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# A Structural Model of Well-being

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# A structural model of well-being: with an application to German Data

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**Abstract**

In this paper we attempt to explain individual, ordinally comparable, satisfaction levels. We postulate a simultaneous equation model where general satisfaction is explained by exogenous shock and level variables, and by the values of the satisfactions with respect to six distinct endogenous domains of life. Taking into account that these satisfactions were categorically measured and allowing for individual effects, the model was estimated on six consecutive waves of the German Socio-Economic Panel. The results are statistically very significant and plausible.

The main conclusions of this paper are: a) given the fact that we get stable significant and intuitively interpretable results, the assumption of interpersonal (ordinal) comparability of satisfactions cannot be rejected on the grounds that it leads to insignificant or implausible results; b) It is possible to explain satisfactions to a large extent by objectively measurable variables; c) Domain Satisfactions are strongly interrelated because of common explanatory variables; d) General Satisfaction may be seen as an aggregate of the six domain satisfactions.

## 1. Introduction

It is generally assumed in the behavioral sciences that individuals' behavior is driven by the achievement of a higher level of well-being and that actual behavior should be seen as the reflection of that. Economists speak frequently of utility instead of well-being, while followers of other disciplines use the term satisfaction or happiness. We shall use the terms indiscriminately. In economics the utility concept is mostly introduced as an elegant and easy way to describe and predict behavior. In the theory of consumer behavior the utility function $u(x)$, defined on the commodity space $X$, is just a device to describe a preference ordering between commodity bundles. Indifference curves are described by the equation $u(x) = c$ where $c$ is a constant. The function $u(x)$ may be estimated from observing consumer choice behavior, i.e. via revealed preferences. Nevertheless, the function $u(x)$ cannot be completely identified. In principle any monotonic transformation $\varphi(u(x))$ will describe the same net of indifference curves and the maximization of $\varphi(u(x))$ will yield the same choice behavior as the maximization of $u(x)$. This brought Pareto (1904), Robbins (1932), Samuelson (1945), Houthakker (1950), and Debreu (1959) to the idea of viewing utility as an ordinal concept, describing a preference ordering only.

Psychologists observe that individuals are more or less satisfied with respect to a specific situation, position, etc. Furthermore, people are able to evaluate their position on a scale between a 'worst' and 'best' case. This can be done on a verbal scale, for instance, consisting of the five categories 'very bad', 'bad', 'neutral', 'good', and 'very good' or on a numerical scale, for instance, by assigning the evaluation 1 to the worst situation and 10 to the best situation.

Psychologists for over 3 decades have used subjective questions regarding individuals' satisfaction with life or happiness. With respect to 'satisfaction with life as a whole' Cantril (1965) developed a question module, which has been asked in various forms since 1965 to over a million of respondents in thousands of questionnaires all over the world (see Veenhoven, 1997). Similar question modules have been developed by

Rensis Likert (1932), yielding the Likert-scale, Visual Analog Scale, etc. See also Bradburn (1969). The question which we use is the following

*"On a scale from 0 to 10, whereby 0 stands for 'extremely unsatisfied' and 10 for 'extremely satisfied', how would you rate your life as a whole?"*

The answers to this question are termed satisfaction levels. Besides asking for satisfaction with life as a whole, which we call general satisfaction (GS), we may also ask for the satisfaction with respect to the individuals' financial situation, their job, their health, etc. We speak then of Domain Satisfactions (DS). In the German data set, which we are studying, questions for general satisfaction and several domain satisfactions have been posed.

If , as generally assumed, individuals are driven by the achievement of a higher level of satisfaction, understanding and analyzing the determinants of satisfaction over a population seems a necessary condition to understand human behavior. In order to do so, we have to be pretty sure that responses of different persons are interpersonally comparable. In other words, it has to be the case that individuals' answering similarly to such satisfaction questions are enjoying the same level of well-being. Is this plausible?

Obviously, satisfaction is not a physical phenomenon which can be easily and objectively measured. However, it is well known (see Shizgal, 1999) that there is a strong positive correlation between emotional expressions like smiling, frowning, brain activity, and the answers to the satisfaction questions. Satisfaction levels are also predictive in the sense that individuals will not choose to continue activities which yield low satisfaction levels (see Kahneman et al., 1993; Clark, 1998; Frijters, 2000).

Two recent psychological findings encourage the view that the levels of satisfaction found are also interpersonally comparable within a given language community. The first is that individuals are able to recognize and predict the satisfaction level of others: in interviews in which respondents are shown pictures or videos of other individuals, respondents were quite accurate in identifying whether the individual shown to them was happy, sad, jealous, etc (see eg. Diener and Lucas, 1999)). This also held when individuals were asked to predict the evaluations of individuals from other cultural communities. Hence, although it is very probable that what makes individuals happy or sad differs greatly amongst different cultures, it does seem as if there is a common human 'language' of satisfaction and that satisfaction is partially observable. The second finding is that individuals in a language community have a common understanding of how to translate internal feelings into a number scale: virtually no respondent expects a very sad individual who is contemplating suicide to evaluate life satisfaction by anything higher than a 5 on a (0, 10)-scale. Also, respondents translate verbal labels, such as 'very good' and 'very bad', into roughly the same numerical values (see Van Praag (1991)).

These recent findings form the basis of this paper: we will assume that individuals belonging to a specific language community interpret satisfaction questions in the same way and consequently that their answers to questions on satisfaction and well-being are interpersonally comparable.

As already mentioned, besides the GS we may distinguish also specific domains such as job, health, financial situation, housing, etc. Hence, we speak of domain satisfactions, $DS_1,...,DS_J$ where J stands for the number of different domains. It stands to reason that general satisfaction must be a composite of the various domain satisfactions, say

$$GS = GS(DS_1,...,DS_J) \tag{1}$$

Moreover, various objective variables such as age, income, gender, etc., say a vector of individual characteristics $x = (x_1,...,x_k)$, will co-determine the domain satisfactions. Finally, it may be that the way in which GS is shaped, given DS, depends also on the vector $x$. Hence, our general model will be:

$$GS = GS(DS_1(x),...,DS_J(x); x) \tag{2}$$

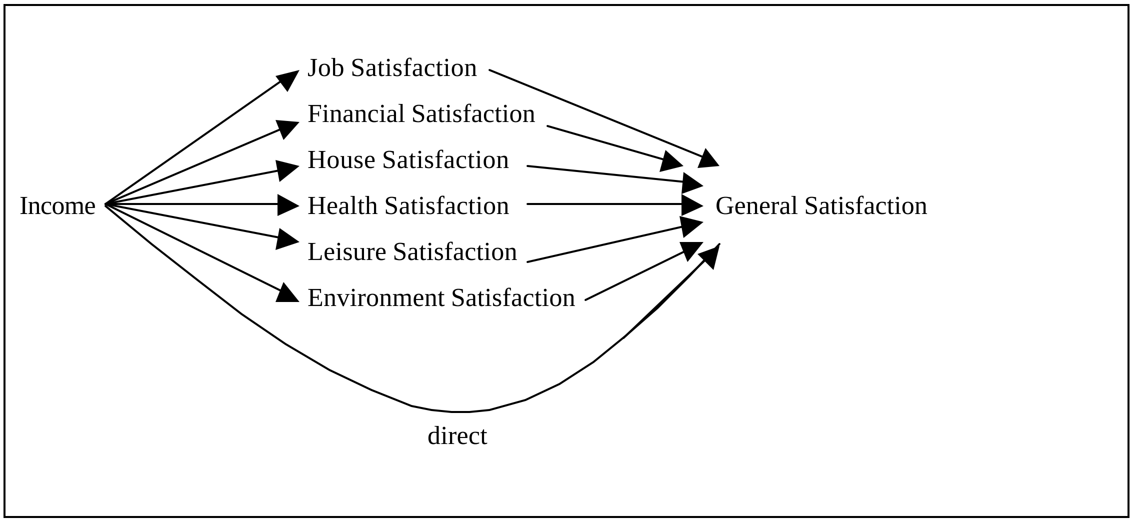
In this paper the objective of our study is to estimate the simultaneous system

$$GS = GS(DS(x); x)$$

$$DS_j = DS_j(x) \qquad j=1,2,\ldots,J \qquad (3)$$

The model is graphically illustrated in Figure 1.

