CENTER OF ECONOMIC RESEARCH

LECTURE SERIES

15.

INVESTMENT AND TECHNICAL CHANGE IN GREEK MANUFACTURING

By

G. C. ARCHIBALD

Reader in Economics
The University of Essex

ATHENS, GREECE

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CENTER OF ECONOMIC RESEARCH

The Center of Economic Research in Greece was established in the expectation that it would fulfill three functions: (1) *Basic research on the structure and behaviour of the Greek economy*, (2) *Scientific programming of resource allocation for economic development and*, (3) *Technical-economic training of personnel for key positions in government and industry. Its financial resources have been contributed by the Greek Government, the United States Mission in Greece and the Ford and Rockefeller Foundations. The University of California at Berkeley participates in the process of selection of foreign scholars who join the Center's staff on an annual basis. It also participates in a fellowship program which supports research in Greece by American graduate students, as well as studies for an advanced degree in economics of Greek students in American Universities.*

Fellowships are also provided to young men who have graduated from a Greek University. They join the Center as junior research fellows for a three-year period, during which they assist the senior fellows in their research and participate in seminars given by them.

The Center's main task, naturally, is the carrying out of research on key aspects of the Greek economy and on the fundamental policy problems facing the country in

its effort to develop rapidly in the framework of the European Common Market. This research is carried out by teams under the direction of senior fellows. The results will be published in a Research Monograph Series.

The lectures and seminars included in the Center's program are not only for the benefit of those working for the Center. Economists, scholars and students of economics are also invited to attend and participate in this cultural exchange which, it is hoped, will be carried out in cooperation with institutions of higher learning here and abroad. A Lecture Series and a Training Seminar Series will round off the publications program of the Center.

Another need which the Center has set out to meet is the establishment of a library and a bibliographical service in the economic sciences. Besides its usefulness for the education of the trainees of the Center, this service will be of particular interest to Greek economists in general.

It is contemplated that the Center will exchange information and results with similar Centers in other countries and will participate in joint research efforts with Greek or foreign public and private organizations.

Finally, one should emphasize that this is one more example of Greek-American co-operation, a pooling of human talent, funds and efforts, designed to promote the training of economists and help in meeting Greece's needs in the field of economic development.

The final aim is eminently practical: to help in creating a better life for the Greek people.

GEORGE COUTSOUMARIS, Director

INTRODUCTION

A visitor such as myself, who spends only three months in Greece and is ignorant of the language, is obviously at an absolute disadvantage: ignorance. But mutually advantageous trade depends on comparative advantage and the visitor may have some comparative advantage: virginity and irresponsibility. Virginity may be only another word for ignorance, but I prefer, in the context, to interpret is as freshness of approach. As for irresponsibility, I admit to having taken advantage of a visitor's freedom to be critical without being constructive. In these *Lectures* I shall exploit my comparative advantage vigorously and, in so doing, expose my comparative disadvantage—which must still remain ignorance of the Greek economy.

The visitor finds a country which has obviously been expanding very rapidly, but whose inhabitants are demanding even more rapid progress. The rate of expansion of the manufacturing sector is widely believed to be particularly inadequate. In view of the importance that is attached to this sector, both in recent literature and in hopes for

the future, I have concentrated upon it and offer here, three very brief and inadequate studies, largely in the hope that they may provide a starting point for more serious and detailed work. In this *Lecture* I present two essays, the first on the observed behaviour of investment in manufacturing, 1953 - 63, and the second on technical change in manufacturing, 1951 - 61 (the non-coincidence of dates is due neither to choice nor inattention, but to data problems). A third essay, on «Industrialisation and Capital Requirements in Greece», is appearing in a second *Lecture*.

These *Lectures*, incomplete in themselves, obviously give an inadequate picture of the performance and possibilities of Greek manufacturing. The over-riding question is: where will comparative advantage lie? Although I consider this question in the second *Lecture*, I cannot pretend that I even know how to answer it. There are two other gaps which I should dearly like to fill because of their importance to policy. The first is the relationship between public and private investment: has the heavy public investment of the last decade been conducted at the expense of private investment, particularly in manufacturing, or has it been necessary to fill an *ex ante* gap and avoid serious unemployment? To answer this it is necessary to obtain a better understanding of the behaviour of saving and investment, and particular-

ly of the methods of public finance and the management of the money supply. The second follows from the first: are public and private investment at this moment competitive or complementary? To answer this, we need some way of knowing, more accurately than we do at present, how close Greece may be at any time to her full-capacity ceiling (whether the ceiling is imposed by plant capacity, the labor force, or other considerations). I greatly hope to be able to return to Greece on some future occasion to make some attempt on these questions.

It is the custom to relegate acknowledgements to a footnote where, however sincerely meant, they look a little cursory and are, at any rate, hard to read. My peculiar dependence upon assistance, and the generosity with which my demands have been met, prohibit me from following custom. Without the help of Mr. Constantine Glezakos and Mr. Andreas Andrikopoulos, Research Assistants at the Center, this work would have been utterly impossible: I cannot thank or commend them too warmly. Mr. John Desprès gave me invaluable help in organising and supervising the Input-Output computations, and in many other ways besides. Professor Pan A. Yotopoulos, Deputy Director of the Center, has been unfailingly generous in the provision of time, good offices and good advice. And I am indebted to many civil servants

for their time and help. If I only mention Mr. Geronimakis of the National Accounts Division of the Ministry of Coordination, it is because I have been so very dependent upon his help, and have spent such an inordinate amount of time in his office.

It will be obvious to anyone who reads these *Lectures* how much I have borrowed from the work of my predecessors here, particularly Professors Coutsoumaris and Papandreou. I should like, however, to express my particular indebtedness to Mr. J. Nugent who has made available to me much as yet unpublished material of remarkable importance and quality.

G. C. ARCHIBALD

I

THE BEHAVIOUR OF INVESTMENT IN GREEK MANUFACTURING, 1953 - 1963

A.1 It is widely believed that investment in manufacturing has been too low, and that is has suffered unduly from competition for scarce capital from sectors such as construction. The question of investment criteria will be taken up in a second Lecture[1]. Here we shall be concerned with the observed behaviour of the time series, first in the hope of obtaining a good fit in the econometric sense and, second, in the hope of testing some popular hypotheses, such as that about the competition from construction. An econometric explanation is important for two reasons:

(a)—the obvious one—short-term forecasting[2].

(b) the choice of policy measures to alter the value of a variable requires quantitative information about its determination.

2. I have been offered many explanations of man-

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1. «Industrialisation and Capital Requirements in Greece».

2. Thanks to the prevalence of ear-marked taxes (see Break and Turvey [1]), much of the revenue and expenditure of the central Government is beyond its control. Thus practically the only «fiscal policy variable» that *is* variable is public investment!

ufacturing investment which are not quantifiable, and some that are simply inconsistent[1]. I have been told again and again that the «poor» performance of Greek manufacturing is due to the idleness and ignorance of Greek entrepreneurs, their desire to maintain family control of their business even at the expense of profit, their indulgence in nepotism, etc., etc. In the first place, although manufacturing investment as a proportion of total investment has, on the whole, fallen, performance can hardly be said to have been poor: output has been increasing at some 7.0% per annum and productivity at some 6.0%, (see section II below). In the second place, I have been given the same «sociological» explanation for the poor performance of the British economy, which has about three times the per capita income and one-third the growth rate of the Greek economy! Curiously enough, in the U.S., with an even higher income and an even lower growth rate in recent years,

1. Thus Coutsoumaris argues in one chapter ([2], pp. 105 - 113) that the growth of manufacturing has been impeded by serious barriers to entry, and in another ([2], pp. 289 - 295) that profit rates have been low. If profit rates were too low to attract capital, the barriers to entry can hardly have been operative; if the barriers were important, profits should have been higher. I believe, as a matter of fact, that the barriers have been very important, thanks largely to the restrictive policies of Governments that have been preaching industrial expansion, and that the profits figures are extremely unreliable (for well-known reasons which are discussed by Coutsoumaris). The effects of Government policies are discussed below.

the one explanation for lagging growth that I was *not* offered was the idleness and incompetence of American entrepreneurs! I think these «explanations» tell us more about the Greek's image of Greece, the Englishman's of England and the American's of America than they do about economics. They are not explanations but epithets, at least until they are quantified, and their use by economists amounts to an admission of professional defeat.

