

Happiness Studies: Ways to Improve Comparability and Some Public Policy Implications*

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Recent happiness studies by psychologists, sociologists and economists have produced many interesting results. These have important implications, including the need to focus less on purely objective (including economic) variables and more on subjective well-being. In particular, the focus on GDP should be supplemented (if not replaced) by more acceptable national success indicators such as the environmentally responsible happy nation index. Welfare economics and cost–benefit analysis that are currently based on economic factors (which are in turn based on preferences) should be revised to be based on happiness or welfare. Public spending on areas important for welfare should be preferred over private consumption that is largely no longer important for long-term welfare at the social level. Public policy should put more emphasis (than suggested by existing economic analysis) on factors more important for happiness than economic production and consumption, including employment, environmental quality, equality, health and safety. Above all, scientific advance in general and in brain stimulation and genetic engineering in particular may offer the real breakthroughs against the biological or psychological limitations on happiness. Some simple ways to improve the accuracy and comparability (including interpersonal) of happiness measurement are suggested: pinning down the level of neutrality, recognising the possible nonlinear scale used in self-reports, and using the just perceivable increment of pleasure as the interpersonally comparable unit.

I Introduction

The last decade witnessed the widespread interest in happiness studies. Instead of being largely confined to sections of psychologists and sociologists, intense

interest has spread to other disciplines, notably economics, and to the general public, with numerous reports on results of happiness studies in the popular press. In economics, apart from numerous papers on economics and happiness (from the three *Economic Journal* papers by Frank (1997), Oswald (1997) and Ng (1997) to the *Journal of Economic Perspective* Symposia on Happiness Economics by Kahneman and Krueger (2006) and Di Tella and MacCulloch (2006), there are also notable monographs (e.g. Frey & Stutzer, 2002a; Van Praag & Ferrer-I-Carbonell 2004; Layard, 2005; Offer, 2006) and collected volumes (e.g.

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Easterlin, 2002; Bruni & Porta, 2005; Ng & Ho, 2006).

This paper suggests some simple ways to improve the (including interpersonal) comparability of happiness and explores some policy implications of results in happiness studies using mainly conceptual and non-technical analysis. It should be of interest and accessible not only to professional economists but also to policy-makers and researchers in happiness studies other than economists. Of course, the policy implications of results in happiness studies and related issues have not escaped the attention of scholars, including economists. Thus, Frank (1999), Ireland (1998), Layard (2005) and others have all written on the implications (especially on taxation) of relative competition and the failure of increases in incomes to increase happiness at the social level. However, while some repetition is unavoidable and not necessarily undesirable, this paper hopes to make some additional contributions.

II Reliability and Comparability of Happiness Measures

Happiness studies are largely based on self-reports. Typically a sample of individuals is asked to rank their own happiness levels over a specified period by ticking an answer (out of, say, very happy, fairly happy, not too happy, unhappy) or choosing a number between, say, 0 and 10. Economists are very sceptical of self-reports. Their professional training makes them trust people's purses (actual willingness to pay), not their mouths (cheap talk). This makes them very sceptical of happiness studies. Their scepticism has some validity. However, there are persuasive arguments that existing measures of happiness, though imperfect, are rather reliable. For example, different measures of happiness correlate well with one another (Fordyce, 1988), with recalls of positive vs. negative life events (Seidlitz *et al.* 1997), with reports of friends and family members (Diener, 1984; Costa & McCrae, 1988; Sandvik *et al.* 1993), with physical measures like heart rate and blood pressure measures (Shedler *et al.*, 1993), with EEG measures of prefrontal brain activity (Sutton & Davidson, 1997), and with more objective measures of well-being like the incidence of depression, poor appetite and sleep (Luttmer, 2005). Pavot (1991) finds that respondents reporting that they are very happy tend to smile more. Di Tella and MacCulloch (2000) note that psychologists who study and give advice on happiness for a living use happiness data. 'Presumably, if markets work and there was a better way to study well-being, people who insist on using bad data would

be driven out of the market' (pp. 7–8). Moreover, correlations of happiness show remarkably consistency across countries, including developing and transitional economies (Graham & Pettinato, 2001, 2002; Namazie & Sanfey, 2001).

Dominitz and Manski (1999) examine the scientific basis underlying economists' hostility against subjective data and found it to be 'meager' and 'unfounded'. Rather, 'survey respondents do provide coherent, useful information when queried systematically'; see Manski (2000, p. 132). Despite remaining problems of happiness measurement (see e.g. Schwarz & Starack, 1999; Bertrand & Mullainathan, 2001), reported happiness indices may be used as good approximations (Frey & Stutzer, 2002b) and 'happiness surveys are capturing something meaningful about true utility' (Di Tella & MacCulloch, 2006, p. 28). For a meta-study of reliability, see Vassar (2008).

While the scepticism of many economists of happiness studies may be excessive, it is true that the reliability and comparability of results in happiness studies are open to question and should be improved. In particular, the comparability problem is very important. Suppose that people 50 years ago with happiness level of X (where X is positive) typically described themselves as very happy or awarded themselves a happiness value of 8 (out of the range of 0–10), while people now with happiness level of $2X$ typically describe themselves as only fairly happy or award themselves a happiness value of just 6.5. Then, an apparently unchanged reported happiness value over time may actually hide a very big increase in happiness. For example, 50 years ago, the average happiness level might equal $0.8X$ and the average reported value might equal 7.5. Now, the average happiness level might equal $3X$ but the average reported value may still equal 7.5. Thus, despite a more than tripling (from $0.8X$ to $3X$) in the average happiness level, the average reported value may remain unchanged. While there are many well-known problems affecting self-reports, like the emotion effects and framing effects, these are likely to affect the individual reported values both ways and unlikely to have large effects on the average values. They are likely to be relatively much less important than the comparability problem just discussed. In the following, three neglected problems of comparability and simple ways to overcome them are discussed.

First, the usually adopted classifications of 'very happy, fairly happy, not too happy, unhappy', or 'very satisfied (with life), fairly satisfied, not too satisfied, unsatisfied' do not locate the level of neutrality precisely. The classification of 'not too

happy' or 'not too satisfied' could mean a level of net happiness or satisfaction level below neutrality (zero) or some unspecified small amount of net positive happiness/satisfaction.¹ The level of neutrality (with positive happiness just offsetting unhappiness to yield a zero amount of net happiness) has a particular interpersonal significance. Irrespective of the unit used for the measurement of happiness/unhappiness, if the amount of positive happiness is equal to that of unhappiness, the net happiness is zero and this is true for all individuals. Thus, an obvious method to increase the comparability of results in happiness studies is to pin down this level of neutrality. Even before the comparability of units of happiness is dealt with (on which see below), the information such as 'society A has 70 per cent of people with happiness levels above neutrality while society B has only 50 per cent' has a clear and comparable meaning. It is true that the information that 70 per cent of society A regard themselves as very happy and only 50 per cent of society B do so may still be useful. However, the cut-off amount of happiness for people in society A to report 'very happy' may be just equal to 2X (ignoring within society interpersonal differences for simplicity, as we are dealing with intersociety comparisons here), while the same cut-off amount for society B may be 4X. Thus, despite the fact that 70 per cent of society A regard themselves as very happy and only 50 per cent of society B do so, society B may in fact have more people with happiness level over say 2X than society A. The difference between the two cases is due to the fact that the categories 'very happy', 'fairly happy' etc. have no objective standards while the neutrality level has an objective standard of a zero amount of net happiness.

