INEQUALITY-ADJUSTED HAPPINESS IN NATIONS

Egalitarianism and Utilitarianism Married in a New Index of Societal Performance

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ABSTRACT

According to the utilitarian creed, the quality of a society should be judged using the degree of happiness of its members, the best society being the one that provides the greatest happiness for the greatest number. Following the egalitarian principle, the quality of a society should rather be judged by the disparity in happiness among citizens, a society being better if differences in happiness are smaller. Performance on these standards can be measured using cross-national surveys, where degree of happiness is measured using the mean response to a question about happiness and disparity expressed as the standard deviation.

In this paper we marry these measures together in an index of 'Inequality-Adjusted Happiness' (IAH) that gives equal weight to either criterion. It is a linear combination of the mean happiness value and the standard deviation and it is expressed as a number on a 0 to 100 scale. We applied this index to 90 nations for the 1990s and observed large and systematic differences, IAH being higher in rich, free and well governed countries. We also considered the trend over time for 14 rich countries and found that IAH has increased over the last 30 years.

Keywords: Social inequality, happiness, utilitarianism, egalitarianism, Inequality-Adjusted Happiness.

1 THE PROBLEM

Since long, there has been heated discussion about the quality of society and calls for social reform. Over the last centuries, political philosophers have brought system in that debate by distinguishing standards for evaluating the quality of society.

Different standards

One of the standards for a good society is the *happiness* of its citizens. This principle is central to 'utilitarian' moral philosophy, more precisely, to 'rule-utilitarianism', which holds that policy makers should aim at a society that provides the greatest happiness for the greatest number of citizens. This criterion is put to practice in empirical happiness research, in particular in studies where average happiness across nations is compared and an attempt is made to identify the societal characteristics behind the observed differences (Veenhoven 1997, 2004).

Another standard used to evaluate the quality of a society is the degree of *inequality* among its citizens. This principle is central to a tradition of 'egalitarian' moral philosophy, which holds that policy makers should try to reduce inequality as much as possible. This

criterion is also applied in empirical social research, mostly in cross-national comparisons of equal rights and income inequality.

These principles could conflict. The promotion of happiness may be at the cost of social equality, and in this context a standard objection against utilitarianism is that it legitimizes the repression of a minority. Likewise, social equality can be to the detriment of happiness and the failed communist experiment has shown this to be the case. Since there is broad support for both principles, policy makers must look for options that satisfy each of the above tenets.

Need for an encompassing measure

This calls for appropriate social indicators; policy makers must know what interventions are most likely to serve both principles. This requires a measure that marries happiness and equality in the research arena.

A similar problem exists in public health. One guiding principle in this field is to preserve life for as long as possible and performance on that criterion is commonly measured using average life expectancy. Yet another moral lead is to promote good health, which is typically measured using surveys on self-reported disabilities. These goals can also come into conflict, since longevity can come at the cost of good health. People can be kept alive, but with a poor quality of life, reflected in their having to deal with bad health for too long. Good health can, in some cases, come at the cost of longevity if its maintenance requires therapies that shorten life. How to find a balance between a short and healthy life and a prolonged but unhealthy life? Policy makers in this field needed an outcome measure that reflects an acceptable mix of these aims. In response the World Health Organization proposed a combined measure, called Disability-Adjusted Life Years; abbreviated to DALY's, which was used for the first time as an outcome criterion in a worldwide comparison of national healthcare systems (WHO 2002).

Likewise, the Human Development Index has been adjusted for inequality. A 'Gender related Development Index (GDI) was proposed in the Human Development Report of 1995 and a correction for poverty was introduced in the 1997 report (UNDP 1998). Further Hicks (1997) proposed a variant of the HDI that adjusts for inequalities in education and longevity in nations.

Plan of this paper

In this paper we propose an index that reflects both happiness and inequality[1] in nations.

In line with earlier research we measure the degree of happiness using the average response to a single question on happiness found in general population surveys. Following the other papers in this issue, we use the same survey data for measuring inequality in nations, taking the standard deviation (Kalmijn & Veenhoven 2005). We take stock of the options for combining these statistics in Section 2. We discuss our choice of an index that gives equal weight to each principle and is expressed on a 0 to 100 scale in Section 3. This index is called the 'Inequality-Adjusted Happiness' index and is abbreviated to '*IAH*'. We apply the *IAH* in a cross-sectional analysis of 90 nations in the 1990s in Section 4, and in Section 5 we apply it in a comparison over time for 14 rich nations. We discuss the strengths and weaknesses of the *IAH*-index in Section 6.

2 OPTIONS FOR COMBINATION

As indicated above, we measure happiness and inequality in nations using responses to questions about happiness to be found in general population surveys. The degree of happiness in nations is measured using the average, and inequality in happiness using the standard deviation: How can these pieces of information best be combined?

The possible configurations of the average and the standard deviation of the responses to the item on happiness in a nation are depicted in Figure 1. The average or mean is denoted by the symbol '*m*' and is plotted on the horizontal axis, and varies between *u*, the rating corresponding to the most unhappy conceivable situation, and *h* for the most happy one. We assume that $u < h$, so $u \leq m \leq h$. The standard deviation, sometimes abbreviated as 'sd', is denoted by the symbol '*s*' and is plotted vertically. All the theoretically possible combinations of the mean and the standard deviation lie within this semicircle or at its circumference. We have presented a formal derivation of this diagram in another paper in this issue (Kalmijn & Veenhoven 2005: Appendix 1).

Mathematically, the problem is to map the points in this two-dimensional vector space onto a one-dimensional (sub)space. The positions in the latter space must reflect the degree to which societies meet these values. Utilitarians and egalitarians will agree that no better society is conceivable than the one that is represented by point H, albeit for different reasons. Yet they will disagree about the worst possible society. Egalitarians will select point T and for utilitarians this is the point L. If one selects some point E inside the semicircle, both views agree on the fact that any other point for which the mean is smaller and at the same time the standard deviation is larger than that of E represents a society that is worse than E. Their arguments are different, but they agree on the conclusion. Therefore, any 'compromise' between both principles on what is the worst possible society is like must be represented by a point on the circumference of the semicircle, somewhere between T and L. The exact location of this point W depends on the weights that are assigned to both views.

Common good-bad dimension
An obvious choice for the one-dimensional space we are looking for is a straight line through H and W, in such a way that good societies will be mapped close to H and bad ones will be to be found nearer to W. The point N in the m-s diagram with abscissa = *m* and ordinate = *s* represents some society with this mean value and standard deviation respectively. Its projection onto the line HW can be made in various ways. We will consider two of them: the orthogonal projection and the central projection.

Orthogonal projection
If for N the image is chosen that is the nearest to N, the result is the orthogonal projection of the point N onto HW, i.e. the point of intersection of the line HW and a straight line through N and perpendicular to HW. In Fig. 1, this intersection is denoted P. Now we define the *inequality-adjusted happiness* (*IAH*) as:

$$IAH_o := (\underline{ZP} / \underline{ZH}) \text{ x}100,$$

where Z is some zero point, which will be defined later, and $\underline{ZP}$ denotes the length of the (straight) line segment ZP. The subscript 'o' means that the projection is orthogonal.

Central projection
In the case of central projection, one has to select a center of projection (outside HW). Now the point N is connected to this center by a straight line, and its point of intersection with HW, denoted C, is the central projection of N with respect to the center. For this center, we made a choice in favor of point L. In that case, inequality-adjusted happiness will be defined as:

$$IAH_c := (\underline{ZC} / \underline{ZH}) \text{ x}100.$$

Scale properties
Different options are available for the point Z. One is the point W. This means that in that case the projection W corresponds to an *IAH*-value of 0 and the IAH-value of H is 100. However, there is one disadvantage, at least in theory: all points in the semicircle segment LW will be projected to the left of W, resulting in a negative *IAH*-value.

