliers. Section 3 describes the matrix of international trade (MIT), which will be used as the data base for our estimates. In Section 4, the methodology used to analyze the impact of growth through international trade is described, and Section 5 presents the empirical results. Final remarks are provided in the last section.

2 Background

The **passive** role of trade related to growth issues was studied in depth, in the first half of this century, when Keynesians started to study the income multiplier effects in a national economy (see Machlup, 1939). Machlup (1943) presented a framework in which the multiplier technique was developed in certain respects (primarily to measure the effects upon national income and trade balances), applicable to the theory of foreign trade. The idea of the foreign-induced trade multiplier was presented, in a demand-driven two-country framework, in which an increase in autonomous income in country A generated, through import leakages, an increase in the income of country B, i.e., part of the increase in the income of A would be spent on imports from country B. Part of this income transfer from A to B, in a second round, through import leakages, would return to A through A's exports to B. This process would continue until the income transfers became negligible. The total effect of the initial increase in the income of A is the foreign-induced trade multiplier effect.

There have been many, diverse methodological contributions to understanding these issues. For example, Goodwin (1983) generalized this idea by implementing input-output techniques for a ten-region world payments matrix and presented the concept of the world matrix multiplier, which was, basically, Machlup's concept of foreign-induced trade multiplier expanded to a many-country context. Prior to Goodwin's contributions, Miyazawa (1960) revised the conventional foreign trade multiplier, considering a sub-multiplier process involving production, i.e., treating the imported intermediate goods required for the production of exported goods as an endogenous factor induced by the initial injection. By taking into account the intermediate products in the circular flow, Miyazawa's foreign trade multiplier provides a more accurate indicator of the direct and indirect effects on the economy. Other approaches, based on input-output systems, have attempted to analyze the structure of multi-regional trade flows. Feedback loop analysis has been used for both interregional national input-output tables (Sonis *et alii*, 1995a), and intercountry input-output tables (Sonis *et alii.*, 1993 and 1995b). However, the data requirements of analysis based on interregional and intercountry input-output tables are more demanding, and it has often proved difficult to gather all the data necessary to carry out the type of analysis that is the subject of this paper, in the context of Miyazawa's foreign trade multipliers (see Ota, 1994, for a similar view).

Hence, this paper offers a less comprehensive perspective and one that necessitates some comporomises and assumptions. As a result, in this paper, induced imports are restricted to finished goods only. The first step in the data assembly involves the construction of a time series (1978-1991) of matrices of international trade for 23 countries

and the rest of the world, in order to generate more precise estimates of foreign-induced trade multipliers. The next step is to analyze the impacts of growth on trade balances and growth in other parts of the world economy. To accomplish this task, the world economy was divided into two blocks, developed countries and Latin American countries, while the rest of the world was allocated to a third block. Trade flows for individual countries were shown in the first two blocks.

3 The Matrix of International Trade (MIT)

The data used by Goodwin (1983) were taken directly from the estimates of the marginal propensities to import developed by Thorbecke and Field (1974). These estimates, however, given by the shares of merchandise imports into region i from region j, expressed in f.o.b. terms, in the GNP of region i, overestimate the multiplier effects, as will become clear after we develop the matrix of international trade (MIT) framework. Furthermore, some world regions had to be considered exogenous in Goodwin's analysis, which does not necessarily happen in the MIT framework. The development of the MIT model follows.

Consider the following balance identity, which is valid for each country i in the world economy:

$$C_i + I_i + G_i + X_i - M_i \equiv Y_i, \quad i = 1,2,...,n \tag{1}$$

where:

C_i is total domestic consumption of country i

I_i is total investments of country i

G_i is total government spending of country i

X_i is total exports of country i

M_i is total imports of country i

Y_i is GDP of country i

Our concern here is the flow of goods and services among countries that participate in international trade. Therefore, the next step is to disaggregate total exports and total imports in the following way.[1] Rearranging equation (1), we have:

$$X_i + C_i + I_i + G_i \equiv M_i + Y_i \qquad i = 1,2,...,n \tag{2}$$

where:

$X_i + C_i + I_i + G_i = Z_i$ is the total demand for domestic output of country i

$C_i + I_i + G_i = F_i$ is the total **domestic** demand for domestic output of country i (exogenous outlays) [2]

$M_i + Y_i = E_i$ is the total expenditure of country i

Building up a trade table, we have:

$$X_i = \sum_{j=1}^{n} x_{ij} \tag{3}$$

where x_{ij} are the exports of country i to country j, and

$$M_i = \sum_{j=1}^{n} m_{ji} \tag{4}$$

where m_{ji} are the imports of country i from country j.

Notice that $[x_{ij}]$ and $[m_{ji}]$ are the same matrix.

Given these definitions, we can propose the design of matrices of international trade (MIT), that present structural similarities to the closed-economy input-output tables. We can also think of the MITs as a special case of a representation of a single-industry-economy

1 Modeling the aggregate demand components would increase the accuracy of the model, without any profound implication for the results.

2 Domestic here refers to the origin of income which generates the demand.

multirregional input-output tables. In this case, since the proposed tables incorporate the whole world economy, there is no reason to include net exports in the "final demand" portion of the table.

Thus, we will have an input-output-type table, in which the rows describe the distribution of a country's domestic production throughout the world economy ($\sum_{j=1}^{n} x_{ij} + C_i + I_i + G_i$), and in the columns we can read the composition of a country's domestic expenditures ($\sum_{j=1}^{n} m_{ji} + Y_i$). Figure 1 shows the layout of the MIT. The mathematical structure of the system consists of a set of n linear equations with n unknowns. Like the input-output systems, the solutions here are straightforward mathematically, but there are differences in the economic interpretations of some of the results.

One very important definition in our framework refers to the extended import coefficients. These coefficients - analogous to the direct requirements coefficients in the input-output framework show the proportion of the total expenditures which is used for imports.[3] An extended import coefficients matrix can be derived, in which we can read, columnwise, the proportion of the total expenditures of a country that goes to external payments of output; as such, it reveals the direct linkages among countries (trade linkages). We are assuming here that for each dollar spent in a certain country, the structure of external expenditures in a given period is indicated by these coefficients, i.e., given the conditions for trade in a given period (e.g. tariffs, transport costs, production technique or consumers' tastes), the result of the behavior of the agents is indicated by a certain fixed proportion of expenditures at that time. In an *ex-post* analysis, the set of actual expenditures is given by the MIT. Thus, we can define the matrix of extended import coefficients as:

$$[t_{ij}] = \frac{1}{E_j}[x_{ij}] \qquad (5)$$

where t_{ij} is the share of total expenditures of country j used to pay the imports from country i. In the case of countries, a typical element t_{ij} is zero, for $i = j$.[4]

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3 Note that the extended import coefficient is strictly smaller than the traditional import coefficient, which is equal to imports divided by the GDP.

4 A country does not export/import to/from itself. In the case of groups of countries as a "sector", t_{ij} represents the total trade among those countries.

Figure 1 - Structure of the Matriz of International Flows

										FINAL DEMAND							
										C	I	G					
										n							
										n-1	S						
										.	T						
										.	R						
										.	E						
										.	X						
										.	P						
										.	O						
										COUNTRIES							
										1	2	.	.	.			
C	1																
O	2										E	X	P	O			
U	.										I						
N	.										M						
T	.										P						
R	.										O						
I	.										R						
E	.										T						
S	n-1										S						
	n																
GDP																	

Given the assumption of fixed proportions of total domestic expenditures in a given period, one can derive the following "closed" system:

$$\sum_{j=1}^{n} t_{ij} Z_j + F_i = Z_i, \quad i = 1,2,...,n \tag{6}$$

In matrix notation, (6) becomes:

$$TZ + F = Z \tag{7}$$

where:

T is the matrix of extended import coefficients (n x n)

Z and F are column vectors (n x 1)

Solving equation (7), it is possible to obtain the total demand for domestic output (=total domestic output) necessary to satisfy the total **domestic** demand for domestic output.

$$Z = (I - T)^{-1} F \tag{8}$$

where $(I - T)^{-1}$ is the Machlup-Goodwin (hereafter, MG) foreign-induced trade multiplier matrix[5] The existence of such an inverse matrix is assured since $(I - T)$ is nonsingular and satisfies the Hawkins-Simon conditions, i.e. the sum of the elements of each column is strictly less than one.

To understand what the MG foreign-induced trade multiplier matrix reveals, first assume an autonomous change in the exogenous outlays in a country, i.e., an autonomous change in the total domestic demand for domestic output of a country, say a $1M increase in investments in Brazil.[6] Earlier, it was noted that the extended import coefficients show the

5 To be more consistent with Machlup's definitions, we should call this matrix, type I foreign-induced trade multiplier matrix, since all the internal components of aggregate demand are exogenous here.

6 Quoting Machlup (1939): "*There are those who feel that primitive stories are unworthy of being embodied in a scientific article. I believe, however, that if more such stories were employed by writers when they develop their arguments, they might avoid a good many pitfalls, or their critics, at least, might discover them more quickly.*"

direct trade linkage among the countries. However, considering this static structure of the world economy that is implied, one that is not affected by different levels of output, **hypothetically**. there would be both direct and indirect trade linkage effects related to the other countries' economies. For instance, for the $1M increase in Brazilian investment, it is assumed that, in a given period, Brazil has an optimal fixed menu of imports from other countries. By homogeneity of degree one, this increase will generate a general increase in imports from all the other countries, which will generate income for Brazil's trade partners. In turn, this increase in their income will generate more imports in order for those countries to balance their optimal structure of expenditures. These interactions involve many rounds of spending and respending and the total effect matrix of direct and indirect trade linkages is represented by the Leontief-type-inverse, namely, the MG matrix. The process described above does not really occur, since the constraints change constantly, but it explains the *ceteris paribus* round-by-round effects in which we are interested in this context.

4 The impact of growth through international trade

As shown in the last section, the structure of the MITs resembles to a great extent closed-economy input-output tables. In this section, we will introduce some techniques pioneered in input-output analysis that can be adopted in order to characterize the structure of international trade. Although there are many similarities between input-output tables and MITs, we still have to take care when applying some of the former analytical tools to the latter framework. Since they provide a rather precious set of temporal "photographs" of the international trade, the use of MITs to characterize the structure of international trade of the world economy can reveal a reliable "portrait" reflecting relevant aspects of trade relations. The first technique presented here relates to the multiplier product matrix "landscape" derived from the MG matrix to reveal visually some of the structural changes that have occured over time; then we explore some suggestions of Goodwin (1983), followed by Miyazawa's (1966) distinction between internal and external multipliers.

The multiplier product matrix and trade linkages

The concept of multiplier product matrix (MPM) (see Sonis *et alii*, 1994) was developed under the notion of field of influence of structure change in an economy. The basic idea draws on the way in which changes in one or more elements in a matrix affect the whole system of interrelationships. The definition of the MPM is as follows: given $T = \|t_{ij}\|$ and

$B=(I-T)^{-1}$, the first-order of field of influence associated with a change, ε_{ij}, in the i^{th} row and j^{th} column is a matrix:

$$F[(i,j)]=\begin{pmatrix} b_{i1} \\ b_{i2} \\ \vdots \\ b_{in} \end{pmatrix}(b_{1j}, b_{2j}, \cdots, b_{nj})=\|b_{ir}b_{sj}\| \tag{9}$$

Let $b._j$ and $b_{i.}$ be the column and row multipliers of the Leontief inverse. These are defined as:

$$b._j=\sum_{i=1}^{j} b_{ij},\ b_{i}.=\sum_{j=1}^{n} b_{ij} \tag{10}$$

Let V be the global intensity of the Leontief inverse:

$$V=\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij} \tag{11}$$

Then, the input-output multiplier product matrix (MPM) is defined as:

$$M=\frac{1}{V}\|b_i.b._j\|=\frac{1}{V}\begin{pmatrix} b_1. \\ b_2. \\ \vdots \\ b_n. \end{pmatrix}(b._1\ \ b._2 \ldots b._n) \tag{12}$$

It can be shown that the MPM has a cross structure; this cross structure can be explored to reveal a hierarchy of transactions such that there exists a cross (one row and column) in which the elements of this row (column) are larger than the corresponding elements of every other row (column). If this cross is now excluded, another cross with the same properties can be identified and the procedure repeated until all the rows and columns have been arranged. This new arrangement will be conducted in such a way that the centers of subsequent crosses will appear on the main diagonal, thereby providing a descending economic landscape. The procedure can be repeated for subsequent years; by maintaining

the ordering of rows and columns from a base year, it is possible to reveal immediately structural changes in the economy (or, in the case of the trade matrix, the strength of flows between countries). If there are no changes in the hierarchical structure of exchange, the ordering from one time period will be preserved in later time periods.

