

SIZE-DISTRIBUTION OF INCOMES  
UNDER SOCIALISM  
IN CZECHOSLOVAKIA

by

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Research Memorandum No. 57

June 1971

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Acknowledgements

This paper is part of a planned broader inquiry into the size-distribution of incomes under socialism in Eastern Europe. It is my pleasant duty to acknowledge financial support of my project by the International Research and Exchanges Board (IREX) in New York and by the U.S. Office of Education, Division of Foreign Studies, Institute of International Studies (Fulbright grant). The State University of New York at Binghamton granted me leave of absence to enable me to work full-time on this study.

I wrote this paper while enjoying the outstanding hospitality of the Institute for Advanced Studies (Institut für Höhere Studien und Wissenschaftliche Forschung) in Vienna, The Austrian Institute for Economic Research (Österreichisches Institut für Wirtschaftsforschung) and the Institute for East and Southeast Europe (Institut für Ost- und Südosteuropa) in Vienna kindly allowed me to use their libraries and other material. Most of the statistical data in this paper comes from publications of the Czechoslovak Statistical Office in Prague. I would like to express my appreciation of this interesting statistical material.

I greatly profited from my discussion with Professor Gerhart Bruckmann and Professor Josef Steindl in Vienna. My indebtedness to other authors is obvious from the References. Messrs. Lloyd Cohen, Hillard Huntington and William McArthur of the State University of New York at Binghamton provided computational assistance. A part of the large program of graphical interpolations was done by my wife. Mrs. E. Lang of the Institute for Advanced Studies transformed my manuscript into a clean typescript.

Vienna, June 1971

J. M. Michal

## I. Introduction

The purpose of this paper is to inquire into the size-distribution of money incomes of individuals and of families (on per capita basis) in Czechoslovakia's socialist economy.

The existing socialist systems have frequently been examined in terms of their distributive aspects have been largely neglected in professional literature.<sup>1)</sup> In the early fifties, the lack of studies of the socialist distributions of incomes by size were understandable. Hardly any statistics were available on the distribution of money incomes. The "use value" of incomes in cash was very limited by widespread rationing and inadequate supply of a number of consumer goods on the market. The non-measurable income in kind loomed largely in total personal income and covered a great part of final consumption in Eastern Europe.

All this has changed in recent years. Several Communist countries, especially Czechoslovakia, Hungary and Poland, have published interesting figures on the dispersion of money incomes. Rationing has been abolished, except for a small number of goods and services (e.g. housing), and an effort has been made to give the consumer a much wider choice of goods. Although prices still do not reflect consumers preferences, and some shortages still occur on the market, the "use-value" of money income has increased considerably. Of course, under socialism money income cannot be used freely by individuals to acquire money-earning assets; in Czechoslovakia the possibility of each private "investment" is limited, with very few exceptions, to saving deposits with a low rate of interest (2 - 4%).

Income in kind (other than "social consumption" as described below) amounted in Czechoslovakia only to 6% of the average money income of families in 1965 [24, p. 461], and its share tends to decline. Income in kind is more important in agricultural families than in other socio-economic groups, and much more important in the low income than the high income families. Thus, it makes the distribution of the real contents of incomes more equal, but the equalizing effect

is not very great (cf. Part VI.).

A more important constituent of the real contents of family incomes in Czechoslovakia is the "social consumption". In 1968, tangible products distributed by the Government free of charge amounted to approx. 2%, and free services to approx. 16% of the average money income of families.<sup>2)</sup> Free tangible goods consisted mainly of free medicine and free school books. Approx. 4|10 of free services were medical services, 3|10 free education at all levels, more than 1|10 free or heavily subsidized housing, almost 1|10 cultural services, etc. Social consumption of the population is, in all probability, more evenly distributed than money incomes of individuals or families, and may have a greater equalizing effect on the distribution of the real contents of incomes; but here again the effect is not likely to be dramatic.

In the sixties, money incomes certainly have been by far the most important component of total incomes of individuals and families, except for the lowest decile or so, of incomes of members of agricultural collectives, the lowest 4 or 5 per cent of incomes of pensioners, and possibly also for the incomes of the remaining handful of independent farmers on which no recent statistics are available. Taken together, all these groups accounted in 1965 for less than 2 per cent of all families.

In recent years Czechoslovak economists and planners have attached much importance to the distribution of money earnings, mainly in connection with the increased reliance on material for the workers incentives to work and to acquire new skills. They also have been studying in much detail the distribution of money incomes (and other money revenues), and expenditures of families, as a basis of social policy and a substitute for market research.<sup>3)</sup> From the standpoint of comparative economic systems, the distribution of earnings and of family incomes is of interest per se. What is the degree of inequality in the distribution of earnings and per capita family incomes in an advanced socialist country? Are the distributions as right-skewed, and do they have as long a Pareto tail, as the corresponding distributions in economically advanced capitalist countries, or do

they tend to be near-normal, at least for fairly homogeneous subpopulations? This paper will try to answer these questions within the limits of available statistics.

No formal model will be offered to explain the socialist distribution of incomes, although some of the existing models, especially the stochastic ones, could be applied.<sup>4)</sup> Instead, a partial informal explanation will be attempted in Part IV, by inquiring into the income differentials between and within occupational groups, economic sectors, male and female earnings, age groups, and the main regions (Czech lands vs. Slovakia).

Although it is not within the scope of this paper to tackle the extremely difficult problem of comparing the inequality of incomes between countries and different economic systems, some international comparisons will be ventured in Part VI.

Before discussing the size distribution of various concepts of income, it may be useful to provide a general picture of personal income by source, and of the structure of the active population and employment by large socio-economic groups.

Table 1 shows "money revenues of the population". This is a broader concept than personal income before tax, because it includes also gross personal borrowing, indemnities paid by the State insurance monopoly, and gross withdrawals from saving accounts. Many sample surveys of the size-distribution of per capita family "incomes" are actually based on this broader concept of money revenues.<sup>5)</sup> In contrast, the large sample survey ("microcensus") for 1965 was based on the "net income" of families. "Net" in this connection means net of borrowings, withdrawals of savings, cost of producing privately sold agricultural produce, etc., but probably gross of direct taxes.<sup>6)</sup> The main sources of per capita family income, as they emerge from the 1965 survey, are also given in Table 1.

Labor incomes, that is income from wages and salaries, including bonuses, and about 9/10 of the income of the members of agricultural cooperatives<sup>7)</sup>, amounted in 1965 to approx. 76% of personal money

income before tax (approx. 73% of money receipts of the population). Cash payments from social security and national health insurance provided approx. 19-20% of personal income (approx. 16% of "money revenue"). Property income, i.e. the interest on saving deposits, and cash rent for the remaining (small) privately owned houses (included under "other income") constituted roughly 1% of personal money income before tax; the remaining 3% or so were mixed incomes from small-scale private enterprise, mainly from private scale of agricultural produce. 8)

All the above figures on the structures of money receipts of the population and of personal incomes exclude the so-called "non-planned components", i.e. the armed forces and employees of the ministry of national defence, the police and employees of the ministry of interior, the Party apparatus, etc. As Table 2 indicates, their share in total active population was approx. 13,5% in 1964, and 10,5% in 1968. Their share in total money revenue of the populations has not been announced, and has been excluded from the published surveys of family receipts and expenditures.

Table 2 provides general information on the share and structure of active population, and on the structure of employment.

A terminological note: Czechoslovak statistics on employment, wages, earnings, and family budgets distinguish between wage-earners ("blue-collar" or manual workers, in Czech dělníci, in French ouvriers, in German Arbeiter); and salary-earners "white-collar" workers, in Czech zaměstnanci, French employés, in German Angestellte). The latter subcategory is sometimes subdivided into ITP ("inženýři a technický personál" - engineers and technical personnel) and "úředníci" (clerical and administrative staff).

## II. Measures of Inequality of Incomes

Inequality of incomes will be measured primarily in terms of relative dispersion of incomes of given units of recipients in a given period of time. Serious problems involved in choosing an appropriate time period over which income is cumulated will be discussed later in Part V.

The following measures of dispersion will be used:

1. The Gini coefficient of concentration,

described also as concentration ratio [13, pp. 178, ff.] or simply "inequality coefficient" [31, Chapter 6, pp. 6, 21], i.e. the main difference divided by two times the arithmetic mean of incomes.

The following formula applicable the grouped data with unequal class intervals has been used:

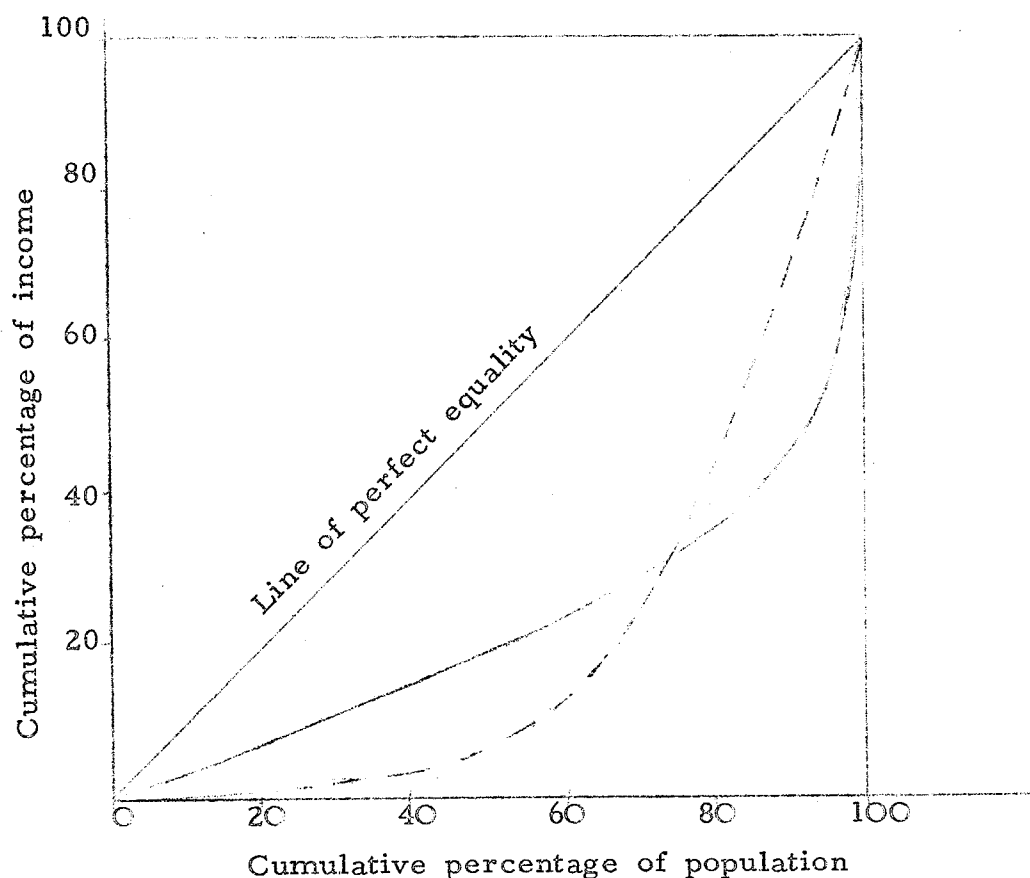
$$R = \frac{\sum_{r=1}^n \sum_{s=1}^n |X_r - X_s| \frac{f_r f_s}{N^2}}{2\bar{X}}$$

where  $X_r$ ,  $X_s$  are incomes in class intervals  $r$  and  $s$ ;  $f_r$  and  $f_s$  are the weights (frequencies of income recipients) in the income classes  $r$  and  $s$ ;  $N$  is the number of income classes, and  $\bar{X}$  is the weighted mean income of the population.

The Gini coefficient corresponds to the ratio of the area between the Lorenz curve and the diagonal to the triangular area under the diagonal; hence it is called sometimes "the Lorenz measure". Its value ranges from 0 (when the Lorenz curve is a straight line, coinciding with the diagonal, i.e. perfect equality of incomes) to 1 (when Lorenz curve coincides with the triangle, i.e. absolute inequality when 99.999% of population have no income).

The properties of the Gini coefficient have been examined recently by Bruckmann [4] who found it to be a good measure of relative concentration (relative dispersion). But the Gini coefficient does not convey any information on the shape of the distribution<sup>9)</sup>, and is thus not an adequate substitute for the Lorenz curve itself. This is immediately obvious from the following hypothetical example:





The Gini coefficient is identical for distributions A and B (the area between A and the diagonal equals the area under B and the diagonal). Yet, under A, there is a widespread relative poverty (60% of population receive only approx. 1|10 of total income), but there are practically no "super rich" (the top 10% of population get less than 1|3 of total income). Under B, there is no widespread relative poverty (60% of population receive approx. 1|4 of income), but some incomes are relatively very high (top 10% of population gets almost 2|3 of income). Under A, the inequality is concentrated in the lower tail, under B in the upper tail of the distribution. Although the Gini coefficient (and the mean of income) may be the same for two distributions, saving, consumption, and social welfare functions may still differ substantially.

Are the actual distributions of income likely to have very different shapes? In Czechoslovakia, the shape of distributions does vary over time, and, even more so, between subpopulations, especially

between male and female earnings (cf. Fig. 1 and Table 3), and between families with 1 child and those with 5 or more children (cf. Table 9).

The shape of the distributions of income also varies between countries, as shown by the Lorenz curves in the ECE study [31, Chapter 6, p. 16] : in Scandinavia, the Lorenz curves are relatively more bowed out near the lower end (loose analogy of the hypothetical distribution A above); in West Germany, they are relatively more curved near the top of the distribution (loose analogy of distribution B above). In the United States, the shapes of the distributions differ, inter alia, between the incomes of whites and of non-whites: according to figures given by P. T. Schultz [23, p. 93], in 1962 the inequality of incomes, measured by the Gini coefficient, was substantially less for white females (concentration ratios 0.477 and 0.561, respectively), whereas the variance of natural logs indicates the opposite (0.800 for white female incomes, 0.782 for non-white female incomes). This contradiction indicates that at least one of the distributions concerned is far from being log-normal, and that the two shapes differ.