In Appendix A it is shown that – in the case of equal weights to the views of egalitarians and utilitarians – this situation occurs only when on a scale with 0 and 10 as lowest and highest score respectively, the mean is less than 1.46 and at the same time the ratio of the standard deviation and the mean exceeds the value 2.41. Until now, we have found no nation for which this outcome has been reported, so the above objection appears to be merely theoretical. However, as more weight will be given to the strictly egalitarian view, W approaches T and the size of the segment LW will increase; in this situation negative index values may eventually become a reality.

Therefore, if one wishes to avoid negative index values, including theoretically possible ones, one has to establish which possible projection is maximally remote from H and to select this point as Z. For orthogonal projection, this is the point V, being the point of intersection of HW and the tangent to the semicircle that is perpendicular to HW; for central projection, it is the point of intersection of HW and the left-hand vertical tangent.

In both cases, the scale value on the index-scale is different from the one on the "short axis", where W is selected as a zero. When a choice is made in favor of a longer axis, a relatively smaller segment of the scale is used for real situations. Moreover, the calculation of *IAH* is slightly more complicated.

Computation
The value of *IAH* can be calculated for each of these variants from u, h, m and s using a formula that is derived in appendix A.
A calculation program is available for download (Kalmijn 2004).

Inspection of the formulae (6) and (7) for IAH_c in Appendix A shows that, in the case $u = 0$, this statistic is a monotonically increasing function of m/s (the ratio of the mean and the standard deviation) only. This means that, in this case, a ranking of societies according to their IAH_c-values is identical to the one on the basis of their mean/standard deviation ratios. Veenhoven (2003a, b) has used this ratio as a measure of inequality-adjusted happiness.

An advantage of using IAH_c over that ratio is that it results in an index scale that ranges from 0 to100, which makes the comparison of societies somewhat easier. Moreover, in contrast to the ratio mean/standard deviation, IAH_c is also a meaningful statistic in the case of a scale with $u \neq 0$, including 'reversed scales'. The main advantage of IAH_c (and IAH_o) is that their values are basically independent of the underlying measuring scale and are at least insensitive to linear scale transformation; linear transformation of scores to an other rating scale is a procedure that is described in Appendix B. Finally, if the standard deviation = 0 and the mean exceeds the value u, IAH_c is defined, as it can be given the value 100 by

definition, whereas the ratio mean/standard deviation is not; this, however, is not only an advantage.

A serious problem with respect to the central projection arises when a relatively large weight is assigned to the utilitarian view. In this case, the *IAH*-axis approaches the *m*-axis and the paradoxical result is a small *IAH*-value for almost all societies, which makes distinction between them very difficult. Index values will, eventually, hardly depend on the mean value, which is the only criterion of the utilitarian pure-sang.

In the case where the full weight is given to the utilitarian view, projection is even impossible, since the center of projection is no longer outside the projection axis and all societies will have a zero *IAH*-value. When the orthogonal projection is selected, which is essentially a linear transformation of the (*m, s*) vector onto a one-dimensional subspace (*IAH*), these problems do not occur.

When most or even all the weight is given to the strictly egalitarian view, in case of both central and orthogonal projection, societies with equal standard deviations get unequal *IAH*-values, which difference may be substantial; in this case they are ranked according to their mean values. The only exception is when the standard deviation = 0 and the mean $m > u$: in the case of central projection $IAH = 100$, irrespective of *m*, whereas in the case of orthogonal projection, $IAH < 100$ and increases with the value of *m*.

In the case of a choice in favor of a strictly utilitarian view, orthogonal projection will give projection onto the *m*-axis, and this is to be considered as a sound result. In the case of a zero weight to the utilitarian view, different situations with different *m*-values, but all with zero standard deviation, are mapped in a way that seems acceptable from both points of view.

3 OUR CHOICE

The above considerations leaves us with three problems:
(1) How do we weigh the utilitarian and the egalitarian approach?
(2) Do we project orthogonally or centrally?
(3) Do we express the combined index on a short or a long scale?
We made the following choices:

Equal weights
We opted for a combination that gives equal weight to the utilitarian and egalitarian principles. Though this choice may be arbitrary, it is a clear one and no less arbitrary than any other choice. In terms of Figure 1, this means that we locate point W half way between T and L on the semicircle circumference.

Orthogonal projection
Central projection might be an obvious choice, since it can be easily interpreted as related to the ratio of the mean to the standard deviation and fits earlier use of the ratio of the mean and the standard deviation as a measure of Inequality-Adjusted Happiness (Veenhoven 2003a, 2003b). As we have seen, however, this projection method gives rise to problems, which become more serious as more weight is given to the strictly utilitarian view on happiness. It could be argued that these objections are mainly theoretical and can be ignored as being practically irrelevant for two reasons. One, we have already made a decision in favor of equal weights. Two, the problems with very small or even zero standard deviations can arise only at a very small number of distinct mean values (Kalmijn & Veenhoven, 2005, Appendix 1). Such values of the standard deviation are all well below the ones that have found for nations until now, since none of the 90 countries listed in Table 1 shows a standard deviation

below 1.5 on a 11-point scale of measurement.
These problems do not occur in the case of orthogonal projection, thus for reasons of generality, we prefer to select the orthogonal projection method.

Long scale
Finally we opted for the long scale option, because this excludes the possibility of negative values under all circumstances.

Formula
This variant of Inequality-Adjusted Happiness index can be computed using the following formula, the derivation of which is explained on Appendix A.

$$IAH_o = 96.0(\,|\,m–u\,|\, – 0.414.s)/(\,|\,h–u\,|\,) + 3.96,$$

where m is the mean score on an indicator of happiness in a society, u and h are ratings that correspond to the most unhappy and happy situations respectively, and s is the standard deviation of the distribution of the happiness ratings[2]. Rounding of *IAH*-values to integers is recommended.
From this formula, it follows that for $m = u$ (then $s = 0$), $IAH_o = 3.96 \approx 4$. The reason why in this case $IAH_o \neq 0$ is that the choice of the worst possible society is a compromise between two views: a society with $IAH_o = 2$ is less attractive than one with $IAH_o = 4$, but only from a utilitarian point of view.

4 DIFFERENCE ACROSS NATIONS

We can now proceed to consider the actual scores on this index. To do this we used the following item that has been used in 90 nations, mainly in the World Value Surveys.

"Taking all together, how satisfied or dissatisfied are you currently with your life as a whole?"

1	2	3	4	5	6	7	8	9	10
Dissatisfied									Satisfied

Means and standard deviations obtained in general population surveys using this item were taken from the World Database of Happiness; section 'Distributional Findings in Nations' (Veenhoven 2004a). These data were combined using the above formula. The resulting *IAH*-scores for all 90 countries are presented in Appendix C. Some illustrative cases are presented in Table 1.

4.1 Pattern of differences

Malta scores best with 74 points and Tanzania worst with 20 points. These extremes illustrate that we still have a long way to go to achieve the best possible society, which would score 100, but we are also well above the theoretically worst possible score of 0.

The actual variation on this scale is 54 points and the cases are well spread over this range. This range will probably broaden somewhat when more data on less happy countries become available.

In Figure 2 we plotted the mean and the standard deviations of happiness in various nations and incorporated the *IAH*-axis in that scattergram. The pattern that appears illustrates that the main variability between the countries is more or less in the same direction as that of

the *IAH*-axis and that projection onto the *IAH*-axis provides a good discrimination between the societies that are more and less successful in meeting utilitarian and egalitarian demands simultaneously.

Figure 2 shows also that there is more divergence in level and inequality of happiness in the left top part of the scattergram than in the right bottom area. Looking closely, we can see a cluster of Latin American nations where high level goes with high inequality. There is also a cluster of former communist countries characterized by a low level of happiness and high inequality.

The confluence of high level and low inequality in the right bottom area of Figure 2 would seem the logical result of the fact that the maximal size of the standard deviation gets smaller, the closer the mean is to the extremes of the scale. Yet this is probably not the whole story, because comparison with the maximally possible values shows that there is still room for variation[3].