B. Realised Private Investment, 1953 - 1963.

B.1 The starting point is naturally Suits' Econometric Model of Greece [11]. Suits attempted to explain the time series by various combinations of the following variables: value added lagged one year, investment cumulated from the beginning of the period (as a proxy for the capital stock), and time. The correlation coefficients were so low that the attempt must be said to have failed completely. Since Suits did his work, however, the series has been substantially revised (due to the use of a new deflator for the import machinery component from 1958). As a first step, therefore, Suits regressions were re-run. The result, again, was a total failure. The equations are not worth printing.

2. The order of magnitude of investment in

Greek manufacturing industry is some $35 million per annum. It is clear that one major project - say, an oil refinery - could account for such a sum (although realisation would be spread over several years). A few such big projects could clearly have a major effect on the time-profile of the investment series. It seems probable that decisions to invest in projects of this magnitude will be governed by somewhat different considerations from those governing the day-to-day expansion of small and medium-sized business. Many big projects are foreign financed, and both the investment decision and its timing are likely to be strongly influenced by international and political considerations. Furthermore, such projects are thoroughly discussed with government departments, so that forecasters might well treat them as autonomous, and concentrate on explaining the rest of (endogenous) investment by variables endogenous to Greece.

For these reasons, an attempt was made to separate the larger projects from the investment series. It was not very successful, but is worth reporting since it brought to light other matters of interest which are discussed below. Much manufacturing investment, particularly of big projects, has been financed by foreign capital under the protection of Law 2687 of 1953 governing Investment and Protection of Foreign Capital (it

deals with the rate at which capital and profits may be repatriated, tax rates, etc., generally in a very favourable manner). Under this law, each foreign-financed project must be approved by the Ministry of Coordination, which has reported in detail[1]. From the list of approved projects, those in manufacturing deemed to be «big» (arbitrarily set at over $1 million) were carefully extracted. Only eight big projects amounting to some $32.5 million were discovered. It is difficult to be sure when the investment actually takes place, but the Ministry of Coordination keeps a running total («Approved» and «Realised») year by year, and this was used to allocate the «big» projects in time. The series is, of course, still defective since any Greek-financed construction component is omitted, but it turns out not to matter: the time-profile of the big project series is very similar to that of total investment, so that subtraction of the former from the latter yields a series which does not differ sufficiently from the total investment series to make any substantial difference to the regression results.

3. Several alternative hypotheses were suggested to me. The construction hypothesis may be con-

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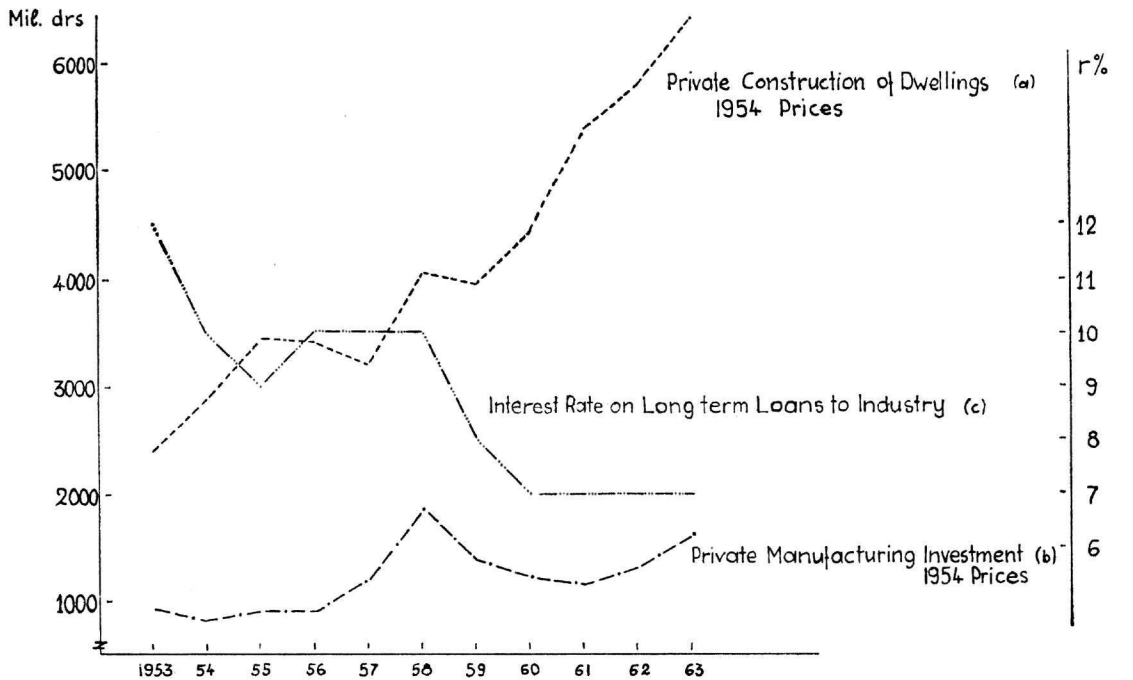
1. «Long Term Investment according to Law Decree 2687/53 for the Protection of Foreign Capital Investment in Greece», Ministry of Coordination, Division of Foreign Capital, Athens, December 1963 (in Greek).

sidered first. This says that the Greek building boom has offered serious and direct competition to manufacturing investment as an alternative use for a limited supply of saving. In particular, as retained profits have not been high, it has been suggested that businessmen have been drawing their profits out of manufacturing in order to invest them in the construction of apartment buildings and the like. If this is the case, construction and manufacturing investment should prove to be inversely related. Chart I.1 shows private construction of dwellings and private manufacturing investment in absolute terms (1954 prices) and Chart I.2 shows them as shares of total investment. Visual inspection does not suggest enough support for the hypothesis for it to be even worth running a regression.

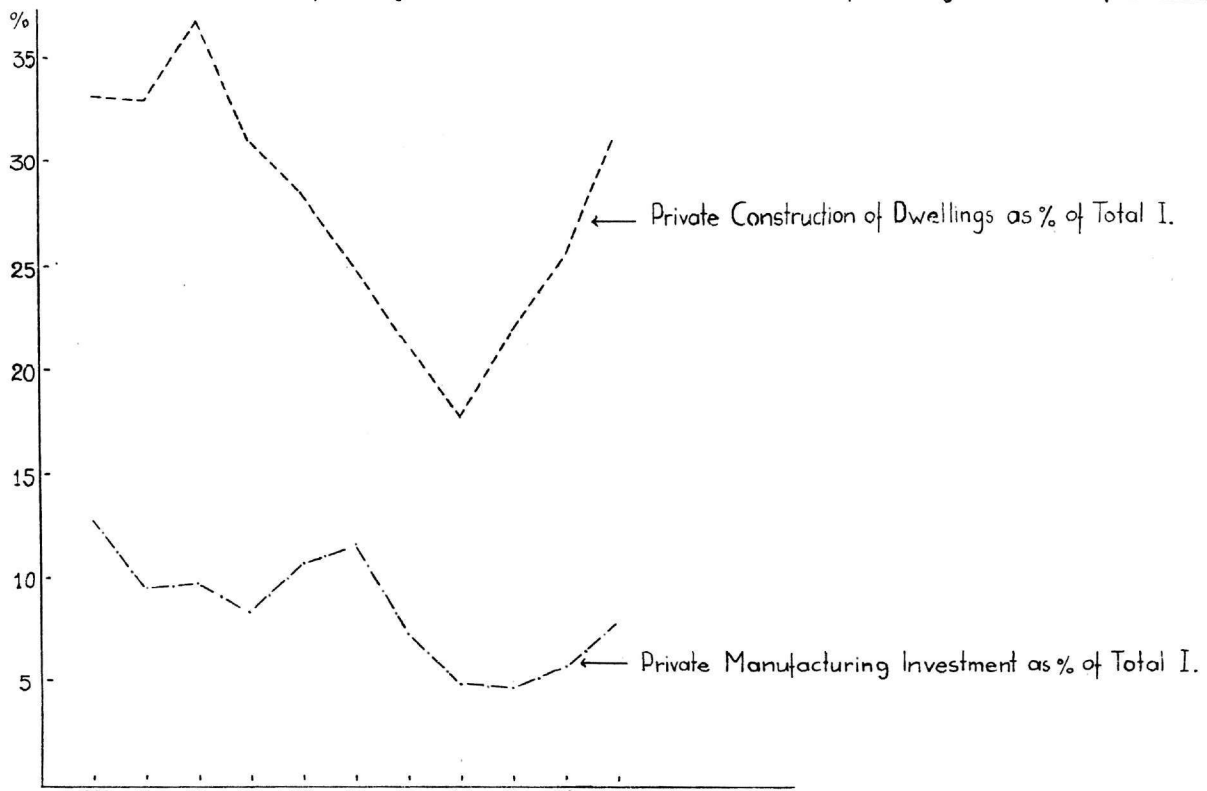
4. It is difficult to obtain reliable information about either profit rates or the interest rates actually effective on bank loans to manufacturing enterprises. The official rates are determined by the Currency Committee; but it is suspected that effective rates are often substantially higher. (A bank may, for example, require the borrower to take out insurance. The insurance company will probably be owned by the bank. The premium must be added to the interest rate to determine the effective cost of the loan). Knowledgeable people have told me that they believed that effective rates

