TI 2002-022/3
Tinbergen Institute Discussion Paper

The Anatomy of Subjective Well-being

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THE ANATOMY OF SUBJECTIVE WELL - BEING

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November 2, 2001

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† The authors would like to thank Rob Alessie and Richard H. Day for useful comments. The usual disclaimers apply. We like to thank the GSOEP-group and their director Prof. G. Wagner for making the data available to us.

Abstract

This paper contributes to the literature on Subjective Well-Being by taking into account different aspects of life, called domains, such as health, financial situation, job, leisure, housing, and environment. We postulate a two–layer model where individual total Subjective Well-Being depends on the different subjective domain satisfactions. A distinction is made between long-term and short-term effects. The individual domain satisfactions depend on objectively measurable variables such as income. The model is estimated using a large German panel data set.

JEL Classification: C23, C25, I31.

Key words: Subjective Well-Being; Satisfaction measurement; Qualitative regressors; Health satisfaction; Job satisfaction.

1. Introduction

The recent issue of this Journal devoted to the theme of 'Subjective Well–Being and Economic Analysis' may be seen as a significant step towards the lifting of the virtual ban on measuring utility that has dominated economics since Robbins (1932). To be honest, it should be noted that various prominent economists such as Frisch (1932) and Tinbergen (1991) always refused to take such a stand. Van Praag (1968), Easterlin (2001), and Holländer (2001) a.o. make a strong case that this anathema has actually caused a stagnation in the development of economic analysis.

In the last decade but prior to the work published in JEBO, scattered economists have started to study Subjective Well-Being (SWB)[1] as a serious subject. See, for example, Clark and Oswald, 1994; DiTella et al., 2001; Frey and Stutzer, 2000; McBride, 2001; Oswald, 1997; Pradhan and Ravallion, 2000; and Van Praag and Frijters, 1999. Earlier studies include Easterlin (1974), Van Praag (1971), and Van Praag and Kapteyn (1973).

This paper extends this line of research by making a first attempt to develop a joint model based on satisfaction with life as a whole and on domain satisfactions. Domain satisfactions relate to individual satisfaction with different domains of life such as health, financial situation, and job. Satisfaction with life as a whole can be seen as an aggregate concept, which can be unfolded into its domain components.

Most studies in this literature have the following structure. Individuals are asked how satisfied they are with their life as a whole or with a specific domain of it. They are invited to cast their response in terms of a small number of verbal response categories such as 'dissatisfied', and 'very satisfied'. Alternatively, the categories are numbered from 0 or 1 to 5, 7 or 10, where 'most dissatisfied ' corresponds to level 0

or 1 and 'most satisfied' with the highest level. The responses are explained by Ordered Probit or Logit models, using objective variables such as age, income, gender, and education. When two respondents give the same answer, they are assumed to enjoy similar satisfaction levels, implying that ordinal comparability is permitted. In other words, ordinal interpersonal comparability is a basic assumption in these models. Next, the effect of the explanatory variables on individual well-being can be assessed. Additionally, one can also consider the substitution ratio between explanatory variables.[2] This paper aims at a somewhat more sophisticated model in which we will assume that satisfaction with life is an aggregate of various domain satisfactions.

This paper is structured as follows. Section 2 presents the model and the estimation procedure. Section 3 describes briefly the data, introduces the satisfaction questions used in the empirical analysis, and highlights the main underlying assumptions. Section 4 shows and discusses the estimation results. Section 5 concludes.

2 The model and estimation procedure

This section introduces the structural model of well-being as well as the estimation procedure. Some technical aspects of the estimation are presented in Appendix A.

[1] We use the terms Subjective Well-Being, satisfaction with life, and general satisfaction as interchangeable.

[2] For instance: Frey and Stutzer (2000) look at the impact of democratic institutions on Subjective Well-Being; Clark and Oswald (1994) assess the importance of unemployment for well-being; and Cutler and Richardson (1997) and Groot (2000) study the effect of various illnesses on health satisfaction.

2.1 The model

The model assumes that there is a set X of objectively measurable explanatory variables X_1 ,…., X_k that explain the various domain satisfactions, which we denote by DS_1 , … , DS_J . It is probable that there will be variables that only affect certain domains but not all of them. In its turn, General Satisfaction (GS) is explained by DS_1 , … , DS_J . We sketch the structure in Figure 1.

[Figure 1 about here]

We might surmise that the structure in Figure 1 is too simple. It is quite probable that the endogenous variables DS would influence each other. For example, job satisfaction depends, among others, on health satisfaction. This being true, the intermediate block of the model in Figure 1 has to be seen as a reduced model in which all cross–relations between domain satisfactions have been eliminated.

Individual satisfaction depends not only on the individual's objective situation but also on his or her personality, which is assumed to be time-invariant. These personality traits are unobservable but they co-determine both GS and the DS. Additionally, there may be other common unobservable variables such as health of the children. To account for this, the model includes a latent component Z in the satisfaction equations.

General satisfaction is described by a function

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

and the domain satisfactions by a set of functions

$$DS_j = DS_j(x_j, z) \qquad \text{j=1,2,…,J} \qquad (2)$$

where x_j stands for the sub-selection of *x* variables for the domain j. The variable *Z* is, by definition, unobservable. Thus, if no special treatment is given, *Z* becomes part of the error terms of the *DS* and *GS* equations. This would imply that the explanatory variables *DS* in equation (1) are correlated among themselves and with the *GS* error term, which would cause an endogeneity bias. In order to avoid that, we have to construct an instrumental variable for *Z*, which is included in equation (1). Appendix A describes the way in which this done.