4.2 Correlation with nation characteristics

The differences make sense at first glance. It will be no surprise that countries like Switzerland, Denmark and The Netherlands perform well, since they have the reputation of being livable and egalitarian. It will be no surprise either to find African countries such as Tanzania and Zimbabwe at the bottom, since life is quite miserable in these countries and inequalities widespread. We can get a more systematic view on the differences by considering the correlations with quantifiable nation characteristics. Data on six societal qualities is presented in Table 2.

Wealth

It is well known that the *level* of happiness is higher in rich nations than in poor ones (Diener and Seligman, 2004) and in this issue Ott (2005a) and Veenhoven (2005) show that *inequality* in happiness is also systematically lower in rich nations. Hence we can also expect a positive correlation of Inequality-Adjusted Happiness with the wealth of nations. This correlation is present and it is remarkably high: $r = +.68$. The higher the buying power per capita in a country, the higher its score on this index of Inequality-Adjusted Happiness.

This correlation reflects the linear relationship between wealth and *IAH*. Yet a look at the scattergram reveals a convex pattern. This is again no surprise since this pattern was also observed in the separate correlations of wealth with level and dispersion of happiness.

Security

The case of security in nations is less clear-cut, since not all aspects of security relate identically to happiness.

Earlier research has shown that people live happier in nations that protect their citizens better against untimely death and in this issue we have also seen that the dispersion of happiness is lower in safe countries (Ott 2005a). We also find sizable correlations with our combined index of Inequality-Adjusted Happiness. The correlation between *IAH* and incidence of lethal accident in a country is -.51. This statistical relationship could be a spurious side effect of the above-mentioned correlation with wealth of the nation, since accidents happen more often in poor countries. Yet when wealth is 'controlled' [4] for, the partial correlation is still -.41.

It is generally believed that social security will also add to the happiness of citizens and will reduce disparities among them. However, earlier analyses by Veenhoven (2000) and Ouweneel (2003) did not confirm this expectation; the level and dispersion of happiness appeared to be no better in nations that spend a lot on social security than in equally rich

nations that spend less. At first sight these findings are contradicted by the data presented here, the zero-order correlation between *IAH* and social security spending being +.32. Yet 'controlling' for wealth of a nation changes the picture dramatically in this case and reduces the correlation to -.11.

Freedom

Several studies have observed that the level of happiness is typically higher in the most free nations of today's world (Veenhoven 2000b), and in this issue we also see that dispersion of happiness tends to be lower in free nations (Ott 2005a, Veenhoven 2005). Hence it is no surprise to find strong correlations between *IAH* and indicators of freedom.

A strong positive correlation between *IAH* and economic freedom is the first thing we see in table 2, and this finding seems to contradict the belief that free market capitalism creates misery and inequality. There are also sizable correlations with political freedom and with personal freedom. Note that the size of these correlations is not entirely comparable, because the number of nations is not identical for each of the freedom variants.

The correlations are substantially reduced after 'controlling' for wealth of the nation, yet in this case the analysis is misleading. Splitting between rich and poor nations shows positive correlations among the former and negative correlations among the latter, and these opposed tendencies balance out in the partial correlations shown in Table 2.

A last thing to note is that the scattergrams show a linear pattern. Unlike the case of wealth, there is no concave pattern of declining returns.

Inequality

It seems rather evident that people live happier in the most egalitarian societies and that the differences in happiness will be smaller. Yet in this issue we have seen that this does not apply to all inequalities and particularly not to income inequality. Income inequality is essentially unrelated to the average happiness of citizens and only modestly related to dispersion of happiness among them (Ott 2005a, Veenhoven 2005). In this light it is no surprise to find no correlation between *IAH* and income inequality; $r = +.02$ and a control for wealth reveals a positive effect, the partial correlation being +.40. Possible explanations for this counterintuitive result are discussed elsewhere in this issue (Ott 2005a).

The results are more in line with common sense in the case of gender inequality. *IAH* is systematically lower in nations where there is discrimination against women, $r = -.48$, but this correlation is much abated when wealth of the nation is 'controlled', the partial correlation being -.20.

Brotherhood

It is also commonly believed that people live happier in a climate of fraternity and that differences in happiness will be smaller in such conditions. This time common sense is supported by the data. In Table 2 one can see that the composite index *IAH* correlates positively with two of the three indicators of brotherhood, that is, with 'tolerance ($r = +.50$) and with trust in people ($r = +.54$). The correlations are quite sizable and appear to be largely independent of the wealth of the nation. Surprisingly, there is no correlation with voluntary work.

Justice

Lastly there are also good reasons to expect that social justice will improve the level of happiness in a nation and will reduce disparities. This expectation is corroborated in strong correlations of *IAH* to rule of law ($r = +.56$), respect for civil rights ($r = +.54$) and absence of corruption ($r = -.63$). 'Controlling' for wealth of a nation washes away much of this

correlation, but we must realize that this does not necessarily mean that the actual effects are negligible.

Explained variance

Together, these six societal qualities explain 85% of the differences in Inequality-Adjusted Happiness. This is probably a conservative estimate of the real effect, since the observed correlations are likely to be attenuated by measurement error.

4.3 Difference with unadjusted constituents

The index of Inequality-Adjusted Happiness was introduced as a means to combine the utilitarian and egalitarian creeds to give one outcome measure that can serve as an alternative to simple average happiness, which only reflects utilitarian value. Does *IAH* show us different things?

A view of the correlations yielded using adjusted and unadjusted happiness is presented in Table 3. These differences appear to be negligible. Inequality-Adjusted Happiness explains only 2% more of the variance in this set of independent variables than unadjusted mean happiness does. Still the main picture is that both indices explain a lot of variance (85% respectively 83%) and convey about the same message.

Likewise, the correlates of *IAH* are largely identical with those of inequality of happiness, though the explained variance is lower in this case (71% vs. 85%).

This all fits the observation of Ott (2005a) in this issue that utilitarian and egalitarian principles can be met in a common program.

5 TREND OVER TIME

To be useful for policy evaluation, the *IAH* must also reflect change over time. Does it? The trends over the last 30 years in the United States and the European Union are presented in Figure 3. These trends are clearly positive, Inequality-Adjusted Happiness rose 3.4 points in the USA and 3.0 points in the eight[5] first member states of the European Union.

There are also time series of at least 30 years for Japan and for -the European nations separately. An overview of the available data is presented in Table 4.

It appears that Inequality-Adjusted Happiness has increased in most developed countries Italy and Denmark witnessed particular great gains in *IAH*. Yet *IAH* has declined in Belgium and Japan

The data for the USA presented here should be regarded as a minimum estimate. This trend is based on the responses to a 3-step question on happiness. Responses to the 11-step ladder rating of ‘Best-Worst possible life (Cantril 1965) show an increase of 6.9 points over the period 1973-2004.

In most cases the rise in *IAH* is due to a simultaneous rise in the average level of happiness and a decrease in differences in happiness. In Japan average happiness stagnated while inequality of happiness increased slightly. In Germany the *IAH* rose until unification in 1990, then it dropped as a result of a slight drop in average happiness and a coincident widening of differences in happiness. Both developments were probably due to the temporary

costs of the unification and in particular to the massive migration that took place in the country.

6 DISCUSSION

What are the strengths and weaknesses of this new social indicator? Below we will first consider its technical qualities and next its use in the policy process.

6.1 Technical merits

The first question is whether this indicator conveys a clear substantive meaning. Further issues are its discriminating power and the availability of data.

Meaning

This measure of Inequality-Adjusted Happiness is meant to indicate how well a society meets the demands of utilitarian and egalitarian ideology. It does so by adjusting average happiness for inequality in happiness.

There are advantages and disadvantages to this combination. The main advantage is that this index conveys a broader meaning than each of its constituents separately does; it provides information about the degree to which both demands are met and warns against attainment of one at the cost of the other. A disadvantage is that a same score can represent different situations, especially in the medium range: an *IAH*-score of 50 can result from the combination of low average - high inequality, but also from the combination high average - low inequality. Any projection of a vector space onto one with a lower dimensionality gives rise to loss of information and is justified only if this loss is relatively small. The proposal of the *IAH*-index is an attempt to minimize this loss.

