PRODUCTIVITY GROWTH IN THE HUNGARIAN ECONOMY[1]

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This paper analyses productivity growth in the Hungarian economy over the two decades between 1950 and 1970 with the aim of establishing what help can be provided in such analyses by the use of total factor productivity index numbers. After the introductory sections the paper deals first with the rates and factors of Hungarian productivity growth, and then with some methodological lessons of the investigation.

1. INTRODUCTION

Owing to the limited space available, the problem of productivity growth will be approached in this paper in a *pragmatic way*: it will be assumed that many kinds of indicators are in practice useful in the analysis of productivity, and the paper will not discuss which of them deserves from the theoretical aspect the name productivity and which of them does not. Neither will it consider the two types of national accounting systems (MPS and SNA) or the differences between them with regard to accounting for services, etc. This approach is justified also by the need to adapt ourselves to the existing data base. For the whole period to be examined, 1950–1970, consistent time series are only available for the material sphere, according to the MPS concept. Recently, the Central Statistical Office in Hungary has carried out calculations including also the non-material sphere but these time series have been reconstructed only for the period 1960–1969. The most important basic index numbers, including these new ones, are reproduced in Tables A1–A6 of the Annex.

For purely technical reasons, the twenty-year period between 1950 and 1970 can be broken down into two ten-year and four five-year periods. Historically the period from 1958, the first year which can be considered as free from the immediate effects of the counter-revolution, to 1967, the year preceding the reform of economic control and management, can be considered as a closed one. From another aspect, however, an important event, the collectivization of agriculture, falls in the middle of this period. At the beginning of the period 1950–1958 some consequences of the post-war reconstruction can be felt, the middle of the period is characterized by changing concepts and measures of economic policy,

[1]The first article suggesting and using total factor productivity index numbers in Hungary was published in 1961 [1]. The proposal was carried out by the Hungarian Central Statistical Office—with the co-operation of the author—in 1966 [2]. For the total economy some calculations were performed and published by Mrs. Falus, Katalin Szikra [3] and by Julia Zala [4]. The present study, much stimulated by the works of S. Fabricant [5, 6], J. W. Kendrick [7] and E. Denison [8, 9] is based on fuller and more consistent new calculations, relying on the data of the Hungarian Central Statistical Office. I wish to thank in this place the staff members of the Central Statistical Office for their kind assistance and complementary calculations. I am indebted for helpful comments on the earlier draft of this paper to Prof. E. Denison and to Prof. S. Fabricant.

while the end of it includes the counter-revolution (1956) and the reconstruction following it.[2]

The years 1968–1970 are the first years of the new system of economic control and management; but this is too short a period to serve as a subject of independent evaluation. Though the separate analysis and comparison of these three subperiods, marked with the years 1958 and 1967, also presents many problems (especially with regard to agriculture), it seems more conclusive than breaking the period down into 5 and 10 year sub-periods. To reduce the effect of special features in the marginal years, calculations were also made by levelling out the starting and closing years. The two periods thus formed—from 1950–1952 to 1958–1960 and from 1958–1960 to 1966–1968—serve to compare a lower and a higher stage of economic growth.

In our productivity index numbers *output* will be measured primarily by the deflated value of national income (net material product), though we made some alternative calculations using other concepts, too (see par. 3.1).

As for *labour input*, consistent time series on man-hours worked are available, unfortunately, only for industry and part of construction[3]; thus, for the other branches and for the other sectors and the whole of the economy, we had to be satisfied with employment figures (man-years).

In 1968 a general reduction of working hours was carried out in Hungarian industry and construction, amounting to about 8 per cent. This influenced productivity growth to such an extent—and at a critical moment, in the year of implementing an essential reform of economic control and management—that it seemed expedient to account, at least approximately, for the difference between man-hours and man-years for the period of 1968–1970.

The three *main types of index numbers* the application of which may be considered in analysing the trends of productivity can be symbolized, in a simplified form, as follows:

(1) $$\frac{O_1}{O_0} : \frac{L_1}{L_0}$$

(2) $$\frac{O_1 - K_1^*}{O_0 - K_0^*} : \frac{L_1}{L_0}$$

(3) $$\frac{O_1}{O_0} : \frac{L_1}{L_0} w_l + \frac{K_1}{K_0}(1 - w_l)$$

Where O = output,[4]
L = labour,
w_l = weight of labour,
K = fixed capital,
K^* = depreciation allowances of fixed capital.

[2]Since this affects the index numbers 1958/1957, the second period is calculated as from 1959.

[3]Even here only for workers; we adjusted index numbers of persons engaged by index numbers of man-hours per worker and this was used for the index numbers of man-hours of persons engaged.

[4]This may be either value of gross output or value added, but the case of net value, net of amortization allowance, has been excluded.

Type (1) will be used in most cases, employing index numbers based on a sample of product series or deflated value of gross output or value added, though none of these reflects the changes in fixed capital consumption. Economic interpretation can be given to these index numbers, too, but their use for judging economic performance is limited, since they reflect both the net saving in labour and its substitution by fixed assets, telling us nothing about the efficiency of this substitution. Therefore demand in socialist countries is also growing—in addition to labour productivity in the sense above—for an examination of the capital/output ratio. If, however, the changes in the ratios of output to labour and output to capital[5] are examined in parallel, it is self-explanatory that also their combined changes, that is, their weighted average, can and should be measured. This leads us to total factor productivity index numbers of type (3).

In calculating total factor productivity, if basic data are available the main problem is the choice of weights for combining labour and capital inputs. We made calculations according to five types of weights (see par. 3.2) and in our analysis used type B, based on wages and actual taxes on wages (25 per cent) on the one hand, depreciation allowances and actual charges on fixed assets (5 per cent of gross value) on the other.

In cases where we use production index numbers based on a sample of product series or deflated gross value, changes in material and energy inputs per unit of output will not be included in the total factor productivity index number of type (3) either.[6] By using index numbers of the deflated value of national income (net material product), the change in fixed capital inputs is already taken into account through the depreciation allowances in the numerator and thus their accounting in the denominator results in some duplication, depending on weights, and leads to a new type (4) of productivity index numbers:

$$(4) \qquad \frac{O_1 - K_1^*}{O_0 - K_0^*} \quad : \quad \frac{L_1}{L_0} w_l + \frac{K_1}{K_0}(1 - w_l)$$

Since in the index numbers quoted above type (1) does not take capital inputs into account at all, types (2), (3) and (4) should be preferred in any case if the basic data needed are available. The characteristics of these latter index numbers will be analysed in par. 3.3; in our analysis, first type (2), then type (4) will be used.

2. Rates and Factors of Productivity Growth

A great many calculations and analyses have been made in Hungary on productivity in industry; the Central Statistical Office regularly publishes index

[5]If fixed capital consumption is considered, working capital inputs must also be accounted for. We had to neglect this component, however, since data were not available. As far as land is concerned, some remarks will be given in par. 2.2 dealing with productivity changes in agriculture.

[6]Since there is a substitution also between labour and energy inputs used for electric motors, in our calculations performed in the Central Statistical Office in 1966 we took into account not only depreciation allowances, but also electric energy inputs for electric motors. The weight of the latter, however, is rarely significant and their changes more or less follow that of capital consumption. Thus, instead of separate accounting of energy inputs it seems simpler to increase the weight of fixed capital inputs.

numbers of productivity in industry and construction. On the other hand, calculations and analyses are exceptional for other branches of the economy, for instance agriculture or the economy as a whole. It seems advisable to mention this fact, since it probably implies also reservations regarding the linking of output and input figures and their utilization for such analyses, and up to now there has not been time to investigate the great number of statistical problems raised by such uses of the data. Due to these constraints, our numerical results should be considered preliminary, especially for construction and agriculture (see par. 2.2), and it is to be hoped they will stimulate also improvements in the statistics. In the following sections, rates and factors of productivity growth in the Hungarian economy will be presented first with the aid of the "traditional" (type (2)) and then with that of the total factor productivity (type (4)) index numbers. It would be useful to add international comparisons to this picture at some later date. The major basic data used in this analysis have been published recently by the Hungarian Central Statistical Office in [10], methodological notes on concepts and methods of calculation in [11].

2.1. *First approach, the change of labour productivity in the material sphere*

Between 1950 and 1970 national income (net material product) increased in Hungary by an annual average of 5.6 per cent, in a way that the national income originating in the major branches

in industry increased by 7.9%
in construction by 7.1%
in agriculture[7] by 0.5% per year.

