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A NEW MEASURE OF DISPARITIES IN DEVELOPMENT

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Abstract

A new statistical measure of the time dimension of disparities is introduced to complement the existing static statistical measures of disparity. S-distance measures the time span (number of years) which separates the points in time when the two units compared achieve a specified level of the indicator. As time-distance is expressed in number of years it is easily comparable across indicators as well as across countries. A formal relationship has been established between static measure of disparity, growth rate and time-distance to show that time-distance is a decreasing function of the growth rate and to introduce a new role of the growth rate in the analysis of disparities and new aspects in the relationship between growth and distributional considerations.

This methodology can be applied to the analysis of economic and social indicators at various levels (like comparisons between macro regions, countries, regions within countries, urban and rural, economic, social or ethnic groups, at the local or family level) and in many fields (like in studies of disparities in individual specialized fields, overall analysis of disparities comparing disparities in numerous attributes, and in studies of economic and social development). Two empirical examples illustrate the application of the conceptual and analytical framework: male-female earning differentials for two units - one indicator case, and regional disparities for two units - many indicators case.

1. Introduction

Economic and social development is by its nature a multidimensional and long-term phenomenon. When people assess the quality of life, on the one hand, and their relative position in the society, on the other, they do so over many dimensions and over time. The need to study a number of economic and social indicators in a long-term perspective creates new methodological problems. While it is difficult to operationalize such a request in a rigorous way, there are some obvious steps which can be undertaken in this desired direction in order to improve our understanding of the reality and thus our ability for a more informed discussion of policy options.

Analytical interest, statistical measures and policy orientation have been mainly concentrated on the static dimension of disparities neglecting the dynamic dimension of the problem. An extended conceptual and analytical framework is suggested here to bring new insights in the evaluation of the degree of disparities in development, both within and between countries. This approach introduces new elements with important implications both at the conceptual and analytical level.

At the conceptual level the overall degree of disparity is viewed upon as a weighted combination of the static and of the dynamic dimensions of disparity. The perception of disparities is not limited to those prevailing at a given point in time as the growth experience, prospects and expectations are taken into account as an important element of evaluation of the intertemporal position of the analyzed units. The methodology

suggested here introduces time distance (time span) as a new statistical measure of the time dimension of disparities to complement the existing static measures of disparities. S-distance measures the time span (number of years) which separates the points in time when the two compared units achieve a specified level of the indicator. As time-distance is expressed in number of years it is easily comparable across indicators as well as across countries. A formal relationship has been established between static measure of disparity, growth rate and time-distance to show that time-distance is a decreasing function of the growth rate and to introduce a new role of the growth rate in the analysis of disparities and new aspects in the relationship between growth and distributional considerations.

While the methodology can be extended to n-units, the empirical examples presented here will deal with two examples of intra-country disparities between two groups: male-female wage differentials as an example of two unit-one indicator case, and disparities between more developed and less developed regions as an example of two units-many indicators case. The latter case will show that the analysis of the time dimension of disparity in a multidimensional framework can produce substantially different results from static comparison as indicators which show a high degree of static disparity between the two compared units may at the same time show a rather small time distance, and vice versa.

Empirical analysis is followed by a discussion of normative and policy implications, and an indication of possible fields of applications. The extended conceptual and analytical framework raises, rather than answers, a number of important questions

about the perception of disparities, statistical measurement and value judgements, and alternative ways of combining growth and distributional considerations in theory and practice.

1. Definition of time distance and formal relationships with static measures of disparity.[1]

In general, time distance measures, for a given level of the indicator, the time span that separates the two compared units. The suggested statistical measure is defined as follows: S-distance in terms of an indicator x (e.g. income, life expectancy, nutritional level) is defined as the distance in time (the number of years) between the points in time when the two units compared (in our case men and women, in general individuals, income, social or ethnic groups, regions or countries) achieve a specified level of the indicator. The observed distance in time (the number of years) is used as a dynamic measure of disparity between the two units in the same way that the observed difference (absolute or relative) at a given point in time is used as a static measure of disparity.

The degree of disparity between two compared units can be expressed simultaneously in (at least) two ways: by a static measure (e.g. that in 1976 the value of the indicator for unit 1- male wage in Table 3 - was 37 percent higher than that for unit 2 - female wage - and the time distance (e.g. that the lag between unit 1 and unit 2 in the past amounted to 7 years which means that the level of the female average real wage for 1976 was attained by men already in 1969). Any single measure - either a static measure or time distance - cannot in itself describe the

complex notion of the overall degree of disparity which is a certain combination of static and dynamic measures of disparity. Static measures of disparity as well as time distance play a useful descriptive role in all cases adding information on a particular aspect of disparity.

If the growth of the indicator x over time (t) is expressed as $X_1 = f_1(t)$ for the first and $X_2 = f_2(t)$ for the second unit in a simple case of two units, the quantitative estimate of the static and dynamic disparity between the two units is obtained in the following way:

1. When the two functions are compared <u>vertically</u> at a given point of time (t), the static dimension of the disparity is observed. The quantitative measures of the static relative positions in this simple case are the absolute static difference

$$A(t) = X_1(t) - X_2(t) \qquad (1)$$

and the relative static difference

$$R(t) = X_1(t)/X_2(t) \qquad (2)$$

2. When the two functions are compared <u>horizontally</u> (i.e. for a given level of the indicator x), the difference represents the time-distance between the two units for that level of x. For a given level of X_L,

$$X_L = X_1(t_1) = X_2(t_2) \qquad (3)$$

and the time distance (i.e. the time span that separates the two units at this level of the indicator) will be written as

$$S(X_L) = \Delta t(X_L) = t_2(X_L) - t_1(X_L) \qquad (4)$$

In a more general notation for the case of many units, the respective static measures of disparities between any two units (ij) can be written as

$$A_{ij}(t) = X_i(t) - X_j(t) \quad R_{ij}(t) = X_i(t)/X_j(t) \qquad (5)$$

and the time span separating unit (i) and unit (j) for the level X_L

$$S_{ij}(X_L) = t_j(X_L) - t_i(X_L) \qquad (6)$$

The three subscripts are needed to indicate: (a) between which two units is the time distance measured and (b) for which level of the indicator (in the same way as the time subscript is used to identify the static measures).

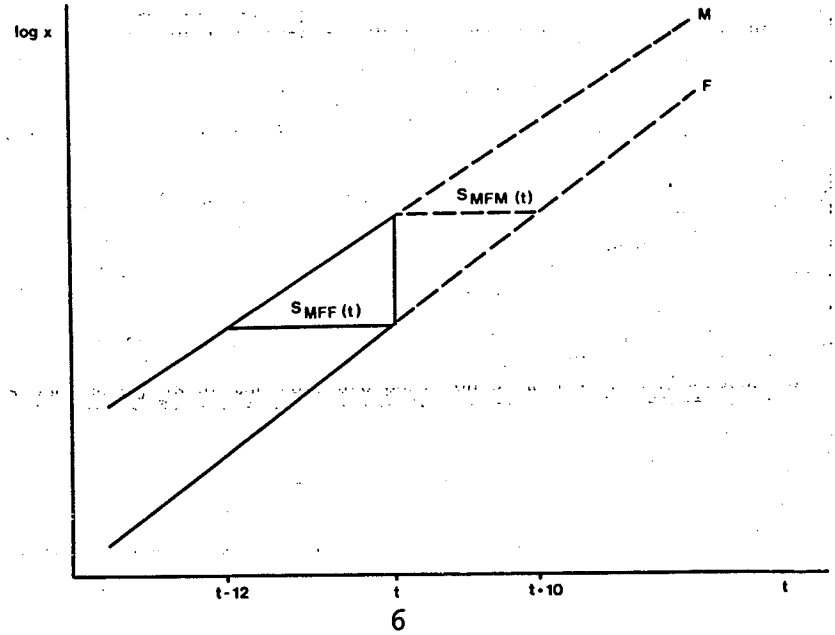
Time-distance as a measure of the time dimension of disparity looks at the disparity from a particular (time) perspective. In performing this role there is no need to relate it to any static measure of disparity or growth rate in a formal way, it can stand on its own as a measure of a particular aspect of disparity.

However, there are certain advantages in combining static and dynamic measures of disparities in a comprehensive and consistent analytical framework. Such an extended framework for analysis of disparities has implications at the conceptual, analytical and policy level, which seem to be more important than the disadvantages arising from various compromises involved in relating the time-distance (which is conceptually defined for a given level of the indicator) to the particular point in time for which the static measures are measured. There are alternative ways of doing this, and this leads in turn to the distinction between ex-post and ex-ante time-distances.

Figure 1 illustrates a possible relationship between relative static difference, growth rate of the indicator and ex-post and ex-ante time distance for male and female wages.[2] If data on real wage for men and women are available up to time (t), ex-post time distances can be measured for levels which both units have already achieved, while time distances for higher levels will depend also on future developments (see dotted lines in Figure 1) and their value can still be influenced by policy action. Thus ex-post and ex-ante definition of S-distance relate to different periods, past and future, and have different analytical and policy implications.