One possible question to get information on proportions of people above, at, and below the neutrality level of happiness is to ask respondents to choose, for a defined period, an answer from say:

- Total happiness far exceeds total unhappiness
- Total happiness somewhat exceeds total unhappiness
- Total happiness equals total unhappiness
- Total unhappiness somewhat exceeds total happiness
- Total unhappiness far exceeds total happiness.

¹ Economists brought up with ordinal utility are generally sceptical of the concept of zero utility/happiness. For arguments in favour of this zero level, see Armstrong (1951), Ng (1997) and Kahneman (1999), with the last reference arguing for the point that 'the zero point of the good-bad (GB) scale is neither arbitrary nor labile' (p. 12).

However, if respondents are asked to choose a value between say 0 and 10, it should be explicitly instructed that the neutral value of 5 should be chosen if total happiness equals total unhappiness (the net happiness level is zero). This will help to make the results more comparable. Without such an explicit instruction (seldom made), some respondents may use 5 for neutrality and some may use 3; we just cannot be sure. This reduces the comparability of the resulting happiness measures. The above methods to make results in happiness studies more comparable are simple and easy to implement. I am surprised that few if any happiness studies have adopted them. This is a mark of the infancy of the science of happiness studies and a reminder of the need to make improvements in the methodology of happiness studies. It is thus not surprising that skeptics have some justification in complaining that 'much happiness data is indeed of poor quality with a low information content' (Johns & Ormerod, 2007, p. 56). The answer is not to dismiss happiness study but to improve it.

Second, the above methods only pin down the level of neutrality. They, like traditional methods, do not answer the question of comparability beyond the point of neutrality. There are different problems of comparability. The problem of interpersonal comparability will be discussed in the third point below. Here, we are concerned with the comparability of differences of happiness values within the same person. Does the same difference in happiness value of one between 8 and 9 have the same significance (whether to the individual herself or to the society) as that between 4 and 5? Is the happiness gap between fairly happy and very happy the same as that between not too happy and unhappy?

Some economists may view such questions as meaningless. Modern economists are trained to regard utility (a measure of the degree of preference satisfaction) as only ordinally measurable. This is so because ordinal utility is sufficient for the positive analysis of behaviour. A given set of indifference curves will give the same demand curves irrespective of the cardinal utilities assigned as long as the ordering is the same. Thus, for positive economics, cardinal utility is unnecessary. However, for problems of public policy or social choice that involve making some individuals better off and some worse off, interpersonal comparisons of cardinal utility are necessary (Mueller, 2003). We do not only need to know how many individuals are made better off and how many made worse off, we also

need to know better off and worse off by a lot or by only a little bit. Thus, cardinal utility is necessary. If we accept my argument for treating a dollar as a dollar or efficiency rules supreme in each specific issue, leaving the pursuit of equality to the general tax and transfer policy (Ng, 1979, 1984a), we do not need to make interpersonal comparisons of cardinal utility for specific issues. However, we still need such comparisons in deciding how much efficiency is worth sacrificing in the pursuit of equality in the general tax and transfer policy.

In happiness studies, the happiness values of different persons are summed together to yield the national or group averages. If the happiness value of one between 8 and 9 is of different significance, or is non-comparable, to that between 4 and 5, the arithmetical averaging is not really meaningful, even if we ignore the problem of interpersonal comparison. Even differences in happiness values for the same individual may not be comparable. It is thus very surprising to find many happiness (and life satisfaction) researchers insisting on only the ordinal significance of happiness/satisfaction values, but freely using arithmetical averaging.

Ignoring technical problems like the difficulties of communication, authoritative happiness researcher Veenhoven asks whether someone can be said to be twice as happy as someone else and answers thus: 'This would require happiness to be rated in equal intervals and that an absolute zero point of happiness exists. Neither of these requirements can be met. Hence the best we can do is to say that someone is "more" happy than someone else. We can not say "how much" happier he is. We cannot say so, even when talking about our own happiness. I can say that I am happier now than when I was a teenager, but I cannot say that I am now twice as happy. This means that happiness can be measured only at the "ordinal" level' (Veenhoven, 1984, p. 61).

I am not against the virtually universal usage of arithmetical averaging. Rather, I am against the insistence on the purely ordinal measurability of happiness only. In fact, I am not only certain that I am happier now than when I was 30-something, I am also absolutely sure that I am now at least 3 times happier than then. It is difficult to be sure that my happiness now is exactly 3.5 or 4.3 times my happiness then. However, I am pretty sure that it is more than 3 times. The imprecision is not due to the intrinsic imperfection in measurability or comparability. Rather, it is due to imperfect memory and the like. This imperfection is similar to the difficulty in ascertaining which of the two

glasses of different shapes contain more water if the amounts of water do not differ by more than say 10 per cent. This imperfection applies even to purely ordinal ranking. If you name two different bundles of goods which differ in different directions in more than several goods and if the two bundles are not far apart from one of my intrinsic indifference hypersurfaces, I may have difficulties deciding which one is higher in my preference. Such difficulties do not make the intrinsic ranking of bundles or alternatives impossible. Similarly, they do not make happiness not cardinally measurable in principle.

The debate on the cardinal versus ordinal measurability of happiness is partly due to different views on the concept of happiness. On the one hand, if one views it more as overall satisfaction, it may be somewhat more ordinal. Even here, however, I still believe, at least to some extent, in the cardinal intensity of satisfaction. On the other hand, I regard my happiness as my net affective enjoyment (pleasures and fulfilment minus pain and sufferings) which I regard as fully cardinal, measurable in the strictest ratio-scale level in principle. Space does not allow a full discussion of the different concepts and their normative standing which I hope to pursue elsewhere. (see Davern *et al.* (2007) for empirical evidence that happiness of subjective well-being is largely affective.)

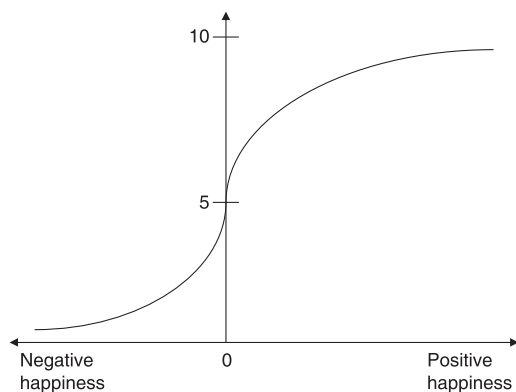
There is in fact an important consideration suggesting that reported happiness values are not linearly comparable in the above sense. To my knowledge, this has apparently not been noticed by happiness researchers. To see the point, consider an individual who regarded himself as fairly happy 10 years ago. If asked then to give a value between 0 and 10 with 5 as the point of neutrality, he might give a figure of 8. Five years later, he underwent some problems and found his (net) happiness level fell by 1/3. He might then correctly give a happiness figure of 7 [$8 - 7 = 1$ being $1/3$ the value of the excess of 8 over the neutrality point of 5]. Another 5 years later (now), his happiness level increases hugely to an amount 10 times the happiness value of 10 years ago. To give a linearly comparable figure, he has to state a happiness value of 35 [$35 - 5 = 10$ ($8 - 5$)]. However, since he has to choose a value between 0 and 10, he cannot use a figure above 10. Moreover, if he knows his happiness level is still on an upward trend, he knows that he should allow some scope for even higher happiness levels. He may thus correctly refrain from choosing 10 and choose 9 instead. Thus, for this particular case, the excess happiness implied by $9 - 8$ is in fact 10 times that

implied by 8–7. It may be thought that such a hypothetical case is impossible to prevail in practice. However, this humble author may honestly say that the case actually describes his situation fairly accurately, with appropriate changes in the actual numbers of 10 and 5 years.