This combination of level and inequality of happiness seems easy to understand and makes more sense than currently used indicators of societal performance such as the Human Development Index (UNDP 2000) and the Index of Social Progress (Estes 1984).

Differentiating power

We have shown above, that this measure differentiates well among contemporary societies. The scores vary from 20 to 74 on this 0 to 100 scale.

The cross-sectional analysis in Section 4 showed strong correlations with several societal characteristics and in particular with wealth, freedom and justice in nations. The six societal characteristics considered explained 68% of the observed differences in Inequality-Adjusted Happiness in nations. There is no doubt that we could explain even more happiness variability if we took more societal traits into account.

The trend analysis presented in Section 5 also showed that this measure of Inequality-Adjusted Happiness is sensitive to change over time. The pattern of change observed in rich countries over the last 30 years is fairly consistent and signifies social progress.

Data availability

This social indicator is based on responses to questions about happiness in representative samples of the general population in different nations. At this moment, such data are available for 90 nations and cover about two-third of the world's population. The variation among these nations is sufficiently great to reveal the relationship of *IAH* with societal organization (cf. Section 4). As yet *IAH* cannot be computed for all the nations of the present

world, in particular not for nations in the Middle East and for many nations in Africa. Hopefully this will change in the coming decades.

As yet time series on happiness are only available for a handful of rich nations and cover no more than 15 to 40 years However increasingly longer time series are emerging from various periodical survey programs, such as the Euro-barometer, the European Welfare Survey, The International Social Survey Program and the World Value Survey.

6.2 Policy use

This measure of Inequality-Adjusted Happiness is helpful for policy makers who try to raise the average level of happiness in the country while minimizing inequality of happiness. Firstly, observations with this measure inform them about the distance to ideal. In Appendix C they can see the gap between current score of their country and the theoretical maximum of 100. Table 1 informs them also about the gap with what is realistically possible, when they compare their country with the one that scores best (currently Malta with a score of 80). Policy makers can also see in Appendix C how their country performs in comparison to other nations and can assess whether they are doing better or worse than similar countries. Lastly, *IAH* helps to find ways to improve the performance of the country. The correlations in Table 4 inform them about the conditions that are likely to enhance the level of happiness of citizens and at the same time decrease inequality of happiness among them.

Better than the mere mean?

Is this index of Inequality-Adjusted Happiness more useful for the policy process than just using a simple average happiness as a measure? It depends, both on the countries under consideration and on the purpose the measure is used for.

Among the most happy nations of the present day world *IAH* does not add much additional information, since a high level of happiness is typically accompanied with low inequality and therefore produces similar *IAH* scores. Yet among the not-so-happy nations there is less confluence of average and dispersion and is *IAH* therefore more informative. Remember figure 2, which showed a cluster of high happiness and high inequality as well as a cluster of low happiness and high inequality.

If used for assessing how well the country is doing, *IAH* provides additional information, in particular for the not-so-happy nations. The more mean and standard deviation diverge, the more useful this summary measure. When used for getting a view on ways for improving performance, the mean would seem to do equally well, since the correlations with societal conditions are almost identical (cf. Table 4). In this line Ott (2005a) concludes in this issue that utilitarians and egalitarians end up using the same policy for different reasons. Yet this is not self evident; but is something that we learned using this measure. Moreover, this coincidence may be specific for this set of nations at this present time. It is conceivable that we will get into situations where utilitarian and egalitarian principles dictate different policies and where this index can be used to help to identify workable compromises.

The use of this *IAH*-index is that it provides an evidence base for discussions about the best ways to combine the principles of utilitarianism and egalitarianism. It helps to identify the policy directions that do so. Egalitarians will not be convinced by data on average happiness alone.

Public appeal

For the same reason, the *IAH*-index is likely to have considerable public appeal. People have reservations about 'mere' utilitarianism and this principle will be better accepted when combined with egalitarianism, even if this is not of real consequence. In a similar vein Ott

(2005b; in preparation) argues that 'negative' utilitarianism is more acceptable than standard utilitarianism even though the practical implications of these principles do not differ.

7 CONCLUSION

The degree to which a society meets the principles of utilitarianism and egalitarianism simultaneously can be measured using a linear combination of the level and dispersion of happiness. This measure can be expressed as a number on a 0 to 100 scale and is called 'Inequality-Adjusted Happiness', abbreviated as *IAH*. This measure can be applied to nations and shows good differentiation at this level, both when compared across borders and over time. Scores on this index show how well their country is doing and correlations of *IAH* with societal characteristics indicate ways to improve performance.

Table 1
Inequality-Adjusted Happiness in nations in the 1990
Scores on 0-100 *IAH*-index; some illustrative cases

Top 5		***Middle 5***		***Bottom 5***	
Malta	74	USA	55	Armenia	29
Denmark	73	Philippines	54	Ukraine	28
Switzerland	73	Iran	51	Moldova	27
Iceland	72	South Korea	49	Zimbabwe	23
The Netherlands	71	India	48	Tanzania	20

Full list of nations on Appendix C
Source: World Database of Happiness, Distributional Findings in Nations, Rank Report 2004/4c

Table 2
Inequality-Adjusted Happiness and societal characteristics in 90 nations in the 1990s

Condition in nation	***Correlation*[6] *with IAH***		***N***
	Zero-order	*Wealth 'controlled'*	
Wealth			
• Purchasing power per head	+.68	--	78
Security			
• Lethal accidents	-.51	-.41	57
• Social security	+.32	-.11	62
Freedom			
• Economic	+.61	+24	88
• Political	+.43	+.11	87
• Personal *	+.51	+.13	39
Inequality			
• Disparity in incomes	+.02	+.40	83
• Discrimination of women	-.48	-.20	57
Brotherhood			
• Tolerance	+.50	+.43	79
• Trust in people	+.41	+.16	79
• Voluntary work	-.00	+.18	71
Justice			
• Rule of law	+.56	+.01	75
• Respect of civil rights	+.54	+.21	87
• Corruption	-.63	-.14	72
Explained variance: Adjusted R^2	85 %		

Indicators described in Appendix D
* = Not included in R^2 due to limited number of cases. N = Number of nations

Table 3
Inequality-Adjusted Happiness and societal characteristics in 90 nations in the 1990s

Condition in nation	***Correlation with***			*N*
	Inequality-Adjusted Happiness *IAH*	*Average Happiness* *Mean*	*Inequality of Happiness* *Standard deviation*	
Wealth				
• Purchasing power per head	+.68	+.66	-.64	78
Security				
• Lethal accidents	-.51	-.51	+.37	57
• Social security	+.32	+.27	-.51	62
Freedom				
• Economic	+.61	+.59	-.48	88
• Political	+.43	+.43	-.34	87
• Personal *	+.51	+.44	-.74	39
Inequality				
• Disparity in incomes	+.02	+.06	+.29	83
• Discrimination of women*	-.48	-.45	+.38	57
Brotherhood				
• Tolerance	+.50	+.50	-.33	79
• Trust in people	+.54	+.37	-.50	79
• Voluntary work*	-.00	+.04	+.22	71
Justice				
• Rule of law	+.56	+.53	-.57	75
• Respect of civil rights	+.54	+.54	-.44	88
• Corruption	-.63	-.60	+.65	71
Explained variance: Adjusted R^2	85 %	83 %	71 %	

Indicators described on appendix D. Data: World Database of Happiness, States of Nations.
* = Not included in regression due to limited number of cases. N = Number of nations

Table 4
Trend Inequality-Adjusted Happiness in 11 rich nations
Change 1973-2004 in points on 0-100 scale

Rise *Significant increase*		***Stable*** *No significant change*		***Decline*** *Significant decrease*	
Italy	+10.57	Ireland	+2.05	Japan	–3.50
Denmark	+5.12	Britain	+1.36	Belgium	–6.14
USA	+3.35	Netherlands	+0.90		
Luxembourg	+3.32	Germany (West)	+0.59		
France	+3.22				

