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GROWTH PERFORMANCE OF EASTERN EUROPEAN ECONOMIES  
AND COMPARABLE WESTERN EUROPEAN COUNTRIES

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This paper compares the growth performance of the centrally planned economies of Eastern Europe with that of decentralized Western European economies at comparable levels of development. The former group of countries includes Bulgaria, Czechoslovakia, Hungary, Poland, and Romania; the latter comprises Spain, Greece, Norway, Ireland, and Yugoslavia -- the only country that has developed a decentralized socialist system. For these countries, the paper provides estimates of total and net factor productivity, the latter being adjusted for economies of scale and improvement in the quality of labor and capital. The period covered is 1953 to 1965; changes between the 1953-59 and 1956-65 subperiods are also considered.

While countries at lower levels of development appear to have an edge over the more developed economies of the group if we use total factor productivity as an indicator of growth performance, this advantage disappears if net factor productivity is calculated. Furthermore, the latter measure enhances the lead of decentralized over centralized economies, and the former but not the latter group also shows an improvement in its performance over time.

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Growth Performance of Eastern European Economies  
and Comparable Western European Countries

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I

The purpose of this paper is to compare the growth performance of the centrally planned economies of Eastern Europe with that of European economies characterized by decentralized decision-making. The investigation covers five centrally planned economies (Bulgaria, Czechoslovakia, Hungary, Poland, and Rumania), four Western European countries (Spain, Greece, Norway, and Ireland), and Yugoslavia which has developed a decentralized socialist system. The choice of the countries included in the study reflects a desire to have a representative group operating under different economic systems at comparable levels of development although it has, to some extent, been constrained by the availability of the data.

The study covers the time period 1953 to 1965; the initial year has been selected to avoid the effects of postwar reconstruction in several of the countries in question while the choice of the terminal year has been dictated by data availabilities. The investigation is limited to manufacturing industry where the most important structural changes have taken place.

As an indication of the relative level of economic development of the countries in question, in Table 1 we present estimates of per capita gross national product calculated by the use of purchasing power parities for the year 1955. The results may be subject to considerable error and, due to differences in the statistical sources, there is greater comparability in the

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data among the centralized and among the decentralized economies than between countries that belong to different groups. Nonetheless, it is encouraging that in the case of Yugoslavia -- the only country that appears in both sets of calculations -- the two estimates are very close. In any case, it would appear that the countries under study can be classified into three groups according to their relative levels of economic development: low - Greece, Yugoslavia, Bulgaria, Spain and Rumania; intermediate - Ireland, Poland, and Hungary; and high - Czechoslovakia and Norway. The latter two groups will further be combined in distinguishing between "less developed" and "more developed" countries among those under study.

## II

International comparison of growth performance is a formidable task and we approach it with some trepidation. There are difficulties in obtaining comparable data for the different countries and a summary measure cannot take account of all the relevant variables. Comparisons of growth rates of output disregard changes in inputs; marginal capital-output ratios neglect labor as well as capital accumulation in earlier periods; while labor productivity comparisons abstract from the capital factor.

In recent years, it has become popular to separate the growth of output attributable to (i) the growth of factor inputs, and (ii) a residual presumably reflecting organizational changes, improvements in labor quality, and technical progress. The residual -- also called the growth of total factor productivity or, simply, total factor productivity -- has been taken by some writers to be an indicator of growth performance  $\bar{1}$ ,  $\bar{2}$ .

The separation of factor inputs and total factor productivity as sources of economic growth, assumes that (a) there are no economies of scale; (b) organizational changes, improvements in labor quality, and technical progress

are independent of the growth of factor inputs; and (c) factor inputs represent purely a cost and their growth does not contribute to economic welfare. We will initially accept these assumptions in calculating total factor productivity for the countries under study. Subsequently, we will remove assumptions (a) and (b) in order to estimate net factor productivity, defined as the residual growth rate that is obtained if one adjusts for both the direct and indirect effects on growth of increases in factor inputs. Finally, we will consider the question of the welfare significance of increases in factor supplies.

