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FOREIGN INVESTMENT, TECHNOLOGY TRANSFER AND STRUCTURAL CHANGE IN GREECE: 1958–1970

Yannis M. IOANNIDES

ABSTRACT: This essay analyzes the inflow of foreign direct investment in thirty-six two-digit sectors of the Greek economy during 1961–1970 and discusses its correlation with structural change, as measured on the basis of input-output tables for the years 1958 and 1970. Conclusions are drawn about linkages and about the overall impact of foreign technology transfer.

I. INTRODUCTION

Foreign direct investment in developing countries has traditionally been considered as a vehicle for transferring to developing countries not only savings but advanced foreign technology, as well. Since modern technology is quite often of the embodied type it makes sense for countries to encourage such forms of technology transfer. For foreign investment to take place it must be profitable. Profitability could, in turn, depend on the general environment provided by development policy. It is, however, quite difficult to evaluate the performance on that account of specific policy measures which governments might take in order to facilitate the inflow of foreign investment. It is to this difficulty that the paper addresses itself using the experience of Greece as a case study. In the absence of detailed information at the level of the firm we argue that some information about the structural impact of technology transfer may be obtained by correlating the presence of foreign investment with aggregate sectoral measures of structural change.

Over the study period, 1958 to 1970, the Greek economy developed at a fairly fast pace, which was not associated with extensive structural change. The role of foreign capital in this development experience has been a controversial political issue. The proponents of favorable treatment of foreign investments have argued that foreign capital is indispensable for rapid industrialization not so much because it constitutes a transfer of foreign savings—domestic savings have been plentiful for most of the time since the 1950's—but primarily because it would act as a vehicle of technological change and also help close a chronic gap in the balance of payments. There is evidence[1] in support of the technology transfer argument: a large component of technical progress in the Greek industry is

[1] See Lianos (1976) and references therein.

"imported" by being embodied in foreign-made capital goods. A set of protective measures for foreign direct investment, known as Law 2687/1953,[2] were enacted in 1953 and provided for a screening procedure of proposed investment projects to ensure that certain important goals of national economic policy were met and that domestic interests were safeguarded. The critics of such favorable treatment have argued, on the other hand, that such treatment to foreign investment would distort the process of economic development and lead to the capture by foreign capital of the dynamic sectors of the Greek ecnomy.

We do not take sides in this controversy and instead try in this paper to provide a quantitative background for some of these issues. To be sure, such a background could be provided by an ex-post evaluation of certain representative projects. An effort in this direction by Ganiatsos (1971) shows that not all projects could stand up under close scrutiny.[3] Unfortunately, the lack of appropriate data prevents us from conducting such a study which would give an integrated view of the impact of foreign investment. An alternative approach would be to examine a number of statistical hypotheses relating the presence of foreign investments to payments for profit repatriation, interest and depreciation, to transfer pricing, to import substitution and export performance, etc., under the light of sectoral data. Such a study has been carried out by Roumeliotis (1975). His provisional results show that the substantial improvement over 1963–1970 in export performance of certain sectors, such as chemicals, nonmetallic minerals, basic metallurgicals, machinery, electrical appliances and manufacturing of transport equipment may be attributed (through regression analysis) to the presence of foreign investment and the reduction in unit labor costs. Yet, the presence of foreign investment does not seem to be strongly correlated with import substitution and the increase in exports, on the other hand, occurs at a rate which is slower than the rate of increase of foreign investments. Furthermore, Roumeliotis's regressions show that sectors with strong presence of foreign investment (chemicals, nonmetallic

[2] Law 2687/1953 was enacted in 1953 and was upheld by the 1975 Constitution but would have to be amended during the course of Greece's proposed accession to the European Economic Community. This law provides constitutional guarantees to a number of protective measures for qualified foreign investment projects. Proposals by investors were screened with respect to, among others, use of domestic primary and intermediate inputs, impact on competing Greek firms, magnitude of external economies created, contributions to regional development goals and, none the least, technology transfer. All qualified projects were ensured of profit repatriation, etc., but some were, in addition, granted some monopolistic privileges.

