The Importance of Trade to an Export-led Economy
in the Present Context of Free Trade Agreements
in the Western Hemisphere:
A Quantitative Analysis for the Puerto Rican Economy

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of Free Trade Agreements in the Western Hemisphere: A Quantitative Analysis for the Puerto Rican Economy

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Abstract:

The purpose of the paper is to analyze the importance of exports of goods to the Puerto Rican economy, in terms of their contribution to employment, production and income that could, at the same time, present a detailed economic profile of export-generated employment by type of industry. We start with an outline of the trade integration process in the region, and of Puerto Rico's trade links with the region. A detailed analysis of the structure and importance of exports and employment is presented. The methodology used is that of input-output, using the 1987 matrix. Estimates of gross output, employment and income generated by exports by industrial sectors are presented, for the years between 1967 and 1994, in order to evaluate the structural changes that might have taken place over time. The importance of trade with the Caribbean Basin is examined, as a regional case study. We conclude the paper with some policy recommendations. (JEL Classification Numbers: C13, C67, F14).

1. Introduction

The trends of globalization and trade liberalization in the world economy have created the basis for international trade to become an engine of economic growth, or to increase its role in that process. For economies that are to an important extent dependent on trade, particularly of exports of goods, the changes that are taking place within the international economy present challenges to their economic future. The way in which they develop and implement policies to confront these challenges will have an important role in improving their competitiveness and the social well-being of the population. Not only

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national economies, but regional economies also face the challenges of globalization, a process that, although proceeding at a fast pace, is still not uniform, one in which technological change is a driving factor, and requires the adoption of integration strategies that not only foster or facilitate greater competitiveness, but also take more fully into consideration previously marginalized social groups (Reynolds: 1995).

For the Puerto Rican economy, the issue, in the light of the above processes and challenges, is how to realize its economic potential, when the localization of productive activities, which is the essence of the world economy today, is undergoing dramatic and fast changes, and in which technology and the mobility of capital are determining factors. Jointly with globalization, there is another emerging trend which is that of regionalism, that is, the union or integration of two or more countries to improve their respective economic advantages against competitors, which takes different forms the most common one that of free trade agreements (Bendesky: 1994). The end-result of this new impetus in regionalism is suppose to be a more broad hemispheric regionalism, embodied in the proposed Hemispheric Free Trade Agreement (HFTA).

The further opening of the US market to potential and existing competitors of Puerto Rico, the flow of investment to countries or regions which represent a competition, new demands for products and services from expanding markets, and the opening-up of markets due to the trade liberalization that is taking place, are some of the significant challenges faced by Puerto Rico as a result of trade liberalization and trade integration. They all have a direct bearing on its competitiveness. For an economy in which external trade is very important, the challenges are not insignificant.

1.1 Outline of the analysis

The purpose of this paper is two-fold. One, to explore several possible economic implications for Puerto Rico of the proposed HFTA, taking as a point of departure the importance of trade, specifically that of exports of merchandise, to the Puerto Rican economy, since one area of possible impact of the HFTA as identified is on the degree of specialization of the economy, the flows of trade, and another on economic growth and employment. The other, to analyze the importance of exports to the economy in terms of their contribution to production, income and employment that would at the same time, present a detailed economic profile of export-generated employment by type of industry. In Section 2 we present a short overview of the proposed hemispheric agreement, with some potential impacts as presented in the literature, emphasizing those on trade flows and employment. A brief overview of Puerto Rico's trade linkages with the region is presented. An analysis of the structure of exports and of trade-related employment in agriculture, mining and manufacturing is presented in Section 3. This is important, because there has been a shift toward high-technology products, which have become an important source of the growth of comparative advantage of Puerto Rico, as different from the rest of the region.[1] Section 4 presents a detailed analysis of the economic importance of exports and their estimated impact on employment and output. The methodology used is that of input-output. A comparative analysis over time is done for the years between 1967 and 1994. We then apply the analysis to trade with one subregion, the Caribbean Basin, as a case study.

1. In other words, the structure of employment shifted as the exports of manufactured products moved toward high-technology industries and away from labor-intensive ones. However, trade cannot be considered as the major reason for this shift, given the role of tax incentives in the process of favoring external investment by companies from certain industries.

2. The HFTA and the Integration Process in the Region

The year 1994 marked a fundamental stage in the international economy, with the implementation of NAFTA, the adoption of the Final Act of the GATT, and the agreement in December of that year of establishing by the year 2005 a free trade zone covering the whole Hemisphere. This last event can be seen as the culmination of the multilateral trade integration process and, if implemented, it would be a significant and decisive step in the process of trade liberalization which was gaining momentum since 1990. There has been a profound transformation process, in which the formation of regional trade blocks and the linkages between existing ones can be singled-out. The processes of economic integration represent a new element in the re-organization of the modern world. It is in this context that the proposed HFTA should be seen.

With the new impetus in the process of economic integration after the late 1980's, stimulated by the trade and economic liberalization being implemented, together with the negotiations for NAFTA and the increase in intra-regional trade as a result of the expansion of these new trade agreements, (ECLAC: 1994) the region enters a new stage in the process of economic integration. The HFTA is, as proposed, an extended agreement on economic integration, by uniting the existing trade blocks into one commercial network. This will be achieved through the expansion of the present trade agreements through bilateral and multilateral consultations among the five regional and subregional groups, starting with the incorporation of Chile to NAFTA and the expansion of Mercosur. But the proposed agreement is something more than a trade agreement. Both, NAFTA and the proposed HFTA

are something more than free trade agreements. They represent a new ordering of the business and investment ordering, with trade playing a key role. It include the preparation and adoption of a uniform investment code in the hemisphere so as to facilitate the movement of capital and inflows of investment.

2.1 Potential impacts

Several areas of impact can be identified, with positive or negative effects, as analized to one degree or another in the literature. In the first place, on the degree of specialization of the economies, levels of integration, and on the flows of trade (trade diversion). In the second place, on economic growth, employment, income distribution and investment (flows and diversion).

Globalization is an economic process which tend to displace sectors and regions with an uneven participation in international markets (Bendesky: 1994). Existing patterns of trade, and the logic of comparative advantage, that is, trade based on differences in relative factor endowments, what they will probably do is to make the HFTA accentuate the specialization of production and exports of some economies who are primary goods producers, but also of certain manufactured products. For the region, manufactured products are becoming more and more important in trade. There has been an important change in the composition of intra-hemispheric trade in the past several years, with Argentina, Brazil and Mexico becoming the major suppliers of these products (Braga, Safadi and Yeats: 1994). In the case of certain producers in the region with more developed and more efficient manufacturing sectors, such as Brazil, Costa Rica and Mexico, they will probably be induced toward this direction.

Not all the regional groups are evenly or equally developed in their integration process and in their relationship with each other. In some cases, there are countries which still maintain different types or degrees of trade liberalization as in the Andean Pact. For subregions such as the Caribbean, this situation is critical given the lack of progress toward NAFTA parity, and the failure of existing mechanisms such as the CBI, CARIBCAN, and the Lomé Agreements, to generate sustainable economic growth (Lewis: 1992). The implementation of NAFTA and the proposed HFTA raises questions about the future viability of the CBI, the grouping of countries with which Puerto Rico trade most (Bryan: 1993). It is possible that these preferential agreements might dissapear, if the benefitiary countries loose them in order to become part of the HFTA.

2.2 Trade and investment

One other important aspect is that of the direction and concentration of trade flows, with markets within and outside the Hemisphere. There are not only serious differences and assymetries in the levels of economic development, but also in the flows of trade. Although intra-regional trade and with the United States has increased, several countries such as Argentina, Brazil, Chile and Peru have a significant share of their external trade with countries outside the Hemisphere. Even in the case of the US, only 14% of its exports are destined to Latin America. Nevertheless, this new regionalism, as exemplified in the impetus since the late 1980's, might increase intra-regional trade more than before (Braga, Safadi and Yeats: 1994).

For Latin America and the Caribbean, it is expected that the HFTA will contribute positively to economic growth, as a result of an expected increase in trade and the flows of

investment, and as the policies of economic liberalization proceed.[2] In the case of the US economy, it is expected that its exports to the region will increase at a higher rate than without the HFTA, with a slight shift toward employment in industries less labor-intensive but with a net increase in employment.[3]

2.3 Investment flows

The start of the NAFTA negociations gave way to an increasing preocupation as to what the economic effects of trade and investment diversion on third countries would be, specifically Southeast Asia and the Caribbean, of investment flows coming from the United States. And investment do have an impact on trade flows. Until now, partial equilibrium analyses on the effect of trade diversion on the Caribbean and Southeast Asia point out that, with the exception of some industrial sectors and economies in particular, the effect will not be significant (Braga, Safadi and Yeats: 1994). The proposed estabishment of the HFTA has renewed that preocupation.

