2009/17

■

What good is happiness?

Marc Fleurbaey, Erik Schokkaert
and Koen Decancq

CORE DISCUSSION PAPER
2009/17

What good is happiness?

Marc FLEURBAEY[1], Erik SCHOKKAERT[2]
and Koen DECANCQ[3]

March 2009

Abstract

In this paper we examine whether, and how, welfare economics should incorporate the insights from happiness and satisfaction studies. Our main point is that measuring well-being by reported satisfaction levels can come in conáict with individualsíjudgments about their own lives and that these individual judgments should be respected. We propose an alternative measure of welfare in terms of equivalent incomes that does respect individual preferences. Satisfaction surveys are useful, however, to derive information about preferences. We illustrate our approach with panel data from the Russian Longitudinal Monitoring Survey (RLMS) for the period 1995-2003 and we compare the results for equivalent incomes with the results for sub jective satisfaction.

Keywords: happiness, satisfaction, preferences, welfare economics, psychology

JEL Classification: D60, D71

---

[1] CERSES, Université Paris-Descartes, France; Université catholique de Louvain, CORE, B-1348 Louvain-la-Neuve, Belgium; and IDEP. E-mail: marc.fleurbaey@parisdescartes.fr

[2] Katholieke Universiteit Leuven, Department of Economics, B-3000 Leuven, Belgium; Université catholique de Louvain, CORE, B-1348 Louvain-la-Neuve, Belgium.
E-mail: erik.schokkaert@econ.kuleuven.be

[3] Katholieke Universiteit Leuven, Department of Economics, B-3000 Leuven, Belgium.
E-mail: koen.decancq@econ.kuleuven.be

"For nothing is more certain, than that despair has almost
the same effect on us with enjoyment, and that we are
no sooner acquainted with the impossibility of
satisfying any desire, than the desire itself vanishes."

D. Hume, *A Treatise of Human Nature*

1 Introduction

Happiness studies are shaking the routine of welfare economics. For decades practitioners and theorists worked within a relative consensus about the view that interpersonal comparisons of utility were deeply problematic. This consensus involved two different ideas, most of the specialists endorsing at least one of them. First, advocates of the ordinal approach (such as Robbins and Samuelson) stated that interpersonal comparisons of utility had no sound empirical basis. Second, even if interpersonal comparisons of utility could be made, the "welfarist" doctrine that considers subjective utility to be the proper metric for the evaluation of the distribution of social advantages was rejected on ethical grounds.

The success of happiness studies has toppled the consensus on the first idea. With the mass of data accumulated on happiness and satisfaction and the development of their econometric exploitation, subjective utility seems more measurable than ever. There now seem to be good reasons to trust the existence of sufficient regularity in human psychology, so that interpersonal comparisons appear feasible in principle. These new developments have triggered a revival of welfarism as well. If utility can be measured after all, why not take it as the metric of social welfare? Several authors have taken this line (Kahneman et al. 2004b, Layard 2005). However, none of the recent developments in the field of measurement directly undermine the arguments that were raised against welfarism in the philosophical debates of the previous decades. The fact that something becomes easier to

measure does not give any new normative reason to rely on it.

Our aim in this paper is to assess whether, and how, the development of happiness studies can be helpful for making progress in welfare economics. In a nutshell, our thesis will be that happiness or satisfaction data can help us obtain information on individual preferences about the various dimensions of life, in particular the dimensions which are not directly connected to economic activity. But we will oppose the welfarist use of such data on the ground that this is unlikely to respect individual preferences on what makes a good life. We will introduce the concept of "equivalent income" as a measure of individual well-being that does respect individual preferences and show how the satisfaction data can be used to implement this concept.

This paper belongs to a stream of critical literature which interrogates the implications of happiness studies for welfare economics, and includes Barrotta (2008), Burchardt (2006), Frey and Stutzer (2007), Nussbaum (2007), Schokkaert (2007). Our work has much in common with these papers, but our line of argument is more formal and, we hope, more precise in the positive part of the proposal.[1] Another related branch of the literature derives estimates of willingness-to-pay from happiness surveys (Clark and Oswald 2002, Frey et al. 2004, Lüchinger and Raschky 2008, Van Praag and Baarsma 2005, Van Praag and Ferrer-i-Carbonell 2007). Our work is similar as it seeks to estimate ordinal preferences but we propose a different use of such estimates.

The paper is structured as follows. Section 2 introduces the basic concepts and the formal framework of our analysis, focusing on the distinction between preferences and satisfaction. Section 3 derives the core argument against welfarism from axioms

---

[1]Our general discussion also addresses the specific worries that have been voiced by some researchers looking at the empirical data on happiness. We give two examples. Ravallion and Lokshin (2001) show that satisfaction with life is strongly influenced by personality traits and then make the point that "the fact that a person is inhibited, rebellious or unconfident would not normally constitute a case for favourable tax treatment" (p. 339). Deaton (2008) observes that HIV prevalence has little effect on Africans' life satisfaction and suggests that satisfaction measures seem not to take up crucial dimensions of life.

expressing the requirement to respect individual preferences over the dimensions of life. It also introduces our own alternative approach in terms of equivalent incomes. Section 4 examines how to make use of happiness and satisfaction surveys in order to derive relevant information about individual preferences. Section 5 illustrates our methodology with individual panel data for Russia in the period 1995-2003. Section 6 concludes.

2   Satisfaction and preferences

The arguments put forward by Sen (1985) were very influential in spreading the criticism of welfarism among economists. He first raised the issue of "physical-condition neglect": utility is only grounded on the mental attitude of the person, and does not sufficiently take into account her real physical condition. Two examples are particularly illustrative. One is the case of expensive tastes, in which a higher level of aspiration may dampen an individual's satisfaction although this hardly seems a sufficient reason to consider him to be really worse-off. The other is the case of persons who adapt their aspirations to their objective circumstances: "A person who is ill-fed, undernourished, unsheltered and ill can still be high up in the scale of happiness or desire-fulfilment if he or she has learned to have 'realistic' desires and to take pleasure in small mercies" (Sen, 1985, p. 21). In such examples aspirations appear to play too big a role in the reported satisfaction while the real conditions of life are insufficiently recorded. A second important problem identified by Sen is what he called "valuation neglect". Valuing a life is a reflective activity in a way that "being happy" or "desiring" need not be (Sen, 1985, p. 29). An acceptable approach to well-being should explicitly take into account this valuational activity by the persons themselves.

While these criticisms of welfarism stand as convincing as ever, non-welfarist approaches have their own problems when it comes to deriving concrete proposals. They

usually start from a list of "functionings" (Sen 1985) that describes individual life in some a priori relevant dimensions. However, to arrive at an overall measure of well-being, it is necessary to compute a synthetic index in which these various items are weighted. It is usually considered that this so-called "index problem" raises a dilemma in which one has to choose between welfarism and paternalism. Welfarists argue that individuals' views of their own life are reflected in their satisfaction level. Any alternative set of weights would not reflect individuals' views on their own life and could therefore be accused of paternalism or perfectionism, of "playing God" and imposing an external definition of the good life.[2] In fact, the main factors shown in the happiness studies to matter tend to be quite similar to the main items in the objective lists proposed in the non-welfarist literature. Happiness studies stress the importance of status and social relations, the harm done by unemployment or by competitive struggles among individuals, the benefits brought by good health and family ties, and so on. Individual autonomy appears to be a key aspect of satisfaction with one's life, which includes but is much broader than access to material resources.

We side with those who consider that one must rely on individual preferences in order to weight the various dimensions of life. It would certainly be utterly absurd to evaluate individual situations without any connection to human needs and goals as perceived by the individuals themselves. However, we firmly reject the conclusion that this necessarily leads to welfarism. Quite the contrary, the central message of this paper will be that *respecting individual preferences requires abandoning welfarism.* This means in particular that there is a way out of the dilemma between paternalism and welfarism. In this section, we describe the intuitive core of our argument, that will be elaborated more formally in

---

[2]Layard (2005) rebuts the adaptation critique by arguing that the alternative is ominous: "If we accept the Marxist idea of 'false consciousness', we play God and decide what is good for others, even if they will never feel it to be so." (p. 121)

section 3.

The delicate part of our argument is to explain that the level of satisfaction and the preference ranking can fall apart. Due to the influence of utilitarianism, economists are naturally attracted to the idea that there is a unique core object that underlies answers to happiness and satisfaction questionnaires and that represents individual preferences — and they call it "utility". But this is not how psychology sees it.[3] As is emphasized, e.g., in Diener (1994) and Diener et al. (1999), utility, if there is such a thing, is an irreducibly multidimensional phenomenon. In particular, there is an essential distinction between affects and cognition. In the cognitive part of their satisfaction, individuals cast a judgment over their life. This judgment is an active exercise that is made whenever they want to make an assessment of their situation (for instance, when a happiness surveyor asks them to do so). It is not a quantity that stands in their brain permanently. In contrast, positive and negative affects flow constantly when individuals are awake. Among them are feelings of pleasure, joy, excitement, pain, sorrow, abatement, love, hate, pride, shame, and so on, most of these items being subdivided into finer categories.

In order to analyze the relationship between affects, cognitions and preferences, a model can be helpful. Let f_i denote the vector of functionings describing the life of individual i.[4] As we will see, it is best to think of f_i as including the affects and feelings that characterize the individual's subjective states in his life. In contrast, the evaluative judgment that he may cast on his life is not part of f_i — although this judgment may generate affects which are part of f_i. In this respect, we assume that each individual i has an ordering over the vectors of functionings, which reflects his informed judgment about

---

[3] J.S. Mill already criticized Bentham's unitary concept of utility, blaming "the empiricism of one who has had little experience" (quoted in Nussbaum 2008).

[4] The term "functionings" is convenient because, in Sen's words, it includes all "doings and beings" that may fill a life. But terminology is not essential, what is important is that the vector f_i includes all personal aspects of life that may matter to the individual. It may also include "capabilities" (opportunities), not just achieved functionings.

what makes a life good or bad. We call it the "valuation ordering", and denote it by R_i. The expression $f_i R_i f_i'$ means that i weakly prefers the life described by f_i to the life described by f_i'. Let $f_i P_i f_i'$ denote strict preference.

To prefer a life to another is not the same thing as having a greater "hedonic score", i.e., a better balance of positive and negative affects. It appears rather implausible that individuals would care only about their hedonic subjective states. Moreover, they may have complex views about the relative importance of various affects. Therefore, affects are best seen as subdimensions of life vectors f_i.[5] In order to see the role of judgment in the evaluation of affects, observe that while positive and negative affects can be easily distinguished, it is not always the case that positive affects are welcome and negative affects are shunned. There are disliked sources of pleasure; there are also certain sorts of grief that testify to the value of what is lost, certain fears that distinguish courage from recklessness.[6] Affects themselves are generally influenced by and mixed with judgments (see Kahneman, 1999), but they do not comprehend the global evaluation an individual makes of all the dimensions of life. The literature often recalls the Benthamite argument that happiness is the only thing that is intrinsically valuable because all other valuable things derive their value from their contribution to happiness.[7] This argument is a sort of tautology if happiness is understood as the evaluation of one's life — obviously, a thing is valuable only insofar as it contributes to a good evaluation — but it is unacceptable if happiness is understood as a hedonic state.

Nor is to prefer a life to another the same thing as being more satisfied in that life, because the satisfaction judgment is not just an ordering of various lives. It also involves the evaluation of one's life with respect to a frame of reference, in particular certain

---

[5]This view is eloquently defended in Loewenstein and Ubel (2008). Becker and Rayo (2008) also propose to model happiness as one argument among others of individual "utility".

[6]This point is made in Nussbaum (2008).

[7]This argument is taken up recently in Layard (2005). Diener (1994) attributes it to Aristotle. See, however, Nussbaum (2008) on Aristotle's conception of happiness.

aspirations. Let A_i denote the vector of variables which determine i's frame of reference. From the happiness literature one knows that such variables include in particular the past history of i's life and the situation of his group of reference.[8] The satisfaction level of individual i, denoted σ_i, can then be described as determined by a function

$$\sigma_i = \sigma(f_i, R_i, A_i). \tag{1}$$

For instance, a simple possibility is when satisfaction depends on the comparison between a level of achievement and a level of aspiration. But many other possibilities are allowed by this model. Moreover, it is not necessary to assume at this stage that satisfaction can be measured in a cardinal way.

Finally, there is the answer to a question such as "Taking all things together, how satisfied are you with your life as a whole these days? Are you very satisfied, satisfied, not very satisfied, not at all satisfied?". We cannot expect individuals to give an answer that is exactly faithful to their true σ_i. Therefore, one can only write the expressed satisfaction, S_i, as determined by a function in which a disturbance term d_i appears:

$$S_i = S(\sigma_i, d_i). \tag{2}$$

Disturbance comes from the fact that individuals are not given enough time to reflect properly and the fact that their judgment can be tinted by the mood of the day, by the good looks of the surveyor or by their feeling a duty to give a rosy (or a not too rosy) answer.[9]

---

[8] See, e.g., Van Praag and Ferrer-i-Carbonell (2007), Clark and Oswald (2002), Clark et al. (2008).