### III

In calculating total factor productivity, we have first attempted to fit production functions of the form shown in equation (1) to data on indus-

$$(1) \quad O = e^{\delta t} L^{\alpha} K^{\beta}$$

trial output (O), employment (L), and the capital stock (K) in manufacturing industries, both with and without constraining the sum of the exponents to one. However, for various reasons, such as multicollinearity, the shortness of the period of observation, and the variability of the data, statistically significant results have not been obtained. We have therefore used equation (2), obtained by differentiating the logarithmic form of equation (1), to estimate total factor productivity ( $\delta$ ).

In the equation, o, l, and k denote the rate of growth of industrial

$$(2) \quad o = \delta + \alpha l + \beta k$$

output, labor, and capital respectively, while  $\alpha$  and  $\beta$  are the elasticities of output with respect to labor and capital. With perfect factor markets,  $\alpha$  and  $\beta$  are the shares of labor and capital, and we can use estimates of factor shares to weight the factor inputs. But there are no capital markets in the

Eastern European economies, and the valuation of capital is largely arbitrary. Accordingly, it has been necessary to make some assumptions concerning the rate of return to capital in these countries.

In the Western European countries under study, the share of labor is between 45 and 65 percent and the gross rate of return to capital ranges from 18 to 22 percent. If 5 percent is deducted for depreciation, the corresponding net rate of return is between 13 and 17 percent.<sup>1/</sup> These rates have been used in evaluating the returns to capital in the Eastern European countries for which capital stock data are available in absolute terms -- Hungary, Rumania, Czechoslovakia, and Yugoslavia. The resulting labor shares for these countries are all in the 45 to 65 percent range. Given the uncertainties associated with the data, we have used both 45 and 65 percent as an estimate of the share of labor in manufacturing industry.

Data on the growth of output, capital, and labor are presented in columns (1) to (3) of Table 2 while estimates of total factor productivity calculated under alternative assumptions as regards labor's share in output are shown in columns (4) and (5). To avoid giving undue weight to initial or terminal years, growth rates of output and factor inputs have been calculated by regressing the relevant data on time. Growth rates of output and capital stock are in real terms although there is a suspicion that the Bulgarian capital stock figures have not been appropriately deflated. Data on the capital stock and, to a lesser extent, on output are subject to considerable error in the other socialist countries, too, and error possibilities exist also in regard to capital stock estimates  
/ for Western European countries. Sources of data are described in the Appendix.

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<sup>1/</sup> By comparison, a range of 8 to 20 percent has been suggested by Bergson in regard to the Soviet Union 2, p.207.

The interpretation of the results is reasonably straightforward. Irrespective of the choice of input weights, Rumania, Spain, and Yugoslavia show the most rapid increases in total factor productivity among the countries in question. With an appropriate deflation of the capital stock figures, Bulgaria would probably also appear in this group. The results<sup>thus</sup>/lend credence to the contention that in countries that have passed the take-off point, the possibilities for utilizing existing technological knowledge permit more rapid growth in countries at lower than at higher levels of development.

Greece, however, provides an exception inasmuch as it belongs to the first group of countries in terms of the level of development and the second in terms of growth performance. Within the latter group, Norway and Czechoslovakia appear to be in the lead, followed by Greece and Poland, with Ireland and Hungary at the bottom of the list. But the ranking of these countries is affected if different input labor shares are assumed in particular cases.

It further appears that unweighted averages of total factor productivity differ little between the centralized socialist economies and the decentralized private enterprise economies. The situation changes however if we add Yugoslavia to the second group. Now decentralized economies seem to be ahead of centralized economies by at least one-half of one percentage point.