**Figure 1: the direct and indirect effect of income on well-being**




Obviously there are some complications. First, the satisfactions are <u>ordinal discrete</u> variables. Estimation of a single equation is possible by traditional methods of ordered probit or logit (see Clark and Oswald, 1994; Blanchflower and Oswald, 2000). However, we do not know of standard methods by which it is possible to estimate a whole system where all or most variables are ordinal and discrete. Secondly, we have to correct for the fact that there are unobserved individual characteristics that are likely to be correlated with observed individual characteristics. Section 2 describes the method we will apply. In Section 3 we describe the data set, extracted from the German Socio-Economic Panel (GSOEP). We use the period 1992-1997 covering around 18,000 households. In Section 4 we formulate the specific model to be estimated. The panel character of the data set leads to the inclusion of fixed time effects and individual random effects, as well as level- and shock-effects. In Section 5 we present and discuss the estimates. Section 6 concludes. The paper builds on Plug and van Praag (1995), Plug (1997), van Praag and Frijters (1998), van Praag and Plug (1999), Frijters (1999).

The main novelty of the paper is content-wise that it estimates for the first time, as far as we know, a simultaneous equation system where the endogenous variables are *feelings of satisfaction*. Method-wise we succeed in estimating a simultaneous model, where some endogenous variables are ordinal discrete variables. Finally, we claim the additional novelty of estimating the system on a longitudinal panel, where time and individual effects are included.

## 2. Method

In this section we describe and discuss the estimation method. There are two particular problems which have to be faced. The first problem is that the observations with respect to satisfaction are discrete. The second complication is that the satisfaction concept is ordinal. We shall consider the two aspects jointly.

It is now well-established (Blanchflower and Oswald, 2000; Clark and Oswald, 1994) that satisfaction may be explained by ordered-logit or -probit methods. There is a collection of *I* ordered verbal labels (for example 'bad', 'sufficient', 'good') or a set of *I* numerical values (for example 1 to 5 or 0 to 10). Individuals describe their satisfaction level by crossing on the appropriate category. The choice decision may be described by the model

$$P(DS = i) = P(m_{i-1} < F(\boldsymbol{e}; x, \boldsymbol{q}) \leq m_i) \qquad \text{i=1,…,I} \qquad (4)$$

where $F$ is a utility or 'satisfaction' function, depending on a vector of characteristics $x$, a parameter vector $\boldsymbol{q}$, a random variable $\boldsymbol{e}$, and a set of nuisance parameters $m_i$. The last are traditionally called the <u>intercepts</u>. In the ordered probit model, which we shall use throughout this paper, it is usual to assume F(.) to be a linear function in $x$, and $\boldsymbol{e}$ to be N(0,1) distributed, that is

$$P(DS = i|x) = P(m_{i-1} < \boldsymbol{q}'x + \boldsymbol{e} \leq m_i) \quad \text{i=1,…,I} \qquad (5)$$

This specification implies a specific cardinalization. First by specifying $F(\boldsymbol{e};x,\boldsymbol{q}) = \boldsymbol{q}'x + \boldsymbol{e}$ and second by choosing the normal distribution. The last point is perhaps less obvious. By specifying the distribution of the error we actually determine the interval$(m_{i-1}, m_i]$, which amounts to a 'discrete' cardinalization. The estimated $m$'s (asymptotically) do not depend on $\boldsymbol{q}$. We have

$$P(DS = i|x) = N(m_i - \boldsymbol{q}'x) - N(m_{i-1} - \boldsymbol{q}'x) \tag{6}$$

Assuming without loss of generality that $x$, itself a random vector, has an expectation zero, we have $p\lim \frac{1}{N}\sum X_n = 0$. We have

$$P(DS \le i|X) = N(m_i - \boldsymbol{q}'X) \tag{7}$$

Using a first-order Taylor expansion we may write

$$N(m_i - \boldsymbol{q}'X) = N(m_i) + \boldsymbol{q}'Xn(m_i + \boldsymbol{d}) \tag{8}$$

where $0 < \boldsymbol{d} < \boldsymbol{q}'X$. We notice that the standard normal density is bounded by $n(0) = 1/\sqrt{2\boldsymbol{p}}$. It follows that the marginal frequency

$$P(DS \le i) = N(m_i) + p\lim \frac{1}{N}\Sigma \boldsymbol{q}'X_n \; n(m_i + \boldsymbol{d}_n) \tag{9}$$

We notice that $n(m_i + \boldsymbol{d}_n) < n(0) = \frac{1}{\sqrt{2\boldsymbol{p}}}$. As

$$p\lim \frac{1}{N}\Sigma \boldsymbol{q}'X_n = E(\boldsymbol{q}'X) \tag{10}$$

and $E(X) = 0$ by assumption, it follows that

$$P(DS \leq i) = N(m_i) \tag{11}$$

Let $f_i$ stand for the fraction in the sample of those respondents who answered $DS = i$. As the sample fractions tend to the marginal probabilities it follows that

$$f_i = N(m_i) - N(m_{i-1}) \tag{12}$$

where $m_0 = -\infty$ and $m_I = +\infty$ by definition. We notice that this remarkable fact has already been derived by Olsson (1979). See also Ronning and Kukuk (1996). It is also interesting that this holds irrespectively of $q$. If $E(X) = \overline{X} \neq 0$, then we have to replace the $m_i$'s by $m_i - q'\overline{X}$ and the whole analysis may be repeated.

It follows that the value of $q'X + e$ for all *i*-respondents is situated in the interval $(m_{i-1}, m_i]$. It is obvious that choosing another distribution would change the values of $m_i$ and hence the values of $q'x + e$. See also Ronning and Kukuk (1996) and Olsson (1979). Actually, and this is not widely understood, the choice of a specific distribution, be it the normal or the logistic, coupled with a linear expectation, implies a specific cardinalization.

A major question is the applicability of ordinal utility functions. What can we do and what can we not do with them?

Let us assume that we have another utility function, say

$$\tilde{F} = j(F) \tag{13}$$

where $j$ is a monotonically increasing function, and that we assume that $e$ has another distribution than the standard normal. There are two types of problems which can be tackled with cardinal utility functions. Say $u_1(x_1, x_2)$ and $u_2(x_1, x_2)$ are the utility functions of two individuals, and both utilities depend on two variables. The first type of problems is that where we try to measure *inequalities* between persons. Here we have to compare *differences* in utility. It is obvious that, except if $\varphi(.)$ is linear, utility differences before and after transformation will be different. Hence, such normative problems as a rule cannot be handled with an ordinal utility concept. They can be handled if we accept a specific cardinalization, but then the outcomes will depend on the cardinalization chosen.

The second type of problems deal with substitution ratios. How much is necessary of $x_1$, to compensate for a loss in $x_2$. This second type of substitution problems will yield the same solution *independently* of the choice of $\varphi$. In other words, they can be handled by the ordinal utility concept. What matters are the substitution ratios between $x_1$ and $x_2$, keeping utility constant. Let

$$F(x_1+\Delta x_1, x_2+\Delta x_2) = F(x_1+x_2) \tag{14}$$

then

$$\left.\frac{\partial x_1}{\partial x_2}\right|_{F=const} = \frac{\partial F/\partial x_1}{\partial F/\partial x_2} \tag{15}$$

Now

$$\frac{\partial \tilde{F}/\partial x_1}{\partial \tilde{F}/\partial x_2} = \frac{\partial \varphi/\partial F}{\partial \varphi/\partial F}\,\frac{\partial F/\partial x_1}{\partial F/\partial x_2} \tag{16}$$

It follows that substitution ratios do not change under a monotonic transformation of the utility function. It follows that applying the ordered probit model does not imply a cardinal restriction for 'substitution' problems.