Data: World Database of Happiness, Distributional Findings in Nations, Trend Report 2005/4c

Figure 1

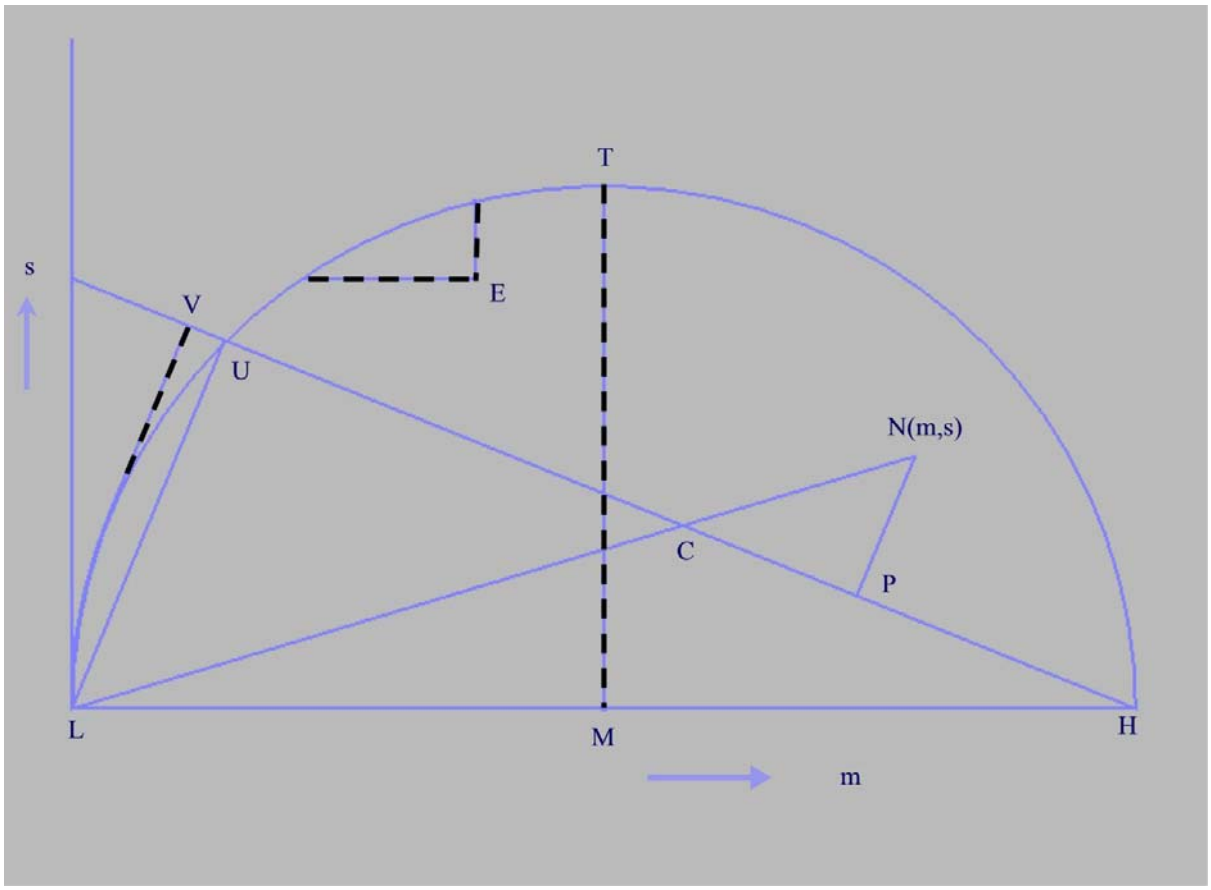
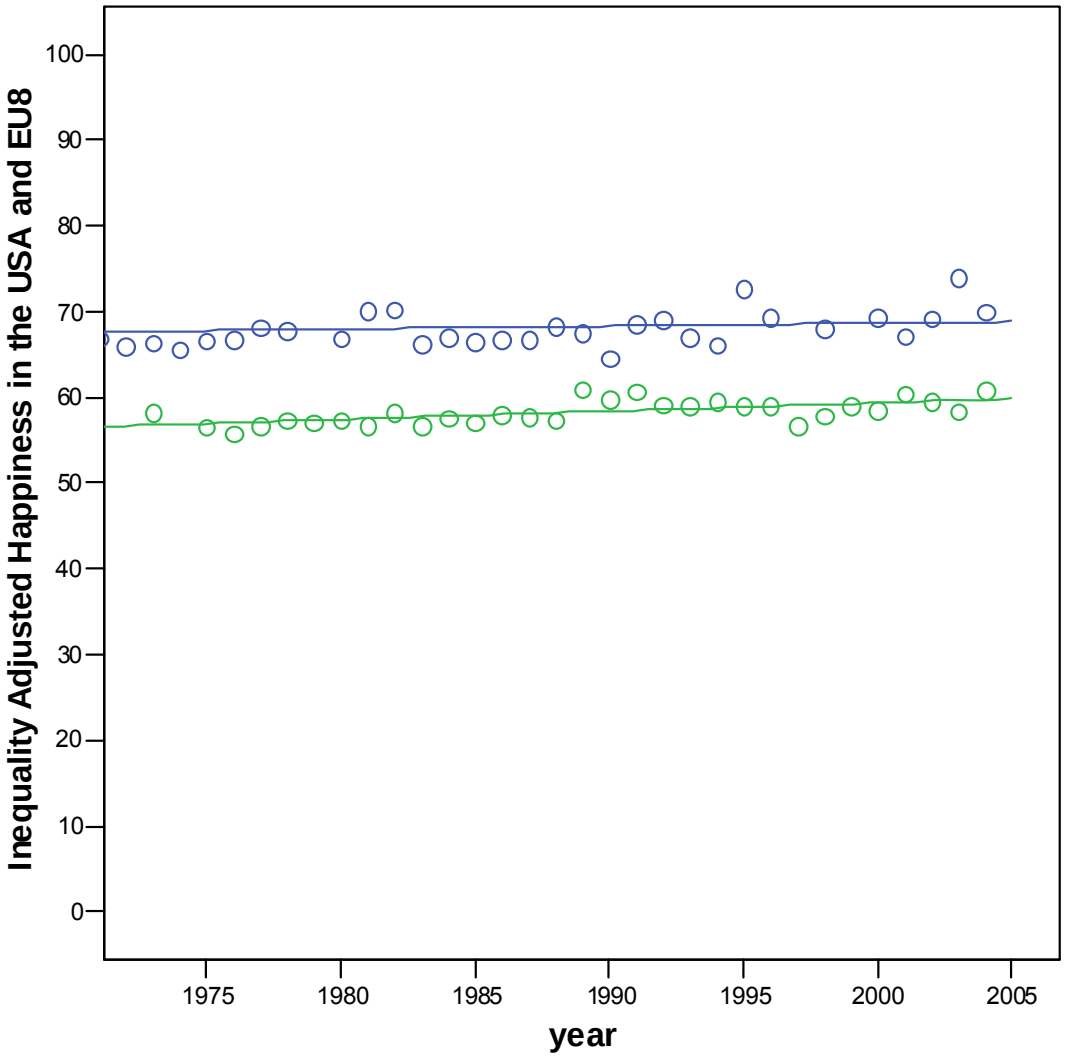


Figure 2
Plot of level and inequality of happiness in 90 nations in the 1990s

Data: World Database of Happiness, Distributional Findings in Nations, Rank Report 2004/4d
Nation codes in Appendix C. Due to space limitation not all cases are presented in this plot.
The straight line is the axis onto which nations are projected orthogonally in order to obtain IAH values