It is true that the discrepancy of 10 times in the amount of happiness represented by the same difference of one in reported happiness value described in the case above is partly due to changes in information. Had that individual known that his happiness would increase by 10 times 10 years later, he probably would not have used 8 to describe his happiness value 10 years ago. However, even in hindsight, he may not use a completely linear representation. For one thing, being confined to the range of 0–10, no linear representation can cover all potential values. To allow for very high potential happiness values, a linear representation has to be very steep and would compress normal changes in happiness values of say 20 per cent to a very small decimal value (e.g. 5.0010 vs. 5.0012). Thus, even in hindsight, he (or I) would probably use some nonlinear representation such as the curve in Figure 1, where the horizontal axis represents the net happiness value and the vertical axis represents the happiness value selected. Such a curve would cover all potential values of positive and negative net happiness. One then never chooses a perfect score of 10 but uses 9.9 and 9.99 and so on. We may call this an arc tangent curve.

A strong support for the arc-tangent representation in Figure 1 may be induced from the

FIGURE 1
The Nonlinear Relationship between Reported and Actual Happiness Levels



happiness values of different activities reported in Kahneman *et al.* (2004, Table 1) which use affect scales ranging from 0 to 6. Sex (or ‘intimate relations’ used in Kahneman *et al.*, 2004) topped the list for positive affect, not surprisingly. What is surprising is that its value (5.1) does not exceed those of other activities (e.g. socialising 4.59, relaxing 4.42, eating 4.34, napping 3.87, commuting 3.45) by that much. Surely, the pleasure of having sex should exceed that of just relaxing by much more than the latter over commuting, instead of the other way round [$5.1 - 4.42 < 4.42 - 3.45$]. It is likely that the former difference of 0.68 [$= 5.1 - 4.42$] may represent a difference in real subjective happiness value far more than the latter difference of 0.97 [$= 4.42 - 3.45$]. Some readers may regard this conclusion as reflecting my own bias. However, the point can really be supported by the basic Darwinian principles of evolution. Paul Watson (who taught the evolution of human sexuality at the University of New Mexico) believes that our greatest joys (and our greatest psychological pain) usually stem from intersexual relations. This is no place to give a detailed argument; interested readers are referred to Cairns-Smith (1996), Ng (1996) and Diamond (1997). Basically, both positive and negative affective feelings are costly to the individual biologically and, hence, must provide appropriate survival and reproductive fitness. Thus, higher pleasures are provided for those activities contributing more to fitness. Ignoring modern family planning, sex directly contributes to reproduction and, hence, gives the most pleasure.

If a significant number of people use the arc-tangent representation in Figure 1, this makes happiness values not *linearly* comparable even for the same individual. The implications of this for happiness measurement, especially regarding arithmetic averaging, need to be further explored. One method to overcome this difficulty is discussed below together with the overcoming of the third difficulty mentioned below. Here, an interesting possibility opened up by the arc-tangent representation may be noted. Many people wish to take into account equality in the distribution of happiness level, just like equality in the income level² (Veenhoven & Kalmijn,

² Personally, I do not believe in the relevance of equality in the ultimate objective of happiness. Inequality in income is undesirable both because of the diminishing marginal utility/welfare/happiness of income and because of the indirect undesirable effects of inequality in reducing happiness through, for example, reducing social cohesion. Since happiness is already the ultimate objective, we can

2005 in fact propose the measure of 'inequality-adjusted happiness'). Most happiness indices fall between 4 and 9 (for a scale of 0–10). Egalitarian adjustments require counting the same increments of happiness indices at the high end (7–9) as less important than those at the low end (4–6). As may be seen from Figure 1, the needed adjustment to account for the likely nonlinearity requires exactly the reverse adjustment. Of course, the two opposite adjustments may not exactly offset each other. However, they may be roughly, or at least partly, offsetting. If so, the arithmetical averaging already implies the required inequality adjustment and no additional adjustments may be needed.

The third problem of comparability is the well-known one of interpersonal comparison. How do we know that the Brahmin is not 10 times more capable of enjoyment than the untouchable? The happiness difference of the same one unit over the same range (say 7–8) for one person may be hugely different from that of another. Economists who follow the Wicksteed/Robbins tradition may regard this as unanswerable, since interpersonal comparisons of utility/welfare/happiness are intrinsically impossible. Despite this, I managed to devise an interpersonally/intertemporally/interculturally comparable measure of happiness and actually use it to measure self-reported happiness levels (Ng, 1996). This is based on Edgeworth's concept of a just perceivable increment of happiness, but developed to be operational and actually used to conduct an actual survey or measurement.³ Edgeworth took it as axiomatic, or, in his words 'a first principle incapable of proof', that the 'minimum sensible' or the just perceivable increments of pleasures for all persons, are equatable (Edgeworth, 1881, pp. 7ff., pp. 60ff.). I derived this result as well as the utilitarian social welfare function (SWF), that social welfare is the unweighted sum of individual

neither have diminishing marginal happiness of happiness nor further indirect effects, except in an intertemporal framework where the happiness in the future has not yet been accounted for. Either accounting for this intertemporal effect or ignoring it, an objective function that is not linear in individual happiness can be shown to violate some compelling axiom; that is, treating a perceivable increment of happiness as less important than an imperceivable one (see Ng, 1984b). Moreover, the argument for the utilitarian social welfare function (Ng, 2000a, ch. 5) supports not taking into account inequality in the ultimate objective.

³ The concept of using the faintest unit of pleasure as the unit of measurement may be traced back to Bentham; see Tännsjö (1998). On Edgeworth's hedonimeter and the quest to measure cardinal utility, see also Colander (2007).

utilities/welfares, from more basic axioms (Ng, 1975). The main axiom is the **Weak Majority Preference Criterion (WMP)**: *For any two alternatives x and y , if no individual prefers y to x , and (i) if I , the number of individuals, is even, at least $I/2$ individuals prefer x to y ; (ii) if I is odd, at least $(I-1)/2$ individuals prefer x to y and at least another individual's utility level is not lower in x than in y , then social welfare is higher in x than in y .*

The reason why WMP leads us to the utilitarian SWF may be explained easily. The criterion WMP requires that utility differences sufficient to give rise to preferences of half of the population must be regarded as socially more significant than utility differences not sufficient to give rise to preferences (or dispreferences) of another half. Since any group of individuals comprising 50 per cent of the population is an acceptable half, this effectively makes a just-perceivable increment of utility of any individual an interpersonally comparable unit.