Taking into consideration both effects, one has to observe closely the implications that the HFTA will have on trade and investment flows. It is worrisome that in the medium and long-term, in the case of the Caribbean, given the competitive differences between this subregion and Mexico, the flows of investment to the former might decline. Even in the case of Puerto Rico, there is preocupation in certain labor-intensive industries, such as apparel and

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2. A study by the Commonwealth Secretariat indicates that for the English-speaking Caribbean, over the next five to seven years, in the case of textiles and clothing exports, trade diversion in favor of Mexico could be serious under the effect of the Uruguay Round and NAFTA. See Commonwealth Secretariat: 1995, pp. 39-42.

3. The best quantitative analysis so far on the subject is that by Gary Hufbauer and Jeffrey Schott (1994 a,b,c) See also Juan A. Castañer : 1995, pp. 10-12.

footwear, that where the CBI Parity Bill approved today, it would have accelerated the movement of operations to the Caribbean and Mexico (Alfaro: 1996), with less new investment forthcoming.[4]

In the case of Latin America, one key objective in establishing the HFTA is to turn it into the most atractive region for external investment, viz-a-viz international competitors such as Southeast Asia. In their analyses, Hufbauer and Schott (1994) estimate that under an HFTA direct investment flows would have increased on average $10 billions per year, increasing significantly the capital stock of the region during the following decade, if it had been approved in 1990. Half of these flows would come from those destined to Asia, Europe and other members of NAFTA (Castañer: 1995). If this were to be the case, then there would be reason for preocupation.

Table 1:
Trade of Puerto Rico by regions, 1993 - 1995 (In millions of dollars)

4. In 1995 the Government of Puerto Rico formally endorsed the CBI Parity Bills.

	1993	1994	1995
Central America			
Exports	61.3	81.7	62.8
Imports	110.4	121.4	125.7
Balance	(49.1)	(39.7)	(62.9)
Latin America			
Exports	235.1	184.2	210.7
Imports	1,451.1	1,155.4	1,060.7
Balance	(1,216.1)	(971.2)	(850.0)
Caribbean			
Exports	775.1	783.2	913.2
Imports	858.6	735.9	849.0
Balance	(83.5)	47.3	64.1
Total exports	1,071.5	1,049.1	1,186.6
Total imports	2,420.1	2,012.7	2,035.5
Balance	-1,348.6	-963.6	-848.9

Note: Information is on a fiscal year basis.
Source: Puerto Rico Planning Board: 1996 b, Table 5.

2.4 Puerto Rico's trade linkages with the region

The participation of the Caribbean and Latin America in Puerto Rico's external trade has been small, representing on average 5% of total exports of merchandise. In terms of market concentration the degree is very high. Exports are concentrated on two, the US, with 88.7% of total exports, and the Dominican Republic, with 2.9%. By region, the Caribbean Basin (including Central America) has the biggest share, 4.1%, and Latin America 1.9%. In fiscal year 1995, total trade with the Caribbean and Latin America amounted to $3.2 billion

dollars, of which 65.5% corresponded to trade flows with the Caribbean Basin (Table 1). As markets, within this Hemisphere exports of merchandise to the Caribbean and Central America have been growing more than to Latin America over the past five years, on average 5.8%. For the second year in a row, Puerto Rico registered a positive trade balance with the Caribbean islands. This suggest that, although its share in exports is small, there are more posibilities for Puerto Rico (Table 1). Exports in 1995 increased by 16.6%, while exports to Latin America increased by 14.4%. Both rate surpass that for total exports, which increased by 9.5%.

One other significant change is that the trade balance, consistently negative, has been improving as a result of a reduction in imports. About 36% of Puerto Rico's imports from the region corresponds to oil and related products, and coal. On the other hand, over 95% of exports are manufactured products. In 1990, the trade balance registered a deficit of $1.3 billions. By 1995, it declined to $859.0 millions, an improvement of $500 millions.

Table 2 presents a distribution of Puerto Rico's total trade with the existing regional and subregional groups under different trade or preferential schemes by 1995. As mentioned, the major market as a region is the Caribbean Basin, followed by the Group of Three and the Andean Pact countries. Trade with the latter groups is dominated by the imports of oil and related products and coal from Colombia, Ecuador and Venezuela. As a matter of fact, the main suppliers of crude and refined oil and related products to Puerto Rico are Venezuela, Ecuador and Perú.

As indicated before, within this Hemisphere (excluding the US) the Caribbean Basin is the region with which Puerto Rico trade is concentrated. Growing inter-dependence with

the Caribbean is shown in increasing intra-industry trade or increased trade in componentes that will be assembled in the importing country. In terms of products, there is a difference in the type of goods exported compared to that for total exports, particularly with the Caribbean. The fastest growing intra-regional export products are generated within the textile, apparel and electronics industries (Castañer and Ruíz: 1992). Goods from labor-intensive industries tend to predominate.

This pattern of specialization has remained this way since the mid-1980's, given impetus by the development of twin plants in the region. It is no surprise then, to see that by 1995, the Dominican Republic accounted for 71.7% of Puerto Rico's total exports to the Caribbean Basin, a country that has experienced a rapid growth of free trade zones with manufacturing establishments geared for production for Puerto Rico or the US in these sectors. This development is not insignificant. As we will see in Part 3, changes which affect the competitive position of labor-intensive industries in Puerto Rico cannot be underestimated, given their still important, albeit declining share, in manufacturing employment (ibid., p.109). It is precisely these industries which have seen their competitive position in the US market decline over the past 15 years.[5]

Table 2:
Total trade with regional integration schemes, 1995 (In millions of dollars)

5. An example of this competition is the case of textile and apparel production in Honduras. In 1984, its exports of apparel to the US were $22.2 million. By 1994 they reached $508 million, when Puerto Rico's exports of apparel to the US amounted to $631.3 million. See John Collins: 1995.

Regional integration scheme	Total Trade
CBI countries	1,939.3
Group of Three	923.9
Andean Pact	766.5
NAFTA*	554.6
Caricom	261.3
Mercosur	193.9
Central American Common Market	151.5

* Excluding the United States.
Note: Since in some cases, one country is a member of more than one integration scheme, the totals for each should not be added.
Source: Puerto Rico Planning Board. 1996 b, Graphs, 18, 19 and 21.

3. Structure and industry composition of exports and employment

The Puerto Rican economy is one in which exports of goods have achieved a great importance measured as a share of GDP.[6] In 1995 its exports of merchandise amounted to $23.8 billion, with total trade of goods representing 100.6% of GDP. Today, it ranks as the third biggest exporter in the region after Mexico and Brazil. This amount was equivalent to 11% of the total exports of goods of Latin America and the Caribbean in that year (CEPAL: 1995). As different from the great majority of the economies in the region, practically all exports of goods of Puerto Rico consist of manufactured products (Table 3).[7] The manufacturing sector is still very important, representing 41.8% of GDP and 17% of total non-agricultural employment (Puerto Rico Planning Board: 1995).

6. Exports are FOB value.

7. The only countries in the region with a share of manufactured products in their exports of over 50% are Mexico and Brazil. ECLAC: 1995, page 113.