Figure 3
Inequality-Adjusted Happiness in the USA and EU8
Trends 1973-2004



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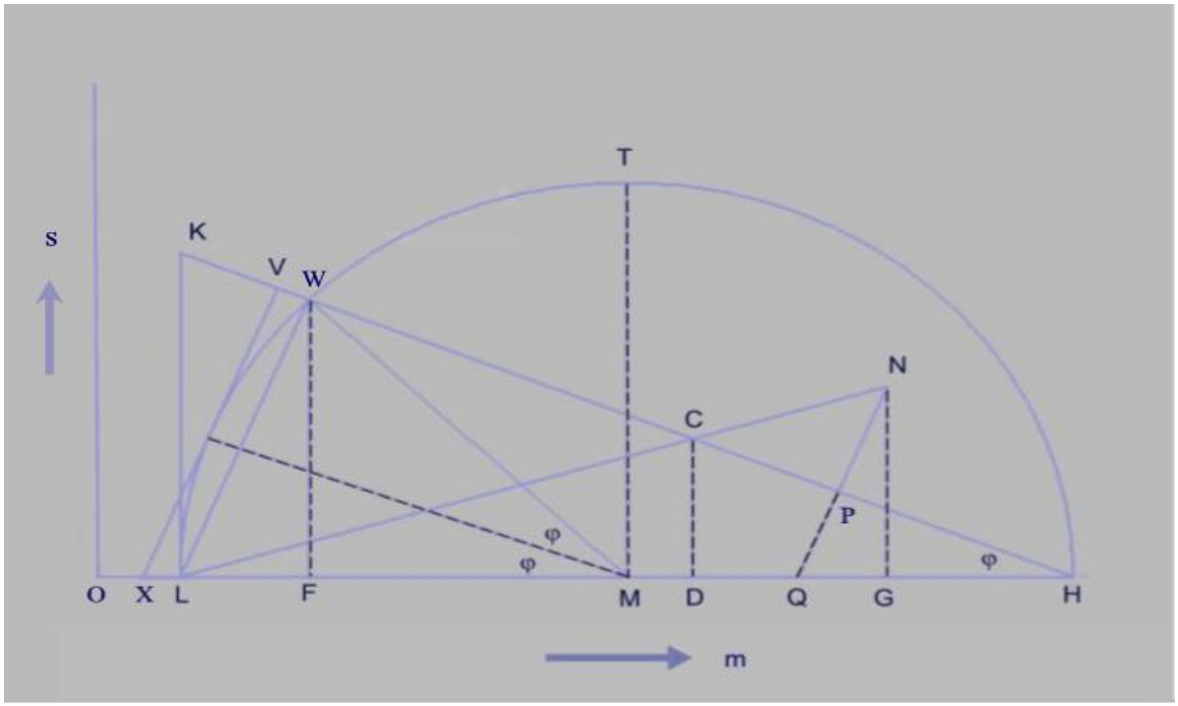
Appendix A
Computation of the Inequality-Adjusted Happiness Index

For the exact position of the most miserable society in the *m-s*-diagram, one has to quantify the weights given to the both views on happiness. Let these be w_E and w_U for egalitarians and utilitarians respectively, where $0 \leq w_E \leq 1$, $0 \leq w_U \leq 1$ and $w_E + w_U = 1$

In Fig. 4 the point W, that represents this society, can be found by dividing the arc TL into two parts according to these weights. Since arc (TL) = $\pi/2$ radians (i.e. 90°), arc (LW) = $w_E \cdot \pi/2$ and arc (WT) = $w_U \cdot \pi/2$.
The angle LMW equals $w_E \cdot \pi/2$ radians and the angle WHL (denoted φ) has half its value = $w_E \cdot \pi/4$ radians.
If the assumption $w_E = w_U = 0.5$ is made, $\varphi = \pi/8$ (i.e. 22°30'). This value of φ has been adopted throughout this appendix, whenever a numerical value has been substituted. For unequal weights, the value of φ in the various formulae has to be adjusted accordingly.

Figure 4



We define $b := |h - u|$, where h is the rating corresponding with the most happy situation and u ($0 \leq u < h$) that with the unhappiest situation. For a k-points rating scale [1;k], $b = k - 1$.
Moreover we apply the notation $\underline{LH}$ for the length of the line segment LH, so $\underline{LH} = \underline{HL} = b$ and $u = \underline{OL}$, where O is the origin of the *m-s*-diagram.

If in the case the **orthogonal projection** the point W is chosen as the one in which the Inequality-Adjusted Happiness *IAH* has a zero value, the calculation of *IAH* is very simple.

The coordinates of W in the above *m-s*-diagram are:

$$m_U = u + \underline{LF} = u + \underline{LM} - \underline{FM} = u + \tfrac{1}{2} b(1 - \cos(2\varphi)), \quad (1)$$

and

$$s_U = \underline{WF} = \tfrac{1}{2} b \sin(2\varphi). \quad (2)$$

For $u = 0$, $b = 10$ and $\varphi = \pi/8$, $m_W = 1.46$ and $s_w/m_w = 2.41$.
Therefore, in that case for all points inside the semicircle segment LW:

$$m < m_w = 1.46 \text{ and } s/m > s_w/m_w = 2.41.$$

Since in Fig. 2 WL and NQ are parallel (both are perpendicular to HW), $IAH = (\underline{WP} / \underline{WH})$ x100 = $(\underline{LQ} / \underline{LH})$ x100. If the coordinates of N are m and s respectively, $\underline{LQ} = \underline{LG} - \underline{QG} = (m - u) - s.\tan\varphi$, so

$$IAH_o = 100\ (m - u - s.\tan\varphi)/b, \qquad (3)$$

where $\tan\varphi = 0.414$ for "equal weights". The index o in IAH_o indicates that the projection is orthogonal, whereas IAH_c will indicate that central projection has been applied.

If, however, one sticks to the condition that, for any theoretically possible (m,s) combination $0 \leq IAH \leq 100$, it is the point V that corresponds to $IAH_o = 0$.
In this case $IAH_o = (\underline{VP} / \underline{VH})$ x 100 = $(\underline{XQ} / \underline{XH})$ x 100, X being the point of intersection of the tangent and the m-axis. Now

$$\begin{aligned} \underline{XQ} &= \underline{XL} + \underline{LQ} \\ &= \underline{VW}/\cos\varphi + (m - u - s.\tan\varphi) \\ &= (\underline{LM} - \underline{LM}\cos\varphi)/\cos\varphi + (m - u - s.\tan\varphi) \\ &= \tfrac{1}{2}\, b(1/\cos\varphi - 1) + (m - u - s.\tan\varphi), \end{aligned}$$

and $\underline{XH} = \tfrac{1}{2}\, b(1/\cos\varphi + 1)$.

Therefore

$$IAH_o = 100 \text{ x } [m - u - s.\tan\varphi + \tfrac{1}{2} b(1/\cos\varphi - 1)]/[\tfrac{1}{2}\, b(1/\cos\varphi + 1)]. \qquad (4)$$

Substitution of $\cos\varphi = 0.924$ and $\tan\varphi = 0.414$ results in

$$IAH_o = 96.0(m - u - 0.414.s)/b + 3.96. \qquad (5)$$

As one might have expected, IAH_o is obtained by linear transformation of m and s, irrespective of the choice of the zero point. Note that in this context the term "linear transformation" has a meaning that is not identical to the one in the case of "linear transformation of happiness scores" as used in Appendix B.