The compelling criterion of WMP makes a just perceivable increment of preference (or pleasure) interpersonally equitable not only at the individual but also at the social level. Thus, if happiness studies use this just perceivable increment of happiness as the unit of measurement (as done in Ng 1996), the resulting measures or values will be interpersonally/intertemporally/interculturally comparable and this will help to solve all problems of comparability (at least at the conceptual level, though practical difficulties will remain). Of course there are other ways to improve the reliability and comparability of happiness measures that have been discussed or remain to be explored. In particular, the moment-based method proposed by Kahneman (2000) is a particularly promising approach.

III Results in Happiness Studies and their Policy Implications

There have been a number of summary reports on the results of happiness studies, especially as related to economics, including the *JEP* symposia and the monographs mentioned above. Thus, I will neither give the detailed results nor full references. Instead, I will just summarise the main findings into several bulleted points that are relevant for the policy implications to be discussed below.

I At the individual level, there is a significant, though not very large, positive correlation between income and happiness levels. (See, among others, Frey & Stutzer, 2002a for a survey. See also Heady

& Wooden, 2004 on the importance of wealth in contrast to incomes and Kahneman *et al.*, 2006 on the focusing illusion regarding the exaggerated importance of income.)

2 At the social level, despite a huge increase (several times instead of just several percentage points) in real income or consumption levels, the average happiness level of a country has typically remained largely unchanged (Easterlin, 1974, 2002).

3 Cross-country comparison of average happiness levels shows lower happiness levels for low-income countries and high happiness levels for high-income countries but the positive correlation between income and happiness is not significant after the income level of about US \$7500 per capita per annum (Inglehart & Klingemann, 2000, figure 7.2 and table 7.1).

4 Other social-economic factors like being married have higher correlation with happiness than income or consumption; interpersonal relationships are essential for happiness (Bruni, 2006).

5 Being unemployed is associated with very significantly lower happiness levels (Winkelmann & Winkelmann, 1998).

6 Individuals are poor in foreseeing their happiness levels and in particular underestimate the adaptation effects, making them overestimate the contribution of current consumption to happiness in the long run (Frijters, 2000; Gilbert, 2006).

7 While our happiness levels undergo wavy up and down movements, the average set points are largely (somewhere between 50 and 80 per cent) explained by genetics or personality traits (Lykken & Tellegen, 1996; Lykken, 1999; see Heady, 2008 for significant long-term changes for some minorities and Konow & Earley, 2008 on the explanation of the hedonistic paradox by the biological or psychological factor of personality).⁴

If the above results, especially points 2 and 3, are valid, a revolution in economic thinking and

policy formulation is needed, as in fact was proposed by Layard (2005). At least at the social (and global) level, pursuit of economic growth may be illusory in not really increasing the value of the ultimate objective: happiness. In fact, if account is taken of the environmental disruption effects, economic growth may well be welfare-reducing (Ng & Ng, 2001), if not survival-threatening. However, as discussed in the previous section, there are some problems regarding the measurement of happiness particularly regarding interpersonal and intertemporal comparability. Thus, an urgent task is to try to make happiness measurement more reliable and comparable as discussed in the last section. Nevertheless, even before that stage, as these results in happiness studies still have reasonable degrees of reliability, some re-orientation of our focus and policies is already appropriate.

Even before the results of happiness studies have become widely known, economists were already aware of the many limitations of national income measurement. Now, it is even more obvious that we should not focus almost exclusively on GDP. Production, incomes and consumption are not our ultimate objective. Production without sufficient environmental safeguard could be disastrous. Even green GDP is not sufficient, as high incomes even with high environmental quality may still not be sufficient to make us happy. Our ultimate objective is happiness. As happiness studies, especially with the further advances made possible by the methods discussed in the previous section, have yielded significant results and will likely provide more, it is time we shift our focus more to happiness. In particular, the chief success indicator for a nation should not be its GDP or GDP per capita. Should the average happiness level be used instead?

The average happiness, life satisfaction, or subjective well-being levels refer to a given period. However, we do not just want to live a happy life but also a long life. Thus, Veenhoven (1996, 2005) suggests the concept of happy life years (HLY). Conceptually, HLY is just the product of the average happiness index over the lifespan and the length of the lifespan (life expectancy). Moreover, in our present era of environmental challenges, a nation that achieves a high HLY may yet impose a high cost on others and the future by producing large environmental disruption. Thus, I propose the use of 'environmentally responsible happy nation index' (ERHNI) as an internationally more acceptable national success indicator. This involves revising HLY to be more acceptable (by counting net instead

⁴ 'It can be seen that results using Australian data are consistent with those found in studies of other countries' (Long, 2005). This is true not only of job satisfaction that Long studies, but also of other aspects of happiness; see, for example, Dockery (2005). Incidentally, the latter finds that 'Paradoxically, having either an increase or decrease in [job] responsibility is associated with an increase in happiness' (Dockery, 2005, p. 331). This needs not be paradoxical, as those having an increase in responsibility may typically be those proficient in their jobs and got promoted and those having a decrease may get relief from over-commitments.

of gross happiness) and taking off the per capita environmental costs imposed on others, calculated at a comparable basis, to given an adjusted HLY. (See Ng (2008) for details.)

The policy implications of findings in happiness studies partly depend on our understanding of the reasons for these findings. Most economists focus on the important role of relative standing. Thus, in his seminal paper, Easterlin (1974) uses it to explain the failure of happiness to increase. Once over the subsistence level, happiness depends more on relative than absolute levels of incomes, consumption, or other objective variables.⁵ In fact, Knight and Song (2006) show that relative income is at least twice as important for individual happiness as absolute income, even in rural China where people are barely above the subsistence level. Studies in the developed world show less dramatic results but still have relative incomes at least half as important as absolute incomes. Frank (1999), Ireland (1998) and others correctly draw the conclusion that this implies very high corrective taxes on incomes. In fact all of the income taxes of most countries could be justified as corrective taxes on the relative competition effects alone. If we add the very substantial environmental costs of most production and consumption, general taxation is likely to be below its optimal level. Rather than imposing excess burdens or distortionary costs, taxes are corrective and this efficiency gain could be increased by increasing tax rates! This would stand traditional public economics on its aspect on its head!

Another important factor accounting for the findings in happiness that appear to be inconsistent with traditional presumptions in economics is the importance of adaptation effects (people get used to their standard of living) and the underestimation of these effects by most if not all people. (See Clark *et al.* (2007) for a survey; I discussed the happiness implications of aspiration and adaptation in Ng (1978) and Ng and Wang (1993)). There are also a host of other results indicating that individuals are far from being perfectly rational. Moreover, this imperfection does not just cause random biases on either side. Rather, partly due to the nature of accumulation instinct and partly due to nurture (peer pressure and commercial advertising), there is a consistent bias towards excessive materialism (Ng, 2003). A distinction between utility (representing preference) and welfare (happiness) is thus necessary.

⁵ For another explanation based on the role of cultural values, see Ahuvia (2002).

Traditional welfare economics and cost-benefit analysis are based on individual preferences or willingness to pay. When individual preference and welfare systematically diverge, adjustments may be necessary, even in the absence of external effects.