2.2 The estimation procedure

First, we distinguish for some of the explanatory variables x_j in equation (2) and DS_j in equation (3) a permanent and a transitory effect. This is realized by including both, their annual value and their mean over the six years considered. For instance, income at time *t*, y_t, is included in the Financial Satisfaction equation as $b\ y_t + g\ \bar{y}$. This can be rewritten as $b\ (y_t - \bar{y}) + (g + b)\ \bar{y}$, where $\bar{y}$ stands for the average over time. Then b is the transitory income effect and $(g + b)$ is the permanent income (Friedman, 1957). Notice that per individual and hence for the whole sample the two terms are uncorrelated. The deviations from the averages per individual identify the *within*-effect, while the means provide the differences *between* individuals. Similarly, the coefficients of the means represent *level* effects, while the coefficients of the differences represent *shock* effects. Obviously, this decomposition makes only sense for those variables where a differentiation between individuals can be assumed, and

where there is considerable year to year deviation from the individual means.[3] Including those within and between effects gives some simple dynamics to the model, because the mean value changes gradually when years pass by.

The second way in which we make use of the panel structure of the data is by allowing for individual random effects. The error terms of the *DS* and the *GS* equations are decomposed into two independent terms

$$e_{jnt} = v_{jn} + h_{jnt} \tag{6}$$

where n stands for the individual. The term v_{jn} represents the individual random effect, i.e. the unobservable individual characteristics and the term h_{jnt} is the pure error term. In a panel regression context this error structure is standard. As usual, we assume $E(e) = E(v) = E(h) = 0$. The model assumes that $E(h, x) = 0$, namely that the individual random effect is not correlated with the explanatory variables (see footnote 3). Additionally, we also include a time fixed effect as a year dummy. The time dummies incorporate several effects, including inflation, changes in external circumstances on individual satisfaction, and any trend effects in satisfaction.

Finally, there is a third aspect of the estimation that needs to be discussed. The DS variables, which are used as explanatory variables of equation (1), are latent discrete variables. The DS are assigned numerical values using Terza's method (1987). The details are discussed in Appendix A. The transformed DS are thus transformed into values on the real axis. The estimation of equation (2) has been done by GLS. The variances $s^2(n)$ and $s^2(e)$ are estimated for each domain. The GS

[3] Mundlak (1978) introduced this specification in order to allow for correlation between the individual random effect and some explanatory variables.

equation is estimated by Ordered Probit. As usual in Ordered Probit analysis, a normalization is needed. Here, the variance of $s^2(e)$ is standardized at 1, and $s^2(n)$ is estimated. The GS estimation is done using the package LIMDEP 7.0.

3. Consideration of the data

The empirical analysis is based on the German Socio-Economic Panel (GSOEP)[4], 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. The paper draws from the period 1992 to 1997. The GSOEP includes more than 14,000 individuals in the Western sample and about 6,000 in the Eastern sample. As the citizens from East- and West - Germany are different on many aspects, we analyze them as two different subsamples. The same holds for working and non-working respondents. The non-working sample includes inactive individuals as well as unemployed. About 30% of Western non-workers are 65 years old or older and 65% are females. For the Eastern non-workers, these percentages are 26% and 62%, respectively. The respondents are all the adults older than 16 years or older living in the household. When people move from East to West or from working to non-working, they are considered as different persons. Given that the transition frequencies are small, the impact of this simplifying assumption cannot be large (Hunt, 1999, 2000). The attrition rate of the panel as well as the causes of this attrition are discussed in Pannenberg (1997).

The GSOEP includes a fairly large number of subjective satisfaction questions. The General Satisfaction question runs as follows

[4] 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 Centre for Demography and Economics of Aging (Syracuse University).

"Please answer by using the following scale in which 0 means totally unhappy, and 10 means totally happy:
How happy are you at present with your life as a whole?"

Psychologists have used this sort of subjective questions for over three decades, starting with Cantril (1965), the Likert (1932)-scale, and the Visual Analog Scale (VAS). Satisfaction questions have been asked in various forms since 1965 to over a million of respondents in thousands of questionnaires all over the world (see Bradburn, 1969, Veenhoven, 1997). Additionally, the respondents of the GSOEP are asked for their satisfaction with respect to various domains (DS).

Table 1 presents some summary statistics for all satisfaction questions. The answers are scaled on a 0-10 scale as in the original questions. Additionally, information on household income is added.

[Table 1 about here]

We notice that the average GS for Western Workers is 7.21 and for Eastern Workers 6.46, a difference of about 0.75. Western Non-Workers score 6.95 on average and Eastern Non-Workers 6.15. The pattern is overall fairly consistent. Workers score higher than non-workers except for housing and leisure satisfaction, and environment for Easterners. A second interesting point is that Westerners score higher than Easterners on almost every domain except for non-workers' environment satisfaction. From this summary table we cannot infer which factors determine satisfaction. For that, we look at the econometric analysis below.

The description of the other variables used in the analysis is presented in Appendix B.

In order to use these questions to elicit individual preferences, two fundamental assumptions have to be made. First, that responses of different persons are interpersonally comparable at an ordinal level. In other words, that individuals answering similarly to such satisfaction questions are enjoying a similar level of satisfaction. The model here does not assume any kind of cardinality, which would imply that a step from, e.g. 6 to 7 would be equal to the well –being or utility difference from, e.g. 7 to 8 (see Suppes and Winet, 1954). Several findings encourage the assumption of ordinal interpersonal comparability 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 e.g., Diener and Lucas, 1999). This also holds when individuals are 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 roughly 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). The third and last finding

is the fairly stable relationship found between satisfaction and objectively measurable variables (see e.g. Diener and Lucas).

The second assumption is that there is a correspondence between what one can measure, i.e. GS, and the metaphysical concept we are actually interested in. Obviously, satisfaction and well-being is not a physical phenomenon that can be easily and objectively measured. Nevertheless, it is well known that there is a strong positive correlation between emotional expressions like smiling, frowning, brain activity, and the answers to the satisfaction questions (see, Shizgal,1999; Fernández-Dols and Ruiz-Belda, 1995; Sandvik et al., 1993). 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 and Oswald, 1998; Frijters, 2000).