It follows from what was said above that the Gini coefficient (or any other single measure of dispersion of incomes) should be accompanied by some information on the shape of the distributions which are being compared.<sup>10)</sup> Furthermore, the Gini coefficient should not be related, without qualifications to the saving, consumption, or social welfare function.<sup>11)</sup>

The computation of Gini coefficients usually involves two problems. Most sets of data give the number or percentage of income recipients in each income class ( $f$  in the above formula), but not the income received ( $X$  in the formula). The latter can be easily computed if the mean in each income class is known (as it is, e.g., in Czechoslovak statistics on per capita family incomes). But most sets of data (in Czechoslovakia, e.g., the statistics of gross earnings) do not give the mean income in each class.  $X$  can be only approximated by assuming that the mean income coincides with the mid-point, i.e. that the distribution within each class is symmetrical. T. P. Schultz [23, p. 76] recommends the use of the geometric mean of the

class limits rather than the mid-point. His recommendation has merits inasmuch as the distribution is log-normal. In Czechoslovakia, the distributions are log-normal only near the middle, but definitely not at the ends. Graphical test (Fig. 3 and 4) shows that selected distributions of gross earnings and of per capita family revenues are log-normal (appear on probability paper as straight lines) within the following cumulative percentiles (from high to low):

Gross full-time earnings in May 1968			Per capita revenues of families	
All wage and salary earners	Males	Females	1956	1967
33-93	12-82	13-89	12-59	56-96

A test based on the 1965 set of data on family incomes, (which exceptionally provides actual means within each income class) has shown that taking the geometric mean instead of the midpoint of class limits does not reduce the margin of error in R.

By taking the midpoint for the mean in each income class, we substitute, of course, a polygon inside of the Lorenz curve for the curve itself. Thus, inequality measured by the Gini coefficient is being understated. If the number of income classes is high, and if the Lorenz curve is rather flat - both these conditions exist in respect of Czechoslovakia in recent years - the understating is negligible. However, if the Gini coefficient is computed in this way for distributions of which the curvature of the Lorenz curve and the number of income classes vary substantially, inequality of the distribution which is based on fewer income classes and/or a more bowed-out Lorenz curve is understated relative to the other distribution.

Another computational problem arises when the lowest and highest income classes are open-ended. I have simply assumed that the mean income in the lowest income class is  $\frac{3}{4}$  of the known upper limit of the class. This is roughly in line with the available information on the shape of the extreme lower tail of Czechoslovakia distributions. Since the frequency of recipients in the lowest income class in recent Czechoslovak statistics hardly ever exceeds 2%, even a large error in estimating the mean of that class has practically no effect on the Gini

coefficient. The highest open-ended income class presents more serious problems. Even though the frequency of income recipients in the highest class usually is also below 2%, and sometimes only a fraction of 1%, the income received is still very substantial, and an error in estimating it would have a noticeable effect on the value of the Gini coefficient. The mean of the open-ended highest income class has been approximated with the help of Pareto's (see point 3 below) by means of the formula

$$x_o = \frac{\alpha}{\alpha - 1} X_o$$

where  $X_o$  is the mean and  $X_o$  the known lower of the highest income class.

## 2. Percentiles related to median

For important distributions, the Gini coefficients have been supplemented by Lydall's indicators of the shape of distribution

$$P_i = \frac{100 p_i}{P_{50}}$$

where  $p_i$  is the income at the  $i$ th percentile (from high to low) and  $p_{50}$  is the median income. The meaning of these indicators is easily to be understood even by non-experts. E.g.  $P_5 = 200$  means that at the 5th top percentile, income is just twice as high as the median income.

$P_{95} = 50$  means that at the lowest 5th percentile, income is just one half of the median. If the shape of two distributions is the same, all the  $P_i$ 's will also be the same. For a perfectly equal distribution all  $P_i$ 's will equal 100.

The following percentiles have been related to the median (from high to low):  $P_1$ ,  $P_2$ ,  $P_5$ ,  $P_{10}$  and  $P_{25}$  to measure the shape of the upper half of the distribution;  $P_{75}$ ,  $P_{90}$  and  $P_{95}$  to measure the lower half. The cumulative frequencies of the available data on income classes usually do not coincide with the above-mentioned percentile levels; therefore an intrapolation of cumulative frequencies was necessary.

This was done graphically by means of the graduation curve (Dalton's ogive) <sup>12)</sup>.

### 3. Pareto's $\alpha$

The Pareto coefficient reflects on a log paper, the slope of the distribution curve above a given income X in the upper half of the distribution; it is derived from the regression equation

$$N = AX^{-\alpha}$$

or, in the log-linear form,

$$\log N = \log A - \alpha \log X$$

where N is the number of recipients of incomes X or greater, and A and X are constants. The smaller the  $\alpha$ , the less the slope of the distribution of logs and the longer is the upper tail (the greater is the inequality over the pertinent range of the distribution).

A main disadvantage of the Pareto coefficient is that it applies only to a part of the distribution. <sup>13)</sup> Fig. 5 shows that in Czechoslovakia,  $\alpha$  has a good fit approximately above the following cumulative percentiles (from low to high):

Gross earnings of full-time wage and salary earners, May 1968			Gross earnings of full-time technical staff, May 1964	
all	males	females	all	
7th	17th	11th	10th	

Above these percentiles, the distribution curve, plotted on the log-paper, is a straight line.

The main reason for estimating  $\alpha$  in the paper is to use it for closing the highest open-ended income class, as mentioned sub 1. I did not go into the laborious testing of the fit in respect of each distribution, but simply approximated the  $\alpha$ 's by applying Pareto's regression equation to closed income classes which fall approximately within the top decile of each distribution (from 3 to 6 classes).

Other measures of dispersion of incomes have been used in Czechoslovakia and other East-European countries, and will be referred in this paper, too.

4. Coefficient of variation (presumably from arithmetic mean)  $V = \frac{\sigma}{\bar{X}}$ .

This coefficient suffers from two specific weaknesses:

Whereas the minimum value is always 0 (complete equality), the maximum value (reflecting absolute inequality) depends on the number of observations (income classes):<sup>13a)</sup>

$$V \text{ max} = \sqrt{N - 1} \quad [33, \text{ p. 428}]$$

Thus, V is not a good comparative measure when the number of income classes differs between the distributions under study.

Furthermore, the coefficient of variation "can be seriously misleading. The difficulty is that the value of V is very much affected by the distance between the mean and the origin... The use of V is straight forward only when the distributions have means of comparative magnitude [12, p. 79]<sup>13b)</sup>.

#### 5. Decile shares

The percentage shares of each 10% of the population in total income provide little information on the tails of the distribution, especially the upper one; the share of income in the top decile has been in Czechoslovakia in recent years around 1|5, but in some countries, it may be as high as 40% or more. Furthermore, this measure of inequality is abolished insensitive to transfer within each decile.

#### 6. Quartile ratio

$Q_3|Q_1$ : relates income at the 75th percentile (from low to high) to the 25th percentile. It is a very crude measure of dispersion; it is absolutely insensitive to transfer within the top and the bottom quartile, and can be very misleading.<sup>14)</sup> Yet, it is the only information available on the size distribution of incomes in some countries (e.g. the post-war USSR), and has been used in the ECE study [31, Chapter 6, p. 18, Chapter 8, pp. 41-2].

### III. Dispersion of individual incomes

#### a) Gross earnings of wage and salary earners

Statistics on the "number of workers according to the earnings in the month of May in the socialist sector of the national economy, excluding agricultural cooperatives" <sup>15)</sup> have been published in the official statistical yearbooks since 1959. They provide information on the size distribution of gross earnings of full-time wage and salary earners by 13 income classes (beginning with 1968, by 21 classes).

The qualification "in the socialist sector", unimportant already in 1959, has become superfluous since 1961.

In 1959, the share of wage and salary earners (full-time and part-time) in the private sector was only 0.02%; in 1961, it fell to 0.00% [28, p. 115]. Since then, practically all wage and salary earners (over 99.99%) have been employed by the socialist enterprises.

All the above data exclude apprentices, the armed forces, police, and other "non-planned components". Thus, statistics on the distributions of full time earnings cover approx. two thirds of the active population, and approx. four fifths of all wage and salary earners (including part-time) in the socialist sector (cf. Table 1, lines 8 and 9).

Definition of "full-time" employment varied somewhat from year to year, as described in the Note to Table 3. The resulting interruption of comparability of the indicators of dispersion of earning over time is slight. A more serious, but not fatal, limitation of comparability occurred in 1968 through a change in the method of including bonuses and premia in the May pay, as also described in Table 3. Except for bonuses, seasonal swings in gross earnings and in employment, are very slight in Czechoslovakia's socialist economy, so that the distribution of earnings in May is fairly representative for the whole year.

As Table 3 indicates, the inequality in gross full-time earnings was falling in 1959-1964; the inequality of earnings was reduced especially at  $P_1$  and  $P_2$  at the top, but also at  $P_{95}$  at the bottom of the distribution. There was not much change over 1964-1966, but the 1968 statistics show an increased inequality, in the upper tail ( $P_1$ ,  $P_2$  and  $P_5$  went up noticeably relative to 1966), while  $P_{90}$  and  $P_{95}$  did not change. Thus, the slightly increased value of R from 0.193 to 0.199 may be due mainly, if not solely, to the broader inclusion of bonuses in the 1968 statistics.

The question arises how the exclusion of approx. one fifth of wage and salary earners who worked less than "full time" affected the inequality. The average monthly earnings of all workers, including part-time wage and salary earners have not been dramatically below the full-time earnings (in Kčs):

	1959	1962	1964	1966	1968
Mean monthly gross earnings in the socialist sector, excl. collective farms and apprentices 24, p. 22-23	1,324	1,407	1,456	1,534	1,750
Mean full-time earnings (approximations from Table 3) in May	1,414	1,556	1,557	1,626	1,827

Večerník (17, p. 298) computed decile shares in all gross earnings (including part-time). These are reproduced in Table 5, and compared with my approximation of decile shares in full-time earnings in May 1959. The comparison suggests that in 1959, dispersion of all gross earnings was only slightly greater than the inequality of full-time earnings.

On the other hand, Fremr's coefficient of variation [8, p. 24-5] is much higher for all earnings subject to wage tax (although that distribution is truncated at the lower end) than for full-time earnings:

	1955	1959	1961	1964	1966
V for earnings subject to wage tax	0.521	0.483	0.475	....	....
V for full-time gross earnings in May	....	0.368	0.351	0.348	0.347



Unfortunately, Fremr does not indicate the mean income and the number of income classes in the underlying statistics. A part of the differences in V may be due just to a difference in the arithmetic mean and in the number of observations (cf. Part II., point 4).

Before we turn to other components of personal income it may be of the interest to give at least some indication of the inequality of incomes from salaried employment under the mixed economic system in 1945-1948.<sup>16)</sup> I calculated the Gini coefficients below from Velimsky's data by 11 income classes based on statistics of the compulsory health insurance [32]. These statistics cover officially all wage and salary earners except miners (who had a special health insurance). However, many of the part-time earnings were not reported to the insurance so that their dispersion may be very roughly compared with the dispersion of full-time earnings in later years.

	Gross earnings subject to national health insurance		Full-time earnings (from Table 3)
	End of April 1947	End of April 1948	May 1959
Gini coefficient	0.313	0.304	0.201
Mean earnings in Kcs	514 <sup>17)</sup>	585 <sup>17)</sup>	1.414
Number of wage and salary earners covered (in 1,000)	2.473	2.539	3.864

The above figures indicate that the dispersion of gross earnings was reduced between 1948 and 1959 by approximately one third. But a remarkable equalization of earnings existed already in the first postwar period prior to the full socialization.

b) Incomes (before tax) of recipients of social security benefits and of collective farmers

Besides the "non-planned components" of economically active population and the apprentices, two other important groups of income recipients have not been covered so far: recipients of

social security benefits, and members of agricultural cooperatives (collectives).

Czechoslovak statistical yearbooks provide information only on the mean of the main categories of social security benefits by socio-economic groups of recipients:

	1960			1965			1969		
	a.	b.	c.	a.	b.	c.	a.	b.	c.
Retired wage and salary earners	705	589	393	741	647	422	848	763	507
Retired collective farmers	275	288	206	330	333	222	497	475	314
Retired self-employed	266	286	195	279	286	209	476	485	397

a. old-age benefits at retirement age;  
 b. invalidity benefits;  
 c. widow's benefits.

Source: [24, p. 532].

As the above table indicates, differentials in the mean benefits were wide in 1960-1965, especially between the benefits of wage and salary earners on one hand and those of the two other social groups on the other hand. From 1965 to 1969, the differentials narrowed noticeably.

No official statistics on the size-distribution (dispersion) of all social security benefits have been available to me. Therefore, I approximated the dispersion on the basis of a survey of the per capita income of families of pensioners in 1965 (see Part V.),<sup>18)</sup> The results can be found in Table 4. The mean of all social security cash benefits (excluding estimated family allowances for dependent children) - in the neighborhood of Kčs 500 per month - was only approx. 36% of the mean earnings of wage and salary earners in 1965; it was almost identical with the median, suggesting that the distribution is not typically right-skewed. Relative dispersion in the upper half of the distribution was somewhat narrower than the dispersion of full-time earnings:  $P_1 = 176$ ,  $P_{10} = 158$ ,  $P_{25} = 119$ , compared with 220, 170 and 125, respectively for full-time wages and salaries (average of 1964-1966, cf. Table 3). But at the lower tail the dispersion of

social security benefits was much wider than full-time wages and salaries:  $P_{90} = 59$ ,  $P_{95} = 42$ , compared to 64 and 57.5, respectively. In 1968-1969 about 350,000 of the lowest pensions have been increased so that the great inequality of social security benefits which prevail in 1965 has probably been reduced in recent years.