[9] Another popular question is: "How happy are you at the moment, all things considered?", with many different variants. In our perspective the focus on "happiness" may make answers provide more information about affects than about the cognitive aspect of satisfaction. The fact that happiness and satisfaction questionnaires usually give similar statistical results in the literature suggests that both suffer from an insufficient clarification of the object of the question, leading respondents to give a confused

The essential distinction between "preferences" and "satisfaction", as reflected in (1) and (2) comes out clearly in the empirical literature. Consider the famous discrepancy between the evolution of satisfaction over time, which is rather stable for most countries in the long run, and the growth of GDP. It is usually interpreted as meaning that income growth, at the national level, does not really improve satisfaction in the long run.[10] Yet it sounds exaggerate to derive from this the claim that people do not really care about material resources. Consider the following thought experiment. Propose to people in the 1960s to double their real income and to have access to mobile phones, internet, low-cost air transport and the rest, in combination with an increase in life expectancy of about ten years. Make sure they understand that it is not their relative standing that will rise but the whole society. Would they not see this perspective as particularly attractive? Symmetrically, ask people living in the 2000s to imagine all of them going back to the standard of living of the 1960s, with the corresponding reduced life expectancy. Would they consider it a minor sacrifice? The most plausible conjecture is that the former would heartily accept the change while the latter would strongly resist it. One interpretation of such attitudes is that people are mistaken about what really matters to them, about what really affects their satisfaction. We believe that there is some truth in this interpretation, but that it is not the whole story, nor even its main part. Even when one forecasts that, by adapting one's aspirations, one's satisfaction will remain stable in the long run, one can still have definite preferences for a longer and more affluent life. Such preferences are not proved to be mistaken when one comes to adapt to one's current conditions and to consider them as the frame of reference when answering satisfaction questionnaires.[11]

---

answer mixing affects or cognitive evaluation, possibly in different proportions for different respondents.

[10] See Easterlin (1995), Oswald (1997). While this is a long-standing finding in the happiness literature, it is still matter of debate. See in particular Stevenson and Wolfers (2008) and, in the same issue, the comments by G. Becker and L. Rayo and by A. Krueger.

[11] Another possible interpretation of the stability of satisfaction curves in the long run is that while some aspects have improved (income, life expectancy), others have worsened (social relations, economic risk). If that were the case, then people should declare indifference to our hypothetical questions if the

Here is another example in the same vein. Schkade and Kahneman (1998) have found that in the USA, students living in California and students living in the Midwest have similar levels of satisfaction with their lives, although both declare that someone like them would have a better life in California than in the Midwest. The most likely explanation for this finding is again that all these students do prefer to be in California, other things equal, while once they are completely settled in one region this preference does not appear in their satisfaction levels because they adapt their standards to their current situation, in what Kahneman has called an "aspiration treadmill".[12]

Given that it is possible and necessary to distinguish preferences, satisfaction and affects, here comes our main argument: the measure of well-being to be used in welfare economics should respect preferences R_i, and should therefore not be based on the satisfaction level σ_i nor on the "happiness" affects featuring in f_i. We consider it essential to respect "individual sovereignty" — a term that we prefer over the more traditional but more restricted notion of "consumer sovereignty". First, we strongly feel that the well-being of individuals should be evaluated on the basis of their (cognitive) view on what is a good life, rather than solely in terms of affects.[13] Second, as far as satisfaction

way of life of the two epochs were described in a sufficiently complete way. We doubt that this would be their answer.

[12]Schkade and Kahneman (1998) suggested that the answers could be the result of a "focusing illusion", namely, considering the difference between the two regions makes them think about the climate and overestimate the importance of the weather for their overall satisfaction. Kahneman (2008) explains how he later hypothesized that the "aspiration treadmill" was a better explanation of the California-Midwest study. He combined it with the hypothesis that people are really happier in California but have higher standards of happiness when declaring their satisfaction. He explains he no longer believes in this joint hypothesis because more recent studies have shown that happiness is more adaptable than satisfaction, i.e., the "hedonic treadmill" is stronger than the "aspiration treadmill". It seems to us, however, that these later results do not disprove the existence of an aspiration treadmill. They just suggest that Californians are neither happier nor more satisfied than others. Our main point is that all this is compatible with everyone having a definite preference for being in California.

[13]An important part of the happiness literature (Kahneman 1999, Kahneman et al. 1997, 2004a,b) has made the interesting point that hedonic states form an "objective" sort of happiness that is not well understood and memorized by the individuals themselves. As a consequence, specific methods are needed to measure it. This literature initially endorsed the Benthamite view that the aggregate quantity of objective happiness should be maximized, in spite of the paradox that this is not what people recall and care about (this objection is raised in Hausman 2007). Kahneman and Krueger (2006) have qualified

judgments are concerned, it appears that people do not seek merely to "be satisfied" by all possible means. According to our model one can "be satisfied" by three means: 1) by achieving one's goals (f_i); 2) by reducing one's aspirations (A_i); 3) by adapting one's preferences (R_i).[14] If we want to respect individual sovereignty, we should focus only on the degree of achievement of people's goals. Satisfaction levels are not a reliable proxy for it. In fact, with our simple model, it is easy to understand why one's satisfaction level is not necessarily in line with one's judgment over one's life. It is indeed possible to have $\sigma(f_i, R_i, A_i) \leq \sigma(f_i', R_i, A_i')$ even though $f_i P_i f_i'$. This can happen if the adaptation of aspirations overshoots, for instance because the reference group undergoes a better improvement than i. Or, if a rich life f^{**} is preferred to a poor life f^* by two individuals i and j having the same views about life, $R_i = R_j$, it can happen that $\sigma(f^{**}, R_i, A_i) = \sigma(f^*, R_j, A_j)$ when the rich "suffers" from high aspirations whereas the poor has adapted his aspirations to his situation. To conclude that the two lives are equally good because $\sigma_i = \sigma_j$, however, would go against these individuals' own unanimous judgments. Therefore, rather than a way to avoid paternalism, welfarism is deeply paternalistic itself.[15]

We do not claim that the individual valuation orderings are always respectable. Individuals may suffer from imperfect information, irrationality, or be conditioned by questionable social customs. An important literature has been emphasizing behavioral anomalies and some authors consider that the mere concept of preferences is problematic in this

---

this view, noting that the happiness data are not so reliable, especially for interpersonal comparisons, because of strong adaptation effects and substantial cultural variations. As a consequence they propose a different index that measures the amount of time that individuals spend in negative mood. This index is less sensitive to scaling errors than average happiness. Diener (2000) also notes that time spent in positive or negative mood is a better predictor of people's own recording of happiness.

[14]Barry (2007) compares an individual who would seek to be satisfied per se — instead of getting what he wants — to a football fan who would support whatever team is most likely to win. What kind of football fan would that be?

[15]Another tradition, coming from Buddhism and Stoicism, downplays the achievement of one's goals and puts the adaptation of preferences and aspirations to the centre stage. This appears to be motivated by the objective of reducing negative affects like anguish and frustration. See, e.g., Kolm (1982).

light.[16] This is why we have been careful to make the principle of individual sovereignty conditional on the assumption that the valuation orderings are respectable. We only claim that *if* there is no reason to attribute flaws to these orderings, they should be respected. If there are convincing reasons to think that preferences are flawed, they should be "laundered"[17] before being used for the evaluation of social states. How and when to launder preferences is a difficult question, but using subjective satisfaction measures as the ultimate criterion is definitely not an attractive option. More generally, a careful examination of how the lessons from behavioral economics should be taken into account in our approach will await future research. Bernheim (2008) argues that some parts of individual preferences are not subject to reversals and can serve as partial orderings from which welfare conclusions can be drawn.[18] We will assume complete individual orderings in this paper but our approach can be extended to incomplete orderings. The details of such extension will be examined in future work.

In the rest of the paper we examine two questions. First, while we have rejected welfarism as an attractive solution to the index problem, we still have to explore more formally the implications of individual sovereignty for defining a proper way of making interpersonal comparisons. This will be done in the following section. In the next sections we explore how to retrieve valuable information about R_i from the happiness surveys.

3   From individual sovereignty to equivalence

When performing interpersonal comparisons, one does not just have to compare functioning vectors f_i across individuals, but also to take account of the concerned individuals'

---

[16]See, e.g., Kahneman and Thaler (2006), Dolan and Kahneman (2008).

[17]The expression comes from Goodin (1986).

[18]We cannot agree with his suggestion to rely on choices in order to elicit such unambiguous preferences, because there are many aspects of quality of life that are not chosen by individuals. Hopefully, statements of satisfaction or preferences can be relied upon for such non-chosen elements of quality of life.

preferences. So, really, one has to compare 4-tuples (f_i, R_i, A_i, d_i). In this section we set aside the informational problem that R_i may be imperfect or imperfectly observed, in order to define an ideal method of comparisons that may guide us in applications involving imperfections.

Our guiding principle is individual sovereignty: when — as assumed in this section — there is no reason to correct R_i for any flaw, we should respect it. We will first show that the *welfarist ranking* that simply compares utilities or satisfaction levels σ_i or S_i across individuals does not respect even a very weak version of the principle of individual sovereignty. We will then show how a natural interpretation of the principle leads to the so-called *equivalence ordering*.

To fix ideas, we assume that there are m dimensions of life and that f_i can take any value in $\mathbb{R}^m_+$. We also assume that R_i is continuous and that it is weakly monotonic, i.e., that $f_i \geq f'_i$ implies $f_i R_i f'_i$ and $f_i \gg f'_i$ implies $f_i P_i f'_i$.

The most important and most immediate application of the principle of individual sovereignty is to respect R_i over comparisons concerning only i, i.e.,

(f_i, R_i, A_i, d_i) is at least as good as (f'_i, R_i, A_i, d_i) if and only if $f_i R_i f'_i$.

Let us call it the "**Personal-Preference Principle**". We can extend this principle to comparisons between individuals having identical preferences. That is,

if $R_i = R_j$, then (f_i, R_i, A_i, d_i) is at least as good as (f_j, R_j, A_j, d_j) if and only if $f_i R_i f_j$.

We will call this the "**Same-Preference Principle**". The Same-Preference Principle logically implies the Personal-Preference Principle (as a special case). The Same-Preference Principle is not familiar in welfare economics, contrary to the Personal-Preference Principle. But, as we argued in the previous sections, when two individuals make identical evaluations of all possible lives, it seems problematic to go against their

13

common view about their *own* lives. Another compelling application of the principle is to changes over time for the same individual. In that setting the "same-preference principle" states that, if preferences over time remain the same, they should be respected, even if the individual adapts to the situation and changes his aspiration level.

The Same-Preference Principle implies that the evaluation of (f, R, A, d) must not depend on A, d at all. Consequently, it is clear that *the welfarist ranking respects the Personal-Preference Principle but does not respect the Same-Preference Principle.* This was precisely the point of the 1960-2000 and California-Midwest examples introduced before. Since the Same-Preference Principle is compelling if one wants to respect individual sovereignty, this appears to exclude welfarism as an approach to interpersonal comparisons. Discarding welfarism, however, brings us back to the "index problem". Is it possible to avoid paternalism, i.e. to extend the application of the principle of individual sovereignty for a world in which different individuals may have different preferences?

Let us start from what seems an obvious idea, which is in line with the examples given before. Why not extend the Same-Preference Principle to situations in which $R_i \neq R_j$? This would read as follows:

(f_i, R_i, A_i, d_i) is at least as good as (f_j, R_j, A_j, d_j) if $f_i R_i f_j$ and $f_i R_j f_j$,

and strictly better if $f_i P_i f_j$ and $f_i P_j f_j$.

Although this may sound like a natural extension, it is impossible to satisfy. Consider the following example. Take $f_i, f_j, f_k \in \mathbb{R}^m_+$ yielding the configuration of indifference curves displayed in Figure 1. By this extended principle, (f_i, R_i, A_i, d_i) is better than (f_k, R_k, A_k, d_k), which is itself better than (f_j, R_j, A_j, d_j), which is better than (f_i, R_i, A_i, d_i) : we have a cycle. Extending the application of the principle of individual sovereignty to a world in which individuals may have different preferences turns out to be far from trivial.
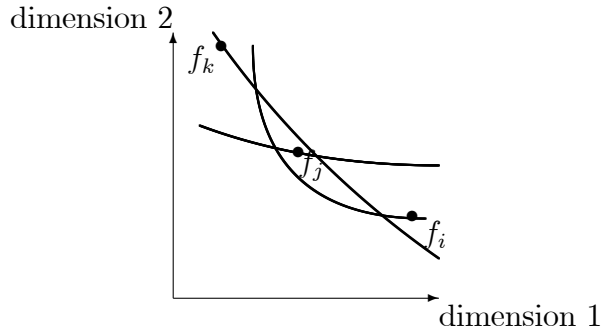
dimension 2

f_k

f_j

f_i

dimension 1

Figure 1: Impossibility of the extended Same-Preference Principle

To make progress, one must add restrictions to the premiss of the requirement in order to make it reasonable. We will consider two possible approaches. A first possible restriction consists in requiring the individuals to agree on other vectors than just f_i, f_j. In particular, one could propose that:

(f_i, R_i, A_i, d_i) is at least as good as (resp., strictly better than) (f_j, R_j, A_i, d_i)

if the indifference set for R_i that contains f_i lies nowhere below (resp., everywhere above)

the indifference set for R_j that contains f_j.

Let us call this the "**Indifference Set Dominance Principle**". This principle logically implies the Same-Preference Principle and seems to be yet another sensible emanation of individual sovereignty.

A second possible restriction consists in requiring to have $f_i R f_j$ (or $f_i P f_j$) for all admissible preference orderings R (not just for R_i and R_j), which in our case is equivalent to requiring $f_i \geq f_j$ (or $f_i \gg f_j$). This gives us the following "**Vector Dominance Principle**":[19]

(f_i, R_i, A_i, d_i) is at least as good as (f_j, R_j, A_j, d_j) if $f_i \geq f_j$,

---

[19]This axiom corresponds to Sen's (1985) "intersection principle". On this issue, see in particular Brun and Tungodden (2004).

and strictly better if $f_i \gg f_j$.

While this principle seems very reasonable at first sight, it is incompatible with the Personal-Preference Principle, which we introduced as the most essential feature of individual sovereignty. Indeed, it implies that (f, R, A, d) is as good as (f, R', A', d') for all f and all R, R', A, A', d, d', so that R plays no role in the evaluation of (f, R, A, d), contrary to what is required by the Personal-Preference Principle.

