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Interregional Versus Intraregional Inequality

Are Regional Policies a Proper Way

of Promoting Equity?

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1. Introduction

Usually, two main aims are formulated for regional economic policy: promotion of interregional equity, and promotion of national economic development. In the first case, attention is focussed on stimulating the regions with low incomes or high unemployment rates. When on the other hand national economic development is the central goal, investment funds will be channeled to the most promising regions, possibly the most developed ones.

The present paper is meant to give some reflections on the first mentioned aim of regional policy. If equity considerations are important in government policy, is it appropriate to develop policies which explicitly discriminate between regions, for example by infrastructure programs or investment subsidies for particular regions? Or, are other, non-spatial, dimensions, such as differences related to sex, age, race, education, economic sector, etc. more important?

For a well-founded choice of the spatial dimension as a point of departure for policies aiming at reducing inequities, one has to consider:

1. the size of spatial inequities compared with inequities according to other dimensions (e.g., sex, race).
2. the effectiveness of policy instruments to influence spatial inequities.
3. the political importance attached to spatial inequities as compared with inequities related to other dimensions.

In this paper we will focus on the first point. A decomposition of total inequality will be carried out to find out the regional contribution to it. The main variable which is usually taken to study interregional inequity is income per capita. Also, unemployment rates are often used. In order to provide a frame of reference for judging the regional dimension in income and unemployment inequalities, we will also investigate the regional dimension for other variables, such as educational attainment, environmental quality and political participation.

The plan of this paper is as follows: in section 2, a statistical formulation is given as a basis of comparison between total and interregional inequality. Sections 3 and 4 are devoted to the measurement of total and interregional variance for binary variables. By doing so, the analysis can be extended from cardinal variables such as income to binary variables such as unemployment, participation in social welfare programs, etc. In section 5, the concept of inequality in life time variables is introduced. In section 6, empirical results are presented for the Netherlands. Finally, in section 7, some reflections are given about the relevance of the statistical results for regional economic policy.

2. Interregional versus Intraregional Variance; a Statistical Formulation

The relationship between interregional and total variance will be investigated by means of a model with the following features. Consider a dependent variable y which is measured at the individual level; for example, y_n denotes the income level of individual n. For our purpose, two groups of independent variables are distinguished: variables operating at the individual level and variables operating at the regional level. For example, x_n denotes the age of the individual, whereas z_r denotes the profile of labour demand in region r (where individual n lives). For the ease of presentation it will be assumed here that there is only one individual variable x and one regional variable z which is relevant. In addition to these variables an error term ε_n is specified, so that - assuming a linear relationship - one arrives at:

$$y_n = \alpha + \beta \left(\sum_r s_{nr} z_r\right) + \gamma x_n + \varepsilon_n \tag{1}$$

where:

$$s_{nr} = 1 \quad \text{if } n \in S_r$$
$$s_{nr} = 0 \quad \text{elsewhere} \tag{2}$$

The set S_r is the set of all individuals living in region r; the factor s_{nr} links the individual n to his region of residence r. Note that the size of the regions is assumed to be so large that commuting - implying a discrepancy between region of work and region of residence - is of negligeable importance.

Equations of type 1 are discussed among others by Tinbergen (1975a, 1975b). In his terminology, equation (1) can be conceived of as a price equation which follows from a system of demand- and supply equations. The term x_n represents personal supply factors, the term z_r represents demand factors as far as they differ between regions.