Table 3:
Exports of registered merchandise (In millions of dollars)

	1993	1994	1995	95 Share
Agricultural products	78.4	85.9	112.6	0.49%
Mining	16.0	62.5	13.6	0.06%
Processed food	3,016.6	2,902.4	2,830.4	12.27%
Tuna	446.8	361.6	350.5	1.52%
Tobacco	93.9	150.8	163.1	0.71%
Textiles	175.4	160.7	191.3	0.83%
Apparel	702.3	678.1	712.4	3.09%
Wood, wood products and furniture	34.2	31.8	43.7	0.19%
Paper, printing and publishing	107.9	131.9	145.3	0.63%
Chemical products	8,532.2	10,168.3	11,170.3	48.42%
Drugs and pharmaceutical preparations	6,420.0	7,987.7	8,868.2	38.44%
Petroleoum refining and related products	266.9	295.4	302.8	1.31%
Rubber and plastic products	192.4	148.8	169.2	0.73%
Leather and leather products	336.7	380.7	433.6	1.88%
Stone, clay, glass, concrete products and cement	99.4	71.4	59.2	0.26%
Primary metal producs	82.0	76.0	108.9	0.47%
Fabricated metal products	277.4	290.9	322.3	1.40%
Machinery except electrical	1,909.7	1,938.7	2,292.9	9.94%
Electronic computers	1,583.5	1,619.8	2,033.0	8.81%
Electrical machinery	1,976.3	2,265.2	2,761.4	11.97%
Transportation equipment	84.6	73.4	91.5	0.40%
Professional and scientific instruments	1,608.5	1,690.4	1,664.1	7.21%
Miscelaneous manufacturing	160.6	166.9	192.2	0.83%
Total	19,049.1	21,047.1	23,068.4	100.00%

Note:Excluding returned or unclassifiend merchandise. Classified by SIC. Information is on a fiscal year basis.
Source:Puerto Rico Planning Board: 1996 a, Table 23.

3.1 Structure and behavior of exports

One important indicator of the competitiveness of an economy at the industry or sub-industry level, is the behavior of its exports over time. If the economy is becoming more efficient in the production of a particular product, this should be reflected in a rising share of its exports (and in world exports). Exports are concentrated in a few industries, which is nothing new as that has been the historical experience (Table 3). What has changed is the type of specialization. As seen in Table 4, 71.3% of exports of goods are concentrated in seven industries, which together represent 30% of total output of the economy. Of these, the

majority corresponds to exports of drugs and pharmaceutical preparations, whose share of total exports is 37%, followed by non-alcoholic beverages and concentrates, which explains the high share of the processed food industry, and electrical and electronic equipment. This importance is also reflected in manufacturing employment, as 30.3% of employment in the sector is concentrated in these seven sub-industries (Puerto Rico Department of Labor: 1994).

Table 4
Main exports by SIC industry at the three digit level, 1995

SIC	Industry	%
283	Drugs and pharmaceutical preparations	37.29
208	Non-alcoholic beverages and concentrates	9.18
357	"Office, computing, and accounting machines"	8.58
384	"Surgical, medical, and dental instruments" and supplies	5.30
286	Industrial organic chemicals	5.14
366	Communication equipment	3.43
284	"Soap, detergents, cleaning preparations," perfumes and cosmetics	2.41

Source: Puerto Rico Planning Board: 1996 b. Table 10.

In Table 5 we present the performance of exports of goods measured by their compound rate of growth, for the period between 1985 and 1995. The industries with the highest growth were drugs and pharmaceutical preparations, followed by fabricated metal products and electrical machinery and equipment. It is interesting to note that exports of textiles also showed a respectable rate of growth. These industries or sub-industries registered a rate of growth higher than that for total exports, which was 8.5%. On the other

hand, the worst performers were apparel, transportation equipment and petroleoum refining and related products.

3.2 Structure and behavior of employment

The shifting structure of the global economy brings prospective employment changes in many industries. Some of the changes are closely associated with external trade, others are not. The changes over time in the case of Puerto Rico can be better appreciated if we classify exports and employment by type of industry, which will also facilitate a comparative analysis with employment in the export-related industries and of their economic importance.

of their economic importance.

Table 5

Growth of exports of merchadise, 1985 - 1995

SIC	Sector	Average Growth*
01-09	Agriculture	6.7%
10-14	Mining	7.8%
20	Processed food an related products	4.7%
21	Tobacco	14.7%
22	Textiles	9.4%
23	Apparel	-0.9%
24-25	Wood, wood products, and furniture	4.9%
26-27	Paper, printing, publishing and related products	7.0%
28	Chemical products	12.9%
283	Drugs and pharmaceutical preparations	14.2%
29	Petroleoum refining and related products	-20.4%
30	Rubber, plastics, and related products	1.8%
31	Leather and leather products	8.5%
32	Stone, clay, glass, concrete and cement	-3.0%
33	Primary metal producs	7.4%
34	Fabricated metal products	15.4%
35	Machinery, except electrical	6.0%
36	Transportation equipment	-2.5%
37	Electrical machinery and equipment	11.3%
36	Professional and scientific instruments	8.4%
38	Miscelaneous manufacturing	-2.8%
39	Total manufactured goods:	8.6%
	Total exports:	8.5%

*Compound rate of growth. Information is on a fiscal year basis.
Source: Puerto Rico Planning Board: 1995 b, 1996 a; Table 23.

In Table 6 we present a similar analysis for employment in agriculture, mining and manufacturing, following as closely as possible the same industry classification for exports (by SIC) at the two-digit level. The sectors that experienced the highest growth in employment were basically the same as in exports. The other export sectors, electrical machinery and equipment, and fabricated metal products were an exception, registering very low or negative rates of growth. Employment in the apparel sector declined by 1.8%. On the other hand, employment in the transportation equipment sector, whose exports declined by 2.5%, experienced an increase in employment of 3.3%, suggesting an increase in production for the local market. Overall, employment in manufacturing remained practically stagnant

over time, barely growing at a compound rate of 0.2%, while exports of manufactured products increased by 8.6% during the same time. However, as will be seen in Part 4, indirect jobs generated by exports increased significantly between 1987 and 1994, with the greater impact being on the service sector.

A picture of the structure and relative importance of each industrial sector in exports and employment is presented in Figure 1. It compares the industry composition of exports with that in employment in agriculture, mining and manufacturing.[8] By 1994, 73.2% of total exports were made by technology-intensive industries, while those of the capital-intensive industries represented 5%. Exports by labor-intensive industries represents 21.2%, down from 28% in 1987, while those from agriculture and mining less than 1%. On the other hand, technology-intensive industries account for 34.3% of employment (as defined above), while that of labor-intensive industries 36.7%. This is not surprising since the former type of industries tend to use less labor, and together with capital-intensive industries have the highest share of capital-labor ratios and higher productivity. Exports from labor-intensive industries have been declining, whereas those from technology-intensive and capital-intensive industries have been increasing (Castañer and Ruíz: 1992).

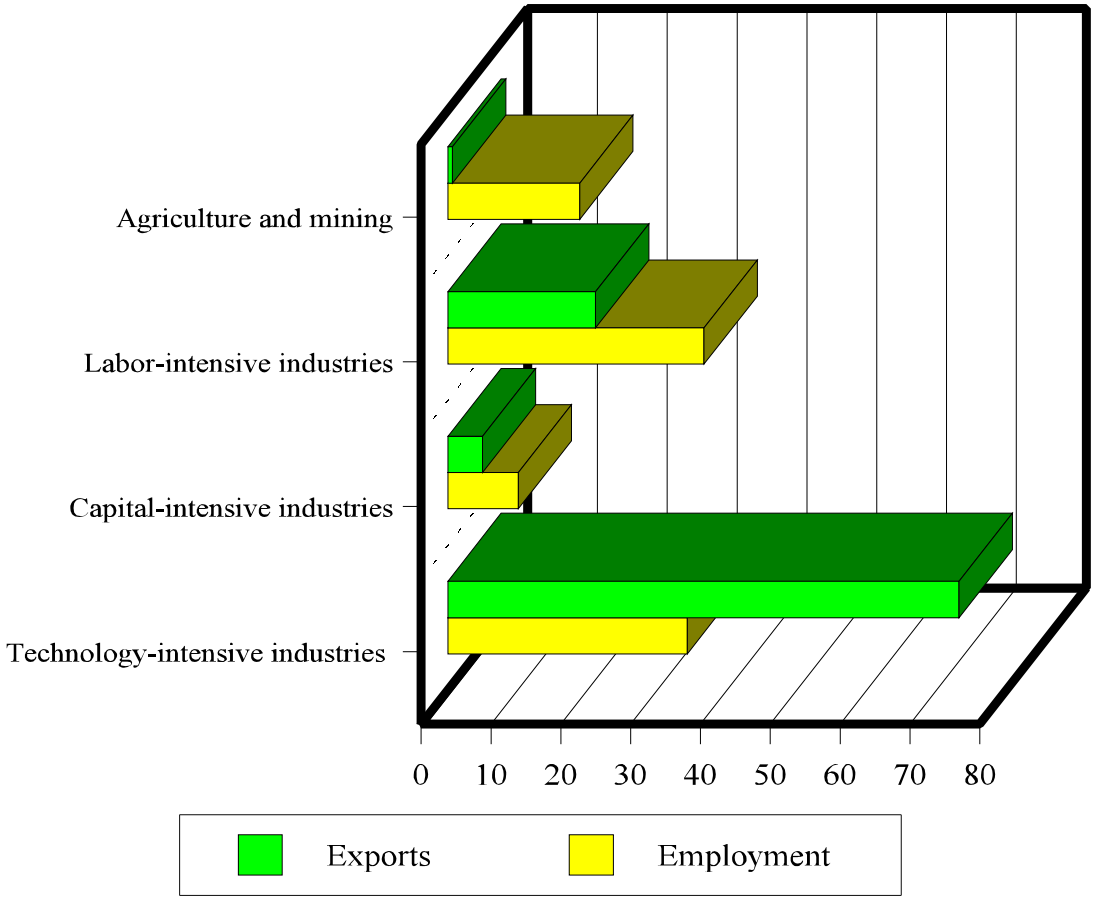
8. The classification has been done on the basis of U.S. Bureau of Labor Statistics typology, by SIC at the two and three digit level. The exception is in the transportation equipment sector where, in the case of Puerto Rico, this industry does not include manufacturing of motor vehicles or other types of vehicles.