One of the curses of discrete measurement is that the latent variable, in this case $\beta' x + \varepsilon$, cannot be exactly observed. Hence, if we try to estimate GS where

$$GS = GS(DS_1(x),...,DS_J(x);x) \quad (17)$$

We cannot put in 'observed' values for $DS_j$. As far as we can go, is to construct a consistent estimate of $DS_j$. For an individual n we have the model

$$DS_{jn} = q'_j x_n + e_{jn} \quad (18)$$

Let $DS$ be observed to be situated in $(m_{i-1}, m_i]$, then we have for its conditional expectation

$$E(DS | m_{i-1} < DS \leq m_i) = \hat{D}S \;\; = q' x_n + \frac{n(m_{i-1} - q' x_n) - n(m_i - q' x_n)}{N(m_i - q' x_n) - N(m_{i-1} - q' x_n)} \quad (19)$$

where we use the well-known results, derived by Stewart (1983) (see also Greene, 1991, p.753 and Heckman, 1976).

<u>Longitudinal aspects</u>

In the present context we shall consider a longitudinal data set. All observations for individual n are dated with an additional index $t = 1,...,T$. Then we assume that the disturbance term $e_{jnt}$ may be decomposed as

$$e_{jnt} = v_{jn} + h_{jnt} \quad (20)$$

where $v_{jn}$ is the individual random effect, and $v_{jn}$ and $h_{jnt}$ are mutually independent. The inclusion of $v_{jn}$ enriches the longitudinal model. It admits correlation between $e_{jnt}$ and $e_{jnt+1}$, which is a natural idea as part of the error term $e$ will stand for omitted variables which are constant for the individual n over time. For individual effects, referring to different domain satisfactions $j$ and $j'$ we assume $v_{jn}$ and $v_{j'n}$ to be mutually independent as well. Although there is something to say against this assumption, we shall assume that any correlation is removed by the joint explanatory variables for the two domains. Moreover, assuming otherwise would pose insurmountable computational problems in the discrete context.

We estimate the panel model in (17)-(20) by means of standard maximum likelihood procedures. We normalize the latent variable by posing $\sigma^2(\eta) = 1$[1]. The variance $\sigma^2(v)$ is then freely estimated. It follows that the equation for the conditional expectations of $\hat{D}S$ has to be modified as $\sigma^2(\varepsilon) = 1 + \sigma^2(v)$. Equation (19) changes into (21).

$$\hat{D}S = \theta' x_{nt} + \sqrt{1+\sigma^2(v)} \cdot \frac{\varphi\left(\frac{\mu_{i-1} - \theta' x_{nt}}{\sqrt{1+\sigma^2(v)}}\right) - \varphi\left(\frac{\mu_i - \theta' x_{nt}}{\sqrt{1+\sigma^2(v)}}\right)}{\Phi\left(\frac{\mu_i - \theta' x_{nt}}{\sqrt{1+\sigma^2(v)}}\right) - \Phi\left(\frac{\mu_{i-1} - \theta' x_{nt}}{\sqrt{1+\sigma^2(v)}}\right)} \tag{21}$$

We notice that for each $DS_j$ $(j = 1,...,6)$ we find a different $\sigma^2(v)$.

In the model given in the previous section we shall replace the unobservable $DS$ 's by the conditional expectations $\hat{D}S$ as in equation (21).

Summing up, the stages of the estimation procedure are the following. First, we estimate the $DS$ 's by ordered probit equations. Afterwards we estimate GS by ordered probit, where we replace the explanatory variables $DS$ by their best-estimated counterparts, $\hat{D}S$ .

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[1] There seem to be only a few ready-made programs which incorporate random individual effects in an ordered-probit setting. Actually we know only LIMDEP 7.0, which we used for this panel-probit model

## 3. Data description

The empirical analysis of the paper uses the German Socio-Economic Panel (GSOEP) [2]. The GSOEP is a longitudinal household panel that started in the Federal Republic of Germany (West-Germany) in 1984. After the reunion (former) East-German households were included in the GSOEP from 1990 onwards. We use the period from 1992 to 1997. As the citizens from East and West are different on many aspects, we take the two as two subpopulations (subsamples). The same holds for working and non-working respondents. The respondents are either the main breadwinner or his/her partner. Variables are more exactly described in the Appendix. When people move from East to West we consider them as different persons. For instance, if a household lives in the East in 1992 and moves to the West in 1994, we observe two households for incomplete periods. The same holds for the difference between workers and non-workers. Whether a move from one region to another would reduce or increase happiness is unclear. The same holds for the switch from worker to non-worker or *vice versa*. The transition frequencies are not large, thus, the impact of our simplifying assumption cannot be large (see also Hunt, 1999; Hunt, 2000).

General Satisfaction (GS) is defined by means of the question developed by Cantril (1965), quoted in section 1. In a similar way GSOEP poses questions with respect to job, financial situation, house, health, leisure, and environment satisfaction. Some summary statistics of the data set are summarized in Table 1. Satisfactions are scaled on a 0-10 scale as in the original questions. Table 1 also presents the average monthly net income in German Marks.

[2] The GSOEP is described in Wagner et al. (1993). The GSOEP is sponsored by the Deutsche Forschungsgemeinschaft and organized by the German Institute for Economic Research (Berlin), and the Center for Demography and Economics of Aging (Syracuse University). We are grateful to these institutes and the project director Prof. Dr. G. Wagner for making this data set available.

**Table 1: Average satisfaction levels in the GSOEP, 1992-1997**

| | West Workers | East Workers | West Non-Workers | East Non-Workers |
|---|---|---|---|---|
| General Satisfaction | 7.21 | 6.46 | 6.95 | 6.12 |
| Job Satisfaction | 7.15 | 6.83 | | |
| Financial Satisfaction | 7.09 | 6.28 | 6.99 | 6.12 |
| Housing Satisfaction | 7.42 | 6.66 | 7.57 | 6.96 |
| Health Satisfaction | 7.06 | 6.90 | 6.27 | 5.94 |
| Leisure Satisfaction | 6.40 | 5.89 | 7.48 | 7.18 |
| Environment Satisfaction | 6.26 | 4.99 | 3.68 | 5.13 |
| Net Family Income (monthly in DM) | 4034 | 3393 | 3115 | 2438 |
| Number of Observations | 29099 | 11668 | 19965 | 8021 |

We notice that the average GS for West Workers is 7.21 and for East Workers 6.46, a difference of about 0.75. West Non-Workers score 6.95 on average and East Non-Workers 6.15. The pattern is overall fairly consistent. Workers score higher than non-workers except for leisure satisfaction. This is intuitively clear as non-workers (mostly retired) will have much more leisure time. A second interesting point is that Westerners score higher than Easterners on almost every domain. From this summary table we cannot infer which factors determine satisfaction. Therefore, we need an econometric analysis. This is the objective of the next section.

## 4. Estimation Results

### Domain Satisfactions

The specification of domain satisfaction equations will always be debatable. We choose our specifications with a view on the literature, the availability of variables in the data set, and on the basis of our own intuition. We would like to be 'parsimonious'. Finally, we evaluated our specification on the basis of statistical significance, plausible values of the estimates, etc. We discuss the specifications for each domain along with the estimation results. There are, however, some structural features which apply to all equations. Given the panel data we naturally include a time effect as a year dummy. As for individual effects, we decompose the error $e_{jnt}$ as

$$\varepsilon_{jnt} = v_{jn} + \eta_{jnt} \tag{22}$$

where $v_{jn}$ stands for the individual random effect. We have

$$E(\varepsilon_{jnt} | v_{jn}) = v_{jn} \tag{23}$$

and $$Cov(\varepsilon_{jnt}, v_{jn}) = 0 \tag{24}$$

Analogously, it stands to reason to decompose the effect of the explanatory variables $x_{nkt}$ into

$$x_{nkt} = \bar{x}_{kn} + (x_{nkt} - \bar{x}_{kn}) \tag{25}$$

where $\bar{x}$ stands for the average of $x$ over time. Notice that per individual and hence for the whole sample the two terms are uncorrelated.