If M stands for males and F for females and if time distances are measured for the current levels of male and female real earnings at time (t), then the above mentioned ex-post time distance for the level of female earnings can be also written as $S_{MFF(t)}$, and the ex-ante time distance for the present level of male earnings as $S_{MFM(t)}$.

Figure 1. Relationship between relative static difference, growth rate of the indicator and ex post and ex ante time distance



The time distance $S_{MFF(t)}$ at the level of the lower unit (female wage) at time (t) is an example of ex-post time distance and indicates how many years ago the male wage reached this level. In the example in Figure 1 this amounts to 12 years which means for this case

$$M(t-12) = F(t)$$

or, in general for the comparison between two units

$$X_1(t-S_{122(t)}) = X_2(t) \qquad (7)$$

or, alternatively, for any given level of X_L

$$X_1(t-S_{12L}) = X_2(t) \qquad (7a)$$

In the second case the time distance $S_{MFM(t)}$ at the level of the present male wage is an example of ex-ante time distance and indicates the numbers of years needed at a given growth rate of female wages to reach the present level of male wage. In the example in Figure 1 it amounts to 10 years

$$M(t) = F(t + 10)$$

and in general for the comparison between two units

$$X_1(t) = X_2(t + S_{121(t)}) \qquad (8)$$

or, alternatively, for any given level of X_L

$$X_1(t) = X_2(t + S_{12L}) \qquad (8a)$$

While the values of the ex-post time-distance for various indicators are indicative of the present time dimension of disparities, it is the ex-ante concept of time-distance which is relevant for the future degree of disparity as its value can still be influenced by policy decisions. The ex-ante time-distance, as a projected value for a future period, will thus depend on given conditions, and the assumed policies and measures

for its implementation.

Similar relationships can be established for other levels in the past and in the future. A particularly interesting level is that of the average (mean) value of the indicator at time (t) -- $X_m(t)$ -- which is important both from the statistical point of view (as many statistical static measures of dispersion are related to this measure of location) and from the point of facilitating comparative analysis (that in cross-country comparisons of various measures of intracountry disparities they can be related also to the level of the indicator). In the case of male (M) and female (F) wage comparison the mean value at time (t) can be written as (T), i.e. average wage for total (male and female). This level is not illustrated in Figure 1 in order not to complicate the graph. However, it can be easily shown that for the average wage level T(t), i.e. average wage for total (not distinguishing men and women) the time distances can be written as

$$M(t-6) = T(t) = F(t+5)$$

and in general case for the mean value $X_m(t)$

$$X_1(t-S_{1mm(t)}) = X_m(t) = X_2(t+S_{2mm(t)}). \qquad (9)$$

The time distance between male and female wages $S_{MFT(t)}$, which is defined for the level of the mean wage at time (t) (total wage) as

$$S_{MFT(t)} = S_{MTT(t)} + S_{FTT(t)}$$

11 years = 6 years + 5 years, and in general

$$S_{12m(t)} = S_{1mm(t)} + S_{2mm(t)}, \qquad (10)$$

is thus the sum of the ex-post time distance between the unit above average and the mean, and of the ex-ante time distance

between the mean and the unit below the mean.

For linear functions or linear approximations it is possible to express the interrelationship between static differences and time distance in a rather simple way. The exact nature of the interrelationship will depend upon the particular functional form of $f_1(t)$ and $f_2(t)$ and the corresponding derivatives with respect to time. In this way the static differences, the time distances and the rates of growth of the analyzed indicator can be integrated in a formally consistent framework.

The general case is discussed in Sicherl (1978). Here only the most frequently used particular functional form of the time trend, i.e. exponential trend with continuous growth, will be used. The growth rates for the indicator X r_1 and r_2 (i.e. the corresponding derivatives with respect to time) are in this case constant over time to facilitate the derivations. The particular expressions for the time distances are:

$$S_{122(t)} = (\ln X_1(t) - \ln X_2(t))/r_1 = \ln R_{12}(t)/r_1 \qquad (11)$$

$$S_{121(t)} = (\ln X_1(t) - \ln X_2(t))/r^*_2 = \ln R_{12}(t)/r^*_2 \qquad (12)$$

$$S_{12m(t)} = \ln R_{1m}(t)/r_1 + \ln R_{m2}(t)/r^*_2 \qquad (13)$$

The asterisk (*) is used to emphasize at this point that this is the future growth rate of the below-the-average unit, which can be still influenced by policy measures, as these are the cases of <u>ex ante</u> time distances. In this simple case where the rates of growth r_1 and r_2 are constant through time, although different for each unit, the relationship between static difference, rate of growth and time distance is rather simple. If the natural logarithm of the relative static difference is

divided by the appropriate growth rate, an estimate of the time distance can be obtained.

Similarly, in all cases which satisfy or approximate the above assumptions this interrelationship can be used to combine the assumptions about some of these magnitudes and look at the reprecussions in other measures. This makes a contribution to the semantics of describing the interrelationships between growth characteristics and various aspects of disparities in various fields of development, and helps to make the underlying relations explicit. The emphasis is on changes, that difference in the speed of change over time makes in the static analytical framework, and on additional insights that can be gained by looking also at the time dimensions of these issues.

Before turning to the discussion of the growth rate effects in the next section, the analysis of the time dimension of disparity (lead or lag for a given level of the indicator) should be complemented by a measure of a different time span involved in the analysis of disparities. This is the time needed for full equalization in the levels of the indicator for the two compared units (in our example that male and female wages would be equal). At that time the time distance defined for a given level of the indicator as well as static measures of disparity would all equal to zero.

$$S_{122(t)} = S_{121(t)} = A(t) = R(t) = 0 \qquad (14)$$

However, there are two important pieces of information which we would like to have about the prospects of full equalization in a dynamic framework. The first one is the time needed to achieve the equalization under certain assumptions, and the second, at

what level of the indicator would the equalization be achieved. This special case of time distance analysis will thus measure the number of years needed to achieve full equalization from the existing initial (relative) disparity R(o) from a chosen starting point in time (t=0). By analogy with the time dimension of disparity for a given level of the indicator we shall combine the estimate of the span in time needed to reach full equalization with the estimate of the level at which this will be achieved, but now in a reverse order. The distance in time that under certain assumptions about future growth rates separates the present starting point from that point in time when the equalization is projected to occur (the time span needed for equalization at the same point in time, not just reaching the present level of the higher unit!) can be written as

$$SE_{12} = \ln R(o)/(r^*_2 - r^*_1), \qquad (15)$$

when SE_{12} means span in time needed for equalization between units 1 and 2, R(o) is the relative static disparity in the starting point in time, and r^*_1 and r^*_2 are projected future growth rates for the two compared units. The time distance in the case of full equalization depends, ceteris paribus, on the difference between the rates of growth for the two units. It can be achieved only if the difference in growth rates $(r_2 - r_1)$ is positive, i.e. in favour of the lower unit.

However, the level at which this equalization might be achieved, depends not only on the difference between the two growth rates $(r_2 - r_1)$ but also on their magnitude:

$$L(SE_{12}) = X_1(o).e^{r_1 \cdot SE_{12}} = X_2(o).e^{r_2 \cdot SE_{12}} \qquad (16)$$

As in the earlier case, the analysis of levels, static disparity, growth rates, and time distance complement each other to bring into the discussion various aspects of a rather complex problem.

3. Growth rate effects

The interrelationships between the static and dynamic measures for the case of exponential trends provide interesting insights into the role of growth rates in the comparative analysis of disparities. Equations (11)-(13) show that for a given relative static disparity, $R_{12}(t)$, the time distance is inversely proportional to the rate of growth of the indicator. A low growth rate thus means, ceteris paribus, a substantial lag in time between the compared units.

The important conclusion is that the S-distance is a decreasing function of the growth rate. Thus, the S-distance as a dynamic measure of disparity offers a quite distinct perspective from that of static measures. This will be illustrated in two fields of analysis of considerable relevance to policy.

First, for the case of one indicator an increase in the growth rate of the indicator for both units which does not change the static disparity reduces the dynamic disparity since it reduces the S-distance. Although a reduction of the time distance by higher growth rates cannot be an argument against the need to reduce the static degree of disparity, the additional effect of the growth rate on the time distance has to be taken in account.

Second, when comparing a set of indicators with respect to degree of disparity, depending on the magnitude of the respective growth rates, attributes which show a high degree of static disparity might show a rather small time distance, and vice versa. The assessment of the degree of disparity with respect to various indicators based on static measures thus might not coincide with the results based on the time distance as a dynamic measure of disparity. This issue will be discussed in more detail in section 5.