Chart I.1 Private Manufacturing Investment Private, Construction of Dwellings and the Long Term Interest Rate, 1953-63



Source: (a) Ministry of Coordination, National Accounts Division
(b) M.O.C. National Accounts Division, Investment Department
(c) Bank of Greece, Monthly Statistical Bulletin, September 1963, April 1964

Chart I.2 Private Manufacturing Investment and Private Construction of Dwellings as Shares of Total Investment, 1953-63



Source: M.O.C. National Accounts Division, Investment Department and National Accounts Nos 8,12.

are as much as one-and-a-half times official rates, to the smaller enterprises at all events, and I have had 10 - 15% quoted to me as giving the range of effective rates, varying with the size of the borrowing enterprise. There is an inconsistency here. The reliance of manufacturing enterprise on borrowed funds, as opposed to equity, whether issued capital or retained profits, is extremely heavy[1]. If it is worth borrowing at, say, 15% the marginal rate of profit can hardly be less (nor can the average rate)! But in that case one hardly expects earnings to be *withdrawn* from business, or profit rates to be as low as they are reported to be[2].

However this may be, official interest rates have decreased markedly over the period and, provided that the effective rate is a stable function of the official rate, we may use the latter as a proxy for the former. The official rate on long-term bank loans to industry has been plotted on Chart I.1. It is obvious that there is no relationship between it and the investment series. Some other measures of the availability of credit were tried, without the smallest success. It would be tedious to rehearse these rather implausible and quite unsuccessful attempts. The upshot of the matter is that I

1. Coutsoumaris [2], pp. 202 - 203. The proportion of borrowed to total capital in 1957 was 45%, (sample of 760 firms).

2. See Coutsoumaris [2], pp. 289 - 295 and Federation of Greek Industries [4], pp. 64 - 66.

can discover no ascertainable relationship between investment in manufacturing and our available measures of the cost or availability of credit which is not, in itself, a particularly surprising result.

5. Another suggestion frequently made to me is that surplus capacity has been particularly important. It is not easy to turn this suggestion into a hypothesis sufficiently formalised to be testable, and it is even less easy to obtain data. Coutsoumaris [2], pp. 304 - 305, reports substantial surplus capacity in 1961. The Greek Federation of Industries is receiving reports of substantial surplus capacity, but its reports are not yet available (and it is by no means clear how surplus capacity was defined in the questionnaire). There are no unemployment series: there is not even a time series for employment in manufacturing covering the whole period. In any event, it is far from clear what is really meant. Sometimes it appears that the surplus capacity hypothesis is intended to explain the («low») mean level of investment over the period as a whole. Given the very high rate of change in output and productivity (due in large part to a big increase in the capital: labour ratio), this seems implausible. Sometimes it appears that fluctuations in surplus capacity are intended to explain fluctuations in the investment series. But Suits' variables—lagged value added and cumulated in-

vestment—should reflect some, at least, of the variation in capacity utilisation. To be on the safe side, some more variables were tried, using the ratio of changes in value added to investment with various lags. These proved to have no more explanatory value than Suits' variables[1].

6. There have been important changes in government policy during the period, particularly a substantial increase in permissible depreciation rates[2]. One major change came into effect at the beginning of 1958, and it is tempting to think in terms of a dummy variable. Unfortunately, there have been many changes in law and policy during the period, and it is hard to say *a priori* which would have been quantitatively the more important. In any case, it is hardly reasonable to use a dummy variable before one has had any success with appropriate independent variables. In fact, however, I think that governmental action has had extremely important effects on manufacturing investment, although they are hard to quantify, and I shall return to this subject below.

7. At this point one might well give up and conclude that, for forecasting purposes, a survey

1. Nor did such rate-of-change of sales variables as were tried.

2. Combined with inducements to invest in certain regions. The whole business has become extremely complicated. For detail see the Industrial Development Corporation's pamphlet «Basic Incentives to Industrial Development and Foreign Investment», Athens, July 1963.

of business intentions offers the only hope[1]. One may, however, consider the investment series in greater detail. Chart I.3 shows the total of private and public investment (including investment in shipyards) in constant prices and its major components, imported machinery, domestically produced machinery and factory construction. (The total exceeds the sum of these components by a small amount. The difference is accounted for by office furniture and equipment, consulting fees to engineers supervising installations, and the like, *plus* investment in shipyards, which becomes important after 1958. It should be noticed that investment in transport equipment by manufacturing firms is omitted[2]). The series calls for some comment.

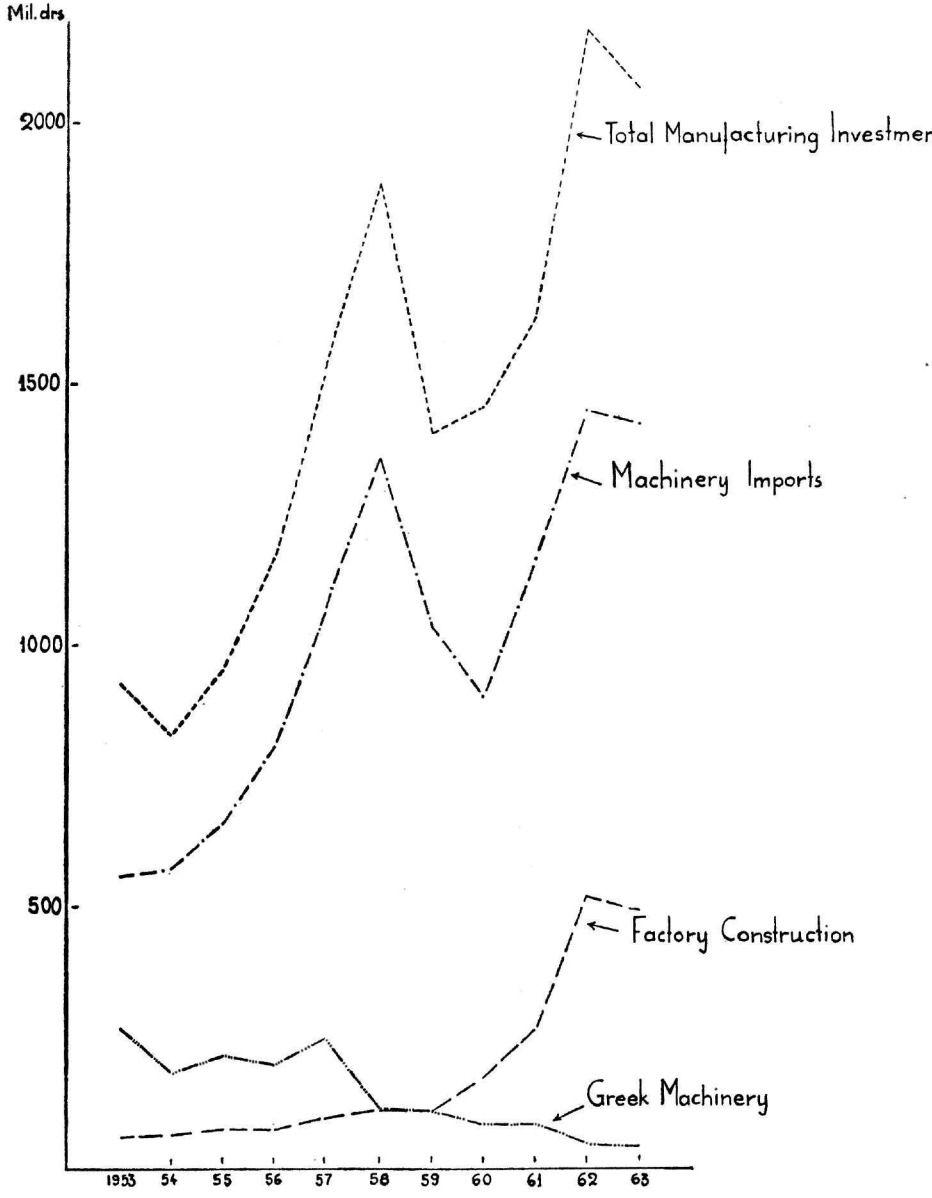
The overwhelming importance of the imported