[3] Ganiatsos (1971) employs the Little-Mirrlees procedure to evaluate three large-scale investment projects, Pechiney, Esso-Pappas and Hellenic Shipyards which were the most important during the 1953–1965 period. He shows that two of them resulted in net welfare loss for the economy not only because of socially costly privileges and subsidies but because of the high import content of domestically produced intermediate inputs (*e.g.*, energy) as well. The impact of the Hellenic Shipyards project was positive primarily because of a large increase in employment of a kind which carried many positive externalities. In addition to these Ganiatsos also performs a microeconomic analysis of foreign firms and analyzes in depth both the entire incentive structure which promoted foreign investment over the period 1953–1965 and the effect of this structure in facilitating such investment.

minerals, basic metallurgicals, machinery, electrical appliances, and manufacturing of transport equipment) register great increase of production, which is correlated with improvements in unit labor costs as well as employment.[4] The problem of technology transfer is not taken up directly, while the impact of transfer pricing on the balance of payments is addressed by Roumeliotis, *et al.* (1976). Another study aiming at the same issues but employing a primarily institutional approach is reported by Yiannitsis (1974). That study uses an interesting synthesis of data from various formal and informal sources and examines, in addition to the above mentioned questions, the correlation between the presence of foreign capital and changes in industrial concentration in manufacturing.

While these studies are interesting, they fail to give an overall vew of the impact of foreign investment on technology transfer and structural change. An appraisal of the impact of technology transfer would require an assessment of the component of productivity improvements which may be directly and indirectly attributed to imported technology. This, however, is quite difficult for two reasons: First, data on individual firms which adopt imported technology are not available in sufficient scale and certainly not in the case of Greece. Second, the indirect effects from productivity improvements and cost reductions which spread out in the entire economy and result from the introduction of foreign advanced technology are very difficult to estimate. Productivity improvements in some sectors may induce in other sectors substitution to previously infeasible or unprofitable methods of production. The diffusion and spread of the benefits from the introduction of new technology and resulting overall level of welfare benefits is a function of sectoral interdependence. In addition, the form of market structure—whether monopolistic or oligopolistic conditions are prevalent in different industrial sectors—may also affect the diffusion of benefits. Correlations of the appropriately weighted sectoral presence of foreign investment with structural parameters, which describe sectoral interdependence and aggregate productivity and are based on an aggregate description of the economy (such as the one provided by an input-output model) may throw some light on the potential indirect effects of technology transfer, which is supposed to accompany foreign investment. Such correlations comprise the main idea of this study.

The remainder of this paper is organized as follows: First, we present the data on the sectoral distribution of foreign investment. Second, we discuss the possibilities input-output models offer in describing structural change. And, third, we discuss our results with Greek data and their implications for economic development.

[4] It should be emphasized, however, that a correlation between labor productivity and presence of foreign capital does not necessarily imply that higher productivity is due to foreign capital. An important explanatory variable for labor productivity is the great capital intensity which characterizes manufacturing sectors and in particular those which seem to attract foreign capital.

II. FOREIGN INVESTMENT, STRUCTURAL CHANGE AND TECHNOLOGY TRANSFER

Foreign Investment

This study restricts itself to foreign direct investments undertaken under the protection of Law 2687/1953 during the period 1961–1970. Total annual capital inflow, in current and constant 1958 prices, classified according to the thirty-six sectors of the input-output tables of the Greek economy,[5] are given in Table 1, Column 1. The relative sectoral distribution of foreign investment indicates that it is primarily concentrated in some sectors. In particular, the percentage distribution of total investment over the period 1961–1970 in each sector (Column 2 of Table 1) shows that the following ten sectors received 82.9 percent of the total (the respective shares are given in parentheses): Petroleum Products (17.5%), Basic Metallurgicals (13%), Manufacturing of Transport Equipment (9.7%), Other Chemicals (7.4%), Transport and Storage (5%), Rubber Products (4.3%), Mining (3.6%), Cement (3.5%) and Other Nonmetallic Minerals (1.7%).