4. Estimation results

This section presents the estimation results of the six DS equations and of the GS equation. The specifications are chosen with a view on the literature and the availability of variables in the data set. Then, the results are evaluated with respect to intuitive and theoretical plausibility and statistical significance[5].

Job Satisfaction

The job satisfaction equation has also been estimated, for example, by Clark (1997), Clark and Oswald (1994), and Groot and Maassen van den Brink (1999) using the British Household Panel Survey (BHPS). Neither of them allow for

[5] All the equations include dummy variables for missing values (see Maddala, 1977, p.202). Those, mostly insignificant, coefficients are not shown in the Tables.

individual effects in an ordered-Probit setting. Notice that for individuals who do not have a job, information on job satisfaction is evidently absent

[Table 2 about here]

Job satisfaction is assumed to depend on age. Since a monotonic relationship looks improbable, we introduce a quadratic relationship in ln(age). We find strong age effects, where satisfaction follows a U-curve. The minimum is reached at the age of 53 for the West and 48 for the East, after which age job satisfaction starts raising with age. Males are less satisfied than females with their job. For West Germans, the number of adults in the household has a negative significant impact of job satisfaction.

The role of income with respect to job satisfaction is ambiguous. We have to distinguish between the income earned in the job by the respondent, i.e., working income, and the household income. Working income is certainly a dimension of the job: it expresses, to a large extent, how the worker is evaluated by the employer. Moreover, given the amount of working hours and the job requirements, the larger the working income the higher job satisfaction. On the other hand, household income, here included as the ratio of household income over the respondent's working income, also influences job satisfaction. A larger household income gives each working member of the household more margin to be selective on his or her type of employment and is also easier to leave an unsatisfactory job, if there is additional income in the household. Table 2 shows that the coefficient of ln(working income) is 0.05 in the West and 0.153 in the East. Hence, changes in working income have a stronger effect on job satisfaction

in the East than in the West. For mean ln(work income), the coefficients are 0.005 and 0.033, respectively. The level effects of work income are 0.055 and 0.186 in the West and East, respectively. The level coefficient for 'household income/working income' is 0.238 (i.e. 0.171 + 0.067) for Western workers, while the shock-effect is 0.067. For the East, figures are similar. Working hours have a negative non-significant influence on Western job satisfaction but are positively evaluated by Easterners.

Financial satisfaction.

The results for the financial satisfaction question are shown in Table 3. The curvi-linear age effects are strongly prominent. Western-workers reach minimum satisfaction at the age of 45 and East workers at 54. For non-workers this is at 38 for Westerners and 39 for Easterners. The quadratic effect may have to do with wage-age profiles and career patterns differences. It may also be caused by moving expectations.

[Table 3 about here]

The household income level effect is 0.382 (=0.120 + 0.262) for Western workers and 0.413 for Western non-workers. For Eastern workers it is 0.362 and for Eastern non-workers 0.467. The income effect is also affected by the number of children. The interaction term with children has a slight additional positive effect for Westerners. Education has a positive impact on financial satisfaction for Westerners but the impact is zero or negative for Easterners. This difference probably reflects the different labor markets characteristics and cultures between

the two regions. As expected, the number of adults and of children living in the household have a mostly significantly negative effect on financial satisfaction, except for the number of children that is non-significant for Eastern Workers. The presence of a partner in the household has a positive effect, and male respondents are less content than female respondents. Having savings has a positive effect on financial satisfaction, as expected.

Housing Satisfaction

Housing satisfaction has also been studied by, e.g., Varady and Carozza (2000). The age effect is U-shaped, reaching a minimum at about 29. The mean of the household income and the monthly housing costs have a strong positive effect on housing satisfaction. Higher housing costs or income probably imply a nicer and better-situated house. The number of children and adults has the expected negative effects, implying that housing satisfaction falls with an increasing number of lodgers. The education effect is negative in both East and West, although not significantly so for the West. We conclude that higher educated people are more critical on their housing conditions or have higher expectations that can not be met. Finally, the dummy variable 'reforms', which equals one if the house has been renovated in the last year, has a positive sign as may be expected.

[Table 4 about here]

Health Satisfaction

Nowadays, health satisfaction is studied by many health economists as a tool to evaluate health gains and losses from illnesses and medical treatments (see, e.g., Cutler and Richardson, 1997). The results of the estimation are shown in Table 5. Health satisfaction falls monotonously with ln(age). Health satisfaction increases with income, although the shock effect is not significant for any of the sub-samples and the level effect is significant only for Westerners. Hence, incidental income changes will have less impact on health than permanent changes. Individuals with higher education are significantly more satisfied with their health. This may indicate that higher educated individuals have a healthier life style. Working males are more satisfied with their health than females, while for non –working individuals the difference is insignificant.

[Table 5 about here]

Leisure Satisfaction

We distinguish in the GSOEP data set between three kinds of time use, i.e. working time, household work, and leisure. Not unexpectedly, the number of working hours has a strong negative effect on leisure satisfaction, while the number of hours spent on leisure has a small positive effect.

[Table 6 about here]

The age effect is again U-shaped with a minimum at about 35 for workers and 31 for non-workers. Household income is not a strong factor for leisure satisfaction,

but the level effects are always positive. More education leads to less satisfaction with leisure. It seems that there is a tendency for people to enjoy their leisure time most when they live alone. Both, the presence of adults and that of children have a negative effect on leisure satisfaction, and living together has also a negative effect, although only significant for Eastern non-workers. Males enjoy their leisure more than females.