Goodwin's Net Foreign Balance (NFB)

The analysis that follows, developed by Goodwin (1983), enables us to measure the effects of a change in the vector of exogenous outlays (F) on the balance of trade of each country. This reveals the extent to which growth affects the balance of trade of all the countries in the world economy. Equation (13) provides the final effect on the net foreign balance for each country, given a change in the vector of exogenous spending. Note that the net foreign balances (NFBs) sum to zero.

$$NFB = \left[[I - \lambda][I - T]^{-1} - I\right]\Delta F\,, \tag{13}$$

where λ is a diagonal matrix of the column sums of T

Miyazawa's internal and external multipliers[7]

Miyazawa's framework of internal and external multipliers (Miyazawa, 1966, 1971), which was extended by Sonis and Hewings (1993, 1995), will prove useful in analyzing the impact of growth of one group of countries on the rest of the world through the trade network. This framework was used by Fritz (1995), in an input-output context, to analyze the transactions between polluting and clean sectors.

This dual approach can be considered by representing the extended import coefficients matrix in the following way:

$$T = \left(\begin{array}{c|c} T_{11} & T_{12} \\ \hline T_{21} & T_{22} \end{array}\right) \tag{14}$$

7 The presentation of this section draws on Sonis and Hewings (1993, 1995), with the necessary changes in notation and interpretation.

where T_{11} and T_{22} are the square matrices of extended import coefficients within the first and second groups of countries, and T_{12} and T_{21} are the rectangular matrices showing the trade relations between the two groups. One of the possible decompositions of T is given by:

$$T = \left(\begin{array}{c|c} T_{11} & 0 \\ \hline T_{21} & 0 \end{array}\right) + \left(\begin{array}{c|c} 0 & T_{12} \\ \hline 0 & T_{22} \end{array}\right) = T_1 + T_2 \qquad (15)$$

It can be shown that the following Miyazawa formula, that will be used to analyze the trade between developed countries and Latin American countries, can be obtained (Sonis and Hewings, 1993) as follows:

$$(I - T)^{-1} = \left(\begin{array}{c|c} B_1 + B_1 T_{12} \Delta_2 T_{21} B_1 & B_1 T_{12} \Delta_2 \\ \hline \Delta_2 T_{21} B_1 & \Delta_2 \end{array}\right), \qquad (12)$$

where $B_1 = (I - T_{11})^{-1}$ is the internal matrix multiplier of group 1, and $\Delta_2 = (I - T_{22} - T_{21} B_1 T_{12})^{-1}$ is the external matrix multiplier of group 2.

The matrix multiplier of interest, $\Delta_2 T_{21} B_1$, reveals the influence of group 1's internal propagation on group 2's income/output levels.[8] This matrix is a rectangular matrix, whose elements, $\delta_{i_2 j_1}$ represent the increase in income/output in country i_2 due to a unit increase in country j_1's exogenous outlays. In order to evaluate the total amount of income/output generated in group 2 by a unit increase in a country of group 1's output, their scalar column multipliers are computed.

$$M_{j_1} = \sum_{i_2} \delta_{i_2 j_1} \qquad (16)$$

where M_{j_1} is country j_1's column multiplier with respect to all countries in group 2.

8 In our context, internal propagation refers to internal direct and indirect import demand.

The multipliers of the matrix $\Delta_2 T_{21} B_1$ result from the interaction of three multiplier matrices, Δ_{22}, B_2, B_1, and the matrix T_{21}, where: $B_2 = (I - T_{22})^{-1}$ is the internal matrix multiplier of group 2, and $\Delta_{22} = (I - B_2 T_{21} B_1 T_{12})^{-1}$ is the Miyazawa external matrix multiplier, such that $\Delta_2 = \Delta_{22} B_2$

Δ_{22} includes the direct, indirect and induced effects of the group 2's import demand from group 1 on group 2's income/output. The sources of income/output induced by the group 1's external demand can be unveiled by looking at the column sums of these matrices with respect to group 2.

T_{21} income/output generated by direct import requirements of group 1

$T_{21} B_1$ income/output generated by direct and indirect import requirements of group 1

$B_2 T_{21} B_1$ income/output generated by internal propagation of group 1 and the induced direct and indirect production (income increase) of sector 2

$\Delta_{22} B_2 T_{21} B_1$ total foreign-induced trade multiplier of group 1. income/output generated by internal propagation of group 1 countries and the induced internal and external propagation of group 2 countries

Country j_1's column sum with respect to these matrices are denoted $m^1_{j1}, m^2_{j1}, m^3_{j1}, and\ M_{j1}$ respectively. The following definitions will be employed in the empirical part:

$\frac{m^1_{j1}}{M_{j1}}$ share of direct import requirements in total multiplier

$\frac{m^2_{j1} - m^1_{j1}}{M_{j1}}$ share of indirect import requirements in total multiplier

$\frac{m^3_{j1} - m^2_{j1}}{M_{j1}}$ share of internal propagation of group 2 countries (stimulated by group of countries 1's import requirements) in total multiplier

$\frac{M_j - m^3_{j1}}{M_{j1}}$ share of external propagation of group 2 countries in total multiplier

In the next section, these methods will be employed to unravel some of the important structural changes in the MIT.

5 Summary of results

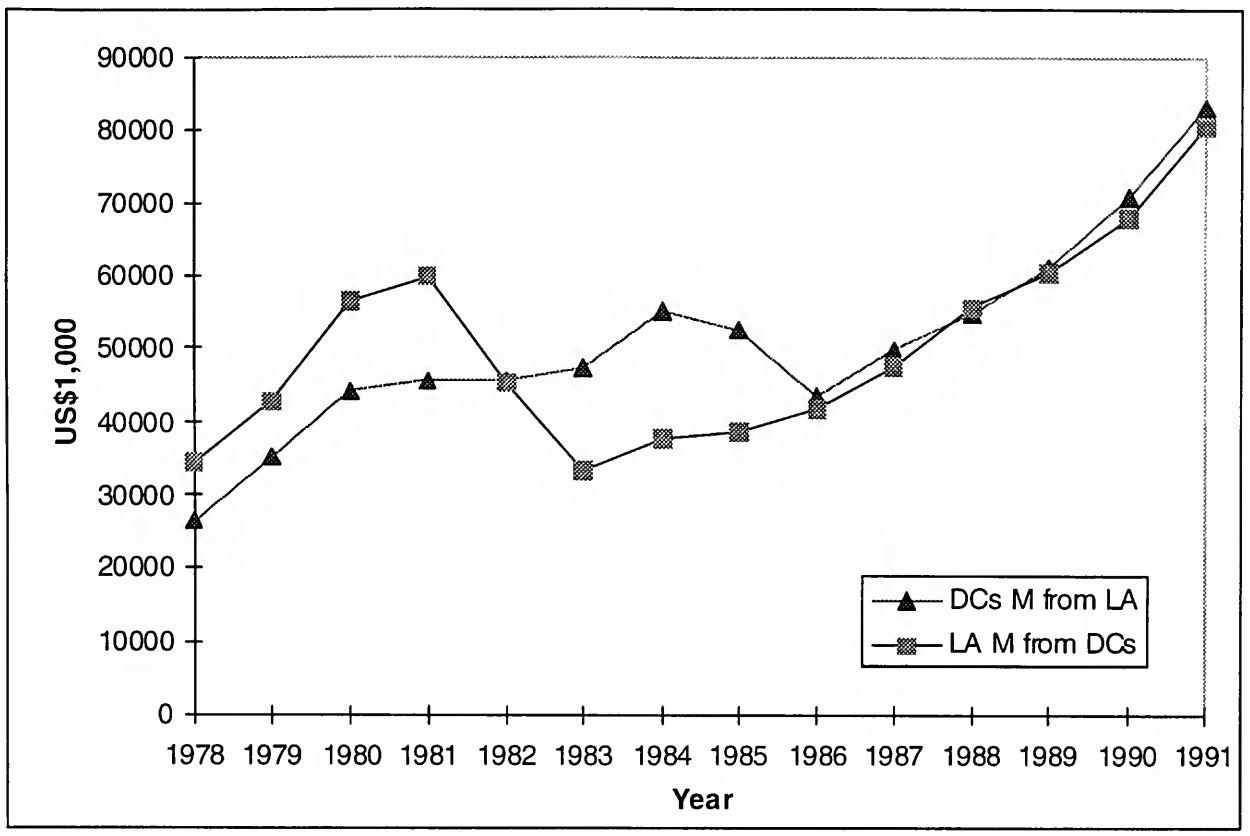
The data base

We used the MITs compiled especially for this study, using data for trade flows from the International Monetary Fund *Direction of Trade Statistics Yearbook* (several years), and for GDP from the World Bank *World Tables*. The data are presented in current US dollars for the basic tables. The definition of the level of country aggregation to be used was determined by data availability and countries' characteristics. We ended up with 23 individual countries and one closing group denoted Rest of the World. The countries are: USA, Canada, Japan, France, Germany, Italy, and UK (developed countries – DCs); Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Paraguay, Peru, Uruguay, and Venezuela (Latin America - LA); and Rest of the World (ROW).

The tables are presented on an annual basis, for the period 1978-1991. This follows the presentation of the basic IMF statistics and, although there are monthly data available, the use of yearly tables reduces the incidence of seasonal effects of trade, especially those related to primary production. Some limitations apply to these tables as they do to input-output systems; the estimates change very quickly in response to trade opportunities. However, the availability of easily compilable data allows for a constant updating of the tables, which is often not possible for input-output tables.

The data on the level of direct trade flows between LA countries and DCs reveal an equilibrium in the balance of trade between the two regions for the period. More precisely, the LA region presented a trade deficit in 1978-1981, and a trade surplus in 1983-1985. In the other years, the flows of goods and services from one region to the other, and vice-versa, nearly balanced (Figure 2).

Figure 2
Balance of Trade Between DCs and LA: 1978-1991



The extended import coefficients reveal some of the important differences between the two groups of countries. The coefficients for LA imports from DCs (6.54% of total expenditures, in the period average) are much higher than those for DCs' imports from LA (0.61% of total expenditures). However, the average total extended import coefficient for LA is smaller (11.66% against 13.20%), which reflects the importance of DCs' goods and services in the LA expenditures structure.

Import and export linkages

An attempt was made to compare the trade structure among LA and developed countries over time. We consider the hierarchy of import and export linkages - related to the column and row multipliers, respectively - and their economic landscape associated with the cross structure of the MPM. A sample fo the results, depicted in Figures 3, 4, 5, reveal the cross structure for the years 1978, 1985, and 1991, the rows represent the hierarchy of export linkages while the columns provide similar detail for the import linkages. For the purpose comparison, we decided to choose the year of 1978 as the **numéraire**. Hence, we can associate structural changes with deviations from the 1978 hierarchy. Figure 3 shows that the United States, followed by Germany, Japan and Brazil, presents far the highest export linkages. The trade connections for the other countries are more smooth or balanced.