For the **central projection**, the coordinates of C (m_C, s_C) as point of intersection of HW and NL follow from

$$\begin{aligned} & b = \underline{LD} + \underline{DH}, \\ & \underline{LD} / \underline{CD} = \underline{LG} / \underline{NG} = (m_N - u) / s_N, \\ & \underline{CD} = s_C, \\ & \underline{DH} = s_C / \tan\varphi, \\ \text{and} \quad & (m_C - u) / s_C = (m_N - u)/s_N . \end{aligned}$$

The result is

$$s_C = b/(m_N/s_N - u/s_N + 1/\tan\varphi) \qquad (6)$$

In this formula, it is assumed that $s_N > 0$.
In the case where W is selected as the point with $IAH_c = 0$,

$$\begin{aligned} IAH_c &= (\underline{WC} / \underline{WH}) \text{ x } 100 \\ &= 100 \text{ x } (\underline{WF} - \underline{CD})/ \underline{WF} \\ &= 100.[\tfrac{1}{2}\, b\sin(2\varphi) - b/(m_N/s_N - u/s_N + 1/\tan\varphi)]/[\tfrac{1}{2}\, b\sin(2\varphi)] \\ &= 100 - 200/[(m_N/s_N - u/s_N + 1/\tan\varphi).\sin(2\varphi)] \qquad (7) \end{aligned}$$

Substitution of $\tan\varphi = 0.414$ and $\sin(2\varphi) = 0.707$ gives

$$\begin{aligned} IAH_c &= 100 - 283/(m_N/s_N - u/s_N + 2.41) \quad s_N > 0, \\ &= 100 \quad s_N = 0. \end{aligned} \qquad (8)$$

If however, it is required that $0 \leq IAH \leq 100$, it is the point K that corresponds to $IAH_c = 0$.
In this case

$$\begin{aligned} IAH_c &= (\underline{KC} / \underline{KH}) \times 100 \\ &= [(\underline{KL} - \underline{CD})/\underline{KL})] \times 100. \\ &= 100 \times [b.\tan\varphi - b/(m_N/s_N - u/s_N + 1/\tan\varphi)]/(b \tan\varphi) \\ &= 100 - 100/[1 - u \tan\varphi /s_N + (m_N/s_N).\tan\varphi]. \end{aligned} \qquad (9)$$

Substituting $\tan\varphi = 0.414$ gives

$$IAH_c = 100 - 100/(1 - 0.414\, u/s_N + 0.414 m_N/s_N) \qquad (10)$$

In the case $u = 0$, IAH_c is a monotonically increasing function of the ratio m/s only.
Comparison of the formulae (3), (5), (8) and (10) reveals that b occurs in the formulae for IAH_o, but not in those for IAH_c. However, the suggestion that the value of the former one is dependent on the number of possible ratings of the happiness measuring scale, whereas the latter is not, is false.
In the formulae for IAH_o, b acts as a scaling factor for both $m - u$ and s. In the case of central projection, there is an 'internal scaling', since both $(m - u)$ and s are measured on the same scale and only their *ratio* occurs in the formulae for the index.

NOTE: Some researchers prefer to use a 'reversed scale', i.e. a scale at which the most happy situation corresponds to the lowest ranking number h; in that case $h \leq m \leq u$.
If one also wants to include these cases, in the formulae (3) to (10) inclusive the difference $m_N - u$ must be replaced with its absolute value $|m_N - u|$.
For formula (10) this generalization results in

$$IAH_c = 100 - 100/(1 + 0.414 \cdot |m_N - u| /s_N) \qquad (11)$$

The ratio m/s is easily recognized as the reciprocal of s/m, a statistic that is often called the "relative standard deviation" or the "coefficient of variation" and is usually reported as a percentage. This statistic is a measure for the dispersion in a distribution. As such it is defined only when the variable is measured at the ratio level of measurement. However, happiness is measured at best at the interval level. At first glance, one might conclude that, if the coefficient of variation is not defined and hence does not exist, its reciprocal value cannot exist. This conclusion is not correct.
The condition that the variable is to be measured on the ratio scale arises from the fact that it should have a natural zero. The problem is not that m occurs in the ratio s/m, but that m occurs just in its denominator. For its reciprocal ratio, this problem does not exist for s, since s is defined in such a way that it is nonnegative and has a natural zero, and in a way can be considered to be a variable at the ratio level. Hence the fact that s/m is not defined is not an argument in itself against the use of m/s in this index of Inequality-Adjusted Happiness.

Appendix B
Linear transformation of scores onto another rating scale

For happiness ratings, different scales are in use. Happiness is typically measured by self-report and cross-national studies on happiness mostly used single questions. An example of a commonly used item is presented below:

"Taking all together, how satisfied or dissatisfied are you currently with your life as a whole?"

1 2 3 4 5 6 7 8 9 10

Dissatisfied Satisfied

In this case, happiness is rated on a 10-step numerical scale. Other items use verbal rating scales, e.g., the 4-step rating scale

'very happy', 'fairly happy', 'not too happy' and 'unhappy'.

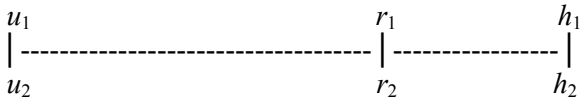
Happiness may be also rated on pictorial scales using smilies and other graphical scales.
Whatever the scale used, the respondent has to select one out of a limited number of discrete ratings, which is recorded eventually as a number, in the above scales one of the numbers from the sets {1(1)10} and {1(1)4} or e.g. {0(1)3} respectively.

For comparing results obtained by using different scales, the results of the primary numerical scale are subjected usually to a linear transformation onto a common 'secondary' scale. Below, we shall give the formulae to be used for this transformation.

Let r_1 = the rating on the primary scale,
h_1 = the rating on the primary scale for the most happy situation, and
u_1 = ditto for the most unhappy situation.
In the above first example $u_1 = 1$ and $h_1 = 10$.
The ratings after transformation will be denoted r_2, h_2 and u_2 respectively.
In most studies $h > u$ is chosen, so $u \leq r \leq h$. Some researchers, however, prefer $u > h$ and in the latter case $h \leq r \leq u$.

The three underlying assumptions for the linear transformation of happiness ratings are:
(a) the possible ratings of the primary scale can be considered as 'equidistant', so it is admissible to process the ratings as observations at the 'metric' level of measurement,
(b) $u_1 \rightarrow u_2$, and
(c) $h_1 \rightarrow h_2$.
The last two assumptions mean that the extreme possible ratings of the primary and the secondary scale are supposed to correspond perfectly to the same verbal or pictorial description label.

The situation in which $h_1 > u_1$ and $h_2 > u_2$ can be represented as follows:



From the proportionality

$$(r_1 - u_1)/(r_2 - u_2) = (h_1 - u_1)/(h_2 - u_2), \qquad (1)$$

it follows for the linear transformation, that

$$r_1 \rightarrow r_2 = u_2 + (r_1 - u_1)(h_2 - u_2)/(h_1 - u_1). \qquad (2)$$

As the reader can verify easily, this formula also holds in case $h_1 < u_1$ and/or $h_2 < u_2$.

The formula (2) can also be applied to the linear transformation of **mean values** *m*:

$$m_1 \rightarrow m_2 = u_2 + (m_1 - u_1)(h_2 - u_2)/(h_1 - u_1). \quad (3)$$

For the corresponding **standard deviation** s, the transformation formula is

$$s_1 \rightarrow s_2 = s_1 \cdot |(h_2 - u_2)/(h_1 - u_1)|. \quad (4)$$

This is based on the fact that, when *x* is a random variable and a and *c* are constants, then

$$\text{var}\,(ax+c) = a^2 \,\text{var}\,(x), \quad (5)$$

so

$$\text{s}(ax+c) = a \cdot \text{s}(x). \quad (6)$$

Example.
As an example we consider the transformation of $m_1 = 2.15$ and $s_1 = 0.64$ as the results of measurements obtained using the above 4-step rating scale

1 2 3 4
'very happy', 'fairly happy', 'not too happy', 'unhappy'.

We want to transform those statistics onto an 11-step scale with $u_2 = 0$ and $h_2 = 10$. This is the usual secondary scale in studies of happiness in nations.
In that case the corresponding transformation formulae are

$$m_1 \rightarrow m_2 = 10 \cdot (m_1 - u_1)/(h_1 - u_1) \quad (7)$$

and

$$s_1 \rightarrow s_2 = 10 \cdot s_1/|h_1 - u_1|. \quad (8)$$

Inserting $h_1 = 1$, $u_1 = 4$, $m_1 = 2.15$ and $s_1 = 0.64$ respectively results in the values $m_2 = 6.17$ and $s_2 = 2.13$ for the corresponding statistics on the [0;10] scale.