Employment grew by an annual 1 per cent and its pattern has substantially changed. In 1950 in the material sphere 61 per cent of total employment was engaged in agriculture, and 28 per cent in industry and construction; in 1970 the corresponding ratios were 34 and 49 per cent. National income per person employed increased on annual average by

3.9 per cent in industry,
2.5 per cent in construction,
2.6 per cent in agriculture, and
4.6 per cent in the total material sphere, including trade, transport and communication, as well as the effects of major structural shifts among these branches.

The data mentioned above are presented for sub-periods in Table 1.

The growth rate of total and, particularly, of per capita national income has accelerated. Though in sub-period 3 industrial output increased at a somewhat slower rate than earlier and that of agriculture diminished—which also reflects the particularities of the base year and flood damages in the terminal year (in respect of agriculture the comparison of individual years is always problematic)—

[7]Gross value of output increased by 2.2 per cent per annum. Value of materials used may be somewhat overestimated and growth of net product underestimated due to the special price relations (high industrial prices) in Hungary, see [12].

TABLE 1

AVERAGE ANNUAL RATE OF GROWTH OF NATIONAL INCOME AND ITS COMPONENTS, IN PERCENTAGES

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
National income (deflated)	5.4	5.8	6.0	5.6	5.1	5.4
Of which:						
industry	7.9	8.5	6.2	7.9	7.1	8.1
agriculture	1.7	−0.1	−0.9	0.5	2.0	0
Population	0.7	0.4	0.4	0.5	0.7	0.4
Per capita national income	4.6	5.4	5.6	5.1	4.4	5.0
Ratio of labour force of working age to population	−0.6	0	0.3	−0.1	−0.6	0.1
Employment of labour force	1.2	0.1	0.9	0.6	1.0	0
Ratio of those enaged in material sphere to total	0.3	−0.3	0.2	0	0.4	−0.3
Employment in the material sphere	1.6	0.2	1.8	1.0	1.5	0.2
National income per person engaged (labour productivity)	3.7	5.6	4.1	4.6	3.6	5.3
Of which						
industry	2.6	5.3	3.6	3.9	2.1	5.0
agriculture	2.6	3.3	0.1	2.6	3.0	3.5
Effect of structural changes on labour productivity**	1.1	1.4	1.9	1.6	0.8	1.2
Effect of other factors	2.6	4.2	2.2	3.0	2.8	3.8

*Assuming that one third of the loss due to the reduction of working hours might be counterbalanced by higher man-hour productivity, the rate of growth of labour productivity without this reduction in working hours would be 5.2 per cent in industry, 4.8 in the total economy.

**Estimates.

under the effect of structural shifts total national income still increased at a somewhat faster rate than earlier. The growth in employment was important, especially in the first subperiod (see Table 2); in the third it mostly compensated for the reduction in working hours. Labour productivity increased most in the second sub-period but—considering also the shorter hours of work—it increased in the third sub-period even faster than in the first.

Structural change played an essential role in these changes: about 30–40 per cent of the growth in productivity was due to this factor. This is, however, a problematic element of our calculations, since according to several investigations the prices of industrial goods are higher and those of agricultural products lower "than justified". (It is, of course, very difficult to qualify these price scissors.) Accordingly the value of output per person engaged at our valid prices may show greater differences between industry and agriculture—mainly in earlier years—than exists between their real productivities. Thus the favourable effect appearing in the calculations is partly unreal. On the other hand the higher prices of industrial products increasingly used in agriculture may cause some downward bias in the rates of national income.

TABLE 2

SOURCES OF GROWTH IN NATIONAL INCOME

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
National income	100	100	100	100	100	100
Population	*13*	*7*	*7*	*9*	*14*	*7*
Ratio of labour force to population	*−11*	*0*	*5*	*−2*	*−12*	*2*
Employment of labour force	*22*	*2*	*15*	*11*	*20*	*0*
Ratio of those engaged in material sphere to total	*5*	*−5*	*3*	*0*	*8*	*−6*
Employment	29	4	30	18	30	3
National income per person engaged (labour productivity)	71	96	70	82	70	97
Effect of structural changes on labour productivity	*21*	*24*	*32*	*29*	*16*	*22*
Effect of other factors**	*50*	*72*	*38*	*53*	*54*	*75*

*In the case of the adjustment for reduction in hours of work, the contribution of changes in labour input amounts to 20 per cent, of productivity 80 per cent; from this, the effect of "other factors" is 48 per cent.

**Estimates.

The comparison of the two sub-periods, with levelling of the starting and closing years, is of interest as a comparison of a lower and a higher stage of economic growth. The main difference between the two periods is that in the second the growth in employment played almost no role whatever; the source of the increase of national income was the growth in productivity, and within that, to an invariably significant extent, the changes in pattern.

2.2. *Changes in productivity of the major branches*

Changes in productivity in the major "material" branches, industry, construction, and agriculture, will be dealt with next. Data needed on trade, transport and communication were not available. At the same time total factor productivity index numbers will be introduced.

Either three or two sub-periods are examined. In *industry*, including mining, manufacturing, and electricity, the change of productivity was most unfavourable in the first sub-period (see Table 3). According to the data adjusted for reduction in hours of work, the second and third sub-periods show a similar picture; if only rough employment figures are examined, the second was more favourable.

In Table 4 an attempt will be made to disaggregate the sources of the growth in industrial output. At the end of the fifties the change is unequivocal: the role of labour and total factor inputs diminishes while the role of labour and total factor productivity increases, as does that of the substitution of capital for labour, measured by the difference between the rates of growth of labour and of labour + capital inputs—which provides a link between growth of labour

TABLE 3

AVERAGE ANNUAL RATES OF GROWTH IN INDUSTRY

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
Output: Deflated value of national income originating	7.9	8.5	6.2	7.9	7.1	8.1
Labour: Persons engaged	5.2	3.0	2.6(1.0)	3.8	4.9	3.0
Capital: Deflated gross value of fixed assets	8.9	7.9	5.7	8.0	8.9	7.8
Labour+Capital**	6.4	5.0	4.0(2.7)	5.4	6.2	4.9
Labour productivity	2.6	5.3	3.6(5.2)	3.9	2.1	5.0
Output/Capital	−0.9	0.5	0.5	−0.1	−1.6	0.3
Total factor productivity	1.5	3.5	2.2(3.5)	2.5	0.9	3.2

*In parentheses data adjusted for reduction of working hours, assuming that one third of this reduction might be counterbalanced by higher man-hour productivity.

**Weighted arithmetical average, by weights of type B, see p. 218.

TABLE 4

SOURCES OF THE GROWTH OF OUTPUT IN INDUSTRY

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
Output: Deflated value of national income originating	100	100	100	100	100	100
Labour: Persons employed	67	36	42(16)	48	70	38
Labour productivity of which:	33	64	58(84)	52	30	62
Effect of substitution**	14	23	23(28)	20	17	22
Efficiency	19	41	35(56)	32	13	40
Total factor input (Labour+Capital)	81	59	65(44)	68	87	60
Total factor productivity	19	41	35(56)	32	13	40

*In parentheses data adjusted for reduction of working hours.

**Calculated as the difference between the rates of growth of labour and labour plus capital inputs.

and total factor productivity. If the years 1968–1970 are investigated with adjustment for the reduction of working hours, no break is visible. But it is too soon to evaluate the effects of the reform of economic control introduced in 1968.

For state-owned industry, representing in 1970 almost 90 per cent of the total factor input of industry, more detailed calculations are available. Table A9 of the Annex shows the change in productivity between 1950 and 1970 in 18 groups of industry. Though the rank correlation between total factor productivity

and labour productivity is high (0.929), examination of total factor productivity shows the development of a few industrial groups in a different light.[8] The low rate of growth of productivity in mining, which has considerable weight in Hungarian industry, is particularly characteristic, especially in the first subperiod. The index numbers calculated for manufacturing exclusive of mining and electric energy (see Table 5) indicate higher rates of growth in all subperiods. The significant difference between the first and second subperiods, to the advantage of the latter, disappears!

TABLE 5

AVERAGE ANNUAL RATES OF GROWTH, TOTAL AND MANUFACTURING INDUSTRY

	1950–1958	1958–1967	1967–1970	1950–1970
Output*				
A	9.3	8.0	4.7	8.0
B	9.9	8.7	5.0	8.6
Output/Man-hours				
A	3.9	4.8	5.1	4.5
B	4.8	5.0	5.3	5.0
Output/Capital (Deflated gross value of fixed assets)				
A	1.1	0.2	−0.9	0.4
B	2.6	1.5	−1.0	1.5
Total factor productivity				
A	2.9	2.8	3.0	2.9
B	3.8	3.8	3.3	3.8

*Index numbers based on product series.

(A) = Total industry including mining and electricity.

(B) = Manufacturing.