Even the requirement that (f_i, R_i, A_i, d_i) be better than (f_j, R_j, A_j, d_j) whenever $f_i \gg f_j$ is incompatible with the Personal-Preference Principle. This incompatibility is shown by the following example. Take $f_i, f_j, f_i', f_j' \in \mathbb{R}_+^m$ and R_i, R_j such that $f_i \gg f_j, f_i' \ll f_j'$, $f_i' P_i f_i$, and $f_j P_j f_j'$. Figure 2 illustrates this configuration in a two-dimensional case. The Personal-Preference Principle implies that (f_i', R_i, A_i, d_i) is better than (f_i, R_i, A_i, d_i) and (f_j, R_j, A_j, d_j) is better than (f_j', R_j, A_j, d_j) while the Vector Dominance Principle implies that (f_i, R_i, A_i, d_i) is better than (f_j, R_j, A_j, d_j) and (f_j', R_j, A_j, d_j) is better than (f_i', R_i, A_i, d_i). By transitivity, one obtains that (f_i, R_i, A_i, d_i) is better than (f_i, R_i, A_i, d_i), which is impossible.
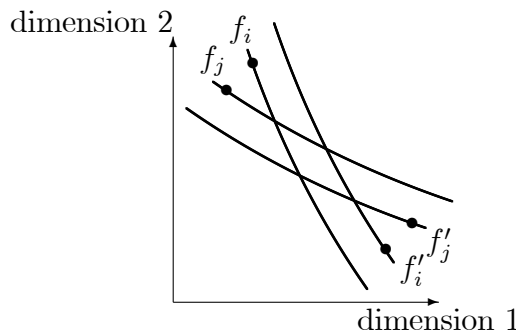

Figure 2: Incompatibility between the Vector Dominance and the Personal-Preference Principles

In virtue of individual sovereignty, we believe that the Personal-Preference Principle must be given priority. We therefore cannot retain the Vector Dominance Principle. We

can nonetheless seek a weakening of the Vector Dominance Principle that is compatible with some respect for preferences. A rather natural solution consists in restricting the application of the dominance idea to a certain region of the space of functioning vectors. The restriction to a region of the space makes a lot of sense in concrete applications. Consider for instance a simple world with only two functionings, health and wealth. Imagine two individuals such that one has slightly more wealth than the other, but both have a poor health. It is not obvious that the wealthier individual is better-off than the other when it happens that he cares more about health and would be willing to make a great sacrifice of wealth if this could alleviate his health problems. In contrast, when individuals are healthy it appears natural to rank them according to their wealth. This amounts to restricting the application of the Dominance Principle to the region of the space where individuals are healthy. We will see other applications in the next sections.

Requiring interpersonal comparisons to satisfy the Personal-Preference Principle in conjunction with the Vector Dominance Principle restricted to a region has strong consequences because it basically imposes a specific approach to interpersonal comparisons, namely, the *equivalence* approach. The equivalence approach consists in specifying a monotone path in the space of functioning vectors $\mathbb{R}^m_+$, and comparing (f_i, R_i, A_i, d_i) and (f_j, R_j, A_j, d_j) by the relative positions of the vectors f_i^* and f_j^* from the monotone path such that $f_i I_i f_i^*$ and $f_j I_j f_j^*$. This is illustrated in Figure 3a, where (f_i, R_i, A_i, d_i) is declared inferior to (f_j, R_j, A_j, d_j) in this fashion, with the monotone path given by the dotted line.

Proposition 1 *Let B be a subset of $\mathbb{R}^m_+$ such that for every (f_i, R_i) there is f_i^* in B such that $f_i I_i f_i^*$. The Vector Dominance Principle restricted to B, in conjunction with the Personal-Preference Principle, implies the equivalence approach (with B as the monotone path), and also implies the Indifference Set Dominance Principle (as well as the Same-*

Preference Principle).

A complete proof of this result is provided in the appendix. The core argument is the following. Suppose that the region B over which the Vector Dominance Principle applies is large enough to potentially contain a configuration as in Figure 2. One would then obtain a contradiction. This fact implies that the region over which the Vector Dominance Principle applies must be as thin as a curve. Moreover, one shows that this curve must be increasing in $\mathbb{R}^m_+$, defining a monotone path that, by the Personal-Preference Principle, serves as in the equivalence approach.

This result suggests that the equivalence approach strikes a good compromise between the ideal of respecting the diversity of preferences, as embodied in the Personal-Preference, Same-Preference and Indifference Set Dominance Principles, and the vector dominance idea. It is particularly satisfactory that the stronger Indifference Set Dominance Principle follows from the combination of the Personal-Preference Principle with a vector dominance requirement.

Although an equivalence ordering is a rather specific approach to interpersonal comparisons — in particular, it is not welfarist — the class of equivalence orderings is large. It consists in all orderings which compare tuples (f, R, A, d) exclusively in terms of the corresponding indifference sets, and evaluate any given indifference set by the point of the monotone path that it contains. A prominent example in this class is famous in economic theory, namely, the ray utility function, which takes a reference f_0 and computes utility as the real number λ such that the individual is indifferent between f and λf_0. This function can be found in many references, e.g., Debreu (1959), Samuelson (1977), Pazner (1979).[20]

---

[20]One can extend the class of equivalence orderings and replace the monotone path by a collection of nested sets. An example is the money-metric utility function, which takes a reference price vector p_0 and computes λ such that the maximum satisfaction attainable with an expenditure equal to λ under the price p_0 is equal to the satisfaction reached with f. This function can be found, e.g., in Samuelson (1974). Blackorby and Donaldson (1988) have criticized the money-metric utility function for failing to yield quasi-concave social orderings over allocations, and their criticism can be extended to apply to the ray

Given the great variety of equivalence orderings, one must ask how to go about the choice of the monotone path. We do not have a complete theory for this, but the literature offers examples where some foundations for a special choice of path can be obtained by specifying distributional judgments that are independent of individual preferences. We introduced already the health-wealth case. As another example, in Maniquet and Sprumont (2004), studying a public good economy with money, a particular path is deduced from the axiom that it is a social improvement to reduce the inequality in money transfers between any agent who contributes and any agent who is subsidized. All recent characterizations of social orderings based on equivalence rankings involve conditions of this sort, i.e., axioms specifying some distributive principle that does not depend on individual preferences.
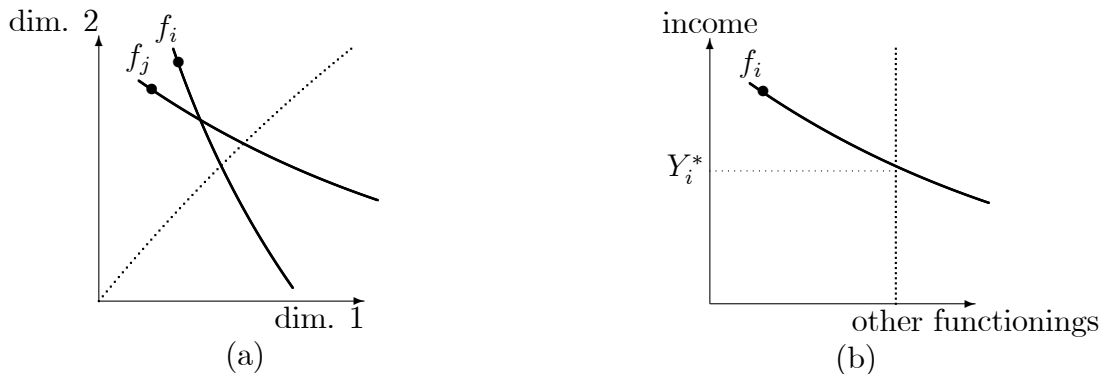
Figure 3: Illustration of the equivalence approach

In the next section, we provide a simple example of how a particular monotone path can be chosen. This is an extension of the health case and is closely related to money-metric utilities proposed by Samuelson (1974) and, for welfare analysis, by Deaton and Muellbauer (1980) and King (1983). In this approach one picks reference values for the various functionings (except income). These reference values are chosen in such a way

---

utility function and similar constructs. The problem, however, disappears when the social aggregation relies on the maximin or leximin criterion, and is substantially alleviated when inequality aversion is put in the social aggregation. For a recent discussion of the pros and cons of the equivalence approach, see Fleurbaey (2008).

that it seems ethically acceptable to compare the well-being of the individuals in terms of their income, independently of their preferences, when they are at these reference values. The equivalence idea then implies that one looks for what we will call an equivalent income Y_i^* for each individual i. This *equivalent income* is such that the individual is indifferent between her actual functionings bundle (including her actual income Y_i) and the bundle containing Y_i^* and all the other functionings at their reference levels. Interpersonal comparisons can then be relevantly made with these values Y_i^*. This is illustrated in Figure 3b.

4 Estimating equivalent incomes with happiness data: some methodological issues

In this section we study if, and how, the theoretical proposal from the previous section can be implemented using data from a satisfaction survey. This requires retrieving information about R_i from data about S_i. The typical "satisfaction with life" question is formulated in the following way: *"To what extent are you satisfied with your life in general at the present time?"*, with answers on a discrete scale ranging from "fully satisfied" to "not at all satisfied". In many publications, the responses to this question are then explained by an (often linear) regression:

$$S_{it} = \gamma' X_{it} + d_{it}. \tag{3}$$

with S_{it} the satisfaction with life of individual i in period t, X_{it} a vector of explanatory variables, d_{it} a disturbance term and γ a vector of coefficients to be estimated. The vector X_{it} usually contains a diverse set of variables, some of which describe the conditions of life of individual i (typical examples are income or expenditures, health, quality of housing, marital status), while others capture personal characteristics (such as gender, ethnicity or

being religious). In addition to measurement errors and to the effects of omitted variables, the disturbance term d_{it} is also meant to capture the mood of the day of the respondent and the effects of short-run random events.

Two econometric issues that have been extensively discussed in the literature, are especially relevant within our theoretical framework (see, e.g. the discussion in Ferrer-i-Carbonell and Frijters, 2004). First, there is a serious concern that unobserved personal characteristics might lead to biased estimates of the parameters of interest γ. In fact, the psychological literature has pointed to the crucial importance of personality traits such as extroversion, conscientiousness and emotional stability for the explanation of satisfaction. It is likely that these personality traits are correlated with some of the variables in X_{it}. Not taking into account this unobserved individual heterogeneity will then lead to biased estimates of γ. It is therefore now generally accepted that it is preferable to work with panel data and to include individual fixed effects in (3). We can make this explicit by rewriting (3) as (with some abuse of notation)

$$S_{it} = \alpha_i + \mu_t + \gamma' X_{it} + d_{it} \; , \tag{4}$$

where individual fixed effects and time effects are represented by α_i and μ_t respectively.

Second, given the discrete nature of the response categories, the natural econometric model to estimate (3) or (4) is an ordered logit or probit model. This has indeed become the dominant approach by economists, who are aware of the ordinal nature of the satisfaction measure and of the problem of interpersonal comparability. We will return to the latter problem at the end of this section. Let us for the moment accept that one wants to estimate an ordered logit model. Estimating (4) then raises the non-trivial econometric issue of how to incorporate individual fixed effects in an ordered logit model. As discussed by Ferrer-i-Carbonell (2004) and Frijters et al. (2006), it has been quite common in the

satisfaction literature either to return to a cardinal specification and estimate a linear fixed effects model or to collapse the satisfaction score into a binary outcome and to apply the Chamberlain (1980) approach. The first approach is unattractive from a theoretical point of view[21], the second approach induces a huge loss of information, since only the individuals that pass the single threshold are taken up in the estimations. Ferrer-i-Carbonell and Frijters (2004) therefore propose an extension of the Chamberlain-approach, in which the single threshold is no longer fixed but is made individual-specific. This "conditional fixed-effect ordered logit model" has been applied by Frijters et al. (2004) and Frijters et al. (2006) to German and Russian satisfaction data. While this extension makes it possible to make a more efficient use of the available information, it is computationally rather complicated. It turns out, however, that a good approximation of the original method is obtained by using the within-individual mean satisfaction score as the threshold.[22]

Let us leave the econometric issues aside and return to our interpretation of the model. A comparison of (4) with (1) and (2) from Section 3 shows that the vector of explanatory variables X_{it} contains indicators of f_{it} (the dimensions of life or the functionings of individual i) as well as variables measuring personal characteristics of i, that are related to her individual frame of reference A_{it} and her individual preferences R_{it}. Remember that we have assumed that S_{it} is a correct numerical representation of the preference ordering R_{it}: we therefore take it for granted that $S_{it} \geqslant S'_{it}$ if and only if $f_{it} R_{it} f'_{it}$.[23] In our approach, differences in the frame of reference (the aspiration levels) should not play a role in the overall evaluation of the living standard, while differences in

---

[21]It should be mentioned, however, that the results for the cardinal model are usually very similar to the results for the ordered logit (or probit) specifications - see Ferrer-i-Carbonell and Frijters (2004).

[22]This simplification can be implemented easily in STATA. Jones and Schurer (2007) report that with their data the results for the full approach and for the simplified approach are very similar. In fact, in their paper they propose a further generalization of the Ferrer and Frijters-method. This generalisation is not attractive for our purposes, however, because it would not allow us to identify all parameters of interest. We thank Andrew Jones for sending us the STATA-code to implement the simplified conditional fixed effects ordered logit model.