#### IV

Using total factor productivity as an indicator of the country's growth performance reflects the assumption that the results are independent of the rate of growth of the inputs themselves. This assumption will not be fulfilled if the quality of productive factors of a later "vintage" is superior to those of an earlier vintage or if there are increasing returns to scale. In the first eventuality, the average quality of factors will be positively related

to the rate of growth of factor inputs; in the second, the rapid growth of factors will bring forth increases in output by increasing the scale of production. As to the former, the reduction in illiteracy, improvements in schooling, and the institution of training programs which may be associated with the rapid growth of labor in manufacturing, will raise the quality of the labor force while the capital stock is upgraded as new investments embody more advanced technology.

We have attempted, therefore, to divide the estimates of total factor productivity into two parts: a part explained by the indirect effects of the growth of productive factors and a residual termed net factor productivity which may more adequately reflect the differences between countries in regard to their systems of economic decision-making and organization. To do this, it is necessary to quantify the relation between factor input growth and total factor productivity as defined earlier.

For U.S. manufacturing, A.A.Walters has found evidence of increasing returns to scale of from 27 to 35 percent 57. But Walters' results may reflect improvements in factor qualities as well, and we have interpreted them as such. At the same time, one can assume that in countries at lower levels of development there is more scope for improving factor qualities and exploiting economies of scale than in the United States. The results obtained for U.S. manufacturing industries therefore may represent a lower limit to the joint effects of the two influences as they operate in national economies that are less developed industrially.

At any rate, the U.S. results derive from the experience of a single country, and greater confidence can be placed in the figures if inter-country comparisons are made. We have attempted to do this by estimating the relationship between the average growth of factor inputs and total factor productivity in a cross-country regression. In order to increase the number of ob-

servations available, we have used data for four-year subperiods in the countries under study, with the exclusion of Bulgaria whose capital stock figures are suspect. The results are given in equations (3) and (4).

$$(3) \quad \gamma_1 = \frac{.09}{(0.13)} + \frac{.54}{(4.24)} T_1 \quad R^2 = .50, D.W. = 2.27$$

$$(4) \quad \gamma_2 = \frac{1.60}{(2.76)} + \frac{.45}{(3.96)} T_2 \quad R^2 = .47, D.W. = 1.61$$

where  $T_1$  and  $T_2$  are the growth rates of factor inputs weighted by  $\alpha = .45$ ,  $\beta = .55$  and by  $\alpha = .65$ ,  $\beta = .35$ , respectively, and t values are shown in parenthesis.

The results tend to confirm our suspicion that in countries at a level of development as those under study, the indirect effects of growth in factor inputs on the growth of output can be very substantial. Equations (3) and (4) show this to be from 45 to 54 percent of the direct effect. On the basis of Walters' results and our findings, we have therefore adjusted the total factor productivity figures on the assumption that a one percent increase in combined factor inputs yields (A) an added .3 percent or (B) an added .5 percentage point growth of industrial output. The resulting net factor productivity figures are presented in columns (6) - (7) and (8) - (9) of Table 2.

This adjustment favors countries where the rate of growth of factor inputs has been relatively low. Thus, Norway joins Rumania, Spain, and Yugoslavia among countries with the highest net factor productivity and the relative positions of Ireland and Czechoslovakia are also improved. Furthermore, the imbalance between the less developed and the more developed countries of the group indicated by comparisons of total factor productivity is greatly reduced. For instance, while the unweighted average of total factor productivity (with  $\alpha = .45$ ) is 5.0 for Greece, Spain, Yugoslavia, and Rumania as compared

to 3.0 for Czechoslovakia and Norway, the corresponding net factor productivities are 2.8 and 2.0 under case A and 1.4 and 1.2 under case B.

Using net factor productivity as an indicator of growth performance, the differences between Yugoslavia and the other decentralized countries also tend to diminish -- significantly so if the higher labor share is assumed. In turn, decentralized economies now appear in a much more favorable light than the centrally planned economies. While the results for the latter group of countries are affected by the exceptionally poor showing of Bulgaria due in part to the previously noted data problems, even excluding Bulgaria net factor productivity is decidedly higher in decentralized than in centrally planned economies. Thus, the hypothesis that the comparable gains in total factor productivity attained in Eastern Europe are the result of more rapid growth in factor inputs appears to be supported by our findings.