Let $\bar{z}$, $\bar{x}$ and $\bar{\varepsilon}$ denote the mean values of z, x and ε, respectively. The corresponding variances and covariances can be found in Table 1. Then the mean and variance of the dependent variable can be shown to be:

$$\bar{y} = \alpha + \beta \bar{z} + \gamma \bar{x} + \bar{\varepsilon} \tag{3}$$

and:

$$v^2(y) = \beta^2 v^2(z) + \gamma^2 v^2(x) + v^2(\varepsilon) + 2\beta\gamma v(z,x) + 2\beta v(z,\varepsilon) + 2\gamma v(x,\varepsilon) \tag{4}$$

Consider now <u>interregional</u> variances. Let $\bar{y}_r$, $\bar{x}_r$ and $\bar{\varepsilon}_r$ denote the mean values of y, x and ε in region r (see Table 1). Then it can easily be shown that

$$\bar{y}_r = \alpha + \beta z_r + \gamma \bar{x}_r + \bar{\varepsilon}_r \tag{5}$$

The interregional variance of a variable can be interpreted as the variance which would occur if that variable would attain the same value for all individuals in each region. Interregional variances will be denoted by vi^2. Making use of Table 1, it can be shown that:

$$vi^2(y) = \beta^2 vi^2(z) + \gamma^2 vi^2(x) + vi^2(\varepsilon) + 2\beta\gamma vi(z,x) + 2\ \beta vi(z,\varepsilon) + 2\gamma vi(x,\varepsilon) \tag{6}$$

Both $v^2(y)$ and $vi^2(y)$ consist of 6 terms for which the following relationships hold:

$$\begin{aligned} v^2(z) &= vi^2(z) \\ v^2(x) &\geq vi^2(x) \\ v^2(\varepsilon) &\geq vi^2(\varepsilon) \\ v(z,x) &= vi\ (z,x) \\ v(z,\varepsilon) &= vi\ (z,\varepsilon) \\ v(x,\varepsilon) &\gtrless vi\ (x,\varepsilon) \end{aligned} \tag{7}$$

so that $v^2(y) \geq vi^2(y)$. The difference between total variance and interregional variance is called the aggregate intraregional variance $vai^2(y)$. Let $v_r^2(y)$ be the intraregional variance in region r:

$$v_r^2\ (y) = \frac{1}{N_r} \sum_{n\varepsilon S_r} (y_n - \bar{y}_r)^2 \tag{8}$$

where N_r denotes the population in region r. Then it can easily be shown that the aggregate intraregional variance can be written as the weighted sum of the $v_r^2\ (y)$, the weights being equal to the regional population share N_r/N:

$$vai^2(y) = \frac{1}{N} \sum_r N_r\ v_r^2(y) \tag{9}$$

How large is interregional variance $vi^2(y)$ compared with total variance $v^2(y)$?

If we apply the usual assumptions of multiple regression: ε is independently distributed from z and x, one obtains for sufficiently large regions:

total variance

$$v^2(y) = \frac{1}{N} \sum_n (y_n - \bar{y})^2$$

$$v^2(z) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})^2$$

$$v^2(x) = \frac{1}{N} \sum_n (x_n - \bar{x})^2$$

$$v^2(\varepsilon) = \frac{1}{N} \sum_n (\varepsilon_n - \bar{\varepsilon})^2$$

$$v\ (z,x) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})(\bar{x}_r - \bar{x})$$

$$v\ (z,\varepsilon) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})(\bar{\varepsilon}_r - \bar{\varepsilon})$$

$$v\ (x,\varepsilon) = \frac{1}{N} \sum_n (x_n - \bar{x})(\varepsilon_n - \bar{\varepsilon})$$

mean value (nation)

$$\bar{y} = \frac{1}{N} \sum_n y_n$$

$$\bar{z} = \frac{1}{N} \sum_r N_r z_r$$

$$\bar{x} = \frac{1}{N} \sum_n x_n$$

$$\bar{\varepsilon} = \frac{1}{N} \sum_n \varepsilon_n$$

interregional variance

$$vi^2(y) = \frac{1}{N} \sum_r N_r (\bar{y}_r - \bar{y})$$

$$vi^2(z) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})$$

$$vi^2(x) = \frac{1}{N} \sum_r N_r (\bar{x}_r - \bar{x})^2$$

$$vi^2(\varepsilon) = \frac{1}{N} \sum_r N_r (\bar{\varepsilon}_r - \bar{\varepsilon})^2$$