1. Some survey material on investment plans is collected by the Federation of Greek Industries ([4] pp. 45 - 46). Unfortunately it does not seem at present to be very suitable for forecasting purposes: the sample changes from year to year, and is inconsistent in its treatment of new enterprises. Furthermore, «investment» seems to be much more broadly defined than it is for national accounting purposes. There is, however, a potentially very valuable source of information here.

2. This is in fact a rather serious omission. Greek manufacturers do a great deal of their own transport (see Coutsoumaris [2], p. 238). One reason is doubtless the fact that the number of commercial vehicle licences granted for public operation appears to have been held down. Between 1956 and 1961 some 26 thousand commercial truck licences were isued, but only about 7½ thousand of these were for public carriage. See National Statistical Service, *Statistics of Vehicles in Operation at* 31. *XII.*61, (in Greek).

Chart I.3 The Components of Manufacturing Investment, 1953-63

(constant prices)



Source: M.O.C. National Accounts Division, Investment Department

machinery item is the most conspicuous feature of Chart I.3. The contribution of Greek-made machinery has declined absolutely and, as a proportion of the whole, must now be regarded as negligible. So much for import substitution! (This is all the more remarkable in that there is a «stop-list» on imported machinery for which it is believed that Greek industry produces substitutes, and an elaborate administrative machinery for enforcing it [1]. This seems to be a case of serious protective measures utterly failing in their purpose, but I have been quite unable to discover how many import licences have been refused under these arrangements [2]). The proportions of factory building both to total manufacturing investment, and to imports of machinery, are shown in Table I.1. From this, is it clear that factory building ran at

1. The latest «stop-list», Protocol No 6613 of 21st January 1959, by the Ministers of Commerce and Industry (pursuant to Article 16 of Emergency Law 1960/1939, Article 2 of Law 5426/32 and Article 4 of Legislative Decree 2415/53), is much reduced from those of earlier years but still, to the lay-eye, formidable. As I understand the administrative procedure, the Ministers of Commerce, Industry and Co-ordination are required to adjudicate the question of whether or not a Greek machine is a (perfect) technical substitute for an imported one. The notion of three Cabinet Ministers debating the qualitites of, say, a Greek and an Italian olive press does not strike one as a good use of resources.

2 A general comment on administrative procedure may be in order here. If the effects of protective and restrictive legislation are to be assessed, it is imperative that full records of what is *prevented*, as well as what is permitted, be kept and be available. This does not appear to be the present practice.

TABLE I. 1

Factory Building as a Proportion of Total
Manufacturing Investment and of Imported Machinery.

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
1. $\frac{\textit{Factory Building} \times 100}{\text{Total investment}}$	6.34	7.47	7.96	6.43	6.27	5.94	7.83	I2.16	16.38	23.93	23.99
2. $\frac{\textit{Factory Building} \times 100}{\text{Imported machinery}}$	10.50	10.86	11.52	9.28	8.98	8.23	10.65	19.64	22.86	35.91	34.81

Source: Ministry of Coordination, National Accounts.

about 10% of machinery imports until 1959, and at almost a third thereafter. One might guess that, until 1959, new machinery was largely replacing old in old buildings, whereas since then it has been necessary to expand physically to accommodate the new machinery. One might guess further that the level of factory building will settle down again at a fairly constant ratio to machinery imports, say some 25% or 30%.

8. Now, given the importance of imported machinery in the total of manufacturing investment, it seems that we could do worse than take machinery imports rather than total investment as the *explicandum*: if we can explain that, we have explained much. At this point, we return to L.D. 2687 of 1953. It turns out that a great deal of imported machinery has been financed under this law. The Ministry of Co-ordination's report was combed once more, this time to select all applications from manufacturing firms[1]. Total applications, 1954 - 63, amount to some 64% of total machinery imports (both in 1954 prices). It thus seems worth paying a little more attention to the operation of this law, which seems to be of major importance to Greek manufacturing industry. In

1. Since the Ministry gives the name and activity of the Greek firm making the application, and the nature of the equipment to be imported, as well as the name of the foreign firm making the loan, it is possible to select the manufacturing items with a reasonable degree of confidence.

TABLE I.2

APPLICATIONS UNDER L. D. 2687/53

(Manufacturing only)

Current prices.

Year	Applications Submitted ('000 U.S. $) (1)	Applications Withdrawn ('000 U.S. $) (2)	Applications Approved ('000 U.S. $) (3)	Proportion Approved (3)/(1) (4)	Proportion Approved (3)—(2)/(1) (5)
1954	6,734.8	638.8	4,532.0	67.3	74.3
1955	2,365.5	1,730.0	1,649.0	69.7	259.5
1956	3,988.8	628.0	2,454.9	61.5	73.0
1957	7,664.9	3,743.0	1,912.4	24.9	48.8
1958	9,529.4	6,355.0	5,089.2	53.4	160.3
1959	43,123.6	25,850.0	7,098.9	16.5	41.1
1960	70,472.4	3,910.0	67,798.4	96.2	101.9
1961	67,082.7	8,216.0	38,728.7	57.7	65.8
1962	39,092.7	1,616.3	49,407.2	126.4	131.8
1963	40,580.1	1,500.0	31,599.2	77.9	80.9
Total	290,634.9	54,187.1	210,269.9	72.3	88.9

fact, of course, we cannot take 64% as the proportion of machinery imports financed under L.D. 2687/53: some applications are withdrawn, some are refused, and applications approved do not by any means lead to realised investment all in the same year. Nonetheless, it does seem that further investigation is called for.

9. Table I.2 shows the value of applications each year (current U.S.$), the value of applications withdrawn, the value of those approved, the ratio of approvals to total applications (co-

lumn (4)), and the ratio of approvals to applications minus withdrawals (column (5)). Column (4) is a little startling, and 1957 and 1959 are wholly remarkable! Column (5) is more reasonable, (numbers in excess of 100% are due to carry-over of applications from previous years). *Prima facie*, column (5) should be taken more seriously than column (4)—after all, an application can hardly be granted if it is withdrawn. And doubtless many applications were withdrawn for the reason I was given—that they were made by Greek firms «on spec», before a foreign loan was actually secured, or before the foreign firm had in fact investigated Greek conditions. On the other hand, I entertain an uneasy suspicion that some were withdrawn because, in the face of extreme delay, the foreign firm either concluded that approval was unlikely to be given, or simply that some other country might be less trouble. (For an example of what can happen, see Ellis, Psilos and Westebbe [3]).