Environment Satisfaction

Finally, we look at the environment satisfaction, that is, the satisfaction with the surroundings where the individual lives. Again, the age effect follows a U–shape with a minimum at the late twenties for all subsamples except for Eastern workers for whom the minimum satisfaction is found at the age of 46. Workers and Western non–workers with more income are more satisfied with their environment; the income effect is non-significant for East non-workers. More education has a negative effect, but this is only significant for Easterners.

[Table 7 about here]

General Satisfaction

The estimation results for the GS equation are presented in Table 8. This Table gives a picture of the complex phenomenon behind human well-being. Table 8 shows that general satisfaction is indeed an amalgam of various domain satisfactions. Almost all *DS* coefficients are strongly significant. In Table 9, the level effects of the DS are tabulated.

[Table 8 about here]

[Table 9 about here]

We see that the level effects for the four German sub-samples are showing nearly the same ranking and are mostly of the same order of magnitude. The three main determinants are, in this order: finance, health, and job satisfaction. Leisure comes next in importance for individual well-being. Housing and environment seem to be less important. This is specially true for the environment satisfaction of Westerners. It may be that there are other determinants of well-being, such as marriage satisfaction and health of children, but information on those aspects is not available in the GSOEP data set.

The shock effects of the domain satisfactions are given by the second block in Table 8. It appears that the shock effect of health is larger than that of finance and job, except for Eastern workers. In any case, it is still true that financial, job, and health satisfaction are the most important domain determinants for individual general satisfaction. In the short term health is the most important consideration, whereas over the long run finances become paramount.

In three of the four subsamples, the latent variable Z has a significant negative coefficient. Additionally, there is a quite remarkable unobservable individual random effect, which accounts for between 25% and 30% of the total variance. In order to test the specification, we estimate the same GS equation but excluding the Z variable. The results, available upon request, show that all domain effects are much more positive but preserve the same order and approximately the same trade-off ratios. If it is added as an explanatory variable the domain effects will be reduced, because the common component effect is estimated in its own right.

5. Conclusions

In this paper we have made an attempt to measure the individual's domain and overall satisfactions and the way in which they are connected. We have postulated a simultaneous equation model, where general satisfaction is explained by the values of the satisfactions with respect to six distinct domains of life. We showed that it is possible to estimate a model for subjective satisfactions in the spirit of traditional econometric modeling, even though the qualitative variables are not measurable in the usual sense.

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 domain satisfactions to a large extent by objectively measurable variables. Domain satisfactions are strongly interrelated because of common explanatory variables.
3. General satisfaction may be seen as an aggregate of the six domain satisfactions.

Obviously, this study is a first step that has to be validated 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 measuring individual satisfaction, happiness, or well-being. The consequence is that self-reported satisfaction is a useful new instrument for the evaluation and design of socio-economic policy. Moreover, the results help us to understand the composite construction of individual well-being and preferences.

Another application of this model is to assess trade-off ratios between, e.g. leisure, environment or health, and income. Such ratios have been calculated by, for instance, Di Tella *et al*., Ferrer-i-Carbonell and Van Praag (2001), and Van Praag and Baarsma (2000). This is left for future research. It will be clear that this model is a major potential playground for future research both for economists, psychologists, and political scientists.

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Appendix A : Technical aspects of the estimation procedure

There are two aspects of the estimation procedure that have to be considered in more detail. First, the satisfactions are categorical ordinal variables. Estimation of a single equation, where the qualitative variable is the one to be explained, is possible by means of traditional methods of ordered probit or logit. Thus, we estimate the General Satisfaction equation by means of Ordered Probit. This is the usual way in the subjective satisfaction literature and implies a normally distributed error sturcture. In our model, however, not only the dependent variable in equation (1) is qualitative, but the same holds for the explanatory variables (DS). The most usual approach is by means of introducing dummy variables. A categorical variable with *k* categories is described by (*k* –1) dummy variables, which are introduced as regressors. This approach is unattractive because it would introduce 54 not easily interpretable regression coefficients.

Since the DS are ordinal variables, one can use any translation into numbers provided that the order of the 'values' is preserved. For instance, assume that we have two 'translations'

$$DS_j \quad \text{and} \quad \ddot{DS}_j = \jmath_j(DS_j) \qquad (j=1,\ldots,6) \qquad (A.1)$$

where the $\jmath_j(\cdot)$ are monotonically increasing functions. Let us assume that GS is explained by a latent variable model

$$y = \gamma_1 DS_1 + \ldots + \gamma_6 DS_6$$

then the alternative model

$$y = \gamma_1 \, j_1^{-1}(\ddot{DS}_1) + \gamma_6 j_6^{-1}(\ddot{DS}_6)$$

can also be used, although the functional specification is quite different in terms of the second translation. It can also be shown that the trade–offs between the basic *X* variables remain the same, irrespective of whether they are calculated from the first model or from the second model. We notice that the translation function $j(\cdot)$ is and should be the same for all individuals, if we assume that the original answers have equal meaning for different respondents.

Hence, the specific choice of assigning numerical values to DS is a matter of expediency. If we want to use DS as an explanatory variable in a regression or a probit model, we would prefer an explanatory variable, which can vary over the whole real axis. We use the device proposed by Terza (1987). In the satisfaction questions described in Section 3, the categories are numbered 0 to 10. We assign a DS value to each category by setting $\ddot{DS}_i = E(DS \mid \mu_{i-1} < DS \leq \mu_i)$ *(i=1,…,11)*, where the values μ_i are the normal quantile values of the sample fractions of the 11 response categories.

The second problem is the possible correlation of the error term of *GS* with the error terms of the *DS* via a common term *Z.* This would lead to an endogeneity bias in the estimation of equation (1). Here, we explain how we instrument *Z*. After estimating the six DS equations (2), we calculated its residuals in order to estimate the part *Z* that is common to all the residuals. This is defined as the first principal component of the (6x6) error covariance matrix. It carries about 50% of the total variance. By adding this *Z* as an additional explanatory variable to the GS-equation,

we may assume that the remaining GS-error is no longer correlated with the DS-errors and that the estimators of the coefficients in (3) do not suffer from endogeneity bias. The addition of *Z* in this estimation procedure may be compared to the Heckman-correction term (Heckman, 1976). Because the introduction of the *Z* eliminates the covariance between the GS-error and the DS-errors, we may deal with the recursive system under the assumption that the error covariance matrix is block-diagonal (see, e.g., Greene, 2000, p. 675).