This addition has been first suggested by Mundlak (1978) in order to correct for correlation between the individual random effect $v_{jn}$ and $x_{knt}$. Therefore, we include the individual mean of those variables that may be correlated with the individual random effect. For example, it may well be that income is correlated with $v_{jn}$ as income depends partly on individual unobservable characteristics. Age, however, is not allowed to correlate with $v_{jn}$, as one grows older independently of her or his personal traits.

Furthermore, there is also an economic argument to include some of the $\bar{x}$'s as separate explanatory variables. The $\bar{x}$ differentiate between individuals while the deviations from the mean per individual identify the within-effect. Or in other words, the coefficient of $\bar{x}$ represents level effects, while the coefficients of the differences represent the shock effects. For example, the level effect of income covers the permanent income concept (Friedman, 1957), while the shock effect describes an individual temporary change. Obviously this decomposition makes only sense for those variables where we assume a differentiation between individuals and a considerable year to year deviation from the individual mean. We distinguish between shock and level effects, depending on the specific equation, for the following variables: family income, working income (defined as the income from labor of the respondents), savings, children, working hours, leisure time, and the number of adults in the household.

In the model we will distinguish between six domain satisfactions, viz., job (only for workers), financial situation, housing, health, leisure, and environment. For each domain satisfaction we use a specific subselection of variables. First, we present and briefly discuss the estimates of the various equations for the domain satisfactions, where we pool all the years together, admitting for time dummies and individual random effects. Then we present the equation for General Satisfaction.

Job Satisfaction

Job satisfaction is assumed to depend on age. A monotonic relationship looks improbable. Hence, we introduce a quadratic relationship in ln(age)[3]. Gender and education level are included as well as both total family income and income earned in work. It is obvious that the two are highly correlated, in the case of a one earner household. The number of working hours, extra hours, and extra money in terms of bonuses, etc., are also included. Finally, we add some variables describing the household composition (such as the number of children and adults). Additionally, we added dummy variables for missing variables (see Maddala, 1977, p.202). These mostly insignificant effects are not shown.

[3] By choosing the logarithmic specification we deviate from the traditional Mincer specification. We find good results when taking logarithms.

## **Table 2**: **Job Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | |
|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev. | Estimate. | Estimate/ Std. Dev |
| Constant | 9.184 | 7.172 | 10.706 | 4.991 |
| Dummy for 1992 | 0.324 | 14.273 | 0.226 | 5.697 |
| Dummy for 1993 | 0.085 | 3.605 | 0.167 | 4.168 |
| Dummy for 1994 | 0.030 | 1.264 | 0.112 | 2.316 |
| Dummy for 1995 | 0.030 | 1.255 | 0.030 | 0.759 |
| Dummy for 1996 | 0.010 | 0.402 | 0.016 | 0.389 |
| Ln(age) | -4.666 | -6.402 | -6.708 | -5.412 |
| Ln(age) ^ 2 | 0.596 | 5.816 | 0.872 | 4.948 |
| *Min Age** | *50.016* | | *46.820* | |
| Male | -0.054 | -2.129 | -0.086 | -2.191 |
| Ln(family income) | 0.109 | 4.392 | 0.105 | 2.372 |
| Ln(yrs. education) | -0.049 | -0.780 | -0.105 | -0.907 |
| Ln(adults) | -0.081 | -2.939 | 0.004 | 0.081 |
| Ln(children+1) | 0.016 | 0.556 | -0.020 | -0.394 |
| Ln(working income) | 0.067 | 3.938 | 0.241 | 7.514 |
| Ln(working hours) | -0.016 | -0.715 | 0.084 | 2.038 |
| Ln(extra money) | 0.010 | 2.911 | -0.020 | -2.923 |
| Ln(extra hours) | 0.003 | 0.478 | 0.016 | 1.747 |
| Mean (ln(f.inc) | 0.230 | 5.462 | 0.246 | 3.393 |
| Mean (ln(w.inc) | 0.010 | 1.145 | 0.042 | 2.837 |
| Mean (ln(ch+1)) | 0.041 | 0.991 | 0.063 | 0.868 |
| Mean (ln(adults)) | 0.023 | 0.521 | -0.083 | -0.99 |
| Std Deviation $v_i$ | 0.948 | | 0.836 | |
| Variance due to $v_i$ as % of the total variance | 0.473 | | 0.412 | |
| Number Observations | 29757 | | 11006 | |
| Log Likelihood | -55345 | | -21256 | |
| Log.Lik./Observation | -1.860 | | -1.931 | |
| Num. of Individuals | 7937 | | 3123 | |

* This is the minimum of the quadratic form in ln(age).

Job Satisfaction seems to fall over the period both in West and East Germany. We find strong age effects, where satisfaction follows a U-curve. The minimum is reached at the age of 50 for the West and 47 for the East. It implies that job satisfaction is falling with age up to 50 or 47, after which it rises again. Males are less satisfied than females with their job. The family income level coefficient is

0.339 (i.e. 0.230 + 0.109), while the shock-effect is 0.109 for Western workers. The level and shock effects of family income are in the West and the East roughly comparable. The working income level coefficient is 0.077 and the shock-effect is 0.067. For the East workers the corresponding amounts are 0.283 for the level and a shock-effect of 0.241.

It is interesting to notice that working income seems to be a much more important aspect of job satisfaction in the East than in the West, while working hours have a non-significant influence on Western job satisfaction but are positively evaluated by Easterners.