$$vi(z,x) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})(\bar{x}_r - \bar{x})$$

$$vi(z,\varepsilon) = \frac{1}{N} \sum_r N_r (z_r - \bar{z})(\bar{\varepsilon}_r - \bar{\varepsilon})$$

$$vi\ (x,\varepsilon) = \frac{1}{N} \sum_r N_r (\bar{x}_r - \bar{x})(\bar{\varepsilon}_r - \bar{\varepsilon})$$

mean value (region)

$$\bar{y}_r = \frac{1}{N_r} \sum_{n \varepsilon S_r} y_n$$

$$\bar{z}_r = z_r$$

$$\bar{x}_r = \frac{1}{N_r} \sum_{n \varepsilon S_r} x_n$$

$$\bar{\varepsilon}_r = \frac{1}{N_r} \sum_{n \varepsilon S_r} \varepsilon_n$$

Table 1. Variance and mean value formulas.

$$v(z,\varepsilon) = vi(z,\varepsilon) \to 0 \qquad (10)$$
$$v(x,\varepsilon)\ ,\ vi(x,\varepsilon) \to 0$$

so that:

$$vi^2(y)/v^2(y) \approx \{\beta^2 v^2(z) + \gamma^2 vi^2(x) + vi^2(\varepsilon) + 2\beta\gamma v(z,x)\}/\{\beta^2 v^2(z) + \gamma^2 v^2(x) + v^2(\varepsilon) + 2\beta\gamma v(z,x)\} \qquad (11)$$

In (11), four sources of interregional variance are involved:

1. Variance in variables operating at the regional level (z), such as production structure, location, resource endowments, quality of infrastructure.
2. Variance in the average regional values of variables operating at the individual level (x), such as age, sex, educational level (mixture component).
3. Unexplained variance (ε), an unknown part of which is of type 1, the rest being of type 2.
4. Covariance between variables operating at the regional and individual level.

The value of the ratio $vi^2(y)/v^2(y)$ depends obviously on the size of the regions used. When only one region would be distinguished, the ratio approaches the value zero, whereas when many extremely small regions are distinguished, the ratio approaches a value equal to 1. In section 6, an empirical study will be carried out for the ratio $vi^2(y)/v^2(y)$.

3. Inequality of Binary Variables

One usually thinks of income as the dependent variable y in equation (1) in the context of inequality analysis. However, there is no a priori reason to exclude other variables as candidates for y in this context. For example, inequality in labour market opportunities, quality of infrastructure, environmental quality, etc. are also relevant items. Empirical study reveals (see Rietveld, 1987) that inequality in the last mentioned variables tends to be larger than income inequality. This is an important result for governments who state that equity is one of the goals of regional development policies. What is needed then is a multidimensional rather than a single-dimensional approach to inequality (see e.g. Atkinson and Bourguignon, 1982).

In the context of the present study we are interested in analyzing the relationship between total and interregional variance. It appears then, that many of these additional variables are measured on a binary scale which has specific consequences for the computation of the total variance. Consider as an example the rate of employment as an indicator of the possibility to obtain jobs on the labour market. Let N_r be the regional labour force, Q_r denotes the number of employed persons, so that $q_r = Q_r/N_r$ is the rate of employment in region r. The corresponding national variables are N, Q, and q, respectively. Then the interregional variance in employment rates is:

$$vi^2(e) = \frac{1}{N} \sum_r N_r (q_r - q)^2 \qquad (12)$$

The total variance is computed for a vector of length N, of which Q elements are equal to 1, the rest being zero. Consequently, we find:

$$v^2(e) = \frac{1}{N} \{Q (1-q)^2 + (N-Q) (q)^2\}$$
$$= q (1-q) \qquad (13)$$

Thus, if the mean value of a binary variable is known (i.e. the percentage of persons with score 1), at the same time the total variance is given. This is very different from the situation with cardinal variables such as income. Knowing mean income does not provide any information about the variance of income.