In the analysis of inequalities it is important to distinguish the role played by the difference in the growth rates between the two compared units $(r_1 - r_2)$ and that played by the absolute magnitude of the growth rates (r_1, r_2). The change over time is for static relative disparity $R_{12}(t)$ a function of the difference between the two growth rates $(r_1 - r_2)$, while the change in time distance depends both on the difference between the growth rates $(r_1 - r_2)$ and on the absolute magnitude of the growth rate in question (r_1 for the ex-post and r_2 for the ex-ante version).[3] If the change of relative static disparity over time from the starting point in time t(o) is written as

$$\ln R_{12}(t) = \ln R_{12}(o) + (r_1 - r_2)t \qquad (17)$$

then the corresponding derivatives with respect to time are

$$\frac{d \ln R_{12}(t)}{dt} = (r_1 - r_2) \qquad (18)$$

$$\frac{dS_{122}(t)}{dt} = (r_1 - r_2)/r_1 \qquad (19)$$

$$\frac{dS_{121}(t)}{dt} = (r_1 - r_2)/r_2 \qquad (20)$$

For the case of one indicator and two units the example of the disparity between male and female wages will be used. In this section the male-female comparisons will be used in general terms to discuss only the direction of change in various measures of disparity, while in the next section an empirical example will be used to illustrate the change in wage disparities over time. First the effect of differences between the growth rates for male and female wages will be discussed.

Table 1.

Change in various measures of gender disparity as a function of the <u>difference</u> between growth rate for men and for women

Measures of disparity	Relationship between the growth rates		
	$r_M > r_F$	$r_M = r_F$	$r_M < r_F$
Absolute difference A(t)	increasing	increasing	decreasing, or increasing first and decreasing later
Relative difference R(t)	increasing	constant	decreasing
Time distance $S_{MF(L)}$	increasing	constant	decreasing

Table 1 shows the relationship between the difference between the male and female growth rates and various measures of

gender disparity in general terms. It is interesting to observe that the direction of change will, under the above assumptions, be the same for the relative static difference and the S-distance. In this respect, a similarity exists between relative static measure and dynamic measure of disparity, but not between the two static measures. The observed similarity with respect to the direction of change in relative static difference and S-distance holds for the <u>difference</u> between the male and female growth rates for the indicator in question among these three possible relationships.

However, very different values of S-distance can correspond to the same value of the relative static difference, if the <u>magnitude</u> (absolute value of the growth rates) are different for different periods for the same indicator or among different indicators. Table 2 shows the changes in various measures of disparity as a function of the <u>magnitude</u> of the growth rate for men and for women for a simplified case, where the rate of growth of wages for women is the same as the rate of growth of wages for men. Now the emphasis in comparison is between the magnitude of the growth rates for wages which prevailed in the past and those which will prevail in the future. In other words, whether the growth rates for wages will be higher in the future period, equal or lower than the respective growth rates of wages in the past. The assumption $r_M=r_F$ is made to simplify the exposition. This situation is quite different from that in Table 1, where the influence of the <u>difference</u> between the male and female growth rate of wages on the change in direction of various measures of gender inequality was studied.

The case of $r_M=r_F$ is a good general illustration of the complexity of the issues in the measurement of disparities, not to mention its qualitative and normative aspects. Let us bring

Table 2.

Changes in measures of disparity as a function of magnitude of the growth rates for men and women for the case ($r_M=r_F$)

Measures of disparity	Change in growth rates in time		
	Growth rate higher than in the past $r(II) > r(I)$	Growth rate equals as in the past $r(II)=r(I)$	Growth rate lower as in the past $r(II) < r(I)$
Absolute difference A(t)	increasing	increasing	increasing or decreasing
Relative difference R(t)	no change	no change	no change
Time distance $S_{MF}(L)$	decreasing	no change	increasing

into the picture also the absolute difference at a given point in time and its change over time. Since there is no difference between the growth rates for the two units of comparison, the only change in the degree of disparity can come as a function of the magnitude of the overall growth rate of the indicator. And here we get three completely different results: (even as far as the direction of change is concerned):

1. relative static difference R(t) (and similar measures, like

the Lorenz curve, the Gini coefficient of concentration, etc.) is completely insensitive to it and shows no change;

2. S-distance as a measure of dynamic inequality is a decreasing function of the magnitude of the overall growth rate;

3. absolute static difference A(t) is an increasing function of the overall growth rate (Sicherl, 1977).

In the dynamic world of today it is hardly satisfactory to rely only on measures of inequality which are insensitive to the changes in the growth rate of the system. In this respect, time-distance plays an important role in the analysis of disparities which is quite distinct from that of static measures. While relative measures of inequality are the most frequently used in the literature, the above analysis has shown that they are incapable of distinguishing various situations regarding the change in the magnitude of the growth rates between different periods. From that point of view, it is of no consequence if a situation changes from a low growth to a high growth situation or vice versa. Hirschman (1973) has indicated how different the situation is with respect to the expectations and interrelationship between development and income distribution, in the case of either the first or second type of change. In other words, a situation of growth, stagnation or decline is in such case undetected by comparing relative static measures of inequality over time.

As mentioned before, time distance measures the dynamic relative position with respect to the absolute level of the indicator. In performing this role, there is no need to relate

time distance to any static measure of disparity of growth rate; it can stand on its own as a measure of the time dimension of disparity. Still, when combined to study the interrelationship between various measures of gender disparity under a given set of assumptions, the nature of the functional form of the trend of wages for men and women over time is also important. The trend of the indicator over time is most commonly described by an exponential or linear trend. The choice among them or other functional forms is partly an empirical question, and partly a question of characteristics of change inherited in the attribute described by the indicator. In accordance with the appropriate form of the trend, also the interrelationship between a static measures of inequality, growth characteristics and time distance will have to be specified appropriately.

For an exponential trend, the following relationships could be used (in brackets the first letter refers to the type of trend - linear or exponential - and the second to the ex-post or ex-ante definition of time distance):

$S(ep) = \ln R(t)/r_M$ $\qquad$ $S(ee) = \ln R(t)/r_F$

and for linear trend:

$S(lp) = A(t)/(DM/n)$ $\qquad$ $S(le) = A(t)/(DF/n)$

where n is the number of years in the analyzed period, which means that DM/n and DF/n represent the average absolute increase per year.[4] Similar tables which have been prepared above can be calculated also for linear trends, i.e. if the change in time is better (or alternatively) expressed as average absolute increase per year.

It is important to stress that the estimation of time

distances, when estimated directly for a given level from the existing statistical data, is independent of the functional form of the trends chosen or of any monotonic transformation of the indicators axis in a time-indicator graph. This seems to be a desirable property of S-distance as a descriptive statistical measure, as it does not depend on the above mentioned choice of functional form of the trends or transformations but can still provide a very useful link in the interrelationship between growth characteristics and various measures of disparity when needed.

4. An example of one indicator, two units case: male-female wage disparity

As an empirical example various measures of disparity in wage earnings per hour in manufacturing between men and women for Finland will be used. Table 3 presents the basic series of wage earnings for total (i.e. average wage without disaggregation by sex), men and women, from which various measures of gender disparity over time will be calculated. The table shows the absolute values of earnings in the respective currency units and constant 1970 prices. In addition, the two most frequently used static measures of disparity -- absolute difference A(t) and relative difference R(t) -- as well as the respective relative difference to the average wage, i.e. expressed as the ratio of male or female wage to the average wage: $R_{FT}(t) = F(t)/T(t)$ for females and $R_{MT}(t) = M(t)/T(t)$ for males, are also given.

Figure 2 shows the growth of the basic series over time, and it is obvious that three broad periods can be distinguished: a

period of continuous moderate growth, followed by a considerable acceleration of growth rate for wages, followed by a period of virutal stagnation for male wages and very slow increase in female wages. It is of interest to see how variations in the rate of growth of wages affected different measures of gender wage disparity.

Also in this example different measures of gender disparity show different directions of change over time. Relative difference is continuously falling, and from that point of view, it could be said that the disparity has been decreasing. For the period 1958-1976, however, the absolute difference between male and female wage has been increasing and has nearly doubled. In the last period 1976-1981 the absolute differences also started to fall. If we are comparing only static measures of gender disparity over time, for the period 1976-1981 the unanimous conclusion of the two static measures is that the male female differentials have been decreasing. The situation will show a less favourable picture when the growth characteristics and the dynamic dimension of disparity will be taken into account.