As regards *agriculture* (see Table 6) growth of production, especially according to the net concept, was slow in the whole period; it was, however, faster in the first than in the second and third subperiods. It should be noted, however, that comparison of periods characterized by individual initial and terminal years may be misleading in the case of agriculture. As mentioned before, growth rates of national income originating in agriculture might be somewhat underestimated because of the special Hungarian price relations. The growth rate of the years 1967–1970 was influenced also by great flood damages in 1970.

Fixed capital increased in agriculture in every subperiod faster than output. The strong decline in employment is characteristic of the later period; collectivization of agriculture took place at the beginning of the sixties. A comparison of total and labour productivities shows here characteristic differences. According to the former, agricultural activity was more efficient in the second period, but, according to the latter in the first period. Of course, efficiency cannot be judged

[8]For the rank correlation between the average growth rates of 63 industrial branches between 1960–1967 a coefficient of 0.817 has been obtained.

TABLE 6

AVERAGE ANNUAL RATES OF GROWTH IN AGRICULTURE

	1950–1958	1958–1967	1967–1970	1950–1970	1950/52–1958/60	1958/60–1966/68
Output: Deflated value of national income originating	1.7	−0.1	−0.9	0.5	2.0	0
Labour: Persons engaged	−0.9	−3.4	−1.0	−2.1	−1.0	−3.4
Capital: Deflated gross value of fixed assets	4.0	4.4	5.6	4.4	4.2	4.4
Labour plus Capital*	−0.3	−1.9	0.8	−0.9	−0.3	−1.9
Labour productivity	2.6	3.3	0.1	2.6	3.0	3.5
Output/Capital	−2.3	−4.3	−6.2	−3.8	−2.1	−4.3
Total factor productivity	2.0	1.8	−1.7	1.4	2.3	1.9

*Weighted arithmetic average using weights of type (B), see p. 218.

here either taken out of context: the outflow of labour from agriculture into industry enabled a significant growth of industry and, obviously, this contributed in some respects also to the growth in industrial productivity (though the inflow of too much labour exerted also an opposite influence) and this change in the structure of manpower had an immediate effect on the productivity of the economy as a whole, as has been indicated in the preceding par. 2.1.

Some problems of measuring national income originating in agriculture due to the effects of relative prices in Hungary have been mentioned already. Significant difficulties arise also in measuring actual labour input both in regard to number of persons engaged, many part-time, in agricultural production and per capita man-hours performed. Data on fixed assets prior 1960 are based mostly on rough estimates. Some additional calculations will be made on these issues but results can not be reported yet.

Land was not accounted in our total productivity figures above. Now we estimate the possible effect of its accounting.

In Hungary the total land area did not change in the 20-year period under review. The agriculturally cultivated area, however, diminished at an annual rate of about 0.5 per cent. According to recent calculations of the Hungarian Central Statistical Office the value of land relative to fixed assets amounts approximately to 250 per cent in agriculture and to 35 per cent in the total economy. This would change our average rates of growth as shown in Table 7.

Thus, including changes in land area influences under our conditions the capital/output ratios, but hardly the total factor productivity figures.

Since employment decreased in agriculture, as did in general labour and capital inputs combined, the increase in productivity compensated also for this fact and contributed to the growth of output of more than 100 per cent. The role of substitution has grown; in the first subperiod it contributed to the growth in labour productivity by 23 per cent, in the second by 45 per cent. It should be noted, however, that fixed assets served in this latter period (that of the

TABLE 7

AVERAGE ANNUAL RATES OF GROWTH WITH AND WITHOUT ACCOUNTING FOR LAND, 1950–1970

	Agriculture	Material sphere
National income	0.5	5.6
Fixed assets	4.4	5.0
Land	−0.5	0
Fixed assets plus land	0.9	3.7
National income/Fixed assets	−3.8	0.6
National income/Land	1.0	5.6
National income/Fixed assets plus land	−0.4	1.8
Labour plus fixed assets*	−0.9	2.2
Labour plus fixed assets plus land*	−0.8	2.0
Total factor productivity:		
National income/Labour plus fixed assets	1.4	3.4
National income/Labour plus fixed assets plus land	1.3	3.6

*Weighted arithmetical average by 1961 weights of type B, see p. 218.

collectivization of agriculture) not only as substitution but to establish facilities for collective farming.

Construction is characterized (see Table 8) by very fast growth of fixed capital, exceeding that of production, but its weight is not large enough yet to influence seriously the change in total factor productivity. Labour productivity increased most favourably in the second subperiod; with adjustments for the reduction in hours of work, the performance in the third subperiod was the same. In the breakdown into two subperiods, in the first period the levelling of the starting years eliminates the fast growth in employment in these years and this results in a very high rate of growth in productivity.

TABLE 8

AVERAGE ANNUAL RATES OF GROWTH IN CONSTRUCTION

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
Output: Deflated value of national income originating	7.0	6.6	8.7	7.1	6.7	5.5
Labour: Persons engaged	4.6	3.7	6.7(5.9)	4.5	1.6	3.5
Capital: Deflated gross value of fixed assets	25.6	11.8	9.6	16.8	20.1	11.9
Labour less Capital**	5.5	4.8	7.3(6.4)	5.5	2.5	4.5
Labour productivity	2.3	2.8	1.9(2.8)	2.5	5.1	1.9
Output/Capital	−14.8	−4.7	−0.9	−8.3	−11.1	−5.6
Total factor productivity	1.5	1.8	1.4(2.3)	1.6	4.2	1.0

*In parentheses data adjusted for reduction of working hours, assuming that one third of this reduction might be counterbalanced by higher man-hour productivity.

**Weighted arithmetic average using weights of type B, see p. 38.

It should be mentioned, however, that our data on construction are less reliable than the data on industry. Only about two thirds of construction output originates in state-owned building enterprises with well-organized statistics and for the remainder the Hungarian Central Statistical Office has to make extensive use of estimates. The trends in productivity of these different segments of construction show striking differences in some cases which need further investigation.

TABLE 9

SOURCES OF GROWTH OF OUTPUT IN CONSTRUCTION

	1950–1958	1958–1967	1967–1970*	1950–1970	1950/52–1958/60	1958/60–1966/68
Output: Deflated value of national income originating	100	100	100	100	100	100
Labour: Persons employed	67	57	78(68)	64	24	64
Labour productivity	33	43	22(32)	36	76	36
of which:						
Effect of substitution**	12	16	6(6)	13	13	18
Efficiency	21	27	16(26)	23	63	18
Total factor input (Labour plus Capital)	79	73	84(74)*	77	37	82
Total factor productivity	21	27	16(26)*	23	63	18

*In parentheses data adjusted for reduction of working hours.

**Calculated as the difference between the rates of growth of labour and labour plus capital inputs.

2.3. *Second approach, the change and role of labour and total factor productivity*

After the major branches, calculations on total factor productivity for the material sphere and the total economy will be presented here with a further attempt to identify factors of growth.

In Table 10 productivity growth rates of the material sphere and its three major branches are compared. Index numbers of total factor productivity show in each case a smaller growth than labour productivity and the picture changes slightly: e.g., in the first subperiod the productivity of labour increased similarly in both industry and agriculture, and total factor productivity increased faster in agriculture; considering the whole period the relative difference is greater in favour of industry. In agriculture in the second subperiod labour productivity increased faster, total productivity slower than in the first subperiod.

According to our data in industry about two-thirds and in construction about three quarters of the growth of output was covered on average by growing inputs. In agriculture inputs diminished; the source of the modest growth in output was increase of productivity.

TABLE 10

GROWTH OF PRODUCTIVITY IN THE MAJOR SECTORS OF THE MATERIAL SPHERE

	1950–1958	1958–1967	1967–*1970	1950–1970	1950/52–1958/60	1958/60–1966/68
Average annual rate of growth of labour productivity						
Industry	2.6	5.3	3.6(5.2)	3.9	2.1	5.0
Construction	2.3	2.8	1.9(2.8)	2.5	5.1	1.9
Agriculture	2.6	3.3	0.1	2.6	3.0	3.5
Material sphere	3.7	5.6	4.1(4.8)	4.6	3.6	5.3
Average annual rate of growth of total factor productivity						
Industry	1.5	3.5	2.2(3.5)	2.5	0.9	3.2
Construction	1.5	1.8	1.4(2.3)	1.6	4.2	1.0
Agriculture	2.0	1.8	−1.7	1.4	2.3	1.9
Material sphere	3.0	3.9	3.0(3.5)	3.4	2.8	3.6
Ratio of growth rates of total and labour productivity (%)						
Industry	58	66	61(67)	64	43	64
Construction	65	64	74(71)	64	82	53
Agriculture	77	55	−1700	54	77	54
Material sphere	81	70	72(71)	74	78	68
Contribution of total factor productivity to the growth of output (national income) %						
Industry	19	41	35(56)	32	13	40
Construction	21	27	16(26)	23	63	18
Agriculture	100	100	100	100	100	100
Material sphere	56	67	50(58)	63	55	67

*In parentheses: the data adjusted for reduction in working hours.