Binary variables have the property that where they are dummy variables (0-1) at the individual level, they are measured as a cardinal variable at the regional level (share of persons with feature x). Other examples in addition to the employment rate are:
- participation rate in the labour market
- share of persons with university education
- share of households searching for a dwelling
- share of households being above the poverty line
- share of households owning a motorcar
- share of households living nearer than 300 meters from a public transport stop.

This list, which can easily be extended, shows that binary variables can indeed be used to reflect many aspects of welfare of persons and households. It also suggests another fact: in principle, most of the binary variables can be replaced by more informative nominal, ordinal or cardinal variables. For example, labour market participation can also be measured by means of hours of work per week. Educational attainment can be specified according to more classes that university versus non-university only. In many cases it appears, however, that data are not available in the more informative (non-binary) form, or that the data can only be attained in that form at high cost. In such cases, the only feassible alternative to using binary data would be: using no data at all.

In most countries, data are collected on personal income distribution. As a result, secondary data usually allow one to analyze total versus interregional income inequality. For other cardinally measured welfare indicators this is usually not the case, however. It is important to note that for binary data this problem does not arise. It can easily be seen from (13) that the total variance of a binary variable follows directly when its mean value is known.

4. The Upper Bound of Interregional Variance

As already noted, the upper bound of the ratio $vi^2(e)/v^2(e)$ is 1. For an appropriate understanding of the meaning of this ratio in the case of binary data, it is important to be aware that in certain cases, this upper bound cannot be attained. Consider for example Table 2 describing alternative interregional distributions

	1.a	1.b	2.a	2.b
q	.5	.5	.05	.05
q_1	.6	1.0	.06	.10
q_2	.4	.0	.04	.00
v^2	.25	.25	.0475	.0475
vi^2	.01	.25	.0001	.0025
vi^2/v^2	.04	1.00	.0021	.0526

Table 2 Alternative interregional distributions of a binary variable.

of a binary variable between two equally large regions. For case 1.a ($q = .5$), the ratio vi^2/v^2 is equal to .04. The maximum attainable value for this ratio appears to be 1 (see case 1.b) as long as $q = .5$. For $q = .05$, much smaller ratios are found: for case 2.a, vi^2/v^2 is equal to .0021, whereas its maximum attainable value is .0526 according to case 2.b.

How can the highest possible value of interregional variance be found? Consider the case of R equally large regions (for regions with different size, more complex results are obtained). Then the highest possible value of vi^2 (denoted as $\overline{vi}^2$) is the solution of:

$$\begin{aligned} \max_{q_1 \ldots q_R}! \quad & vi^2 = \frac{1}{R} \sum_r (q_r - q)^2 \\ \text{s.t.} \quad & \frac{1}{R} \sum_r q_r = q \\ & 0 \leq q_r \leq 1 \qquad r = 1, \ldots, R \end{aligned} \tag{14}$$

This is a programming problem with a quadratic convex function to be maximized and linear constraints. Then there is a <u>basic</u>

solution of (14)' which maximizes vi^2 (see Wagner, 1975). If Rq happens to be an integer (say M), then this basic solution implies a value $q_r = 1$ for M regions and $q_r = 0$ for R-M regions.

If Rq is not an integer, the optimal solution can be characterized as follows. Let T be the first integer which is smaller than Rq. Then in the optimum $q_r = 1$ in T regions, $q_r = Rq - T$ in one region, and $q_r = 0$ in R-T-1 regions. As a result one finds for $\overline{vi}^2(e)$:

$$\overline{vi}^2(e) = \frac{1}{R}\,[T + T^2 - 2qRT + q^2R^2 - q^2R] \qquad (15)$$

Especially when T = 0 (i.e. Rq < 1), $\overline{vi}^2(e)$ may attain values which are much smaller than $v^2(e)$:

$$\overline{vi}^2(e) = q^2\,(R-1) \qquad (16)$$

This result is in agreement with Table 2 where for a small q a much lower value of vi^2/v^2 is found than for a medium size q. It is not difficult to check that for values of q near to 1 a similar result is obtained.