Even before that, the evaluation of the period 1958-1976 where the relative differences were decreasing while the absolute differences were increasing (see Figure 4), calls for a value judgement on which measure or which combination of two measures one should base the assessment of what has occurred in gender disparity. It was argued earlier that static and dynamic measures of disparity might in certain situations lead to different conclusions, not only about the degree of disparity but

Table 3

Earnings per hour in manufacturing (deflated by consumer price index) and absolute and relative static differences between men and women

	Earnings in currency units (1970 prices)			Absolute static differ.	Relative static differ.	Relative to average earnings	
Years	T(t)	M(t)	F(t)	A(t) M(t)-F(t)	R(t) M(t)/F(t)	RMT(t) M(t)/T(t)	RFT(t) F(t)/T(t)
1958	3.21	3.69	2.5	1.19	1.48	1.15	0.78
1959	3.33	3.82	2.57	1.25	1.49	1.15	0.77
1960	3.46	3.96	2.63	1.33	1.51	1.14	0.76
1961	3.65	4.18	2.76	1.42	1.51	1.15	0.76
1962	3.69	4.22	2.77	1.45	1.52	1.14	0.75
1963	3.76	4.28	2.85	1.43	1.5	1.14	0.76
1964	3.86	4.37	2.96	1.41	1.48	1.13	0.77
1965	4.01	4.53	3.08	1.45	1.47	1.13	0.77
1966	4.18	4.71	3.23	1.48	1.46	1.13	0.77
1967	4.28	4.83	3.33	1.5	1.45	1.13	0.78
1968	4.39	4.92	3.41	1.51	1.44	1.12	0.78
1969	4.68	5.24	3.66	1.58	1.43	1.12	0.78
1970	5.06	5.64	3.97	1.67	1.42	1.11	0.78
1971	5.49	6.11	4.33	1.78	1.41	1.11	0.79
1972	5.86	6.51	4.65	1.86	1.4	1.11	0.79
1973	6.13	6.81	4.88	1.93	1.4	1.11	0.8
1974	6.39	7.08	5.12	1.96	1.38	1.11	0.8
1975	6.59	7.3	5.29	2.01	1.38	1.11	0.8
1976	6.65	7.37	5.37	2	1.37	1.11	0.81
1977	6.43	7.04	5.23	1.81	1.35	1.09	0.81
1978	6.42	7.02	5.25	1.77	1.34	1.09	0.82
1979	6.67	7.28	5.48	1.8	1.33	1.09	0.82
1980	6.75	7.35	5.54	1.81	1.33	1.09	0.82
1981	6.79	7.38	5.63	1.75	1.31	1.09	0.83

Source: Based on data for Finland, ILO, Yearbook of Labour Statistics, various years.

even with respect to the direction of change of disparity over time. The above example shows that a similar statement, which is easily recognized but often forgotten, holds also within the group of static measures: absolute and relative differences at a given point in time (not to mention other static measures) measure the same qualitative aspect in different ways and need not give the same answer even to the respect of the direction of change.

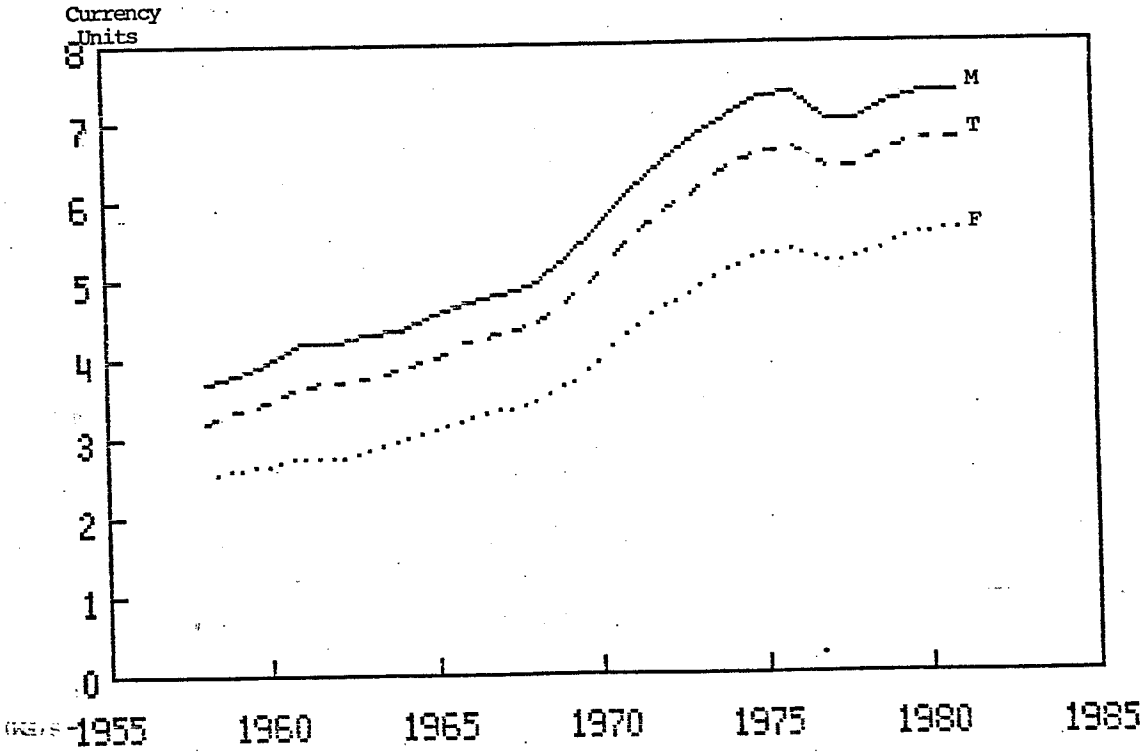
Table 4. Points in time when different units achieve a specified level of the indicator and time distances for the level of the average wage

Time for level T(t)			Time span for level T(t)			Time M for F(t)	Time F for M(t)
T	M	F	S(MT)	S(FT)	S(FM)		
1958	1952.6	1965.9	-5.4	7.9	13.3		1969.1
1959	1953.9	1967.0	-5.1	8.0	13.1		1969.5
1960	1955.3	1968.2	-4.8	8.2	13.0		1970.0
1961	1957.3	1969.0	-3.7	8.0	11.7		1970.6
1962	1958.0	1969.1	-4.0	7.1	11.1		1970.7
1963	1958.5	1969.3	-4.5	6.3	10.8	1948.4	1970.9
1964	1959.3	1969.7	-4.7	5.7	10.4	1949.7	1971.1
1965	1960.2	1970.1	-4.8	5.1	9.9	1951.1	1971.6
1966	1961.0	1970.6	-5.0	4.6	9.6	1952.8	1972.3
1967	1963.0	1970.9	-4.0	3.9	7.9	1953.9	1972.8
1968	1964.1	1971.2	-3.9	3.2	7.1	1954.7	1973.2
1969	1965.8	1972.1	-3.2	3.1	6.3	1957.5	1974.7
1970	1968.4	1973.8	-1.6	3.8	5.3	1960.1	1981.3
1971	1969.6	1979.2	-1.4	8.2	9.5	1963.6	1987.9
1972	1970.5	1984.6	-1.5	12.6	14.2	1965.7	1992.8
1973	1971.1	1988.1	-2.0	15.1	17.1	1967.6	1996.3
1974	1971.7	1991.3	-2.3	17.3	19.6	1968.6	
1975	1972.3	1993.7	-2.7	18.7	21.4	1969.1	
1976	1972.5	1994.4	-3.5	18.4	21.9	1969.3	
1977	1971.8	1991.8	-5.2	14.8	20.0	1969.0	
1978	1971.8	1991.7	-6.2	13.7	19.9	1969.0	
1979	1972.5	1994.6	-6.5	15.6	22.1	1969.6	
1980	1972.8	1995.6	-7.2	15.6	22.8	1969.8	
1981	1972.9	1996.0	-8.1	15.0	23.1	1970.0	

Source: calculated from data in the first half of Table 3 and extrapolation.