In manufacturing alone, total foreign investment over the study period comprised a 19.8 percent of total investment in major industrial establishments. The shares by sector are given in Column 3 of Table 1.[6] In addition, total foreign investment may be compared with total fixed capital in major establishments[7] for each manufacturing sector [Ioannides (1976b), T. 6]. For the manufacturing sectors among the ten most important—from the point of view of foreign investment—sectors the total (for the period 1961–1970) gross foreign investment as a percentage of total fixed capital of major establishments in 1970 is: Petroleum Products, 62.3%; Basic and Other Chemicals, 62.3%; Basic Metallurgicals, 18.1%; Manufacturing of Transport Equipment, 46.2%; Products from Rubber and Plastics, 24.5%; Cement, Glass and Other Nonmetallic Minerals, 11.6%. The percentage for the entire manufacturing was 20.2%.

Finally, it is worth noting that labor productivity in these ten sectors varies substantially. For example, if value added per employee (as measured from the input-output tables) is used as a measure of labor productivity Petroleum Products, Basic Metallurgicals and Cement rank very high while Rubber Products,

[5] The input-output tables are from Mylonas (1973), for 1958, and from Center for Planning and Economic Research (1977), for 1970. The foreign investment data are discussed in greater detail in Ioannides (1976b), which may be requested from the author. The processing of the original data files was carried out by Lilly Charitonidou and Aphrodite Matthaiou, of the staff of the Secretariat of the Commission for the Control of Prices of Imports and Exports, and I would like to thank them for their assistance.

[6] Some sectors were pooled because the data on total investment are available only for twenty two-digit manufacturing sectors.

[7] According to the National Statistical Service of Greece major establishments are those with ten or more employees. Unpublished capital stock series were kindly supplied by Professor Andreas Kintis of the Athens School of Economics and Business. These data do not include expenditures for land acquisition.

Other Nonmetallic Minerals, and Manufacturing of Transport Equipment rank low.[8]

These percentages are only a proxy for the multitude of effects from the presence of foreign investment and thus do not reflect a number of important quantifiable dimensions, such as differences in capital intensity of production among the various sectors and differences in market shares. Other dimensions of the impact of foreign investment, such as technological and growth potential of the various sectors in which foreign investments are present, may not be quantifiable at all but are important nonetheless.

The Input-Output Framework

Estimates of various indices of structural change which are based on input-output models have been used in the literature ever since the original work by Chenery and Watanabe (1959). We present below first a brief theoretical framework for such measures and then we proceed to discuss specific indices of structural and technological change.

Let X_i, F_i, M_i, VA_i and T_i stand for gross value of production, final demand (including exports), imports, value-added in the sector and taxes minus subsidies, respectively for the i^{th} sector, and let X_{ij} denote the purchases by the j^{th} sector from the i^{th} sector. The defining equations may then be written as:

$$X_j = \sum_{i=1}^{N} X_{ij} + VA_j + M_j + T_j \,, \qquad j = 1, \cdots, N; \tag{1}$$

$$X_i = \sum_{j=1}^{N} X_{ij} + F_i \,, \qquad i = 1, \cdots, N \,. \tag{2}$$

Let $a_{ij} = X_{ij}/X_j$ and write $A = [a_{ij}]$, the Leontief matrix. Equation (2) thus yields:

$$X = [I - A]^{-1} F \,, \tag{3}$$

and the Leontief inverse may be computed from the existing data.

A total differentiation of (3) yields:

$$\mathrm{d}X = [I - A]^{-1}\mathrm{d}F + [I - A]^{-1}\mathrm{d}A[I - A]^{-1}\mathrm{F} \,. \tag{4}$$

The first term of the right-hand side of (4) gives the changes in gross value of production of each sector which would result from a change in final demand $\mathrm{d}F$ and the second term gives the changes to gross value of production of each sector which are due to changes in the technological coefficients $\mathrm{d}A$.

The input-output model allows us to compute the total content of final demand in primary factors and imports. If the row vector β stands for the direct content in some factor per unit of product in each sector the total content is given by the row vector B:

[8] More details may be found in Ioannides (1976b), Tables 8, 9 and 10.