Financial Satisfaction

**Table 3: Financial Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West Non-Workers | | East Non-Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 5.654 | 4.883 | 5.280 | 2.694 | 14.324 | 14.389 | 16.319 | 11.023 |
| Dummy for 1992 | 0.300 | 11.845 | -0.115 | -2.794 | 0.091 | 2.850 | -0.326 | -6.252 |
| Dummy for 1993 | 0.307 | 11.639 | 0.152 | 3.579 | 0.292 | 8.991 | -0.078 | -1.631 |
| Dummy for 1994 | 0.244 | 10.564 | -0.314 | -8.120 | 0.380 | 13.837 | 0.058 | 1.379 |
| Dummy for 1995 | 0.214 | 8.075 | 0.107 | 2.543 | 0.302 | 9.501 | 0.103 | 1.999 |
| Dummy for 1996 | 0.287 | 9.224 | 0.213 | 4.582 | 0.273 | 7.149 | 0.112 | 1.966 |
| Ln(age) | -4.012 | -6.077 | -4.099 | -3.655 | -9.029 | -16.692 | -9.142 | -11.514 |
| Ln(age) ^ 2 | 0.530 | 5.698 | 0.508 | 3.187 | 1.245 | 16.829 | 1.251 | 11.520 |
| *Min. Age** | *44.136* | | *56.369* | | *37.578* | | *38.576* | |
| Ln(family income) | 0.157 | 5.510 | 0.362 | 6.978 | 0.155 | 4.619 | 0.248 | 3.877 |
| Ln(yrs. education) | 0.164 | 2.886 | -0.053 | -0.521 | 0.190 | 2.635 | -0.325 | -3.307 |
| Ln(adults) | -0.119 | -4.202 | -0.224 | -4.041 | -0.027 | -0.673 | -0.081 | -1.045 |
| Ln(children+1) | -0.605 | -2.208 | -0.162 | -0.321 | -0.658 | -2.271 | -0.525 | -0.919 |
| ln(f.inc.)*ln(ch.+1) | 0.066 | 1.996 | -0.006 | -0.097 | 0.068 | 1.914 | 0.052 | 0.725 |
| Gender | -0.034 | -1.516 | -0.070 | -2.051 | -0.193 | -6.820 | -0.107 | -2.846 |
| Ln(Savings) | 0.020 | 6.085 | 0.032 | 5.789 | 0.022 | 5.000 | 0.031 | 4.486 |
| Living together? | 0.139 | 5.148 | 0.187 | 3.253 | 0.187 | 7.425 | 0.065 | 1.455 |
| Earners | -0.019 | -0.762 | -0.086 | -1.826 | XXX | XXX | XXX | XXX |
| Mean (ln(f.inc) | 0.362 | 8.439 | 0.395 | 5.323 | 0.376 | 7.458 | 0.218 | 2.601 |
| Mean (ln(savings) | 0.059 | 10.085 | 0.053 | 5.403 | 0.067 | 8.98 | 0.057 | 5.129 |
| Mean (ln(ch+1)) | -0.087 | -2.164 | 0.077 | 1.125 | -0.145 | -2.638 | -0.333 | -3.337 |
| Mean (ln(adults)) | -0.117 | -2.7 | -0.257 | -3.173 | -0.270 | -4.804 | -0.032 | -0.358 |
| Std Deviation $v_i$ | 0.773 | | 0.721 | | 0.819 | | 0.640 | |
| Variance due to $v_i$ as % of the total variance | 0.374 | | 0.342 | | 0.401 | | 0.291 | |
| Number Observations | 30356 | | 11256 | | 20510 | | 8501 | |
| Log Likelihood | -56119 | | -20888 | | -38891.55 | | -16902.4 | |
| LogLik/Observation | -1.849 | | -1.856 | | -1.896 | | -1.988 | |
| Num. Of Individuals | 8130 | | 3191 | | 6361 | | 2690 | |

* This is the minimum of the quadratic form in ln(age).

Age effects are strongly prominent and even more so for non-workers. West-workers reach minimum satisfaction at the age of 44. In the East it lies at 56. This may also have to do with differences in wage/age profiles and career patterns. For non-workers the age pattern is much more pronounced with a minimum at 38 for Westerners and 39 for Easterners. The effect of family income enters as a level and as a shock variable. But the income effect itself is also affected by the number of children. The level effect is (0.157 + 0.362)=0.519 for West workers and 0.757 for West non-workers. For Eastern workers it is 0.531 and for Eastern non-workers 0.467. The interception term with children has a slight additional positive effect. The education effect is positive in the West but zero or negative in the East. This probably reflects the strongly different labor markets and labor cultures between the two former German states. As expected both the number of adults and that of children to be maintained have a negative effect on financial satisfaction. The level effect of adults is about -0.236 for West-workers and -0.419 for East-workers. For non-workers the effect is less pronounced. In the latter case we may expect that the adults will produce more in kind in terms of household production. The effects of children on financial satisfaction is rather pronounced and negative, where it seems to be stronger in the West than in the East. 'Living together' has a positive effect, and male respondents are less content than female respondents. Savings have a mild but positive effect.

Housing Satisfaction

**Table 4: Housing Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West non-Workers | | East Non-Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 8.981 | 7.066 | 10.279 | 4.754 | 8.050 | 7.194 | 8.772 | 5.433 |
| Dummy for 1992 | -0.035 | -1.486 | -0.074 | -1.820 | 0.187 | 6.546 | 0.176 | 3.417 |
| Dummy for 1993 | -0.004 | -0.173 | -0.122 | -2.986 | 0.207 | 6.936 | 0.097 | 2.166 |
| Dummy for 1994 | 0.019 | 0.796 | -0.045 | -0.964 | 0.223 | 7.395 | 0.165 | 3.734 |
| Dummy for 1995 | 0.007 | 0.287 | -0.086 | -2.218 | 0.088 | 2.950 | -0.005 | -0.109 |
| Dummy for 1996 | 0.050 | 1.998 | 0.007 | 0.171 | 0.076 | 2.476 | 0.054 | 1.130 |
| Ln(age) | -6.719 | -9.221 | -5.545 | -4.427 | -6.365 | -10.309 | -5.094 | -5.762 |
| Ln(age) ^ 2 | 1.001 | 9.717 | 0.824 | 4.597 | 0.953 | 11.161 | 0.747 | 6.092 |
| *Min.Age** | *28.706* | | *28.972* | | *28.219* | | *30.223* | |
| Ln(family income) | 0.053 | 1.977 | -0.079 | -1.655 | 0.045 | 1.249 | -0.155 | -2.607 |
| Ln(yrs. Education) | -0.116 | -1.649 | -0.832 | -6.780 | -0.087 | -0.925 | -0.629 | -4.970 |
| Ln(adults) | -0.211 | -8.127 | -0.116 | -2.522 | -0.102 | -2.829 | -0.067 | -1.007 |
| Ln(children+1) | -0.159 | -0.564 | -0.117 | -0.245 | -0.398 | -1.204 | -1.008 | -1.707 |
| ln(f.inc.)*ln(ch.+1) | 0.005 | 0.143 | 0.012 | 0.209 | 0.041 | 1.016 | 0.121 | 1.638 |
| Gender | -0.076 | -2.770 | -0.033 | -0.796 | -0.126 | -3.471 | -0.057 | -1.198 |
| Ln(rent) | 0.319 | 27.050 | 0.426 | 25.674 | 0.143 | 9.222 | 0.331 | 15.056 |
| Reforms? | 0.076 | 7.453 | 0.086 | 6.013 | 0.047 | 2.713 | 0.080 | 4.221 |
| Mean (ln(f.inc) | 0.424 | 9.477 | 0.302 | 3.985 | 0.641 | 12.073 | 0.473 | 5.558 |
| Mean (ln(ch+1)) | -0.112 | -2.633 | -0.063 | -0.867 | -0.325 | -5.578 | -0.107 | -1.145 |
| Mean (ln(adults)) | -0.069 | -1.491 | -0.140 | -1.614 | -0.358 | -5.835 | -0.293 | -2.784 |
| Std Deviation $v_i$ | 1.029 | | 0.964 | | 1.160 | | 0.959 | |
| Variance due to $v_i$ as % of the total variance | 0.514 | | 0.482 | | 0.574 | | 0.479 | |
| Number Observations | 30400 | | 11268 | | 20585 | | 8443 | |
| Log Likelihood | -56094 | | -22321 | | -36552 | | -16469 | |
| LogLik/Observation | -1.845 | | -1.981 | | -1.776 | | -1.951 | |
| Num. Of Individuals | 8134 | | 3194 | | 6369 | | 2672 | |

* This is the minimum of the quadratic form in ln(age).

The age effects are similar in the West and the East, always with a minimum about 29. Family income and 'rent' (all the monthly housing costs) have a strong positive effect on housing satisfaction. A higher rent probably implies a nicer and better situated house. The number of children and adults have the expected negative effects. The education effect is negative on both, East and West, although not significant for the West. Higher educated people are more critical on their housing conditions.