Table 11 gives a summary of our data on the sources of the growth in national income. Some figures for the whole period 1950–1970 are given also on the total economy including the non-material sphere.[9] In most cases the difference is but a few tenths of a per cent and seems to be negligible. Our further analysis can therefore be restricted to the material sphere. According to the data given also for the two and three subperiods, between the first and second half of the total period the growth rates of population, employment and the efficiency of fixed assets diminished, while those of total and per capita national income, labour and total factor productivity accelerated.

The growth rate of total factor productivity was smaller in each subperiod and also increased slower than that of labour productivity, owing to the slower improvement in the efficiency of fixed assets. The effect of structural changes was important in each subperiod and contributed about one third of the growth in productivity. These figures, however, might be overestimated (see p. 205).

[9]Since these estimates are based partly on an assumption regarding changes in productivity (see p. 218), apart from the general problems of measuring productivity in the service sectors, they cannot be used for a more detailed productivity analysis.

TABLE 11

AVERAGE ANNUAL RATES OF GROWTH OF NATIONAL INCOME AND ITS FACTORS, SECOND APPROACH

	1950–1958	1958–1967	1967–*1970	1950/52–1958/60	1958/60–1966/68	1950–1970** (A)	(B)
Deflated value of national income	5.4	5.8	6.0	5.1	5.4	5.6	5.4
Population	0.7	0.4	0.4	0.7	0.4	0.5	0.5
Per capita national income	4.6	5.4	5.6	4.4	5.0	5.1	4.9
Ratio of labour force of working age to population	−0.6	0	0.3	−0.6	0.1	−0.1	−0.1
Employment of labour force	1.2	0.1	0.5	1.0	0	0.6	0.6
Ratio of those engaged in the material sphere to total	0.3	−0.3	0	0.4	−0.3	0	—
Persons engaged	1.6	0.2	1.2	1.5	0.2	1.0	1.0
Labour productivity	3.7	5.6	4.8	3.6	5.3	4.6	4.4
Deflated gross value of fixed capital	4.5	5.5	4.9	4.6	5.5	5.0	4.1
National income/ Capital	0.9	0.3	1.1	0.5	−0.1	0.6	1.0
Labour plus capital (Total factor input)	2.4	1.9	2.5	3.3	2.8	2.2	2.0
Total factor productivity	3.0	3.9	3.5	2.8	3.6	3.4	3.4
Of which:							
Effect of structural changes***	1.3	1.1	1.6	1.2	1.1	1.3	1.3
Other factors***	1.7	2.8	1.9	1.6	2.7	2.1	2.1

*Adjusted for reduction in working hours.

**(A) = material sphere, (B) = total economy including non-material sphere; the latter figures are estimates (see p. 218).

***Estimates.

In Table 12 a twofold breakdown of the sources of the growth in national income is given, showing both labour and total productivity.

Considering the period as a whole, 18 per cent of the growth in national income came from higher employment and 82 per cent from growth in productivity. Of the 18 per cent 11 was due to increased employment proper and 7 per cent to demographic changes. Of the 82 per cent growth in productivity, 21 per cent may be attributed to substitution of capital for labour and 61 per cent to growth in total factor productivity. Looking at the subperiods, the role of higher employment declined and that of substitution increased.

Viewing the problem in terms of total factor productivity, in the period as a whole it contributed 61 per cent to the growth in national income, while total factor (labour and capital) inputs contributed 38 per cent. The role of structural effects amounted to 23 per cent and that of other factors to 38 per cent.

TABLE 12

SOURCES OF GROWTH IN NATIONAL INCOME, SECOND APPROACH

	1950–1958	1958–1967	1967–*1970	1950/52–1958/60	1958/60–1966/68	1950–1970** (A)	(B)
National income	100	100	100	100	100	100	100
Population	*13*	*7*	*7*	*14*	*7*	*9*	*9*
Ratio of labour force to population	*−11*	*0*	*5*	*−12*	*2*	*−2*	*−2*
Employment of labour force	*22*	*2*	*8*	*20*	*0*	*11*	*11*
Ratio of those engaged in the material sphere to total	*5*	*−5*	*0*	*8*	*−6*	*0*	—
Persons engaged	29	4	20	30	3	18	18
Labour productivity	71	96	80	70	97	82	82
Of which:							
Effect of substitution	*15*	*29*	*22*	*15*	*30*	*21*	*19*
Total factor productivity	*56*	*67*	*58*	*55*	*67*	*61*	*63*
Total factor input	44	33	42	45	33	39	37
Total factor productivity	56	67	58	55	67	61	63
Of which:***							
Structural effect	*24*	*19*	*27*	*24*	*20*	*23*	*24*
Effect of other factors	*32*	*48*	*31*	*31*	*47*	*38*	*39*

*Adjusted for reduction in working hours.

**(A) = material sphere, (B) = total economy including non-material sphere, too; the latter figures are estimates (see p. 218).

***Estimates.

Finally, an attempt will be made to quantify the effects of another three factors. As for the "quality" of labour, two factors had a primary role: increasing skills and the great number of new entrants in the labour force. For the growth in skills, approximate calculations yielded an average annual growth rate of 0.8 per cent.[10] If labour inputs were adjusted on this account, their annual growth rate would be 1.8 per cent instead of 1.0 per cent, the growth rate of labour productivity 3.8 per cent instead of 4.6 per cent, and that of total productivity 2.8 per cent instead of 3.4 per cent. Increased skills may, however, be also conceived of as a factor in the growth of labour productivity and in harmony with the adjusted calculations above let us assume that every one per cent increase in skills results in a one per cent increase of productivity. The validity of this assumption needs further investigation.

Increase of employment and the outflow of labour from agriculture meant that many new workers entered production or another kind of production, and this undoubtedly reduced the average productivity of those already employed

[10]The weighting of persons employed by different skill levels according to alternative sets of weights, based on school-years completed, costs of education, etc., gave very similar results.

there. The ratio of new labour was calculated on the basis of the increment in non-agricultural employment, and this is 2 per cent on annual average for the whole period. It was also assumed that the productivity of the new labour is 20 per cent below average, and thus every one per cent of new labour reduces the average productivity by 0.2 per cent. The total effect is 0.4 per cent. This effect, however, was the same both in the initial and the terminal year of the period under review, hence the logic of our calculations seems not to allow its inclusion in our framework of factors. Nevertheless it could be of importance in particular for international comparisons of rates of growth. Thus this problem deserves further attention.

An important role in the growth of productivity should be attributed certainly to economies of scale. Their role is, however, difficult to estimate. The faster growth in foreign trade than in national income probably increased the role of this factor in Hungary, while a possible under-utilization of the advantages inherent in specialization reduced it. Therefore, we took the lowest value to be found in literature for such estimates: to each per cent growth in output a 0.1 per cent growth in productivity was assigned. For an annual 5.6 per cent growth in national income this yields 0.6 per cent.

The consideration of these factors does, unfortunately, not help much in the comparison of the subperiods since their growth rates are nearly the same in the subperiods.

TABLE 13

SOURCES OF GROWTH IN NATIONAL INCOME AND PRODUCTIVITY 1950–1970

	Average Annual Rate of Growth (or Effect)	Contribution (%) of the Factors to the Growth of			
		National Income	*Per Capita* National Income	Labour Productivity	Total Factor Productivity
National income	5.6	100	—	—	—
Population	0.5	9	—	—	—
Per capita national income	5.1	—	100	—	—
Employment ratio	0.5	9	10	—	—
Persons engaged	1.0	(18)	—	—	—
Labour productivity	4.6	(82)	(90)	100	
Qualification	0.8	14	16	17	17
Economies of scale	(0.6)	11	12	13	18
Structural effects	(1.3)	23	25	28	38
Substitution	(1.2)	34	37	26	—
Other factors	(1.1)			16	27
Total factor input	2.2	39	33	—	—
Total factor productivity	3.4	61	67	—	100

Table 13 gives a summary of the weights tentatively attributed to the factors under review for the changes in national income, per capita national income, labour and total factor productivity.

3. Methodological Notes

3.1. *Index numbers of output*

In our productivity index numbers output was measured primarily by the deflated value of national income (net material product) but calculations were made also for the deflated value of gross output and, for the years 1960–1969, including the non-material sphere. As regards industry, for the state-owned sector index numbers based on a sample of product series were also available.