TABLE 1. FOREIGN INVESTMENT AND SECTORAL MEASURES OF STRUCTURAL CHANGE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Total foreign investment, 1961–1970 (million drs, 1958 prices)	Sectoral distribution of total foreign investment (%)	Foreign investment as a % share in total sectoral investment, 1958–1970 (manufacturing)	Total labor coefficients, 1958	Total labor coefficients, 1970	Value added per employee, 1958 (thousand drs)	Value added per employee, 1970 (thousand drs)	Total value added coefficients, 1958	Total value added coefficients, 1970	Index of backward linkages, 1958	Index of backward linkages, 1970	Total import coefficients, 1958	Total import coefficients, 1970	Total productivity change, 1958–1970 (column sums of $[I-A]^{-1}\,dA[I-A]^{-1}$)
1. Agriculture	79.6	1.3	—	.52	.54	15	33	.87	.88	1.37	1.41	.09	.09	−1.159
2. Mining	257.3	3.6	—	.43	.27	69	152	.70	.49	1.38	1.22	.20	.44	.391
3. Foodstuffs	65.0	0.9	1.5	.40	.35	47	84.1	.73	.70	2.17	2.04	.19	.20	−.241
4. Beverages	26.2	0.4	2.6	.30	.26	96	138	.75	.68	2.11	1.86	.08	.11	−.054
5. Tobacco	43.5	0.6	3.1	.36	.22	67	110	.60	.43	1.65	1.62	.05	.04	.073
6. Textiles	79.8	1.1	1.7	.34	.25	49	65	.63	.64	2.03	1.81	.31	.22	.113
7. Footwear	0.0	0.0	5.3	.37	.27	23	40	.85	.75	2.11	2.20	.10	.18	.069
8. Clothing	22.3	0.3	5.3	.31	.25	75	42	.76	.72	2.26	2.31	.20	.16	−.131
9. Wood and cork	49.7	0.7	8.5	.20	.19	25.0	101	.51	.57	1.63	1.54	.39	.28	−.269
10. Furniture	5.2	0.0	2.2	.31	.22	30	47	.76	.76	1.86	1.74	.18	.14	.016
11. Paper	116.1	1.6	8.7	.18	.15	66	108	.33	.38	1.65	1.73	.53	.43	.060
12. Printing and publishing	2.2	0.0	.5	.36	.28	69	94	.74	.69	1.70	1.71	.21	.20	.191
13. Leather	4.2	0.0	2.7	.37	.23	45.0	67	.73	.59	2.32	2.03	.18	.32	.142
14. Rubber products	305.4	4.3	22.8	.18	.16	62.0	77	.40	.37	1.47	1.50	.47	.43	−.067
15. Plastics	36.5	0.0	22.8	.28	.24	157	129	.61	.71	1.78	1.69	.30	.18	.132
16. Basic chemicals	1144	17.2	65.6	.19	.15	74	160	.34	.42	1.51	1.54	.58	.42	−.188
17. Other chemicals	525	7.4	65.6	.19	.13	73	237	.41	.35	1.64	1.44	.43	.44	−.074
18. Products of petroleum and coal	1252	17.5	65.6	.01	.07	1620	661	.01	.21	1.03	1.32	.58	.26	−.095
19. Cement	356.7	3.5	12.0	.25	.19	289	383	.62	.72	1.67	1.65	.21	.12	.019

20. Glass and glass products	61.2	0.6	12.0	.19	.18	273	164	.61	.51	1.31	1.38	.25	.31	.047
21. Other non-metallic minerals	173.5	1.7	12.0	.42	.28	39	16	.63	.64	1.59	1.57	.25	.24	−.048
22. Basic metallurgical	1337.8	13.0	15.1	.07	.12	195	549	.16	.48	1.30	1.54	.70	.39	−.002
23. Metal products	140.7	1.4	6.5	.22	.16	37	76	.42	.47	1.66	1.69	.44	.42	−.148
24. Machinery, excluding el. appl. and transport.	7.7	0.0	1.2	.10	.07	79	77	.17	.17	1.16	1.19	.77	.72	.121
25. Electrical appliances	261.3	2.7	16.3	.15	.15	87	112	.29	.39	1.36	1.63	.53	.41	.186
26. Manufacturing of transport equipment	890.6	9.7	35.0	.09	.23	59	80	.14	.40	1.12	1.42	.80	.47	.174
27. Other industry	16.5	1.6	8.6	.12	.12	47	5	.28	.33	1.30	1.29	.54	.47	−.056
28. Construction	158.3	1.6	—	.45	.33	49	96	.74	.72	1.81	1.79	.18	.15	−.010
29. Electricity, etc.		0.0	—	.41	.28	108	225	.77	.84	1.55	1.32	.15	.07	.054
30. Transport and storage	429.5	5.0	—	.45	.35	92	199	.79	.70	1.43	1.48	.16	.13	.174
31. Communications		0.0	—	.68	.48	98	180	.95	.89	1.22	1.10	.04	.04	−.037
32. Commerce	114.5	1.4	—	.20	.18	67	96	.88	.85	1.36	1.33	.07	.06	−.123
33. Banking and insurance	125.1	1.5	—	.60	.47	144	229	.91	.78	1.11	1.23	.02	.09	.522
34. Other services	49.2	0.5	—	.33	.23	94	129	.87	.84	1.27	1.17	.06	.05	.156
35. Dwellings		0.0	—	.00	.01	14766	12952	.96	.98	1.01	1.07	.00	.01	.0
36. Public services		0.0	—	.95	.87	104	137	1.00	.94	1.00	1.00	.00	.06	−.061