Health Satisfaction

**Table 5: Health Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West Non-Workers | | East Non-Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 1.980 | 1.496 | 2.465 | 1.085 | 13.170 | 11.616 | 8.710 | 4.441 |
| Dummy for 1992 | 0.207 | 9.115 | 0.419 | 11.232 | 0.107 | 3.943 | 0.120 | 2.613 |
| Dummy for 1993 | 0.044 | 1.842 | 0.231 | 5.913 | 0.037 | 1.314 | 0.061 | 1.387 |
| Dummy for 1994 | 0.013 | 0.564 | 0.083 | 1.791 | -0.042 | -1.456 | -0.030 | -0.710 |
| Dummy for 1995 | 0.050 | 2.088 | 0.110 | 2.824 | 0.007 | 0.257 | -0.017 | -0.370 |
| Dummy for 1996 | -0.018 | -0.751 | 0.033 | 0.826 | -0.017 | -0.585 | 0.023 | 0.505 |
| Ln(age) | 0.716 | 0.946 | 0.374 | 0.289 | -5.337 | -8.742 | -2.718 | -2.586 |
| Ln(age) ^ 2 | -0.300 | -2.816 | -0.264 | -1.433 | 0.507 | 6.080 | 0.154 | 1.070 |
| *Max.Age** | *3.294* | *Max* | *2.030* | *Min* | *193.919* | *Min* | *6953.529* | |
| Ln(family income) | 0.027 | 1.054 | 0.086 | 1.894 | 0.002 | 0.071 | 0.030 | 0.529 |
| Ln(yrs. education) | 0.226 | 3.100 | 0.381 | 2.841 | 0.422 | 4.618 | 0.571 | 4.066 |
| Ln(children+1) | 0.028 | 0.094 | -0.113 | -0.214 | -0.454 | -1.394 | 1.329 | 1.949 |
| ln(f.inc.)*ln(ch.+1) | -0.002 | -0.068 | 0.013 | 0.199 | 0.054 | 1.353 | -0.157 | -1.828 |
| Gender | 0.140 | 4.946 | 0.189 | 4.227 | -0.013 | -0.38 | 0.043 | 0.791 |
| Living together? | -0.007 | -0.332 | 0.032 | 0.731 | 0.081 | 2.933 | 0.005 | 0.082 |
| Mean (ln(f.inc) | 0.260 | 5.715 | 0.215 | 2.682 | 0.245 | 4.699 | 0.161 | 1.847 |
| Mean (ln(ch+1)) | -0.022 | -0.554 | -0.213 | -2.816 | -0.075 | -1.509 | -0.313 | -3.422 |
| Std Deviation $v_i$ | 1.089 | | 1.069 | | 1.179 | | 1.144 | |
| Variance due to $v_i$ as % of the total variance | 0.542 | | 0.533 | | 0.581 | | 0.567 | |
| Number Observations | 30535 | | 11330 | | 20733 | | 8498 | |
| Log Likelihood | -56033 | | -20413 | | -40304 | | -16531 | |
| Log Lik/Observation | -1.835 | | -1.802 | | -1. 944 | | -1.945 | |
| Num. Of Individuals | 8146 | | 3202 | | 6409 | | 2696 | |

* This is the minimum or maximum of the quadratic form in ln(age).

Not surprisingly health satisfaction falls monotonously with age. Health satisfaction increases significantly with income. While the shock effect is not significant, the level effect is significant and fairly strong. This is not surprising given the existing evidence (see, for example, Smith, 1998). We neglect here the children effect.

Individuals with higher education are significantly more healthy. Working males are more satisfied with their health than females.

Leisure Satisfaction

**Table 6 Leisure Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West Workers | | East Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 19.119 | 14.710 | 20.305 | 9.456 | 17.673 | 16.625 | 14.831 | 9.061 |
| Dummy for 1992 | -0.031 | -1.403 | -0.265 | -7.195 | 0.104 | 3.653 | 0.091 | 1.926 |
| Dummy for 1993 | -0.047 | -2.105 | -0.246 | -6.789 | -0.036 | -1.296 | -0.085 | -1.955 |
| Dummy for 1994 | -0.018 | -0.760 | -0.240 | -5.192 | 0.008 | 0.286 | -0.104 | -2.346 |
| Dummy for 1995 | -0.143 | -6.614 | -0.371 | -10.137 | 0.056 | 2.058 | 0.129 | 2.906 |
| Dummy for 1996 | 0.126 | 5.247 | 0.032 | 0.798 | 0.112 | 3.736 | 0.004 | 0.071 |
| Ln(age) | -7.8901 | -10.65 | -7.058 | -5.731 | -8.696 | -14.914 | -7.250 | -8.184 |
| Ln(age) ^ 2 | 1.095 | 10.506 | 1.000 | 5.725 | 1.265 | 15.844 | 1.057 | 8.795 |
| *Min.Age** | *36.707* | | *34.040* | | *31.139* | | *30.898* | |
| Ln(family income) | 0.001 | 0.050 | -0.030 | -0.682 | 0.020 | 0.661 | 0.110 | 2.089 |
| Ln(yrs. Education) | -0.139 | -2.155 | -0.411 | -3.831 | -0.189 | -2.314 | -0.320 | -2.789 |
| Ln(adults) | -0.051 | -2.481 | -0.046 | -1.200 | -0.124 | -4.613 | -0.241 | -4.617 |
| Gender | 0.240 | 9.064 | 0.240 | 6.397 | 0.155 | 4.818 | 0.082 | 1.879 |
| Living together? | -0.012 | -0.605 | -0.204 | -4.819 | -0.029 | -1.065 | 0.049 | 0.995 |
| Ln(working hours) | -0.410 | -22.732 | -0.721 | -20.031 | XXX | XXX | XXX | XXX |
| Ln(leisure time) | 0.026 | 11.199 | 0.028 | 6.623 | 0.024 | 9.755 | 0.020 | 5.251 |
| Mean (ln(f.inc) | 0.095 | 2.474 | 0.090 | 1.34 | 0.066 | 1.545 | 0.036 | 0.525 |
| Mean (ln(les.time)) | 0.030 | 5.856 | 0.036 | 4.162 | 0.042 | 8.953 | 0.012 | 1.665 |
| Mean (ln(ch+1)) | -0.215 | -6.660 | -0.117 | -2.169 | -0.273 | -6.447 | -0.175 | -2.579 |
| Std Deviation $v_i$ | 0.957 | | 0.845 | | 0.976 | | 0.815 | |
| Variance due to $v_i$ as % of the total variance | 0.478 | | 0.417 | | 0.488 | | 0.399 | |
| Number Observations | 30513 | | 11333 | | 20755 | | 8497 | |
| Log Likelihood | -61651 | | -23299 | | -37899 | | -16337 | |
| LogLik/Observation | -2.020 | | -2.056 | | -1.826 | | -1.923 | |
| Num. Of Individuals | 8145 | | 3200 | | 6412 | | 2694 | |

* This is the minimum of the quadratic form in ln(age).

The age effect is U-shaped with a minimum at about 35 for workers and 32 for non-workers. Family income is not a strong factor for leisure satisfaction. More education leads to less satisfaction with leisure. It seems that there is a tendency of people enjoying their leisure best when they are alone. Both, the presence of adults and that of children have a negative effect on leisure satisfaction, and living together has also a negative although only significant for Eastern non-workers.

Males enjoy their leisure more than females. Not unexpectedly the number of working hours has a strong negative effect on leisure satisfaction. The number of hours actually spent on leisure has a small positive effect.