Figure 3
1978: "Landscape" for First Order MPM

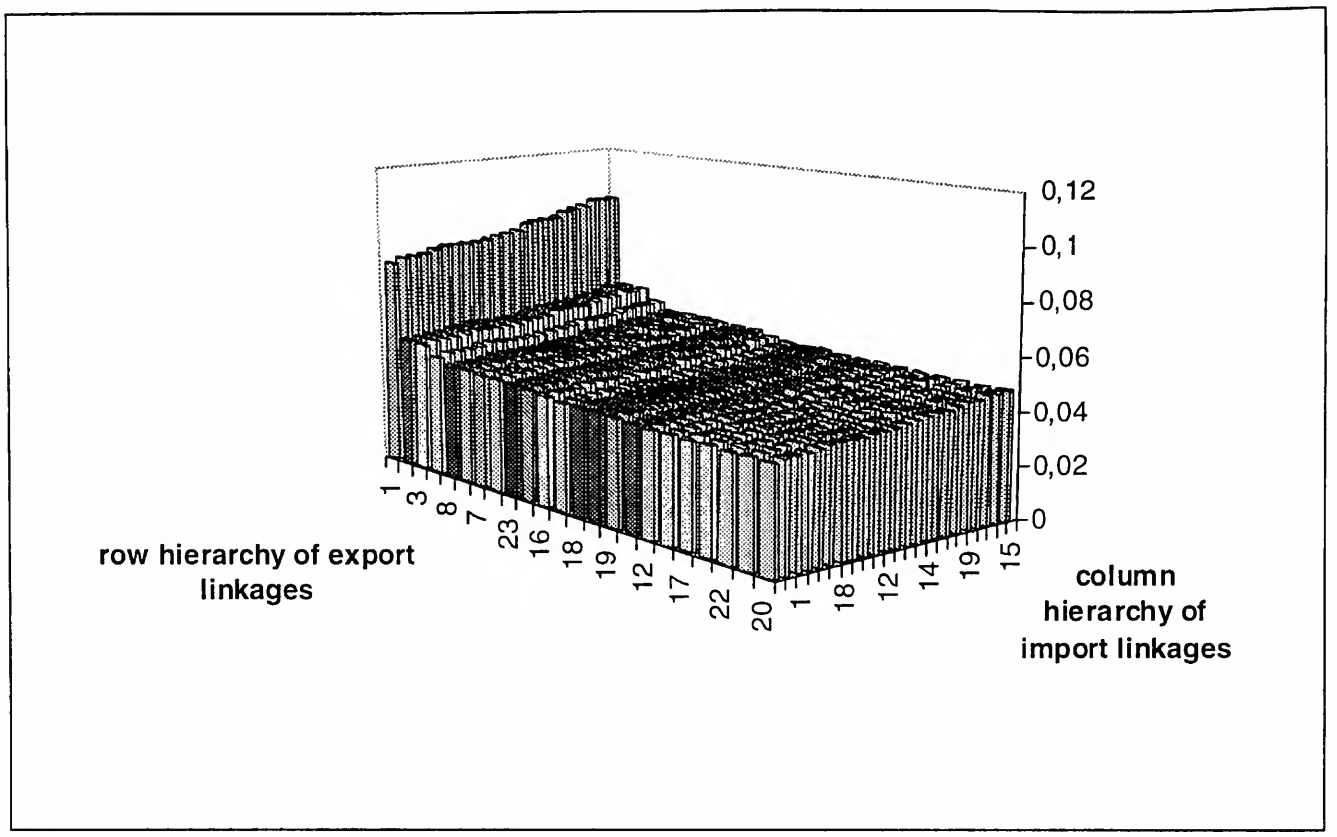


Figure 4
1985: "Landscape" Using 1978 Imposed Hierarchy

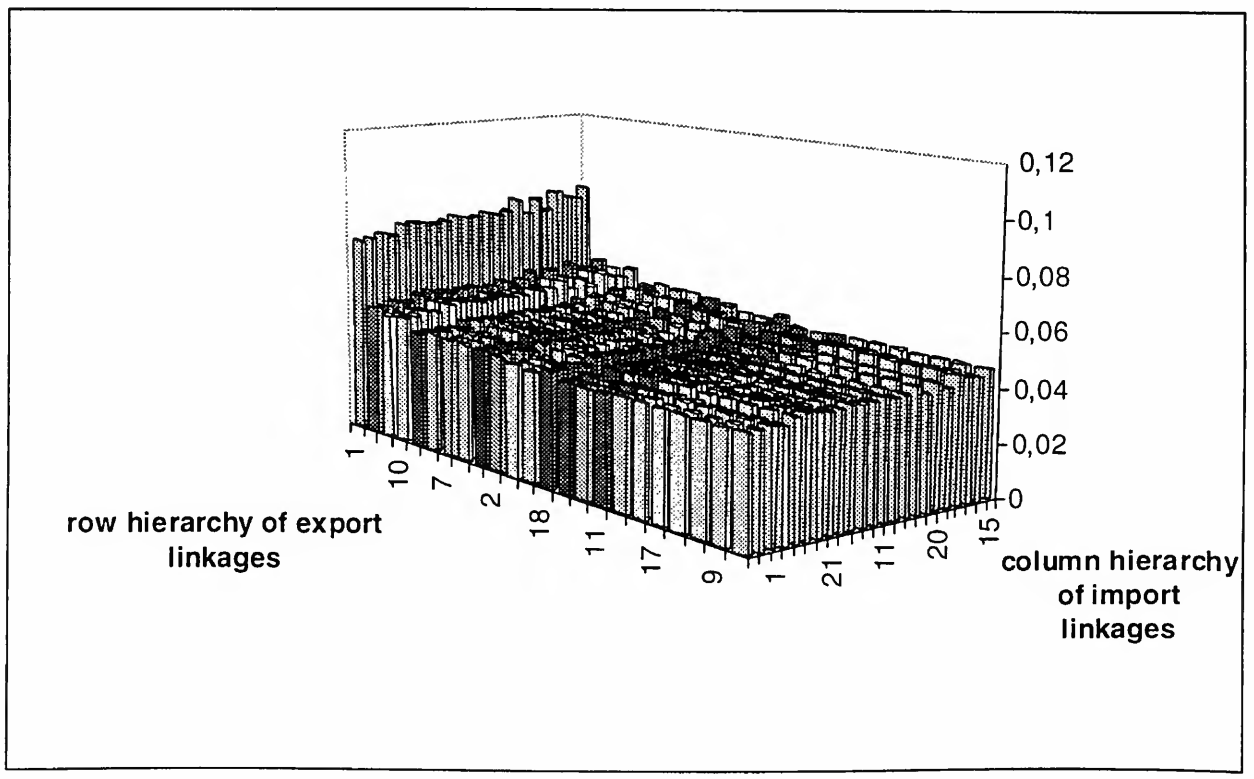
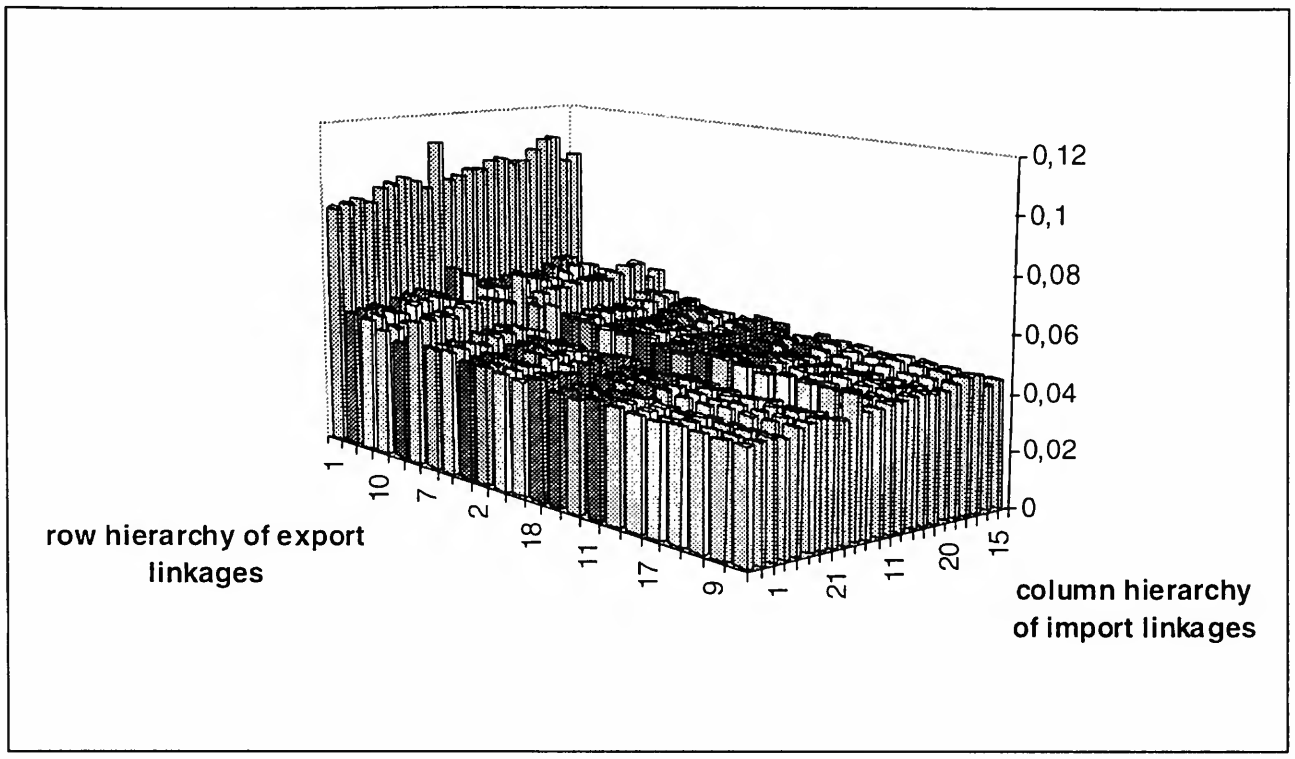


Figure 5
1991: "Landscape" Using 1978 Imposed Hierarchy



Inspection of the figures reveal some important differences over time. There is an increase in the relative linkage intensity of high-export-linkage countries, showing that these countries maintained their trade advantage over the period. Obviously, extending the structure into the 1990s, a period of greater trade liberalization, it would be likely that the changes would be more readily apparent.

Balance of payments consequences

For the analysis of the impact of growth on the balance of trade, we carried out a simulation, in which, for every year, there was an expansion of exogenous outlays of $1000 by each country, individually. Table 1 shows the results for the year of 1985. Each column shows the net effects of an increase of $1000 in the exogenous outlays of one country on the external payments of all the countries, including that country itself. It is clear that, for this particular year, benefits from individual countries growth, **in the form of positive net foreign balance**, were concentrated in some of the other countries. From injections in LA countries, it can be seen that DCs, especially the US, first, and Japan and Germany, were the countries that benefited the most; in general, benefits in LA were concentrated in three countries, namely, Brazil, Venezuela and Mexico.

Table 1 - Net Foreign Balance (NFB): Injections Country by Country of $1000 (1985)

		1	2	3	4	5	6	7	8	9	10	11	12
1	USA	-67,67	98,91	14,64	10,83	12,58	9,82	20,06	7,54	29,03	12,56	31,16	33,41
2	Canada	12,55	-150,06	2,60	1,11	1,38	0,97	2,99	0,55	0,97	1,90	2,77	2,86
3	Japan	13,91	11,31	-69,47	4,78	9,71	3,55	9,40	2,56	11,71	2,97	8,46	10,23
4	France	1,93	2,57	1,15	-157,40	16,08	17,39	12,76	2,32	2,97	1,71	3,63	3,07
5	Germany	4,08	4,50	2,34	29,29	-166,63	23,40	24,15	4,80	6,75	3,36	9,05	5,44
6	Italy	2,11	2,39	0,88	15,35	14,13	-140,55	9,11	2,21	1,27	1,03	2,50	2,26
7	UK	3,09	4,75	1,20	13,69	12,74	7,96	-166,98	0,28	3,10	1,27	4,27	2,52
8	Argentina	0,25	0,18	0,27	0,28	0,45	0,61	0,11	-39,46	16,57	1,95	5,02	3,05
9	Bolivia	0,02	0,00	0,00	0,01	0,04	0,01	0,10	3,38	-133,31	0,03	0,25	0,10
10	Brazil	1,52	1,13	0,97	1,43	1,78	2,21	1,31	5,61	40,08	-55,73	10,62	2,47
11	Chile	0,19	0,18	0,23	0,23	0,43	0,35	0,42	0,80	3,17	0,75	-121,36	1,16
12	Colombia	0,24	0,12	0,11	0,15	0,66	0,20	0,21	0,36	0,19	0,03	0,92	-91,19
13	Costa Rica	0,07	0,03	0,00	0,03	0,12	0,04	0,05	0,02	0,00	0,00	0,01	0,04
14	Ecuador	0,33	0,05	0,05	0,03	0,08	0,04	0,03	0,09	0,04	0,02	1,88	1,38
15	El Salvador	0,06	0,03	0,02	0,01	0,15	0,01	0,01	0,01	0,00	0,00	0,00	0,07
16	Guatemala	0,08	0,03	0,02	0,02	0,10	0,08	0,02	0,00	0,00	0,00	0,03	0,15
17	Honduras	0,08	0,02	0,03	0,01	0,05	0,03	0,02	0,00	0,00	0,00	0,00	0,03
18	Mexico	2,69	1,13	1,08	1,25	0,49	0,62	1,21	0,40	0,17	1,16	0,84	2,74
19	Nicaragua	0,01	0,02	0,02	0,02	0,05	0,01	0,00	0,00	0,00	0,00	0,00	0,00
20	Paraguay	0,00	0,00	0,00	0,04	0,05	0,01	0,00	0,14	0,07	0,21	0,52	0,02
21	Peru	0,21	0,07	0,19	0,08	0,18	0,15	0,23	0,36	2,99	0,20	2,14	1,65
22	Uruguay	0,03	0,02	0,01	0,03	0,08	0,04	0,06	0,58	0,25	0,50	0,17	0,15
23	Venezuela	1,33	1,61	0,31	0,35	0,79	1,31	0,51	0,05	0,14	0,96	10,13	4,88
24	ROW	22,89	21,01	43,35	78,38	94,51	71,74	84,22	7,40	13,84	25,12	26,99	13,51
	SUM	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DC's share	55,7%	82,9%	32,8%	47,7%	40,0%	44,9%	47,0%	51,3%	41,9%	44,5%	51,0%	65,6%
	LA's share	10,5%	3,1%	4,8%	2,5%	3,3%	4,1%	2,6%	29,9%	47,8%	10,4%	26,8%	19,6%
	ROW's share	33,8%	14,0%	62,4%	49,8%	56,7%	51,0%	50,4%	18,8%	10,4%	45,1%	22,2%	14,8%
	Brazil-Mexico-Venezuela's share in LA	77,9%	83,8%	71,3%	76,3%	55,6%	72,4%	70,6%	51,4%	63,4%	36,5%	66,4%	56,4%