Finally, it should be noted that factors other than the direct and indirect effects of input growth would seem to have a negative impact on the growth of output in five countries if the lower (.45) value is assumed for the  $\alpha$  coefficient and the higher value (.5 percent) is used for indirect effects. This unlikely result may be interpreted as evidence that the higher values of  $\alpha$  are more reasonable. With  $\alpha = .65$  only Hungary and Bulgaria show negative net factor productivity, and Hungary is a special case because of the 1956 events as is Bulgaria because of data problems. Of course, the results might also be interpreted as evidence that the indirect effects of factor input growth on total factor productivity are less pronounced than is assumed in case B.

V

Net factor productivity has been estimated under the assumption that part of the increase in total factor productivity is explainable by the in-

direct effects of the growth of factor inputs on output growth, when such indirect effects reflect economies of scale and improvements in factor qualities. There are few problems with the first assumption, but the second opens possibilities of error since it disregards possible differences in the rate of improvement of the quality of capital and labor. The resulting error will be the greater, the larger are differences in factor growth rates.

To remove this source of error, it would be necessary to estimate the extent of improvements in the capital stock and in labor over time. While "embodied" technical progress has been much discussed in recent years,<sup>1/</sup> no reliable estimates exist and even less can be said of its numerical importance in the countries under consideration. Similar considerations apply to the extent of improvements in the labor force. At the same time, Walters' findings and our regression results suggest that the proportionality assumption made in this study does not involve substantial error.

The problem remains that we have considered factor inputs purely as a cost and thus have attached no welfare significance to increasing the rate of saving and reallocating labor from low productivity occupations or from the ranks of the unemployed to manufacturing industry. Yet, while in Western Europe (although not in centrally planned economies) capital accumulation largely depends on individual decisions and the absorption of labor in manufacturing industry is predicated on the availability of labor, the growth of factor inputs is affected by the economic policies followed.

It has not been possible to incorporate such considerations in the present study, however. Apart from the difficulties of statistical measurement, these considerations raise intricate welfare problems. In this connection it

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<sup>1/</sup> This problem was first raised in [4].

may be recalled that the Soviet Union was strongly criticized for forced reductions in consumption (increasing the rate of saving) and forced collectivization (increasing the mobility of labor) during the nineteen-thirties. Today some would look differently at that period of "initial accumulation" but any judgment would involve interpersonal and intertemporal comparisons which we have wished to avoid in this paper.

## VI

A further question is whether there have been significant changes over time in the growth performance of the countries under consideration. In order to deal with this question, we have divided the total period into two sub-periods -- 1953-1959 and 1959-1965. But instead of simply comparing estimates of factor productivity in the two sub-periods, we have used a statistical test which involved calculating the value of the elasticity of output with respect to labor ( $\alpha$ ) that would equate factor productivity between periods in the three cases considered earlier.<sup>1/</sup> A judgment as to whether the calculated values of  $\alpha$  are reasonable or not permits us to conclude whether, and in what direction, factor productivity has changed.

In Table 3 we show the condition placed on  $\alpha$  in order that factor productivity in the period 1959-1965 is greater or equal to that for the period 1953-1959. On the assumption that the actual value of  $\alpha$  will be between 0 and 1 and, most likely, between .45 and .65, we can conclude that (a) an increase in factor productivity has definitely occurred in Spain, Hungary, and Ireland while there has been a decline in Czechoslovakia and Greece and (b) factor productivity also seems to have increased in Bulgaria and Norway and decreased in Rumania and Yugoslavia.

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<sup>1/</sup> This technique of analysis is due to Kaplan and has been previously used by him to analyze changes in total factor productivity in the Soviet Union [3].