Environment Satisfaction

**Table 7: Environment Satisfaction**

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West Non-Workers | | East Non-Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 3.866 | 3.168 | -1.418 | -0.700 | 9.215 | 9.086 | 6.721 | 4.132 |
| Dummy for 1992 | 0.042 | 1.835 | -1.109 | -29.761 | 0.060 | 2.168 | -0.826 | -17.791 |
| Dummy for 1993 | -0.240 | -10.568 | -0.727 | -20.073 | -0.201 | -7.420 | -0.616 | -14.249 |
| Dummy for 1994 | 0.256 | 11.211 | -0.291 | -7.037 | 0.295 | 10.825 | -0.056 | -1.370 |
| Dummy for 1995 | -0.012 | -0.505 | -0.322 | -8.986 | -0.015 | -0.577 | -0.274 | -6.223 |
| Dummy for 1996 | 0.113 | 4.757 | -0.126 | -3.339 | 0.084 | 3.008 | -0.125 | -2.771 |
| Ln(age) | -1.845 | -2.654 | 1.793 | 1.551 | -4.288 | -7.793 | -2.194 | -2.497 |
| Ln(age) ^ 2 | 0.275 | 2.806 | -0.239 | -1.463 | 0.628 | 8.388 | 0.341 | 2.847 |
| *Min.Age** | *28.681* | | *42.680* | | *30.323* | | *24.982* | |
| Ln(family income) | 0.075 | 3.359 | 0.115 | 2.759 | 0.031 | 1.100 | -0.007 | -0.140 |
| Ln(yrs. education) | -0.085 | -1.319 | -0.499 | -4.43 | -0.056 | -0.741 | -0.356 | -3.279 |
| Gender | 0.186 | 7.286 | 0.137 | 3.546 | -0.026 | -0.851 | 0.078 | 1.805 |
| Living together? | -0.008 | -0.418 | -0.036 | -0.875 | 0.013 | 0.495 | -0.015 | -0.322 |
| Mean (ln(f.inc) | 0.237 | 6.346 | 0.188 | 2.868 | 0.116 | 2.795 | 0.058 | 0.864 |
| Std Deviation $v_i$ | 0.961 | | 0.891 | | 0.946 | | 0.852 | |
| Variance due to $v_i$ as % of the total variance | 0.480 | | 0.442 | | 0.472 | | 0.420 | |
| Number Observations | 30595 | | 11372 | | 20629 | | 8520 | |
| Log Likelihood | -59056 | | -22218 | | -40321 | | -17275 | |
| LogLik/Observation | -1.930 | | -1.954 | | -1.955 | | -2.028 | |
| Num. Of Individuals | 8145 | | 3207 | | 6373 | | 2697 | |

* This is the minimum of the quadratic form in ln(age).

Finally we look at the environment satisfaction, i.e., satisfaction with the surroundings where the individual lives. Again, age is an important factor. Workers with more income enjoy the environment more, the effect is non-significant for non-workers. More education has a negative effect, but this is only significant for Easterners.

**General Satisfaction**

In Table 8 we present our estimates for the explanation of general satisfaction (GS). We do this by applying ordered probit on the general satisfaction question (given in section 1). We include the domain satisfactions. Again, we admit for shock- and level effects by means of applying the Mundlak device. As a matter of fact, the domain satisfactions will settle for most people at a nearly fixed level, approximated by the average over the observation period (Diener and Lucas, 1999). Especially for job, financial, and health we may expect temporary fluctuations. Technically we do this as follows.

We have for the latent variables DS consistent estimators as given in equation (21) (see Stewart, 1983). General satisfaction is modeled as:

$$GS_{nt} = \boldsymbol{\gamma}_o{}' \hat{D}S_{nt} + \boldsymbol{\delta}_o{}' \overline{DS} + \boldsymbol{\beta}_o' X_{ont} + \boldsymbol{\alpha}_o' \overline{X}_{on} + \boldsymbol{\varepsilon}_{ont} + v_{on} \qquad (22)$$

where $\boldsymbol{\gamma}_o' = (\boldsymbol{\gamma}_{1o},...,\boldsymbol{\gamma}_{6o})$ is the vector of shock-effects and where $\boldsymbol{\delta}_o = (\boldsymbol{\delta}_{1o},...,\boldsymbol{\delta}_{6o})$ is the vector of coefficients corresponding to the means of the domain satisfactions. The vector $(\boldsymbol{\gamma}_o + \boldsymbol{\delta}_o)'$ is the vector of the level effects.

The results for the GS equation have been tabulated in Table 10. The estimation includes, as for DS, fixed time effects and individual random effects. We notice that apart from the explanatory variables there is a quite remarkable individual effect, which accounts for about 30% of the total variance.

## Table 10: General Satisfaction

Ordered Probit with Individual Random Effect, Mundlak Transformation

| | West Workers | | East Workers | | West Non-Workers | | East Non-Workers | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev | Estimate | Estimate/ Std. Dev | Estimate. | Estimate/ Std. Dev |
| Constant | 3.380 | 3.089 | 3.322 | 1.717 | 2.121 | 2.348 | 12.723 | 7.817 |
| Dummy for 1992 | 0.250 | 10.529 | -0.044 | -1.142 | 0.292 | 10.476 | -0.096 | -1.992 |
| Dummy for 1993 | 0.196 | 7.893 | -0.008 | -0.188 | 0.248 | 8.272 | -0.104 | -2.184 |
| Dummy for 1994 | 0.164 | 6.784 | 0.114 | 2.925 | 0.104 | 3.592 | -0.153 | -3.355 |
| Dummy for 1995 | 0.144 | 5.966 | 0.153 | 3.839 | 0.095 | 3.333 | -0.091 | -2.002 |
| Dummy for 1996 | 0.069 | 2.778 | 0.068 | 1.657 | 0.035 | 1.215 | -0.068 | -1.489 |
| Job Satisfaction | 0.092 | 27.115 | 0.102 | 20.140 | XXX | XXX | XXX | XXX |
| Finan. Satisfaction | 0.086 | 24.878 | 0.093 | 18.219 | 0.077 | 19.458 | 0.085 | 13.397 |
| House Satisfaction | 0.046 | 13.203 | 0.049 | 8.931 | 0.045 | 9.646 | 0.060 | 8.480 |
| Health Satisfaction | 0.103 | 30.028 | 0.062 | 11.278 | 0.132 | 33.758 | 0.099 | 15.605 |
| Leis. Satisfaction | 0.015 | 3.134 | 0.003 | 0.350 | 0.018 | 3.170 | 0.026 | 3.103 |
| Envir. Satisfaction | 0.053 | 8.382 | 0.048 | 4.807 | 0.059 | 7.746 | 0.042 | 3.548 |
| Ln(age) | -1.730 | -2.802 | -2.012 | -1.841 | -1.414 | -2.872 | -7.410 | -8.637 |
| Ln(age) ^ 2 | 0.248 | 2.853 | 0.267 | 1.723 | 0.203 | 3.002 | 1.029 | 8.762 |
| *Min.Age** | *32.564* | | *43.273* | | *32.427* | | *36.598* | |
| Ln(family income) | 0.063 | 2.385 | 0.246 | 5.250 | 0.039 | 1.239 | 0.154 | 2.631 |
| Ln(yrs. education) | -0.166 | -3.253 | -0.089 | -0.989 | -0.111 | -1.646 | -0.027 | -0.275 |
| Ln(children+1) | 0.030 | 0.109 | -1.050 | -2.133 | -0.349 | -1.112 | -1.372 | -2.160 |
| Ln(f.inc.)*ln(Ch+1) | 0.001 | 0.018 | 0.145 | 2.391 | 0.037 | 0.953 | 0.194 | 2.425 |
| Gender | -0.035 | -1.714 | -0.041 | -1.341 | -0.146 | -5.663 | -0.143 | -3.753 |
| Living together? | 0.128 | 5.871 | 0.169 | 3.886 | 0.215 | 8.315 | 0.137 | 2.795 |
| Ln(children+1)^2 | 0.015 | 0.381 | -0.161 | -1.853 | 0.087 | 1.661 | 0.111 | 1.014 |
| Livg.tog.*ln(ch.+1) | -0.060 | -1.888 | -0.044 | -0.664 | -0.080 | -2.091 | -0.129 | -1.539 |
| Mean (ln(f.inc) | -0.131 | -3.341 | -0.194 | -2.695 | -0.007 | -0.151 | -0.110 | -1.345 |
| Mean (ln(ch+1)) | 0.018 | 0.494 | 0.149 | 2.404 | -0.032 | -0.701 | -0.138 | -1.577 |
| Mean (ln(w.inc) | 0.006 | 0.943 | 0.022 | 2.036 | XXX | XXX | XXX | XXX |
| Mean (ln(savings) | 0.017 | 3.717 | 0.037 | 4.721 | 0.008 | 1.406 | 0.034 | 3.883 |
| Mean (ln(Work. Hr) | 0.022 | 2.124 | 0.005 | 0.268 | XXX | XXX | XXX | XXX |
| Mean (ln(Les.Time) | -0.014 | -3.705 | -0.010 | -1.654 | -0.006 | -1.719 | -0.009 | -1.685 |
| Mean (ln(adults)) | 0.110 | 3.845 | -0.086 | -1.506 | -0.008 | -0.208 | -0.098 | -1.469 |
| Mean (Job S.) | 0.031 | 5.088 | 0.020 | 2.056 | XXX | XXX | XXX | XXX |
| Mean (Financial S.) | 0.143 | 20.252 | 0.141 | 13.726 | 0.187 | 24.048 | 0.160 | 13.148 |
| Mean (House S.) | 0.000 | 0.012 | -0.013 | -1.355 | -0.000 | -0.022 | -0.027 | -2.463 |
| Mean (Health S.) | 0.063 | 11.194 | 0.049 | 5.597 | 0.082 | 13.454 | 0.054 | 5.758 |
| Mean (Leisure S.) | 0.054 | 6.940 | 0.025 | 1.945 | 0.041 | 4.286 | 0.065 | 4.412 |
| Mean (Environ. S.) | -0.040 | -3.679 | 0.030 | 1.731 | -0.047 | -3.585 | 0.002 | 0.097 |
| Std Deviation $v_i$ | 0.582 | | 0.575 | | 0.665 | | 0.608 | |
| Variance due to $v_i$ as % of the total variance | 0.253 | | 0.248 | | 0.306 | | 0.270 | |
| Number Observations | 29099 | | 11668 | | 19965 | | 8021 | |
| Log Likelihood | -42577 | | -17785 | | -32314 | | -13702 | |
| LogLik/Observation | -1.463 | | -1.524 | | -1.619 | | -1.708 | |
| Num. Of Individuals | 7914 | | 3107 | | 6224 | | 2569 | |