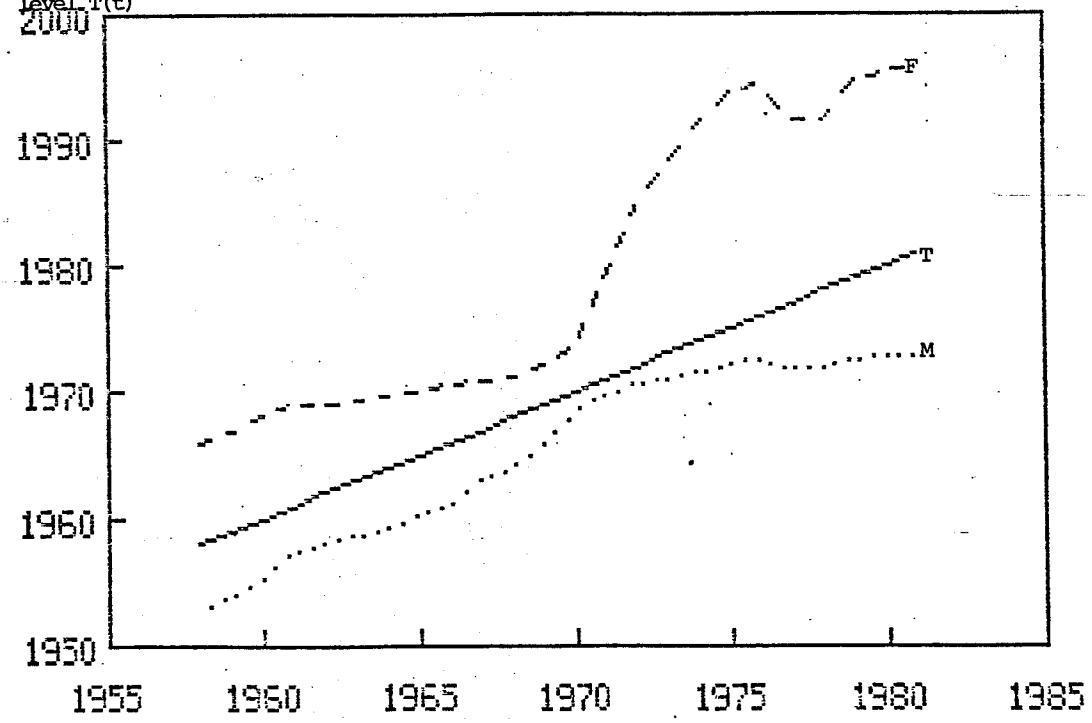
Table 4 provides more information on the time dimension of disparities. As mentioned earlier, time distance is defined for a given level of the indicator. Where one is attempting to combine static measures and time distance in a consistent framework, some compromises have to be made, and there are alternative ways of relating them to each other. The first three columns in Table 4 and Figure 3 take the average wage (i.e. the value for total T(t)) as the reference level with respect to which the time distances are estimated. Thus, for instance, the level of the average wage for 1965 T(1965)=4.01 currency units was achieved by men in 1960 (which means that the lead in time for male wage for that level was 5 years compared to average wage) and by women in 1970 (which means that the lag in time behind the level of average wage for women was 5 years). In accordance with equation (10), the time distance between men and women for that level can be estimated as the sum of the respective time distances in relation to the average wage: it amounts to 10 years. In simpler terms, if the point in time where this level was achieved by men is 1960, and for women 1970, the time span for that level is 10 years. In Figure 3 the vertical distance between the respective lines gives the first impression of changes in the time dimension of gender disparity over time. Before entering into more detailed discussion of these values, it is necessary to see the growth characteristics of wages over time.

Figure 2. Male, female and total earnings per hour in manufacturing (1970 prices) for period 1958-1981



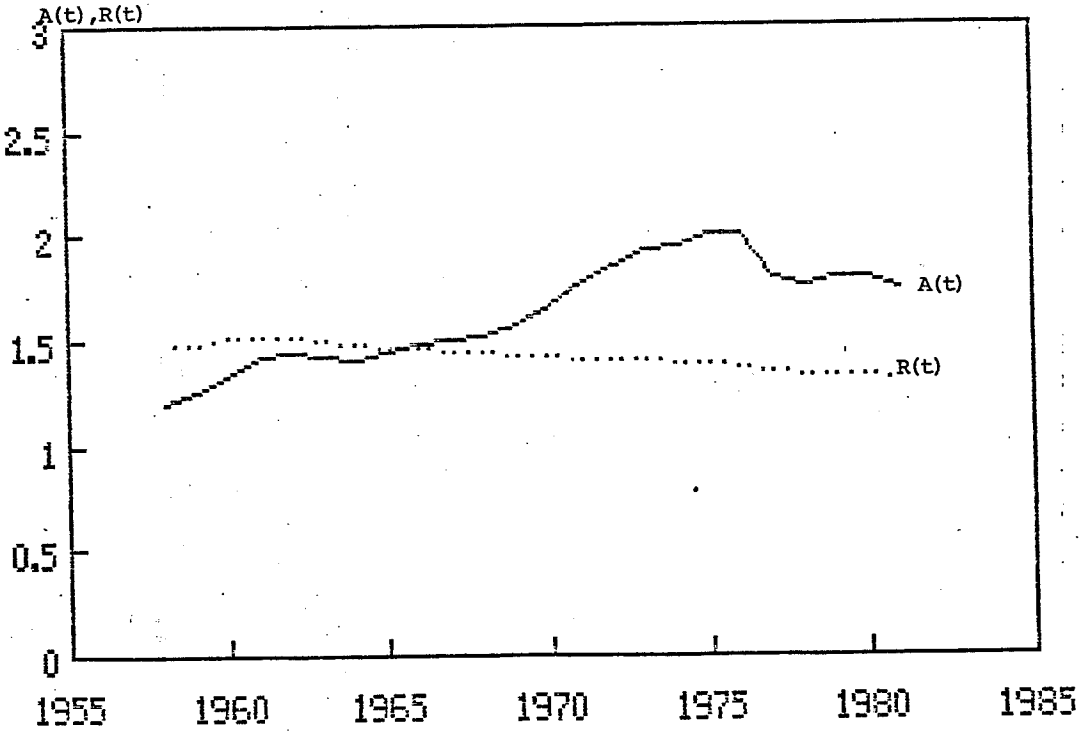
Source: Table 4

Figure 3. Points in time when the average wage level (T(t)) is achieved by men and women



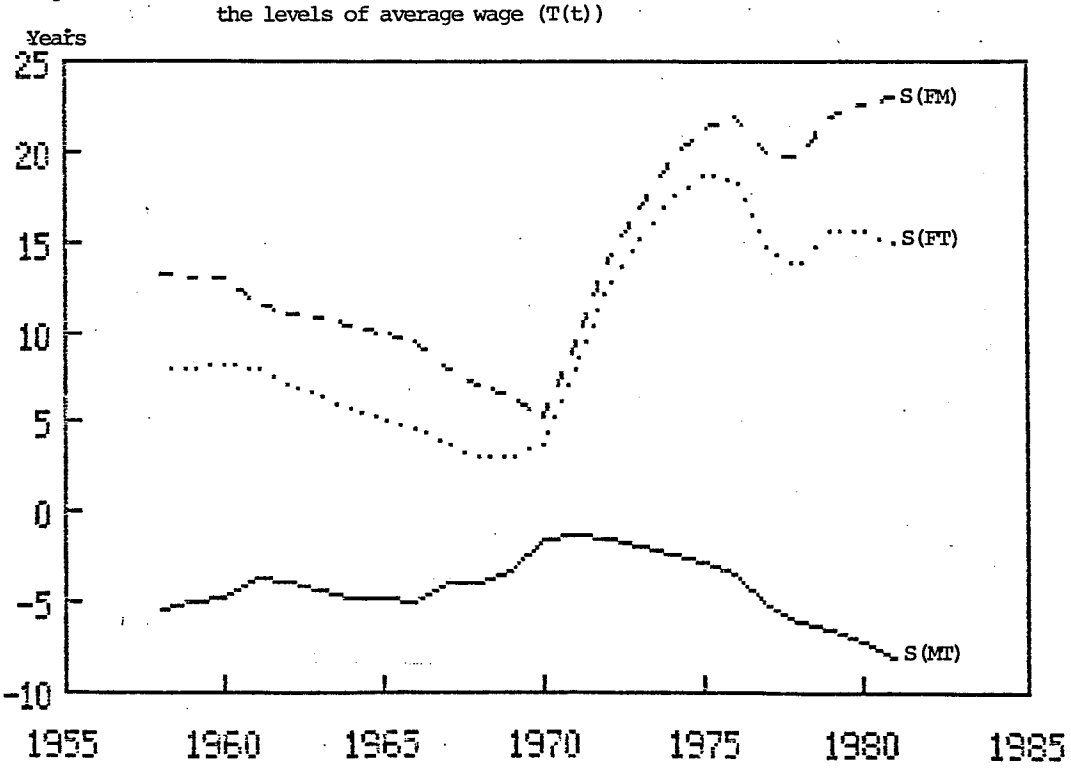
Source: Table 5

Figure 4. Absolute and relative static difference between male and female wage (1958-1981)



Source: Table 4

Figure 5. Time distances between male, female and total series for the levels of average wage (T(t))



Source: Table 5

Table 6

Growth of wages over time

Period	Change in wages (currency units)			RDFT	Growth rate of wages (percent)			Difference in growth rates
	DT	DM	DF	DF/DT	r_T	r_M	r_F	(r_M-r_F)
1958-68	1.18	1.23	0.93	0.77	3.1	2.9	3.2	-0.2
1968-76	2.26	2.45	1.96	0.87	5.3	5.2	5.8	-0.6
1976-81	0.14	0.01	0.26	1.86	0.4	0.0	1.0	-1.0

DT=T(t)-T(t-n), DM=MT(t)-M(t-n) and DF=F(t)-F(t-n), where n is the number of years in each subperiod.

In the period under consideration the growth of wages in the three subperiods presented in Table 5 is quite different. In the left part of the table the absolute changes in the wages for each subperiod are presented. The last subperiod 1976-1981 shows very different situations than the previous two. There is a near stagnation over the five year period for male wages and a very small increase in female wages. Even when the absolute increase is calculated per year and not per period, the increase in the female wages in the last subperiod is about five times smaller than that in the previous subperiod. The relative position of women against that for the total, calculated on the basis of changes for the last subperiod is 1.86, which is much higher than the value of 0.83 for 1981, which relates to the level of female wage rather than to the change in wage. It can be said that women are gaining in the last subperiod in relation to men; but in comparison to the experience of the past, the growth in wages has been very meager and disappointing in relation to the expectations which have been formed in the past.