$$B=\beta[I-A]^{-1}\,. \tag{5}$$

Indices of Technical and Structural Change

The input-output model could, in principle, be used like any production function to study technical change. We cannot, however, proceed very far in this direction because, first, the necessary framework is not well developed[9] and second, we do not have price data to supplement our input-output data in value terms. The only alternatives left to us are the use of total factor content coefficients and of the dominant (Perron-Frobenius) root of the Leontief matrix.

The total factor content is obtained by using equation (5). Changes over time in, say, the total content in labor and in capital of the product of each sector (which are referred to in the sequel as total labor and capital coefficients, respectively) are indicative of the direction of economic development as long as the actual sectors of the economy are comparable. Furthermore, the interpretation of total labor coefficients as employment multipliers provides a useful perspective on the impact on employment from the growth of certain sectors.

The dominant root of A, $\Lambda(A)$, may be taken as an aggregate productivity characteristics of the Leontief matrix and may be interpreted as the supremum of the minimum (among all sectors) ratio of intermediate demand to total supply. Decrease of $\Lambda(A)$ over time implies that it is easier to satisfy a given level of final demand and thus the entire system has become more productive. In this sense, $\Lambda(A)$ may be interpreted as an aggregate productivity measure.

The increase in gross value of production of each sector which would be required to meet a marginal unit increase in the final demand of any sector, with technology held constant, may be computed by using (4). The total increase in the gross value of production which would be required to satisfy a unit marginal increase in final demand for the product of the j^{th} sector is equal to the sum of the elements of the j^{th} column of the Leontief inverse and is known in the literature as index of backward linkages.[10]

The index of backward linkages may be used to rank the various sectors of the economy. To the extent that the presence of foreign investment in some sector denotes technological improvement, such presence in sectors with high backward linkages would be desirable, because that would ensure a more extensive diffusion of the benefits from technological improvements. This measure contains a double counting of intermediate inputs, but the latter's importance in the transmission of technological progress has been noted recently in the literature [Starr (1974)]. Furthermore, an interesting measure of structural change is obtained by measuring the correlation between the change from 1958 to 1970 in the rankings of the

[9] See Ioannides (1976a) for a preliminary discussion of a theoretical framework.

[10] For further explanations see Ioannides (1976b), p. 42 and Panayotopoulos (1976) and for a recent application see Laumas (1975). The welfare significance of the index of backward linkages is explained further in Ioannides (1976a).

sectors of the economy and the sectoral presence of foreign investment.

Equation (4) gives the total change in the volume of production which is caused by changes in technological coefficients provided that the same vector of final demand is satisfied. As a result, the sum of the elements of the j^{th} column of $[I-A]^{-1}\ \mathrm{d}A[I-A]^{-1}$ may be interpreted as the change in gross value of production per unit of final demand from sector j. Correlating this measure with the sectoral presence of foreign investment yields an index of the technological impact of foreign investment.