A cost-benefit analysis aiming to maximise happiness (or welfare; the two terms are used interchangeably) may be quite different from one aiming at net-income or even preference maximisation (including Pareto optimality in the sense of preference). For example, if a certain protection measure is shown to cost the economy more than the total wages of the protected workers, most economists regard this as more than conclusive proof that the measure is inefficient. However, while this is inefficient in terms of income maximisation, it needs not be inefficient in terms of happiness maximisation. The protective measure may well still be inefficient in happiness terms if unemployment will only increase very temporarily without the measure. If displaced workers could get alternative jobs quickly, no protection is usually the best choice. However, if prolonged unemployment will be involved, it may worth spending more than the total wages to protect the jobs. This is so because of two results in happiness studies: (i) Unemployment causes a lot of unhappiness, way beyond the mere losses in incomes (Winkelmann & Winkelmann, 1998); and (ii) At least for rich countries, more income no longer contribute to happiness at the social level in the long run. It may thus make sense to spend a lot of money at negligible marginal happiness to protect jobs that are important for happiness. Economists' case against protection has to rest more with the working of the market to make unemployment temporary. This also implies the higher importance of job search or transition assistance.

Consider issues like accidents/risk/security, health care, and value of life. Modern economics has replaced incomes-based analysis with willingness-to-pay or preference-based analysis. If we ignore possible concern for others, ignorance and irrational preferences, individual preference and welfare coincide and analysis based on preference and that based on welfare are equivalent at the individual level. At the social level, we then only have to take into account external effects and issues of equality that economists are already familiar with. However, recent results in happiness studies and behavioural economics suggest that individual choices often involve imperfect information and/or imperfect rationality, and this is so especially for choices involving the future and changes in

small probabilities. In combination with the basis of excessive materialism/consumerism mentioned above, this may make people engage in excessive competition/consumption (to the detriment of health and family life), under-save for old age (making compulsory superannuation possibly sensible and actually practised in many countries), and a host of other welfare-reducing activities not warranted even at the individual level (before counting the additional external costs through the environmental and relative-income effects). Thus, asking people's willingness to pay for a marginal increase in safety or a slight reduction in the risk of a fatal accident may not give reliable values of life in the sense of true expected welfare maximisation. On the one hand, such figures may be under-reported due to people's pressure for present consumption and hence under-rating the willingness to pay for safety. On the other hand, these figures may be over-reported due to the innate irrational fear of death (which has clear selection value but may be inconsistent with welfare maximisation). Thus, it is desirable to supplement the willingness-to-pay studies with happiness studies. For expected welfare maximisation,⁶ the value of life should equal the total happiness of remaining life divided by the true happiness value of a marginal dollar. Since this latter value is likely to be very low (if still positive) even just taking into account the adaptation effect alone, the correct value of life may be very large even at the individual level. At the social level, this is even more so, as the true happiness value of a marginal dollar has to be further discounted by environmental effects and the mutually offsetting relative-income effects. This may partly explain the very large sums of money some decision makers at the social level are willing to spend to improve safety that most economists regard as many times beyond the efficient levels. While there may be some efficiency problems at the public decision-making level, it may also be the case that economists should revise their analysis to be more consistent with welfare maximisation.

A particular area where very substantial adjustments are necessary is public spending. Since government spending on public goods has to be financed from taxation and government spending may involve some unavoidable inefficiency, most economists emphasise the excess burden of taxation and are in favour of lowering government spending. This position ignores the probably greater inefficiency of private production

⁶ For the argument that this is the appropriate objective in the presence of risk/uncertainty, see Ng (1984b).

and consumption due to unaccounted-for environmental costs and the mutually cancelling effects (at the social level) of competition for relative standing. In addition, if additional private consumption no longer contributes to happiness at the social level, the monetary costs of public spending may be very high, but the ultimate happiness costs may be zero. Thus, provided that the relevant items of public spending do contribute to happiness ultimately, they may still be worth the high costs and some inefficiency in public spending.⁷

In the light of recent results in happiness studies, Layard (2005) has convincingly argued for the need to rethink public policy with respect to many areas, including work-life balance, family life, helping the poor, eliminating high unemployment, mental illness, and community life. Here, I wish to mention a few areas of public spending that are more likely to increase happiness than private competitive spending.

First, in the light of the threatening effects of climate change and other environmental disruption, public actions in controlling pollution both in the form of taxing external costs and in abatement spending will likely be necessary to protect our future. Economists are familiar with the desirability in principle of taxing external effects in accordance to the damages inflicted. However, for environmental disruption that affects the long future, many regard it as difficult if not impractical to estimate. In fact, for most cases where some abatement is desirable, it is desirable to tax disruption at least at the marginal cost of abatement (which is easier to estimate than the marginal damage of disruption). Such a tax will normally yield total revenue in excess of the optimal amount of abatement spending (Ng, 2004). However, due to the global nature of some if not a large part of environmental disruption, international cooperation will likely be necessary.⁸

As noted by Cosier (2006), the real per capita income of the world now is about 7–8 times that of a century ago. If we proceed along an environmentally responsible path of growth, our great grandchildren in a century will have a real per capita income 5–6 times higher than our level

⁷ In addition, there are also arguments (Kaplow, 1996; Ng, 2000b) that, even if we ignore these factors, the spending side tends to produce offsetting effects to the excess burden on the taxation side.

⁸ On ways to foster international cooperation and compliance, see Ng and Liu (2003).

now. Is it worth the risk of environmental disaster to disregard environmental protection now to try to grow a little faster? If this faster growth could be sustained, our great grandchildren would enjoy a real per capita income 7–8 times (instead of 5–6 times) higher than our level now. However, they may live in an environmentally horrible world or may well not have a chance to be born at all! The correct choice is obvious.

Easterly (1999) shows that, with economic growth, while some quality-of-life indicators increase, others decrease. Rather, it is the advance in knowledge at the world level that is more positively associated with higher values of quality-of-life indicators. In addition, as knowledge is largely a global public good with long-term benefits, it is likely to be well under-supplied. Thus, public investment in education and research to promote the advance of knowledge will most certainly yield very high benefits. While this is true for research in general, I wish to single out the issue of brain stimulation for pleasure. I support Layard's (2005, ch. 13) endorsement of the *appropriate* use of drugs to promote happiness.⁹ However, brain stimulation and genetic engineering provide far more potential.

Positive reward associated with brain stimulation was discovered by Olds and Milner (1954) when they observed that a rat returned to the place where it received direct electrical stimulation of certain parts of its brain. Further research established sites that induce pleasure (medial forebrain bundle, septal, limbic and hypothalamic areas), pain, and ambiguous or mixed feelings. Stimulation of the pleasurable sites clearly produces positive reward as suggested by experiments in which rats were willing to cross a painful shock grid in order to obtain the stimulation, and as confirmed by human subjects. Moreover, the pleasure induced is so intense that rats prefer brain stimulation to food and sex, and if not stopped by experimenters, will continuously seek stimulation until exhausted. In humans, 'patients who were having emotional or physical pain experienced such intense pleasure with stimulation that the pain was obliterated' (Heath *et al.*, 1968, p. 188).