[23]We assume implicitly that fixing t also fixes A_{it} and d_{it}.

preferences should be respected. Therefore, to proceed we have to think explicitly about the interpretation of the different variables in the vector X_{it}. Moreover, in our interpretation it is hardly acceptable to work with a simple linear specification of (4). Indeed, since the vector of achieved functionings f_{it} is part of X_{it}, such a linear form would imply that all individuals have identical preferences, and that these preferences are characterized by perfect substitutability between the functionings f_{it}. These unrealistic assumptions would make the application of our approach trivial. At the same time, with the available data, it is not feasible to estimate a highly nonlinear specification of the satisfaction equation which at the same time allows for preference variation. We therefore propose the following compromise specification:

$$S_{it} = \alpha_i + \mu_t + \beta \ln(Y_{it}) + (\vartheta + \Lambda Z_{it})' f_{it} + \delta' Z_{it} + d_{it} \tag{5}$$

with $(\beta, \vartheta, \delta)$ a vector of direct effects and Λ a matrix with interaction effects to be estimated. Let us explain more carefully the different components of (5).

The initial step is the definition of the vector of relevant life dimensions f_{it}. Everybody agrees that income (represented in (5) by Y_{it}) is relevant. It is common to introduce a logarithmic transformation of Y_{it} in the satisfaction equation to capture some relevant nonlinearities.[24] With respect to the other functionings, different "lists" have been proposed in the literature. However, they are to a large extent overlapping and the most common items on these lists are part of the typical X-vector in the happiness literature: health, quality of housing and employment are examples. We will return to the problem

---

[24]We use here the logarithmic transformation of Y_{it} only as an example, because it turned out to be the most adequate specification in our data. Yet the argumentation in this section does not depend on this specific choice and could easily be adapted to other nonlinear transformations of Y_{it}. Moreover, we agree with Oswald (2008) that the fact that the logarithmic transformation yields the best fit for the observed satisfaction scores does not allow us to draw direct conclusions about the cardinalization of the "true" utility function.

of specifying the relevant functionings in the next section, when we interpret our own empirical results for Russia. Let us now for the moment suppose that the problem is solved and that we can define a vector f_{it}, containing the relevant dimensions of life apart from income.

The variables Z_{it} then measure the other personal characteristics of the individuals - typical examples being age and gender. These conditioning variables enter (5) in two ways. First, the direct effects of changes in Z_{it} are captured by the coefficients δ. These direct effects only shift the level of satisfaction upward or downward, without changing the marginal rates of substitution between the functionings. In our theoretical framework such upward and downward shifts (leaving the indifference curves the same) are interpreted as changes in aspiration levels. The individual fixed effects α_i, the time variables μ_t and the disturbance terms d_{it} have an analogous effect. They are all interpreted as features of the frame of reference of individual i. Note that the fixed effects α_i take up all the time-invariant individual characteristics. For instance, if individuals have preferences about some of their fixed bodily characteristics, the inequalities generated by their satisfaction about these characteristics cannot be recorded by this approach.

Second, the interaction terms between the conditioning variables Z_{it} and the functionings f_{it} allow us to model differences and changes in preferences. More specifically, (5) implies that the vector MRS_{it}^{Yf} of marginal rates of substitution between income and the different functionings is individual and time-dependent:

$$MRS_{it}^{Yf} = \frac{Y_{it}(\vartheta + \Lambda Z_{it})}{\beta} \qquad (6)$$

While (5) allows for preference variation, this variation is still limited, as we assume that it is linked only to variation in the variables Z_{it}. Individuals with the same values for

these conditioning variables are assumed to have identical preferences.[25] It is difficult to do better with the available data, which contain only one observation of individual satisfaction at each moment of time.

Let us now apply the ideas from the previous section to derive an overall indicator of the individual quality of life. We first choose a monotone path, which will allow us to derive a relevant equivalence ordering. As mentioned before, the most straightforward way to do so is to pick reference values for all the dimensions of life, except income. Let us denote these reference values for the life dimensions by $\overline{f}$. We can then calculate the "equivalent income" Y_{it}^* that makes individual i indifferent between the bundle of functionings $(Y_{it}^*, \overline{f})$ and his actual bundle (Y_{it}, f_{it}), by solving the following equation:

$$\beta \ln Y_{it}^* + (\vartheta + \Lambda Z_{it})' \overline{f} = \beta \ln Y_{it} + (\vartheta + \Lambda Z_{it})' f_{it} \tag{7}$$

which yields

$$Y_{it}^* = Y_{it} \exp\left[\left(\frac{\vartheta + \Lambda Z_{it}}{\beta}\right)' (f_{it} - \overline{f})\right] \tag{8}$$

These equivalent incomes will be our measure of the welfare position of the individuals. Note that the conditioning variables Z_{it} only appear in (8) in so far as they influence the preferences — the direct effects on the level of satisfaction (captured by δ in (5)) are irrelevant for the welfare evaluation. The same is true for the idiosyncratic disturbance term d_{it} and for the fixed effects α_i and the time effects μ_t, none of which appear in (7) and (8).[26]

---

[25] Note that this is not the case for the aspiration levels, which are different for different individuals because of the presence in eq. (5) of the individual fixed effects α_i and of the idiosyncratic disturbance term d_{it}.

[26] At this stage one could wonder why not simply use the right-hand side of eq. (7) as a measure of well-being. In fact, differences in aspiration levels will not influence these "corrected" measures of satisfaction either (see also Schokkaert, 2007). However, the use of equivalent incomes is clearly preferable for two reasons. First, using the right-hand side of eq. (7) would not satisfy the Subset Dominance Principle. Second, when comparing two individuals with $f_{it} = f_{jt} = \overline{f}$, their relative levels of well-being would

Our theoretical framework points to the importance of two further features of the empirical approach. First, social interdependencies and adaptation played an essential role in our interpretation of the satisfaction measures. To introduce these effects in the empirical analysis, we have to interpret Z_{it} broadly. Social interdependencies can be approximated by introducing relevant features of the reference groups of the individuals, e.g., average levels for the achieved functionings. The adaptation of aspiration levels can be analyzed by exploiting the panel nature of the data and introducing past achievements of the various functionings (Burchardt, 2005; Di Tella et al., 2007).[27] Equations (5) and (7) then illustrate the double role of social interdependencies and past achievements. If they induce changes in the aspiration levels, this will be captured by the direct effects δ and will not influence the equivalent incomes. If they change preferences, i.e. marginal rates of substitution, this will be reflected in (8). Identification of these different effects is based on the estimation of the interaction effects in (5).

Second, we return to the issue of interpersonal comparability of the satisfaction measures. The simplest way to specify an ordered logit (or probit) model is to introduce a set of fixed threshold parameters η_j ($j = 1, ..., q-1$, with q the number of response categories). Interpreting S_{it} as a "latent" satisfaction variable, the observed discrete responses $\widetilde{S}_{it}$ are then modelled as

$$\widetilde{S}_{it} = j \text{ if } \eta_{j-1} < S_{it} \leqslant \eta_j$$

Substituting (5) for S_{it} and assuming that d_{it} follows a logistic distribution leads to the ordered logit model.[28] Econometricians have proposed different methods to relax the assumption of fixed thresholds in this simple ordered logit model, but all these methods require specific assumptions if one wants to identify all parameters of interest. Our setting

depend on the values of Z_i and Z_j, in a way which seems rather arbitrary.

[27] We acknowledge that this implies an abuse of the notation Z_{it}, and more specifically of the subscript it.

[28] Assuming that d_{it} follows a normal distribution leads to the ordered probit model.

with changing and variable aspiration levels suggests a natural approach to this issue, which is to assume that the thresholds depend on those personal characteristics of the individuals that are related to their frame of reference. We can write this as:

$$\eta_{jit} = \pi_j + \kappa_i + \tau_t + \xi' Z_{it} \quad \text{for} \quad j = 1, ..., q - 1 \tag{9}$$

with κ_i an individual fixed effect, τ_t a time effect and (π_j, ξ) a vector of coefficients to be estimated. Equation (9) still implies that the range of the response categories $(\eta_{jit} - \eta_{(j-1)it})$ is fixed and equal to $(\pi_j - \pi_{j-1})$ for all individuals and all periods of time, but the specific values of the thresholds are now individual-specific and time-dependent. Using (5) and (9), we can model the answers of the respondents as

$$
\begin{aligned}
\widetilde{S}_{it} \quad = \quad & j \text{ if } \pi_{j-1} + (\kappa_i - \alpha_i) + (\tau_t - \mu_t) - \beta \ln(Y_{it}) - (\vartheta + \Lambda Z_{it})' f_{it} + (\xi - \delta)' Z_{it} < d_{it} \\
\leqslant \quad & \pi_j + (\kappa_i - \alpha_i) + (\tau_t - \mu_t) - \beta \ln(Y_{it}) - (\vartheta + \Lambda Z_{it})' f_{it} + (\xi - \delta)' Z_{it} \tag{10}
\end{aligned}
$$

With suitable distributional assumptions on d_{it}, we can estimate this model with ordered logit or ordered probit.[29] At first sight, adopting the more flexible specification (9) comes at a considerable cost, as it is no longer possible to identify the parameters $(\alpha_i, \mu_t, \delta)$ in the satisfaction equation (5). For our purposes, however, this does not matter, since these parameters do not play any role in the calculation of the equivalent incomes (8). We therefore do not need to make the strong identification assumption that the values of the response categories are the same for all individuals and are constant over time.

---

[29] As explained in the beginning of this section, the presence of individual fixed effects forces us to use only one threshold per individual for estimation purposes.

5 With the data: Russia 1995-2003

To illustrate our approach, we use the data from the Russia Longitudinal Monitoring Survey (RLMS). These RLMS-data have already been used to analyse life satisfaction in Russia by Frijters et al. (2006), Graham et al. (2004), Ravallion and Lokshin (2001, 2002), Senik (2004) and Zavisca and Hout (2005). We introduce the data and show the results for the estimation of the satisfaction equation in the first subsection. In the second subsection we derive and discuss the estimates of the equivalent incomes.

5.1 Life satisfaction in Russia

The Russia Longitudinal Monitoring Survey (RLMS) is an extremely rich panel of nationally representative surveys designed to monitor the effects of Russian reforms on the health and economic welfare of households and individuals in the Russian Federation. These effects are measured by a variety of means: detailed monitoring of individuals' health status and dietary intake; precise measurement of household-level expenditures and service utilization; and collection of relevant community-level data, including region-specific prices and community infrastructure data. Data have been collected thirteen times since 1992. As it is generally thought that the data of the pre-1995 waves are less reliable, we use the data for the seven waves of 1995, 1996, 1998, 2000, 2001, 2002 and 2003. After dropping the observations with inconsistent information we keep a sample of 12016 individuals. There is considerable sample attrition, with replenishment of the sample at each wave. On average, the 12016 individuals appear in 3.82 waves. Of the 4227 individuals in the wave of 1995, 2498 remain present in the sample until 2003. Since the relatively rich and young individuals living in the urban areas are more likely to drop out of the sample, the balanced subpanel is not representative for the population. Since, moreover, working with this balanced subpanel would entail a considerable loss of efficiency, all our estimates are

28

for the full unbalanced panel.[30]

Russia in the period 1995-2003 was an economy in turmoil, with in 1998 a sharp devaluation of the ruble. From an econometric point of view, this has the advantage that there is a lot of variation in the data, with many individuals experiencing large (and often exogenous) changes in their living standard. The general economic situation is amazingly well reflected in the average results for the question: "*To what extent are you satisfied with your life in general at the present time?*", with answers on a five point-scale from "not at all satisfied" to "fully satisfied". Figure 4 shows the distribution of the answers to that question: compared to most other life satisfaction studies, a large fraction of the Russian population was "less than satisfied" or "not satisfied" with their life, with an all-time low of satisfaction in 1998, the year of the devaluation. After 1998, there is a gradual increase in average satisfaction, in parallel with the improvement of the economic situation.[31]

The RLMS contains all the information that is commonly used in the happiness literature. Descriptive statistics for the variables used in our analysis are given in Table 1. By way of introduction, we show the estimation results for (3) and (4) in the first two columns of Table 2 (models A and B respectively). We work at the level of the individuals and correct the standard errors for clustering at the household level. For the reasons explained in the previous section, all the results shown are for an ordered logit specification.[32] The results for model A, i.e. the pooled ordered logit without individual fixed effects, are perfectly in line with what is usually found in the literature. We prefer to introduce the logarithm of household expenditures, rather than household income. Despite

---

[30] Frijters et al. (2006) also work with the unbalanced panel and show that attrition may bias the estimates obtained from the balanced panel.

[31] Many authors working with the RLMS have pooled the answers for the top categories of satisfaction, as the number of fully satisfied individuals is rather low. We did not opt for that approach, because the number of "fully satisfied" individuals is increasing in the later periods (that were not included in the previous work) and shows overall a very reasonable pattern.

[32] The results for the simple cardinal specification are very similar.
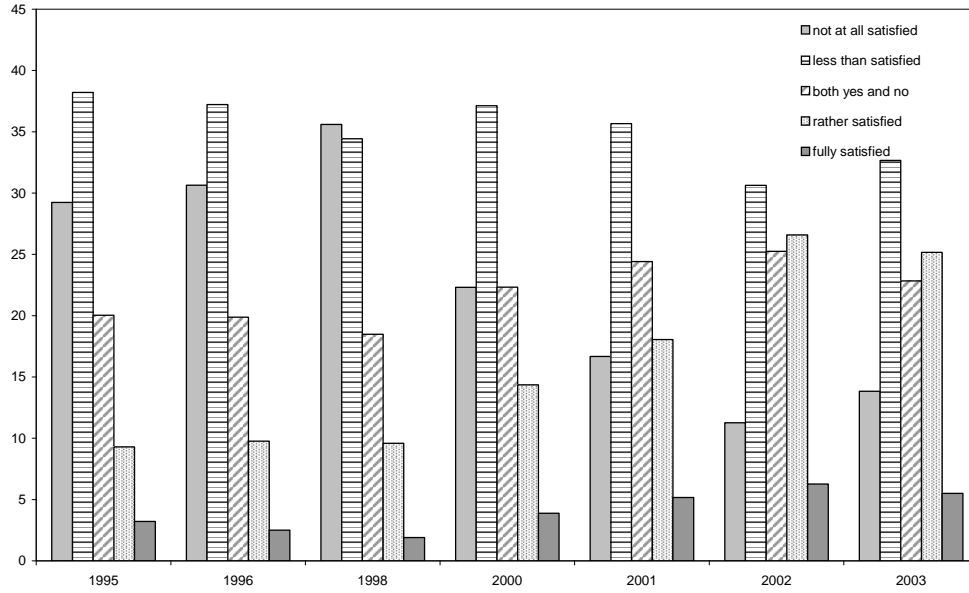
Figure 4: Evolution of satisfaction over time.