Outright rejections are supposed to occur only in cases in which projects are deemed to be «wild», *or* to enforce protection already granted under L.D. 2687/53. If only we knew how much had been on which account, and what the definition of «wild» had been! Protection under the law means that, in the case of foreign investment, in an activity not already established in Greece, the Ministry may undertake to withhold approval

from any competitive investment for a period of five years. This is intended to encourage the initial investment; but it is not clear how much subsequent investment it has prevented. One sus-suspects that, in some cases, protection has lasted *de facto* for more than five years, but it is not possible to make any quantitative assessment of the results of the protective clause. The total figure in column (5), some 89%, does not appear «bad». If, however, withdrawals were due to the discovery that a protective agreement was still in force, the picture becomes more disturbing.

10. In some cases the Greek firm takes the initiative in looking for foreign capital, in some cases the foreign firm takes the initiative. It is possible, however, that Applications under L.D. 2687/53 may represent, more or less, a series for *ex ante* investment in Greek manufacturing. Indeed, it is possible that this series will prove easier to explain than *ex post* investment, which is what comes out, so to speak, when *ex ante* investment has been put through the erratic coffee-grinder of government regulation[1]. One would still like to explain *ex post*

1. During the period in question, the system of «expediency licencing» was still in force (see Coutsoumaris [2], pp. 318-319, and Ellis, Psilos & Westebbe, [3]). The chief effect of this system seems to have been to choke off competition and it must, therefore, have frustrated much intended investment. It does not appear that we shall ever know how much damage was done under this system.

TABLE I.3

REGRESSION EQUATIONS FOR EX ANTE INVESTMENT.

Equation	Coefficients					$\bar{r}^2$, $\bar{R}^2$
	Constant	X_1	X_2	X_3	X_4	
1	40.8	5.27				.38
2	15.1		.13			.12
3	274.0	—33.64		25.42		.74
4	427.3	—50.95			45.77	.68
5	2.0				4.53	.44

$\bar{r}^2$, $\bar{R}^2$: adjusted for degrees of freedom.

Dependent Variable: Value of Applications under L. D. 2687/53, Manufacturing only, deflated.

Independent Variables:

X_1 Value Added in Manufacturing, 1954 prices, lagged one year.

X_2 Value of Applications deflated, cumulated to t-1.

X_3 Realized Investment in Manufacturing cumulated to t-1.

X_4 Time

investment in quantitative terms, but this appears to be impossible; and for planning purposes an explanation of *ex ante* investment might in fact be more valuable. With this in mind, Applications were deflated (by the Ministry of Coordination's deflator for imported machinery) and regressed on Suit's variables. The results are shown in Table I.3. They are, at first glance, more encouraging than any previously obtained: but closer inspection shows that there is still a lot to be desired.

Equation 1 at least suggests some relationship between investment plans and value added. Unfortunately, however, when value added is used in

a multiple regression, the wrong sign is obtained (equations 3 and 4), and, indeed, the sign of the coefficient on the capital stock proxy variable, X_3, is wrong too. Thus the relatively high values of $\overline{R}^2$ for equations 3 and 4 cannot be taken seriously. Clearly the trouble here is multicollinearity. In fact, $\overline{R}^2$ for X_1 on X_3 is 0.985, and for X_1 on X_4 it is 0.994! If the signs of the coefficients were correct, either equation 3 or equation 4 might be used for forecasting purposes, but this is unfortunately not the case. Futhermore, the deviations of X_1 from trend increase with time, so that, even if a linear trend is removed from X_1, the residuals remain correlated with time (X_4).

It is evident that nothing more can be done with these variables: the world has not generated observations which allow us to disentangle from time the effects on our *ex ante* investment series of value added and cumulated *ex post* investment (the capital stock proxy).

Hence the relationship between the *ex ante* series and the other independent variables discussed above was also examined. There is some slight relationship with a surplus capacity proxy (the ratio of the first difference of value added to realised investment lagged one year), but once again the sign is «wrong» in a multiple regression [1]. The over-

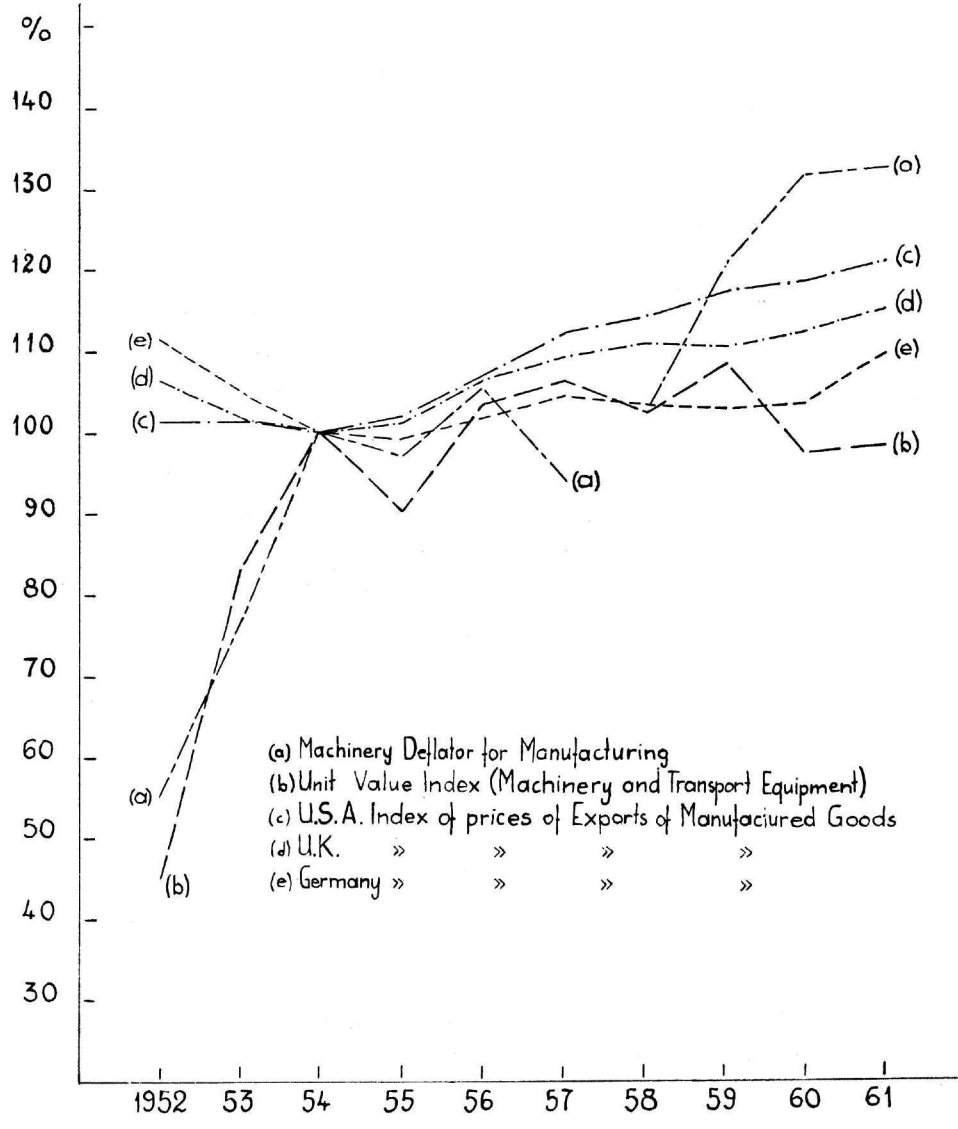
1. With the very small number of observations we have, regression analysis becomes extremely sensitive to one or two «odd» years.

all result must be accounted a defeat: the only equations which make sense are 1 and 5 of Table I.3, and the values of $\bar{r}^2$ are hardly impressive.

11. All in all, it must be admitted that this section consists of a collection of miscellaneous information rather than an explanation of the investment time series. This being the case, it may be appropriate to add a little more. It was remarked in B.1 above that the series had been revised from 1958. The revision is the result of applying, from 1958, a new deflator to the imported machinery component of manufacturing investment. This deflator cannot be run back before 1958; and the two parts of the series are not in fact consistent (nor are the deflators linked). What happened was that, in 1959, the figures of imported machinery on a detailed commodity classification became available to National Accounts for the first time. The 1954 base-weighted deflator was scrapped. National Accounts now compiles the real imported machinery series by multiplying each item by its 1954 price and adding, so that the result is current-weighted and the deflator implicit. The result is fairly dramatic. Chart I.4. shows the

Value added fell below its growth path in 1959, by a substantial amount, returning to it in 1960. 1960 and 1961 are the peak years for the *ex ante* investment series. It is this that accounts for «wrong» signs when variables employing the first difference of value added are employed, and for poor results when the absolute value is employed.