There is some support in our findings for the hypothesis that in the more developed economies of the group, decentralized decision-making has been more successful in maintaining or raising factor productivity than central planning. Thus, an increase in factor productivity has occurred in Norway and Ireland while a decrease is shown for Czechoslovakia. The exception to this hypothesis provided by Hungary may in fact be just that; an exception explainable in terms of the retarding effects in the earlier period of the 1956 events. As far as the less developed countries are concerned, no unambiguous conclusions are suggested by the results since improved performance occurs in Spain and Bulgaria, while a decrease in total factor productivity is shown in Greece, Rumania, and Yugoslavia.

## VII

In this paper an attempt has been made to compare the growth performance of five centrally planned economies, four Western European countries and Yugoslavia -- the only country with a decentralized socialist system. The countries selected for the investigation can also be classified according to the degree of economic development: low (Greece, Yugoslavia, Bulgaria, Spain, and Rumania), intermediate (Ireland, Poland, and Hungary), and high (Czechoslovakia and Norway).

Calculations of total factor productivity for the manufacturing sector in the 1953-65 period show the low income countries other than Greece in the lead, with Ireland and Hungary at the bottom of the list. Averages of total factor productivity for centrally planned economies and Western European countries are about the same but adding Yugoslavia to the second group puts decentralized economies ahead of centrally planned economies.

The measurement of total factor productivity reflects the assumptions of constant returns to scale and unchanged factor qualities over time. These

assumptions are not fulfilled in practice; indeed, our results indicate the existence of a positive correlation between the growth of factor inputs and total factor productivity. Adjusting for the effects of the former on the latter, we obtain estimates of net factor productivity. As this adjustment favors countries with a relatively low rate of growth of factor inputs in manufacturing, the relative positions of Norway, Ireland, and Czechoslovakia improve while Bulgaria, Spain, and Yugoslavia now rank lower.

It also appears that if we adjust for the indirect effects of the growth of factor inputs, differences in the growth performance of countries at lower and at higher levels of development/ Yugoslavia's advantage over decentralized free enterprise economies disappears; and the latter group of countries has a decided edge over centrally planned economies. Such an advantage is also shown if we consider changes in factor productivity over time.

Apart from the conceptual problems and the statistical difficulties of the calculations, note should be taken of the fact that the procedure applied considers the growth of factor inputs as a cost and attaches no welfare significance to it. If instead we take a high rate of saving and increases in manufacturing employment to have welfare significance in themselves, the relative position of the socialist countries will improve. But against this we should set the relatively poor performance of agriculture in these countries which has not been considered in this study; yet increases in the capital stock and in labor have taken place in part at the expense of agriculture.

**TABLE 1:** Estimates of Gross National Product per Capita of Selected European Countries in U.S. Dollars, 1955, Derived by the Use of Purchasing Power Parities

	(1)	(2)
Bulgaria	515	
Czechoslovakia	1,163	
Hungary	835	
Poland	755	
Rumania	551	
Greece		336
Ireland		704
Norway		1,394
Spain		516
Yugoslavia	444	427

**Source:** Column (1) derived from data in F. L. Pryor and G. J. Staller "The Dollar Values of the Gross National Products in Eastern Europe, 1955" Economics of Planning, Vol. 6, No. 1 (1966). Column (2) from Bela Balassa, Trade Prospects for Developing Economies, Homewood, Illinois: Richard D. Irwin, Inc., 1964, pp. 384 and 385.