Table 1: Descriptive statistics

	1995	1996	1998	2000	2001	2002	2003
N	4227	4879	5832	7096	7673	8262	7894
satisfaction	2.19	2.16	2.08	2.40	2.59	2.86	2.76
income (per consumption unit)	3780	3515	3037	3429	4168	4666	5187
expenditures (per consumption unit)	5278	4775	3807	4517	5009	5224	5828
self-assessed health	3.10	3.13	3.12	3.11	3.11	3.11	3.10
house (in 100.000 rubbles)	1.54	1.55	1.65	1.68	1.74	1.76	1.77
unemployment (in %)	7	8	10	8	8	8	8
arrears (in %)	26	32	53	14	12	11	10
male (in %)	41	43	43	44	43	43	43
minority (in %)	15	15	14	14	14	14	14
rural (in %)	28	27	27	28	26	27	27
higher education (in %)	70	68	68	68	72	75	76
age (in 2000)	50	48	45	43	43	42	42
high status (in %)	2	1	2	3	4	4	3
middle status (in %)	51	54	51	51	50	49	49
married (in %)	72	66	58	55	53	53	53
as married (in %)	7	7	6	7	8	9	10
divorced (in %)	11	11	7	6	7	8	8
widowed (in %)	-	-	11	12	13	13	13

the care taken in the RLMS, income is notoriously difficult to measure, certainly in Russia 1995-2003 with a large shadow economy. Moreover, expenditures are a better measure of permanent income (and of the living standard), the crucial component in our theoretical framework. In this pooled specification we introduce the logarithm of household size as a separate variable. Expenditures, self-assessed health[33] and quality of housing[34] have a highly significant positive effect on life satisfaction. Being unemployed has a significantly negative effect. The same is true for the variable "wage arrears", capturing the (at that time in Russia common) phenomenon that wages were not paid in time, creating significant income uncertainty. We find the usual U-shaped pattern with respect to age, with the minimum level of life satisfaction reached at the age of 48. Being married or living as a married couple increases life satisfaction. Nothing of this is surprising: these are basically the regularities that are found in most of the happiness literature. Some other findings are less common in the literature, but seem typical for Russia and have also been found in the other work with the RLMS. Males are *ceteris paribus* more satisfied than females. Being a member of a minority group (i.e. having a non-Russian nationality) also has a positive effect.[35] The effect of education is negative (after controlling for all the other variables). This may have to do with frustrated expectations, but we will later see that introducing interaction effects gives additional insights into this result. Note also that

---

[33]To some extent, self-assessed health raises similar issues with respect to the influence of aspiration levels as are raised by subjective satisfaction (see, e.g., Groot, 2000; van Doorslaer and Jones, 2003). Yet we follow the common practice in the happiness literature and use the questionnaire answers for "self-assessed health" as if they yield a cardinal and interpersonally comparable measure.

[34]The RLMS-data contain a lot of information on housing characteristics: space in square metres, availability of central heating, hot water, metered gas, sewerage, telephone, video and computer. They also contain information on the price of the house. We first estimated on the pooled data a hedonic price equation, including regional and year dummies ($R^2 = 0.73$, all variables significant with the correct sign). To correct for household size, we then calculated for each individual an index of the housing quality as the value predicted by the hedonic equation after having substituted "equivalized space" for "space". These computed values for housing quality only change over time if the family moves, if one of the real characteristics of the house changes or if the number of individuals living in the house changes. More information about the estimation procedure and the results is available from the authors on request.

[35]We also introduced "being religious" in the regression, but this variable turns out not to have any explanatory power, most probably because of the high correlation with "minority".

31

the pattern of the time dummies most probably reflects the general feelings of trust and mistrust in the Russian economy (as suggested by Zavisca and Hout, 2005).

Table 2: Happiness estimation

	Model A satisfaction	Model B satisfaction	Model C satisfaction	Model D satisfaction	Model E satisfaction
log expenditures	0.407*** (0.0193)				
log household size	-0.219*** (0.0390)				
log expenditures (per consumption unit)		0.265*** (0.0241)	0.335*** (0.0300)	0.345*** (0.0300)	0.374*** (0.0375)
self-assessed health	0.511*** (0.0204)	0.319*** (0.0249)	0.435*** (0.0424)	0.432*** (0.0424)	0.460*** (0.0523)
house (in 100.000 rubles)	0.336*** (0.0254)	0.179*** (0.0463)	0.281*** (0.0826)	0.282*** (0.0826)	0.251* (0.106)
unemployed	-0.646*** (0.0444)	-0.440*** (0.0611)	0.163 (0.136)	0.190 (0.137)	0.201 (0.186)
wage arrears	-0.320*** (0.0275)	-0.197*** (0.0366)	-0.0840 (0.0678)	-0.0882 (0.0680)	-0.0508 (0.0810)
age	-0.0822*** (0.00456)				
age squared/100	0.0850*** (0.00494)	0.0737*** (0.0168)	0.0817*** (0.0171)	0.0810*** (0.0171)	0.0332 (0.0243)
married	0.271*** (0.0442)	0.0793 (0.102)	0.0929 (0.102)	0.0898 (0.102)	0.121 (0.141)
as married	0.340*** (0.0538)	-0.0331 (0.103)	-0.0250 (0.103)	-0.0228 (0.103)	-0.0730 (0.146)
divorced	-0.103 (0.0557)	-0.314** (0.110)	-0.289** (0.110)	-0.291** (0.110)	-0.345* (0.151)
widowed	-0.0787 (0.0629)	-0.502*** (0.120)	-0.493*** (0.121)	-0.491*** (0.121)	-0.514** (0.161)
male	0.116*** (0.0205)				
minority	0.206*** (0.0435)				
rural	-0.0967*				

Table 2: Happiness estimation

	Model A satisfaction	Model B satisfaction	Model C satisfaction	Model D satisfaction	Model E satisfaction
	(0.0383)				
higher educ.	-0.0925**	-0.119	0.244	0.239	0.172
	(0.0319)	(0.0808)	(0.153)	(0.153)	(0.208)
high status	0.402***	0.330***	0.326***	0.327***	0.248*
	(0.0667)	(0.0967)	(0.0969)	(0.0970)	(0.119)
middle status	0.172***	0.262***	0.260***	0.262***	0.295***
	(0.0297)	(0.0461)	(0.0461)	(0.0461)	(0.0586)
1996	-0.0199	-0.185***	-0.188***	-0.189***	
	(0.0404)	(0.0517)	(0.0520)	(0.0525)	
1998	-0.0388	-0.357***	-0.380***	-0.400***	-0.122
	(0.0431)	(0.0703)	(0.0722)	(0.0753)	(0.0789)
2000	0.341***	-0.0321	-0.0657	-0.0785	0.362**
	(0.0405)	(0.0937)	(0.0957)	(0.0962)	(0.112)
2001	0.613***	0.200	0.156	0.158	0.667***
	(0.0398)	(0.106)	(0.109)	(0.109)	(0.134)
2002	1.068***	0.660***	0.603***	0.613***	1.180***
	(0.0402)	(0.121)	(0.124)	(0.124)	(0.156)
2003	0.874***	0.389**	0.322*	0.349*	0.964***
	(0.0410)	(0.136)	(0.139)	(0.139)	(0.178)
ref. group expenditures				-0.158*	-0.204**
				(0.0622)	(0.0757)
ref. group unemployment				-1.065**	-1.524***
				(0.333)	(0.428)
log expenditures (lagged)					0.0376
					(0.0272)
young X health			-0.101*	-0.0964*	-0.0860
			(0.0445)	(0.0444)	(0.0549)
young X expend			0.0350	0.0320	0.0316
			(0.0188)	(0.0188)	(0.0239)
male X health			-0.119*	-0.120**	-0.128*
			(0.0466)	(0.0465)	(0.0587)
male X unemployed			-0.335***	-0.334***	-0.384**
			(0.101)	(0.101)	(0.131)
rural X health			-0.112*	-0.112*	-0.0902

Table 2: Happiness estimation

	Model A satisfaction	Model B satisfaction	Model C satisfaction	Model D satisfaction	Model E satisfaction
			(0.0540)	(0.0540)	(0.0664)
rural X expend			-0.126*	-0.111*	-0.124*
			(0.0492)	(0.0497)	(0.0598)
rural X house			0.232*	0.235*	0.190
			(0.107)	(0.107)	(0.132)
minority X health			0.113	0.119	0.151
			(0.0667)	(0.0667)	(0.0852)
minority X expend			-0.259***	-0.245***	-0.242**
			(0.0628)	(0.0621)	(0.0781)
minority X unemployed			-0.243	-0.219	-0.239
			(0.134)	(0.134)	(0.173)
high educ. X house			-0.196*	-0.195*	-0.205
			(0.0815)	(0.0814)	(0.105)
high educ. X unemployed			-0.457***	-0.460***	-0.530**
			(0.132)	(0.132)	(0.177)
high educ. X arrear			-0.152*	-0.149*	-0.167
			(0.0754)	(0.0756)	(0.0905)
N	45863	40120	40120	40120	27887
$(pseudo)R^2$	0.077	0.078	0.081	0.082	0.097

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Let us now turn to the results for model B. This model is estimated with the simplified conditional fixed effects ordered logit specification described in the previous section.[36] All the time-invariant individual characteristics are now taken up by the fixed effects. Since we also include time dummies, we can no longer identify the linear effect of age. The nonlinear effect is still captured by the quadratic term. As household size does not vary sufficiently in our sample to estimate its effect separately, we have introduced expenditures per consumption unit, with as equivalence scale the square root of the number of household

---

[36]We also estimated the model with the original Chamberlain (1980) approach. The coefficients have in general the same sign, but, as expected, are estimated less efficiently.

members. This equivalence scale is in line with the results of the pooled specification.[37]
A comparison of models A and B immediately shows that controlling for unobserved heterogeneity through the introduction of fixed effects makes a substantial difference (as in Ferrer-i-Carbonell and Frijters, 2004). Most of the significant effects remain significant, but become smaller in absolute value. This is in perfect agreement with the psychological findings pointing to the importance of personality traits for life satisfaction, and can also be partly due to the presence of reverse causation (from satisfaction to functionings). From our own theoretical perspective, neglecting this unobserved individual heterogeneity is not defensible, and all the other results in this paper are derived for models with individual fixed effects. However, since most coefficients go down in absolute value, the marginal rates of substitution between the different functionings (as given in eq. (6)) change less than could be guessed when looking only at the effects on the individual coefficients. In this model, unobserved personality traits influence in the first place the frame of reference.

In a next step (model C) we introduce interaction effects to model intergroup differences in preferences (see (5)). At this point it is convenient to have an idea of the main functionings we want to put in the vector of explanatory variables X_i. Four elements of this vector appear in almost all lists of functionings proposed in the literature: expenditures (or income) per consumption unit, health, housing and (un)employment. We include them all in f_i. The fact of being (un)employed is only a primitive indicator of labour market status. We therefore propose to include also in the list of functionings the variable "wage arrears", pointing to income and job uncertainty. We have more doubts about the "occupational prestige"-variable. Would this be a functioning? Or is it better seen as a variable capturing aspirations? We opt for the latter possibility, but this is

---

[37]The coefficients for log expenditures (0.407) and for log household size (- 0.219) in model A imply an equivalence scale parameter of 0.538, very close to 0.5. Note that we use the terminology "expenditures per consumption unit" to avoid confusion with our concept of equivalent income.

obviously not a straightforward choice to make. It turns out that the distinction between life dimensions and conditioning variables is not as clear-cut as it may seem at first sight. Note that we are unable to introduce feelings (like happiness, sadness and others) in the list of functionings because specific information about them is not present, although feelings —the mood of the day— are likely to influence the answers to the satisfaction question.

Consider the variable "education": the level of education appears as such in many lists of relevant dimensions of life, or it is at least closely related to proposed functionings (or capabilities).[38] Yet it has a negative effect in model B. Because it is hard to defend that education as a functioning is negatively valued, i.e. that less education is perceived as better, we did not include it in our list of life dimensions, and interpret the negative effect as linked to changes in aspirations. However, it is possible that education is a true life dimension (i.e. that individuals prefer higher education), but *at the same time* also influences the frame of reference. If the two effects play together, it is impossible to disentangle them with the available data.

And what about personal family situation (being married, divorced, as married or widowed)? We are looking for a concept of well-being that is useful for policy analysis. More specifically it should be of help in evaluating the desirability of redistributive policies. For this purpose, it seems reasonable to focus on the dimensions of life that are at the centre of the attention of public policies, and to compare individual situations in these dimensions, at the exclusion of the life dimensions which are in the private sphere. We therefore will treat personal family situation as a conditioning variable in our main analysis, and not as a dimension of life that should be taken into account in the evaluation of living standards. Certainly, one could take the opposite view and argue that "having

---

[38] To give an example: one of the capabilities on Nussbaum (2000)'s list is "being able to think and reason in a way informed and cultivated by an adequate education".