continue

Table 1 - Net Foreign Balance (NFB): Injections Country by Country of $1000 (1985) - continuation

		13	14	15	16	17	18	19	20	21	22	23	24
1	USA	68,10	36,76	71,54	33,80	58,55	57,85	13,58	22,22	24,99	11,32	42,80	15,54
2	Canada	3,37	2,64	2,65	1,42	2,78	1,92	3,54	0,88	1,97	0,88	3,32	2,34
3	Japan	15,02	11,61	8,43	4,98	10,03	5,25	7,52	7,14	7,63	3,65	5,38	15,14
4	France	2,73	2,03	1,54	1,53	3,37	1,41	8,89	4,85	3,21	3,59	3,96	9,02
5	Germany	8,09	8,01	5,61	4,78	4,91	3,53	5,37	5,81	5,94	8,56	4,71	16,42
6	Italy	4,77	3,08	2,49	1,08	2,73	1,20	4,40	1,99	2,36	3,06	5,29	6,18
7	UK	3,35	4,56	2,09	1,66	2,54	1,35	2,73	4,36	2,64	3,33	2,83	8,75
8	Argentina	0,69	1,01	0,66	0,27	1,37	1,13	6,75	15,66	8,11	15,37	0,97	0,84
9	Bolivia	0,01	0,02	0,00	0,00	0,01	0,01	0,03	0,06	0,59	0,06	0,01	0,01
10	Brazil	3,14	7,38	1,07	1,11	2,48	1,08	2,02	63,84	4,71	21,51	3,82	1,93
11	Chile	0,05	1,93	0,04	0,02	0,04	0,22	0,04	1,21	2,10	1,78	0,41	0,19
12	Colombia	1,32	3,30	1,62	0,44	1,00	0,05	0,90	0,04	1,52	0,07	1,57	0,19
13	Costa Rica	-175,26	0,15	6,33	2,77	4,98	0,03	5,92	0,00	0,01	0,00	0,07	0,03
14	Ecuador	0,12	-112,67	0,12	0,03	0,13	0,03	0,11	0,03	0,29	0,04	0,05	0,16
15	El Salvador	3,45	0,01	-167,52	4,33	1,08	0,00	0,75	0,00	0,00	0,00	0,00	0,01
16	Guatemala	6,91	0,17	17,99	-89,57	4,76	0,05	3,86	0,00	0,01	0,01	0,01	0,06
17	Honduras	1,63	0,01	2,31	0,23	-146,02	0,01	2,57	0,00	0,00	0,00	0,00	0,03
18	Mexico	3,59	2,98	13,80	8,02	5,30	-83,08	7,41	0,18	0,73	3,64	0,63	0,71
19	Nicaragua	2,19	0,00	0,57	0,76	0,94	0,03	-148,29	0,00	0,00	0,00	0,00	0,02
20	Paraguay	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-147,15	0,03	0,89	0,00	0,02
21	Peru	2,40	4,41	0,52	0,03	0,18	0,06	0,43	0,03	-83,97	0,38	0,52	0,16
22	Uruguay	0,01	0,09	0,01	0,00	0,01	0,03	0,01	1,24	0,09	-121,80	0,05	0,05
23	Venezuela	18,64	0,26	12,19	5,88	17,42	0,15	1,50	0,13	1,37	0,25	-90,95	0,66
24	ROW	25,68	22,26	15,94	16,43	21,41	7,69	69,96	17,48	15,67	43,41	14,55	-78,46
	SUM	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	DC's share	60,2%	61,0%	56,3%	55,0%	58,1%	87,3%	31,0%	32,1%	58,0%	28,2%	75,1%	93,5%
	LA's share	25,2%	19,3%	34,2%	26,7%	27,2%	3,5%	21,8%	56,0%	23,3%	36,1%	8,9%	6,5%
	ROW's share	14,7%	19,8%	9,5%	18,3%	14,7%	9,3%	47,2%	11,9%	18,7%	35,6%	16,0%	0,0%
	Brazil-Mexico-Venezuela's share in LA	57,5%	48,9%	47,3%	62,8%	63,5%	42,7%	33,8%	77,8%	34,8%	57,7%	54,9%	65,1%

Figure 6
Average NFB Given Injections Country by Country of 1000 in Developed Countries: 1978-1991

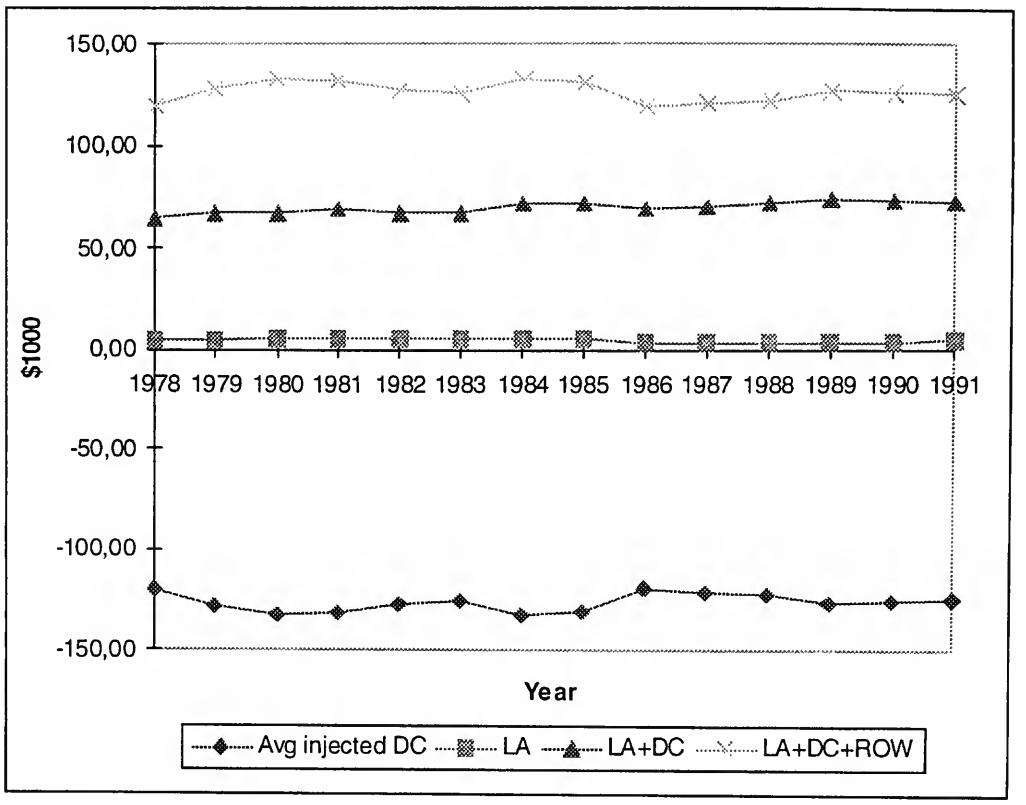
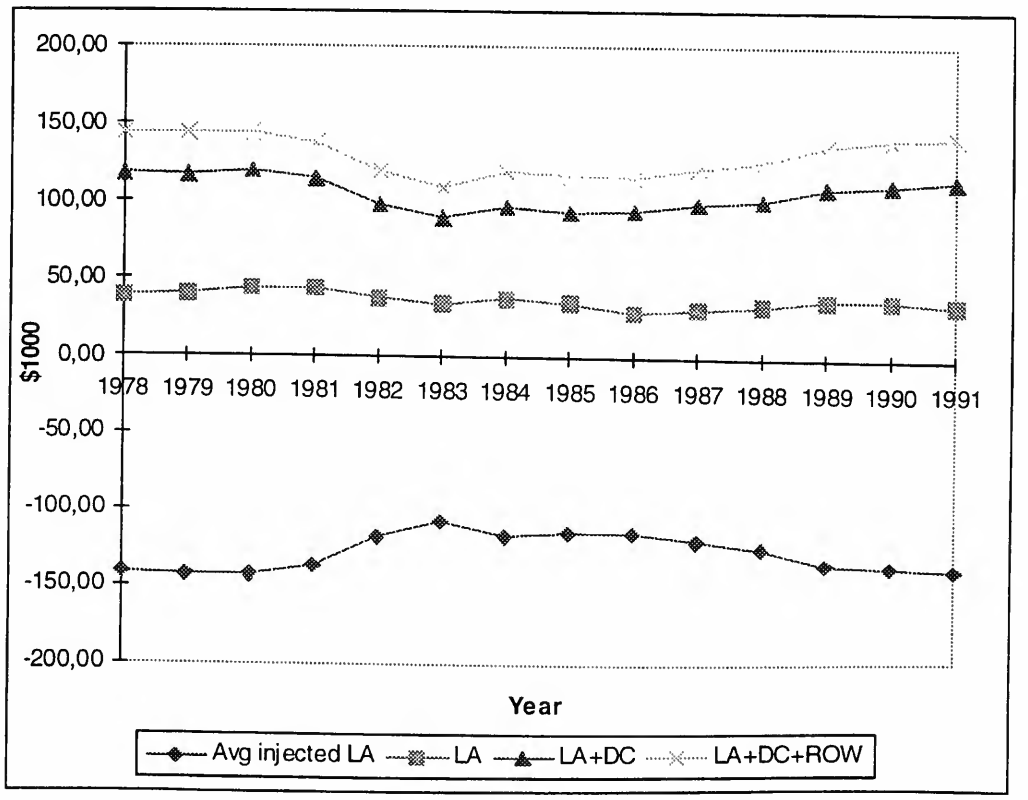
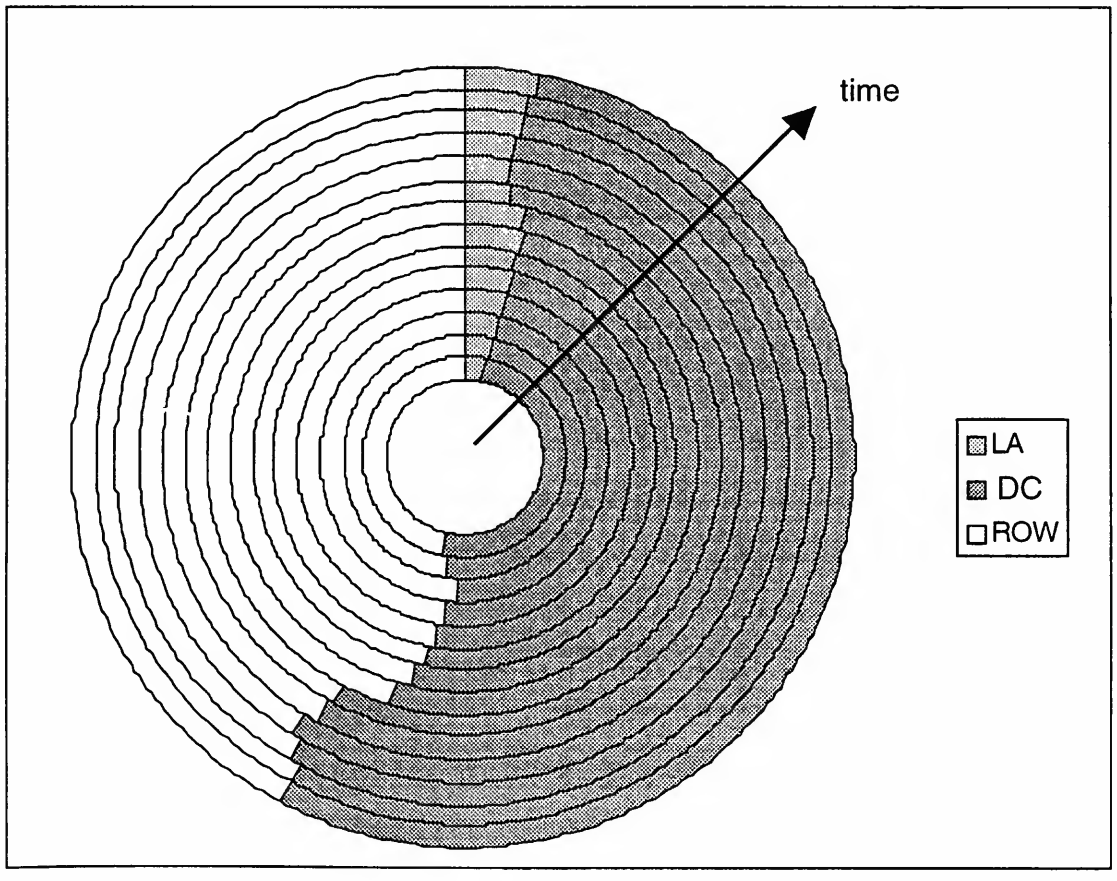