Published statistics on income of collective farmers are scarce. One can roughly estimate the total annual money income from agricultural per one active member of family whose head is a collective farmer (member of JZD) from the family budget data. In 1965 the annual income, including net income from private sale of agricultural produce, was approx. Kčs 11,800 per person active in farming (including wives). Thus, it was approx. 67% of the average gross earnings of wage and salary earners in that year. If, however, income in kind (other than social consumption) is included, the income of collective farmers was around 90% of the income of wage and salary earners. No statistics on the dispersion of collective farmers incomes have been available to me so far, <sup>20)</sup> but a histogram of the frequency distribution of monthly income in 1965 (separately for males and females) can be found in Vecernik's contribution to [17, p. 301]. Unfortunately, he does not specify whether this histogram refers to all incomes of collective farmers, or money income from agriculture, or money incomes from agricultural collectives (excluding incomes from private sale of agricultural produce). Nor it is clear whether the incomes are per member of the agricultural collectives, or per economically active member of families whose head is member of an agricultural collective. If I read the small graph correctly, the percentage distribution of recipients is approximately as follows:

Gross monthly incomes of collective farmers in 1965, in Kčs										
below 600	601- 800	801- 1000	1001- 1200	1201- 1400	1401- 1600	1601- 1800	1801- 2000	2001- 2200	over 2201	
18.0	12.5	15.0	15.5	12.0	10.0	6.5	3.8	4.2	3.0	Males %
45.5	16.0	13.5	9.5	7.0	3.5	2.0	1.0	1.0	1.0	Females %

Unfortunately, the classification is too crude at the low end, especially for women. On the basis of the above distribution, approximations of the median income and of the percentiles related to the median have been calculated, and can be found in Table 4. The table suggests that in the mid-sixties money incomes of collective farmers were more dispersed over the range of distribution, over which information is available, than the gross incomes of full-time wage and salary earners. This is especially true about incomes of women.

c) Personal money income before tax

What is the inequality of personal incomes of all socio-economic groups combined (excluding the "non-planned components" and apprentices) ?

We have already seen that the mean and the median income of old-age benefit recipients and of collective farmers of the mid-sixties are substantially below the corresponding central tendencies of incomes of wage and salary earners, and that their dispersion is greater. Thus, the dispersion of all personal incomes must be wider than the dispersion of gross earnings alone. The only information on the dispersion of personal incomes that is accessible to me is again the decile analysis by Večerník, reproduced in Table 5. It shows that, indeed, the inequality of all personal incomes is greater, especially in respect of the lower tail than the inequality of earnings from wages and salaries.

Večerník computed also tax-based decile shares in personal income in 1946, prior to the introduction of socialist economy. These are also reproduced in Table 5. Despite serious doubts about their comparability with the post-1948 data, they strongly suggest that the narrowing of inequality of personal gross incomes over 1945-1959 was greater than the previously mentioned reduction of inequality of gross full-time earnings over 1948-1959. They are reproduced in Table 5 and suggest that inequality of gross personal incomes was reduced over 1946 - 1965 somewhat faster than inequality of gross earnings from employment.

#### IV. A partial explanation

The combined impact of differences in the mean earnings between, and in the dispersion of earnings within, subpopulations on the shape of the distribution and the degree of inequality of earnings of the whole population is a complex mathematical problem. An attempt to solve it would go far beyond the scope of this paper<sup>21)</sup>. Furthermore, as the pertinent variates (subpopulations) go into many thousands (combinations of economic sectors, occupations, skills, sex, age groups, regions, etc.), a statistical test would not be easy.

Normally, the smaller the deviation of the means of earnings of subpopulations from the over-all men, and the smaller the dispersion within each subpopulation, the less dispersed will the aggregate distribution tend to be. With this in mind, I shall try to point out the main factors which have contributed to the unusually low degree of inequality of gross earnings from civilian employment in Czechoslovakia.

##### a) Differentials of earnings between and within economic sectors.

Table 6 shows the differences in mean earnings between economic sectors, and Table 7 the differences between industrial branches. Economically speaking, these averages of earnings are not very meaningful as the structure of employment by skill, sex etc., and productivity of labor, vary from sector to sector and from branch to branch. Nevertheless, tables 6 and 7 indicate that differences in mean earnings between economic sectors and industrial branches in Czechoslovakia have been substantial, and have not been reduced over the period covered. In fact, until the late fifties, the differences tended to increase because of preferential treatment of "productive sectors" (Marxian definition) and of heavy industry; in most recent years there has been only a slight tendency to reverse this trend.

Relative dispersion of full-time earnings within industry (mining, utilities, manufacturing) and within construction is illustrated in Table 4. The pertinent Gini coefficient for industry is practically the same as, and the coefficient for construction only slightly lower

than, the coefficient for all full-time earnings; and there is no great difference in the shapes of the distribution concerned.

Fremr [8, pp. 25-26] provides coefficients of variation of full-time earnings in selected sectors as well as industrial branches; they have been reproduced in Tables 6 and 7. Comparability of these coefficients is limited in view of the substantial difference in the underlying arithmetic means; but they tend to support the view that the dispersion of earnings within sectors and branches is not generally smaller than dispersion of all earnings from employment. <sup>22)</sup>

To explain the equalization of earnings under socialism in Czechoslovakia, we have to look for other factors than the reduction of earnings differentials between and within sectors.

b) Differentials of earnings between and within occupational groups.

A standard comparison, frequently used in Czechoslovak sources, is between the mean earnings of three large occupational groups: wage earners (manual workers, but probably excluding foremen), and clerical and administrative staff:

	1953	1959	1966	1968	1969
<u>Industry</u> (mining, utilities, manufacturing):					
Gross monthly earnings of wage earners, in Kčs	1,155	1,358	1,550	1,712	1,818
Gross earnings of engineers and technical staff, in % of line 1	129.3	133.7	140.4	140.9	139.7
Gross earnings of clerical and administrative staff, in % of line 1	88.2	88.5	88.6	89.3	88.0
<u>Construction</u>					
Gross monthly earnings of wage earners, in Kčs	1,193	1,457	1,727	1,922	2,068
Earnings of engineers, etc. in % of line 1	127.2	126.3	132.0	135.2	135.0
Earnings of clerical and administrative staff, in % of line 1	89.3	85.3	83.9	85.1	82.7

Source: 24, pp. 28-31

Earnings of wage earners (unskilled, semi-skilled and skilled) are, of course, not good, stable base, because its structure changes over time, between sectors and between countries. Nevertheless, it is fairly safe to state that average earnings of engineers and technicians, and of clerical and administrative staff are rather low in Czechoslovakia relative to the earnings of wage earners: the corresponding ratios are clearly lower than in the Western industrial countries (cf. [31, Chapter 5] ) or in some other socialist countries [31, Table 8.18] <sup>23)</sup>

Earnings within each of these three large occupational groups are less dispersed than earnings of the whole population. In May 1964, the coefficients were as follows:

	All wage earners	Engineers and technical staff	Clerical and admin. staff
R (full-time gross earnings)	.182	.140	.140
V (full-time gross earnings)	.346	.279	.269
V (tariff rates)	.287	.213	.229

Sources: Gini coefficient R computed by me on the basis of data by 15 classes of gross earnings in [8, p. 50].

Coefficient of variation (line 2) computed by Fremr [8, p. 50] on the basis of the same data.

Coefficient of variation of tariff rates computed by Fremr on the basis of 8 tariff ("qualification") classes for wage earners, and 18 tariff classes for engineers and for administrative staff. In view of the varying number of classes, V for wage earners in the third line should not be compared to V for the other two occupational groups, and the third line should not be compared to the second line, without due qualifications.

By international standards, the dispersion of earnings within these occupational groups appears to be very low, especially for engineers and technicians, and for clerical and administrative staff.

Dispersion of earnings of wage earners reflects in the first place unequal distribution of overtime pay, bonuses, premia, and other supplements to the basic time wage, and differentials between sectors and branches, whereas the wage rates are little dispersed within each branch. The Gini coefficients for time-wage rates are as follows (based on a special statistical inquiry into the distribution of wage earners by 8 wage rate classes in April 1967):

	All industry	Fuels	Electric power, thermal energy	Engineering	Wood working	Textiles	Food processing
Mean hourly wage rate	6.66	9.77	7.14	6.71	6.11	5.45	5.44
R	.113	.127	.074	.089	.062	.079	.100
Number of workers covered (in 1,000)	1,651	150	46	557	70	164	153

Source: [26, p. 238].

Available information on earnings in a finer break-down by occupations is sketchy. The following index numbers of the mean earnings by occupations in the mid-fifties (probably 1957) are from Gerloch's study: Mean earnings of wage earners (all skills below foreman) = 100

Industrial branch	Occupation									
	1	2	3	4	5	6	7	8	9	10
Fuels	159	...	119	135	133	67	103	300	193	343
Chemicals	139	111	135	125	123	94	98	174	206	257
Heavy engineers	129	115	117	112	115	85	95	172	226	310
Manufactured consumer goods	141	137	159	128	132	107	103	163	192	302
Food processing	129	134	138	128	133	102	107	136	163	228
Construction	119	120	135	134	114	97	94	136	147	178

Code of occupations: 1. foreman; 2. draftsman-designer ("konstrukter"); 3. technician ("technolog"); 4. controller of work standards ("normovac"); 5. planner; 6. Bookkeeper; 7. stock keeper ("skladnik") 8. technical manager ("vedouci provozu"); 9. Manager ("reditel zavodu"); 10. director of a socialist (large-scale) enterprise ("reditel podniku").

Source: [9, p. 102].

The weakness of these index numbers is again the non-homogeneous base "all wage earners". As Gerloch<sup>points</sup> out, in some industries the earnings of wage earners in the highest tariff categories exceeded the earnings of controllers of work standards ("work-norm setters").



The structure of earnings by occupations in agriculture was examined recently by Jaroslava Glaserová [10]. The most important figures from her study - some of which conveniently supplement the inadequate information on the mean incomes in collective farms (sub a. above) - are reproduced below:

A. Gross monthly earnings in State farms; "net monthly rewards" in collective farms, in Kčs.

B. Number of workers covered by pertinent statistics, in 1000 workers.

	Collective farms			State farms	
	1966	1968		1968	
	A	A	B	A	B
All full-period workers	1,024	1,323	758	...	...
of which manual workers	997	1,274	672	1,630	162
of which tractor and combine drivers	1,413	1,779	72	2,027	23
truck drivers,	1,492	1,890	12	...	...
workers in vegetable production (except all drivers)	670	759	262	1,212	47
keepers of milk cows	1,329	1,601	88	1,837	26
keepers of other cattle	1,077	1,358	49	1,572	14
poultry keepers	960	1,181	15	1,406	3

Source: [10, pp. 463-4]

Glaserová measures the change in dispersion of the arithmetic means of earnings between occupations by coefficient of variation <sup>24)</sup>, and finds that the trend towards reduced dispersion was reversed in 1967. She describes the widening of dispersion as "a favorable tendency" and "positive phenomena". [10, pp. 462, 465].

Several Czechoslovak economists as well as high Government and Party officials have also criticized the narrow over-all dispersion of earnings. <sup>25)</sup> These criticisms are apparently aimed at the failure of the present differentials in earnings to reflect differentials in skill, responsibility, performance and other criteria which may be applicable to determine a non-specific "optimum" degree of inequality in earnings.

It seems to me that in many Czechoslovak pronouncements on this matter there is some confusion between undesirable structure of earnings and the low degree of inequality of earnings. A wider dispersion of earnings does not necessarily reflect an improved structure (by given criteria); it may well be due to increased inequality in the wrong place, and may even reflect a "deteriorated" structure. <sup>26)</sup>

A better approach is to rely on the coefficient of correlation between earnings and other characteristics of work which are considered to be important (e.g. skills, complexity of work, etc.) or to use multivariate analysis.

Several Czechoslovak authors inquired into the links between complexity of work, skills, education etc. on one hand, and earnings on the other hand, and found that there was little correlation (e.g. Rošlo, Podoláková and Jančovičová [17, pp. 506-508]; Večerník [17, pp. 303-306]; Fremr [8, pp. 52 ff.]) But the only actual coefficients of correlation I could find are those calculated by Alan. [17, pp. 280-281]. He relates six income classes <sup>27)</sup> to six levels of education, from unfinished elementary school to college graduates, on the basis of a large random sample of population (30,000) on 1967.

The resulting coefficient of correlation is only 0.442 for all working age groups, and 0.445 for persons born 1907-1921. Probability to reach a monthly income exceeding Kčs 2,000 was in 1967 as follows [17, p. 282].

	College graduates	High school graduates	Graduates of trade schools	Others
Persons born 1907-21	70.7%	40.5%	23.9%	6-10%
Persons born 1922-36	44%	over 50%		...

To conclude: dispersion of earnings between and within occupations in Czechoslovakia is very narrow, and this is a major factor in the unusually low degree of inequality of all earnings. The differentials have been reduced inter alia by weakening the link between skill, education etc. on one hand and earnings on the other. The spread of education in Czechoslovakia (cf. Alan, 17, pp. 268-74) seems to have only a limited equalizing effect on earnings.

c) Male and female earnings

Data on the difference between earnings of men and women have not been regularly published in the standard Czechoslovak statistical sources. For full-time earnings in the socialist sector (excluding collective farms and apprentices) the difference can be approximated from estimates in Table 3:

---

	Gross earnings of females in per cent of earnings of males in the month of May				
	1948	1959	1962	1966	1968
Mean	(59.2) <sup>28)</sup>	65.1	64.9	...	65.9
Median	...	66.0	65.9	66.2	66.6

---

If part-time workers were included, the ratios of female earnings to male earnings in 1959-1968 would probably be somewhat lower, and thus not much above the 1948 ratio. At any rate, in the sixties the difference between the mean earnings of men and women in Czechoslovakia was greater than in France, and approximately as great as in some other countries (cf. [31, Chapter 5, pp. 25-26, and Chapter 8, pp. 36-37] ).