36

harmonious personal relations" is a crucial feature of a good life. This is even more true if social circumstances make it impossible for individuals to have a normal family life.

The fact that these choices are difficult does not in the least detract from the usefulness of our general approach. Defining what are the relevant functionings is in the first place an ethical and political choice. Our methodology makes it possible to derive a relevant weighting scheme for all possible choices. For the time being we will illustrate the approach with our initial choice of five functionings: expenditures per consumption unit, health, quality of housing, (un)employment and wage arrears. In the next section we will discuss the sensitivity of the calculated equivalent incomes for this specific choice.

Even with our restricted set of five functionings, there remains a huge amount of interactions to be estimated. We therefore simplified the model by keeping only the significant interactions.[39] The resulting estimates are shown in the third column of Table 2 (Model C). Particularly interesting are the results for "unemployment" and "education". For both variables the direct (linear) effect is no longer significant. However, unemployment has a significantly negative effect for males, members of minorities and (very strongly) for the higher educated. Wage arrears are also more important to the latter group. These results suggest that education does not only have an effect on aspirations —it also has a clear effect on preferences. Moreover, we get a richer picture of the subtle effect of unemployment on life satisfaction. Further, we find that the young give a relatively smaller weight to health, and a relatively larger weight to material welfare. Health is less important for males and in rural areas, and more important for members of minority groups. Housing matters more in rural areas, and less for the highly educated. All these results stand to reason.

In a last step, we want to introduce more explicitly the possibility of changes in the

---

[39] For the estimation of these interaction effects we do not introduce age as a continuous variable, but we opt to use a dummy variable "young", taking the value 1 for individuals with an age below 40.

frames of reference resulting from social interactions and/or from processes of adaptation. The usual approach to model social reference effects is to introduce in the satisfaction equation the average value of the relevant functionings for the social reference groups. There is no consensus at all, however, about how to define these social reference groups. In her analysis of the RLMS-data, Senik (2004) uses as a proxy for the individual's reference group income the income predicted for that individual with an estimation including education, years of experience, region, branch, age, sex and primary occupation code. She finds that these predicted expenditures have a significantly positive effect on satisfaction, and draws the conclusion that the positive cognitive (or information) effect dominates the (negative) social comparison effect. This is indeed a very natural interpretation with her definition of the social reference variable. Frijters et al. (2006) use a geographical definition and introduce real average income, calculated separately for about 100 areas in Russia. Its effect is insignificant. We experimented with many different definitions of the social reference groups (including clustering on age, gender, region, education, being member of a minority, living in the same household) and our results of the reference group effects are rather robust to the choice of definition. As we want to focus on the social comparison effect, we finally opted for the geographical approach and introduce the mean values for unemployment and for expenditures per consumption unit calculated at the level of the 162 sites that are distinguished in the RLMS. The results are shown in the fourth column of Table 2 (Model D). We find that with this geographical definition the comparison effect seems to dominate for expenditures: the effect is significantly negative. For unemployment, however, the informational effect seems to be the stronger of the two.[40] Remember that in these Russian data the influence of unemployment goes through different, sometimes rather subtle, channels.

---

[40]This result is different from what is found in most previous work, see e.g. Clark (2003).

Adaptation processes have been taken up in previous work by variables capturing "past expenditures". As shown in the last column of Table 2 (Model E), we find a positive (although not significant) effect for lagged past expenditures. This confirms the results from previous work with the RLMS-data (Graham et al., 2004; Ravallion and Lokshin, 2002; Senik, 2004; Zavisca and Hout, 2005). There is therefore hardly any indication of adaptation of aspiration levels to increases in material welfare, at least in the short run. It is very well possible that the living standards of many individuals in Russia in the period 1995-2003 were so volatile and uncertain that it was hard to adapt —and, again, in such a situation of deep uncertainty, expectations may also be more sensitive to all kinds of informational signals. More work is needed to understand the intricate pattern of adaptation of aspirations and generation of expectations. However, since the effect of past expenditures is insignificantly estimated with our data, we propose not to use the results from model E and to work further with model D.[41]

We can illustrate the implications of model D with the indifference curves that are implied by it. By way of illustration, Figure 5 compares the indifference map in the health-expenditures space for young and old Russians living in an urban or in a rural environment. The larger weight of health in the preferences of the old shows up clearly.

5.2   Equivalent incomes and satisfaction with life

Before we can calculate the equivalent incomes, there still remains the crucial question of the choice of the reference values $\overline{f}$ for all functionings except the expenditures per consumption unit. This is ultimately an ethical choice: we have to fix the reference values

---

[41]The dynamic specification of the model again raises difficult issues with respect to the identification of differences in preferences versus differences in aspiration levels. To give an example: it is very well possible that for some of the variables included (e.g. expenditures per consumption unit) individuals have well-defined preferences over growth rates, rather than over levels. With the available data, it is not possible to distinguish between these different interpretations, as some of these cases may be observationally equivalent.
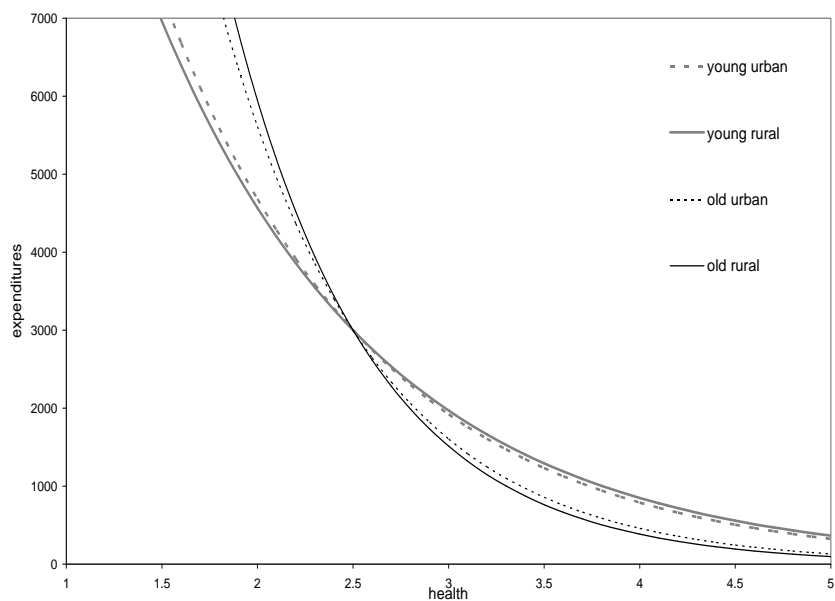
Figure 5: Indifference map in the health-expenditure space.

in such a way that they lead to acceptable distributional judgments. For our illustrative purposes, we propose the following choices:

- as argued before, for *health* it is natural to take perfect health as the reference. If two individuals are equally healthy, we can rank their quality of life on the basis of their expenditures.

- a similar argument can be put forward with respect to *employment*. "Not being unemployed" is the natural social reference point for a comparison of well-being, in that if two individuals are employed we can rank them on the basis of their expenditures only. It would be strange to compensate one of the two if she claims that she cares less than the other about being employed.[42] However, take two unemployed individuals with a different income. In that case it makes sense to check if one of the two suffers more from the social and psychological stigma related to

---

[42]With the proviso that our data do not allow us to include a rich set of job characteristics.

unemployment, implying that a ranking in terms of expenditures would not suffice. Note that we are not taking a position on psychological feelings of happiness here, our aim being to respect individual preferences and views about the importance of life dimensions.

- similar arguments lead to the conclusion that also for *wage arrears* the natural choice of a reference is the situation without wage arrears.

- *housing* raises more difficult issues, because it is not obvious what is the natural point of reference. In our empirical work, we will use the median value of housing in the total sample.

Using these values for $\overline{f}$, the observations for the relevant functionings f_i and our estimates for the parameters β, ϑ and Λ from model D, we can now calculate the equivalent incomes for all individuals in our sample (see (8)). In our approach, these equivalent incomes are the preferred measure of individual welfare.

Table 3: Cross-tabulation of equivalent incomes Y_{it}^* and equivalized expenditures.

equivalized expenditures	quintiles of Y_{it}^*				
	1	2	3	4	5
1	0.39	0.36	0.16	0.06	0.02
2	0.20	0.29	0.26	0.19	0.06
3	0.16	0.18	0.28	0.24	0.14
4	0.14	0.11	0.22	0.27	0.26
5	0.11	0.06	0.08	0.23	0.52

Table 4: Cross-tabulation of equivalent incomes Y_{it}^* and subjective satisfaction

subjective satisfaction	quintiles of Y_{it}^*				
	1	2	3	4	5
1	0.29	0.27	0.20	0.15	0.09
2	0.19	0.21	0.22	0.20	0.17
3	0.16	0.14	0.19	0.24	0.27
4	0.12	0.11	0.14	0.24	0.40
5	0.16	0.09	0.13	0.19	0.43

To understand better the relevant features of these equivalent incomes, it is instructive to compare them with the two most popular alternatives. The first is using expenditures per consumption unit as such, i.e. considering only material welfare. This is probably still the most common approach in applied work, partly because of the operational difficulties in implementing ethically richer and more attractive approaches. The second is the welfarist alternative, which has gained so much popularity since it has become feasible to measure subjective satisfaction (and/or happiness) with survey questions. Here welfare is measured with the raw satisfaction measures. Tables 3 and 4 show for the year 2000 the cross-tabulations of Y_{it}^* with expenditures per consumption unit Y_{it} and with subjective satisfaction S_{it}.[43] It is obvious that the different concepts lead to different rankings. Equivalent incomes are far from perfectly correlated with expenditures per consumption unit, and the correlation with subjective satisfaction is even very low.

Table 5: Intertemporal transition matrices of equivalent incomes Y_{it}^*.

quintiles of Y_{it}^* in 1996	quintiles of Y_{it}^* in 2000				
	1	2	3	4	5
1	0.70	0.18	0.05	0.02	0.05
2	0.19	0.41	0.24	0.11	0.04
3	0.07	0.26	0.35	0.25	0.07
4	0.02	0.11	0.25	0.35	0.27
5	0.01	0.04	0.11	0.27	0.57

quintiles of Y_i^* in 2000	quintiles of Y_i^* in 2003				
	1	2	3	4	5
1	0.74	0.18	0.05	0.02	0.03
2	0.19	0.43	0.25	0.11	0.02
3	0.05	0.25	0.37	0.25	0.08
4	0.02	0.11	0.25	0.37	0.25
5	0.01	0.03	0.09	0.26	0.62

Tables 5 - 7 give an idea about the intertemporal mobility using the three welfare concepts. Tables 5 and 6 show the quintile transition matrices from 1996 to 2000 and from

---

[43]The results for other years are similar.

Table 6: Intertemporal transition matrices of equivalized expenditures.

quintiles of expend in 1996	quintiles of expenditures in 2000				
	1	2	3	4	5
1	0.42	0.22	0.16	0.12	0.07
2	0.29	0.28	0.19	0.14	0.10
3	0.12	0.23	0.23	0.24	0.17
4	0.10	0.15	0.24	0.24	0.28
5	0.07	0.12	0.17	0.26	0.37

quintiles of expend in 2000	quintiles of expenditures in 2003				
	1	2	3	4	5
1	0.48	0.25	0.14	0.08	0.04
2	0.27	0.26	0.24	0.14	0.09
3	0.13	0.20	0.26	0.22	0.18
4	0.08	0.18	0.22	0.28	0.24
5	0.04	0.11	0.14	0.27	0.44

Table 7: Intertemporal transition matrices of subjective happiness.

satisfaction in 1996	satisfaction in 2000				
	1	2	3	4	5
1	0.39	0.38	0.14	0.07	0.01
2	0.20	0.44	0.23	0.11	0.02
3	0.15	0.36	0.31	0.15	0.03
4	0.09	0.28	0.27	0.27	0.08
5	0.14	0.21	0.21	0.24	0.19

satisfaction in 2000	satisfaction in 2003				
	1	2	3	4	5
1	0.29	0.39	0.15	0.13	0.03
2	0.13	0.40	0.25	0.19	0.03
3	0.08	0.31	0.30	0.26	0.04
4	0.05	0.20	0.25	0.43	0.07
5	0.03	0.21	0.14	0.36	0.26

2000 to 2003 for our equivalent income concept and for expenditures per consumption unit respectively. Table 7 describes the intertemporal mobility for the subjective satisfaction measure. For this variable we could not make use of quintiles, because it is measured on a discrete 1-5 scale. The rows and columns in Table 7 therefore refer directly to the scale values. We show conditional probabilities per row, e.g. the first row in Table 7 gives the probabilities that someone who was "not at all satisfied with his life in general" in 1996 moves to one of the other values in 2000. As the distribution of the individuals on

the subjective satisfaction scale moves up over time (see Figure 4), care is needed with the interpretation of Table 7. Despite this difficulty, the message is clear. The welfarist measure is by far the most volatile, our equivalent incomes are by far the most persistent. More than 70% of the individuals in the lowest quintile of equivalent incomes remain in that quintile in the later period —the analogous number for expenditures per consumption unit is between 40 and 50%, for happiness it is between 30 and 40% (but with the caveat described before). An analogous picture is found for moves out of the highest quintile (or the highest satisfaction value), where the caveat is no longer applicable.[44] This result is easily understood. It is to be expected that satisfaction measures are more influenced by the mood of the day and by random events (captured by the disturbance term d_i) than expenditures per consumption unit. Moreover, our equivalent income is to some extent a weighted sum of five characteristics, some of which hardly change over time, while the other two measures are determined exclusively by one variable. It is not surprising then that the former is less volatile than the latter.