Figure 7
Average NFB Given Injections Country by Country of 1000 in Latin American Countries: 1978-1991



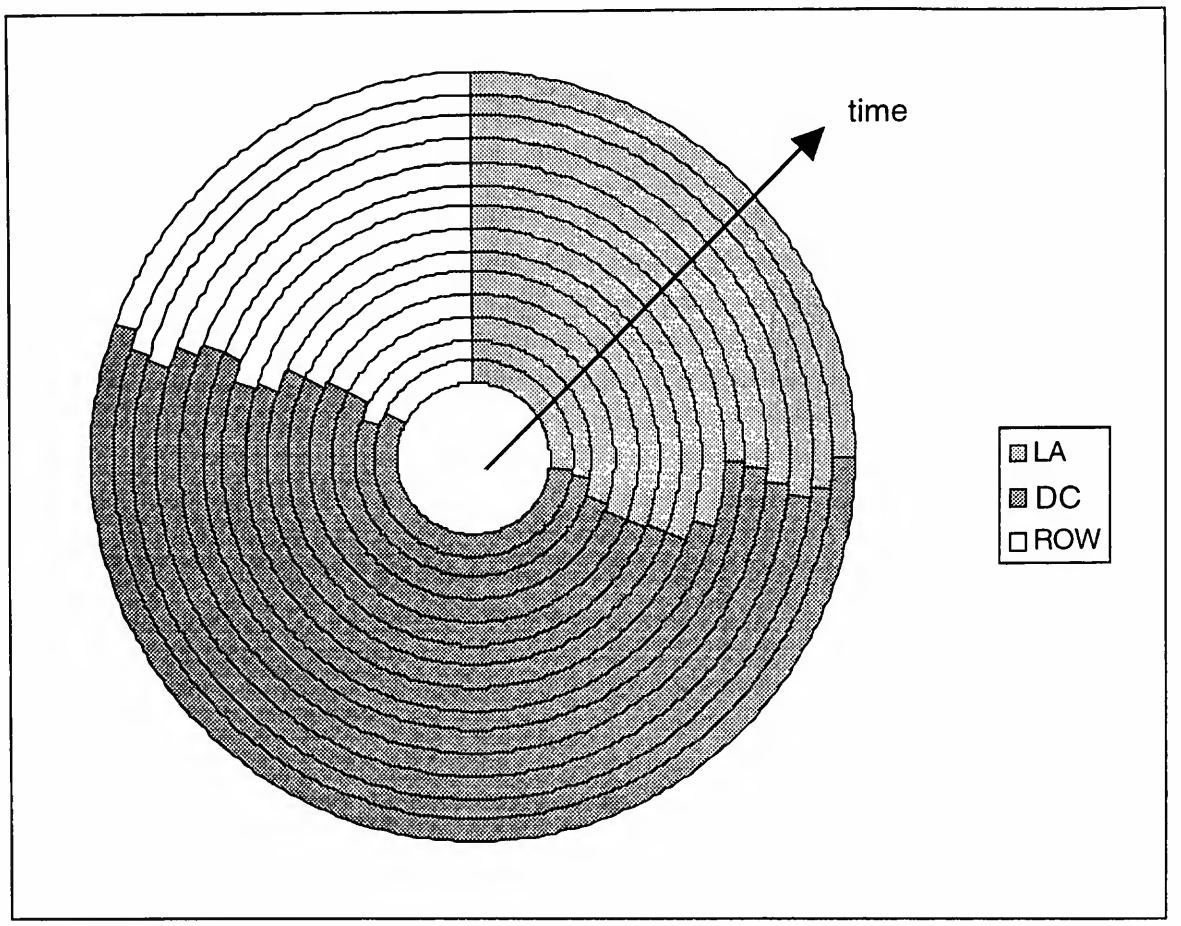
The trends established in the period 1978-1991 reveal the following highlights. First, the average benefit for LA countries from the growth in DCs is very small when compared to the average benefits that DCs achieve from the growth in LA (see Figures 6 and 7). This is the counterpart of the high dependency of LA on DCs imports and exports. Secondly, we should point out the trends in the distribution of benefits from growth in both DCs and LA countries (Figures 8 and 9). In both cases, the share of benefits to DCs increased over time, while the share of benefits to LA countries decreased. In **relative terms**, therefore, given the structure of international trade in the period 1978-1991, LA countries became potentially worse off than developed countries.[9] However, since trade flows are expressed in current US dollars, this might also reflect changes that occur as a result of movements in exchange rates, rather than true changes in trade relationships.

Figure 8
Average Percentual Distribution of Benefits from Growth in Developed Countries: 1978-1991



9 *Relativity* implies that we are not considering the level of output in each country, but only the trade linkage structure. In a sense, we are dealing with marginal changes in output. Economy-size effects are not considered here.

Figure 9
Average Percentual Distribution of Benefits from Growth in Latin American Countries: 1978-1991



Growth consequences

We estimated, for each year, both the effects of DCs growth on LA countries, and the effects of LA growth on DCs, with international trade as the mechanism generating such spillover effects. Table 2 shows the estimated ROW and LA foreign-induced trade multipliers for DCs, for the years 1978, 1985 and 1991, which are computed as the column sums of DCs across all the rows, in the ROW case, and excluding the ROW row in the LA case. The table also shows the ROW and DCs foreign-induced trade multipliers for LA countries, computed in a similar way. In our notation, M1, M1(LA), M2, and M2(LA) stand for the four multipliers. M1 indicates the effect of a $1 increase in the exogenous outlays of a DC on the rest of the world (M1(LA), the effects on LA only). M2 indicates the effect of a $1 increase in the exogenous outlays of a LA country on the rest of the world (M2(DC), the effects on DCs only).

Table 2 - Estimated M1, M1 (LA), M2, and M2 (DC) for Selected Years: 1978, 1985, 1991

	M1							M1(LA)					
	1978	*Rank*	*1985*	*Rank*	*1991*	*Rank*		*1978*	*Rank*	*1985*	*Rank*	*1991*	*Rank*
USA	0,0362	6	0,0343	6	0,0397	6	USA	0,0064	1	0,0078	1	0,0085	1
Canada	0,0307	7	0,0294	7	0,0327	7	Canada	0,0062	2	0,005	4	0,0061	2
Japan	0,0491	5	0,0539	5	0,0402	5	Japan	0,0023	7	0,0036	7	0,0024	7
France	0,0832	3	0,0953	3	0,0843	3	France	0,0025	6	0,0043	6	0,0031	5
Germany	0,0951	2	0,1158	1	0,1127	1	Germany	0,005	3	0,006	3	0,0044	3
Italy	0,0827	4	0,0895	4	0,0684	4	Italy	0,005	4	0,0062	2	0,0032	4
UK	0,1054	1	0,1025	2	0,0872	2	UK	0,0037	5	0,0047	5	0,0028	6

	M2							M2(DC)					
	1978	*Rank*	*1985*	*Rank*	*1991*	*Rank*		*1978*	*Rank*	*1985*	*Rank*	*1991*	*Rank*
Argentina	0,061	16	0,0316	16	0,0323	16	Argentina	0,0399	15	0,023	16	0,0228	16
Bolivia	0,1591	2	0,0779	11	0,0754	14	Bolivia	0,1149	6	0,0618	9	0,0622	12
Brazil	0,0617	15	0,0569	15	0,048	15	Brazil	0,0345	16	0,0278	15	0,0301	15
Chile	0,1155	9	0,1005	6	0,1334	6	Chile	0,0739	10	0,0691	7	0,0851	9
Colombia	0,0919	10	0,0819	10	0,0924	11	Colombia	0,0713	12	0,0662	8	0,0733	11
Costa Rica	0,1546	5	0,1458	1	0,1869	2	Costa Rica	0,1202	3	0,1159	1	0,1468	2
Ecuador	0,1549	4	0,1021	5	0,1362	4	Ecuador	0,1195	4	0,0763	5	0,1104	4
El Salvador	0,1568	3	0,1216	3	0,1176	10	El Salvador	0,1303	2	0,1031	2	0,0979	7
Guatemala	0,1183	8	0,0733	12	0,1301	9	Guatemala	0,0919	9	0,0542	11	0,1022	6
Honduras	0,1716	1	0,1181	4	0,1926	1	Honduras	0,1387	1	0,0932	3	0,157	1
Mexico	0,0827	13	0,088	9	0,132	8	Mexico	0,0731	11	0,0791	4	0,1149	3
Nicaragua	0,1336	7	0,1336	2	0,182	3	Nicaragua	0,0998	7	0,0523	13	0,0974	8
Paraguay	0,0812	14	0,0732	13	0,1339	5	Paraguay	0,0637	14	0,0529	12	0,0837	10
Peru	0,0885	11	0,0725	14	0,0822	12	Peru	0,0646	13	0,0543	10	0,0607	13
Uruguay	0,0879	12	0,0897	8	0,0803	13	Uruguay	0,0926	8	0,0393	14	0,0514	14
Venezuela	0,144	6	0,0926	7	0,1333	7	Venezuela	0,1156	5	0,0757	6	0,1081	5

The M1 multiplier maintains roughly the same rank for the three years, with UK and Germany presenting the highest multipliers, followed by France, Italy, Japan, USA and Canada, in this order. However, the rank changes for M1(LA). USA has the highest multiplier in the three years considered. We should also notice the position of Canada, one of the countries whose growth generated a larger impact on LA. By examining the MIFs more closely, we see that Canada's trade linkages with the USA are important in explaining this relatively high impact, since a considerable part of it is achieved through the linkages Canada→USA→LA. The consistent behavior of Germany, occupying the third place, should also be pointed out.

In the M2 case, the highest multipliers were found in small countries in the region, namely, Honduras, Costa Rica, Ecuador, El Salvador, and Nicaragua. Larger, more developed countries, such as Argentina and Brazil presented smaller multipliers. For the M2(DC), it is remarkable the positions gained in the rank by Mexico, whose growth impact on DCs increased over time, especially by the trade linkages with USA and Canada (na effect that pre-dated NAFTA). Also, the high multipliers shown by Honduras, El Salvador, Costa Rica, Ecuador, and Venezuela should be noted. Finally, the MERCOSUL countries (Argentina, Brazil, Paraguay, and Uruguay) contained the lowest multipliers.