The right hand part of the table gives elements for discussion in terms of growth rates of wages and time distance as a dynamic measure of disparity. In all three subperiods, the rate of growth of female wages was higher than that for male wages, and that difference has been even increasing in time, from 0.2 percent in the first subperiod, to 0.6 percent in the second subperiod and to 1.0 percent in the last subperiod. Again, if the only concern of women were the comparison with men, the situation would also seem to be improving, if the difference in the growth rates would be taken as a indicator of their relative position in a dynamic framework. The higher growth rate of wages for women than for men by definition also means that the static relative differences will be decreasing over time.

In the conceptual part it was argued that not only the difference in the growth rates but also the absolute magnitudes of the growth rates for the two sexes is important, both for the absolute position of men and women and for the time dimension of gender inequalities. The growth rates in Table 5 and the time distances presented in Table 4 can illustrate this point. The three subperiods are very different as far as the absolute magnitude of the growth of wages is concerned. In the first subperiod, the rate of growth of wages was around 3 percent per year; in the next subperiod, the growth rate increased to over 5 percent per year, and the comparison of these two subperiods can be used as an example of what happens to various measures of gender inequality, if the growth rate of the indicator changes (the change in the growth rate for wages between the analyzed

subperiods is a result of the changes in the economy as a whole, as the differences in growth rates between the three subperiods is much greater than the difference in growth rates of male and female wages within a given subperiod). An even more striking example of changes in the growth characteristics is that of the high 5 percent growth rate of wages in the second subperiod to near stagnation in the last subperiod.

The values of time distance in table 4 show a very different picture than the static measures of gender inequality. The ex post time distance can usually be calculated for time series data by simply looking at the tables, to check in which year in the past the male wage was the same as the level of female wages at a given point in time. In this case, comparing the third and the fourth column in Table 3, the level of female wages in 1969 was attained by men in 1958 (i.e. 11 years ago), the level of female wages in 1976 in 1969 (i.e. 7 years ago), and that of 1981 in 1970 (i.e. 11 years ago). Thus, even the ex post definition of time distance showed an improvement, when the rate of growth increased, and a deterioration, when the rate of growth decreased.

The above examples show how simple it is in principle to calculate the time when a certain level of the indicator was achieved by the compared units and to calculate the respective time distances. The problems arise when all compared units have not yet achieved a certain level or if the information from some periods in the past is not available. The last two columns in Table 6 are a good example of such a situation. The last column shows the time when female wage reached (or is assumed to reach)

a wage level which men attained during the analyzed period 1958-1981. Obviously, even the highest wage attained by women (in 1981) just about matches the male wage in 1970. So, if one wishes to calculate time distance between male and female wages for higher levels (later periods), one has to make some assumptions about future growth of female wages. In this section an example has been used to see what would happen if growth rate for female wages in the future would be about 1.3 percent per year (what has been the least squares estimate of the growth rate for female wages for the last observed subperiod 1976-1981).

Even if extrapolated until 1996 at this growth rate the female wage will only reach the male level of 1973, an expected time distance of 23 years. Namely, the respective time distances for the last two columns in Table 4 can be calculated by simply subtracting from the values in these columns the calendar time (which is the time when the level at which the comparison is being made is reached by F(t) or M(t), respectively). Similarly, when the female level F(t) is chosen for calculation of time distances between male and female wages (see second to the last column in Table 4) the history of movement of male wages over time for these levels is not known before 1958 (not routinely published in statistical publications where usually the concentration is on providing comparable data for shorter periods). When available, it is proper that actual data for the past is used. As an approximation, a similar (now backward) extrapolation for female wages can be used as earlier in (forward) extrapolation for female wages. This is done in Table

4 by extrapolating male wage backwards until 1948. Again by subtracting from this series the calendar time, the ex post distance between male and female wages measured at the female level F(t) would be 15 years in 1963, would diminish over time to reach a minimum of 5 years in 1973, and start increasing again to reach 11 years for the female level in 1981.

As mentioned before, there are some advantages in using the level of the average wage T(t) as the level at which the respective time distances are estimated. The results of forward and backward extrapolation, similar to the one described above, are presented in the first six columns of Table 4, and shown in Figure 3 and Figure 5. By comparing Figure 4 and Figure 5 we can observe what has happened with the measures of various aspects of gender disparity in wages over time. The difference in conclusions based on absolute static difference A(t) and relative static difference B(t) before 1976 has been mentioned before. Time distance $S_{FMT(t)}$ started at 13 years in the beginning of the period, has been reduced to 5 years (as a combination of higher female growth rate and, especially, as a result of considerably higher growth rates of both male and female wage up till mid 1970's), and started to increase again sharply with a projected value of 23 years (for the level of average wage in 1981).

As mentioned before, the period 1976-1981 - when wages grew very little - would from the point of view of static measures of disparity look the best for advancement of women's relative position, as both the absolute and the relative difference decreased. Only S-distance as a dynamic measure of disparity warns that even the statistically measurable ex post time

distance has increased again to 11 years. But an assessment of the possible deterioration in the women's dynamic relative position can be evaluated if one calculates the value of the ex ante S-distance. If the growth rate of wages of female workers observed for 1976-1981 period would prevail in the future, it would take 23 years for the present (1981) level of real wage of male workers to be reached. This means a drastic change in expectations, which is not at all observable in static statistical measures of inequality.

A good property of S-distance defined for a given level of the indicator is that it is in this way related to absolute levels, which facilitates comparisons between absolute levels and measures of disparities. This is useful both for analysis of disparities within a country or a smaller unit, as well as for cross-country comparisons. An illustration of importance of taking into account also the absolute levels is that the use of the time span needed for full equalization $SE_{(MF)}$ as an indication of women's positions without reference to other measures could be misleading.

If the situation from the subperiod 1976-1981 had prevailed in the future, the time needed for full equalization would, with one percent of difference in the growth rates for wages in favour of women, amount to about 30 years. However, the level at which this equalization of male and female wages would occur around the year 2010 would be 7.38 currency units, since the absolute levels of the growth rates are very low. Had the situation characteristic for the subperiod 1968-1976 continued in the

future, the time needed for full equalization of male and female wages would be about 50 years, to occur around year 2030. But, in the year 2010 the level of female wages would be 36.40 currency units, which is nearly 5 times that of the previous case, though the female wages would still not be equalized with the male wages. It is not difficult to infer which of the two situations would be better or which women would choose, if such a choice were possible. Taking into account the dynamic characteristics of gender disparity S-distance is both a more complex and a more sensitive measure of disparity than the relative static difference R(t) and the time needed for full equalization $SE_{(MF)}$. As mentioned before, the aim is to combine them in a comprehensive framework for analyzing gender (and other) disparities.

5. An example of more indicators, two units case: regional disparities

As mentioned before, the analysis of disparities between two units in a multidimensional framework (across many indicators) may indicate that some indicators which show a high degree of static disparity may at the same time show a smaller time distance, and vice versa. Technically, the greater are the differences between the growth rates of the indicators measuring various aspects of development and welfare, the greater the possibility that such a situation will arise. Table 6 will show as a concrete example that it is possible that the static relative comparison shows greater degree of disparity for indicator A than for indicator B ($R_A > R_B$), while at the same

time S-distance for indicator B is greater than S-distance for indicator A($S_B > S_A$)[2].

This theoretical possibility of divergence between the measurements of disparity assessed by static measures and by time-distance, becomes an important practical issue if one takes into account the multivalent nature of objectives in social and economic development and the fact that development is not a matter of proportional improvements in all aspects, a certain degree of asymmetry is one of its basic characteristics. In a dynamic analytical framework this asymmetry becomes apparent in at least three respects. In cross-section analysis (across the indicators) it means different static degree of disparity for different indicators, over time different growth rates for different indicators may also change, and different combinations between static differences and growth rates result in different time distances for different aspects.

This situation will be illustrated with data pertaining to the regional disparities in Yugoslavia. There are substantial differences in the degree of development as between the various regions (resulting from very different historical backgrounds which shall not be discussed here). To simplify the exposition the regions are grouped into two groups: a more developed region (MDR) and a less developed region (LDR).[6] And important characteristic of post-war development has been that all the regions have experienced a high rate of growth of GDP which has been very similar in all regions. For the period 1947-1972 the average growth rate of GDP for all regions has been between 6 and 7 per cent. All regions have experienced the rapid structural

change which Yugoslavia, as a developing country, has been making in the post-war period. The rates of growth of population have, however, been very different.

The values of relative static differences and time-distances for a set of indicators in Table 6 illustrate the point that attributes which show a high degree of disparity in a static comparison may at the same time show a rather small time distance, and vice versa. It also ranks the indicators for the MDR and the LDR in 1971 by the value of relative static difference $R_{12}(71)$, showing at the same time the ex-post time-distance $S_{122(71)}$ and the corresponding growth rates for the MDR for these indicators. The ranking of attributes by the static degree of disparity is very different from the ranking according to time distance. The value of Spearman's rank correlation coefficient of-0.22 indicates a slight, but statistically insignificant, negative correlation between static and dynamic degree of disparity between the MDR and the LDR.