Dispersion of full-time earnings by size is narrower within each sex group, especially within female earnings, than the corresponding dispersion of all earnings (cf. Table 3); this is an example of the effect of the difference in mean income of subpopulations on the aggregate dispersion.

The difference in the shape of the distributions, is even more interesting. The distribution curve of female earnings is leptokurtic and less right-skewed in relation to the curve of male earnings (over the 95th to the 5th percentile. Yet it has a longer pareto tail, as indicated by the lower value of alphas) Combining the two subpopulations, with widely different means of earnings, we obtain distribution for the whole population which is more sight-skewed than the components:

	Coefficients of skewness $\frac{P_{95} - P_{50}}{P_{50} - P_5}$		
	(based on Table 3):		
	1959	1964	1968
Male earnings	1.48	1.52	1.62
Female earnings	1.25	1.61	1.60
All earnings	1.87	1.67	1.71

This is also illustrated in Fig. 1.

To conclude: The low degree of inequality in all earnings has not been achieved by a substantial reduction of differentials between male and female earnings. The persistent differentials are probably not due to a discrimination in pay for the same work, but to employment of women in the less paying jobs (although a very small fraction of women have reached very high earnings - see the long, thin Pareto tail!).

d) Differentials of earnings by age groups

Detailed figures on earnings by age groups are available to me only in respect of full-time earnings of manual workers (all skills) in construction in April, 1967. The age profile of these earnings is extremely flat at the median, and only slightly more curved at the ends of the distribution, as illustrated in Fig. 6. Indicators of dispersion of earnings within the youngest and the oldest age groups, and within the age group with the highest mean (31-35 years), can be found in Table 4. As it was to be expected, the dispersion is wider in the middle-age and older groups than in the youngest group, but the difference is small.

Age profile of earnings in other sectors and other occupations, according to various reports, is also rather flat. Differentials in all earnings between age groups are probably rather small in Czechoslovakia in comparison with some Western countries (cf. [31, Chapter 5, p. 26], [16, pp. 118-122], [23, p. 95]); this is probably one of the factors in the narrow dispersion on earnings in Czechoslovakia.

e) Differentials in earnings between the Czech and the Slovak Socialist Republic Republic, and between regions.

Average earnings in Slovakia have been catching up fast with average earnings in the Czech lands: the mean of gross monthly earnings in the socialist sector (excluding collective farms and apprentices) in per cent of the mean of earnings in the Czech lands developed as follows:

---

1948	1959	1968	1969
91.6	95.9	98.7	98.8

---

Source: [24, pp. 42-43, 58-59].

---

Equalization of mean earnings between the Czech and the Slovak Socialist Republic is part of a broader equalization between all 12 "regions" (kraje) in Czechoslovakia. In 1968, the highest monthly gross wage and salary earnings were reported in Prague (Kčs 1,867), the lowest in East Bohemia (Kčs 1,648), the second lowest in Southern Bohemia (Kčs 1,662), the third lowest in Western Slovakia (Kčs 1,680) [6, p. 263]. The small inter-regional differences are another factor in the narrow dispersion of all earnings in Czechoslovakia.

V. Dispersion of per capita incomes of households.

So far we have discussed the dispersion of primary money incomes of individuals. From the viewpoint of social welfare, the approximate unit of income would be per capita income of households, after tax and after all transfers in real terms.

Because of statistical difficulties, the analysis in this section will be limited to nominal per capita money incomes of households after Government transfers, including some other revenue in cash, but before deduction of direct taxes. This is, basically, the income variant on which regular, rather detailed surveys of family budgets are based in Czechoslovakia: money revenues from employment, agricultural collectives, private sale of agricultural products (net of cost), social security and national health insurance (incl. family allowances), gross withdrawals of personal savings, and gross personal borrowing are balanced against expenditures for food manufactured goods, services, direct taxes, insurance premia, interest on and amortization of personal loans, and gross saving. The pertinent data are by 12 to 20 income classes, depending on the survey.<sup>29)</sup> They are broken down by socio-economic groups of households; usually, they are available for households of wage earners, of salary earners, and of members of agricultural collectives, according to the occupation of the head; less frequently also for families of pensioners (old-age benefit recipients) and for "all households".<sup>30)</sup>

Some large surveys like the 1965 survey ("microcensus") are based on what is called "net annual money revenue" [27, pp. 461 ff.], but it is not clear whether "net" means net of cost to produce products and services for private sale, or also net of taxes and transfers. I am inclined to believe that direct taxes and at least some cash transfers are included even in the 1965 data.<sup>31)</sup>

The use of the concept of money revenue before direct tax is regrettable from the point of view of social welfare analysis, but it is not a fatal weakness, since direct taxes in Czechoslovakia are neither high nor very progressive. The wage tax (direct tax on wages and salaries) in 1968 amounted to approx. 10% of the average annual per capita money

revenue of households of wage and salary earners [24, p. 458]. In my rough estimate (based on wage-tax laws), the tax in the lowest income class (approx. Kčs 4,800) was around 4%, and in the highest income class (mean approx. Kčs 25,000) around 13% of per capita money revenue of households.<sup>32)</sup> Direct taxes on income of collective farmers' households, on per capita basis, are even lower (cf. [24, p. 458]). Tax on other incomes (from self-employment) is substantially higher, but only a very small percentage of the total income of households is subject to it. Contributions to national (health and social security) insurance are paid in toto by the employer.

The inclusion of borrowing in the income (revenue) of households is also to be deplored from the viewpoint of social welfare analysis,<sup>33)</sup> but again its importance is not overwhelming. In 1968 gross borrowing households amounted to roughly 9% of the money revenue of the households of wage and salary earners, but was unimportant in farmers households. A part of it could be viewed as a quasi-transfer because the rate of interest on various personal loans is very low (0 - 4%) and because a part of special loans is never repaid. Borrowing is progressive with the level of household income (cash revenue), and thus weakens the equalizing effect of mildly progressive direct taxes.

The socio-economic structure of households developed as follows:

	1950	1961	1967	
Wage earners	55.0%	59.1%	37.3%	
Salary earners			23.3%	
Wage earners engaged also in independent farming			5.7%	1.3%
Wage earners who are also members of collective farms				2.7%
Collective farmers	0.8%	5.7%	6.8%	
Independent farmers	18.3%	1.8%	1.2%	
Pensioners	19.4%	22.9%	26.9%	
Self-employed outside of agriculture	5.3%			
Others	1.2%	0.5%	0.5%	
"All households"	100.0%	100.0%	100.0%	

Source: 6, p.191 .

The two-stage random samples on which family budgets are based are fairly large. E. g. in 1967 the sample covered 2,387 households of wage earners, 2,192 households of family earners, and 1,338 households of collective farmers [26, p. 449]. A "microcensus" sample is even larger, and covers 1-2% of the whole population. For instance, the 1965 microcensus covered a total of 39,275 households, of which 15,039 households of wage earners, 8,563 households of salary earners, 3,189 households of collective farmers and 9,911 households of pensioners [27, pp. 461-463]. The sampling method has been described in [3], [7]. The samples seem to be representative, although the economic functions based on them occasionally show kinks which call for explanation.<sup>34)</sup>

The estimated median of annual per capita money revenues of households, the Gini coefficient of concentration, and the percentiles related to the median, can be found in Table 8. Dispersion of per capita money revenues of households of wage and salary earners is wider than dispersion of individual (full-time) wage and salary earnings (cf. Table 3). This is due, inter alia, to the differentials in per capita revenues of households with a different number of dependent children. Family allowances, although higher and more progressive with the size of family in Czechoslovakia than in some other socialist countries (cf. [31, Table 9.2]) have not sufficiently compensated these differences. Table 8 shows the distribution of revenues of families of wage and salary earners with 1 dependent child, and with 5 or more dependent children. The difference in the median of per capita revenue is dramatic. A comparison of the dispersion of revenues in these two distributions is also of interest; it supports the critique of the Gini coefficient in Part II. While the difference in  $R$  is very small, differences in  $P_i$  are great. The inequality of per capita revenues of one-child households is relatively more pronounced in the lower half, the inequality of revenues of large-size households in the upper half of the distribution.

As it was to be expected, Table 8 shows that revenues of all households in 1965 were substantially more dispersed than revenues of households of wage and salary earners. This is due in part to the median (and the mean) being lower for collective farmers households and especially for pensioners households. Furthermore, the size distribution of per



capita revenues of the farmers households, and of the pensioners households was more dispersed than the distribution of revenues of wage and salary earners. The inequality in respect of revenues of households of pensioners was especially great near the lower end of the distribution ( $P_{95} = 39$ , compared to 46 for collective farmers' households, 50 for wage earners and 55 for salary earners households).

As the gap between money incomes of collective farmers and pensioners on one hand, and of wage and salary earners on the other was reduced after 1965, and as old-age benefits became somewhat more even distributed (cf. Part III b.), the dispersion of per capita revenues of all households narrowed. At the same time, the distribution became less skewed, as illustrated in Fig. 2, and by the following approximative coefficients of skewness:

---

$\frac{P_5 - P_{50}}{P_{50} - P_{95}}$	for per capita revenues of all households:		
	1956	1965	1967
	1.69	1.54	1.51

---

There seems to be a progressive tendency in the distribution of per capita money revenues of households in Czechoslovakia to approach a greater symmetry, except for a thin Pareto tail. If per capita revenues of households were adjusted for direct taxes, for income in kind, and especially for "social consumption", the distribution of the real contents of per capita incomes would probably come even closer to a normal symmetrical distribution with a low  $\sigma$ .

VI. Concluding remarks: some international comparisons.

We have examined the dispersion of several variants of nominal money incomes in Czechoslovakia over short periods of time (monthly earnings, annual per capita money receipts of households). How does the degree of inequality which emerged from this study compare with some other countries?

First of all, it cannot be emphasized enough that there is a conflict between "equality" in the distribution of different variants of income. If there is a perfect equality among primary individual incomes, primary incomes of consumers units, and of families (households) will necessarily be rather widely dispersed, because the number of income-earning members is unequal. Per capita incomes of families (households) will tend to be even more unequal because of the varying number of dependents.

If incomes tend to be equalized over short periods of time, life-time incomes will be unequal because of the different age profile between subpopulations (especially between occupational groups). An interesting example of the stream of life-time earnings can be found in [30, p. 24]:

---

Cumulative (gross?) earnings by age intervals in the engineering industry, in 1,000 Kčs (based on data reported in October, 1965):

	Age								
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60
Fitter	25	123	259	400	545	690	835	980	1125
Engineer-designer	--	17	132	269	413	557	701	845	989
Turner	22	107	224	344	465	586	707	828	949
Lawyer	--	17	127	253	380	507	634	761	888
Laborer	48	111	194	277	360	443	526	609	692

---

Thus, according to the 1965 structure of earnings for males in the engineering industry, a fitter earns, until the normal retirement age at 60, 11% more than an engineer, and 21% more than a lawyer. The

above streams of earnings have apparently not been discounted to a common time base. But they should be discounted, and this creates additional problems: What is the appropriate  $t_0$  (the middle of the gainful life?), and what is the appropriate social discount rate?

Economic analysis of income dispersion by size should be in real terms, not merely in money terms. But this is extremely difficult to do. The conventional cost-of living indicators are not adequate to reduce nominal incomes to a real base, as the cost of living differs between low-income and high-income classes in view of the differentials in the pattern of consumption and in relative prices.

From the viewpoint of social welfare consumption, and private saving functions, the most appropriate variant of income is the per capita real income of households, after allowance has been made for all redistributions; but the overwhelming difficulties of measuring real incomes after all taxes and transfers are well known.

Relative dispersion of incomes is not very meaningful without a reference to the level of economic development. There is one thing if the same degree of dispersion of incomes by size applies to the mean of per capita incomes of perhaps \$ 200, and another thing if it applies to the mean of per capita incomes of perhaps \$ 5.000 per year.

In addition to difficult problems of economic analysis, international comparisons of the dispersion of incomes are full of statistical pitfalls. It is almost impossible to find even two countries where the statistical coverage as to the sources of income, population, intensity of income-creating activities (combinations of full-time, part-time, full period, part-period work), cumulation period, etc. is identical. There is also a host of technical problems, e.g.: tax-based data are of doubtful validity and should not be compared with census data; there is always a vestige of doubt about data based on sample surveys; classification of income intervals varies, and this affects the value of many indicators of relative dispersion; and none of the summary measures of relative dispersion is quite satisfactory.

Another limitation of comparability which is sometimes disregarded is the different size of countries. A very large country, with great differentials in climate and other natural conditions with a multi-national or multiracial population or with a substantial international movement of the population would tend, ceteris paribus, to show a larger dispersion of incomes than a small country with a homogeneous stable population.

In spite of all the unsolved economic and statistical problems I confronted some data on relative dispersion of incomes in selected countries in the sixties (Table 9), without any claim to have reduced the data to a fairly comparable basis.