Appendix B: Variables description

In Appendix B, the variables used for the regressions that may need clarification are described.

Household income: Net monthly 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. For the East, we have applied similar conversion rules.

Children + 1: The number of children (+ 1) younger than 16 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.

2nd Earner in house: Dummy variable that takes value 1 if there is more than one earner in the household.

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

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, i.e. overworked hours.

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

Monthly housing costs: Indicates housing costs and includes: 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: Dummy variable that takes value 1 if the respondents or their landlord have made any modernization at their house the last year.

Leisure time: Hours spend on hobbies and other free time in a typical week (weekday and Sundays).

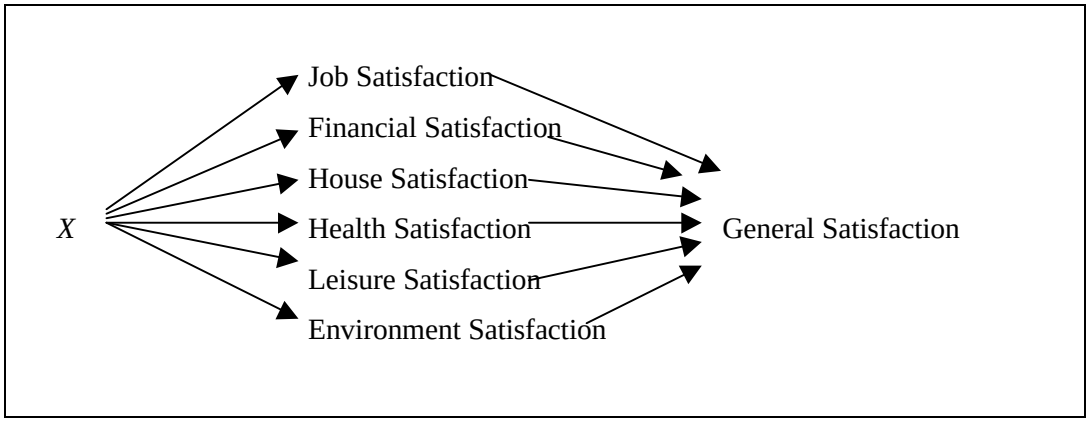

Figure 1: The two layer model

Table 1: Average and (standard deviations) of satisfaction levels and income in the GSOEP, 1992-1997

	West Workers	East Workers	West Non-Workers	East Non-Workers
General Satisfaction	7.21 (*1.632*)	6.46 (*1.615*)	6.95 (*1.947*)	6.12 (*1.970*)
Job Satisfaction	7.15 (*1.972*)	6.83 (*2.074*)		
Financial Satisfaction	7.09 (*1.887*)	6.28 (*1.890*)	6.99 (*2.120*)	6.12 (*2.136*)
Housing Satisfaction	7.42 (*2.145*)	6.66 (*2.297*)	7.57 (*2.186*)	6.96 (*2.319*)
Health Satisfaction	7.06 (*2.073*)	6.90 (*1.941*)	6.27 (*2.484*)	5.94 (*2.364*)
Leisure Satisfaction	6.40 (*2.318*)	5.89 (*2.392*)	7.48 (*2.235*)	7.18 (*2.245*)
Environment Satisfaction	6.26 (*2.008*)	4.99 (*2.073*)	3.68 (*2.065*)	5.13 (*2.174*)
Net Household Income (monthly in DM)	4034 (*2150*)	3393 (*1516*)	3115 (*2014*)	2438 (*1318*)
Number of Observations	29636	11941	20427	8335

Table 2: Job Satisfaction

GLS with Individual Random Effect and Fixed Time Effects

	West Workers		East Workers	
	Estimate	Estimate/ Std. Dev.	Estimate.	Estimate/ Std. Dev
Constant	3.155	*3.262*	5.276	*3.238*
Dummy for 1992	0.101	*6.466*	0.043	*1.516*
Dummy for 1993	0.028	*1.752*	0.101	*3.599*
Dummy for 1994	0.009	*0.584*	0.039	*1.431*
Dummy for 1995	0.014	*0.880*	0.024	*0.902*
Dummy for 1996	-0.008	*-0.493*	0.010	*0.385*
Ln(age)	-2.766	*-5.023*	-4.640	*-4.951*
Ln(age) ^ 2	0.348	*4.497*	0.600	*4.512*
*Min Age**	52.911		47.666	
Male	-0.041	*-2.097*	-0.038	*-1.353*
Ln(household income/ Working income)	0.067	*3.737*	0.068	*2.017*
Ln(yrs. education)	-0.044	*-0.939*	-0.042	*-0.509*
Ln(adults)	-0.056	*-2.790*	0.018	*0.449*
Ln(children+1)	0.009	*0.472*	-0.001	*-0.020*
Ln(working income)	0.050	*3.876*	0.153	*6.274*
Ln(working hours)	-0.010	*-0.562*	0.038	*1.077*
Ln(extra money)	0.007	*2.678*	-0.009	*-1.825*
Ln(extra hours)	0.002	*0.416*	0.009	*1.380*
Mean (ln(hous. income/ Working income)	0.171	*5.368*	0.179	*3.207*
Mean (ln(w.inc)	0.005	*0.785*	0.033	*2.993*
Mean (ln(ch+1))	0.020	*0.598*	-0.080	*-1.277*
Mean (ln(adults))	0.031	*1.049*	0.013	*0.249*
Std Deviation v_i	0.669		0.625	
Variance due to v_i as % of the total variance	0.471		0.408	
Number Observations	30084		12122	
R-squared: within	0.007		0.006	
R-squared: between	0.024		0.059	
R-squared: overall	0.019		0.034	
Num. Of Individuals	8023		3180	