⁹ 'Ironically, what will in the end defeat the bad drugs, especially heroin and cocaine, will be the new medical drugs that work better than they do. These new drugs will be safer and non-addictive. Side by side with cognitive therapies, they will enable people whose natures are rough or whose lives have been tough to become happier people' (Layard, 2005, p. 221).

Apart from relieving pain and inducing pleasure, brain stimulation may also be used as a 'primer' in improving well-being. For example, Heath (1964, p. 236) reported, 'strong pleasure [from brain stimulation] was associated with sexual feelings, and in most instances the patient experienced spontaneous orgasm ... This patient, now married to her third husband, had never experienced orgasm before she received ... stimulation to the brain, but since then has consistently achieved climax during sexual relations'. Once the right neurones have been excited, they become excitable more easily. The right neural pathways have been established.

Among the important social problems of our time are drug addiction, crimes and (mental) depression. These social problems, and possibly others, seem to be largely solvable with the widespread use of brain stimulation. In comparison to brain stimulation, the use of addictive drugs like heroin is a very inefficient and dangerous method of achieving a 'high'. If one has easy access to pleasurable sensations by just turning on the electricity, there seems little reason left to try dangerous alternatives. Just as intractable pain may be relieved by brain stimulation, mental depression should also be largely removable by positive brain stimulation. Since most depressions are caused by the failure to achieve happiness one way or other, the availability of happy sensations by brain stimulation should provide a definite relief. Among others, the amelioration of stress (Patterson *et al.*, 1994), treatment of depression (Mayberg *et al.*, 2005; Schlaepfer *et al.*, 2007), reduction of stress ulcers (Yadin & Thomas, 1996), improved performance in a maze (Jiang *et al.*, 1997), and the treatment of alcoholics (Krupitskii *et al.*, 1993) have been reported.

Common methods of enjoyment through the stimulation of our senses (through the peripheral nervous systems) like eating delicious food and having sex is, after some point, subject to fast diminishing marginal returns. This is so because we are programmed through natural selection to protect ourselves from over-eating etc. However, activities that yield no significant diminishing marginal returns such as reading typically produce low levels of reward at each moment. This is so since these activities had not been very essential over our long evolutionary history in increasing our selection fitness. True, humans are capable of higher levels of happiness, including spiritual fulfilment. If it is not the only species on Earth that is capable of spiritual feelings, it is certainly the

only one where such feelings could be so strong or intense. Nevertheless, even here adaptation and diminishing marginal utility apply quickly. Even the winning of a Nobel prize is said to yield a high for only about 2 weeks. Thus, our ordinary biological capacity for happiness is rather limited. However, in our eons of evolution, our brain was not stimulated intracranially (bypassing the peripheral nervous systems) and, hence, there has been no need to program diminishing marginal returns directly within the pleasure centres in our brain. Thus, brain stimulation promises high happiness due to the absence of diminishing marginal utility.

Apart from isolated therapeutic uses, why has the technique of brain stimulation not been developed for common use to increase happiness enormously? Could it be the resource costs of doing this? Definitely not! The technique has been well-known and used therapeutically. Developing it for common enjoyment would be relatively easy. The initial cost of a set of brain stimulation machines would not be more than that of a TV set, at least at the time when TV was introduced. With mass production, the cost would also fall dramatically like TV sets and most other technological gadgets. However, many people (myself included) would be willing to pay much more than their annual incomes to have access to it. In terms of consumer surplus, it would be enormous.

Short of the extremes like brain stimulation and starving, the happiness level of a person depends more on the subjective factors than the objective circumstances. (Thus, to achieve sustainable gains in happiness, Sheldon & Lyubomirsky, 2006 advise 'Change Your Actions, not Your Circumstances'.) The subjective factors are shaped by our upbringing, education, social contacts, and a host of other factors. However, these factors affect mainly the waves of happiness around a set point. The level of this set point for each person is largely genetic. This does not mean that we cannot affect our happiness levels at all. Even Lykken (1999), who has established the high degree of association of happiness and a host of other things with genetic factors through the study of identical twins (including those reared apart), believes that we can learn to become happier by affecting the waves of happiness. Nevertheless, the dominance of the genetic factors in determining the set points remains. This suggests that a way to increase happiness by a quantum leap more important than brain stimulation is through genetic engineering. Of course, a very high degree of care has to be in place for such an endeavour. Is it too risky never-

theless? While there are some risks, they could be reduced by sufficient safeguards. Moreover, the risks involved are far less than those created by our current path of high growth without sufficient environmental protection. The returns of this high growth are just some chance (that problems like climate change turn out to be of no significance) of higher output that contributes virtually nothing to happiness. The risks are the high chance of environmental disasters including human extinction. In contrast, genetic engineering promises a very high chance of huge quantum leaps in our happiness, at negligible and avoidable risks. Why do many people still feel comfortable with the former and not with the latter? Irrational fear with the unfamiliar is at work. We have to keep talking about brain stimulation and genetic engineering until people get used to them.

REFERENCES

- Ahuvia, A. C. (2002), 'Individualism/Collectivism and Cultures of Happiness: A Theoretical Conjecture on the Relationship Between Consumption, Culture and Subjective Well-being at the National Level', *Journal of Happiness Studies*, **3**, 23–36.
- Armstrong, W. E. (1951), 'Utility and the Theory of Welfare', *Oxford Economic Papers*, **3**, 257–71.
- Bertrand, M. and Mullainathan, S. (2001), 'Do People Mean What They Say? Implications for Subjective Survey Data', *American Economic Review*, **91**, 67–72.
- Bruni, L. (2006), *Civil Happiness: Economics and Human Flourishing in Historical Perspective*. Routledge, New York.
- Bruni, L. and Porta, P. L., eds. (2005), *Economics and Happiness*. Oxford University Press, Oxford.
- Cairns-Smith, A. G. (1996), *Evolving the Mind: On the Nature of Matter and the Origin of Consciousness*. Cambridge University Press, New York.
- Clark, A. E., Frijters, P. and Shields, M. A. (2007), 'Income and Happiness: Evidence, Explanations and Economic Implications', Paper Presented at Australian Conference of Economists, Hobart, September 2007.
- Colander, D. (2007), 'Edgeworth's Hedonimeter and the Quest to Measure Utility', *Journal of Economic Perspectives*, **21**, 215–25.
- Cosier, P. (2006), 'Will Climate Change Cost Us the Earth', Paper Presented at The Green Capital Conference, Sofitel Wentworth, Sydney, 8 November.
- Costa, P. T. and McCrae, R. R. (1988), 'Personality in Adulthood: a Six-year Longitudinal Study of Self-reports and Spouse Ratings on the NEO Personality Inventory', *Journal of Personality Social Psychology*, **54**, 853–63.
- Davern, M. T., Cummins, R. and Stokes, M. A. (2007), 'Subjective Wellbeing as an Affective-Cognitive Construct', *Journal of Happiness Studies*, **8**, 429–49.