5. The Inequality of Life Time Variables

The variances discussed up to here have a snapshot character. They relate to inequalities at a certain point in time and are therefore subject to various incidental influences. If one wants to get rid of these incidental factors one may use life time variables rather than instantaneous ones. Life time variables indicate the mean level of the variable during the relevant life time of an individual. Thus, let y_{nt} denote the level of variable y at time t (t=1,....,T) for individual n. Then, the level of the life time variable for individual n is:

$$y\ell_n = \frac{1}{T}\sum_t y_{nt} \qquad (17)$$

For example, when y relates to income, $y\ell_n$ denotes the average income of individual n during the period he is an income earner. For unemployment, $y\ell_n$ would indicate the share of time individual n is unemployed during the period he is in the labour force. Note that a life time variable which is based on a binary instantaneous variable, is itself no longer binary. When the correlation coefficients between the instantaneous variables are relatively low from period to period, one may end up with a variance in life time variables which is much smaller than the variance of the instantaneous variables. See also Fase (1972) and Creedy (1985).

It is not easy to measure the values of life time variables. One needs panel data for it during very long periods. Such data are in general not available. As a second best approach one can use observed transition rates or correlations between variables measured in two consecutive periods only. Thus, one may arrive at calculations of life time variables under the assumption that the conditions prevailing in the periods concerned are constant during the life time of individuals.

If one may assume that the population per region is stationary and that the incidental factors cancel out within regions, the regional average of life time variables and instantaneous variables are equal. This would imply that interregional variance does not depend on whether or not instantaneous or life time variables are used. Although the above assumptions may not entirely hold true, one may still expect that the ratio vi^2/v^2 will increase if one used life time variables instead of instantaneous variables. The extent of the reduction of v^2 depends strongly on the correlation between the instantaneous variables in the consecutive years.

6. Empirical Results

In this section, empirical results on interregional inequalities are presented for a group of variables (see Table 3) In addition to economic, labour market and housing market variables, also political, social, demographic and urbanization data are considered. The data have been collected at the provincial level (12 provinces are distinguished) around the year 1982. The average population size of a province is 1.2 million persons. Income (y_1) and environmental quality (y_9) are the only cardinal variables; the other variables have been formulated as binary ones. Table 4 contains numerical results for the total variance v^2, the maximum attainable interregional variance $\overline{vi}^2$ and the actual interregional variance vi^2, as formulated in equations (13), (15) and (12), respectively.[1)]

The ratio vi^2/v^2 is in most cases not far removed from $vi^2/\overline{vi}^2$, except for the variables with a very low mean value: y_3, y_6 and y_8. This underlines the importance of introducing $\overline{vi}^2$ in section 4 to achieve an appropriate understanding of interregional variance of binary variables.

The ratio vi^2/v^2 varies between .01% to .73% for y_1 up to y_8. For $vi^2/\overline{vi}^2$, the range is between .10 and .99%. Thus, interregional variance is only a very small part of total variance for these variables (including income).

individual:	regional:
economic	
y_1: disposable income per recipient (dfl 1000 per year)	y_1: average regional disposable income (dfl 1000 per year)
labourmarket	
y_2 = 1: unemployed individual (male) = 0: employed individual (male)	y_2: regional unemployment rate (male)
housing market	
y_3 = 1: dwelling is vacant = 0: dwelling is occupied	y_3: regional vacancy rate
political	
y_4 = 1: individual does vote = 0: individual does not vote	y_4: regional participation rate in elections
education	
y_5 = 1: enter university = 0: otherwise	y_5: share of persons 17-19 years old entering university
social	
y_6 = 1: poverty allowance recipient = 0: otherwise	y_6: share of persons receiving a poverty allowance
y_7 = 1: disability allowance recipient = 0: otherwise	y_7: share of persons receiving a disability allowance
demographic	
y_8 = 1: person dies (in certain year) = 0: otherwise	y_8: mortality rate
environment	
y_9 : mean yearly concentration of SO_2 to which individuals are exposed ($\mu g/m^3$)	y_9: mean yearly concentration of SO_2 in region ($\mu g/m^3$)