The dispersion of wage and salary earnings, as illustrated in Table 9, seems to be slightly narrower in Czechoslovakia than in East Germany<sup>35)</sup> and in Hungary, and substantially narrower than in other countries covered. As to the dispersion of all personal incomes, only on some Western countries are readily available for an approximately comparison: they indicate that primary personal incomes are much more equally distributed in Czechoslovakia than in the West. Comparison of households incomes (allowing for at least a part of the redistribution) presents many difficulties. One of them is the (more appropriate) per capita basis of the Czechoslovak statistics, in contrast to the total-household-income statistics in most other socialist and Western countries. I am inclined to believe, on the basis of the information in Table 9 and of some other indicators, that family incomes after tax and transfers, total and per capita, also more equally distributed in Czechoslovakia than in other countries.<sup>36)</sup>

Critical voices have been raised in Czechoslovakia that the egalitarian tendency has gone too far, presumably because it conflicts with incentives to maximize production within given constraints.<sup>37)</sup> But social satisfaction, social equilibrium, and "quality of life" do not depend only on the absolute level of per capita production (per capita real income) which makes it possible to maximize per capita consumption (within a given time horizon). They depend also on the rate of increase of material well-being over time, and last but not least on real income in relation to other comparable units of recipients, i. e.

on the size distribution of income. Maximizing the level and the rate of growth of consumption of goods and services usually conflicts with the social welfare postulate of a high degree of equality of incomes by size. It is impossible, on the basis of economic analysis alone, to attach relative weights of importance to each of the above-mentioned three main economic components of social satisfaction, in order to determine an "optimum" degree of inequality of incomes under any socioeconomic system. This is a matter for philosophers rather than for economists and statisticians.

Footnotes

- 1) Noteworthy exceptions to this neglect are, in this author's knowledge, the ECE study [31] and Lydall's study [16]. As far as Czechoslovakia is concerned, both studies contain data only up to 1964, without break-down by sex, occupational groups, etc. Lydall measures the dispersion of gross earnings in Czechoslovakia by relating selected percentiles to the median; ECE study relies mostly on the quartiles ratio as an approximative measure of dispersion.
- 2) Based on [25, p.440] and the assumption that average per capita money income of families in 1968 was Kčs 19,500. In Czechoslovak literature "social consumption of the population" is usually evaluated at a much higher percentage of personal income. The difference may be due to including old age benefits and other payments in cash under "social consumption" although these items are included already in "money incomes" of families in the family-budget statistics (see Part II).
- 3) An interesting by-product of this research is the splitting of each of the official cost-of-living indices for the blue-collar workers, the white-collar workers, and for collective farmers into two: for the "high income families" and the "low income families". Cf. Statisticke prehledy No. 3-4|1970, pp. 89-90.
- 4) For a recent survey of models of the size distribution of incomes see Lydall [16, Chapter 2] and Mincer [19].
- 5) E.g., the structure of money revenues of families of wage earners in 1969 was as follows [24, p. 457]: gross income from employment 74.6%, money income from agricultural collectives 1.1%, benefits of national insurance (social security payments, etc.) 11.4%, withdrawals (gross) from saving deposits 6.2%, other money receipts 6.8%. On the basis of various official statistics, "other money receipts" can be broken down as follows: Gross borrowing 3%, receipts from private sale of agricultural produce 0.2%, all other receipts (incl. indemnities paid by the State insurance company) 3%.
- 6) Money revenues, as derived from sample surveys of families, are balanced against money expenditures which include wage tax and other direct taxes (cf. [23, p. 449], [24, p.458]).
- 7) About 1|10 of payments received from agricultural collectives are shares in profits. The rest are payments for "work units" performed.
- 8) In 1966-1969 the share of income from self-employment tended to increase. Furthermore, if personal incomes from "working on the side" (performing various jobs, mostly repairs of houses, cars and appliances, in Czech "melouchy") and illegal incomes (mostly from blackmarketing) were included, the share of "entrepreneurial" income would probably be more than double of the above. But it would still be less than a half of the share of the official entrepreneurial income in the U.S. or in Western Europe (cf. contributions by Haley, Jeck, Falise and others to [18]).

Footnotes (continued)

- 9) Bruckmann is primarily interested in the difference between absolute and relative concentration, and probably assumes that the shapes of distributions are comparable.
- 10) A combination of several single measures of inequality does not help very much. Each of them may rank differently the distributions under study, as has been shown recently by Atkinson [1], and it is difficult to attach relative weight if importance to each of the single measures used.
- 11) Atkinson [1] has demonstrated mathematically that, if Lorenz curves cross, one can always find a utility function which will rank the distributions in the reverse order to their ranking by the Gini coefficient. Newberry [2] carried this analysis one step further demonstrating that there exists no additive (concave?) utility function which ranks income distributions in the same order as the Gini coefficient. His "proof by reductio ad absurdum" can be supported by common-sense reasoning. The mean difference in the denominator of the Gini coefficient attaches equal importance to any two equal differences in income; it implies a constant marginal utility of income. A concave utility function implies a falling marginal utility of income. Thus, the two extreme cases of absolutely even or absolutely uneven distribution of income.
- 12) In view of the great variety of shapes, the graphical method has some advantages. When the information on the extreme upper or lower tail was not detailed enough,  $P_1$ ,  $P_2$ , occasionally also  $P_5$  and  $P_{95}$  could not be estimated accurately. If the margin of error is likely to exceed 2%, the pertinent figures are in parentheses. If the margin of error is likely to exceed 5%, the pertinent figures have been omitted in the tables.
- 13) Champernown attempted to fit a Pareto-like function also to the lower part of the distribution. For a discussion of his theory, explaining the existence of Pareto tails by a stochastic process, see [16, pp. 20 ff.] .
- 13a) J. Fremr [8, p. 24] states that the value of  $V$  ranges from 0 to 1. Unless he has normalized  $V$  in some way, this statement is not correct; see also footnote 13.
- 13b) An interesting example of the values of  $V$  in comparison to the values of the Gini coefficient and of the standard deviation of the logs of income can be found in Kravis (13, p. 184):

Before tax income in the U.S., 1950  
(based on Department of Commerce data):

	V	Gini's R	$\sigma$ of logs
All consumer units	.96	.41	.37
Non-farm units	.98	.40	.29
Families of two or more	1.10	.38	.26

$V$  moves in the opposite direction relative to the other measures of dispersion.

Footnotes (continued)

- 14) E.g. the sets of data on gross full-time earnings in Czechoslovakia, if compared in a purely formal manner (disregarding the change in statistical definitions), certainly indicate an increase in inequality from 1966 to 1968:  
Incomes in the upper tail increased noticeably relative to the median ( $P_1$  from 221 to 227,  $P_2$  from 194 to 294,  $P_5$  from 170 to 175), while incomes in the lower tail,  $P_{90}$  and  $P_{95}$  did not move relative to the median. R went up from 0.193 to 0.199 (cf. Table 3). Yet, the interquartile ratio decreased from 1.57 in 1966 to 1.38 in 1968, indicating a more equal distribution in the later year.
- 15) Including, however, wage and salary earners in the State farms (220 thousand full-period workers in 1966, 188 thousand in 1968, cf. 26, p. 322). Lydall's reference to "non-farm" employment 16, p. 303 is not accurate.
- 16) Approx. 2/3 of industry (mining, public utilities and manufacturing) and all banks and insurance companies were nationalized already in 1945, but farming, trade and other sectors remained predominantly privately owned until 1949-1952. Cf. J.M. Michal, Central Planning in Czechoslovakia (Stanford University Press, 1960) and [29, Sections IV. and V.] .
- 17) In "new" KČs, introduced by the currently reform in May, 1953. The original data in old currently units have been converted at the official ratio 5:1 which is questionable, (cf. Michal, op.cit. and [29, Section V, Chapter 4] ). Furthermore, the mean excludes earnings of miners; on the average, miners earnings were approx. twice as high as the earnings of other workers. For this reason, too, the above 1947-1948 nominal earnings are not comparable with the 1959 nominal earnings.
- 18) By excluding incomes from employment, agriculture and the estimated family allowances for dependent children, from total money incomes of families of social security recipients [27, p. 463] , and recalculating the adjusted per capita incomes of these families on the per-recipient-of-benefits basis, for 20 income classes.
- 19) Based on [27, p. 462] ,
- 20) Size-distribution of incomes of collective farmers could be computed from very detailed data based on the family budgets in the mimeographed series "Československá statistika". The Institute for Advanced Studies in Vienna has requested a copy of this paper, but has not yet received any response from the Czechoslovak Federal Statistical Office in Prague.
- 21) Lydall gives some examples of aggregate distributions based on additive and multiplicative factors 16, Appendix 2.
- 22) Except in sectors in which employment is rather homogeneous by skills and especially by sex, e.g. retail trade where almost 3/4 of workers are women.



Footnotes (continued)

- 23) Only in the USSR the ratio of clerical and administrative earnings to the manual workers' earnings was (in early sixties) as low as the corresponding ratio in Czechoslovakia.
- 24) She seems to recognize the weakness of V as a measures of relative dispersion. She calculated V as the ratio of the sum of standard deviations to the current arithmetic mean as well as to a constant arithmetic mean in the base year. This, it seems to me, is not a very efficient remedy. It is difficult to evaluate the meaning of these two, often contradictory, series of V.
- 25) "The fast increase in wages in recent years failed to lead to a more pronounced differentiation of labor rewards and to stronger incentives to work", V. Hůla, minister of planning, on Oct. 17, 1969 (Hospodářské noviny 43 | 1969).  
"Sozialisation of the Czechoslovak economy was accompanied by elimination of excessive differences in remunerating individual categories of workers... However, this process has surpassed the desirable optimum". Z. Urbánek, "Development of Consumption and Wages in Czechoslovakia 1956-1965", Czechoslovak Economic Papers No. 10.
- 26) E.g. if rewards for work requiring below-average skill are above the average rewards, and are further increased. An example of a widening dispersion "in the wrong place" maybe this: suppose within the same category of skill, responsibility, productivity, etc., earnings become more differentiated by sex, or age, or regions. Coefficients of relative dispersion would then go up, but the coefficient of correlation between earnings and skill etc. would not change.
- 27) Presumably gross earnings from work although the questionnaire of the sample survey [17, pp. 545-548] suggests that some transfer payments might be included.
- 28) Based on health insurance date for April; the underlying date exclude miners, but include part-time workers.
- 29) In the detailed mimeographed series, most of which have not yet been available to me (cf. footnote 20). In some secondary source I have used data are classified only by 9 income classes (e.g. in 6).
- 30) Excluding families of armed forces, prisoners etc. (cf. [26, p. 448]).
- 31) "Net" in the title of Fig. 2 should be interpreted accordingly.
- 32) For wage tax rates on individual earnings, in the mid-sixties, see [31, Chapter 9, pp. 4-5].
- 33) Borrowing has been probably included because the main purposes of family budgets is to analyse and forecast consumers demand.

Footnotes (continued)

- 34) For instance new deposits as percentage of "net" per capita money revenue in 1967 increased monotonically with the level of per capita revenue of households up to the annual revenue of 12,000 Kčs, then (suddenly dropped) in the 12,001 - 13,200 class from 9.7% to 8.9% increased to 9.4% in the revenue class 13,201 - 14,400 and continued to increase monotonically again to the upper end of the distribution [25, p. 453] .
- 35) Večerník [17, p.298] states with reference to [31] that earnings (which he calls "wages") are more equally distributed in the German Democratic Republic than in Czechoslovakia. His statement is probably based on the interquartile ratio, 1.60 and 1.62, for East Germany and Czechoslovakia, respectively, in 1959 [31, Table 9.19]. The interquartile ratio, however, is not a good measure of dispersion over the whole distribution because it is absolutely insensitive to inequality within the highest and the lowest quartile (cf. Part II.7). Wage and salary earnings within the highest quartile were substantially more unequal East Germany than in Czechoslovakia, as indicated by the higher values of  $P_5$  and  $P_{10}$  (cf. Table 9 in this paper). Table 9.19 in [31] earnings within the lowest quartile, but there are some indications that is also was more unequal than the corresponding distribution in Czechoslovakia. Furthermore, one has to bear in mind that the share of wage and salary earnings in total personal incomes is, in all probability, substantially smaller in East Germany than in Czechoslovakia.
- 36) I approximated the dispersion of total money receipts (incomes plus transfers and quasi-transfers) for all families in Czechoslovakia in 1965. The distribution of total receipts seems to be much more equal in the upper half, and only very slightly more unequal at the low end, than the distribution of per capita receipts:
- |                      | $P_2$ | $P_5$ | $P_{10}$ | $P_{25}$ | $P_{90}$ | $P_{95}$ | Median in Kčs<br>(approx.) |
|----------------------|-------|-------|----------|----------|----------|----------|----------------------------|
| Total money receipts | 125   | 123   | 121      | 118      | 53       | 40       | 29,600                     |
| Per capita           | 257   | 219   | 185      | 142      | 53       | 42       | 8,410                      |
- 37) To my knowledge, however, the much emphasized relationship between inequality of individual earnings and incentives to work and to acquire new skills has not yet been examined in Czechoslovakia on a rigorous statistical basis.

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Table 1

A. Money revenue of the population (before tax)

	1965	1968
Total revenue, in million Kčs	152,912	194,333
of which, in percent of total		
wages and salaries	67.6	66.6
income of collective farms	6.5	6.8
net income from private sale of agricultural produce	1.6	1.6
health insurance and social security benefits	15.9	15.8
personal loans granted by State savings banks	2.5	3.1
interest received	0.5	0.5
Indemnities paid by the State insurance company	0.6	0.6
income received from abroad	0.3	0.2
all other personal incomes (incl. Income of members of non-agricultural co-operatives and from self-employment)	4.4	4.8
	<u>100.0</u>	<u>100.0</u>

Source: 24, p.447

B. "Net" per capita money revenue (money receipts before tax) of households, in 1965

	Households of				
	wage earners	salary earners	collective farmers	pensioners	all
Total, in Kčs	8,479	10,113	8,118	6,993	8,467
of which, in %					
wage and salary earnings	84.5	87.8	17.4	25.4	70.3
from agriculture	0.6	0.3	68.0	5.4	8.3
from national insurance	13.8	10.8	13.4	67.1	19.6
all other	1.1	1.1	1.2	2.1	1.8
Source: 26, pp.	461-463				



Table 2

Population, active population and employment (in 1,000 persons)

	1953	1959	1964	1966	1968	1969
	Annual averages, except line 7					
1. Present population	12,820	13,565	14,058	14,240	14,362	14,418
2. Of which in productive age (men 15-59, women 15-54 years of age)	7,454	7,601	7,899	8,026	8,139	...
3. Of which able to work	...	...	7,658	7,793	7,903	7,955
4. Working population in post-productive age	...	...	638	635	625	630
5. Total active population (3+4)	...	...	8,296	8,428	8,528	8,585
-----						
6. Wage and salary earners in the socialist sector excl. collective farms and apprentices <sup>1)</sup>	4,029	4,468	5,245	5,524	5,713	5,838
7. Of which full-time <sup>2)</sup>	...	3,864	4,327	4,385	4,670	...
8. Line 7 in per cent of 6	...	82.5	82.5	79.4	80.2	...
9. Line 7 in % of line 12	...	63.8	67.9	66.4	68.6	...
10. Members of collective farms	381	970	909	866	858	864
11. Self-employed: (estimate) <sup>3)</sup>	1,273	406	220	218	223	214
12. Approx. civilian employment (lines 6+10+11)	5,683	6,058	6,374	6,608	6,794	6,916
13. Students	...	...	474	484	495	497
14. Apprentices	...	...	324	318	332	326
15. "Non-planned components" <sup>4)</sup>	...	...	1,124	1,018	907	846
16. Total (lines 12+13+14+15)	...	...	8,296	8,428	8,528	8,585

1) Excl. women on maternity leave.