- Di Tella, R. and MacCulloch, R. (2000), 'A New Explanation for European Unemployment Based on Rational Institutions', Working Paper No. 01-037, Harvard Business School, Cambridge, MA.
- Di Tella, R. and MacCulloch, R. (2006), 'Some Uses of Happiness Data in Economics', *Journal of Economic Perspectives*, **20**, 25–46.
- Diamond, J. M. (1997), *Why is Sex Fun?: The Evolution of Human Sexuality*. HarperCollins, New York.
- Diener, E. (1984), 'Subjective Well-being', *Psychological Bulletin*, **95**, 542–75.
- Dockery, A. M. (2005), 'The Happiness of Young Australians: Empirical Evidence on the Role of Labour Market Experience', *Economic Record*, **81**, 322–35.
- Dominitz, J. and Manski, C. F. (1999), 'The Several Cultures of Research on Subjective Expectations', in Willis R. and Smith J. (eds), *Wealth, Work and Health*, Ann Arbor. University of Michigan Press, Ann Arbor, MI.
- Easterlin, R. A. (1974), 'Does Economic Growth Improve the Human Lot? Some Empirical Evidence', in David P. A. and Reeder M. W. (eds), *Nations and Households in Economic Growth: Essays in Honour of Moses Abramowitz*. Academic Press, New York.
- Easterlin, R. A. (2002), *Happiness in Economics*. Edward Elgar, Cheltenham, UK.
- Easterly, W. (1999), 'Life during Growth', *Journal of Economic Growth*, **4**, 239–76.
- Edgeworth, F. Y. (1881), *Mathematical Psychics*, Kegan Paul, London.
- Fordyce, M. (1988), 'A Review of Research on Happiness Measures: a Sixty Second Index of Happiness and Mental Health', *Social Indicators Research*, **20**, 355–81.
- Frank, R. H. (1997), 'The Frame of Reference as a Public Good', *Economic Journal*, **107**, 1832–47.
- Frank, R. H. (1999), *Luxury Fever: Why Money Fails to Satisfy in an Era of Excess*. Free Press, New York.
- Frey, B. S. and Stutzer, A. (2002a), *Happiness and Economics: How the Economy and Institutions Affect Well-Being*. Princeton University Press, Princeton, NJ.
- Frey, B. S. and Stutzer, A. (2002b), 'What can Economists Learn from Happiness Research?', *Journal of Economic Literature*, **40**, 402–35.
- Frijters, P. (2000), 'Do Individuals Try to Maximize General Satisfaction?', *Journal of Economic Psychology*, **21**, 281–304.
- Gilbert, D. (2006), *Stumbling on Happiness*. Random House, Simi Valley, CA.
- Graham, C. and Pettinato, S. (2001), 'Happiness, Markets, and Democracy: Latin America in Comparative Perspective', *Journal of Happiness Studies*, **2**, 237–68.
- Graham, C. and Pettinato, S. (2002), *Happiness and Hardship: Opportunity and Insecurity in New Market Economies*. Brookings Institution Press, Washington, D.C.
- Heady, B. (2008), 'The Set-Point Theory of Well-being: Negative Results and Consequent Revisions', *Social Indicators Research*, **85**, 389–403.
- Heady, B. and Wooden, M. (2004), 'The Effects of Wealth and Income on Subjective Well-Being and Ill-Being', *Economic Record*, **80**, S24–S33.
- Heath, R. G. (ed.) (1964), *The Role of Pleasure in Behavior*. Harper & Row, New York.
- Heath, R. G., John, S. B. and Fontana, C. J. (1968), 'The Pleasure Response: Studies by Sterotaxic Technics in Patients', in Kline N. S. and Laska E. (eds), *Computers and Electronic Devices in Psychiatry*. Grune & Stratton, New York.
- Inglehart, R. and Klingemann, H.-D. (2000), 'Subjective Well-being by Level of Economic Development', in *Genes, Culture and Happiness*. MIT Press, Cambridge, MA.
- Ireland, N. J. (1998), 'Status-Seeking, Income Taxation and Efficiency', *Journal of Public Economics*, **70**, 99–113.
- Jiang, F., Racine, R. and Turnbull, J. (1997), 'Electrical Stimulation of the Septal Region of Aged Rats Improves Performance in Open-field Maze', *Physiology and Behavior*, **62**, 1279–82.
- Johns, H. and Ormerod, P. (2007), *Happiness, Economics and Public Policy*. Institute of Economic Affairs, Research Monograph 62.
- Kahneman, D. (1999), 'Objective Happiness', in Kahneman D. Diener E. and Schwarz N. (eds), *Well-Being: the Foundations of Hedonic Psychology*. Russell Sage Foundation, New York; 325.
- Kahneman, D. (2000), 'Experienced Utility and Objective Happiness: A Moment-based Approach', in Kahneman D. and Tversky A. (eds), *Choices, Values and Frames*. Russell Sage Foundation, Cambridge University Press, New York.
- Kahneman, D. and Krueger, A. B. (2006), 'Developments in the Measurement of Subjective Well-being', *Journal of Economic Perspective*, **20**, 3–24.
- Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N. and Stone, A. A. (2004), 'A Survey Method for Characterizing Daily Life Experience: The Day Reconstruction Method', *Science*, **306**, 1776–80.
- Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N. and Stone, A. A. (2006), 'Would you be Happier if you were Richer? A Focusing Illusion', *Science*, **312**, 1908–10.
- Kaplow, L. (1996), 'The Optimal Supply of Public Goods and the Distortionary Cost of Taxation', *National Tax Journal*, **49**, 513–33.
- Knight, J. and Song, L. (2006), 'China's Emerging Wage Structure, 1995–2002', in Gustafsson B., Shi L. and Sicular T. (eds), *Inequality and Public Policy in China*. Cambridge University Press, Cambridge, MA.
- Konow, J. and Earley, J. (2008), 'The Hedonistic Paradox: Is Homo Economicus Happier?', *Journal of Public Economics*, **92**, 1–33.
- Krupitskii, E. M., Burakov, A. M., Karandashova, G. F. and Lebedev, V. B. (1993), 'A Method of Treating Affective Disorders in Alcoholics', *Journal of Russian and East European Psychiatry*, **26**, 26–37.
- Layard, R. (2005), *Happiness: Lessons from a New Science*. Penguin Press, New York.
- Long, A. (2005), 'Happily Ever After? A Study of Job Satisfaction in Australia', *Economic Record*, **81**, 303–21.
- Luttmer, E. F. (2005), 'Neighbors as Negatives: Relative Earnings and Well-being', *Quarterly Journal of Economics*, **120**, 963–1002.