Table 3. List of variables used in inequality analysis

Further, we note that the interregional differences in the labour market, housing market, and political participation are larger than in income. These findings indicate that at the provincial level, interregional differences in income are very modest. Obviously, when a smaller spatial scale is used, one will end up with higher values for the interregional component. However, as indicated by Molle and Beumer (1984), interregional differences in income between COROP regions (of which there are 40) are not much larger than between provinces (of which there are 12).

For interregional differences in environmental quality quite different results are obtained. The interregional variance in the concentration of SO_2 experienced by inhabitants is approxim ately 50% of the total variance. The SO_2 concentrations display a clear spatial pattern: high concentrations are observed in the Western and Southern part; how concentrations occur in the rest of the country. This spatial pattern is the result of the mixture of economic activities in the Western part of the country, as well as of pollution from neighbouring countries. It is estimated (NML, 1985), that appr. 70% of the SO_2 concentration in the Netherlands is due to foreign emissions. One may conclude that the spatial dimension is important for environmental equity: interregional (and international) relocation of big polluters can yield a distribution of environmental quality, which is substantially more equitable.

Up to here, the analysis is based on instantaneous variables in which data on only one year are used. As already explained in section 5, rather different results may be ontained when life time variables are used. Therefore we carry out an additional analysis of the regional component for some life time variables (income and unemployment). The results, which are presented in Table 5, must be considered as tentative, since the information necessary to compute life time variables is rather incomplete (see section 4).

	mean	total variance v^2	maximum possible interregional variance; $\overline{vi}^2$	actual interregional variance, vi^2	vi^2/v^2 (%)	$vi^2/\overline{vi}^2$ (%)
1. disposable income	29.0	252.0	252.0	.659	.26	.26
2. unemployment rate (male)	.164	.137	.135	784.10^{-6}	.57	.58
3. vacancy rate (dwellings)	.0206	.0201	.00465	459.10^{-7}	.23	.99
4. election participation rate	.810	.154	.137	112.10^{-5}	.73	.81
5. university education participation rate	.088	.0801	.0692	220.10^{-5}	.27	.32
6. share of persons receiving poverty allowance	.0190	.0186	.00397	200.10^{-7}	.11	.50
7. share of persons receiving disability allowance	.0790	.0728	.0687	171.10^{-6}	.24	.25
8. mortality rate	.00819	.00812	.000738	730.10^{-9}	.01	.10
9. concentration SO_2	22.2	56.4	56.4	28.0	49.7	49.7

Table 4. Interregional versus total variance for nine variables. (Netherlands, 1982)
Sources: CBS (1985a, 1985b), NML (1985).

	disposable income (dfl 1000)	unemployment rate (male)
mean	29.0	.164
total instantaneous variance v^2	252.0	.137
total life time variance $v\ell^2$	105.0	.018
interregional variance vi^2	.66	.00078
vi^2/v^2 (%)	.26	.57
$vi^2/v\ell^2$ (%)	.63	4.33

Table 5 Interregional versus total variance for life time variables

These results indicate that after taking into account life time variables, the interregional component in total variance is indeed larger. For income, it must still be considered as rather small, however (less than 1%). For unemployment, a clear regional component is found in total variance of the life time variable (appr. 4.4%). Interregional differences in unemployment manifest themselves in interregional income differences in a rather limited way. This is related, among others, to the system of unemployment allowance used in the Netherlands.