Empirical Results for Technical Change, Structural Change, and Foreign Investment

The empirical results which are obtained by following the above theoretical framework are presented here. First, the results for the aggregate productivity characteristic, the dominant root of the Leontief matrix, are as follows:

$$\Lambda_{58}=0.3243\,, \qquad \Lambda_{70}=0.3211\,.$$

There seems to be minor improvement. Such a small difference between 1958 and 1970 may, however, be due to the way in which the available input-output tables treat imports.[11]

All the results pertaining to the study of structural change in conjunction with the presence of foreign investment are presented in Table 1. For all thirty-six sectors (according to the classification of the input-output tables) each column may be defined as follows: We have already talked about Columns 1, 2 and 3. Columns 4 and 5 give total labor content coefficients for 1958 and 1970.[12] Columns 6 and 7 contain value added[13] per employee (in thousand drachmas per employee, and current prices) for 1958 and 1970. Columns 10 and 11 give the index of backward linkages for 1958 and 1970, and Columns 12 and 13 give total import coefficient for both of those years. Column 14 gives the change, between 1958 and 1970, in gross value of production per unit of final demand from each sector, namely the sector obtained from summing up the elements of the column vectors of the matrix[14]

$$[I-A_{58}]^{-1}(A_{70}-A_{58})\,[I-A_{58}]^{-1}\,. \tag{5}$$

All correlation coefficients between measures of structural change, on the one

[11] To the extent that significant increases in imports of intermediate products have taken place from 1958 to 1970 then intermediate inputs would be reflected in relatively higher technological coefficients. As a result, the range within which the dominant root (A) may vary is pushed upwards. (According to a well-known theorem the dominant root is contained between the minimum and the maximum of the sums of the elements of the columns of A.)

[12] The elements of the 38th row of the normalized input-output matrix are used as direct labor content coefficients.

[13] The 43rd row of the normalized input-output matrix is used as the vector of value added (value added in factor costs).

[14] If dynamic input-output tables were available a better set of indices of structural change could be obtained. For the possibility offered by the dynamic inverse see Ioannides (1976a).

hand, and total foreign investment over the study period as a proportion of total investment over the same period in major manufacturing establishments (Column 3) are given in Table 2. These results are discussed below.

TABLE 2. CORRELATION BETWEEN PRESENCE OF FOREIGN INVESTMENT AND MEASURES OF STRUCTURAL CHANGE

Structural sectoral measures	Correlation coefficient	
	1958	1970
Total labor coefficients (Column 3 with 4, 5)	−.518	−.465
Percentage decrease in total labor content, 1958–1970	−.468	
Value added per employee (Column 3 with 6, 7)	.507	.499
Total value added coefficients (Column 3 with 8, 9)	−.547	−.483
Index of backward linkages	−.454	
Total import coefficients	.463	.250
Change in total productivity (Column 14), 1958–1970	−.136	

It is observed from Columns 4 and 5 of Table 1 that the total labor coefficients have decreased for all sectors except Agriculture (1), Petroleum Products (18), Basic Metallurgicals (22) and Manufacturing of Transport Equipment (26). For Agriculture[15] the increase is relatively small but for the rest of these sectors it is much larger.

The correlation coefficient between total labor coefficients for each manufacturing sector in 1958 and foreign investment over 1961–1970 as a percentage of fixed capital in each manufacturing sector in 1970 is equal to −.518. That is, the presence of foreign investment is negatively correlated with labor intensity. The correlation coefficient between this same measure of the presence of foreign investment and the total labor coefficients in 1970 is −.465 and between the same measure and the percentage change, from 1958 to 1970, in total labor coefficients for each sector is −.468.

The data show positive correlation between the sectoral presence of foreign investment and value added per employee—a measure of labor porudctivity—in 1970. The correlation between the presence of foreign investment in the various sectors and the total value added coefficients for both 1958 and 1970 is negative, with correlation coefficients −.547 and −.483 respectively.

[15] Since the input-output tables give only total value added for the sector of Agriculture, I made the assumption that labor remuneration, element (38, 1), is equal to 0.6 of value added, element (40, 1). The relative importance of Agriculture makes this a significant assumption.