* This is the minimum of the quadratic form in ln(age).

The results in Table 10 give a picture of the complex phenomenon behind human well-being. First we see that general well-being is an amalgam of various domain satisfactions. The level effects of the DS are tabulated below:

**Table 11: Level Effects of DS on GS**

| Level Effects | West Workers | East Workers | West Non-Workers | East Non-Workers |
|---|---|---|---|---|
| Job Satisfaction | 0.123 | 0.122 | XXX | XXX |
| Finan. Satisfaction | 0.229 | 0.234 | 0.264 | 0.245 |
| House Satisfaction | 0.046 | 0.037 | 0.045 | 0.033 |
| Health Satisfaction | 0.166 | 0.111 | 0.214 | 0.153 |
| Leis. Satisfaction | 0.069 | 0.027 | 0.058 | 0.092 |
| Envir. Satisfaction | 0.013 | 0.078 | 0.012 | 0.044 |

We see that the level effects for the four subsamples are showing nearly the same ranking and are mostly of the same order of magnitude. The three main determinants in order of magnitude are finance, health, and job satisfaction. Housing, leisure, and environment seem to be much less important. It may be that there are other well-being determinants, i.e. marriage quality, health of children, etc., but in this data set information on those aspects is not available.

Now we look at the shock effects of the domain satisfactions, as given by the second block above in Table 10. It appears that the shock effect of health is larger than of finance, except for East workers. The sensitivity for health seems to be lower in the East that in the West.

The time dummies incorporate several effects, including any effect from inflation, any effect from average circumstances on individual satisfaction, and any trend effects in satisfaction. If we only allow for this last interpretation, these dummies indicate both for Western workers and non-workers a steady decline in well-being from 1992 up to 1997. For Eastern workers and non-workers the patter is different. After an initial decline Eastern workers experienced an increase in well-being until 1995 after which it seems to fall again. For Eastern non-workers we see an initial fall but an improvement of conditions after 1994.

The non-zero coefficients of some of the explanatory variables (age, education, gender, living together) indicate that general satisfaction is not completely predictable from the domain satisfactions but that objective variables have also a separate direct effect. Males are consistently less satisfied than females.

## 5. Conclusions

In this paper we have made an attempt to measure the individual's domain and overall satisfactions. We have postulated a simultaneous equation model where general satisfaction is explained by exogenous shock and level variables, and by the values of the satisfactions with respect to six distinct domains of life. We showed that it is possible to model and estimate a model for subjective satisfactions as any econometric model. The results are statistically very significant and plausible.

The main conclusions of this paper are:

1. Given the fact that we get stable significant and intuitively interpretable results, the conclusion seems justified that the assumption of interpersonal (ordinal) comparability of satisfactions cannot be rejected.
2. It is possible to explain satisfactions to a large extent by objective measurable variables.
3. Domain satisfactions are strongly interrelated because of common explanatory variables.
4. General satisfaction may be seen as an aggregate of the six domain satisfactions.

Obviously, this study is a first step which has to be replicated on other data. Moreover, it is easy to think of a number of refinements. Nevertheless, we believe that there is ample evidence that the answers to subjective questions can be used as proxies for satisfaction. Using these proxies, general and domain satisfactions are to a large extent explainable. The consequence is that we have found a very interesting instrument for the evaluation and desing of socio-economic policy.

Finally, this study suggests that the individual evaluation behavior may be seen, with all the natural caveats, as a kind of input/output mechanism. Given specific values of *x* the expected value of satisfactions can be calculated. For instance, an increase in income will influence all Domain Satisfactions and General Satisfaction, directly (i.e. ln(income)), through the level (i.e. mean ln(income), and via the number of children (i.e. ln(income)*ln(children+1)). Thus, changes on values of x have various effects on DS and on the GS (*direct effect*). We may distinguish for some variables a short term (shock) and a long term effect (level). Furthermore, the effect of the changes of x on the DS will have an impact on GS since DS are incorporated into the GS (*indirect effects*). It falls outside the aim of this paper to discuss in depth what different effects of specific variables teach us over and above the direct effects known in the literature. However, it will be clear that this is a major potential application of the framework presented here and an important line of future enquiries.

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## Appendix A: The data

The GSOEP panel was started in West Germany in 1984. Later, in 1990, the household panel was extended to East Germany. For the purposes of our analysis we have divided the respondents not only between East and West Germany but also between workers and non-workers. Across time, individuals are treated as multiple if they move from one region to the other, or if they change employment status. The attrition rate of the panel as well as the causes of this attrition are widely discussed in Pannenberg (1997).

The variables used in the regression analysis that need clarification are:

*Family income*: Net household income in German Marks (equal to all the respondents of the same household)

*Years of education*: For the west, this variable is computed according to the GSOEP documentation[4]. For the East, we have applied similar conversion rules.

*Children + 1*: The number of children (+ 1) that the respondent has, even if they do not live in the household.

*Adults*: The number of adults that live in the household.

*Living together*: Dummy variable where 1 stands for being married or having a partner living in the household.

*Working income*: Is the sum of gross wages, gross self-employment income, and gross income from second job income.

*Working hours*: Weekly average.

*Extra money*: Is the sum of the extra working income such as 13th or 14th month, Christmas bonus, holiday benefit, or profit-sharing.

*Extra Hours*: Extra working hours.

*Savings*: Amount of money left over each month for major purchases, emergencies, or savings.

*Earners*: Dummy variable where 1 stands for having a partner that works.

[4] The author of the generated variable "years of schooling" for the West is J. Schwarze.

*Rent*: Is the sum of: rent per month, interest and amortization per month, other costs per month, housing costs per month, maintenance costs previous year (*1/12), and heat and hot water costs previous year (*1/12).

*Reforms*: Indicate whether the respondents (or their landlord) have made any modernization at their house the last year.