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

Table 3: Financial Satisfaction

GLS with Individual Random Effect and Fixed Time Effects

	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	1.815	*2.081*	1.404	*1.03*	8.473	*11.348*	10.549	*8.917*
Dummy for 1992	0.214	*13.308*	-0.076	*-2.904*	0.078	*3.800*	-0.232	*-6.485*
Dummy for 1993	0.105	*6.352*	0.007	*0.248*	0.117	*5.493*	-0.140	*-4.171*
Dummy for 1994	0.054	*3.266*	-0.288	*-11.195*	0.181	*8.583*	-0.021	*-0.641*
Dummy for 1995	0.035	*2.146*	-0.030	*-1.189*	0.117	*5.715*	-0.012	*-0.369*
Dummy for 1996	0.015	*0.846*	-0.025	*-0.932*	0.021	*0.923*	-0.081	*-2.302*
Ln(age)	-2.830	*-5.71*	-2.677	*-3.455*	-6.833	*-16.667*	-7.255	*-11.337*
Ln(age) ^ 2	0.373	*5.343*	0.336	*3.061*	0.941	*16.730*	0.992	*11.342*
*Min. Age**	44.596		53.876		37.791		38.684	
Ln(household income)	0.120	*5.496*	0.231	*6.109*	0.122	*4.397*	0.205	*4.077*
Ln(yrs. Education)	0.116	*2.797*	-0.032	*-0.485*	0.141	*2.559*	-0.273	*-3.520*
Ln(adults)	-0.087	*-4.124*	-0.139	*-3.617*	-0.013	*-0.435*	-0.068	*-1.139*
Ln(children+1)	-0.359	*-1.731*	0.018	*0.052*	-0.341	*-1.409*	-0.289	*-0.607*
ln(f.inc.)*ln(ch.+1)	0.038	*1.551*	-0.021	*-0.493*	0.034	*1.143*	0.025	*0.426*
Gender	-0.023	*-1.394*	-0.037	*-1.698*	-0.152	*-7.159*	-0.086	*-3.015*
Ln(Savings)	0.015	*6.28*	0.017	*4.246*	0.018	*5.318*	0.024	*4.283*
Living together?	0.094	*4.777*	0.172	*4.267*	0.140	*7.192*	0.054	*1.528*
2nd Earner in house	-0.015	*-0.854*	-0.073	*-2.292*				
Mean(ln(hous. income)	0.262	*8.2*	0.225	*4.289*	0.291	*7.402*	0.157	*2.372*
Mean (ln(savings)	0.043	*9.899*	0.031	*4.614*	0.050	*8.858*	0.045	*5.137*
Mean (ln(ch+1))	-0.080	*-2.498*	-0.154	*-2.803*	-0.207	*-4.822*	-0.253	*-3.301*
Mean (ln(adults))	-0.065	*-2.283*	0.042	*0.893*	-0.127	*-3.212*	-0.023	*-0.324*
Std Deviation v_i	0.564		0.463		0.620		0.495	
Variance due to v_i as % of the total variance	0.745		0.287		0.386		0.279	
Number Observations	30622		12357		20867		8536	
R-squared: within	0.014		0.035		0.011		0.037	
R-squared: between	0.116		0.132		0.181		0.201	
R-squared: overall	0.074		0.080		0.146		0.142	
Num. Of Individuals	8148		3236		6419		2699	

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

Table 4: **Housing Satisfaction**

GLS with Individual Random Effect and Fixed Time Effects

	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	3.306	*3.832*	5.703	*3.978*	2.564	*3.707*	3.756	*3.386*
Dummy for 1992	0.077	*5.304*	0.081	*3.221*	0.210	*12.378*	0.237	*7.009*
Dummy for 1993	0.049	*3.304*	0.010	*0.421*	0.171	*9.812*	0.142	*4.664*
Dummy for 1994	0.030	*2.008*	0.001	*0.037*	0.146	*8.424*	0.151	*5.078*
Dummy for 1995	0.038	*2.652*	-0.005	*-0.207*	0.087	*5.198*	0.046	*1.600*
Dummy for 1996	0.015	*1.071*	0.009	*0.390*	0.027	*1.586*	0.039	*1.330*
Ln(age)	-4.068	*-8.211*	-4.23844	*-5.123*	-3.718	*-9.703*	-3.520	*-5.798*
Ln(age) ^ 2	0.605	*8.650*	0.623	*5.276*	0.555	*10.495*	0.515	*6.132*
*Min.Age**	28.891		30.077		28.539		30.390	
Ln(household income)	0.041	*2.236*	-0.041	*-1.256*	0.031	*1.427*	-0.089	*-2.070*
Ln(yrs. Education)	-0.060	*-1.383*	*-0.510*	*-6.627*	-0.032	*-0.590*	-0.409	*-4.898*
Ln(adults)	-0.133	*-7.150*	-0.085	*-2.445*	-0.071	*-2.878*	-0.048	*-0.928*
Ln(children+1)	-0.038	*-0.195*	*-0.192*	*-0.570*	-0.201	*-0.966*	-0.565	*-1.260*
ln(f.inc.)*ln(ch.+1)	-0.004	*-0.181*	0.023	*0.556*	0.021	*0.824*	0.067	*1.199*
Gender	-0.045	*-2.648*	-0.032	*-1.247*	-0.075	*-3.517*	-0.037	*-1.194*
Ln(monthly housing costs)	0.195	*23.026*	0.268	*22.282*	0.082	*8.343*	0.214	*13.637*
Reforms?	0.047	*6.643*	0.052	*5.442*	0.027	*2.606*	0.053	*4.195*
Mean (ln(hous. income)	0.258	*8.804*	0.144	*2.875*	0.376	*11.567*	0.300	*5.146*
Mean (ln(ch+1))	-0.040	*-1.298*	-0.0611	*-1.075*	-0.196	*-5.070*	-0.187	*-2.557*
Mean (ln(adults))	-0.073	*-2.684*	-0.0313	*-0.659*	-0.204	*-5.711*	-0.062	*-0.911*
Std Deviation v_i	0.643		0.622		0.691		0.626	
Variance due to v_i as % of the total variance	0.489		0.469		0.545		0.450	
Number Observations	30554		12309		20810		8477	
R-squared: within	0.021		0.048		0.011		0.020	
R-squared: between	0.086		0.108		0.122		0.120	
R-squared: overall	0.063		0.087		0.116		0.090	
Num. Of Individuals	8143		3232		6393		2681	