Using the index of backward linkages to rank the sectors of the Greek economy shows that no major changes in these rankings took place between 1958 and 1970.[16] The Spearman rank correlation coefficient between the rankings for 1958 and 1970 is .914 and the simple correlation coefficient is .916. The correlation between the sectoral foreign investment as a share of total investment (Column 3) and the index of backward linkages for 1958 is negative, −.454—but small. Foreign investment went to sectors characterized by weak backward linkages. The correlation coefficient between the sectoral share of foreign investment (Column 3) and the changes (due to technological change) in gross value of production per unit of final demand from each sector (Column 14) is small, −.136. The sectors of Petroleum Products (18), Basic Chemicals (16), Basic Metallurgicals (32), Manufacturing of Transport Equipment (26), and Transport and Storage (30), (which together received 66% of foreign investment for the entire period) have lower than average indices of beckward linkages for 1958. These sectors and, in addition, Other Chemicals (17) and Rubber Products (14) remain below the average value of the index of backward linkages in 1970, as well. Finally, according to the measure of technological change of Column 14 of Table 1—the change between 1958 and 1970 in gross value of production per unit of final demand for each sector—the sectors of Rubber Products (14), Other Chemicals (17), Petroleum Products (18), Other Non-metaleic Minerals (21), and Basic Metallurgicals (22) show small improvements, the sector of Basic Chemicals (16) shows great improvement and all the remaining ones (except for Cement (19)) show great deterioration.

The results regarding the total import content of the product of various sectors in 1958 and 1970 (given in Columns 12 and 13 of Table 1, respectively) are particularly interesting. A comparison of the elements of Column 12 with the corresponding ones in Column 13 yields the following: Total import content decreases from 1958 to 1970 for all sectors except for Mining (2), Beverages (4), Footwear (7), Leather (13), Banking and Insurance (33) and Public Services (36) for all of which substantial increases are registered. Also for Foostuffs (3) total import content increases slightly and Agriculture (1) remains practically at the same level. The changes are impressive, however, for some of these sectors: For Mining (2) an increase from .20 to .44, for Textiles (6) a decrease from .31 to .22, for Footwear (7) an increase from .10 to .18, for Leather (13) an increase from .18 to .32, for Petroleum Products (18) a decrease from .58 to .22, for Cement (19) a decrease from .21 to .12, for Basic Metallurgicals (22) a decrease from .70 to .39 and for Manufacturing of Transport Equipment (26) a decrease from .80 to .47. The correlation coefficient between the sectoral share of foreign investment and the total import content coefficients for 1958 is equal to .463 and for 1970 is equal to .250. Yet this change may not be construed as a major improvement since the foreign exchange burden also depends on the absolute magnitude of various

[16] For further details see Ioannides (1976b), pp. 42–51, and Panayotopoulos (1976).

sectors and no conclusions regarding structural change may be drawn without a detailed examination of intermediate imports.

III. SUMMARY AND CONCLUSIONS

Ten sectors out of the thirty-six two-digit sectors for which data are available seem to have attracted 82.9% of total foreign investment over the period 1961–1970. These sectors are (with the percentage of total foreign investment received) as follows: Petroleum Products (17.5%), Basic Chemicals (17.2%), Basic Metallurgicals (13%), Manufacturing of Transport quipment (9.7%), Other Chemicals (7.4%), Transport and Storage (5%), Rubber Products (4.3%), Mining (3.6%), Cement (3.5%) and Other Non-metallic Minerals (1.7%). As we noted earlier, the percentages are only indicative of the presence of foreign capital, and do not by any means sum up its significance. The sectoral share of foreign in total investment is negatively correlated with the total labor coefficients (employment multipliers) in 1958 and 1970 and positively correlated with sectoral labor productivity in both of those years. Foreign investment was attracted to sectors which had weak backward linkages with the rest of the economy and high total import coefficients. Finally, the sectoral share of foreign in total investment is very weakly (but negatively) correlated with the change in gross value of production per unit of final demand from each sector—an aggregate measure of productivity change. To the extent that foreign direct investment is associated with technology transfer the above results may be translated in terms of technology transfer. Finally, we may note that, in general, foreign investment in Greece does not seem to have been associated with major structural change.

This study comprises an attempt to study the impact of foreign investment during a period of rapid transformation of the Greek economy and could provide a starting point for an international comparison. Yet lack of data made possible only a partial view on the impact of foreign investment. The particular measures of structural change which were employed could be of use in the design of public policy on foreign investment along with the political and institutional considerations which occupy other analysts.

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