Table 6
Growth of employment in manufacturing, agriculture and mining, 1985 - 1995

SIC	Sector	Average
20	Food and related sectors	-1.0%
21	Tobacco	-0.5%
22	Textiles	2.0%
23	Apparel	-1.8%
24-25	Wood, wood products, and furniture	-0.6%
26-27	Paper, printing, publishing and related	3.6%
28	products	4.8%
29	Chemical products	7.7%
30	Drugs and pharmaceutical preparations	-2.6%
31	Petroleoum refining and related products	3.3%
32	Rubber, plastics, and related products	1.9%
33	Leather and leather products	1.7%
34	Stone, clay, glass, concrete and cement	0.4%
35	Primary metal producs	-9.8%
36	Fabricated metal products	-0.3%
37	Machinery, except electrical	7.9%
38	Transportation equipment	1.3%
39	Professional and scientific instruments	-1.9%
	Miscelaneous manufacturing	0.2%
01-09	Total manufactured	-1.9%
10-14	goods:	3.6%
	Agriculture**	
	Mining	

*Compound rate of growth. Information is on a fiscal year basis.
**Household Suvey.
Source: Puerto Rico Planning Board, Bureau of Statistics, data from the Establishment Survey.

Figure 1
Distribution of exports and employment
by type of industry, 1994



Note : Classified by SIC at the two and three digit level, on the basis of information at the four digit level.
Source : Puerto Rico Department of Labor: 1994; agricultural employment from the Household Survey; Puerto Rico Planning Board, Bureau of Economic Analysis, unpublished trade data.

This trend is important, given the still relatively high share of labor-intensive industries in employment. It is these exports which face competition from low-cost areas in the region. All of these industries have been undergoing adjustments in terms of employment and in changes in the production process, in order to be able to compete. The decline in employment in the apparel sector, for instance, which represents 17% of total manufacturing employment, has been a leading factor in the reduction of employment in labor-intensive industries. One key factor in this development has been the increased competition from low wage countries as the level of protection in the US market declined over time. There are at least four different US trade provisions plus the phased-out of tariffs and quotas under the WTO in the case of apparel imports, that affect directly Puerto Rico's shipments of apparel to the US market (Stewart: 1995).

4. Economic Importance of Exports

An important aspect of the trade performance of the Puerto Rican economy is how it affectemployment and economic growth. Section 3 presented, at a macroeconomic level, an analysis of the structure of exports and of employment in the manufacturing sector by type of industry. Although this information provide us with a good idea of the importance of exports in the economy and change over time, it does not say how many jobs exports generate, how important they are as direct and indirect generators of jobs, and their impacton output and income and by industrial sector. The purpose of this section is to estimate and analyze that impact and importance over time, and to link it with the previous analysis by type and degree of industry concentration and the impact on employment.

For the analysis an input-output model is used to estimate the indirect and indirect economic effects of domestic final demand, exports of goods and services, and exports of manufactured goods. Five different input data bank and models, from 1967 to 1994, are used for our estimates, which is possible since for the Puerto Rican economy there are available input-output tables since 1963. The effects are shown in terms of output, employment and wage income by industrial sectors.

4.1 Methodology

First, the input-output table, value added, and final demand matrices were made compatible in terms of industrial sectors and prices. All input-output tables were aggregated to 53 industrial sectors and expressed in 1967 prices. Vectors of output, final demand labor coefficients, and wage coefficients, for 53 sectors of the economy were used to derive estimates of employment and income.

Labor content of final demand and exports were estimated by multiplying direct and indirect labor and income coefficients by vectors of one million dollar of final demand, exports of goods and services and exports of manufactured goods. Direct and indirect employment and income coefficients were obtained by multiplying the row vectors of direct coefficients of each year by the corresponding inverse matrices. The complete mathematical model is described in the appendix.

4.2 Summary of results

The results derived from the input-output model are presented as follows:

1. The impact of final demand, exports of goods and services, and the exports of manufactured goods on total output of the economy.

2. The output impact by major industrial sector (aggregated to five sectors).
3. The effect on employment of output generated by final demand, exports of goods and services, and manufacturing exports further divided by:
   a.. the aggregate for the total economy
   b. the impact on five major industrial sectors
   c. the ratio of employment per million dollars of output of generated by final demand, exports of goods and services, and manufacturing exports in five major sectors.
4. The effect on wage income of output generated by final demand, exports of goods and services, and manufacturing exports divided by:
   a. the aggregate effect for the total economy
   b. the impact on five major industrial sectors
5. Labor content of one million dollar of final demand, exports of goods and services, and manufacturing exports.

4.3.1 Output

Table 7 shows the output generated by domestic final demand, exports of goods and services, and exports of manufactured goods. The analysis of the table shows that from 1967 to 1994 the share of output generated by exports increased from 25.0 to 51.1 percent of total output generated by final demand, which is significant. Output per unit of final demand also increased from 1967 to 1977, decreasing until 1987 and remaining practically static from 1987 to 1994. The low ratio of output generated to exports and final demand implies that linkages hardly increased during the whole period under consideration.

Table 7
Final Demand, Exports, Output Generated and Output per unit of final demand
Puerto Rico 1967 - 1994 (1967-100)

Final Demand and Exports (in thousand $)

Year	Total Final Demand	Exports of Goods and Sevices	Exports of Manufactured Goods
1967	4,711,681	1,313,357	1,151,225
1972	6,903,105	1,817,936	1,669,571
1977	8,114,946	2,663,687	2,459,938
1982	10,333,233	4,612,135	4,435,994
1987	12,978,462	5,647,718	5,381,752
1994	18,977,651	9,247,108	8,849,538

Output Generated by Find Demand and Exports (in thousand $)

Year	Total Final Demand	Exports of Goods and Sevices	Exports of Manufactured Goods
1967	6,370,784	1,799,393	1,593,493
1972	9,886,410	2,668,507	2,463,995
1977	12,739,824	4,353,201	4,021,296
1982	14,638,055	6,199,786	5,923,275
1987	18,190,907	7,786,832	7,388,643
1994	23,884,649	12,795,010	12,208,840

Output per Unit of Final Demand (Output muitipliers)

Year	Total Final Demand	Exports of Goods and Sevices	Exports of Manufactured Goods
1967	1.35	1.37	1.38
1972	1.43	1.47	1.48
1977	1.57	1.63	1.63
1982	1.42	1.34	1.34
1987	1.40	1.38	1.37
1994	1.41	1.38	1.38

Table 8 shows the economic impact for five sectors of the economy. The major impact of exports of manufactured goods is on the manufacturing sector. The impact on agricultural output declined from $81.8 million to $32.8 million between 1967 and 1994. However, the effect of manufacturing exports on the output of the service sector increased significantly. Output generated in the service sector by the exports of manufactured goods increased from $158.2 million in 1967 to $2,148.2 million in 1994. One implication of this result is that the service sector could be adversely affected if the economy suffers a

significant decrease in exports. The estimates also shows that the difference between the output impact of exports of goods and services and those of manufactured goods is minimal, implying a low proportion of service sector exports to final demand.