The largest relative static difference is that of passenger cars per capita (2.44), for which, paradoxically, the dynamic dimension of disparity is only 4.1 years, the smallest time distance among all the twelve indicators. It is not important here to explain the consumer preferences revaled by the extraordinary growth rate of more than 20 per cent per annum for passenger cars per capita and it is questionable for how long it may be sustained, but a time distance of four years gives a completely different notion of regional disparity than the nearly 2 1/2 times higher static value for the MDR compared with the LDR

would suggest.

Of the four indicators which showed higher relative static differences than for GMP (gross material product) per capita, the infant mortality improved by a rate of 6.5 per cent per annum; all other indicators showed a higher growth rate than 10 per cent and a correspondingly lower time distance. GMP per capita and infant mortality show similar static differences and time distances of over 11 years.

An examination of the regional disparities in standard of living shows that they have been considerably smaller than those in GMP per capita; this indicates that GMP per capita is in the Yugoslav regional context not a good proxy variable for the general level of regional development and welfare, since it overstates the position of the MDR relative to that of the LDR. The same is true regarding social and public services; with the help of the central government's intervention, they have been regionally distributed much more equally than would result from the regional distribution of economic activity.[7]

Table 6 Regional case: Comparison of relative static difference and time-distance between the MDR and the LDR

1971

Indicator	Relative static difference $R_{12(71)}$	Rank	S-distance $S_{122(71)}$ (years)	Rank	Growth rate r_1 (%)
Passenger cars per capita	2.44	1	4.1	12	21.7
Telephones per capita	2.27	2	8.0	6	10.3
Infant mortality (inverse value)	2.07	3	11.2	5	6.5
Household electricity consumption per capita	2.04	4	5.5	8	12.9
Per capita income	1.98	5	11.5	4	5.9
Employment in the social sector per capita	1.60	6	15.7	3	3.0
GMP per active person	1.40	7	5.1	10	6.6
GMP per active person in the private sector	1.35	8	6.7	7	4.5
Employment component	1.35	9	17.6	2	1.7
Productivity component	1.30	10	5.2	9	5.0
GMP per person employed in the social sector	1.24	11	4.4	11	4.9
Demographic component	1.13	12	40.7	1	0.3

MDR = more developed regions of Yugoslavia
LDR = less developed regions of Yugoslavia

Source: Sicherl (1980)

The demographic, employment and productivity components in Table 6 refer to a decomposition of the relative static difference in per capita product between the MDR and the LDR into the three components.[8]

	$\frac{\text{product}}{\text{population}}$	=	$\frac{\text{labour force}}{\text{population}}$	$\frac{\text{employment}}{\text{labour force}}$	$\frac{\text{product}}{\text{employment}}$
$R_{11(71)}$	1.98	=	1.13	1.35	1.30
$S_{122(71)}$ (years)	12		41	18	5

If one would assess the degree of disparity between the two regions in these indicators only by the relative static degree of disparity, the problems of employment and of productivity would carry a very similar weight, both in terms of showing the degree of severity of the regional differentials in the respective fields, as well as in terms of the contribution to the explanation of the regional disparity in the per capita product. However, when the respective time distances are also brought into the picture, the time dimension of disparity (18 years as against 5 years) shows that the disparity in employment will be much more difficult to overcome. By combining static measures and time distance it is now in such situations possible also on the basis of "objective" statistical measures to hypothesize that in overall terms the disparities in employment opportunities are a more severe problem -- a conclusion which is expected to receive overwhelming support if people would be asked to express their intuitive assessment of the situation. Time distance thus hopefully enriches the "objective" analytical apparatus. Its

advantages are that it is simple, easy to comprehend, expressed in years as widely understood unit of measurement and thus comparable between indicators and units. A much more difficult set of questions arises with respect to its normative and policy implications which will be discussed in the next section.

6. Normative and policy implications

While it is difficult to assess what weight people and police makers attach to the time dimension of disparity relative to the static degree of disparity, the expression of disparity between two units in terms of time distance for a given level (lead or lag in time) is quite frequent way of thinking in business towards competitors or in expressing the lag or lead between two countires in certain fields. Similarly, the notion of the number of years needed to reach a certain level of an indicator from a given starting point is implicit or explicit in policy formulation and plan documents. The concept of the time dimension of disparity is thus by no means an unfamiliar notion in everyday and political discussions. Time distance or time span as one of the measures of disparity has also in policy discussions a very distinct advantage that the concept of lag or lead is time easily comprehensible by policy makers as well as laymen, and the same holds for years as the unit of measurement.

This does not, however, mean that it is known in what way are policymakers and people in general combine various "objective" measures of disparities and their value judgements into an overall assessment of their relative position and deduce their position and action with respect to (in)equality at the

interpersonal, social, income, ethnic, regional or international level. Some of these issues can be clarified only through long-term interdisciplinary research.

Two hypotheses are offered here. On the one hand, at the conceptual level the overall degree of disparity is viewed as a weighted combination of static and dynamic dimensions. In other words, that both of them matter. On the other hand, while in their role as descriptive statistical measures all of them are useful to describe the existing situation or policy alternatives from various perspectives over the whole range of possible application, from individual to international level, the normative implications will be more important when comparing groups within a country or smaller units than in the international framework.

However, it should be stressed that time distance in its analytical application will give a certain answer which in this stage is not associated with any value judgement. The evaluation of whether such a disparity is tolerable or not will be possible only when a certain set of social values and policy objectives will be introduced, and the outcome of the evaluation will depend on what is the particular set of goals and values which one uses in arriving at the value judgement. In this respect there is no conceptual difference between time distance and static measures of disparities. Whether a 40 per cent discrepancy in the value of a given indicator is acceptable or not requires the same type of criteria exogenous to the analytical framework as the judgement whether a time distance of 11 years is, in the

particular conditions at a given point in time, politically acceptable or not.[9]

Although a conclusion with respect to the relative importance of static comparisons and time distance in the normative field can not be drawn on a priori grounds, it is possible to explore some possible implications of the extended conceptual and analytical framework for formulation of economic and social policy.

For analytical work as well as for policy considerations it is of great importance to recognize and take into account the fact that different measures measure different aspects of disparity and should complement one another, to show the complex nature of the problem. It was shown that if the growth rate for both units increased, e.g., from 3 to 5 percent, different measures show not only a different magnitude but even a different direction of change and it is easy to envisage that different interest groups might utilize the possible differences in the conclusions based on different measures of disparity in policy debates to argue that disparities are increasing (taking as the yardstick of comparison absolute static differences from such an example), others would claim that there is no change (using relative static differences), and a third group might argue that disparities decreased (as time distance decreased). There is no inconsistency in the statements that one aspect of disparity is increasing at the same time as another is decreasing, if one recognizes that there are more aspects of disparity even for a given indicator which should be approximated by different statistical measures. It seems clear that for any useful

discussion of policy alternatives, both static and dynamic considerations should be taken into account simultaneously.

The conclusion that S-distance is a decreasing function of the growth rate of the indicator indicates that this dynamic measure of disparity deals with a characteristic of disparities which is quite distinct from that of static measures. This is especially important in a multidimensional analysis across a larger number of economic and social indicators. In looking at the overall picture of gender inqualities the speed of social change might have important repercussions on the dynamic degree of disparity and thus on the overall degree of disparity.

Conceptually and analytically, this opens new avenues to be explored in the relationship between growth and disparities. The predominant line of though in this field is that of trade-off between growth and inequality. This dynamic framework points to a new role of the growth rate in distributional considerations. The fact that high growth rates reduce, ceteris paribus, the time dimension of disparity, can be taken as an important indication that the conflict between growth and distributional objectives is often exaggerated, and that the real problem is the quality of growth in relation to the interests of the whole population, i.e. development as a synthesis of economic growth and social progress, and not the growth in itself.

It is important to realize that for any given value of relative difference R(t), higher magnitude of growth rates brings a net reduction in time distance additional to whatever reduction in time distance has been achieved by the improvement in the

relative difference. In normative terms, the effect of reducing time distance by higher rates of growth should not be used as an argument against the need of improvement in relative and absolute differences at a given point in time, but its additional effect has to be taken into account when the decision on overall strategy is being considered.[10]

It has been concluded that an action program to alleviate poverty and reduce disparities must be concerned also with the absolute magnitudes of the growth rates for the indicators (r_1 and r_2) and not only with the difference in the growth rates ($r_2 - r_1$) (the target that unit 2 should grow faster than unit 1), since the former affects both the absolute levels and the dynamic dimension of disparities. If one were to rely only on the relative static measures of disparity, where the effect of difference in the growth rate between two compared units is reflected while that of the magnitudes of the growth rates is not, our understanding of disparities would lack an important dimension. Relative static measures would show the same change over time if the respective growth rates for unit 1 and unit 2 would be 0 and 2 percent, or 3 and 5 percent. However, time distance would be considerably shorter in the second case. In this framework it matters for the degree of disparity also how fast and not only how much faster is the less privileged unit growing.