A better insight into the differences between the three approaches can be obtained from Table 8. This table gives at the same time an idea about the sensitivity of our results with respect to the choice of the elements in the functioning vector f_i. Our sample for 2000 contains 1583 individuals with the lowest value (one) on the life satisfaction scale.[45] The last column of Table 8 draws a portrait of these individuals. The first column draws a similar portrait for the 1583 individuals with the lowest expenditures per consumption unit. The other columns show analogous information for different definitions of the equivalent income, i.e. different vectors of functionings. Expenditures per consumption unit coincide with equivalent incomes if they are seen as the only functioning - we call this set

---

[44]A simple "persistency" measure (0.2*(trace of the transition matrix)) gives for equivalent incomes .48 (1996-2000) and .51 (2000-2003). This is the expected number of individuals staying in the same quintile. The analogous figures for equivalized expenditures are .31 and .34 respectively.

[45]Again, the results for other years are similar.

Table 8: Portrait of the deprived in different approaches in 2000.

	Set I	Set II	Set III	Set IV	Set V	Set VI	Set VII	Set VIII	Set IX	Set X	Set XI	Set XII
N	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583	1583
happiness	2.03	2.14	2.11	2.09	2.09	2.09	2.13	2.13	2.12	2.12	2.17	1
income (equivalized)	1694	2664	2691	2695	2690	2684	2715	2681	2784	2821	2947	2667
expenditures (equivalized)	1188	2997	2956	2984	2975	2985	3066	3084	3188	3300	3021	3468
self-assessed health	2.98	2.50	2.59	2.63	2.65	2.65	2.65	2.67	2.69	2.69	2.78	2.87
house (in 100.000 rubbles)	1.41	1.60	1.44	1.44	1.42	1.43	1.43	1.48	1.47	1.48	1.66	1.53
unemployment (in %)	12	7	9	16	15	16	15	13	14	14	17	13
arrears (in %)	14	10	11	10	15	13	12	10	10	10	20	17
male (in %)	41	26	28	32	31	32	33	30	30	30	41	42
minority (in %)	12	43	44	44	44	44	44	44	44	45	14	12
rural (in %)	34	28	38	40	42	43	44	41	42	41	28	35
higher education (in %)	59	57	54	57	59	57	49	48	49	49	72	66
age (in 2000)	47	55	53	52	51	52	53	54	54	54	49	47
high status (in %)	1	2	1	1	1	1	1	1	1	1	2	2
middle status (in %)	36	28	28	25	28	21	21	21	21	21	36	37
married (in %)	45	50	50	50	51	51	50	40	40	40	58	52
as married (in %)	11	6	7	7	7	8	7	7	7	7	6	8
divorced (in %)	8	7	7	7	7	7	7	9	8	9	9	8
widowed (in %)	18	27	25	23	22	23	24	34	33	33	18	17

Legend: The sets successively incorporate as functionings: equivalized expenditures (Set I), self-assessed health (Set II), housing (Set III), unemployment (Set IV), wage arrears (Set V), occupational status (Set VI), education (Set VII), marital status (Set VIII), reference group expenditures (Set IX), reference group unemployment (Set X), age and personality traits (Set XI), the disturbance term (Set XII).

I. When we add health as a second functioning, and consider the 1583 individuals with the lowest resulting equivalent incomes, we get the picture in set II. The functionings vector is then gradually extended while moving from the left to the right of the table. When all variables, including the disturbance term, are considered as functionings, we are back in the last column with the satisfaction measures.[46]

It is instructive to focus first on our three key concepts: expenditures perconsumption unit (set I), equivalent incomes in our favourite definition with five functionings (set V) and subjective satisfaction (set XII). These columns are shown in bold. Who are the deprived in these three approaches? The differences between the results for the welfarist satisfaction measure and for the equivalent incomes are especially striking. The subjectively least satisfied individuals have larger expenditures, a better health and a nicer house than those with the lowest value of equivalent incomes. They are younger and better educated, are more likely to be male and less likely to belong to a minority group. Clearly, subjective satisfaction does not capture deprivation on the objective dimensions of life. The larger correlation between expenditures per consumption unit and our concept of well-being also shows up in this table. The main difference is with respect to health: health is valued strongly in our well-being concept, certainly for a large fraction of (older and minority) people. This effect is of course not taken up in expenditures per consumption unit The same is true (to a smaller extent) for the non-monetary cost of being unemployed.

The other columns in Table 8 show the sensitivity of the results with respect to the choice of the relevant functionings, with the figure in italics indicating each time the variable added. Most of the results speak for themselves. Taking up health, i.e. moving from set I to set II, induces a strong shift in the characteristics of the most deprived. Our decision of not including the occupational prestige variable did not have important

---

[46] All the results in Table 8 are derived with Model D (see table 2), i.e. we did not repeat for each column the intensive search for potential interaction effects between functionings and conditioning variables.

consequences, as the characteristics of the deprived according to sets V and VI are very similar. Set VIII is an interesting one, because it includes all the variables pertaining to social life (including education) in the set of functionings. As noted before, having "harmonious personal relations" could be seen as a crucial feature of a good life. The reference group variables (sets IX and X) raise another intriguing question about the definition of functionings. In our (preferred) set V, social comparisons are seen as an aspiration and as a functioning. Yet one could also argue that comparisons to others are directly related to the functioning "not being ashamed to appear in public", one of Sen's favourite examples, which he relates to the work of Adam Smith. In our empirical results, the effect of the reference group variables is minor. The introduction of age and individual fixed effects (compare sets X and XI) is also relatively innocuous. In contrast, it is striking that the inclusion of the disturbance term, i.e. the mood of the day and the effect of short-run random events (the move from set XI to set XII), has a strong effect on the identification of the deprived. This of course is in line with the results on mobility shown in Tables 5 - 7 and supports the idea that ordinal preferences are more trustworthy data than satisfaction levels. The sensitivity analysis in Table 8 is only meant to be an illustration. As we noted, some of the sets of functionings are almost impossible to defend from an ethical point of view. Yet, it shows convincingly that the general approach with equivalent incomes can easily accommodate different definitions of the functionings vector. More importantly, Table 8 indicates that the choice of concept used for interpersonal comparisons does indeed matter —and that our well-being concept gives reasonable results for the identification of the deprived.

6 Conclusion

The recent happiness literature suggests that interpersonal utility comparisons are to some extent possible. Yet this does not undermine the basic philosophical criticism of utilitarianism (or, more generally, of subjective welfarism). A focus on subjective utility may lead to a relative neglect of the real conditions of life. Moreover, valuing a life is a reflective activity that should not be reduced to the evaluation of hedonic states. In fact, the psychological literature has also argued that "utility" is a multidimensional phenomenon and that it is crucial to distinguish affects and cognition. Therefore it appears unlikely that we should witness a revival of primitive utilitarianism in the near future. At the same time, however, the empirical work on happiness has drawn attention to the importance of the non-material dimensions of life — a welcome shift away from the exclusive focus on material consumption.

We have argued that an adequate normative approach should indeed focus on the vector of "functionings" that describes the life of the individual in relevant dimensions. The list of dimensions may include affects and feelings in addition to the objective circumstances of life. In aggregating these different dimensions, one may seek to respect individuals' well-informed ordinal preferences, reflecting their opinion about what is valuable in life. Such respect for preferences does not imply subjective welfarism. Quite to the contrary, it is precisely when one wants to respect individual preferences that one should not use the level of happiness or satisfaction as the measure of well-being, as these happiness levels are influenced by adaptation and by changes in the aspiration levels.

If one discards "happiness" or "satisfaction" as an adequate aggregator of the different dimensions, one is confronted with a difficult indexing problem when different individuals have different preferences. We have described one promising approach to that problem, which consists in calculating equivalent incomes. These correspond to the hypothetical

incomes that would put individuals at the same welfare level, i.e. on the same indifference curve, as in their actual situation, if they were at well-defined reference levels for all other dimensions. Equivalent incomes fully respect individual preferences. To calculate them, we need knowledge about these preferences. We have described how the traditional life satisfaction equations can be used to recover some of the information which is needed for the calculations of equivalent incomes. We illustrated the method with RLMS-data for Russia. It turns out that the picture of well-being obtained with equivalent incomes is very different from the picture that is obtained by focusing either on material consumption or on subjective welfare.

Satisfaction surveys are only one possible source of data on ordinal preferences that may serve to the computation of equivalent incomes. Other sources include revealed preferences from observed choices and stated preferences. Each of these potential sources of information suffers from limitations. Our study of satisfaction surveys has shown, in particular, that such data cannot simultaneously remove individual fixed effects linked to adaptation and give us good information about preferences bearing on functionings which are fixed although possibly unequal, like childhood histories or certain bodily characteristics. Another important limitation is that we only measure the average preferences of subgroups defined by characteristics, ignoring additional personal variation. Finally, we believe that the pollution of satisfaction answers by the mood of the day should be eliminated as much as possible by putting respondents in adequate conditions for carefully thinking about the difficult issues the questionnaires confront them with. While these limitations are important, they do not impugn our general conclusion that happiness and satisfaction surveys are a valuable source of information about individual well-being that welfare economics should heartily welcome and intensively use.

References

Barrotta P. 2008, "Why economists should be unhappy with the economics of happiness", *Economics and Philosophy* 24: 145-165.

Barry B. 2007, "Rationality and want-satisfaction", in M. Fleurbaey, M. Salles, J. Weymark (eds.), *Justice, Political Liberalism and Utilitarianism: Themes from Harsanyi and Rawls*, Cambridge: Cambridge University Press.

Becker, G., L. Rayo 2008, "Comment", *Brookings Papers on Economic Activity* 1: 88-95.

Bernheim B.D. 2008, "Behavioral welfare economics", NBER WP 14622.

Blackorby C., D. Donaldson 1988, "Money-metric utility: A harmless normalization?", *Journal of Economic Theory* 46: 120-129.

Brun B., B. Tungodden 2004, "Non-welfaristic theories of justice: is the "intersection approach" a solution to the indexing impasse?", *Social Choice and Welfare* 22: 49–60.

Burchardt T. 2006, "Happiness and social policy: barking up the right tree in the wrong neck of the woods", *Social Policy Review* 18: 145-164.

Burchardt T. 2005, "One man's rags are another man's riches: Identifying adaptive preferences using panel data", *Social Indicators Research* 74: 57-102.

Chamberlain G. 1980, "Analysis of covariance with qualitative data", *Review of Economic Studies* 47: 225-238.

Clark, A.E., P. Frijters, M.A. Shields 2008, "Relative income, happiness, and utility: an explanation for the Easterlin paradox and other puzzles", *Journal of Economic Literature* 46(1): 95-144.

Clark A.E., A.J. Oswald 2002, "A simple statistical method for measuring how life events affect happiness", *International Journal of Epidemiology* 31: 1139-1144.

Deaton A. 2008, "Income, aging, health and wellbeing around the world: Evidence from the Gallup World Poll", *Journal of Economic Perspectives* 32(2): 53-72.

Deaton A., J. Muellbauer 1980, *Economics and consumer behaviour*, Cambridge: Cambridge University Press.

Debreu G. 1959, "Topological methods in cardinal utility theory", in K. J. Arrow, S. Karlin, and P. Suppes (Eds.) *Mathematical methods in the social sciences*, Stanford: Stanford University Press, 16-26.

Diener E. 1994, "Assessing subjective well-being: Progress and opportunities", *Social Indicators Research* 31: 103-157.

Diener E. 2000, "Subjective well-being: The science of happiness and a proposal for a national index", *American Psychologist* 55: 34-43.

Diener E., E.M. Suh, R.E. Lucas, H.L. Smith 1999, "Subjective well-being: Three decades of progress", *Psychological Bulletin* 125: 276-302.

Di Tella R., J. Haisken-De New, R. MacCulloch 2007, "Happiness adaptation to income and to status in an individual panel", NBER Working Paper 13159.

Dolan P., D. Kahneman 2008, "Interpretations of utility and their implications for the valuation of health", *Economic Journal* 118: 215–234.

Easterlin R. 1995, "Will raising the incomes of all increase the happiness of all?", *Journal of Economic Behaviour and Organization* 27: 35-48.

Ferrer-i-Carbonell A., P. Frijters 2004, "How important is methodology for the estimates of the determinants of happiness?", *Economic Journal* 114: 641-659.

Fleurbaey M. 2008, "Willingness to pay and the equivalence approach", mimeo.

Frey B., S. Lüchinger, A. Stutzer 2004, "Valuing public goods: The life satisfaction approach", CESIfo Working Paper 1158.

Frey B., A. Stutzer 2002, *Happiness and economics: How the Economy and Institutions Affect Human Well-Being*, Princeton: Princeton University Press.

Frey B., A. Stutzer 2007, "Should National Happiness be maximized?", Working Paper

306, Institute for Empirical Research in Economics, University of Zurich.

Frijters P., J. Haisken-De New, M. Shields 2004, "Changes in the pattern and determinants of life satisfaction in Germany following reunification", *Journal of Human Resources* 39: 649-674.

Frijters P., I. Geishecker, J.P. Haisken-DeNew, M. Shields 2006, "Can the large swings in Russian life satisfaction be explained by ups and downs in real incomes?", *Scandinavian Journal of Economics* 108(3): 433-458.

Goodin R. 1992, "Laundering preferences," in J. Elster, A. Hylland (eds.), *Foundations of social choice theory*, Cambridge: Cambridge University Press.

Graham C., A. Eggers, S. Sukhtankar 2004, "Does happiness pay? An exploration based on panel data from Russia", *Journal of Economic Behavior and Organization* 55: 319-342.

Groot W. 2000, "Adaptation and scale of reference bias in self-assessments of quality of life", *Journal of Health Economics* 19: 403-420.

Hausman D. 2007, "Hedonist welfare economics and the value of health", mimeo.

Jones A., S. Schurer 2007, "How does heterogeneity shape the socioeconomic gradient in health satisfaction?", mimeo.