Figure 10
Average ROW and LA Foreign-Induced Multiplier of DCs, M1 and M1(LA): 1978-1991

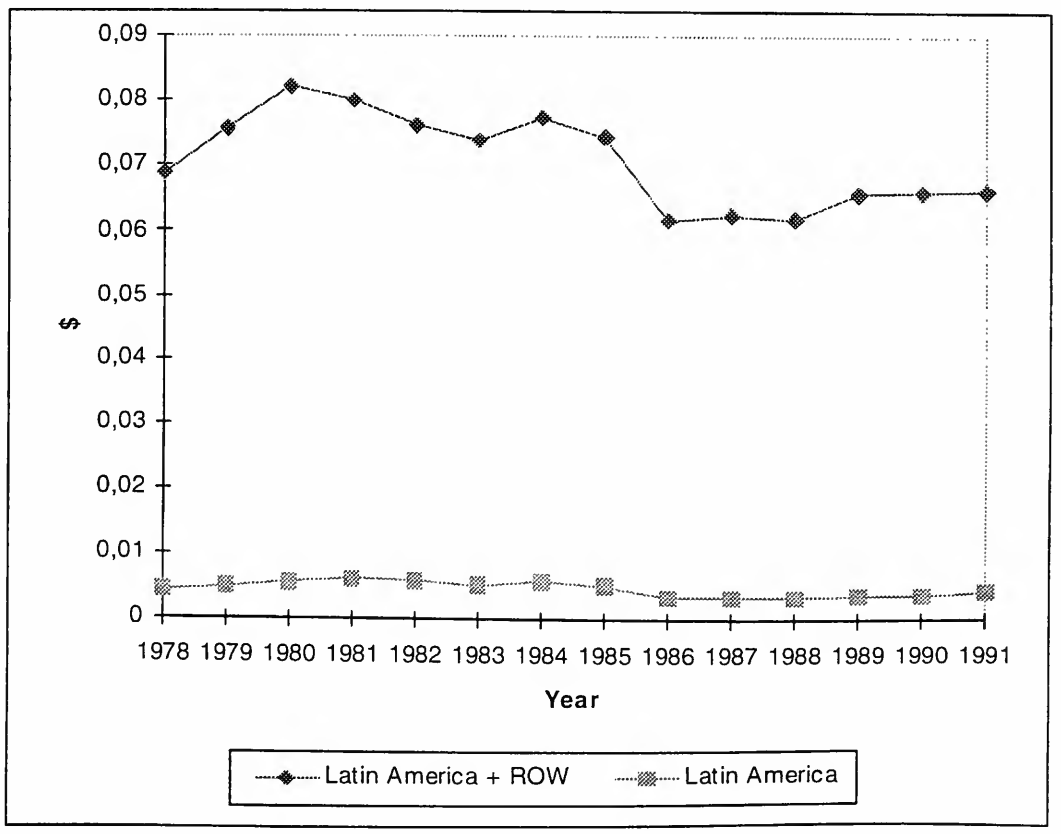
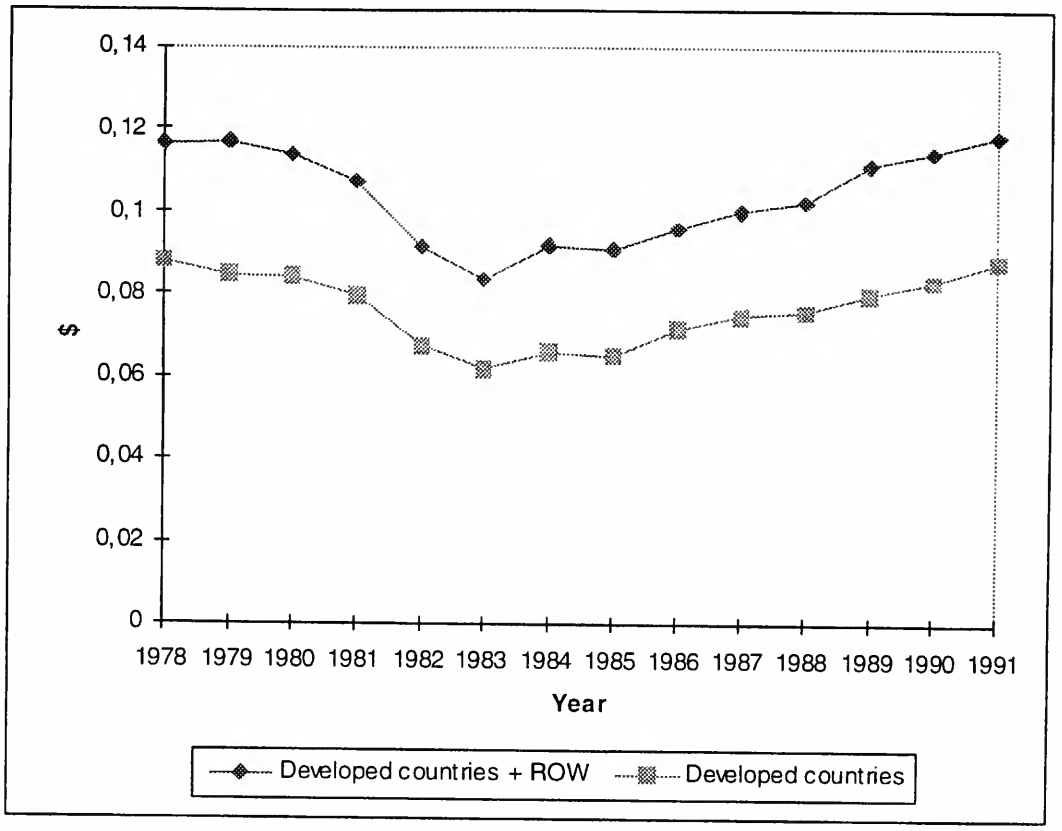


Figure 11
Average ROW and DCs Foreign-Induced Multiplier of LA Countries, M2 and M2(DC): 1978-1991



To compare the multipliers M1(LA) and M2(DC), we took the country averages for each year. Figures 10 and 11 show the behavior of M1 vs. M1(LA), and M2 vs. M2(DC), respectively. In the first graph, we see that the impact of DCs growth on LA is very small. On average, during 1978-1991, for each $1 increase in the exogenous outlays in a DC, there is a $0.0047 potential increase in income in LA. This indicator provides a useful measure of the degree to which DCs growth influences LA growth through trade linkages. By comparing M1 and M1(LA), we can verify that the share of the impact of DCs growth for LA is very small (only 6.60% over the period). Both multipliers are also declining over time, indicating that changes in the structure of international trade, in the period 1978-1991, implied reduced indirect effects of DCs growth on LA countries.

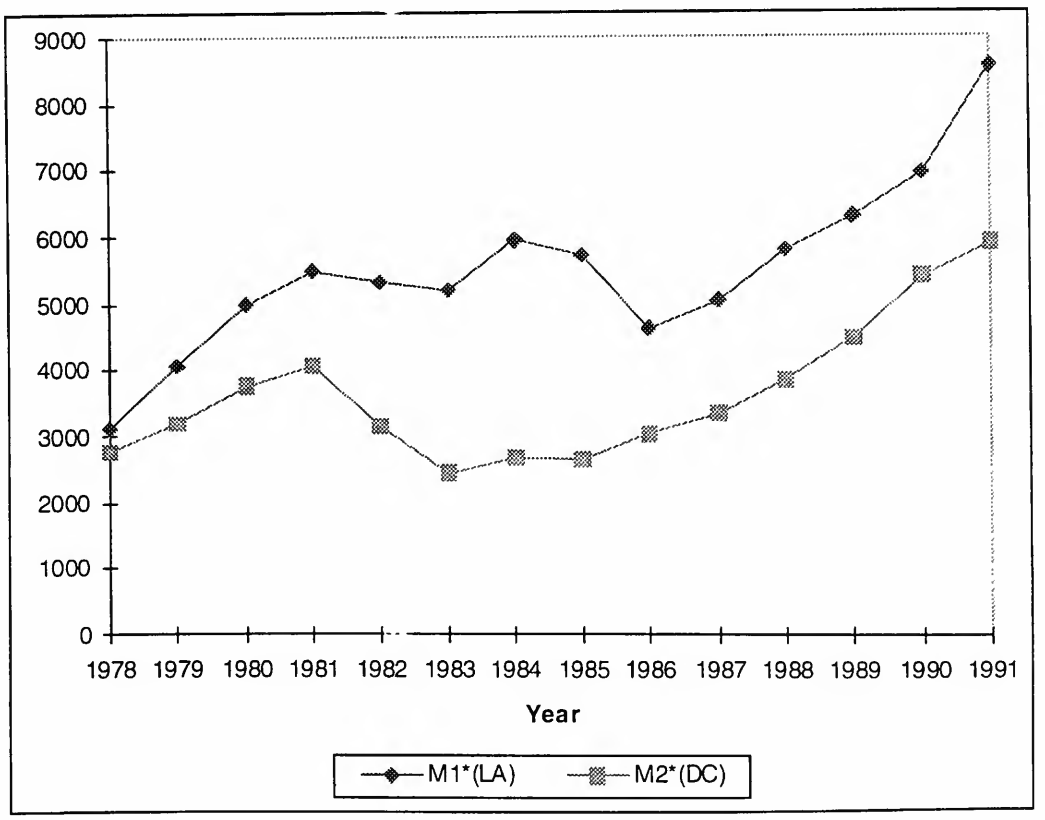
If attention is now directed at the impact of growth in a LA country on the DCs, $0.0764 was generated for each $1 of increase in the former's exogenous outlays. First, the LA growth impact on DCs is much higher than the DCs impact on LA countries (approximately 16 times, in the average, for each $1).[10] Secondly, the share of the impact of LA growth that goes to DCs is incredibly high (73.44%).

10 Even for the total multipliers, the values of M2 are higher (the period average was 0.0709 for M1, and 0.1040 for M2).

The above facts combined would lead us to the conclusion that an increase in the exogenous outlays, of the same *level*, of all the countries would benefit disproportionately the DCs, increasing the income gap between LA countries and DCs in favor of the latter. However, one fact that we do not take into account when carrying out this type of analysis is that we do not consider the scarcity of money[11] in each country or region. To contemplate this issue, we should weigh the multipliers with the respective exogenous outlays, giving more importance to the multipliers of countries where money is less scarce (for weighted-multiplier schemes, see Hazari, 1970). Figure 12 shows the weighted partial multipliers, which refers to proportional changes in exogenous outlays (instead of absolute changes). These results reverse, in a sense, our prior conclusion, in that, now, LA countries benefit more than DCs from overall proportional changes in exogenous outlays in the world economy. The time series of the weighted multipliers reveal that the difference between them increased in the 1980's. This decade, known in Latin America as the "lost decade", was characterized by economic stagnation in LA, when its GDP grew at an annual rate of only 1.7%, therefore resulting in increases in the scarcity of money in the region, and, *ceteris paribus*, lower weighted multipliers M1*(LA).[12]

Figure 12

Weighted Multipliers: 1978-1991



11 By scarcity of money we mean the inverse of the total level of expenditures ($1/E_i$). Thus, in a country with low levels of expenditures, money will be relatively more scarce than in a country with higher levels of expenditures.