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

Table 5: **Health Satisfaction**

GLS with Individual Random Effect and Fixed Time Effects

	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	-1.121	*-1.333*	-0.935	*-0.712*	5.254	*7.357*	2.731	*2.315*
Dummy for 1992	0.016	*1.148*	0.132	*6.366*	0.001	*0.037*	0.021	*0.746*
Dummy for 1993	-0.008	*-0.577*	0.109	*5.213*	0.021	*1.211*	0.053	*2.021*
Dummy for 1994	-0.002	*-0.139*	0.042	*2.050*	-0.003	*-0.179*	0.023	*0.914*
Dummy for 1995	-0.002	*-0.130*	0.039	*1.955*	0.000	*0.000*	-0.005	*-0.193*
Dummy for 1996	-0.035	*-2.374*	0.029	*1.329*	-0.001	*-0.031*	0.050	*1.803*
Ln(age)	0.852	*1.778*	0.627	*0.834*	-2.536	*-6.446*	-1.125	*-1.741*
Ln(age) ^ 2	-0.238	*-3.531*	-0.207	*-1.940*	0.210	*3.891*	0.023	*0.260*
*Max.Age**	5.976		4.560		424.307		4.E+10	
Ln(household income)	0.004	*0.232*	0.032	*1.175*	-0.009	*-0.456*	0.015	*0.399*
Ln(yrs. Education)	0.131	*3.068*	0.193	*2.697*	0.233	*4.215*	0.273	*3.359*
Ln(children+1)	0.012	*0.063*	-0.147	*-0.494*	-0.222	*-1.067*	0.814	*1.999*
ln(f.inc.)*ln(ch.+1)	0.000	*0.005*	0.017	*0.469*	0.027	*1.060*	-0.095	*-1.862*
Gender	0.082	*4.928*	0.104	*4.301*	-0.001	*-0.025*	0.027	*0.878*
Living together?	-0.011	*-0.843*	0.017	*0.634*	0.044	*2.492*	-0.003	*-0.099*
Ln(Savings)	0.006	*2.748*	-0.002	*-0.480*	0.008	*3.014*	0.003	*0.582*
Mean (ln(hous. income)	0.097	*3.236*	0.071	*1.432*	0.069	*1.944*	0.020	*0.325*
Mean (ln(ch+1))	0.019	*0.773*	-0.096	*-2.209*	-0.012	*-0.395*	-0.149	*-2.690*
Mean (ln(savings)	0.018	*4.355*	0.014	*2.108*	0.020	*3.749*	0.017	*2.096*
Std Deviation v_i	0.643		0.595		0.702		0.658	
Variance due to v_i as % of the total variance	0.515		0.513		0.549		0.532	
Number Observations	30669		12359		20883		8532	
R-squared: within	0.008		0.023		0.006		0.009	
R-squared: between	0.126		0.124		0.274		0.262	
R-squared: overall	0.083		0.090		0.191		0.174	
Num. Of Individuals	8153		3238		6424		2705	

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

Table 6. Leisure Satisfaction

GLS with Individual Random Effect and Fixed Time Effects

	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	9.890	*11.412*	10.607	*7.824*	8.978	*13.231*	8.170	*7.024*
Dummy for 1992	0.049	*3.380*	-0.077	*-3.359*	0.110	*6.286*	0.116	*3.661*
Dummy for 1993	0.061	*4.220*	-0.042	*-1.903*	0.041	*2.333*	0.010	*0.335*
Dummy for 1994	0.092	*6.043*	-0.023	*-1.009*	0.080	*4.395*	0.010	*0.342*
Dummy for 1995	0.001	*0.047*	-0.111	*-5.124*	0.078	*4.603*	0.142	*4.962*
Dummy for 1996	0.080	*5.446*	0.034	*1.459*	0.036	*2.081*	-0.025	*-0.866*
Ln(age)	-5.023	*-10.204*	-4.680	*-6.020*	-5.357	*-14.310*	-4.953	*-7.837*
Ln(age) ^ 2	0.696	*10.045*	0.661	*6.001*	0.777	*15.138*	0.720	*8.339*
*Min.Age**	36.855		34.456		31.466		31.155	
Ln(household income)	0.001	*0.074*	-0.008	*-0.292*	0.012	*0.597*	0.072	*1.815*
Ln(yrs. Education)	-0.092	*-2.196*	-0.274	*-4.051*	-0.134	*-2.663*	-0.227	*-2.912*
Ln(adults)	-0.034	*-2.421*	-0.038	*-1.609*	-0.086	*-4.984*	-0.168	*-4.695*
Gender	0.153	*8.807*	0.148	*6.368*	0.102	*5.128*	0.060	*2.067*
Living together?	-0.011	*-0.805*	-0.129	*-4.559*	-0.020	*-1.136*	0.037	*1.052*
Ln(working hours)	-0.261	*-19.096*	-0.429	*-15.970*				
Ln(leisure time)	0.017	*10.333*	0.018	*6.414*	0.014	*8.504*	0.013	*4.629*
Mean (ln(hous. income)	0.063	*2.481*	0.060	*1.462*	0.050	*1.809*	0.028	*0.570*
Mean (ln(les.time))	0.020	*5.810*	0.024	*4.473*	0.025	*8.504*	0.008	*1.574*
Mean (ln(ch+1))	-0.138	*-6.704*	-0.059	*-1.833*	-0.182	*-7.060*	-0.122	*-2.753*
Std Deviation v_i	0.624		0.528		0.610		0.556	
Variance due to v_i as % of the total variance	0.471		0.400		0.460		0.377	
Number Observations	30569		12323		20804		8528	
R-squared: within	0.016		0.021		0.011		0.016	
R-squared: between	0.072		0.141		0.156		0.108	
R-squared: overall	0.055		0.100		0.140		0.090	
Num. Of Individuals	8151		3230		6415		2703	