Chart I. 4. Price Indices for Machinery Imports



Source: (a) Ministry of Coordination
(b) NSSG, Statistical Yearbook of Greece, 1962 p. 229
(c)(d)(e) UN, » » 1962, Table 157, p. 460

National Accounts Implicit Deflator for Imported Machinery and the National Statistical Service Unit Value Index for Machinery and Transport Equipment, together with the U. N. Indexes of prices of manufactured goods exported from the major supplying countries. It is clear that the current-weighted implicit deflator has a life of its own after 1958: in other words the weights must be changing rather drastically.

There is, in fact, one major reason for a systematic change in weights of a sort that would push the index up: in 1959 the import of second-hand machinery was stopped [1]. It was not prohibited outright, but the approval of the Minister of Industry was required, and I am informed that this approval has been given only in exceptional (and rather unimportant) cases. It is, as is so often the case with restrictive measures, impossible to determine the full effects of this prohibition; but a well-informed guess has put the proportion of used machinery in total machinery imports prior to 1959 at one-third! One observes that realised private investment in manufacturing has yet to regain the level it reached in 1958; in 1959 it fell by about a quarter. In fact, of course, without

1. By Protocol Number 6613 of 21st January 1959, by the Ministers of Commerce and Industry, pursuant to Article 16 of Emergency Law 1960/1939, Article 2 of Law 5426/32, and Article 4 of Legislative Decree 2415/53.

a reasonable explanation of the time series, and particularly the peak of 1958, we cannot attribute its behaviour since 1958 to this one measure. We can say, however, that the concidence is alarming.

12. The overall result, then, is a total failure to provide an econometric explanation of the *ex post* time series, a little success with our *ex ante* series, and the accumulation of a good deal of evidence of both the importance and the erratic behaviour of the governmental coffee-grinder. As to the quantitative effects of the coffee-grinder, there is virtually no evidence whatever.

II

TECHNICAL CHANGE IN MANUFACTURING, 1951 - 1961

1. The basic fact is that manufacturing output has been increasing very rapidly. The increase is obviously to be explained by increases in the capital stock and the labor force, by increases in the quality of both and by «disembodied» technical change such as improved entrepreneurial know-how, external economies, and economies of scale [1]. We cannot, however, be content with such a qualitative explanation, which is little more than a catalogue of possibilities: we need a quantitative explanation. Most manufacturing equipment installed in Greece in the last ten years has been imported, and one might expect a good deal of technical change to have been embodied in it. When account has been taken of the increase in the capital stock as conventionally measured, plus its quality improvement, and of the increase in labour inputs as conventionally measured, any residual technical change may be ascribed to gen-

1. The last two items are obviously not technical changes in the ordinary sense, but our techniques of measurement will allocate them to disembodied technical change.

uinely domestic improvement—in the skills of entrepreneurs and workers, in the reallocation of resources from less to more efficient enterprises, in the realisation of external economies as the infra-structure improves, and so on. It would be disappointing if the residual to be ascribed to domestic improvement were not large. If the increase in manufacturing output (or productivity) is to be ascribed largely to the use of improved foreign machinery, the prospects for the development of an endogeneous Greek manufacturing industry cannot be very good. At the same time, there is no doubt that the infra-structure has been improving, and one would hope to see something for it. Furthermore, a good deal of technical know-how, won at a considerable cost in the past in developed countries, is now virtually a free good to underdeveloped countries that have the enterprise to ask for it, and I do not believe that Greeks are lacking in enterprise. On this count, again, one would hope that the residual, or domestic component of technical change proved to be large.

2. The residual is in fact the creature of three statistical parents, the input and output series used and the weights. The basic method of measuring technical change is due to Solow [9]. Suppose that it is neutral and disembodied. Then we may write a Cobb-Douglas production function as:

$$X = Ae^{rt} L^{a} K^{1-a} \qquad (1)$$

which yields:

$$r = \frac{\dot{X}}{X} - a\frac{\dot{L}}{L} - (1-a)\frac{\dot{K}}{K} \qquad (2)$$

Using conventional measures of inputs and normal weights, this has the unfortunate consequence of making r much too high and the contribution of capital much too low: totally disembodied technical progress implies that one can get a great deal of growth without investing and, vice-versa, that the pay-off to increasing the rate of investment is trivial. Solow [10] next tried embodying all technical progress in new investment, but this is most objectionable. In the first place, it is not true. In the second place, starting with any $\dot{X}$ and any r, it is always possible to calculate the rate of increase in one of the input series separately which will «mop up» that r. This is quite arbitrary and solves no problems.

It was left to Griliches[1] [5] to point out that one should use independent evidence to improve each input series separately by allowing for the education of the labor force, the quality of machinery, and so on. Proceeding in this way, he is able to reduce the residual or disembodied to negligible proportions. Indeed, if I have a criti-

1. I am greatly indebted to Professor Zvi Griliches for making available to me an unpublished paper [6] on which I have drawn heavily.

cism, it is that he is too anxious to reduce it to zero (and too successful!): when the input series have been fully adjusted, residual r measures the contribution of improved interfirm allocation and external economies, and should not be zero.

3. The method to be followed here is simply to use equation (2), and several alternative estimates of output and inputs, combining these with cross-section Cobb-Douglas weights obtained by Coutsoumaris. He fitted the production function to a sample of 968 firms (1957 sample, National Statistical Service), obtaining a labor coefficient of 0.719 and a capital coefficient of 0.279. The sum is not significantly different from unity, so I have taken a as 0.72. I prefer Coutsoumaris' figure to another obtained by Anna Kokkova[1] ($a = 0.82$) from a 1960 sample on the grounds that he used net capital plus inventory whereas she excluded inventory. This, of course, may only be a rationalisation for the fact that I find his figure more «reasonable». (Both samples exclude firms with less than ten employees. This cannot be helped, and probably does not matter much. Both Coutsoumaris and Kokkova of course used Value Added as the dependent variable.) It is not necessary to rehearse here all the well-known criticisms

1. I am greatly indebted to both Dr. Anna Kokkova and Professor George Coutsoumaris for making their results freely available to me.

TABLE II.1

THE MEASUREMENT OF TECHNICAL CHANGE IN GREEK MANUFACTURING 1951 - 61

Equation: $r = \frac{\dot{X}}{X} - a\frac{\dot{L}}{L}(1-a) - \frac{\dot{K}}{K}$

Weights: $a = 0.72$

	Estimates				Sources		
	$\frac{\dot{X}}{X}$	$\frac{\dot{L}}{L}$	$\frac{\dot{K}}{K}$	r	$\frac{\dot{X}}{X}$	$\frac{\dot{L}}{L}$	$\frac{\dot{K}}{K}$
(1)	7.36	.41	4.3	5.86	(a)	(d)	(f)
(2)	6.81	.41	4.3	5.31	(b)	(d)	(f)
(3)	7.11	.41	4.3	5.61	(c)	(d)	(f)
(4)	7.11	.94	4.3	5.26	(c)	(e)	(f)
(5)	7.11	.94	8.37	4.09	(c)	(e)	(g)
(6)	7.11	.94	9.07	3.89	(c)	(e)	(h)

Sources

(a) National Accounts Value Added.
(b) N.S.S. Index of Manufacturing Output
(c) Nugent's [7] Index of Manufacturing Output
(d) Employment, 1951 and 1961 Census
(e) » » » » » adjusted for the estimated number in the Armed Forces, 1951, and for seasonal change.
(f) Depreciated Capital Stock Series
(g) Gross Capital stock series
(h) » » » » adjusted on the assumption that machinery imported in year t is 1% more productive than machinery imported in year t-1.