A high growth rate is thus not only a means for reaching higher levels of satisfaction of needs faster but also an instrument for alleviating the problem of disparities, at least in one dimension. The search for better practical solutions is

to be sought within the general strategic orientation for growth and equity. While the policy advise favoring high growth rates in economic and social field is difficult to implement in view of the many constraints that exist in the real world, the importance of growth and efficiency in this context establishes macroeconomic development as an important factor in analyzing the degree of disparities from a dynamic perspective. The macroeconomic conditions depend not only on efficiency but also on resources and the international environment. The deterioration of economic conditions in the current decade, especially in the developing countries means a lower rate of growth (in some countries stagnation or even a decline) of resources available in general and for the improvement of the position of less privileged groups in particular. One way of quantifying the effect on the disparity between various groups, regions or countries is through time distance. A lower growth rate increases the time distance. In this way the increased time distance reflects the perception of increased disparities within a country, or among countries, if the argument is applied to international level.

The interconnection between this framework of measuring disparities in various fields and dynamic causal models is twofold. On the one hand, the results of various simulations of dynamic causal models form the basis for the calculation of various measures of the analyzed disparities, associated with alternative assumptions about the conditions and policy measures, and thus the description of the expected effects of various

alternatives on these disparities. On the other hand, various measures of disparity can be used already in the construction phase of such models, either as dependent or explanatory variables. A further extension of the use of these statistical measures is in the setting of targets in plans and other policy documents and in monitoring their implementation in the course of time.

7. Conclusions

The conceptual and analytical framework presented in this paper is relatively simple and yet it may provide useful new insights for the analysis of development and the discussion of policy alternatives by emphasizing the time dimension of the processes involved and the time dimension of the disparities which exist both within and between countries. Time distance as a new statistical measure of disparities in economic and social indicators between two units expresses the lead or lag between them in number of years. They represent a common unit of measurement, easily understandable by policy makers as well as laymen, and comparable among different indicators for the same unit, and among different units, which is a very useful property of a statistical measure.

There are many interrelationships between growth and (in)equality. The simple model outlined here helps to conceptualize and quantify some of them. It provides a framework for describing and presenting some aspects of disparities in terms of statistical measures and thus, naturally, shows the

effects rather than the factors which have led to such developments. This approach shows that the overall degree of disparity is a complex phenomenon, and cannot be adequately measured in one way only. Static measures of disparity and time distance play a useful descriptive role in all cases adding information on a particular aspect of disparity to complement each other for a better description of a multidimensional situation. The value judgements which people and policy makers attach to the time dimension of disparity relative to its static measures is an open question for interdisciplinary research, similar to that of how they evaluate the relative importance of various static measures.

But the potential of this approach is not limited to the evaluation of time distances for various indicators, and the suggestion that the overall degree of disparity depends both on its static and dynamic dimensions. Under certain assumptions a formal relationship can be established between a static measure of disparity, time distances and the growth rate of the analyzed indicator, and thus growth characteristics and various aspects of disparity in economic and social indicators can be integrated in a formally consistent dynamic analytical framework. Such a framework is useful for calculating various relationships between these measures, and especially as a help to researchers and policy makers in a better integration of growth and distributional considerations in analytical work and policy discussions. For policy purposes it is important that a higher rate or growth, _ceteris paribus_, will reduce the time dimension of disparity, and _vice versa_. A higher growth rate is thus not

only instrumental as a means for reaching higher levels of satisfaction of needs faster but also for alleviating the problem of disparities, at least in one dimension. In this context, factors which influence the magnitude of the overall and sectoral growth rates (availability of resources, efficiency, internal and external environment, overall and sectoral policy, to mention a few groups) become important also for analyzing disparities from a dynamic perspective.

As one of the many possible examples one may mention the hypothesis that the prolonged world depression in recent years has aggravated the problems of disparity and that the perception of increased disparities both in the individual countries and in the world as a whole is very much influenced by the stagnation or lower rate of growth which increases the time distance and thus via the dynamic dimension also the overall degree of disparity. Thus these considerations would be important in the work both at national level and international level.

With this methodology a more comprehensive analysis of disparities can be carried out in a number of individual fields: nutritional level, per capita income, poverty, employment, education, literacy, health services, life expectancy, infrastructure, productivity, income and wealth distribution, and many others. Apart from the improvements in the analysis of these particular fields, time distance analysis has also important implications for an overall assessment of disparities when one looks at the development and welfare as a multidimensional category composed of numerous attributes. It

can be applied in overall studies of social and economic development to study the dynamic characteristics of the development process, relative priorities in various phases, magnitues of time lag or lead in social and economic fields, effects of accelerated development under different development strategies, dynamic aspects of the distribution of benefits of economic growth, etc. Since this approach has not been applied systematically before, there is a need to process the existing data along these lines to see what additional conclusions about the development process can be brough about when the time perspective is added in an explicit way. The empirical examples presented in this paper show that the results are quite distinct from those based only on static measures of disparity, especially when comparing a number of economic anc social indicators. An important question from the point of view of policy options is to what extent are the wide differences in growth rates for different indicators inherent in the nature of some particular attributes and to what extent can be quickly changed by appropriate policy measures in line with social objectives. An action program to reduce disparities should not be concerned only with the difference in the growth rates for a given indicator between the two (or more) compared units but also with the absolute magnitude of the respective growth rates.

The introduction of time distance into the measurement of disparity emphasizes an earlier neglected dimension of disparity and reveals a new role of the growth rate in the analysis of disparities. Time distance is not a measure of great precision since it deals with a long-term phenomenon, yet it can help us to

present a more realisic picture of disparities in our world, and within the extended conceptual and analytical framework it may also contribute to a better integration of distributional considerations into overall development strategy.

NOTES

1. For a more detailed elaboration of the methology see Sicherl (1977) or Sicherl (1978).

2. From Sicherl (1985).

3. For details see Sicher (1978).

4. DM = M(t) - M(t-n), DF = F(t) - F(t-n).

5. This section is based on Sicherl (1980), p. 84-86.

6. The MDR consists of Slovenia, Croatia and Serbia (except SAP Kosovo), while the LDR comprises Bosnia and Herzegovina, Macedonia, Montenegro and SAP Kosovo, or about 35 per cent of the country's population.

7. See also Sicherl (1975).

8. See e.g. Sicherl (1975), pp. 98-9.

9. Sicherl (1973), p. 572.

10. Sicherl (1973), p. 573. The main trade-off to be resolved is now between absolute static differences and time distance, since they move in different directions when the overall growth increases or decreases (r_1-r_2). However, in essence this is the same type of a problem to be resolved as the question whether the static degree of disparity should be measured by absolute or relative difference or in which particular combination.

REFERENCES

Elteto, O. and E. Frigyes (1968) "New Income Inequality Measures as Efficient Tools for Causal Analysis and Planning," Econometrica, April.

Hirschman, A. (1973) "Changing Tolerance for Income Inequality in the Course of Economic Development," Quarterly Journal of Economics.

Johnston, D.F. (1985) "The Development of Social Statistics and Indicators in the Status of Women," Social Indicators Research, April.

Kendal, M.G. and A. Stuart (1963) The Advanced Theory of Statistics, Volume I, London: Griffin & Co.

Leibenstein, H. (1962) "Notes of Welfare Economics and the Theory of Democracy, Economic Journal, June.

Madzar, L. (1963) "Stopa porasta i eliminacija razlika u razvijenosti pojedinih regija," KM-MS Serija B, broj 20, SZPP, Beograd.

Patel, S.J. (1966) "The Economic Distance Between Nations: Its Origin, Measurement and Outlook," Economic Journal, March.

Sicherl, P. (1973) "Time Distance as a Dynamic Measure of Disparities in Social and Economic Development," Kyklos, XXVI, Fasc. 3.

_____ (1975) "The Regional Distribution of Government Expenditures in Yugoslavia," Review of Income and Wealth, 1.

_____ (1977) "The Time Distance Approach to the Dynamic Aspects of Inequalities," Working Paper of the Income Distribution and Employment Programme, WEP, ILO, Geneva.

_____ (1978) "S-distance as a Measure of Time Dimension of Disparities," in Z. Mlinar, H. Teune (eds.), The Social Ecology of Change, London and Beverly Hills: Sage Publications.

_____ (1980) "Growth and the Time Dimension of Inequalities," in R.C.O. Mathews (ed.), Economic Growth and Resources, Vol. 2, Trends and Factors, MacMillan for IEA, London.

_____ (1985) "An Extended Framework for Analysis of Inequalities," Joint ECE/INSTRAW Meeting on Statistics and Indicators on the Role and Situation of Women, Geneva, March 19, 1985, CES/AC.60/23.

_____ (1986) Methods of Measuring Disparities Between Men and Women, (draft), INSTRAW, Santo Domingo.