Table 8
Output generated by final demand, Exports of goods and services, and Exports of manufactured goods, 1967 - 1994 (in thousnd $, 1967=100)

Final Demand	Agriculture	Mining and Construction	Manufacturing	Services	Government	Total
1967	255,932	588,077	2,293,896	2,485,17	747,601	6,370,78
1972	242,481	929,191	3,948,837	1,059,44	1,059,440	9,886,41
1977	280,383	654,758	5,993,736	1,210,51	1,210,510	12,739,8
1982	257,655	522,924	7,098,874	1,449,89	1,449,997	14,638,0
1987	291,536	636,152	7,986,561	1,918,49	1,918,498	18,190,9
1994	330,937	1,039,160	10,326,626	2,364,13	2,364,134	23,884,6
Good and Services						
1967	88,560	9,350	1,343,653	10,806	10,809	1,799,39
1972	69,796	15,059	2,186,595	6,987	6,987	2,668,50
1977	57,115	24,152	3,602,822	649,502	19,611	4,353,20
1982	47,239	32,639	5,136,526	971,380	12,002	6,199,78
1987	58,341	45,903	6,041,532	1,611,90	29,148	7,786,83
1994	50,920	96,580	9,941,610	2,661,64	44,260	127,950
Manufactured Goods						
1967	81,851	8,074	1,336,064	158,183	9,320	1,593,49
1972	54,418	13,203	2,167,763	222,726	5,884	2,463,99
1977	44,167	19,372	3,578,161	363,326	16,270	4,021,29
1982	65,370	27,802	5,652,993	612,744	12,658	6,371,56
1987	43,571	43,516	6,026,889	1,252,41	22,251	7,388,64
1994	32,790	73,070	9,920,340	2,148,17	34,470	12,208,8

4.3.2 Employment and Income.

Table 9 shows labor and income generated by final demand and direct and indirect labor and income generated by exports from 1967 to 1994. The results show the following main findings:

Table 9
Employment and income generated and employment and income per million dollar of output, Puerto Rico, 1967 - 1994 (1967=100)

Employment Generated by:			
Year	**Total Final Demand**	**Exports of Goods and Sevices**	**Exports of Manufactured Goods**
1967	643,474	154,991	130,768
1972	171,310	129,243	111,045
1977	691,223	119,067	993,69
1982	721,982	177,102	163,869
1987	862,465	202,835	184,892
1994	1,011,763	318,493	238,334
Employment per Million Dollar of Output			
Year	**Total Final Demand**	**Exports of Goods and Sevices**	**Exports of Manufactured Goods**
1967	10,100	8,614	8,206
1972	7,255	4,843	4,507
1977	5,426	2,735	2,471
1982	4,932	2,857	2,767
1987	4,716	2,605	2,502
1994	4,236	2,489	1,952
Income Generated (in thousand dollars) by:			
Year	**Total Final Demand**	**Exports of Goods and Sevices**	**Exports of Manufactured Goods**
1967	1,839,527	414,871	344,180
1972	2,757,540	452,358	397,128
1977	2,884,113	534,612	466,366
1982	3,154,219	721,265	777,244
1987	3,422,717	908,696	908,696
1994	4,445,155	1,532,247	1,406,939
Year	**Total Final Demand**	**Exports of Goods and Sevices**	**Exports of Manufactured Goods**
1967	28,874	23,056	21,599
1972	27,892	16,952	16,117
1977	22,639	12,281	11,597
1982	21,548	16,634	13,122
1987	18,816	11,670	12,299
1994	18,611	11,975	11,524

In the first place, employment per million dollar of exports of goods and services declined from 86.14 to 24.89 between 1967 and 1994. For total final demand the same ratio

shows a reduction from 101.0 to 42.36 during the same period. The implications of this change in the number of jobs supported by exports are obvious. Over the years exports have lost the potential to increase employment. Productivity increases have been highly significant, while the low linkages have kept the generation of indirect employment at very low levels (Carroll: 1994). Studies in the case of the US economy have found a similar result, with respect to the impact of increasing productivity on export-related jobs during the 1980's (U.S. Dept. of Commerce: 1989). This might be problematic, in the case of an economy still with unemployment problems. But, on the other hand, without this increased productivity, loss of competitiveness would have resulted in a higher loss of export-related jobs. Nevertheless, the estimates for Puerto Rico suggest that starting in the 1980's indirect employment increased, pointing to a greater integration of the manufacturing sector with the local economy, especially with the service sector.

Secondly, the coefficients of employment (employment per million dollar of output) shows how the output generated by exports, as well as the final demand as a whole, have been produced with less and less labor content. The reciprocal of this ratio can be used as a proxy of labor productivity. A mathematical manipulation of the ratios show dramatic increases in partial labor productivity.

Wage income is a fundamental part of value added. In countries highly dependent on external capital, that part of value added remaining for local use is of fundamental importance. As can be seen from the results, the ratio of wage income to output generated by exports has been decreasing dramatically. Information published by the Puerto Rico Planning Board shows an increasing share of other value added in the total. Thus, it is clear

that export-led development strategy failed to increase the welfare derived from increasing the purchasing power of salaried workers. The ratio of wage income to output generated by exports of manufactured goods declined from 0.214 in 1967 to 0.099 in 1994.

Tables 10 and 11 show the results for five sectors of the economy. The analysis by industrial sector shows a reduction in the employment impact of final demand on the construction industry. This is probably due to the industry's diminishing role from 1972 to 1987, since new constrution is fundamental part of final demand. A significant recovery has been experienced since 1987. A dramatic reduction of the impact of exports of manufactured goods on employment is shown by the reduction from 28,849 to 3,961 jobs generated from 1967 to 1994. However, the service sector has experienced a significant increase in jobs indirectly induced by the exports of both, goods and services as well as of manufactured goods.

Table 10 also shows that 52.7% of total employment in 1994 was generated by the private service sector, compared with 43.3% in 1967. The employment impact of manufactured exports increased slightly from 1967 to 1994, namely, from 20.35% to 23.5% of total employment during the period. However, a more significant measure of employment impact is the employment per million dollar of output generated by exports. This indicator declined significantly from 1967 to 1994, from 82.06 to 19.52 direct and indirect jobs per million dollar of the output generated by the exports of manufactured goods, once again showing the low capacity to generate jobs by an export-led economy.

Table 10
Employment generated by final demand, Exports of goods and services, and Exports of manufactures goods, 1967 - 1994

Final Demand	Agriculture	Mining and Construction	Manufacturing	Services	Government	Total
1967	87,935	63,951	122,698	278,938	89,953	643,476
1972	56,417	77,723	141,676	317,117	124,378	717,310
1977	38,864	40,110	136,383	320,575	155,288	691,220
1982	35,278	37,052	134,874	341,557	172,234	720,993
1987	36,032	38,748	155,461	414,843	212,895	857,980
1994	33,953	54,482	165,594	533,664	224,070	1011763
Good and Services						
1967	31,110	957	84,143	37,738	1,043	154,991
1972	16,155	1,234	79,873	31,396	585	129,243
1977	9,167	1,527	69,439	37,103	1,829	119,065
1982	7,230	1,887	94,557	50,668	1,135	155,476
1987	7,762	2,606	109,649	80,123	2,695	202,835
1994	5,224	5,064	159,420	144,590	4,195	318,493
Manufactured Goods						
1967	28,849	829	83,926	16,232	932	130,769
1972	12,831	1,080	79,415	17,199	518	111,044
1977	7,546	1,231	69,062	20,090	1,439	99,367
1982	5,440	1,354	94,303	39,059	694	140,851
1987	6,011	2,464	109,359	65,099	1,969	184,901
1994	3,961	3,384	137,239	90,882	2,869	238,334

Table 11
Income generated by final demand, Exports of goods and services, and Exports of manufactured goods, 1967 -1994 (in thousand $, 1967=100)

Final Demand	Agriculture	Mining and Construction	Manufacturing	Services	Government	Total
1967	67,948	169,748	379,834	749,301	472,697	1,839,527
1972	48,875	267,330	562,129	1,020,384	858,821	2,757,540
1977	60,199	157,706	610,614	1,243,340	812,254	2,884,113
1982	58,462	117,574	700,631	1,459,773	817,469	3,153,909
1987	63,619	103,215	764,254	1,463,452	1,028,177	3,422,717
1994	57,383	186,833	943,031	2,129,875	1,128,035	4,445,155
Good and Services						
1967	35,012	2,573	243,016	127,258	7,013	414,871
1972	13,712	3,914	314,210	115,167	5,355	452,358
1977	17,589	5,850	321,404	177,355	12,414	534,612
1982	17,093	7,361	491,005	198,750	7,056	721,265
1987	18,651	7,359	552,182	314,243	16,261	908,696
1994	8,829	17,364	907,871	577,064	21,118	1,532,24
Manufactured Goods						
1967	33,976	2,229	242,114	57,256	6,054	341,629
1972	11,688	3,400	312,116	63,804	4,585	395,594
1977	15,546	4,697	319,508	113,348	10,207	463,306
1982	14,790	4,325	489,559	261,121	4,741	774,536
1987	16,229	6,973	550,585	242,874	12,553	829,214
1994	26,691	9,612	797,142	354,689	18,776	1,206,91

Looking at wage income by sector we see that agriculture is the only sector showing increases in the ratio of wage income to output generated by exports, specially from 1982 to

1994. A significant finding is the low ratio of wage income to output in the manufacturing sector. This ratio declined from 0.181 to 0.080 during the mentioned period. For the whole economy (the average for the five sectors), the reduction was from 0.289 to 0.186. What the data shows for both, employment and wage income, is an economy mostly based on exports with a diminishing impact on job creation and value added in the form of wages and salaries. Since we observed large increases in output during the period we must conclude that other value added (profits, interests, etc.) were increasing significantly, and that other factors of production have been substituted for labor in the production process.