Based on these four kinds of production index numbers some comparisons have been made. Considering the *material sphere* and its three main branches, industry, construction and agriculture, combined (see Tables A1 and A3) we have altogether 80 pairs of rates of annual changes for deflated gross value of output and national income. Rounded up to whole figures, the index numbers of gross output are higher for two-thirds of these pairs, and those of national income for one-third.

Among the ten periods examined, the two kinds of index numbers are greater or smaller to almost the same extent, with the exception of agriculture, where the index number of gross output is always higher. Examining, however, the three subperiods more characteristic of economic growth, 1950–1958, 1958–1967, and 1967–1970, in industry, which is continuously gaining in importance, national income increased faster in the second and even more in the third subperiod, and in the third subperiod this was already decisive for the whole material sphere (see Table 14).

TABLE 14

Average Annual Rates of Growth of Output

	1950–1958		1958–1967		1967–1970		1950–1970	
	G.O.	N.I.	G.O.	N.I.	G.O.	N.I.	G.O.	N.I.
Material sphere	7.8	5.4	6.4	5.8	5.0	6.0	6.8	5.6
Industry	10.3	7.9	7.8	8.5	5.1	6.2	8.4	7.9
Construction	9.7	7.0	6.3	6.6	8.3	8.7	7.9	7.1
Agriculture	3.0	1.7	2.1	−0.1	0.4	−0.9	2.2	0.5

G.O. = deflated gross value of output, N.I. = deflated national income.

For *state-owned industry* (see Table A5) there is also a third kind of index number available calculated with the aid of product series. If annual changes are examined, this index number usually falls between the two others of gross output and of national income, but in five cases out of the 20 it indicates smaller growth than either of the other two. It is usually closer to the index number of

gross output: the correlation coefficient between the annual rates[11] is 0.995, while that with the index number of national income is 0.857. In six cases out of the ten periods examined, and in the later periods, it is the index number based on product series that shows the smallest average rates of growth.

TABLE 15

AVERAGE ANNUAL RATE OF GROWTH OF OUTPUT, STATE-OWNED INDUSTRY

	1950–1958	1958–1967	1967–1970	1950–1970
Deflated gross value of output	10.0	8.7	4.8	8.6
Deflated national income originating	7.9	8.8	6.2	8.1
Index numbers based on product series	9.3	8.0	4.7	8.0

For the 18 industrial groups and the two aggregate groups (heavy and light industries) within state-owned industry, the Hungarian Central Statistical Office has recently started to calculate index numbers of national income originating but for a longer period only those for gross output and those based on product series are available. Table 16 shows the deviations between the two kinds of index numbers for four periods.[12]

TABLE 16

RELATION BETWEEN INDEX NUMBERS BASED ON PRODUCT SERIES AND ON GROSS OUTPUT CALCULATED FOR 20 INDUSTRIAL GROUPS

	Number of Cases when the Index Number Relying on Product Series Relative to that Relying on Gross Output is		
	Greater	Smaller	Almost identical
1950–1960	3	12	5
1950–1958	1	9	10
1958–1967	3	15	2
1950–1967	2	13	4
The four periods combined	9	49	21

*Based on average growth rates; differences of at least 0.2 per cent are qualified as smaller or greater.

For nine years 1960–1969 we also have index numbers which include the non-material sphere (see Table A7). There is only a slight difference between our index numbers calculated according to the two concepts: the inclusion of

[11]Correlation with the base index numbers is less characteristic, but shows still a difference: it is 0.999 for gross output, and 0.995 for national income.

[12]In some cases even the index number based on product series relies on gross value of output.

the non-material sphere somewhat reduces the rates of growth. Comparing annual changes of GDP, rounded off to whole percentages, they are smaller in one case out of nine; comparing annual changes of national income in two out of nine; in the others they are identical. According to our estimates for the period 1950–1960—on the basis of changes in employment in the non-productive sphere and assuming the rate of growth in productivity to be identical with that between 1960–1969—we obtained a growth rate smaller by 0.5 per cent and for the whole period 1950–1970 one smaller by 0.2 per cent.[13]

TABLE 17

AVERAGE ANNUAL RATES OF GROWTH, MATERIAL SPHERE AND TOTAL ECONOMY

	Material sphere	Total economy
1960–1969		
GDP (deflated)	5.6	5.4
National income (deflated) (Net domestic product)	5.4	5.3
1950–1960		
National income (deflated)	5.9	5.4*
1950–1970		
National income (deflated)	5.6	5.4*

*Estimates.

3.2. *Total factor productivity; weights*

As regards the problem of combining labour and capital inputs, considering the conditions prevailing in the Hungarian economy weighting with marginal products is impractical. We thus start from the concept that the two kinds of input should be *added up*, in identical units of measurement. Of course, even in this case many solutions lend themselves, and from among them calculations were made with five kinds of weights, with some variants for different years:

(A) wages—amortization allowances,

(B) wages and taxes on wages (25 per cent)—depreciation allowances and charges on fixed assets (5 per cent on gross value),[14]

(C) wages and taxes on wages (25 per cent)—depreciation allowances and charges on fixed *and* liquid assets (5 per cent of gross value),

(D) Employment in man years—labour-input contents of the depreciation allowances in man-years,

(E) Employment in man years—labour-input contents of the depreciation allowances and the charge on fixed assets in man-years.

[13]In Hungary in 1950 the non-productive sphere employed 16 per cent, in 1970, 19 per cent of total employment. Owing to this small weight, even if we assume for the non-material sphere a 2 per cent growth in productivity instead of 1 per cent between 1950 and 1960, this will involve for the total economy and the total period only a difference of 0.1 per cent.

[14]Actually, charges on fixed assets are calculated in Hungary on the basis of gross value; a net value base would somewhat reduce the weight of capital.

The labour-input content of the depreciation allowance has been calculated from the input–output table for 1968, with the assumption that one money unit of depreciation allowance is identical with the labour-input needed for the *reproduction* of fixed assets worth one unit of the currency in the given period. In our calculations, in addition to the usual total labour coefficients we have taken into account also the labour input contents of the import materials used (the labour input of the exports needed to acquire the foreign exchange to be paid for imports). For the sake of simplicity, the charge on fixed assets was also calculated in the indicator under (E) using the same coefficient.

TABLE 18

WEIGHT OF LABOUR INPUTS IN 1969*

	(A)	(B)	(C)	(D)	(E)
Industry	75	64	61	87	77
Construction	94	92	87	96	94
Agriculture	89	80	76	94	86
Transport and communication	59	41	41	73	52
Trade	91	85	71	96	91
Material sphere	82	70	67	89	82
Non-material sphere	78	52	52	87	61
Total**	81	66	64	89	76

*For explanation of the symbols see p. 218.

**The weight based on the ratio of consumption and accumulation amounts to 76 per cent.

Considering the major branches of the economy, using 1969 weights, including liquid assets (Variant C) causes significant difference only in trade. Including taxes on wages and charges on assets (Variant B) reduces the weight of labour inputs, while calculating with labour-input contents (Variant D) increases it. Practically between (B) and (C) there is not much difference, and (E) yields almost the same as (A); thus the choice had to be made between (A), (B), and (D).

Since it is almost universal that labour input grows slower than capital input, the combined index number of these two factors is the smaller—and the index number of total factor the greater—the greater the weight of labour input. Accordingly in our calculations the greatest growth is shown by (D), the smallest by (B), while (A) always falls between the two (see Table A7).

The differences are but a few tenths of a percentage in the examples given; with the exception of three cases out of 23 they are under one per cent. When the rate of growth is small, however, this one per cent is not negligible. When comparing branches and periods these variants may even in some rather exceptional cases yield a different ranking.[15]

[15]We have alternative calculations also for the industrial groups and subgroups according to the weights (A) and (B). In some cases the differences are significant, though they modify the ranking of the groups and subgroups in a few cases only.

Use of weights of different periods cannot be considered to be a problem peculiar to total factor productivity index numbers. Some lessons of our calculations (see Table A8) will be summed up briefly.

For the material sphere and its three major sectors for three periods, as well as for the total economy including the non-material sphere and its six sectors for the period 1960–1969, two kinds of weights (1961 and 1969) were used. In the 1969 weights the share of labour is greater and thus the growth of total factor input calculated by these weights is nearer to the lower growth rates of labour and results in a greater growth of total productivity. The ranking by growth in productivity is the same between subperiods; the ranking of sectors changes in a few cases.

For state-owned industry for three periods weights of three different years were used, 1950, 1958, and 1968. In later years, particularly in 1968, the share of labour is smaller; calculating with these weights results in smaller rates of growth of productivity. The ranking of subperiods changes in a few cases. In our analyses generally calculations by weights of 1961 or 1958 were used.