Note: all figures are the average annual compound growth rates for the decade.

of cross-section Cobb-Douglas production functions. We may, however, look for an alternative method of estimating weights. We cannot esti-

mate our own from time-series regression because we only have end-point observations. The remaining method is to use relative shares. *The Annual Industrial Surveys* of the National Statistical Service report, since 1958, labor remuneration and value added in their sample. Both figures are, however, seriously defective. The remuneration figure omits employers' contributions to social security, etc., and the earnings of working proprietors. The value added figure is obtained by subtracting from gross output only raw materials and power: no deduction is made for bought-in services (advertising, insurance, communications, etc.). Adjusting the remuneration but *not* the value added figure, National Accounts calculate a share of about 0.63 or 0.66. It seems that, with a corrected value added figure, we could hardly arrive at a weight of less than the 0.72 used here, but the reader is, of course, entitled to try any weights in which he has more confidence.

4. The results are displayed in Table II.1, the conspicuous feature of which is the high value of the last r in row (6), which should be an approtimate measure of domestic change[1]. It is highly desirable to attribute *this* to its sources, but, before

1. There is one important qualification to make here. Greek manufacturing imports a substantial proportion (perhaps some 30%) of its intermediate inputs. Technical change may be embodied in these imports as well as in imports of capital.

starting on this task, some explanation of the sources used in Table II.1 is called for.

(i) We have a choice of two output and one value added series. These, fortunately, do not differ greatly. The intermediate figure has been selected for all calculations from row (4) on[1].

(ii) The vitally important figure is $\frac{\dot{L}}{L}$. For the labor force, *we have only the* 1951 *and* 1961 *Censuses*: there are no time series for employment in Greek manufacturing that go back before 1958. Thus *the whole operation depends on two end-point observations*. In fact, the 1951 Census was seriously defective: among other things, men doing their military service were allocated to their civilian occupations! It will be observed that my attempt to adjust for this raises $\frac{\dot{L}}{L}$ from 0.41 (d) to 0.94 (e). (Neither Coutsoumaris [2], p. 368, or Papandreou [8], pp. 172 - 3, made any adjust-

1. It should be noticed that the output series of the N.S.S. grows less rapidly than National Accounts Value Added. This is contrary to expectations. Economic growth should have been accompanied by an increase in the division of labor, and therefore an increase in the inter-industry input:output coefficients, with a corresponding *decrease* in the ratio of value added to gross output. The N.S.S. series is based on a mixture of techniques. Sometimes inputs are used rather than outputs. All things considered, it is probably less reliable than value added. Choice of Nugents' series rather than value added for subsequent computations in Table II.1 was partly a gesture toward conservatism, partly due to the fact that it is an independently estimated output series.

ment on this account). Knowing neither how many men were doing their service, nor how the Census enumerators had allocated them, I proceeded as follows. There were 1,030 thousand males in the age-group 15-29 in 1951. Assuming this to be the group at risk, and that they served for two years, division by 7 gave 147 thousand. Allowing for the physically unfit, etc., I put the Armed Forces at 125,000. These were distributed proportionally: 14% of the Active Population were in manufacturing, which would give 17,500 soldiers allocated to manufacturing. Allowing for the fact that farmers have more children, I took 15,000 as my figure. A seasonal adjustment also appeared to be necessary: the 1958 Census of Industry shows marked seasonal fluctuations in manufacturing employment, due to the seasonality of tobacco and food processing, etc., and while the 1951 Census was taken on April 7, that of 1961 was taken on March 19. My seasonal adjustment came to 6.8 thousand[1], probably a good deal too much, and the total adjustment to 21.8 thousand, probably about right. I conclude that the total adjustment is about right because I have been quoted 19

1. The seasonal adjustment was calculated as follows. 1958 figures for mid-February and mid-May show manufacturing employment to be increasing at 0.5% per week on the average. The dates of the 1951 and 1961 Censuses differ by three weeks, so the former was reduced by 1.5%. The assumption that the seasonal pattern was unchanged is almost certainly wrong.

thousand as the adjustment used by the Ministry of Coordination[1]. Mercifully, the small discrepancies remaining prove not to matter much: a 1% change in our estimate of employment in manufacturing in 1951 (some 4 thousand) would only alter our estimate of r by 0.07[2].

(iii) The capital figure is based on a rather doubtful (private) estimate of the Greek capital stock in 1948. The series may then be constructed by adding investment. There is some doubt as to whether the depreciated or underdepreciated series should be used: it makes a big difference. Both are used, and the results shown in Table II.1. An attempt has also been made to adjust the capital stock series for improvement in the

---

1. It appears that I (a) overestimated the total numbers in the Forces, but (b) underestimated the proportion to be allocated to manufacturing, because a higher proportion of the younger age groups than of the total active population are in manufacturing, and (c) overestimated the seasonal adjustment.

2. This is obtained by taking the derivative of r with respect to L_{1951}.

Obviously $\frac{dr}{d\left(\frac{\dot{L}}{L}\right)} = -a = -0.72$. To obtain

$\frac{d\left(\frac{\dot{L}}{L}\right)}{d\ L_{51}}$, we use the compounding formula, $L_{61} = \left(1 + \frac{\dot{L}}{L}\right)^t L_{51}$,

whence $\frac{d\left(\frac{\dot{L}}{L}\right)}{d\ L_{51}} = -\frac{1}{t} L_{61}^{\frac{1}{t}} L_{51}^{-\left(\frac{t+1}{t}\right)}$ which is equal to approximately 0.0000244.

quality of machinery. Nearly all Greek manufacturing equipment is imported; and one would expect it to improve at the same rate as any other equipment produced in the supplying country. It is important to allow for this if our final residual r is to reflect the contribution which can properly be attributed to improvements internal to Greece. The main suppliers of manufacturing machinery to Greece are the U.S.A., the U.K., Western Germany and Canada. For the first country, we have estimates of the rate of improvement in machinery by both Solow [10] and Griliches [6]. But Solow's figure—3% or 4% per annum—is much too high, since it is obtained, in effect, by attributing all the previously unexplained technical progress to improvements in the quality of capital. Griliches, as previously noted, starts by adjusting both the capital and the labor inputs independently and carefully, and then guesses the residual rate of improvement in producer goods at 1% p.a. Since he then finds himself with very little unexplained change left over, I am disposed to adopt his guess of 1%; and I accordingly assume that a dollar's worth of (constant 1954 prices) imported machinery is 1% more productive each year than the year before. Thus if we start with a capital stock of K in 1951 we calculate:

$$K_{1961} = K_{1951} + \sum_{t} (1 + 0.01)^{t} I_t \qquad t=o \ 1951$$

and then take the average annual (compound) rate of change for the decade.

In fact, this procedure probably underestimates the contribution of foreign machinery. Serious imports did not begin until 1953, and the machinery then imported was probably vastly more than 1% more productive than the capital stock then existing. Unfortunately this adjustment, whatever its merits *per se*, has far less effect on $\frac{\dot{K}}{K}$ than the switch from net to gross, and consequently far less effect on residual r, as a glance at rows (4), (5), and (6) of Table II.1 will show. All that I can say is that row (6) gives the best estimates presently obtainable.

5. It is not easy to assess how much confidence should be placed in the figures of Table II.1. We can say, however, that we have an increase in output, amounting to some 3.9% per annum over the decade, yet to account for, and that this figure should in some sense represent improvements in Greek inputs and environment. (We may notice unhappily the effects of the wide variations in the capital stock series; and also wonder how neutral technical progress is likely to be when a country has suddenly started to import vastly superior equipment). The next problem is to try to allocate some of the remaining 3.9%. A rough list of candidates for the rôle of contributors to «technical change» is:

(a) reallocation of the labor force from less to more efficient productive units (interfirm);

(b) more efficient utilisation of the labor force, longer hours, etc. (intra-firm);

(c) changed composition of the labor force—age, structure, sex, etc.,

(d) changed skills and education of the labor force—and of entrepreneurs;

(e) external economies due to increased division of labor, changed infra-structure, etc.;

(f) returns to scale.

((f) is not, of course, independent of (b)).

Ideally, we should measure the contribution of all of these, and perhaps pay particular attention to (d), but we do not have the information. I have, however, been able to make a start, albeit a very crude one, with (a) and (c).