The diminishing employment impact of exports is better illustrated by estimating the labor content of exports. This procedure, first used by Leontieff, consist of multiplying direct and indirect labor coefficient by one million dollars' worth of exports (Leontief: 1953). Table 12 show the results. The analysis of table 12 corroborates our main conclusions in a more clear way. Labor content of exports of manufactured goods decreased significantly from 1967 to 1994. In 1967 the labor content of one million dollars of exports of manufactured goods amounted to 113.59; by 1994 the coefficient decreased to 34 jobs per one million dollars' worth of exports. On the other hand, the labor content of final demand, except exports, shows a less drastic reduction implying that other components of final demand still have a significant impact on employment.

Table 12
Coefficient of labor content per million dollar of final demand and exports

Final Demand	Agriculture	Mining and Construction	Manufacturing	Services	Government	Total
1967	4.06	16.28	43.81	49.72	22.70	136.57
1972	2.20	14.67	27.10	39.30	20.64	103.91
1977	1.49	5.84	22.56	34.83	20.46	85.18
1982	1.07	3.80	21.76	25.07	18.17	69.87
1987	1.31	3.59	19.13	24.53	17.56	66.11
1994	0.83	4.18	17.42	23.01	14.39	59.83
Final Demand, Except Export						
1967	4.92	22.56	22.26	62.52	31.48	143.74
1972	2.29	19.9	14.95	50.47	28.03	115.64
1977	1.89	8.68	15.36	48.57	30.46	104.96
1982	1.6	6.75	10.66	43.41	32.81	95.24
1987	2.07	6.35	8.64	41.21	31.09	89.37
1994	1.58	8.97	7.36	47.02	31.61	96.53
Exports of Good and Service						
1967	1.81	0.04	99.57	16.59	0.00	118.01
1972	1.94	0.01	61.08	8.05	0.00	71.09
1977	0.67	0.01	37.31	6.72	0.00	44.70
1982	0.41	0.14	35.53	2.31	0.00	38.40
1987	0.31	0.00	32.74	2.87	0.00	35.91
1994	0.20	0.18	25.83	2.94	0.00	29.15
Exports of Manufactured Goods						
1967	0.00	0.00	113.59	0.00	0.00	113.59
1972	0.00	0.00	66.51	0.00	0.00	66.51
1977	0.00	0.00	40.40	0.00	0.00	40.40
1982	0.00	0.00	36.94	0.00	0.00	36.94
1987	0.00	0.00	34.36	0.00	0.00	34.36
1994	0.00	0.00	34.49	0.00	0.00	34.49

4.3.3 Impact of Exports to the Caribbean Basin Countries.

In Section 3 we mentioned how important is the Caribbean region for Puerto Rico's external trade. This relative small share in total exports nevertheless, does not give an accurate picture of their importance to the economy in terms of employment.[9] Previous analyses in the case of the Puerto Rican economy have shown that, for certain type of industries, exports to certain regions such as the Caribbean Basin are very important in terms of employment (Castañer and Ruíz: 1992). There are several industries whose exports to the Caribbean are important as a share of its total exports. The participation of the Caribbean is higher in food-related exports, followed by certain non-durable and durable goods industries such as printing and publishing and transportation equipment (Table C in the Appendix).

In this section we present the results, although in a limited way, for the year 1994, in the case of Puerto Rico's exports to the Caribbean Basin, derived by running the input-output model with the exports of goods and services and of manufactured goods. Tables 13 and 14 show the results of the exercise.

Table 13 shows that 1994 exports of goods and services (at 1967 prices) to the Caribbean Basin countries amounted to $321.3 million, representing 3.5% of total exports. This exports generated $435.6 million of output, 14,876 direct and indirect employment and $59.2 million in wages and salaries. Table 14 shows that for the economy as whole employment per million dollars of exports amounted to 34 while the employment coefficient

9. The analysis underestimates the true impact of exports, since it does not include indirect exports to the region through the US.

of exports to countries in the Caribbean Basin amounted to 46. These results imply that exports to the Caribbean are more labor-intensive than exports to the rest of the world. Thus, this trade is important to this type of employment as analyzed in Section 3.

Table 13
Output, Employment and Income generated by exports of goods and Services and Manufactures goods

	Exports of Goods and Services	**Exports of Manufactures**
Exports (in thousand $)		
Puerto Rico	9,247,107.62	8,849,838.37
Caribbean Basin	321,325.02	303,521.31
Percentage of Total	3.47	3.43
Output Generated (in thousand $)		
Puerto Rico	12,795,010.00	12,208,840.00
Caribbean Basin	435,652.66	412,093.09
Percentage of Total	3.40	3.38
Employment Generated		
Puerto Rico	318,493	286,237
Caribbean Basin	14,876	13,363
Percentage of Total	4.67	4.67
Wage Income Generated (in thousand $)		
Puerto Rico	1,532,247.12	1,406,938.63
Caribbean Basin	59,198.32	55,580.03
Percentage of Total	3.86	3.95

Table 14

Output, Employment and Income per dollar unit of exports (1967=100)

	Export of Goods and Services	Exports of Manufacture
Output Per Unit of Exports		
Puerto Rico	1.38	1.38
Caribbean Basin	1.36	1.36
Employment Per Million Dollar of Exports		
Puerto Rico	34	32
Caribbean Basin	46	44
Wage Per Million Dollar of Exports		
Puerto Rico	165,700	158,984
Caribbean Basin	184,232	183,117

The above results are further corroborated by the estimates of the labor content of exports. Labor content of one million dollars' worth of exports of goods and services to the countries in the Caribbean Basin amounted to 57.35 compared to only 29.15 for exports to the rest of the world (Table 15). An analysis by industrial sector shows that industries exporting goods and services to the Caribbean region are more labor intensive than those exporting goods to the rest of the world. One of those industries is agriculture, which exported 5% of total exports of goods and services to these countries. This is a reflection of the role of intermediate sectors such as wholesale trade and transportaton play in this trade.

Table 15
Labor Content of Exports: Total for Puerto Rico and the Caribbena Countries

	Labor Content
Exports of Goods and Services	
Puerto Rico	29.15
Caribbean Basin	57.35
Exports of Manufactured Goods	
Puerto Rico	34.49
Caribbean Basin	53.62

6. Summary and Conclussions

The trade liberalization implemented over the past few years has had an important role in the economic transformation of the region. Together with these processes there is the new regionalism, the development of new regional and sub-regional trade integration schemes which are facilitating significantly the flow of goods, services and investment. In this context, the Puerto Rican economy face several challenges to its economic future and growth: 1) the competition of the more developed economies in the region as they become more attractive for investment; 2) a significant reduction in preferential access to the US market; 3) competitiveness of its exports of goods, and 4) how to increase tke linkages of export production with the rest of the economy.

The opening of the regional markets to US products and to external investment is considerable. By the same token, there is the further opening of the US market, Puerto Rico's main market, to the production of countries which are actual or potential competitors in the

same market of products which are still important for Puerto Rico. This preferential access to the US market, which it had maintained until recently and gave the Puerto Rican economy a competitive edge, will continue to decline.