3.3. *A comparison of different types of productivity index numbers*

Four major types of productivity index numbers were mentioned in par. 1 (see p. 202). The components[16] of these index numbers show these general trends and relationships:

$$\frac{O_1}{O_0} \gtrless \frac{K_1}{K_0} \tag{4}$$

$$\frac{O_1}{O_0} > \frac{L_1}{L_0} \tag{5}$$

$$\frac{K_1}{K_0} > \frac{L_1}{L_0} \tag{6}$$

and this results in

$$\frac{O_1}{O_0} \gtrless \frac{O_1 - K_1^*}{O_0 - K_0^*} \tag{7}$$

$$\frac{L_1}{L_0} < \frac{L_1}{L_0} w_l + \frac{K_1}{K_0}(1 - w_l). \tag{8}$$

Accordingly the index number of type (3) should generally indicate a smaller rate of growth than type (1), which was perfectly confirmed by our calculations. The index number of type (2) may be either smaller or greater than that of type (1) but seldom shows a significant difference.

A comparison of types (2) and (3) seems more interesting since both account for changes in fixed capital but not in an identical way. If we eliminate the difference due to the fact that in formula (3) a greater weight can be given to K than is necessary in (2) (thus, e.g., a charge on assets may be added to depreciation allowance), it is still significant that in formula (3) the changes in K have greater effect. The differences between the changes in output and capital (O and

[16] O denotes output, L = Labour, K = Capital (fixed assets), K^* = depreciation allowances of fixed assets, w_l = weight of labour.

K^*) are usually slight, but those between the changes in capital and labour (K and L) are significant. In our calculations this is accentuated by the fact that in formula (3) K always obtains greater weight than in (2). We may thus expect that among the three types of index numbers it will be type (3) that shows the smallest rate of growth. Types (3) and (4) might differ in any direction but usually not very much.

For the comparison of the four types of productivity index numbers detailed data are available only for the period 1960–1969, for the total economy and its six major sectors. Comparing first types (1) and (2)—that is, calculating with deflated value of output with or without depreciation allowance—and considering annual changes rounded up to full percentages, among the $6 \times 9 = 54$ chain index numbers 32 are identical, and in 15 cases the gross, in 7 cases the net figures are greater. The difference is bigger than 2 per cent only in a single case, in all other cases 1 per cent, at growth rates about 5 per cent.

The average rates of growth according to types (1) and (2) are identical in one case; four times the gross index is bigger, three times by 0.1 per cent and once by 0.5 per cent, and once the net is bigger by 0.3 per cent. The change of depreciation allowance (see Table 19) deviates in a few cases from national income significantly but, owing to its small weight, its effect is slight. For comparison, in Table 19 average growth rates for labour, capital and labour + capital are also given, weighted by wages and depreciation allowances. In this second calculation the effect of having included fixed capital inputs is noticeably greater.

TABLE 19

AVERAGE ANNUAL RATES OF GROWTH OF OUTPUT AND INPUTS, 1960–1969

	Net Domestic Product	Depreciation Allowance	Gross Domestic Product	Labour	Fixed Capital	Labour plus Capital
	1	2	3	4	5	6
Industry	6.6	7.0	6.6	2.8	7.2	4.1
Construction	4.6	11.1	4.7	4.1	11.4	4.8
Agriculture	3.3	13.0	3.8	−2.8	5.8	−1.9
Transport and communication	4.8	5.6	5.3	1.1	3.2	2.1
Trade	5.0	9.9	5.1	2.2	10.0	3.3
Non-material sphere	3.8	4.5	3.9	2.2	3.3	2.5
Material sphere	5.4	7.5	5.6	0.5	5.5	1.6
Total	5.3	6.9	5.4	0.8	4.6	1.6

Note: All value data deflated.

Our four types of productivity index numbers, calculated from Table 19 as the ratios 3/4, 1/4, 3/6 and 1/6 (see Table 20) in the period between 1960 and 1969 show some characteristic relationships:

(i) There are only small differences between types (1) and (2) and types (3) and (4); mostly types (1) and (3) indicate higher rates of growth;

(ii) Types (1) and (3), and types (2) and (3) give definitely different growth rates and the latter where fixed capital inputs are accounted in the denominator mostly lower rates of growth.

In our example the ranking of sectors by rate of growth does not change and even the relative differences in rates of growth change but slightly.

TABLE 20

AVERAGE GROWTH RATE OF PRODUCTIVITY, ALTERNATIVE CALCULATIONS, 1960–1969

	Gross Domestic Product/ Labour	Net Domestic Product/ Labour	Gross Domestic Product/ Labour and Capital	Net Domestic Product/ Labour and Capital
	Type (1)	Type (2)	Type (3)	Type (4)
Industry	3.7	3.7	2.4	2.4
Construction	0.6	0.5	−0.2	−0.3
Agriculture	6.8	6.3	5.8	5.3
Transport and communication	4.2	3.7	3.1	2.6
Trade	2.9	2.8	1.7	1.6
Material sphere	5.1	4.9	3.9	3.7
Non material sphere	1.7	1.6	1.4	1.3
Total	4.6	4.5	3.7	3.6

Note: All value data deflated.

Thus, including capital inputs in the denominator of the productivity index numbers results unequivocally in smaller rates of growth. This is, of course, not disturbing if only figures of this type are compared. It is, however, more important that in judging the development of countries, sectors and periods it may in some cases yield a different ranking than the other types of index numbers and should be considered a better indicator of economic performance. Compared to index numbers of type (1) it takes into account not only labour but also fixed capital inputs, and compared to index numbers of type (2) it takes fixed capital inputs into account with a greater weight and this might be also accepted as justified.

This paper has not attempted to evaluate the use of total factor productivity figures for explaining other phenomena and relationships of economic growth. For a final appraisal this is also of major importance. Connecting labour and total productivity index numbers through the link of the rate of substitution, though based on simplified assumptions, seems to be promising.

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ANNEX

TABLE A1

BASIC INDICATORS, 1950–1970

	Deflated Value of Gross Output	Deflated Value of National Income			Persons Engaged		Deflated Gross Value of Fixed Assets	
	Material Sphere		Population	Labor Force	Material Sphere	Total	Material Sphere	Total
Index Numbers, 1958 = 100								
1950	55	66	94	99	88	90	70	76
1951	67	76	95	99	90	93	73	78
1952	72	75	96	100	91	93	77	81
1953	81	84	97	100	92	94	82	85
1954	82	80	98	101	94	96	87	89
1955	88	87	99	101	96	98	90	92
1956	80	77	100	101	97	98	94	95
1957	92	95	100	100	98	99	97	97
1958	100	100	100	100	100	100	100	100
1959	108	107	101	100	101	101	105	104
1960	117	116	101	101	101	101	110	108
1961	124	122	101	101	99	100	115	113
1962	131	129	102	101	99	101	121	117
1963	139	136	102	102	99	101	128	123
1964	148	141	102	102	99	102	137	130
1965	151	142	103	103	100	103	145	136
1966	162	153	103	103	101	104	154	142
1967	175	166	103	104	102	105	161	148
1968	183	174	104	105	104	107	169	155
1969	192	188	104	106	106	109	179	162
1970	202	197	105	106	107	110	186	168
Average Annual Rates of Growth								
1950–55	10.0	5.7	1.0	0.5	1.8	1.6	5.1	3.9
1955–60	5.9	6.0	0.3	−0.1	1.0	0.7	4.0	3.2
1960–65	5.3	4.1	0.3	0.5	−0.2	0.3	5.7	4.8
1965–70	6.0	6.8	0.4	0.6	1.5	1.3	5.1	4.2
1950–60	7.9	5.9	0.7	0.2	1.4	1.1	4.5	3.6
1960–70	5.7	5.3	0.3	0.6	0.6	0.9	5.5	4.5
1950–58	7.8	5.4	0.7	0.1	1.6	1.3	4.5	3.5
1958–67	6.4	5.8	0.4	0.4	0.2	0.5	5.5	4.5
1967–70	5.0	6.0	0.4	0.7	1.8	1.6	4.9	4.3
1950–70	6.8	5.6	0.5	0.4	1.0	1.0	5.0	4.1