**TABLE 2: Rates of Growth of Output and Factor Inputs and Measures of Factor Productivity in the Manufacturing Industry of Selected European Countries.**

Country	Period	Annual Rate of Growth			Total Factor		Net Factor Productivity			
		Output	Capital	Labor	Productivity		Case A		Case B	
					$\alpha = .45$	$\alpha = .65$	$\alpha = .45$	$\alpha = .65$	$\alpha = .45$	$\alpha = .65$
Bulgaria	1953-1965	12.5	11.6	7.6	2.6	3.4	-.3	.7	-2.3	-1.5
Czechoslovakia	1953-1965	7.0	6.6	2.7	2.1	2.9	.7	1.6	-.3	.6
Hungary	1953-1965	6.5	7.3	3.0	1.1	2.0	-.4	.6	-1.5	-.2
Poland	1961-1965	6.6	6.5	3.0	1.7	2.4	.2	1.1	-.8	.2
Rumania	1953-1965	11.1	8.3	4.1	4.6	5.5	2.7	3.8	1.4	2.6
Centrally Planned Economies										
- including Bulgaria (a)					2.4	3.0	.6	1.5	-.7	.3
- excluding Bulgaria (a)					2.4	3.2	.8	1.7	-.3	.7
Greece	1951-1965	6.9	7.1	2.8	1.7	2.6	.2	1.3	-.8	.4
Ireland	1953-1965	4.7	4.2	1.7	1.7	2.2	.8	1.4	.1	.9
Norway	1953-1965	5.4	5.1	0.8	2.2	3.1	.7	2.4	.6	1.9
Spain	1959-1965	11.2	8.7	4.5	4.5	5.3	2.5	3.7	.3	1.6
Decentralized Private Enterprise Economies (a)					2.5	3.3	1.0	2.2	.1	1.2
Yugoslavia	1953-1965	11.8	7.5	6.7	4.5	4.7	2.4	2.6	1.0	1.2
Decentralized Economies (a)					2.9	3.6	1.3	2.3	.3	1.2

(a) unweighted average Sources: See Appendix.

**TABLE 3: Conditional Values of the Elasticity of Output with Respect to Labor for which Total Factor Productivity Industry in 1959-1965 is as great or greater than in 1953-1959 for Selected European Countries.**

Country	Comparison of Total Factor Productivity	Comparison of Net Factor Productivity	
		Case A	Case B
Bulgaria	$\alpha \geq .34$	$\alpha \geq .31$	$\alpha \leq .30$
Czechoslovakia	$\alpha \leq 4.03$	$\alpha \geq 3.23$	$\alpha \leq 2.88$
Hungary	$\alpha \leq 1.86$	$\alpha \leq 1.20$	$\alpha \leq 1.01$
Iceland	(n.a.)	(n.a.)	(n.a.)
Rumania	$\alpha \leq .36$	$\alpha \leq .10$	$\alpha \leq .01$
Greece (a)	$\alpha \leq .96$	$\alpha \leq .46$	$\alpha \leq .23$
Ireland	$\alpha \leq 12.47$	$\alpha \leq 4.65$	$\alpha \leq 1.66$
Norway	$\alpha \leq 1.15$	$\alpha \leq .92$	$\alpha \leq .78$
Spain (b)	$\alpha \leq 1.86$	$\alpha \leq 1.34$	$\alpha \leq 1.11$
Yugoslavia	$\alpha \geq .98$	$\alpha \geq .82$	$\alpha \geq .75$

(a) 1961-1965 compared with 1951-1961.

(b) 1961-1965 compared with 1957-1961.