2) In the month of May, as covered by statistics on the size distribution of earnings. For definition of "full time", see Table 3.

3) Incl. women on maternity leave and some other small groups of active population

4) see page

Table 2 (continued)

4) Employees of the ministry of defence (armed forces, etc.); of the ministry of interior (police, etc.); Party officials; probably also prisoners and possibly a small number of unemployed, although officially unemployment does not exist in Czechoslovakia.

Sources: Lines 1, 2, 6: [24, pp. 22-23]  
Lines 3, 4, 5, 13, 14, 15, 16: [24, p. 119], [23 p. 119].  
Line 11: based on 24, [p. 124] and on previous issues of  
Statistical Yearbook  
Line 7: Table 3.

Table 3

## Dispersion of gross earnings of full-time wage and salary earners in the month of May

	A l l				M a l e s				F e m a l e s						
	1959	1962	1964	1966	1968 <sup>x)</sup>	1959	1962	1964	1966	1968 <sup>x)</sup>	1959	1962	1964	1966	1968 <sup>x)</sup>
R.	.201	.195	.192	.193	.199	.173	.163	...	...	.170	.150	.137	.135	.138	.150
σ (approx.)	1.9	2.0	1.9	1.9	2.0	1.9	2.0	...	...	1.9	1.2	1.1	1.1	1.2	1.4
Mean, Kčs(est)	1,414	1,556	1,557	1,626	1,827	1,614	1,795	...	...	2,125	1,050	1,170	1,175	1,230	1,400
Median, Kčs(est)	1,340	1,470	1,470	1,530	1,720	1,540	1,715	1,720	1,795	2,020	1,020	1,130	1,130	1,190	1,345
P <sub>1</sub>	245	227	219	221	227	202	199	201	201	209	189	187	192	(188)	216
P <sub>2</sub>	21	199	196	194	204	188	182	184	182	188	173	168	170	171	182
P <sub>5</sub>	181	171	171	170	175	162	159	157	157	162	151	149	152	149	156
P <sub>10</sub>	152	151	151	152	153	143	141	142	140	143	138	134	137	136	140
P <sub>25</sub>	125	125	125	125	125	119	119	119	119	119	118	116	117	117	118
F <sub>75</sub>	78	79	79	79	80	83	84	85	86	84	86	86	87	86	85
F <sub>90</sub>	63	64	64	64	64	74	70	71	71	70	77	73	74	74	74
P <sub>95</sub>	55	57	58	57	57	58	61	62	61	62	(59)	65	68	66	65
Number of workers covered (in 1,000)	3,864	4,160	4,327	4,385	4,670	2,488	2,561	2,617	2,626	2,742	1,377	1,599	1,710	1,759	1,929
Column no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

## Sources:

"Full-time" workers are those who worked (in occupations subject to normal working week) in May 1959, 1964 and 1968 at least 170 hours, in May 1962 and 1966 at least 180 hours; in occupations with legally reduced time (such as miners), 160 and 170 hours, respectively. "Full-time" varies mainly due to the varying number of holidays, and the resulting interruption of comparability over time is slight.

x) Including all bonuses and premia paid in May. Prior to 1968, only bonuses and premia up to 1,000 Kčs were included in full in the May pay. Bonusws and premia paid in May in excess of Kčs 1,000 were prorated. Thus 1968 is not quite comparable to previous years (especially in the upper half of the distribution).

Columns 1-4, 6-9, 11-14:  
[27, pp. 117-118].

Columns 5, 10, 15:  
[25, p. 131].

Table 4  
Dispersion of gross monthly full-time earnings within selected economic sectors and occupational groups (excluding apprentices).

	I n d u s t r y					
	All wage and salary earners		Wage earners (manual workers)		Engineers and technical staff	Administrative and clerical staff
	May 1959	May 1964	May 1968 <sup>x)</sup>	May 1964	May 1964	May 1964
R	.197	.190	.194	.182	.141	.140
$\sigma$ (approx.)	2.0	2.1	1.9	2.1	2.1	...
Mean, Kčs(est.)	1,480	1,620	1,850	1,730	1,855	1,400
Median, Kčs(est.)	1,410	1,530	1,750	1,520	1,730	1,200
P <sub>1</sub>	218	217	216	214	198	197
P <sub>2</sub>	197	198	201	191	185	182
P <sub>5</sub>	172	171	173	171	164	162
P <sub>10</sub>	152	137	151		145	141
P <sub>25</sub>	124	124	125	123	120	119
P <sub>75</sub>	75	78	78	78	90	88
P <sub>90</sub>	63	65	65	65	77	78
P <sub>95</sub>	57	59	60	59	69	71
Number of workers covered (in 1,000)	1,785	2,051	2,196	...	...	...
Column no.	1	2	3	4	5	6

x) Not fully comparable with previous years (see note in Table 3).  
For definition of "full-time", see Table 3.

Sources: Columns 1, 2: [27, p.117]  
Column 3: [26, p.132]  
Columns 4, 5, 6: [8, p.50]

Table 4 (continued)

Dispersion of gross monthly full-time earnings within selected economic sectors and occupations (excluding apprentices).

	Wage and salary earners		C o n s t r u c t i o n				Collective farmers incomes		Old-age benefits (approximation) 1965
	May 1959	May 1968 <sup>x)</sup>	All age groups		wage earners		Males (approximation) 1965	Females (approximation) 1965	
			below 20 years April 1967	31-35 years	56-60 years				
R	.187	.173	(.191)	(.152)	(.19)	(.190)	...	...	...
σ <sub>L</sub> (approx.)	1.9	2.0	(2.4)	(2.4)	(2.4)	(2.4)	...	...	...
Mean, Kčs (est.)	1,590	2,075	2,020	1,670	2,240	1,970	...	...	...
Median, Kčs, (est)	1,515	1,995	1,885	1,640	2,040	1,820	1,060	655	605
P <sub>1</sub>	207	(201)	...	...	...	...	...	...	176
P <sub>2</sub>	191	184	...	...	...	...	...	305	170
P <sub>5</sub>	167	161	159	148	(157)	163	195	244	158
P <sub>10</sub>	148	144	142	133	144	145	171	210	143
P <sub>25</sub>	122	120	119	117	121	120	135	153	119
P <sub>75</sub>	80	82	83	85	85	84	69	...	83
P <sub>90</sub>	63	66	67	71	72	70	...	...	59
P <sub>95</sub>	55	56	60	62	63	63	...	...	42
Number of workers covered (in 1,000)	348	387	28	...	...	...	...	...	12
Column no.	1	2	3	4	5	6	7	8	9

x) For notes, see p. 1 of Table 4 and Table 3.

Sources: Columns 1; [27, p. 117] Column 2; [26, p. 133] Columns 3-6; [5, pp.68-70] Column 9; Derived from histogram in [17, p. 301.] Derived from [27, p. 463].

Table 5

Decile shares in full-time gross earnings and total gross earnings of wage and salary earners, and in total personal income before tax.

Deciles of recipients (from low to high)	Full time gross earnings 1959 (approx.)	All gross earnings			Personal income before tax	
		1959	1964	1966	1946 <sup>1)</sup>	1965
1st	5.2	4.9	5.4	5.1	1.7	2.9
2nd	6.6	6.4	6.7	6.8	2.1	3.4
3rd	7.4	7.6	7.3	7.5	5.2	6.3
4th	8.2	8.1	8.4	8.1	5.8	7.7
5th	9.1	8.1	9.1	9.3	8.7	9.1
6th	10.2	10.0	9.8	10.0	9.3	10.6
7th	10.7	10.8	11.0	10.8	11.2	12.0
8th	11.8	12.1	11.9	11.9	12.9	13.6
9th	13.3	13.5	13.7	13.7	16.9	14.2
Top 10 %	17.5	17.3	16.7	16.8	26.2	20.2
Arithmetic mean in Kčs	1,414	1,309	1,430	1,503	n. a.	n. a.

1) Based on a special levy on property and income. Comparability of these tax-based data with the rest of the table is thus limited.

Sources:

Full-time earnings: approximated by intrapolation from data in [27, p. 117].

Total gross earnings: computed by Vecernik [17, p. 298].

Personal income before tax: computed by Vecernik [17, p. 297].

Table 6

Differentials in average gross monthly earnings between economic sectors; variation of full-time gross earnings within some sectors.

	1953	1959	1966	1968	1969	May 1959	May 1966
Average gross monthly earnings of all wage and salary earners in the socialist sector, excl. collective farms and apprentices, in Kčs	1,097	1,324	1,534	1,750	1,880	.368	.343
	Index, average earnings in socialist sector = 100					Coefficient of variation <sup>1)</sup>	
<b>Productive sectors: (Marxian definition):</b>							
Industry	108.2	105.1	105.1	102.2	100.9	.359	.342
Construction	114.6	113.1	114.9	113.7	112.6	.339	.334
Agriculture (State)	70.3	82.7	91.1	94.1	95.1	.378	.334
Forestry	82.3	90.6	95.0	95.5	95.6	...	...
Transport	104.9	107.8	108.3	116.5	120.0	...	...
Communications	89.8	89.4	86.5	86.6	90.5	...	...
Material supplies	96.2	95.8	97.2	96.4	93.5	... <sup>2)</sup>	... <sup>2)</sup>
Trade	77.5	81.6	83.2	97.8	87.4	.307 <sup>2)</sup>	.296 <sup>2)</sup>
Procurement	90.2	94.4	91.1	91.4	91.1	...	...
<b>Non-productive sectors (Marxian definition):</b>							
Transport (non-prod.)	108.0	105.0	105.4	111.3	114.2	...	...
Communications (n. p.)	89.8	89.4	86.5	88.6	90.5	...	...
Science and research	120.3	115.8	117.1	113.8	113.0	...	...
Communal services	82.2	78.0	75.1	76.2	76.4	...	...
Housing	65.8	59.4	62.1	63.4	64.1	...	...
Health	90.4	88.7	83.1	86.3	92.0	.448	.411
Education	92.8	95.2	91.6	95.1	96.2	.389	.375
Public administration	99.8	100.2	103.5	106.2	109.3	...	...
Banking and insurance	100.0	98.6	94.0	101.1	110.2	...	...
						1) full-time earnings	
						2) retail trade only	

Sources: The first five columns, [4, pp. 126-7]  
The last two columns, [8, p. 25].

Table 7

Differentials in average gross monthly earnings between industrial branches. Variation of full-time earnings within some branches.

All industry, average monthly earnings of all wage and salary earners, Kčs	1955	1968	1969	May, 1966 Coefficient of variation x)
	1,272	1,712	1,818	
Index, average earnings in industry	100			
Fuel extraction	145.0	146.8	147.0	.352
Fuel processing	114.3	113.5	112.4	
Electric power, thermal energy	113.7	114.0	112.8	.269
Ferrous metallurgy	125.1	119.6	118.1	.356
Non-ferrous metallurgy	115.7	109.1	107.6	.245
Chemicals	101.6	99.8	99.8	.305
Rubber	98.6	95.6	95.5	
Engineering and metal-working	103.2	101.3	100.7	.307
Building materials	105.4	105.6	106.8	.281
Wood-working	92.7	91.2	93.0	.258
Wood-pulp and paper	91.0	91.3	91.9	.299
Glass, ceramics, china	89.0	87.5	88.4	.336
Textiles	75.4	78.0	78.7	.283
Clothing	70.2	73.8	75.9	.294
Lether, shoes, furs	86.1	86.6	89.2	.298
Printing	90.9	93.6	93.5	.362
Food processing, drinks	89.8	95.4	96.2	.308

x) full-time earnings only

Sources: the first three columns, [24, p. 237]  
the last column, [8, p.26].



Table 8

Dispersion of annual per capita money revenue of households  
(see Part V. for definition of "revenue")

R	All families		Households of wage earners 1965	Households of salary earners 1965	Households of collective farmers 1965	Households of old-age benefit recipients 1965	Households of wage and salary earners 1 child 5 or more children 1967		
	1956	1965	1965	1965	1965	1965	1967		
	.277	.40	.239	.194	.232	.249	.148	.153	
Median in Kcs (estimate)	5,530	8,410	9,020	10,245	8,090	6,245	902 <sup>x)</sup>	405 <sup>x)</sup>	
P <sub>1</sub>	282	243	228	222	240	256	...	...	
P <sub>2</sub>	257	219	211	200	222	232	...	...	
P <sub>5</sub>	219	190	188	175	191	202	...	155	
P <sub>10</sub>	185	167	167	156	170	173	122	141	
P <sub>25</sub>	142	133	133	114	132	137	114	121	
P <sub>75</sub>	70	72	72	80	75	73	79	85	
P <sub>90</sub>	48	53	53	63	60	52	64	72	
P <sub>95</sub>	30	42	42	55	46	39	60	...	
Column No.	1	2	3	4	5	6	7	8	9

Sources: Columns 1,3: based on histogram in [6, p.195]. Data should be viewed as approximations only.  
Columns 2,4,5,6,7: [27, pp. 461-463].  
Columns 8,9: Batúra, A., "Factory diferenciace v příjmech rodin s různým počtem dětí", Sociální politika, 1970, p.7.