TABLE A2

BASIC RATIOS, MATERIAL SPHERE, 1950–1970

	Per Capita Deflated Value of		Deflated National Income (Material Sphere) per		Total Factor Productivity, by Weights of	
	Gross Output	National Income	Persons Engaged	Deflated Gross Value of Fixed Assets	Type (A)	Type (B)
Index Numbers 1958 = 100						
1950	58	70	75	93	78	79
1951	70	80	85	104	88	89
1952	75	78	82	98	85	86
1953	83	87	91	102	93	94
1954	83	82	85	93	86	87
1955	88	87	90	96	91	92
1956	80	77	79	82	80	80
1957	93	95	96	97	97	97
1958	100	100	100	100	100	100
1959	107	106	105	102	104	104
1960	116	115	115	106	113	113
1961	122	120	123	105	119	118
1962	129	127	130	106	125	123
1963	136	133	137	106	130	128
1964	144	138	142	104	133	130
1965	147	138	142	98	131	127
1966	157	149	152	100	139	134
1967	169	160	163	103	147	141
1968	176	168	168	103	150	144
1969	184	181	178	105	157	151
1970	193	189	184	106	162	154
Average Annual Rates of Growth						
1950–55	8.9	4.6	3.9	0.6	3.3	3.1
1955–60	5.5	5.7	5.0	1.9	4.4	4.2
1960–65	5.0	3.7	4.3	−1.6	3.0	2.5
1965–70	5.6	6.4	5.3	1.6	4.3	3.9
1950–60	7.2	5.2	4.4	1.3	3.9	3.6
1960–70	5.2	5.0	4.8	−0.1	3.5	3.2
1950–58	7.1	4.6	3.7	0.9	3.2	3.0
1958–67	6.0	5.4	5.6	0.3	4.4	3.9
1967–70	4.6	5.6	4.1	1.1	3.3	3.0
1950–70	6.2	5.1	4.6	0.6	3.7	3.4

*See p. 218.

TABLE A3

BASIC INDICATORS, MAJOR MATERIAL SECTORS, 1950–1970

	Industry				Construction				Agriculture			
	Gross Output	National Income	Persons Engaged	Gross Value of Fixed Assets	Gross Output	National Income	Persons Engaged	Gross Value of Fixed Assets	Gross Output	National Income	Persons Engaged	Gross Value of Fixed Assets
Index Numbers 1958 = 100												
1950	46	54	67	51	48	58	70	45	79	88	108	73
1951	59	64	71	55	60	70	98	27	92	104	105	74
1952	72	74	76	60	67	76	120	38	72	65	101	77
1953	80	83	83	69	83	87	121	59	83	90	97	81
1954	83	79	90	77	67	70	104	81	84	86	97	85
1955	90	88	92	83	77	79	93	85	95	99	99	89
1956	79	74	91	89	80	81	93	89	84	82	101	95
1957	90	90	94	94	93	91	95	94	94	97	102	99
1958	100	100	100	100	100	100	100	100	100	100	100	100
1959	109	108	104	109	108	112	108	108	106	104	98	104
1960	122	124	108	117	116	130	110	124	100	93	93	108
1961	132	138	111	127	123	133	110	142	99	85	87	110
1962	142	148	114	136	127	136	114	154	102	92	83	114
1963	151	155	118	148	133	141	118	171	108	96	78	119
1964	162	167	123	162	141	147	118	198	113	99	75	126
1965	170	174	127	174	144	148	125	223	106	89	74	133
1966	181	191	128	187	153	156	135	247	117	98	74	139
1967	197	208	131	198	173	178	139	274	120	99	73	147
1968	206	220	135	207	185	192	146	293	120	98	72	155
1969	213	229	139	224	200	210	158	343	128	111	72	164
1970	228	249	141	234	220	228	169	361	122	96	71	174
Average Annual Rates of Growth												
1950–55	14.6	10.1	6.8	10.5	9.9	6.3	5.8	39.8	3.9	2.5	−1.6	4.1
1955–60	6.2	7.1	3.2	7.1	8.6	10.5	3.5	7.5	1.0	−1.3	−1.4	3.9
1960–65	6.9	7.1	3.2	8.3	4.4	2.5	2.5	12.4	1.2	−0.8	−4.3	4.2
1965–70	6.1	7.4	2.2	6.1	8.9	9.1	6.2	10.1	2.8	1.5	−0.9	5.5
1950–60	10.3	8.6	5.0	8.8	9.2	8.4	4.7	22.6	2.4	0.6	−1.5	4.0
1960–70	6.5	6.8	3.8	7.2	6.6	5.8	4.3	11.0	2.0	0.4	−2.7	4.8
1950–58	10.3	7.9	5.2	8.9	9.7	7.0	4.6	25.6	3.0	1.7	−0.9	4.0
1958–67	7.8	8.5	3.0	7.9	6.3	6.6	3.7	11.8	2.1	−0.1	−3.4	4.4
1967–70	5.1	6.2	2.6	5.7	8.3	8.7	6.7	9.6	0.4	−0.9	−1.0	5.6
1950–70	8.4	7.9	3.8	8.0	7.9	7.1	4.5	16.8	2.2	0.5	−2.1	4.4

Note: All value data deflated.

TABLE A4

BASIC RATIOS, MAJOR MATERIAL SECTORS, 1950–1970

	Industry			Construction			Agriculture		
	1	2	3	1	2	3	1	2	3
Index Numbers 1958 = 100									
1950	82	108	89	83	359	89	82	120	86
1951	90	117	97	71	258	76	99	140	103
1952	98	124	105	63	200	67	64	85	67
1953	100	119	105	72	147	75	94	112	96
1954	88	103	92	67	86	68	89	102	90
1955	95	106	98	85	92	86	100	111	102
1956	81	83	82	87	91	87	82	87	82
1957	95	95	95	95	96	95	96	99	96
1958	100	100	100	100	100	100	100	100	100
1959	103	99	102	104	104	104	106	99	105
1960	115	106	111	118	105	117	101	86	98
1961	124	108	118	121	94	118	98	77	95
1962	130	109	122	119	89	116	112	81	106
1963	131	105	120	120	82	115	123	81	114
1964	135	103	122	125	74	118	132	79	120
1965	138	100	121	118	66	110	121	67	108
1966	149	102	128	116	63	108	133	70	118
1967	159	105	134	128	65	118	136	67	118
1968	162	106	136	132	66	121	136	63	116
1969	165	103	135	133	61	120	154	67	130
1970	177	106	143	135	63	123	136	56	112
Average Annual Rates of Growth									
1950–55	3.2	−0.4	2.1	0.5	−23.9	−0.8	4.2	−1.5	3.5
1955–60	3.7	0	2.5	6.7	2.7	6.4	0.1	−5.0	−0.7
1960–65	3.8	−1.1	1.9	0	−8.8	−1.1	3.7	−4.8	2.0
1965–70	5.1	1.2	3.4	2.8	−0.9	2.2	2.4	−3.8	0.7
1950–60	3.5	−0.2	2.3	3.6	−11.6	2.7	2.1	−3.3	1.4
1960–70	4.3	0	2.7	1.4	−5.0	1.6	2.6	−4.3	1.4
1950–58	2.6	−0.9	1.5	2.3	−14.8	1.5	2.6	−2.3	2.0
1958–67	5.3	0.5	3.5	2.8	−4.7	1.8	3.3	−4.3	1.8
1967–70	3.6	0.5	2.2	1.9	−0.9	1.4	0.1	−6.2	−1.7
1950–70	3.9	−0.1	2.5	2.5	−8.3	1.6	2.6	−3.8	1.4

1 = Deflated national income/Persons engaged; 2 = Deflated national income/Deflated gross value of fixed assets; 3 = Total factor productivity by weights of type (B), see p. 218.

TABLE A5

STATE-OWNED INDUSTRY, 1950–1970

	Production Index Numbers based on						Output* per			Total Factor Productivity by weights** of	
	Deflated Value of Gross Output	Deflated Value of National Income Originating	Product Series	Persons Employed	Manhours Performed	Gross Value of Fixed Assets	Persons Employed	Manhours	Fixed Assets	Type (A)	Type (B)
Index Numbers 1958 = 100											
1950	47	54	49	66	67	53	75	73	92	79	80
1951	60	64	63	76	78	57	83	81	110	90	91
1952	73	75	76	86	90	63	89	85	122	97	99
1953	81	83	84	94	97	69	89	87	121	98	100
1954	81	79	82	97	100	76	84	82	107	90	92
1955	87	88	87	97	99	82	90	88	106	95	96
1956	80	75	79	98	93	88	80	85	90	83	84
1957	89	90	88	96	95	94	92	93	94	93	93
1958	100	100	100	100	100	100	100	100	100	100	100
1959	111	108	111	106	106	108	105	105	102	104	104
1960	125	124	125	112	112	116	111	112	108	110	110
1961	139	137	138	116	115	126	119	121	110	116	115
1962	151	147	149	120	118	135	124	126	110	119	118
1963	161	158	159	125	123	148	127	129	108	120	119
1964	175	171	171	130	128	160	132	134	107	123	121
1965	184	179	177	130	128	173	136	139	102	123	121
1966	196	195	188	131	129	186	143	145	101	126	123
1967	213	214	200	134	131	197	149	152	101	129	126
1968	224	224	210	139	131	206	151	160	102	131	127
1969	230	237	215	143	128	222	150	167	97	127	124
1970	245	256	229	143	130	232	160	177	99	133	129