Appendix C
Inequality-Adjusted Happiness in 90 nations in the 1990s

Nation	**Code** *ISO*	***Level of life satisfaction*** *Mean 0-10*	***Inequality in life-satisfaction*** *Standard deviation*	***Inequality-Adjusted life satisfaction*** *IAH- index 0-100*
Albania	al	4.6	2.5	**38**
Algeria	dz	5.2	3.2	**41**
Angola	ao	4.8	2.5	**40**
Argentina	ar	6.8	2.5	**60**
Armenia	am	3.7	2.6	**29**
Australia	au	7.3	2.1	**66**
Austria	at	7.0	2.1	**62**
Azerbaijan	az	4.9	2.6	**41**
Bangladesh	bd	5.7	2.5	**48**
Belarus	by	4.3	2.5	**36**
Belgium	be	7.3	2.2	**65**
Bolivia	bo	6.0	2.6	**51**
Bosnia	ba	5.1	2.6	**43**
Brazil	br	7.0	2.8	**60**
Great Britain	gb	7.2	2.2	**64**
Bulgaria	bg	4.5	2.7	**37**
Canada	ca	7.6	2.0	**69**
Chile	cl	6.9	2.4	**60**
China[1]	cn	6.5	2.6	**56**
Colombia[1]	co	8.1	2.2	**73**
Croatia	hr	5.9	2.5	**51**
Czech Rep.	cz	6.7	2.2	**60**
Denmark	dk	8.0	2.1	**73**
Dominican Rep	do	6.8	2.7	**58**
Egypt	eg	4.8	3.7	**36**
El Salvador	sv	7.2	2.7	**63**
Estonia	ee	5.2	2.4	**44**
Finland	fi	7.5	1.9	**69**

France	fr	6.6	2.2	**58**
Georgia	ge	4.1	2.9	**31**
Germany	de	7.1	2.2	**64**
Ghana[1]	gh	7.7	2.4	**69**
Greece	gr	6.3	2.4	**55**
Guatemala	gt	7.6	2.4	**67**
Honduras	hn	7.2	2.6	**62**
Hungary	hu	5.5	2.7	**46**
Iceland	is	7.8	1.8	**72**
India	in	5.7	2.7	**48**
Indonesia	id	6.6	2.3	**58**
Iran	ir	6.0	2.7	**51**
Ireland	ie	7.8	2.1	**71**
Israel	il	6.7	2.4	**59**
Italy	It	6.9	2.3	**61**
Ivory Coast	ci	5.9	2.5	**51**
Japan	jp	6.2	2.1	**55**
Jordan	jo	5.1	2.8	**42**
Kenya	ke	5.5	2.4	**47**
Latvia	lv	4.8	2.6	**40**
Lebanon	lb	5.6	2.5	**48**
Lithuania	lt	4.9	2.9	**39**
Luxembourg	lu	7.6	2.1	**68**
Macedonia	mk	4.9	2.7	**40**
Mali	ml	5.2	2.1	**45**
Malta	mt	8.0	1.8	**74**
Mexico	mx	7.5	2.5	**66**
Moldova	md	3.5	2.6	**27**
Montenegro	yum	5.5	2.5	**46**
Morocco	ma	5.6	2.8	**47**
The Netherlands	nl	7.6	1.6	**71**
New Zealand	nz	7.4	2.3	**66**
Nigeria	ng	6.5	2.7	**55**
Norway	no	7.4	2.0	**67**
Pakistan	pk	4.3	1.6	**39**

Peru	pe	6.0	2.7	**51**
Philippines	ph	6.4	2.7	**54**
Poland	pl	5.9	2.8	**50**
Portugal	pt	6.7	2.3	**60**
Romania	ro	4.7	3.1	**37**
Russia	ru	4.4	2.6	**35**
Senegal	sn	5.9	2.4	**51**
Serbia	yu	5.1	2.7	**42**
Singapore	sg	6.9	2.0	**63**
Slovakia	sk	5.6	2.5	**48**
Slovenia	si	6.3	2.4	**55**
South-Africa	za	5.6	3.1	**45**
South-Korea	kr	5.8	2.6	**49**
Spain	sp	6.6	2.2	**59**
Sweden	se	7.6	2.0	**69**
Switzerland	ch	8.0	1.9	**73**
Taiwan	tw	6.6	2.3	**58**
Tanzania	tz	3.2	3.6	**20**
Turkey	tr	5.6	3.0	**46**
Uganda	ug	5.2	2.7	**43**
Ukraine	ua	3.6	2.7	**28**
Uruguay	uy	6.7	2.6	**59**
USA	us	7.4	2.1	**67**
Uzbekistan	uz	6.4	2.6	**55**
Venezuela	ve	6.8	3.1	**57**
Viet Nam	vn	6.1	2.3	**54**
Zimbabwe	zw	3.3	3.1	**23**

1) Findings in some countries are not beyond doubt, in particular in Colombia where surveys using another question found a relatively lower degree of life-satisfaction.

Appendix D

Characteristics of nations, used in correlational analysis

Wealth	
• Income	Purchasing power per head in 1995 Human Development Report 1999, table 1 (UNDP)
Security	
• Murder rate	Medical registration of cause of death UN-DY 1998 table 21
• Lethal accidents	Medical registration of cause of death UN-DY 1998 table 21
• Social security	Expenditures in percent of GDP ILO 1995
Freedom	
• Economic	Index of economic freedom 1999. Heritage Foundation
• Political	Index of suppression of political rights 1994-95 (reversed) Karantnycky et. Al. 1995
• Personal	Index of freedom in personal life. Involves absence of restrictions to traveling, religion, marriage, sex and suicide. Both legal restrictions and public acceptance Veenhoven 2000b
Inequality	
• Income Inequality	Gini index Human Development Report 2001 table 12 (UNDP)
• Gender Inequality	SIGE index of gender inequality Dijkstra 2000
Brotherhood	
• Tolerance	Responses to survey questions about the kind of people one would like to have as a neighbor. World Value Surveys 1990-1995, items 51-60
• Trust in people	Responses to survey question World value Surveys 1990-1995, item 165
• Voluntary work	Responses to survey questions World Value Surveys 1990-1995, items 28-35
Justice	
• Rule of law	Aggregated survey data on extent to which respondents have confidence in, and abide by, the rules of society; perceptions of the incidence of violent and non-violent crime, the effectiveness and predictability of the judiciary and the enforceability of contracts Kaufmann et al 1998
• Violation of civil rights	Index of suppression of civil rights 1994-95 Karantnycky et. al. 1995
• Corruption	Rating by foreign businessmen and journalists Transparency International

Notes:

[1] We prefer to use the term "inequality" to "equality". The former exists in gradations and can be quantified, e.g. with the standard deviation. This does not apply to "equality", which is basically a "zero-inequality".

[2] Usually, for *u* the rating with the lowest number on the measurement scale is selected ($u \leq m \leq h$). However, some researchers prefer to use a 'reversed scale', i.e. a scale at which the most happy situation corresponds to the lowest ranking number *h;* in that case $h \leq m \leq u$. The use of the absolute value of the difference $m–u$ in the above formula enables also the application of the *IAH*-index to reversed scale situations.

[3] Computation based on Appendix A in Kalmijn & Veenhoven 2005, gives maximal possible values for the standard deviation of 4.5, 4.2 and 3.7 for the mean 6,7 and 8 respectively on a 1 to 10 step scale.

[4] In this paper the term “controlled for” in partial correlation situations does not refer to variables that are ‘under control’; often such variables are not controllable at all. "Controlled for wealth" is a shorthand expression for “after having accounted ‘wealth’ as a source of variation for its maximum possible contribution to the total happiness variability”.

[5] The nations that participate in the EuroBarometer survey since 1973 are: Belgium, France, West Germany, Great Britain, Ireland, Italy, Luxembourg and The Netherlands. Figure 3 presents average IAH scores, weighted by population size.

[6] We do not report the statistical significance of correlations. This is because this set of nations cannot be considered a random sample of all countries on earth. Since the correlation coefficients are descriptive statistics in this case, it makes no sense to calculate confidence limits fro the true, but unknown correlation in the population or to report a statistical significance.