<sup>x)</sup> per month

Table 9

## Some approximative international comparisons

## A. Dispersion of wage and salary gross earnings

	Czechoslovakia		Hungary		East Germany	Poland		Yugo- slavia	West Germany	France	Sweden	United Kingdom	United States
	1959	1959 <sup>M</sup>	1959	1962	1959	1962	1964	1964	1964	1962	1963	1963	1959
P <sub>5</sub>	177 <sup>1</sup>	181 <sup>1</sup>	189	190 <sup>2</sup>	186	...	200 <sup>5</sup>	229	222 <sup>7</sup>	282 <sup>8</sup>	233 <sup>9</sup>	210 <sup>10</sup>	240 <sup>11</sup>
P <sub>10</sub>	153	152	161	162 <sup>2</sup>	158	176	172	190	180 <sup>7</sup>	205 <sup>8</sup>	189 <sup>9</sup>	176 <sup>10</sup>	197 <sup>11</sup>
P <sub>90</sub>	63	63	62	...	...	56	...	57	...	...	...	...	...
P <sub>95</sub>	...	55	...	51 <sup>2</sup>	...	...	45 <sup>5</sup>	52 <sup>6</sup>	(10) <sup>7</sup>	39 <sup>8</sup>	16 <sup>9</sup>	(31) <sup>10</sup>	14 <sup>11</sup>
Q <sub>3</sub>   Q <sub>1</sub>	1.62	1.61	1.67	...	1.60	1.82	...	...	1.76	1.97	2.62	2.04	...
R	...	.20	...	.26	...	.29	...	...	.26	.35	.36	.27	.31 <sup>12</sup>
Skewness	1.16	1.12	1.37 <sup>3</sup>	...	...	...	1.29	...	1.11	1.34	1.07	1.18 <sup>4</sup>	...

The above distributions cover both sexes, nearly all economic sectors (but agricultural employment is partly or totally excluded from some of the distributions), and all incomes from wages and salaries (in some distributions, income of apprentices is excluded). International comparability is severely limited, as indicated in the sources listed below. In addition, intensity of work and periods covered vary between countries. E.g., in Czechoslovakia, Poland and possibly some other countries, only full-time wage and salary earners in one month (May, September) are covered, although this has not been stated explicitly in the ECE study, Tables 8.20 and 9.19.

Sources: Estimates for Czechoslovakia 1959<sup>M</sup>, 1964<sup>M</sup> and 1968<sup>M</sup> by me. All other data, unless stated otherwise by footnotes, from ECE Study Incomes in Post-War Europe; for the socialist countries, except Yugoslavia, Tables 8.20, 9.19; for Yugoslavia, Table 12.15; for other countries, Tables 6.11, 6.13.

<sup>1</sup> Difference between the ECE estimate and my estimate may be due mainly to a different method of extrapolation. ECE relied on straight-line extrapolation of the logs of the cumulative shares. This implies an assumption that the distribution is log-normal. In Czechoslovakia, the upper tail of the distribution of gross earnings is not log-normal (cf. Fig. 3). My method of extrapolation is based on laying a smooth curve through the available points on the graduation curve (ogive). For the above distribution the available data provide points at the 89.2nd, 97.0th and 99.2nd cumulative percentiles (from low to high), so that I am confident that my estimate of earnings at the 95th percentile ( $p_5 = K\check{c}s\ 2,440$ ) is fairly accurate. My estimate of the median ( $p_{50} = K\check{c}s\ 1,340$ ) is somewhat more

Table 9 (continued)

doubtful, as the available data provide me only with the following cumulative percentiles near the middle of the distribution: 38.6th, 55.3rd, 70.3rd. Nevertheless, I believe that my estimate  $P_5 = K\check{c}s\ 2,440$  |  $K\check{c}s\ 1,340 = 181$  comes closer to reality than the ECE estimate.

- 2 [16, Table HU-1]
- 3 1958
- 4 1964
- 5 [16, Table PO-4]
- 6 [16, Table YU-2]; According to this source,  $P_5 = 237$ ,  $P_{10} = 191$ ,  $P_{95} = 13$ .
- 7 1961; [16, Table GE-1]
- 8 1963; [16, Table FR-6]
- 9 1964; taxpayers only [16, Table SW-13]
- 10 1958-59; 16, Table UK-5
- 11 [16, Table US-22]. If coverage is limited to the Nord-East of the U.S., the dispersion is narrower:  $P_5 = 237$ ,  $P_{10} = 191$ ,  $P_{95} = 13$ .
- 12 Covers only family heads who worked full year. Morgan, "The Anatomy of Income Distribution", Rev. Econ. Stats. 1962, p. 272.

Definition of indicators used:

$P_i$  are percentiles (from high to low) related to the median (cf. Part II.2)

$Q_3/Q_1$  is the inter-quarterly ratio (cf. Part II, 7).

R is Gini's coefficient of concentration (Lorenz measure).

Skewness in the above table is measured by  $(Q_3 - M) / (M - Q_1)$  - in my notation  $(p_{75} - p_{50}) / (p_{50} - p_{25})$ . Thus, it is different from the coefficient of skewness used in Part IV.c and Part V. of this paper:  $(p_{95} - p_{50}) / (p_{50} - p_5)$ , with cumulative percentiles  $p_i$  counted from low to high.

Table 9 (continued)

B. Dispersion of wage earners (manual workers) in industry  
(minings, electricity, gas, thermal energy, and manufacturing)

	Czechoslovakia May 1964		U.S.S.R.	
	1956	1959	1956	1959
P <sub>5</sub>	171	...	...	...
P <sub>90</sub>	65	...	...	...
Q <sub>3</sub> /Q <sub>1</sub>	1.59	1.85	1.84	
R	.18	...	...	...
Skewness	1.05	1.28	1.33	

Sources: Czechoslovakia, my estimates (cf. Table 4).  
USSR, ECE study, op. cit., Table 8.20

C. Dispersion of personal income before tax (all sources of income)

Decile shares in % of total personal income:	Czecho- slovakia 1965	West Germany 1964	France 1962	Sweden 1963	UK 1964	USA 1965
highest decile	20.2	41.3	36.8	27.9	29.3	45 <sup>1)</sup>
second highest	14.2	11.5	16.9	16.1	14.9	
second lowest	3.4	3.2	1.4	2.8	3.1	5 <sup>1)</sup>
lowest decile	2.9	2.1	0.5	1.6	2.0	
R	...	.47	.52	.40	.40	51 <sup>2)</sup>

Sources: Czechoslovakia, Table 5.

Other countries, unless stated otherwise in footnotes: ECE,  
table 6.10

- 1) Family personal income in 1962; Haley, in Marchal-Ducros, op. cit., p. 5.  
2) [23, p. 81].

D. Dispersion of gross incomes (probably including most transfers) of  
households of wage and salary earners (excl. agricultural households)

	Czechoslovakia (per capita)		Hungary Per Total cap. income		East Germany Total income		Poland Per capita	Yugoslavia Total income
	1958	1965 <sup>M</sup>	1962	1962	1959	1964	1962	July 1964
P <sub>5</sub>	196	181	208	191	188	179	238	...
P <sub>10</sub>	165	163	176	165	159	155	191	...
P <sub>90</sub>	60	59	53	50	54	55	53	...
Q <sub>3</sub> /Q <sub>1</sub>	1.75	1.71	1.85	1.85	1.75	1.70	1.91	...
R	...	.212	...	...	...	...	...	.298

Sources: ECE, op. cit., Table 9.19, except for Czechoslovakia 1965  
and Yugoslavia.

Czechoslovakia, 1965: Table 8.

Yugoslavia: ECE, op. cit., Table 12.14 (limited comparability).