7. Implications for Regional Policy Making

The regional component in the instantaneous variance of various welfare indicators such as income, unemployment, participation in social welfare programs, etc. is small (less than 1%) for the Netherlands at the provincial level in the 1980s. Which policy conclusions can be drawn? Does it imply that governments worrying about inequities in society had better neglect regional inequality and focus on other components of inequality?

First of all, we note that there is a major exception to the above result. The regional component in the variance of environmental quality as measured by the concentration of SO_2 is circa 50%. There is a close link between environmental equity and the spatial location pattern of big polluters. Environmental equity can be promoted by changes in the location pattern of these polluters. Here, the importance of the regional dimension is unquestionable.

For the other variables, the regional component in total inequality is much lower. It is important to note that only part of the interregional inequality can be influenced by regional policy. In terms of the model presented in section 2, interregional variance $vi^2(y)$ does not only depend on $v^2(z)$- the variance of the variable operating at the regional level - but also on the interregional variance of individual variables ($vi^2(x)$) and the corresponding covariances. Thus, the variable z, which is the traditional subject of regional economic policy is in general not the only component of $vi^2(y)$ (see expression (10)). This implies that even if regional economic policy would bring down $v^2(z)$ to zero, $vi^2(y)$ will not necessarily become equal to zero. Thus, we reach the conclusion[2] that regional economic policies aiming at reducing inequity can only bring down interregional variance in income and other welfare indicators with a certain unknown fraction.

There is still another limitation of regional policy which needs to be mentioned: a reduction of interregional inequality does not necessarily imply a reduction of total inequality. For example, if regional elites benefit disproportionately from regional policies, a decrease in interregional variance $vi^2(y)$ may be concomitant with an increase in total inequality. [3] Thus, from the equity viewpoint, it is not only average regional income or unemployment which has to be taken into account when selecting rregions to be assisted; also intraregional inequalities have to play a role here.

From the above, we may infer that the potential power of regional policies to reduce total variance $v^2(y)$ of various welfare indicators is rather insignificant. As we will argue now, this does not necessarily imply, that from the viewpoint of promoting equity, the regional dimension can be neglected without any harm. The reason is that as will be explained below, total instantaneous variance $v^2(y)$ has only limited relevance as a frame of reference for equity judgements.

First, instantaneous variance is influenced by many incidental factors, which vary from period to period. The numerical results in section 6 indicate that when one computes the life time variance, a considerable reduction of total variance can be achieved. This holds true especially for unemployment.

Second, part of total variance is due to $v^2(\varepsilon)$, where ε

stands for all kinds of variables at the personal level which are unknown, unmeasurable, or difficult to control (e.g. motivation, willingness to accept highly paid but unattractive work, willingness to work overtime). This part of $v^2(y)$ is not policy relevant. It is the unavoidable consequence of the fact the people may be so different.

Third, part of total variance due to $v^2(x)$ is not policy relevant, because the personal features concerned cannot be changed (e.g. race, sex). In this case policies can only be oriented towards changing the parameter γ. Governments can aim at preventing discrimination according to race or sex by legislation, requiring for example that males and females doing the same job and being equal to all relevant aspects, have to receive the same payment. In practice, such measures can only be implemented to a limited extent, however.

Fourth, inequality as represented by the variance $v^2(y)$ is not necessarily a sign of inequity. For example, differences in income related to experience, or the number of hours of work may be perfectly in accordance with norms of justice. The same holds true for a social welfare system implying certain (limited) differences in income between persons earning their own income and recipients of welfare payments.

From the above point, one may draw the conclusion that the policy relevant part of total variance may be rather small for variables such as income or unemployment. Consequently, if interregional variance in these variables [4] is related to the policy relevant part of variance, much higher shares will be obtained than in Table 4. Interregional inequalities may remain an important issue for governments aiming at equity. Using the perspective of life time variables (Table 5), it is especially interregional inequalities in <u>unemployment</u> which are pertinent.