The competitiveness of exports is another consideration, specifically, of those goods or commodities that are still important in terms of local production and employment such as apparel, and electrical and electronic products, given their importance in the economy, as analyzed previously. But exports could be considered as a reflection of the economy's competitiveness. Puerto Rico is not alone in this problem and how to reconcile it with the new dynamics of the international economy. For instance, competition from low-cost producers in the region, specially in labor-intensives industries, represent an element of competition that will intensify as the HFTA, once in full place, will contribute to the expansion of manufacturing production of those economies that are cost-effective producers. There is a clear relationship between the growth of the volume of exports and a reduction in their prices (Dean and Sherwood: 1994). For the Puerto Rican economy the implications are not insignificant, as we saw in Section 3.

In order to improve the competitiveness of its exports, Puerto Rico must recognize, as indeed it already had, that it must expand its productive base besides that of goods to include services so as to take full advantage of opportunities in the markets. The services revolution, particularly of "knowledge-based" services such as professional and technical services have been expanding rapidly in the region.[10] In today's global economy, the

10. For an analysis of the service sector of Puerto Rico and an identification of the sectors with export potential, see " El sector de los servicios: Análisis histórico, impacto inter-sectorial y potencial de exportación," in Puerto Rico Planning Board: 1995 a, Chapter 4.

production process is dispersed throughout the Hemisphere and other parts of the world, one in which each stage of production is done where it is more cost-effective, and where labor costs is not the only criteria used when determining the profitability of investment and production. To some industries, such as the labor-intensive ones, this factor is critical. Nevertheless, if the Caribbean Basin and Mexico compete on the basis of cheap labor, Puerto Rico cannot pretend to compete on the same basis in a free trade scheme where this relative advantage might disappear.[11]

In the same way, the type of industries and of specialization that the economy will adopt within the existing global context acquires particular relevance, since this aspect is very much linked to the structure of exports and their competitive improvement. This might mean a more selective identification of industries on the basis of objective and specific criteria, and which markets or segments the Puerto Rican economy want to target. Specific criteria could be the actual or potential benefit of an industry to increase value added, employment creation sustainability and contribution to local technological development.

The above imply a re-examination of Puerto Rico's present economic linkages with the sub-regions with which it maintains considerable trade relations, such as the Caribbean Basin, as seen previously, with the objective of increasing them. To some of these such as Caricom, trade with Puerto Rico has been increasing in importance. An increase in this intra-regional trade will allow Puerto Rico (and the Caribbean countries too), to develop an integration scheme more wide and profound.

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11. In itself, this factor seems to be loosing its attractiveness as an instrument to attract new external investment, given the reduction of direct labor costs as a percentage of total costs of the firm. See " Cheap labour no longer so vital, says UNIDO," *Third World Economics*: 1996, p. 21.

The findings of section 4 should not be construed as to mean that the economic future for Puerto Rico, in the context of hemispheric trade integration and further expansion of exports in terms of employment and income, is limited. Obviously, given the structural changes that took place in the manufacturing sector during the period examined, the possibilities of exports of manufactured goods to expand or generate more employment diminished as productivity increased. It is important in this analysis to keep in mind the difference between direct and indirect employment, particularly with the above conclussions. Direct employment did not increased as a result of the type of manufacturing industries which developed more over time compared to others, in which capital and technology dominate, thus resulting in the productivity increases mentioned before.

Indirect employment is more important given the backward linkages it implies with the rest of the economy. It is this type of employment which increased more over time acquiring more importance, as shown with respect to the service sector. This sector is one type of industry which has the potential to increase indirect employment. Finally, as the analysis in section 4 shows, those industries which have greater backward linkages potential with the rest of the economy will contribute more to employment generation.

APPENDIX

The Model

The following equations describe the input-output models (from 1967 to 1994) developed, to estimate the impact of exports and final demand on the Puerto Rican economy.

1. $\mathbf{(I-A)^{-1} Ex = X_{Ex}}$

2. $\mathbf{(I-A)^{-1} F_d = X_{Fd}}$

3. $\mathbf{(I-A)^{-1} E_{mg} = X_{mg}}$

where:

A = a matrix of 93 by 93 known as "direct domestic coefficient matrix"

I = Identity Matrix,

Ex = Exports of goods and services

F_d = Final Demand vectors for the total economy

X_{ex} = Gross Output generated by exports

X_{fd} = Gross Output generated by final demand

E_{mg} = Exports of manufactured goods

X_{mg} = Output generated by exports of manufactured goods

$(I-A)^{-1}$ = Direct and indirect coefficient matrix better known as "Leontief"s inverse".

4. E/X = L

4-a. X * L = E

where:

E = vector of Employment flows (93 industries)

X = vector of gross output as defined in the input-output methodology

e = vector of employment coefficients (employees per million dollar of output)

5. S/X = W

5-a. $\mathbf{X * W = S}$

where:

S = vector of wages and salaries

X = the same as defined above

W = row vector income coefficients

Equations 4-a and 5-a are used together with the solution of the models (X vectors), to obtain employment and income flows respectively.

6. L((I-A) = N

7. L((I-A)$^{-1}$Ex*

where (I-A)$^{-1}$ and L are defined as above, Ex* is a column vector equal to one million dollar of exports and N is a row vector of direct and indirect employment coefficients.

Table A

INCOME GENERATED BY EXPORTS OF MANUFACTURED GOODS, 1967 - 1994 (in thousand dollars, 1967=100)

Sector Industrial	1967	1972	1977	1982	1987	1994
Sugar Cane	30,303	5,737	10,433	10,284	9,815	22,172
Other Agriculture, Forestry & Fishing	3,674	5,952	5,113	4,506	6,414	4,520
Mining	525	1,221	475	184	913	1,146
Construction	1,703	2,179	4,221	4,141	6,060	8,466
Meat and Meat Products	76	72	779	375	991	718
Milk and Dairy Products	97	62	253	384	506	326
Canned and Preserved Fruits and Vegetables	445	441	946	731	3,287	1,752
Grain MillProducts	287	2,074	1,010	820	1,025	868

Bakery Products	140	1,753	506	354	243	246
Sugar Mills, Refineries & Confectionery	16,412	4,244	5,916	9,797	12,334	17,559
Beer, Malt and Alcoholic Beverages	4,964	8,331	7,054	6,512	4,409	1,792
Bottled and Canned Soft Drinks	504	2,455	1,673	5,431	11,083	10,696
Miscellaneous Food Products	7,575	13,749	14,838	17,897	27,545	18,603
Tobacco Products	17,372	13,374	8,550	5,049	1,884	3,131
Textile Mill Products and Apparel	91,073	97,678	62,361	93,636	74,054	144,801
Furniture, Lumber, and Wood Products	1,101	1,363	674	1,520	1,111	1,491
Paper and Allied Products	2,276	2,683	2,031	2,861	4,150	5,796
Printing and Publishing	2,398	3,071	4,517	5,318	7,213	14,823
Petrochemicals	5,259	24,305	28,445	19,322	3,240	3,108
Drugs and Pharmaceutical Preparations	3,746	14,527	46,786	75,448	109,187	156,573
Other Chemical Products	1,165	2,178	6,492	8,811	10,140	49,304
Petroleum Refining	6,352	8,097	5,701	5,522	2,595	2,034
Other Petroleum Products	461	1,183	7,873	1,721	1,056	7,856
Rubber and Plastic products	7,078	7,197	8,935	11,310	13,827	15,006
Leather and Leather Products	18,510	13,690	6,272	11,514	12,433	16,317
Stone, Clay, Glass and Concrete Products	6,071	9,507	6,613	9,107	10,464	14,542
Primary Metal Products	2,399	2,888	2,786	2,494	2,526	2,441
Fabricated Metal Products	5,472	8,390	7,245	6,820	9,944	22,577
Machinery, Except Electrical	4,809	5,146	9,979	37,446	33,104	21,780
Electrical and Electronic Machinery	18,297	37,982	41,001	80,829	108,837	165,979
Transportation Equipment	585	468	1,350	2,184	1,461	793
Professional and Scientific Instruments	10,109	15,672	23,610	52,555	68,904	86,179
Miscellaneous Manufacturing Industries	7,080	9,535	5,313	13,792	13,034	10,049
Transportation	6,191	7,948	5,712	11,942	11,120	19,156
Communications	4,637	6,691	6,345	11,959	17,305	24,922
Electricity and Irrigation services	4,159	5,523	13,376	11,812	14,377	21,199
Water and Sewerage Services	629	314	1,249	3,384	2,981	5,485
Wholesale and Retail trade	9,397	18,656	14,731	29,572	75,787	124,907
Finances	3,623	5,154	6,725	22,427	29,971	33,278
Insurance	1,409	2,594	5,932	4,753	6,061	8,610
Real Estate	742	1,294	1,557	1,503	2,066	3,181
Hotels	2	2	3,333	4,678	4,279	7,492
Personal Services	22	371	93	50	35	49
Business Services	3,862	6,608	38,337	110,632	43,542	56,592
Repair Services, Car Rental and Parking	807	956	2,844	31,091	7,778	9,236
Amusement and Recreation	197	487	421	749	1,465	2,172
Medical and Hospital Services	59	19	164	114	347	562
Other Services	21,518	7,187	12,530	16,454	25,760	37,847
Commonwealth Government	3,891	2,439	3,859	1,896	6,508	8,830
Municipal Goverment	44	49	272	85	538	983
Federal Government	2,119	2,097	6,076	2,760	5,507	8,963
Total	**341,629**	**395,594**	**463,306**	**774,536**	**829,214**	**1,206,911**