Fig. 1

Histogram of gross earnings of full-time wage and salary earners, May 1968

Per cent of workers

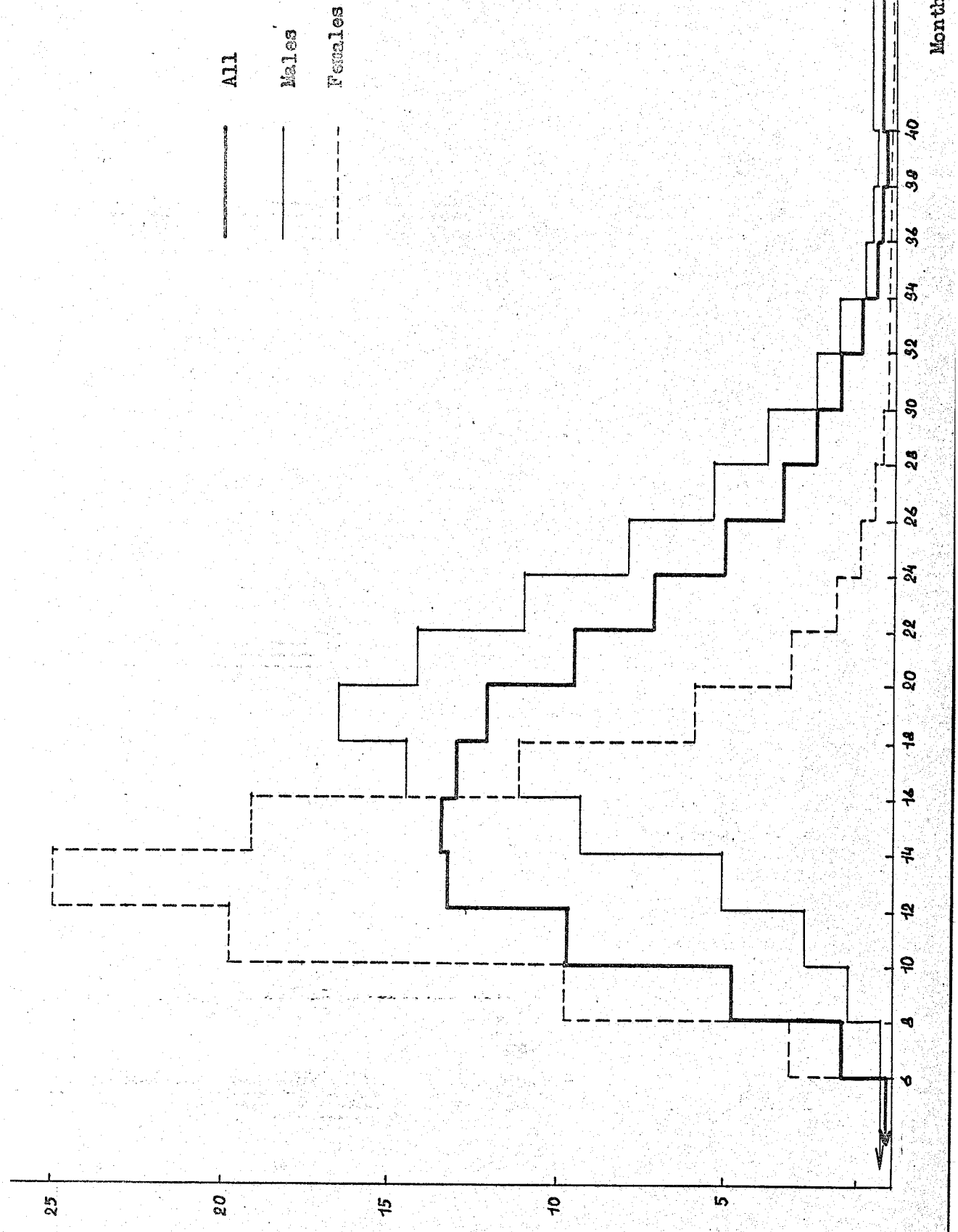


Fig. 2

Polygon of net annual per capita money incomes of families

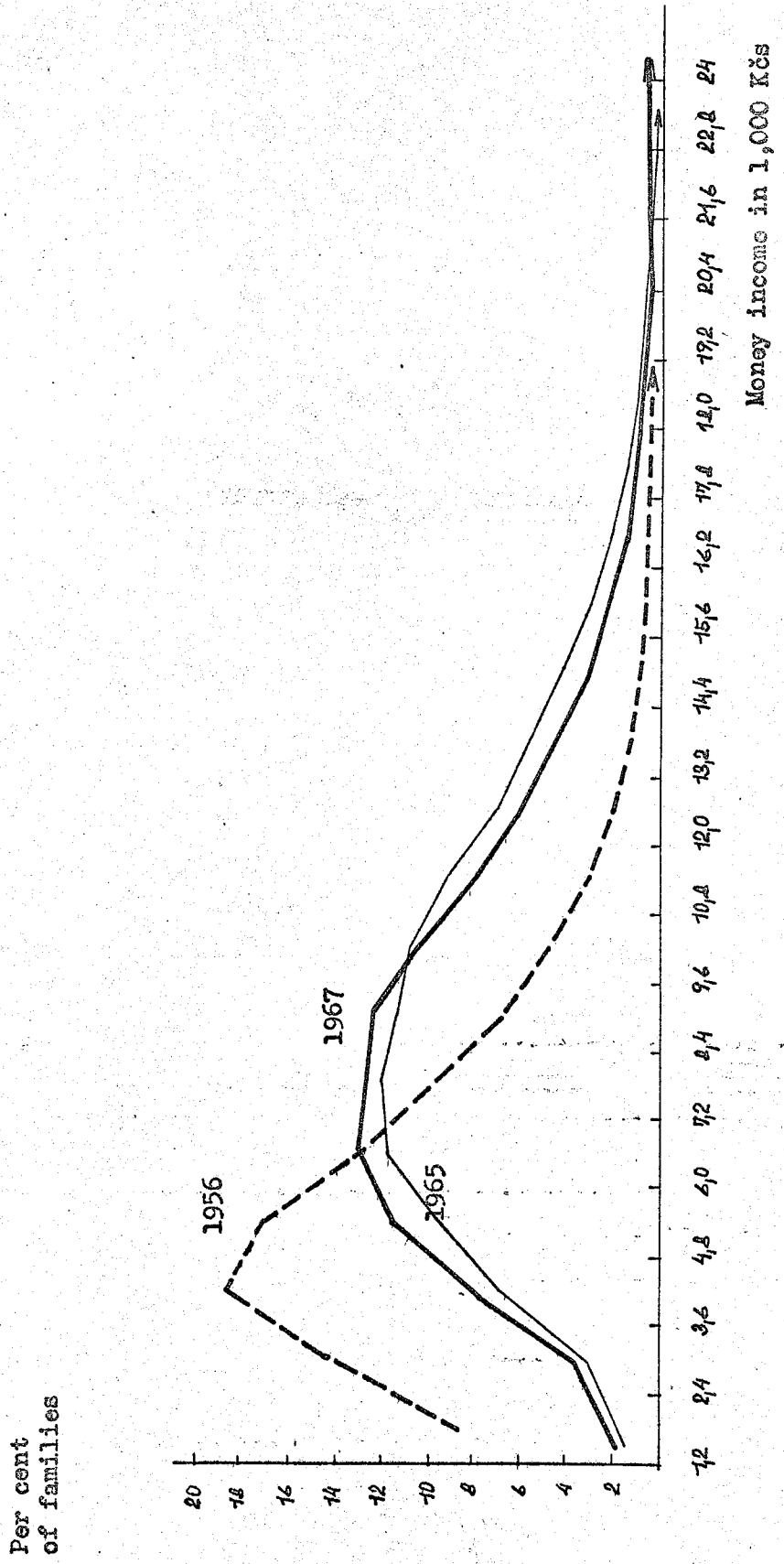


Fig. 3

Test of log-normality of distribution

Gross earnings of full-time wage and salary earners, May 1968

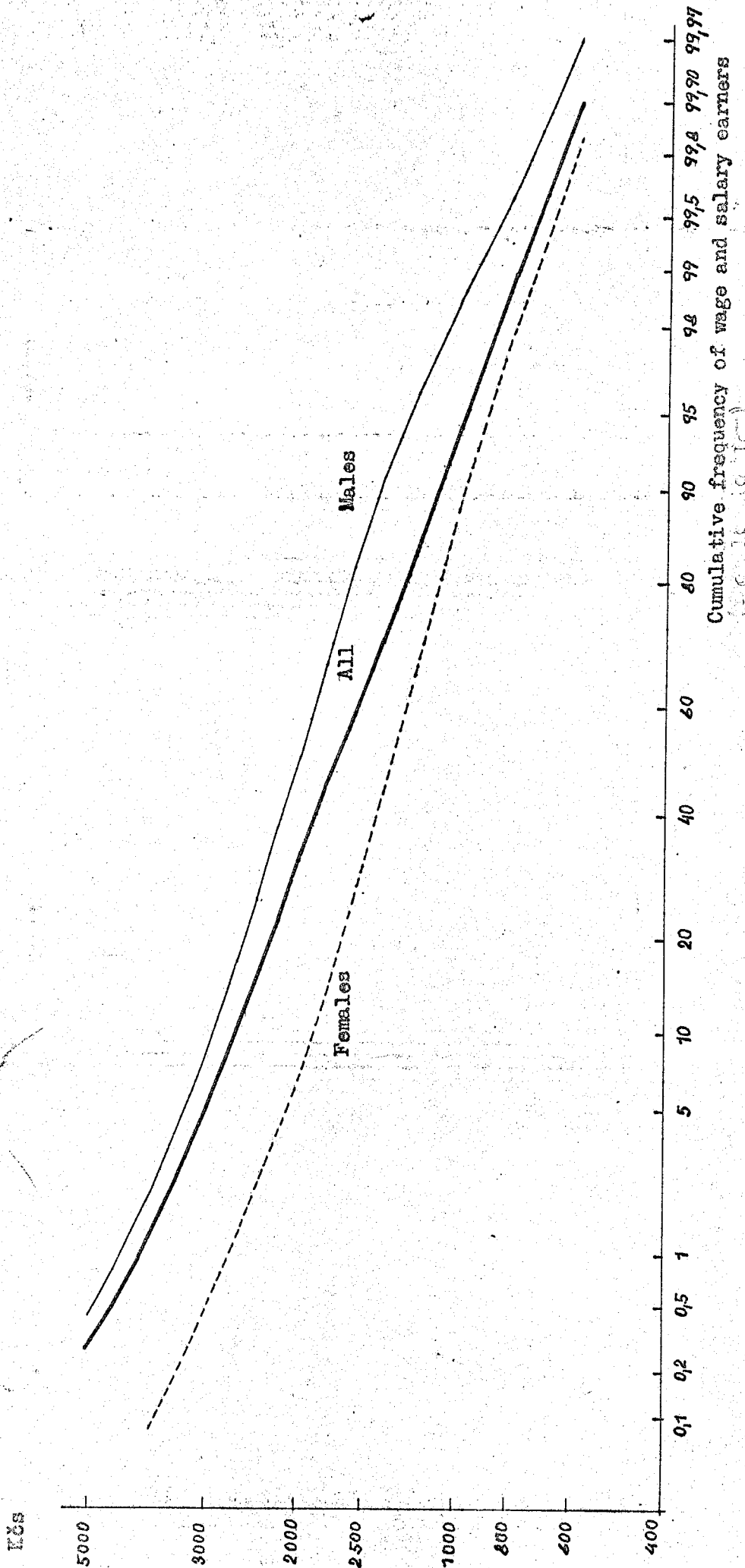


Fig. 4

Test of log-normality of distribution  
Per capita net annual money incomes of families

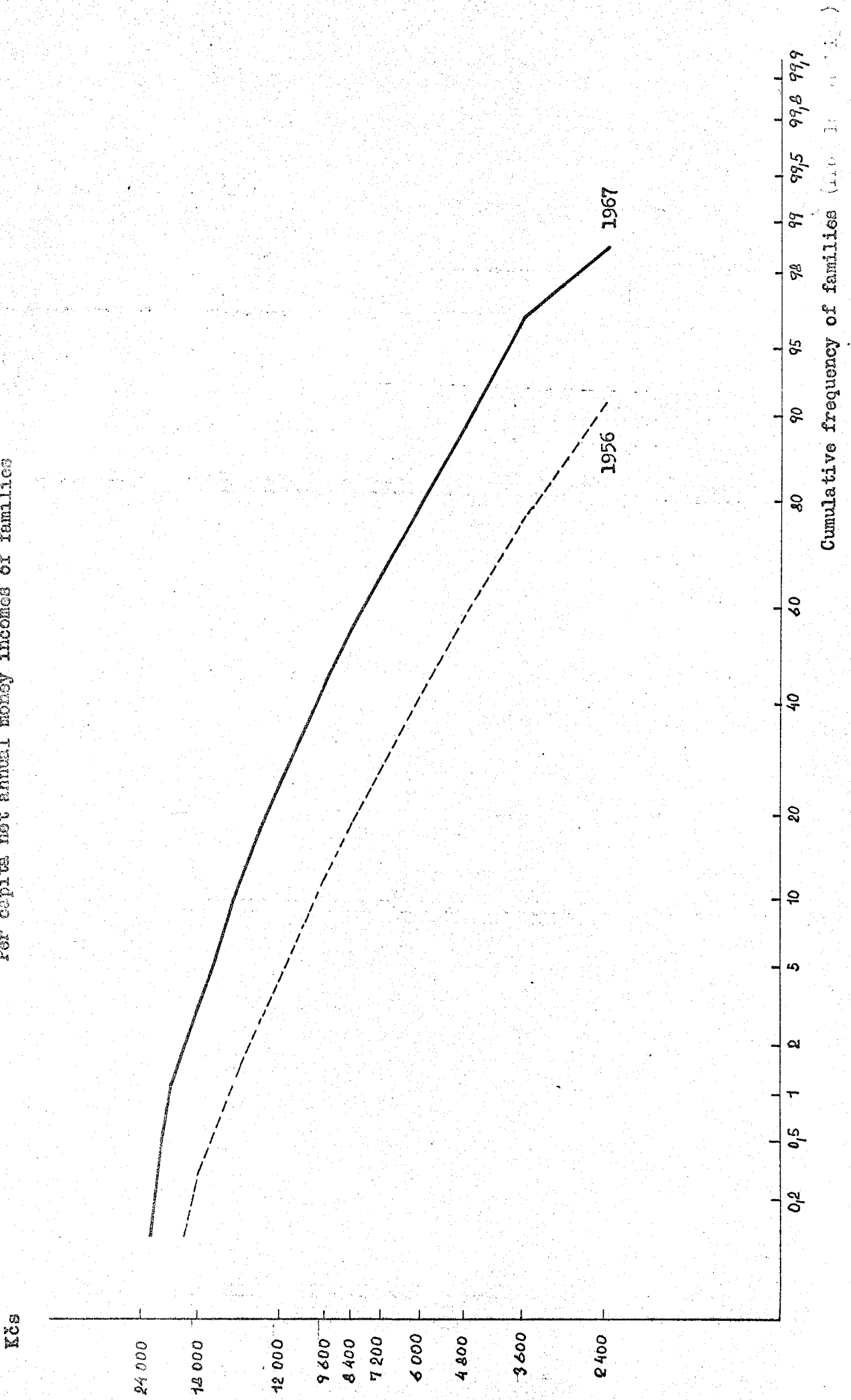




Fig. 5  
 Test of fit of the Pareto coefficient  
 Gross earnings of full-time workers

All wage and  
 salary earners,  
 May 1968

All males,  
 May 1968

All females,  
 May 1968

Engineers and technical  
 staff in mining and  
 manufacturing, April 1967

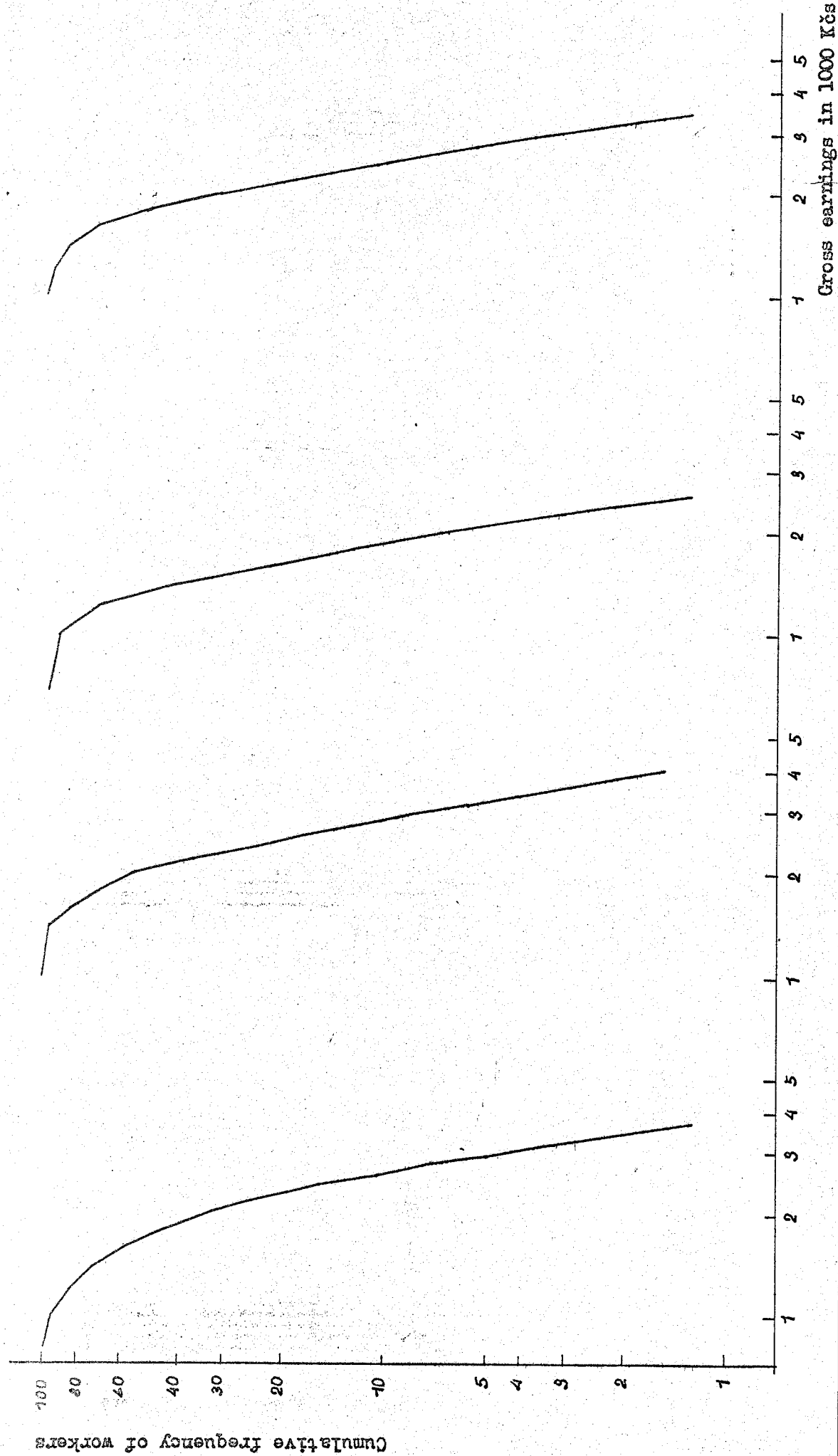


Fig. 6

Age profile of gross earnings of full-time wage earners in construction, April 1967