## APPENDIX

- Bulgaria:** Growth rates of industrial output, capital stock and labor were derived from Lazarcik and Wynnyczuk, Bulgaria: Growth of Industrial Output 1934 and 1948-1965, Occasional Paper no. 27 of the Research Project on National Income in East Central Europe, pp. 4 and 9.
- Czechoslovakia:** Growth rates of industrial output, capital stock, and labor were derived from Lazarcik and Staller, A New Index of Czechoslovak Industrial Output 1937 and 1947-1965, Occasional Paper no. 24 of the Research Project on National Income in East Central Europe, pp. 24 and 27. In estimating factor shares, payments to labor were obtained from Lazarcik and Staller, ibid., p. 49, while value of net capital stock was estimated as 75 percent of full replacement value given in L. Alton and Associates, Czechoslovak National Income and Product (1947-1948 and 1955-1956), New York: Columbia University Press, 1962, p. 223.
- Rumania:** Growth rates of industrial output, capital stock, and labor were derived from Tables 36, 46, 47, and 49 in Directia Centrala de Statistica, Anuarul Statistic al R.P.R., 1968. Net capital stock and payments to labor used in estimating factor shares are from M. Montias, Economic Development in Communist Rumania (Cambridge, Mass., M.I.T. Press, 1967), pp. 57 and 58.
- Yugoslavia:** Growth rates of industrial output and labor were derived from Federal Institute for Statistics, Statisticki Godisnjak, 1968, pp. 164 and 170. Growth rate of net capital stock was derived from I. Vinski, "Fixed Assets, 1946-1966," Yugoslav Survey, Nov. 1968, p. 88. Net values of capital stock and payments to labor used in estimating factor shares are from I. Vinski, ibid., p. 88, and Federal Institute for Statistics, Interindustry Relations for the Yugoslav Economy in 1962, Belgarde, 1966, respectively.
- Poland:** Growth rate of industrial output derived from data provided by Thad Alton, Director, Research Project on National Income in East Central Europe. Growth rates of industrial capital and labor derived from Central Statistical Office, Roznek Statystezny, 1968, pp. 65, 100 and 180.
- Hungary:** Growth rates of output were derived from a series prepared by L. Czirjak of the Project on National Income in East Central Europe. Data on the capital stock, labor, and payments to labor were obtained from the Hungarian Statistical Yearbook and other publications of the Hungarian Statistical Office.
- Greece:** Growth rates of output and data on payments to labor and capital are from U.N., Growth of World Industry. Data on employment and the capital stock were made available by Professor Balopoulos, Director of the Center of Planning and Economic Research in Athens.

Appendix (cont'd.)

**Ireland:** Growth rates of output and data on payments to labor and capital are from U.N., Growth of World Industry, and manufacturing employment figures are from the International Labor Office, Yearbook of Labor Statistics. Capital stock in manufacturing was estimated for 1853-1959 in Edward Nevin, The Capital Stock of Irish Industry, The Economic Research Institute, Paper No. 17. We made adjustments for the apparent overestimation of depreciation on investment prior to the Second World War and extended the figures from 1959 on.

**Spain:** Growth rates of output and data on payments to labor and capital are from U.N., Growth of World Industry, and manufacturing employment figures from ILO, Yearbook of Labor Statistics. Estimates on the capital stock were made for 1965 in La Riqueza Nacional de Espana. These figures were adjusted on the basis of the gross investment figures provided in a private communication by Professor Lasuen of Madrid University and estimates of depreciation derived from national accounts statistics.

**Norway:** Growth rates of output and data on payments to labor and capital are from U.N., Growth of World Industry, and manufacturing employment figures from ILO, Yearbook of Labor Statistics. Capital stock data were made available by Odd Aukrust, Research Director of the Norwegian Central Bureau of Statistics.

#### REFERENCES

- [1] Bela Balassa, "The Dynamic Efficiency of the Soviet Economy", American Economic Review, Papers and Proceedings, May 1964, pp. 490-505.
- [2] Abram Bergson, "National Income", in Economic Trends in the Soviet Union, A. Bergson and S. Kuznets, eds. (Harvard University Press, 1963), pp. 1-37.
- [3] N. M. Kaplan, "Retardation in Soviet Growth" Review of Economics and Statistics 50: 293-303, August, 1968.
- [4] R. M. Solow, "Investment and Technical Progress", Mathematical Methods in the Social Sciences, K. J. Arrow, S. Karlin, and P. Suppes, eds. (Stanford University Press, 1960), pp. 89-104
- [5] A. A. Walters, "A Note on Economies of Scale", Review of Economic and Statistics, 45: 425-27, November, 1963.