Average Annual Rates of Growth											
1950–55	13.2	10.1	12.1	8.0	8.2	8.9	3.8	3.6	3.0	3.5	3.8
1955–60	7.6	7.1	7.5	3.1	2.4	7.2	4.3	5.0	0.3	3.1	2.8
1960–65	8.0	7.6	7.3	3.0	2.7	8.3	4.2	4.4	−1.0	2.3	1.9
1965–70	5.9	7.4	5.2	1.9	0.2	6.1	3.2	5.0	−0.8	1.6	1.3
1950–60	10.4	8.6	9.8	5.5	5.3	8.0	4.0	4.3	1.6	3.3	3.3
1960–70	6.9	7.5	6.2	2.4	1.5	7.2	3.7	4.7	−0.9	1.9	1.6
1950–58	10.0	7.9	9.3	5.4	5.2	8.2	3.7	3.9	1.1	2.9	2.8
1958–67	8.7	8.8	8.0	3.3	3.1	7.8	4.5	4.8	0.2	2.9	2.6
1967–70	4.8	6.2	4.7	2.2	−0.4	5.6	2.4	5.1	−0.9	1.0	0.8
1950–70	8.6	8.1	8.0	4.0	3.4	7.6	3.9	4.5	0.4	2.6	2.4

*Measured by index numbers based on product series.

**See p. 218.

TABLE A6

AVERAGE ANNUAL RATES OF GROWTH, MATERIAL AND NON-MATERIAL SPHERES, 1960–1969

	Industry	Construction	Agriculture	Transport and Communication	Trade	Material Sphere	Non-material Sphere	Total
Gross domestic product	6.6	4.7	3.8	5.3	5.1	5.6	3.9	5.4
Depreciation allowances	7.0	11.1	13.0	5.6	9.9	7.5	4.5	6.9
National income (Net domestic product)	6.6	4.6	3.3	4.8	5.0	5.4	3.8	5.3
Persons engaged	2.8	4.1	−2.8	1.1	2.2	0.5	2.2	0.8
Gross value of fixed assets	7.2	11.4	5.8	3.2	10.0	5.5	3.3	4.6
National income/Persons engaged	3.7	0.5	6.3	3.7	2.8	4.9	1.6	4.5
GDP/Persons engaged	3.7	0.6	6.8	4.2	2.9	5.1	1.7	4.6
GDP/Fixed assets	−0.5	−6.0	−1.9	2.0	−4.4	0.1	0.6	0.8
Total factor productivity measured by GDP according to weights of*								
Type (A) 1961	2.4	−0.2	5.8	3.1	1.7	3.9	1.4	3.7
Type (B) 1961	2.0	−0.3	4.7	2.8	1.2	3.4	1.1	3.2
Type (C) 1961	1.9	−0.4	4.2	2.8	−0.2	3.2	1.1	3.0
Type (A) 1969	2.8	0.3	6.1	3.3	2.4	4.3	1.4	4.0
Type (B) 1969	2.3	0.2	5.4	3.0	2.0	3.8	1.2	3.4
Type (C) 1969	2.2	0	5.2	3.0	1.2	3.6	1.2	3.4
Type (D) 1969	3.2	0.4	6.4	3.6	2.7	4.6	1.5	4.2
Type (E) 1969	2.8	0.3	5.9	3.2	2.4	4.3	1.3	3.8

*See p. 218.

Note: All value data deflated.

TABLE A7

AVERAGE ANNUAL RATES OF GROWTH (TOTAL FACTOR PRODUCTIVITY) BY DIFFERENT WEIGHTS*

	Period	Type (D)	Type (A)	Type (B)
Material sphere	1950–58	3.5	3.4	3.2
	1958–67	5.1	4.8	4.3
	1960–69	4.6	4.3	3.8
	1950–70	4.3	4.1	3.7
Industry	1950–58	2.3	2.0	1.8
	1958–67	4.8	4.3	3.8
	1960–69	3.2	2.8	2.3
	1950–70	3.5	3.2	2.8
State-owned industry	1950–58	3.3	2.9	2.7
	1958–67	3.7	2.9	2.6
	1950–70	3.2	2.6	2.4
Construction	1950–58	2.2	2.1	2.0
	1958–67	2.6	2.5	2.4
	1960–69	0.4	0.3	0.2
	1950–70	2.3	2.2	2.1
Agriculture	1950–58	2.5	2.4	2.2
	1958–67	3.1	2.9	2.3
	1960–69	6.4	6.1	5.4
	1950–70	2.3	2.1	1.7
Transport and communication	1960–69	3.6	3.3	3.0
Trade	1960–69	2.7	2.4	2.0
Non-material sphere	1960–69	1.5	1.4	1.2
Total	1960–69	4.2	4.0	3.4

*See p. 218.

TABLE A8

AVERAGE ANNUAL RATES OF GROWTH (TOTAL FACTOR PRODUCTIVITY) BY DIFFERENT WEIGHTS,* 1950–1970

	(A) 1961	(B) 1961	(C) 1961	(A) 1969	(B) 1969	(C) 1969	(D) 1969	(E) 1969
Material sphere								
1950–58	3 2	3.0	2.9	3.4	3.2	3.1	3.5	3.4
1951–67	4.4	3.9	3.7	4.8	4.3	4.1	5.1	4.8
1950–70	3.7	3.4	3.3	4.1	3.7	3.6	4.3	4.1
Industry								
1950–58	1.8	1.5	1.4	2.0	1.8	1.7	2.3	2.1
1951–67	3.8	3.5	3.3	4.3	3.8	3.7	4.8	4.4
1950–70	2.8	2.5	2.4	3.2	2.8	2.7	3.5	3.2
Construction								
1950–58	1.5	1.5	1.3	2.1	2.0	1.7	2.2	2.1
1951–67	1.9	1.8	1.7	2.5	2.4	2.1	2.6	2.5
1950–70	1.7	1.6	1.5	2.2	2.1	1.8	2.3	2.2
Agriculture								
1950–58	2.3	2.0	1.8	2.4	2.2	2.1	2.5	2.3
1951–67	2.7	1.8	1.4	2.9	2.3	2.1	3.1	2.7
1950–70	2.0	−1.7	1.0	2.1	1.7	1.6	2.3	2.0
State-owned industry								
1950–58	3.3	3.1	3.1	2.9	2.7	2.6	3.3	3.1
1951–67	3.6	3.3	3.2	2.9	2.6	2.4	3.7	3.3
1950–70	3.2	3.0	2.8	2.6	2.4	2.2	3.2	2.9

*For explanation of symbols, see p. 218.

**State-owned industry calculations use production index numbers based on product series, all others based on deflated national income data.

TABLE A9

AVERAGE ANNUAL RATES OF GROWTH IN STATE-OWNED INDUSTRY, 1950–1970

	Labour Productivity (Output per Person Engaged)	Output per Deflated Gross Value of Fixed Assets	Total Factor Productivity	Substitution Capital for Labour	Weight of Labour (%)
Mining	1.1	−6.5	−1.3	2.4	74
Electricity	4.6	0.5	1.6	3.0	33
Iron and steel	3.3	−0.4	1.7	1.6	57
Engineering industry	4.8	2.6	4.3	0.5	79
Transportation equipment	6.0	1.6	4.9	1.1	77
Electrical machinery	4.7	−2.2	3.5	1.2	81
Telecommunication products	5.9	2.4	5.4	0.5	84
Instruments	8.9	1.2	8.1	0.8	87
Fabricated metal products	5.7	3.8	5.3	0.4	80
Building materials	4.0	−1.1	2.3	1.7	72
Chemicals	7.1	−0.3	4.0	3.1	56
Wood and furniture	3.2	0.6	2.7	0.5	87
Pulp and paper	3.3	0.5	2.0	1.3	57
Printing	6.2	1.9	5.4	0.8	82
Textiles	2.2	−0.2	1.4	0.8	73
Leather, footwear	1.1	0.3	0.8	0.3	66
Clothing	0.9	1.2	0.9	0	95
Food industries	4.1	3.8	4.0	0.1	65
Total	3.9	0.4	2.7	1.2	70

Note: Output measured by index numbers based on product series. Weights Type (B), see p. 218.

*Measured by the difference of the rates of growth of labour and total factor inputs.