- Lykken, D. T. (1999), *Happiness: What Studies on Twins Show Us About Nature, Nurture, and the Happiness Set Point*. Golden Books, New York.
- Lykken, D. T. and Tellegen, A. (1996), 'Happiness is a Stochastic Phenomenon', *Psychological Science*, **7**, 186–9.
- Manski, C. F. (2000), 'Economic Analysis of Social Interactions', *Journal of Economic Perspectives*, **14**, 115–36.
- Mayberg, H. S., Lozano, A. M., Voon, V., McNeely, H. E., Seminowicz, D., Hamani, C., Schwab, J. M. and Kennedy, S. H. (2005), 'Deep Brain Stimulation for Treatment-resistant Depression', *Neuron*, **45**, 651–60.
- Mueller, D. (2003), *Public Choice III*. Cambridge University Press, Cambridge, MA.
- Namazie, C. and Sanfey, P. (2001), 'Happiness in Transition: The Case of Kyrgyzstan', *Review of Development Economics*, **5**, 392–405.
- Ng, Y.-K. (1975), 'Bentham or Bergson? Finite Sensibility, Utility Functions and Social Welfare Functions', *Review of Economic Studies*, **42**, 545–70.
- Ng, Y.-K. (1978), 'Economic Growth and Social Welfare: The Need for a Complete Study of Happiness', *Kyklos*, **31**, 575–87.
- Ng, Y.-K. (1979/1983), *Welfare Economics: Introduction and Development of Basic Concepts*. Macmillan, London.
- Ng, Y.-K. (1984a), 'Quasi-Pareto Social Improvements', *American Economic Review*, **74**, 1033–50.
- Ng, Y.-K. (1984b), 'Expected Subjective Utility: Is the Neumann-Morgenstern Utility the Same as the Neoclassical's?', *Social Choice and Welfare*, **1**, 177–86.
- Ng, Y.-K. (1996), 'Happiness Surveys: Some Comparability Issues and an Exploratory Survey based on Just Perceivable Increments', *Social Indicators Research*, **38**, 1–29.
- Ng, Y.-K. (1997), 'A Case for Happiness, Cardinal Utility, and Interpersonal Comparability', *Economic Journal*, **107**, 1848–58.
- Ng, Y.-K. (2000a), *Efficiency, Equality, and Public Policy: With a Case for Higher Public Spending*. Macmillan, Basingstoke, Hampshire.
- Ng, Y.-K. (2000b), 'The Optimal Size of Public Spending and the Distortionary Costs of Taxation', *National Tax Journal*, **52**, 253–72.
- Ng, Y.-K. (2003), 'From Preference to Happiness: Towards a More Complete Welfare Economics', *Social Choice and Welfare*, **20**, 307–50.
- Ng, Y.-K. (2004), 'Optimal Environmental Charges/taxes: Easy to Estimate and Surplus-Yielding', *Environmental and Resource Economics*, **28**, 395–408.
- Ng, Y.-K. (2008), 'Environmentally Responsible Happy Nation Index: Towards an Internationally Acceptable National Success Indicator', *Social Indicators Research*, **85**, 425–46.
- Ng, Y.-K. and Ho, L. S. (2006), *Happiness and Public Policy: An Introduction, in Happiness and Public Policy: Theory, Case Studies, and Implications*, Palgrave Macmillan, London.
- Ng, Y.-K. and Liu, B. D. (2003), 'Global Environmental Protection: Solving the International Public Goods Problem by Empowering the United Nations through Cooperation with WTO', *International Journal of Global Environmental Issues*, **3940**, 409–17.
- Ng, Y.-K. and Wang, J. (1993), 'Relative Income, Aspiration, Environmental Quality, Individual and Political Myopia: Why may the Rat-race for Material Growth be Welfare-Reducing?', *Mathematical Social Science*, **26**, 3–23.
- Ng, S. and Ng, Y.-K. (2001), 'Welfare-reducing Growth despite Individual and Government Optimization', *Social Choice and Welfare*, **18**, 497–506.
- Offer, A. (2006), *The Challenge of Affluence: Self-Control and Well-Being in the United States and Britain since 1950*. Oxford University Press, Oxford.
- Olds, J. and Milner, P. (1954), 'Positive Reinforcement Produced by Electrical Stimulation of Septal area and Other Regions of the Rat Brain', *Journal of Comparative Physiological Psychology*, **47**, 419–27.
- Oswald, A. J. (1997), 'Happiness and Economic Performance', *Economic Journal*, **107**, 1815–31.
- Patterson, M., Krupitsky, E., Flood, N. and Baker, D. (1994), 'Amelioration of Stress in Chemical Dependency Detoxification by Transcranial Electrostimulation', *Stress Medicine*, **10**, 1815–26.
- Pavot, W. (1991), 'Further Validation of the Satisfaction with Life Scale: Evidence for the Convergence of Well-being Measures', *Journal of Personality Assessment*, **57**, 149–61.
- Sandvik, E., Diener, E. and Seidlitz, L. (1993), 'Subjective Well-being: The Convergence and Stability of Self-report and Non-self report Measures', *Journal of Personality*, **61**, 317–42.
- Schlaepfer, T. E., Cohen, M. X., Frick, C., Kosel, M., Brodesser, D., Axmacher, N., Joe, A. Y., Kreft, M., Lenartz, D. and Sturm, V. (2007), 'Deep Brain Stimulation to Reward Circuitry Alleviates Anhedonia in Refractory Major Depression', *Neuropsychopharmacology*, Advance online publication 11 April; doi: 10.1038/sj.npp.1301408.
- Schwarz, N. and Sarack, F. (1999), 'Reports of Subjective Well-Being: Judgmental Processes and Their Methodological Implications', in Kahneman D. Diener E. and Schwarz N. (eds), *Well-Being: the Foundations of Hedonic Psychology*. Russell Sage Foundation, New York; 61–84.
- Seidlitz, L., Wyer, R. S. Jr and Diener, E. (1997), 'Cognitive Correlates of Subjective Well-being: The Processing of Valenced life Events by Happy and Unhappy Persons', *Journal of Research in Personality*, **31**, 240–56.
- Shedler, J., Mayman, M. and Manis, M. (1993), 'The Illusion of Mental Health', *American Psychology*, **48**, 1117–31.
- Sheldon, K. M. and Lyubomirsky, S. (2006), 'Achieving Sustainable Gains in Happiness: Change Your Actions, not Your Circumstances', *Journal of Happiness Studies*, **7**, 55–86.
- Sutton, S. and Davidson, R. (1997), 'Prefrontal Brain Symmetry: a Biological Substrate of the Behavioral Approach and Inhibition Systems', *Psychological Science*, **8**, 204–10.
- Tännsjö (1998), *Hedonistic Utilitarianism*. Edinburgh University Press, Edinburgh.
- Van Praag, B. M. S. and Ferrer-I-Carbonell, A. D. A. (2004), *Happiness Quantified: a Satisfaction Calculus Approach*. Oxford University Press, Oxford.
- Vassar, M. (2008), 'A Note on the Score Reliability of the

- Satisfaction with Life Scale: An RG Study', *Social Indicators Research*, **86**, 47–57.
- Veenhoven, R. (1984), *Conditions of Happiness*. Kluwer Academic, Dordrecht.
- Veenhoven, R. (1996), 'Developments in Satisfaction Research', *Social Indicators Research*, **37**, 1–46.
- Veenhoven, R. (2005), 'Return of Inequality in Modern Society? Test by Dispersion of Life-Satisfaction Across Time and Nations', *Journal of Happiness Studies*, **6**, 457–87.
- Veenhoven, R. and Kalmijn, W. M. (2005), 'Inequality-adjusted Happiness in Nations', *Journal of Happiness Studies*, **6**, 351–5.
- Winkelmann, L. and Winkelmann, R. (1998), 'Why are the Unemployed so Unhappy?', *Economica*, **65**, 1–15.
- Yadin, E. and Thomas, E. (1996), 'Stimulation of the Lateral Septum Attenuates Immobilisation-induced Stress Ulcers', *Physiology and Behavior*, **59**, 883–6.