12 See Baer *et alii* (1991).

Figure 13
Share of Direct Import Requirements in Total Multiplier M1: 1978-1991

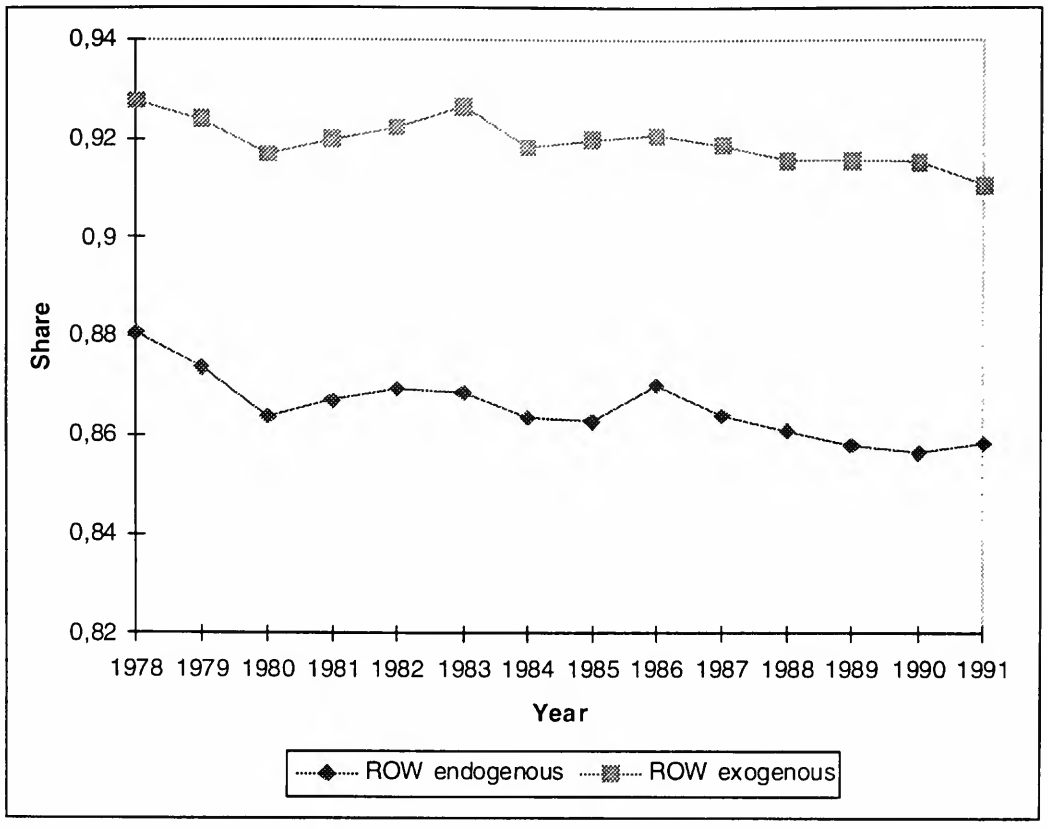


Figure 14
Share of Indirect Import Requirements in Total Multiplier M1: 1978-1991

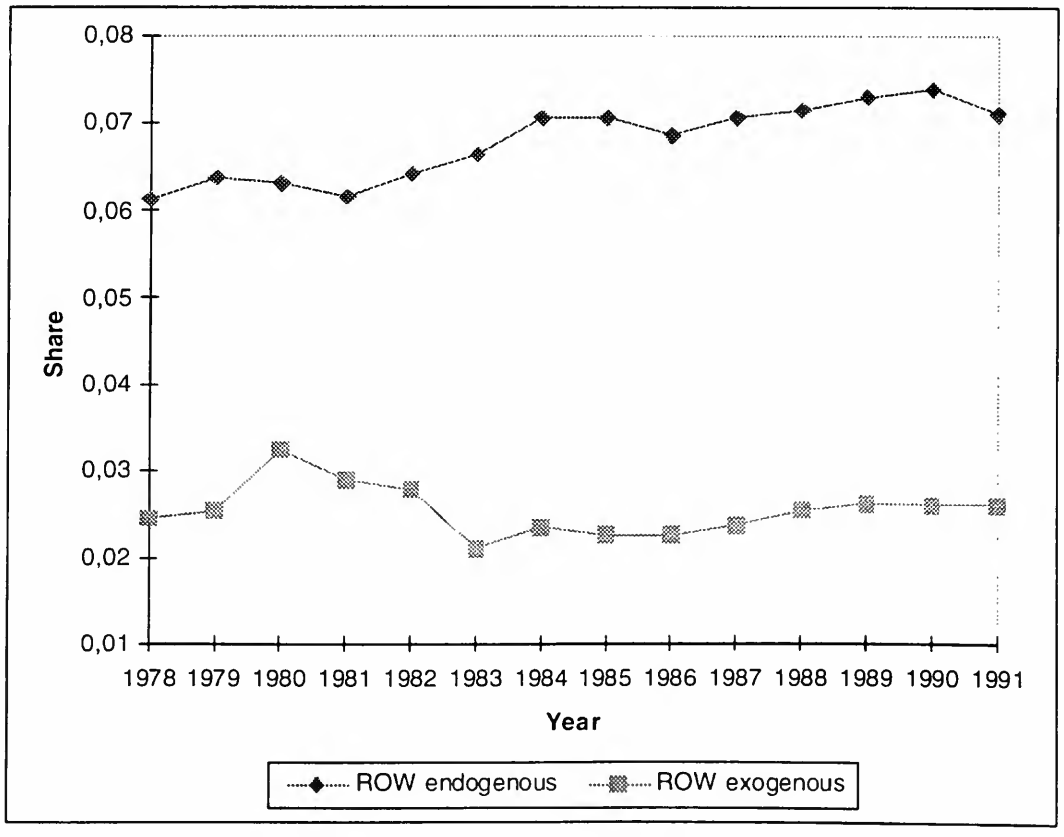


Figure 15
Share of Internal Propagation of LA Countries (and ROW) in Total Multiplier M1: 1978-1991

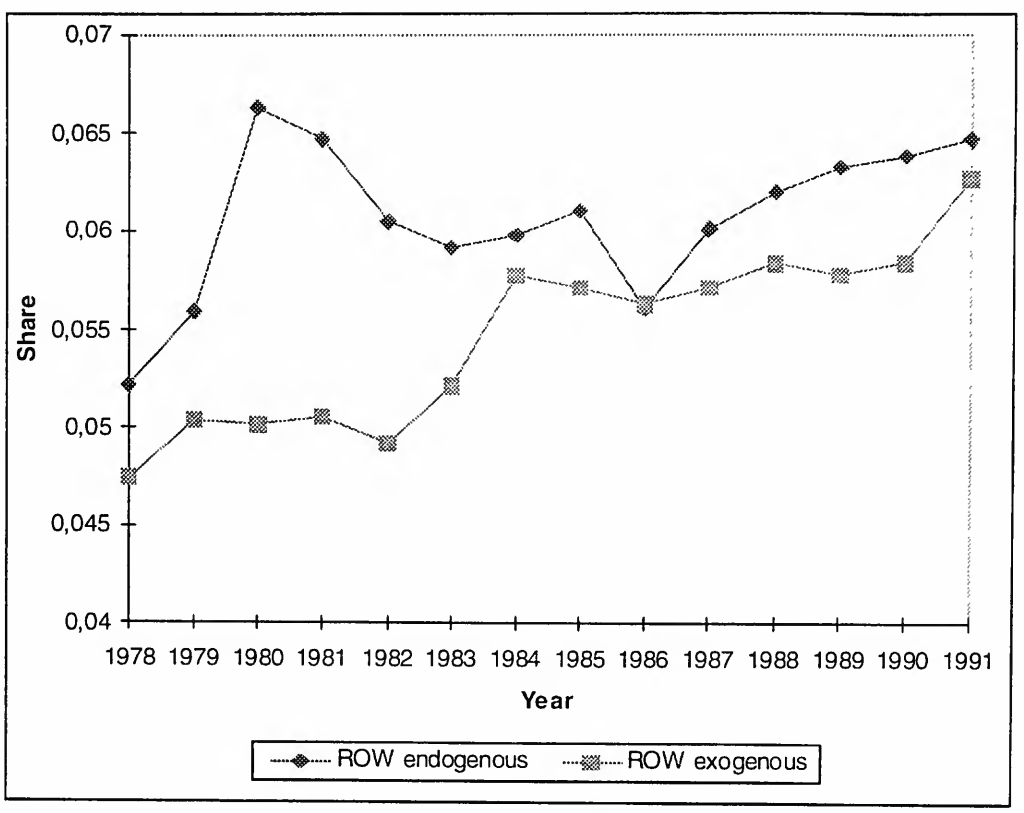


Figure 16
Share of External Propagation of LA Countries (and ROW) in Total Multiplier M1: 1978-1991

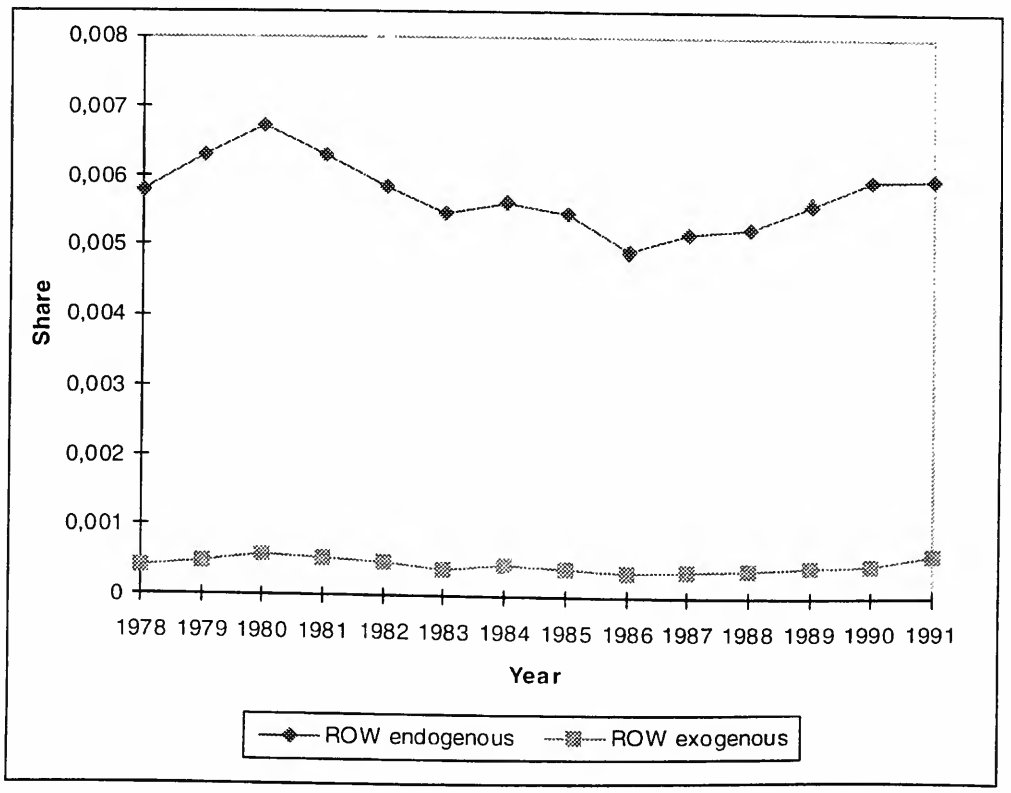


Figure 17
Share of Direct Inport Requirements in Total Multiplier M2: 1978-1991

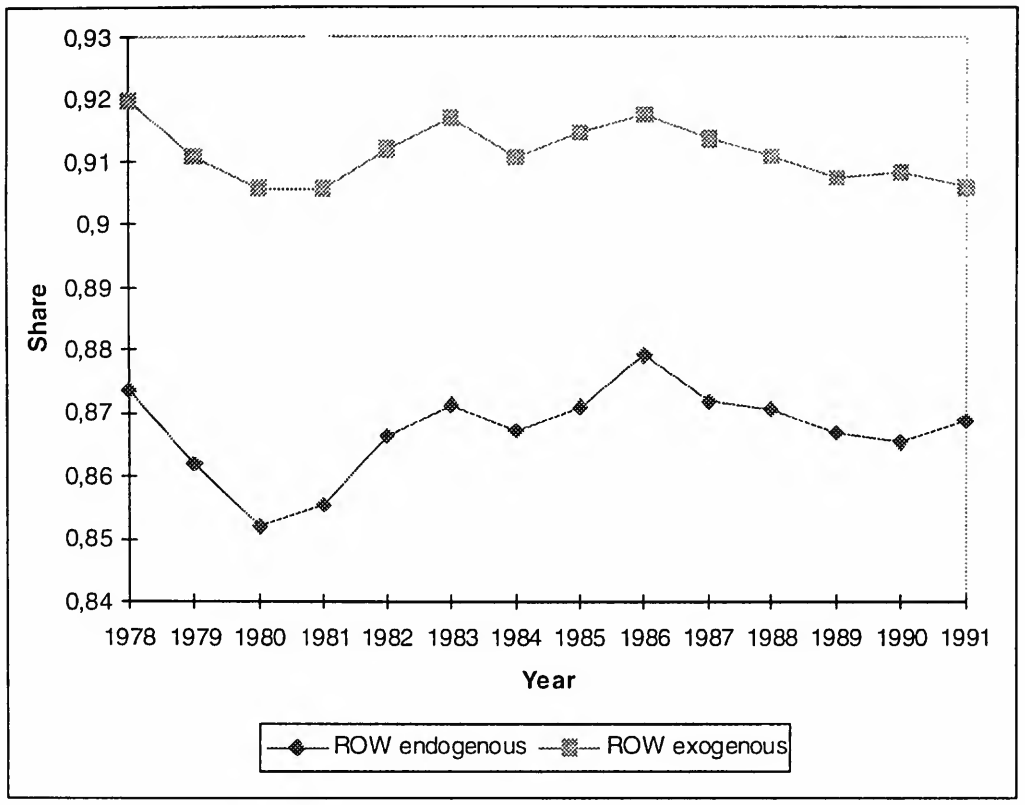


Figure 18
Share of Indirect Import Requirements in Total Multiplier M2: 1978-1991