Which factors influence the position of interregional inequalities on the political agenda? Obviously statistical observations as presented above are not the only factor here. Electoral or more general political reasons will also play a role. Political pressure from disadvantaged regions will be an important factor. This pressure will be compared with the pressure exerted by other electoral or social groups trying to improve their position such as: ethnic groups, pensioners or women groups.

There is an important difference between groups based on a territorial criterion and the other groups mentioned above: (cf. Hoover and Giarratani, 1984): people can in principle move from one region to another, whereas they cannot change ethnicity, age or sex. Therefore, there may be a voluntary element involved in people's location. If the costs of moving from one region to another (broadly defined) do not exceed the potential improvement in income, people may yet decide not to move because their region of residence is sufficiently attractive according to other viewpoints such as the quality and accessibility of facilities and the quality of the natural environment. In such a case, equity reasons are not very convincing as a basis for regional economic policy aiming at reducing interregional inequalities. A more general concept of welfare inequality giving rise to multidimensional inequality analysis is in order here.

Notes

1. Instead of the variance one could also use another decomposable inequality measure, such as Theil's inequality index (cf. Maasoumi, 1986). In that case one will obtain other numerical values, but the main pattern will remain unchanged. In the present context, an advantage of the variance is that with binary variables the interregional part of total inequality is not sensitive to the way the binary variable is specified. For example, if one assigns the values 2 and 1 to the two possible outcomes, instead of 0 and 1, the interregional share of total variance will remain unchanged. For Theil's inequality index, such a property will not be found.

2. Here the implicit assumption is made that the covariance between x and z is positive. If the covariance would be negative, a decrease of $v^2(z)$ could imply an increase in $v^2(y)$!

3. This can be represented as an interaction term x.z in equation (1) of section 2.

4. Be aware that not all interregional variance is policy relevant in the sense of section 7. There are good reasons to assume, however, that the part of interregional variance which is policy relevant is (much) larger than the part of total variance which is policy relevant.

References

Atkinson, A.B. and F. Bourguignon, The Comparison of Multi-Dimensioned Distributions of Economic Status, Review of Economic Studies, vol.-39, 1982, pp. 183-201.

Bartels, C.P.A., Economic Aspects of Regional Welfare, Income Distribution and Unemployment, M. Nijhoff, Leiden, 1977.

CBS (Central Bureau of Statistics), Regionaal Statistisch Zakboek 1984, Staatsuitgeverij, The Hague, 1985a.

CBS (Central Bureau of Statistics), Personele Inkomens Verdeling 1981, Staatsuitgeverij, The Hague, 1985b.

Creedy, J. Dynamics of Income Distribution, Basil Blackwell, Oxford, 1985.

Fase, M.M.G., The Distribution of Lifetime Earnings, Statistica Neerlandia, vol. 26, pp. 103-111, 1972.

Hoover, E.M. and F. Giarratani, Regional Economics, Knopf, New York, 1984.

Maasoumi, E., The Measurement and Decomposition of Multi-Dimensional Inequality, Econometrica, vol. 54, 1986, pp. 991-997.

Molle, W. and L. Beumer, Regional Income Disparity in the Netherlands, Tijdschrift voor Econ. and Soc. Geografie (TESG), vol. 75, no.2, 1984, pp. 82-98.

NML (Nationaal Meetnet voor Luchtverontreiniging), Publikatiereeks NML-RIVM nr. 28, 1985.

Rietveld, P., On Multidimensional Inequality Comparisons, Department of Economics, Free University, Amsterdam, 1987.

Tinbergen, J., Income Distribution, Analysis and Policies, North Holland, Amsterdam, 1975a.

Tinbergen, J., Income Differences, Recent Research, North Holland, Amsterdam, 1975b.

Wagner, H.M., Principles of Operations Research, Prentice Hall, London, 1975.

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