A conspicuous feature of Greek manufacturing industry is the high proportion of the labor force that is still in very small, basically handicrafts establishments, with less than ten employees. The *Surveys* of the National Statistical Service also reveal that value added per man increases dramatically as we move from smaller to larger establishments. This, of course, suggests the existence of important economies of scale quite inconsistent with the Cobb-Douglas results of Coutsoumaris and Kokkova and, therefore, with the weights used in Table II.1. Nothing can be done about the

weights, but we can discover if part of our residual figure of 3.9% is not accounted for by the movement of labor from small and inefficient to larger and more efficient establishments. Table II.2. a shows the number and proportions of employees in establishments by size-class in 1951 and 1961, and the weights used. For weights, the value added per capita[1] by establishment size from the 1958 Survey[2] was used: 1958 because the later Surveys give no figure for the very important 1 - 9 class. Now there are two methods of using the data of Table II.2.a.

(i) The absolute number in each class is multiplied by the weight of the class, and summed for each year, giving weighted labor input in 1951 and 1961. This is shown in columns (6) and (7), Table II.2.b. The compound rate of change is 0.65%, which may be compared with the unweighted rate of change, $\frac{\dot{L}}{L}$, of 0.94% (Table

1. In principle, it is probably better to use remuneration per capita, which would give an even wider dispersion in the weights. Believing that the remuneration figures reported exaggerate the effects of size differences (chiefly because working proprietors, who are omitted, are naturally concentrated in the smaller establishments), I have preferred to use the value added figures. As Table II.2.a. shows, this gives a wide enough dispersion in the weights!

2. Comparison of the *Surveys* from 1958 to 1961 shows that the rate of change of value added per capita varied substantially between different sizes of establishments. Thus the weights unfortunately depend on the year chosen. It would be best to have either 1951 or 1961 weights; but there is no data at all for 1951, and no data for the 1 - 9 class for 1961.

TABLE II.2

REALLOCATION OF LABOR FORCE IN GREEK MANUFACTURING BETWEEN SIZES OF ESTABLISHMENTS, 1951 - 61, AND ITS CONTRIBUTION TO THE CHANGE IN OUTPUT

2.a. Allocation of the Labor Force

Size Group	(1) 1951 (a) thousand	(2) 1951 %	(3) 1961 thousand	(4) 1961 %	(5) W
1 - 9	218.7	54.1	248.0	55.9	.17
10 - 49	60.1	14.9	73.3	16.5	.34
50 & over	125.5	31.0	122.7	27.6	.49
	404.3	100.0	444.0	100.0	1.00

2.b. Contribution to the Change in Output

	(6) (1) x (5)	(7) (3) x (5)	(8) (2) x (5)	(9) (4) x (5)
1 - 9	37.2	42.2	9.2	9.5
10 - 49	20.4	24.9	5.1	5.6
50 & over	61.5	60.1	15.2	13.5
	119.1	127.2	29.5	28.6

2.c. Numbers of Establishments by Number of Employees

	1951 (b)	1958
1 - 9	89,676	103,569
10 - 49	2,553	4,947
50 & over	520	720
	92,749	109,236

(a) The enumeration of employees by size of establishments in the 1951 Census, produced a total of employees less than the Census figure and less than our total (see II.4. (ii) above) by 64.4 thousand. This figure was redistributed to establishment classes in accordance with Census proportions.

(b) Footnote (a) above applies here too. The figure for establishments, however, is not corrected for this discrepancy because an adjustment similar to the one used for the number of employees did not seem convincing enough.

II.1). Thus it appears that the weighted labor input series increases *less* than the unweighted series: the contribution of reallocation has been *negative.* A measure (of a sort) may be obtained by multiplying the difference between the two rates of change (-0.29) by the Cobb-Douglas weight (0.72), giving—0.21% as the *loss* of output caused by unfavourable reallocation.

(ii) The proportion in each class is multiplied by the weight of the class, and summed for the year (columns (8) and (9) of Table II.2.b.). This gives a direct measure of reallocation, abstracting from the change in the size of the labor force. The result is a compound rate of change of —0.33 per annum.

The accuracy of these results cannot be very high. What stands out is that the reallocation effect, though small, has been *negative.* This is surprising, and demands some explanation. The explanation is to be found in Table II.2.c: the rapid growth of the absolute number of small establishments. What has happened, in effect, is that the growth of the number of small establishments has swamped the effect of the increase in the number of larger establishments. If the number of establishments had been held constant, doubtless reallocation would have accounted for some of our 3.9% residual r; but it has not. It does not, of course, follow from this that policy should be

directed at impeding the foundation of small establishments (if they pay, they pay; and there are probably too many restrictions in the way of new enterprise already). Some policy implications, however, may be considered. The differences in productivity between sizes of establishment are vast, as the weights in Table II.2.a. show. It appears, however, that the most capital intensive establishments are the largest *and the smallest* (see Coutsoumaris [2], p. 300) which is perhaps contrary to expectation. One might think that there are substantial gains yet to be made from reallocating labor towards the larger establishments, and capital towards the smaller, but the picture is not altogether clear[1].

6. It remains to be seen what adjustment can be made for the changed composition of the labor force between 1951 and 1961. The principle on which I am operating follows very closely that of Griliches: we can adjust whenever we can find independent weights. Now, so far as I can discover, we have no data on earnings by education or age group in Greece, but we do have average wage rates for men and women, which may be used as weights if we assume equality between wages and

1. The apparently high capital intensity of the smallest establishments (1 - 9) must be due to working capital, probably mainly excessive inventory. It does not seem possible that it can be due to fixed capital.

marginal products. It turns out, however, that the change in the female participation rate had not been sufficient to make correction on this score important. Coutsoumaris ([2], p. 78) gives the percentage of females in the manufacturing labor force as 26.8 in 1951 and 32% in 1961. This is the labor force, however, not the employed labor force. Correcting for unemployment, since we are interested in inputs, and subtracting 19 thousand from the males in 1951 (the Armed Forces Correction: see II.4. (ii) above), the proportion of females in 1951 becomes 28.3 and in 1961 29.7%. No plausible set of weights can make this change matter[1]. Insofar as the proportion of females has gone up, the correction is, of course, negative but, on the figures we have, it is simply unimportant. One may feel that the increase in the proportion of women «should» have been greater than 1.4%; but a correction on this account can only serve to increase r, not to explain it.

7. The result is that we still have an unexplained r of some 3.9%. The most that can be said of the last two sections is that we have eliminated some possible explanations. In II.5 we really eliminated two explanations, reallocations and

---

1. From some recent I.K.A. figures, we took the weights 0.61 (men) and 0.39 (women). Proceeding as in II.5. (ii) above, we obtain an annual rate of change of —0.06%. This is trivial.

returns to scale [1]. In II.6 we have only eliminated one aspect of the composition of the labor force: there is still age structure to consider. But the broad conclusion is that the bulk, at least, of the 3.9% must be attributed to increased skills, more efficient utilisation and external economies, a most satisfactory picture [2].

It would be more encouraging still if this rate of advance could be projected into the future. Here one should be extremely careful. None of the contributors are costless. More efficient utilisation is presumably the consequence of better management. Good management is not a free good: it requires education, training, and incentives. The greater skill of the labor force is doubtless acquired partly on the job, and partly at school, but neither is free. (Greek industry carries an extraordinarily large number of apprentices. Part, at least, of their remuneration might well be regarded as investment). External economies may be due partly to the increased division of labor accompanying industrial growth; but, insofar as they are due to an improved infra-structure, this is not free. Indeed, there is only one serious contribu-

1. Only partially: there remains the possibility of scale effects *within* the very large size-classes of establishments.

2. With the important qualification that we know nothing about the hours and intensity of work, in other words we have estimated employment (approximately) rather than real labour inputs.

tor to r that might be effectively free: imported technical knowledge. *My own opinion is that, if r continues to be a satisfactorily large number, it will only be because of continued and expensive improvement in education, vocational training, transport, communications, etc.* What is exasperating is our inability to assess the separate contributions of these uses of resources.

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