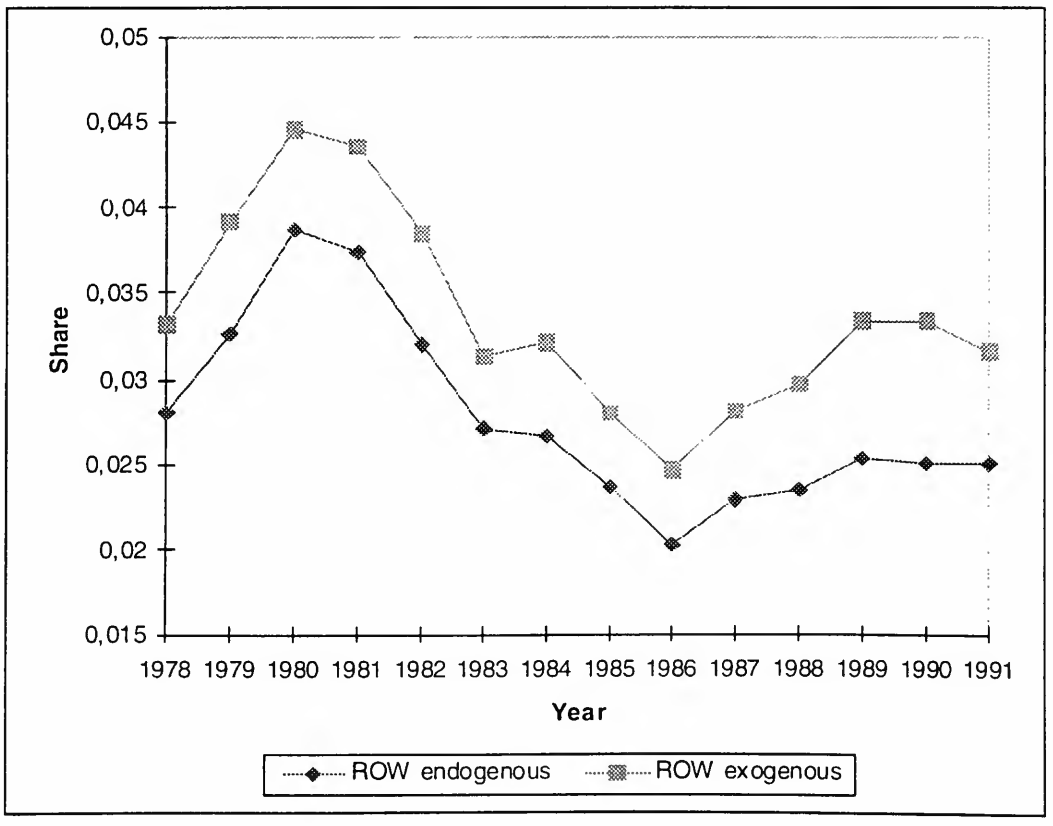


Figure 19
Share of Internal Propagation of Developed Countries (and ROW) in Total Multiplier M2: 1978-1991

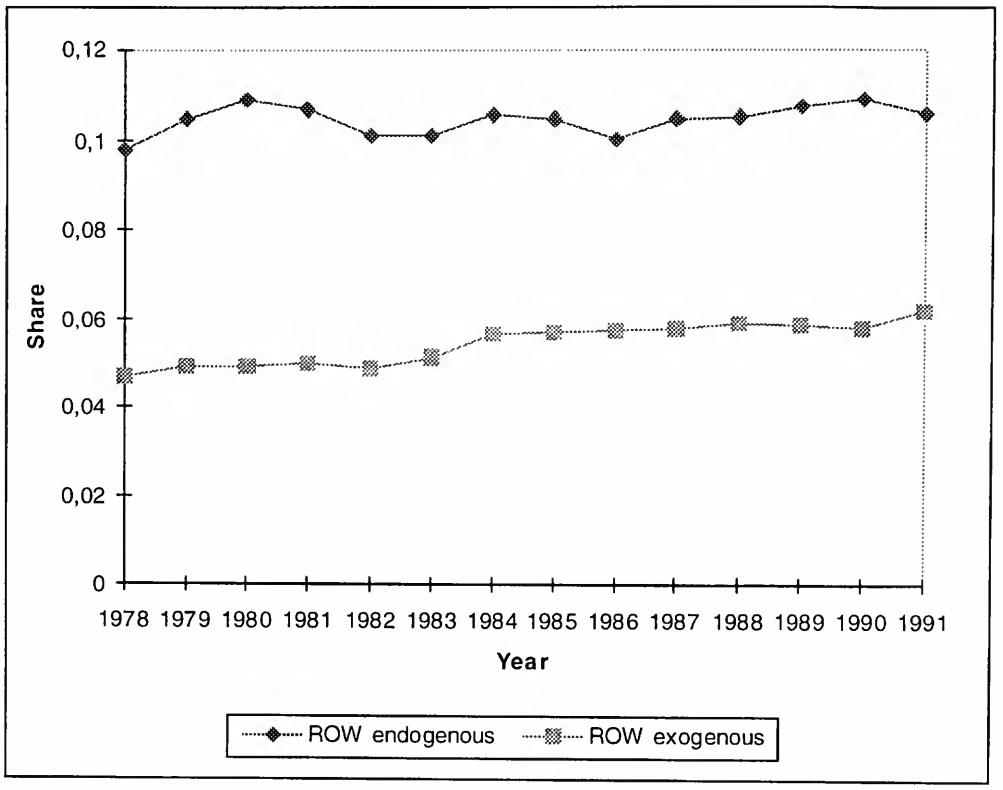
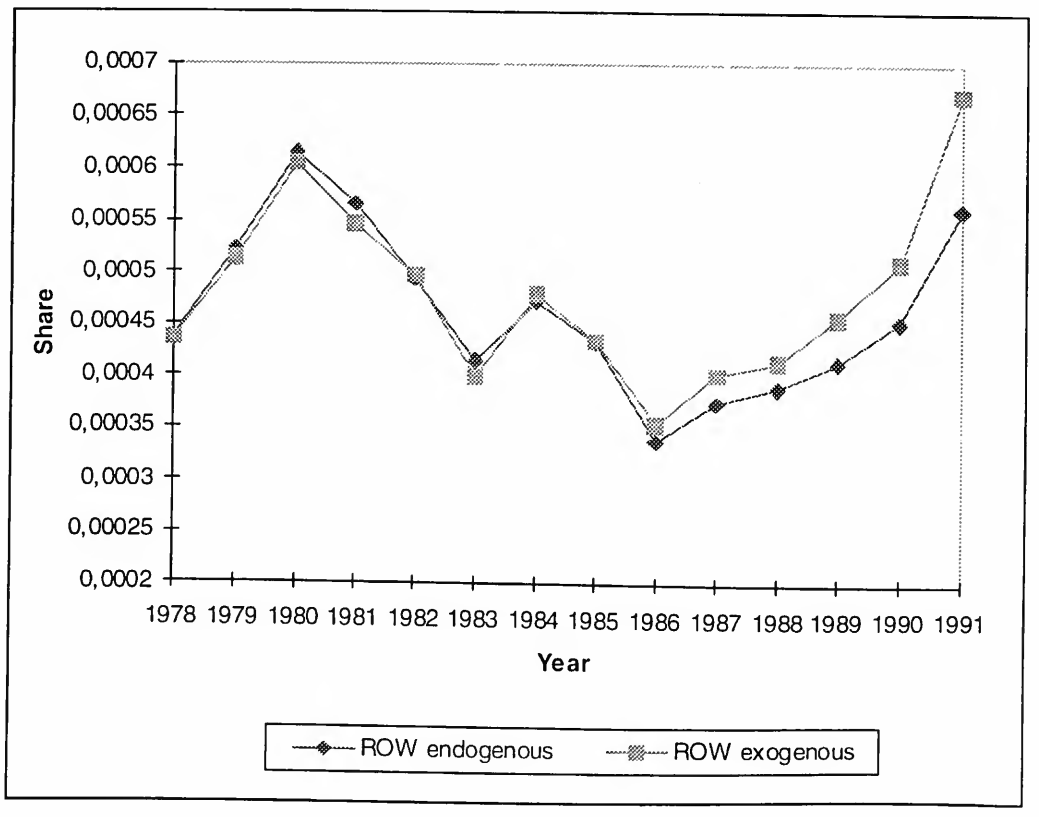


Figure 20
Share of External Propagation of Developed Countries (and ROW) in Total Multiplier M2: 1978-1991



The decomposition (into internal and external effects) of the multipliers M1 and M2 indicates important trends in the composition of the external demands of DCs and LA countries (Figures 13-20).[13] Regarding M1, we have: a) on average, DCs show decreasing shares of direct import requirements from LA countries (88.09% in 1978, and 85.85% in 1991); b) changes in the shares of indirect import requirements for DCs are positive in the period (6.11% in 1978, and 7.09% in 1991); c) and the shares of internal propagation of the LA countries stimulated by DCs, on average, are increasing over time (5.21% in 1978, and 6.46% in 1991). In the case of M2, a trend is more clearly perceived from 1980 on: a) LA countries show increasing shares of direct import requirements from DCs (85.20%, in 1980, and 86.91% in 1991); b) decreasing shares of indirect import requirements for LA are present (3.87% in 1980, and 2.50% in 1991); and c) increasing shares, but not monotonic, of internal propagation of DCs (9.77% in 1978, and 10.54% in 1991).

Putting together the trends of the decomposition of both multipliers, M1 and M2, there is evidence that both DCs and LA countries are reducing their external demand for LA goods and services. This reflects, to a great extent, the commodity recession of the 1980's.[14] However, recent evidence suggests that the impact of the formation of MERCOSUL has generated siginificantly larger trade increases in percentage terms among the member LA countries than their trade with DC and ROW countries.

6 Final remarks

The analysis of the impacts of growth in DCs on LA countries, and the impacts of growth in LA countries on DCs, carried out in this paper, reveal the potential for analysis of trade flows using techniques pioneered in input-output analysis. In a broader sense, the use of the MIT framework provides an analytical tool to study different aspects of the structure of international trade. Different issues might be addressed from the use of MITs, which can be constructed for different purposes by varying, for instance, the country aggregation.

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13 The shares were computed for ROW botn endogenous and exogenous, in order to make the point clearer.

14 "*The Latin American countries depend on a relatively small number of primary commodity exports for a large amount of their foreign exchange earnings. Ten nonfuel commodities have contributed at least 1% to total regional export earnings in the last fifteen years namely coffee (9.2%), soybeans (4.7%), copper (3.6%), iron ore (3.6%), sugar (2.9%), beef (1.7%), cotton (1.6%), cocoa (1.3%), bananas (1.3%), and maize (1.2%).*" (Lord and Boye, 1991)

In our specific study of the passive role played by trade in the growth process, involving DCs and LA countries, some features of their relations were revealed (growth impact on trade balance and indirect income/output growth), which might be used as indicators to help in the formulation and evaluation of development policies by international agencies, such as the IMF, the World Bank and the Inter-American Development Bank.

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