Table B

OUTPUT GENERATED BY EXPORTS OF MANUFACTURES GOODS, 1967 - 1994 (in thousand dollars, 1967=100)

Industrial Sector	**1967**	**1972**	**1977**	**1982**	**1987**	**1994**
Sugar Cane	58,019	8,583	11,300	6,377	4,171	5,550
Other Agriculture, Forestry & Fishing	23,832	45,835	32,867	27,073	39,400	27,240
Mining	2,206	5,670	1,812	812	6,271	9,350
Construction	5,868	7,533	17,560	18,421	37,245	63,720
Meat and Meat Products	3,350	2,460	19,836	6,984	19,432	10,630
Milk and Dairy Products	774	465	2,907	5,286	6,151	4,590
Canned and Preserved Fruits and Vegetables	4,561	4,481	9,527	6,603	24,668	11,790
Grain MillProducts	6,113	29,242	23,973	16,160	13,861	10,020

Table B

Bakery Products	670	12,320	2,077	1,470	1,180	1,200
Sugar Mills, Refineries & Confectionery	123,846	21,721	48,068	78,559	76,568	101,810
Beer, Malt and Alcoholic Beverages	86,291	138,616	86,894	175,244	105,500	55,440
Bottled and Canned Soft Drinks	2,826	20,956	16,260	82,221	434,218	827,610
Miscellaneous Food Products	68,738	130,362	135,847	161,157	206,110	130,110
Tobacco Products	94,038	123,512	73,645	44,368	16,238	31,750
Textile Mill Products and Apparel	318,814	399,952	239,206	399,716	329,997	702,130
Furniture, Lumber, and Wood Products	4,192	4,302	2,559	5,918	4,739	6,620
Paper and Allied Products	12,004	13,747	27,126	25,186	35,586	58,930
Printing and Publishing	6,367	9,761	15,685	20,229	25,774	58,770
Petrochemicals	44,528	248,846	582,245	325,152	39,938	43,690
Drugs and Pharmaceutical Preparations	56,801	242,007	825,516	1,582,759	1,973,027	3,008,380
Other Chemical Products	8,019	25,276	88,286	126,241	101,309	561,170
Petroleum Refining	130,021	197,642	353,005	223,615	102,227	100,780
Other Petroleum Products	8,527	18,130	254,328	23,779	10,564	63,360
Rubber and Plastic products	21,560	31,302	44,214	73,306	89,220	125,920
Leather and Leather Products	76,779	45,555	34,156	56,296	73,393	108,980
Stone, Clay, Glass and Concrete Products	25,370	38,243	33,806	46,016	54,062	80,920
Primary Metal Products	10,950	11,114	16,071	11,215	29,178	39,030
Fabricated Metal Products	30,784	48,753	43,534	43,353	60,324	140,630
Machinery, Except Electrical	12,297	28,953	85,091	315,191	376,634	417,850
Electrical and Electronic Machinery	98,089	195,985	321,513	738,916	1,182,509	2,309,180
Transportation Equipment	2,332	2,680	5,496	14,764	9,585	6,200
Professional and Scientific Instruments	43,983	65,275	152,754	388,569	539,740	829,300
Miscellaneous Manufacturing Industries	33,438	56,106	34,535	123,269	85,156	73,550
Transportation	24,829	27,044	32,941	54,517	47,638	83,980
Communications	14,020	29,036	29,725	73,634	101,731	184,900
Electricity and Irrigation services	13,200	30,610	59,922	61,541	70,103	120,130
Water and Sewerage Services	1,706	604	2,287	6,045	6,875	11,950
Wholesale and Retail trade	31,803	58,047	47,052	97,116	270,662	454,570
Finances	8,233	16,061	19,074	74,988	212,433	351,240
Insurance	3,146	4,780	20,893	16,368	25,980	46,370
Real Estate	12,313	23,449	33,139	36,892	47,814	82,730
Hotels	5	3	6,776	20,448	9,557	16,410
Personal Services	88	1,127	270	392	248	420
Business Services	11,439	10,556	70,632	175,662	288,828	497,810
Repair Services, Car Rental and Parking	3,303	3,991	13,388	84,460	93,409	161,700
Amusement and Recreation	738	2,115	2,049	3,881	8,609	14,940
Medical and Hospital Services	181	52	470	393	1,203	2,040
Other Services	33,179	15,252	24,708	34,835	67,326	118,980
Commonwealth Government	5,955	2,791	5,742	3,471	12,575	18,510
Municipal Goverment	95	81	359	147	979	1,690
Federal Goverment	3,270	3,012	10,168	4,258	8,697	1,427
Total	**1,593,493**	**2,463,995**	**4,021,296**	**5,923,275**	**7,388,643**	**12,208,840**

Table C
Exports to the Caribbean Basin, and share in total exports, 1994 (in millions of dollars)

Industrial Sector	Total*	Caribbean*	Share of Caribbean in Total
Sugar Cane	0.0	0.0	
Other Agriculture, Forestry & Fishing (SIC 01- 09)	85.9	33.3	38.77%
Mining** (SIC 10 - 14)	62.5	5.3	8.48%

Meat and Meat Products (SIC 201)	8.7	4.3	49.43%
Milk and Dairy Products (SIC 202)	5.2	2.7	51.92%
Canned and Preserved Fruits and Vegetables (SIC 203)	32.1	5.6	17.45%
Grain MillProducts (SIC 204)	41.8	12.8	30.62%
Bakery Products (SIC 205)	3.1	0.9	29.03%
Sugar Mills, Refineries & Confectionery (SIC 206;207)	136.2	3.3	2.42%
Beer, Malt and Alcoholic Beverages (SIC 2084;2085)	138.6	2.6	1.88%
Bottled and Canned Soft Drinks (SIC 2086;2087)	2,059.5	56.0	2.72%
Miscellaneous Food Products	477.2	10.7	2.24%
Tobacco Products	105.8	24.9	23.53%
Textile Mill Products and Apparel	838.8	100.4	11.97%
Furniture, Lumber, and Wood Products	31.8	11.8	37.11%
Paper and Allied Products	71.8	11.8	16.43%
Printing and Publishing	60.1	26.7	44.43%
Petrochemicals (SIC 281;282)	111.0	21.4	19.28%
Drugs and Pharmaceutical Preparations (SIC 283)	7,987.7	26.7	0.33%
Other Chemical Products (SIC 284-289)	2,069.6	18.2	0.88%
Petroleum Refining (SIC 2911)	135.2	18.0	13.31%
Other Petroleum Products (SIC 295-299)	160.2	12.5	7.80%
Rubber and Plastic products	148.8	28.0	18.82%
Leather and Leather Products	380.7	61.8	16.23%
Stone, Clay, Glass and Concrete Products	71.4	3.9	5.46%
Primary Metal Products	76.0	5.4	7.11%
Fabricated Metal Products	290.9	16.8	5.78%
Machinery, Except Electrical	1,938.7	42.8	2.21%
Electrical and Electronic Machinery	2,265.2	117.8	5.20%
Transportation Equipment	73.4	32.3	44.01%
Professional and Scientific Instruments	1,690.4	114.4	6.77%
Miscellaneous Manufacturing Industries	166.9	14.7	8.81%
Total:	**21,725.2**	**847.8**	**3.90%**

* Excluding returned or unclassified merchandise.

** Include crude petroleum and natural gas.

Source: Puerto Rico Planning Board, Bureau of Economic Analysis.

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