Kahneman D. 1999, "Objective happiness", in D. Kahneman, E. Diener, N. Schwarz (eds.), *Well-Being: The Foundations of Hedonic Psychology*, New York: Russell Sage Foundation.

Kahneman D. 2008, "The sad tale of the aspiration treadmill", http://www.edge.org/q2008/q08_17.html.

Kahneman D., A. Krueger 2006, "Developments in the measurement of subjective well-being", *Journal of Economic Perspectives* 20: 3–24.

Kahneman D., A. Krueger, D.A. Schkade, N. Schwarz, A. Stone 2004a, "A survey method for characterizing daily life experience: the day reconstruction method", *Science* 306:

1776–1780.

Kahneman D., A. Krueger, D.A. Schkade, N. Schwarz, A. Stone 2004b, "Toward national well-being accounts", *American Economic Review* 94(2): 429–434.

Kahneman D., R.H. Thaler 2006, "Anomalies. Utility maximization and experienced utility", *Journal of Economic Perspectives* 20: 221-234.

Kahneman D., P. Wakker, R. Sarin 1997, "Back to Bentham? Explorations of experienced utility", *Quarterly Journal of Economics* 112: 375–405.

King M. 1983, "Welfare analysis of tax reforms using household data", *Journal of Public Economics* 21: 183–214.

Kolm S.C. 1982, *Le bonheur-liberté. Bouddhisme profond et modernité*, Paris: PUF.

Layard R. 2005, *Happiness. Lessons from a New Science*, London: Allen Lane.

Loewenstein G., P.A. Ubel 2008, "Hedonic adaptation and the role of decision and experience utility in public policy", *Journal of Public Economics* 92: 1795-1810.

Luechinger S., P.A. Raschky 2008, "Valuing flood disasters using the life satisfaction approach," *Journal of Public Economics*, doi:10.1016/j.jpubeco.2008.10.003

Maniquet F., Y. Sprumont 2004, "Fair production and allocation of a non-rival good", *Econometrica* 72: 627-640.

Nussbaum, M.C. 2000, *Women and human development: the capabilities approach,* Cambridge: Cambridge University Press; 2000.

Nussbaum M.C. 2008, "Who is the happy warrior? Philosophy poses questions to psychology", forthcoming in *Chicago Law Review*.

Oswald A.J. 1997, "Happiness and economic performance", *Economic Journal* 107: 1815-1831.

Oswald A.J. 2008, "On the curvature of the reporting function from objective reality to subjective feelings", *Economics Letters* 100: 369-372.

Pazner E. 1979, "Equity, nonfeasible alternatives and social choice: A reconsideration of the concept of social welfare", in J.J. Laffont (Ed.), *Aggregation and Revelation of Preferences*, Amsterdam: North-Holland.

Ravallion M., M. Lokshin 2001, "Identifying welfare effects from subjective questions", *Economica* 68: 335-357.

Ravallion M., M. Lokshin 2002, "Self-rated economic welfare in Russia", *European Economic Review* 46: 1453-1473.

Samuelson P.A. 1974, "Complementarity: An essay on the 40th anniversary of the Hicks-Allen Revolution in Demand Theory", *Journal of Economic Literature* 12: 1255-1289.

Samuelson P.A. 1977, "Reaffirming the existence of 'reasonable' Bergson-Samuelson social welfare functions", *Economica* 44: 81-88.

Schkade D.A., D. Kahneman 1998, "Does living in California make people happy? A focusing illusion in judgments of life satisfaction", *Psychological Science* 9: 340-346.

Schokkaert E. 2007, "Capabilities and satisfaction with life", *Journal of Human Development* 8: 415-430.

Sen A. 1985, *Commodities and Capabilities*, North-Holland, Amsterdam.

Senik C. 2004, "When information dominates comparison. Learning from Russian subjective panel data", *Journal of Public Economics* 88: 2099-2123.

Stevenson, B., J. Wolfers 2008, "Economic growth and subjective well-being: reassessing the Easterlin paradox", *Brookings Papers on Economic Activity* 1: 1-87.

van Doorslaer, E., A. Jones 2003, "Inequalities in self-reported health: validation of a new approach to measurement", *Journal of Health Economics* 22: 61-87.

Van Praag B.M.S., B.E. Baarsma 2005, "Using happiness surveys to value intangibles: the case of airport noise," *Economic Journal* 115: 224–246.

Van Praag B.M.S., A. Ferrer-i-Carbonell 2007, *Happiness Quantified. A Satisfaction*

Calculus Approach, Oxford: Oxford University Press.

Zavisca J., M. Hout 2005, "Does money buy happiness in unhappy Russia?", Berkeley Program in Soviet and Post-Soviet Studies Working Paper.

Appendix

Proof of Proposition 1. Let $B \subset \mathbb{R}^m_+$ denote the subset over which the Vector Dominance Principle is satisfied. Consider two vectors $f, f' \in B$ such that neither $f \geq f'$ nor $f \leq f'$. One can then find R, R' such that fPf' and $f'P'f$. By the Personal-Preference Principle, (f, R, A, d) is better than (f', R, A, d) and (f, R', A', d') is worse than (f', R', A', d'). By the Vector Dominance Principle restricted to B, (f, R, A, d) is as good as (f, R', A', d') and (f', R, A, d) is as good as (f', R', A', d'). By transitivity, one obtains a contradiction. This implies that for all $f, f' \in B$, either $f \geq f'$ or $f \leq f'$. As B is assumed to be such that for every (f_i, R_i) there is f_i^* in B such that $f_i I_i f_i^*$, necessarily B contains 0, is unbounded and arc-connected, and is therefore a monotone path in $\mathbb{R}^m_+$.

Pick any $f \in \mathbb{R}^m_+$ and any R. By monotonicity of R, and the fact that B is a monotone path, there is a unique $f_0 \in B$ such that $f_0 I f$. By the Personal-Preference Principle, (f, R, A, d) is as good as (f_0, R, A, d). As a consequence, for all $f, f' \in \mathbb{R}^m_+$, all R, R', (f, R, A, d) is at least as good as (f', R', A', d') if and only if (f_0, R, A, d) is at least as good as (f'_0, R', A', d'), where $f_0, f'_0 \in B$ are defined by $f_0 I f$ and $f'_0 I' f'$. Therefore, by the Vector Dominance Principle restricted to B, (f, R, A, d) is at least as good as (f', R', A', d') if and only if $f_0 \geq f'_0$. This proves that pairs (f, R, A, d) are ranked by the equivalence approach with B as the reference monotone path.

That every equivalence ordering satisfies the Same-Preference Principle and the Indifference Set Dominance Principle is easily checked. ■

Recent titles

CORE Discussion Papers

2008/62.   Giorgia OGGIONI and Yves SMEERS. Average power contracts can mitigate carbon leakage.

2008/63.   Jean-Sébastien TANCREZ, Philippe CHEVALIER and Pierre SEMAL. A tight bound on the throughput of queueing networks with blocking.

2008/64.   Nicolas GILLIS and François GLINEUR. Nonnegative factorization and the maximum edge biclique problem.

2008/65.   Geir B. ASHEIM, Claude D'ASPREMONT and Kuntal BANERJEE. Generalized time-invariant overtaking.

2008/66.   Jean-François CAULIER, Ana MAULEON and Vincent VANNETELBOSCH. Contractually stable networks.

2008/67.   Jean J. GABSZEWICZ, Filomena GARCIA, Joana PAIS and Joana RESENDE. On Gale and Shapley '*College admissions and stability of marriage'*.

2008/68.   Axel GAUTIER and Anne YVRANDE-BILLON. Contract renewal as an incentive device. An application to the French urban public transport sector.

2008/69.   Yuri YATSENKO and Natali HRITONENKO. Discrete-continuous analysis of optimal equipment replacement.

2008/70.   Michel JOURNÉE, Yurii NESTEROV, Peter RICHTÁRIK and Rodolphe SEPULCHRE. Generalized power method for sparse principal component analysis.

2008/71.   Toshihiro OKUBO and Pierre M. PICARD. Firms' location under taste and demand heterogeneity.

2008/72.   Iwan MEIER and Jeroen V.K. ROMBOUTS. Style rotation and performance persistence of mutual funds.

2008/73.   Shin-Huei WANG and Christian M. HAFNER. Estimating autocorrelations in the presence of deterministic trends.

2008/74.   Yuri YATSENKO and Natali HRITONENKO. Technological breakthroughs and asset replacement.

2008/75.   Julio DÁVILA. The taxation of capital returns in overlapping generations economies without financial assets.

2008/76.   Giorgia OGGIONI and Yves SMEERS. Equilibrium models for the carbon leakage problem.

2008/77.   Jean-François MERTENS and Anna RUBINCHIK. Intergenerational equity and the discount rate for cost-benefit analysis.

2008/78.   Claire DUJARDIN and Florence GOFFETTE-NAGOT. Does public housing occupancy increase unemployment?

2008/79.   Sandra PONCET, Walter STEINGRESS and Hylke VANDENBUSSCHE. Financial constraints in China: firm-level evidence.

2008/80.   Jean GABSZEWICZ, Salome GVETADZE, Didier LAUSSEL and Patrice PIERETTI. Pubic goods' attractiveness and migrations.

2008/81.   Karen CRABBE and Hylke VANDENBUSSCHE. Are your firm's taxes set in Warsaw? Spatial tax competition in Europe.

2008/82.   Jean-Sébastien TANCREZ, Benoît ROLAND, Jean-Philippe CORDIER and Fouad RIANE. How stochasticity and emergencies disrupt the surgical schedule.

2008/83.   Peter RICHTÁRIK. Approximate level method.

2008/84.   Çağatay KAYI and Eve RAMAEKERS. Characterizations of Pareto-efficient, fair, and strategy-proof allocation rules in queueing problems.

2009/1.   Carlo ROSA. Forecasting the direction of policy rate changes: The importance of ECB words.

2009/2.   Sébastien LAURENT, Jeroen V.K. ROMBOUTS and Francesco VIOLANTE. Consistent ranking of multivariate volatility models.

2009/3.   Dunia LÓPEZ-PINTADO and Juan D. MORENO-TERNERO. The principal's dilemma.

2009/4.   Jacek B. KRAWCZYK and Oana-Silvia SEREA. A viability theory approach to a two-stage optimal control problem of technology adoption.

2009/5.   Jean-François MERTENS and Anna RUBINCHIK. Regularity and stability of equilibria in an overlapping generations model with exogenous growth.

Recent titles

CORE Discussion Papers - continued

2009/6.   Nicolas GILLIS and François GLINEUR. Using underapproximations for sparse nonnegative matrix factorization.

2009/7.   Michel M. DENUIT, Louis EECKHOUDT and Mario MENEGATTI. Correlated risks, bivariate utility and optimal choices.

2009/8.   Michel M. DENUIT, Louis EECKHOUDT and Mario MENEGATTI. Adding independent risks in an insurance portfolio: which shape for the insurers' preferences?

2009/9.   Antoine BOMMIER and Stéphane ZUBER. The Pareto principle of optimal inequality.

2009/10. Raouf BOUCEKKINE, Jacek B. KRAWCZYK and Thomas VALLEE. Environmental negotiations as dynamic games: Why so selfish?

2009/11. Théophile T. AZOMAHOU, Raouf BOUCEKKINE and Phu NGUYEN-VAN. Promoting clean technologies under imperfect competition.

2009/12. Patrice PIERETTI and Skerdilajda ZANAJ. On tax competition, public goods provision and jurisdictions' size.

2009/13. Jeroen V.K. ROMBOUTS and Lars STENTOFT. Bayesian option pricing using mixed normal heteroskedasticity models.

2009/14. Gauthier de MAERE d'AERTRYCKE and Yves SMEERS. The valuation of power futures based on optimal dispatch.

2009/15. Thierry BRECHET, Tsvetomir TSACHEV and Vladimir M. VELIOV. Prices versus quantities in a vintage capital model.

2009/16. François VANDERBECK and Laurence A. WOLSEY. Reformulation and decomposition of integer programs.

2009/17. Marc FLEURBAEY, Erik SCHOKKAERT and Koen DECANCQ. What good is happiness?

Books

H. TULKENS (ed.) (2006), *Public goods, environmental externalities and fiscal competition.* New York, Springer-Verlag.

V. GINSBURGH and D. THROSBY (eds.) (2006), *Handbook of the economics of art and culture.* Amsterdam, Elsevier.

J. GABSZEWICZ (ed.) (2006), La différenciation des produits. Paris, La découverte.

L. BAUWENS, W. POHLMEIER and D. VEREDAS (eds.) (2008), *High frequency financial econometrics: recent developments*. Heidelberg, Physica-Verlag.

P. VAN HENTENRYCKE and L. WOLSEY (eds.) (2007), *Integration of AI and OR techniques in constraint programming for combinatorial optimization problems*. Berlin, Springer.

P-P. COMBES, Th. MAYER and J-F. THISSE (eds.) (2008), *Economic geography: the integration of regions and nations*. Princeton, Princeton University Press.

J. HINDRIKS (ed.) (2008), *Au-delà de Copernic: de la confusion au consensus* ? Brussels, Academic and Scientific Publishers.

CORE Lecture Series

C. GOURIÉROUX and A. MONFORT (1995), Simulation Based Econometric Methods.

A. RUBINSTEIN (1996), Lectures on Modeling Bounded Rationality.

J. RENEGAR (1999), A Mathematical View of Interior-Point Methods in Convex Optimization.

B.D. BERNHEIM and M.D. WHINSTON (1999), Anticompetitive Exclusion and Foreclosure Through Vertical Agreements.

D. BIENSTOCK (2001), Potential function methods for approximately solving linear programming problems: theory and practice.

R. AMIR (2002), Supermodularity and complementarity in economics.

R. WEISMANTEL (2006), Lectures on mixed nonlinear programming.