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

Table 7: **Environment Satisfaction**

GLS with Individual Random Effect and Fixed Time Effects

	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	0.003	*0.003*	-2.721	*-2.018*	3.717	*5.185*	2.605	*2.201*
Dummy for 1992	0.224	*15.019*	-0.426	*-18.440*	0.227	*12.017*	-0.297	*-9.374*
Dummy for 1993	0.115	*7.749*	-0.151	*-6.740*	0.124	*6.608*	-0.113	*-3.805*
Dummy for 1994	0.450	*28.754*	0.102	*4.365*	0.458	*23.616*	0.253	*8.437*
Dummy for 1995	0.069	*4.854*	-0.103	*-4.736*	0.061	*3.435*	-0.086	*-2.981*
Dummy for 1996	0.070	*4.715*	-0.089	*-3.877*	0.036	*1.940*	-0.105	*-3.567*
Ln(age)	-1.033	*-2.096*	0.971	*1.265*	-2.717	*-6.925*	-1.664	*-2.595*
Ln(age) ^ 2	0.157	*2.258*	-0.126	*-1.168*	0.401	*7.508*	0.256	*2.940*
*Min.Age**	27.094		46.370		29.544		25.662	
Ln(household income)	0.051	*3.211*	0.062	*2.342*	0.016	*0.758*	0.002	*0.049*
Ln(yrs. Education)	-0.060	*-1.397*	-0.350	*-4.895*	-0.042	*-0.762*	-0.254	*-3.167*
Gender	0.122	*7.091*	0.092	*3.779*	-0.032	*-1.479*	0.061	*2.041*
Living together?	0.000	*-0.020*	-0.033	*-1.139*	0.016	*0.878*	-0.021	*-0.600*
Ln(leisure time)	0.004	*2.292*	-0.002	*-0.681*	-0.001	*-0.807*	-0.007	*-2.357*
Mean (ln(hous. income)	0.160	*6.085*	0.124	*2.908*	0.092	*3.083*	0.041	*0.822*
Mean (ln(les.time))	0.006	*1.743*	-0.006	*-1.084*	0.014	*4.323*	-0.001	*-0.265*
Std Deviation v_i	0.653		0.579		0.665		0.587	
Variance due to v_i as % of the total variance	0.476		0.437		0.462		0.399	
Number Observations	30606		12346		20865		8523	
R-squared: within	0.051		0.075		0.051		0.068	
R-squared: between	0.022		0.043		0.036		0.038	
R-squared: overall	0.036		0.050		0.045		0.051	
Num. Of Individuals	8145		3235		6417		2697	

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

Table 8: **General Satisfaction**

Table 2: General Satisfaction

Ordered Probit with Individual Random Effect and Fixed Time Effects

	West Workers		East Workers		West Non-Workers		East Non-Workers	
	Estimate	Estimate/ Std. Error	Estimate.	Estimate/ Std. Error	Estimate	Estimate/ Std. Error	Estimate.	Estimate/ Std. Error
Constant	4.147	86.317	4.774	52.202	3.860	87.905	4.098	59.593
Dummy for 1992	0.250	10.212	-0.011	-0.289	0.220	7.670	-0.039	-0.837
Dummy for 1993	0.189	8.268	-0.046	-1.248	0.184	6.677	-0.090	-2.152
Dummy for 1994	0.118	4.961	0.078	2.128	-0.007	-0.235	-0.245	-5.575
Dummy for 1995	0.139	6.085	0.151	3.981	0.064	2.401	-0.058	-1.308
Dummy for 1996	0.121	5.140	0.116	3.031	0.068	2.497	0.048	1.098
Job Satisfaction	0.265	17.128	0.376	15.905	XXX	XXX	XXX	XXX
Finan. Satisfaction	0.244	15.954	0.383	15.855	0.243	15.003	0.455	16.000
House Satisfaction	0.146	9.607	0.238	9.748	0.178	9.482	0.387	12.739
Health Satisfaction	0.324	20.481	0.297	11.494	0.448	25.395	0.548	17.800
Leis. Satisfaction	0.125	8.050	0.168	6.725	0.168	9.206	0.354	12.396
Envir. Satisfaction	0.093	5.964	0.186	7.270	0.138	7.894	0.293	10.131
Mean (Job S.)	0.087	5.316	0.053	2.081	XXX	XXX	XXX	XXX
Mean (Financial S.)	0.393	21.416	0.476	15.899	0.517	27.413	0.441	14.847
Mean (House S.)	0.002	0.130	-0.054	-2.068	0.022	1.026	-0.060	-2.013
Mean (Health S.)	0.177	10.733	0.148	5.092	0.210	12.808	0.111	3.965
Mean (Leisure S.)	0.099	6.049	0.101	3.772	0.014	0.736	0.181	6.310
Mean (Environ. S.)	-0.043	-2.613	0.038	1.389	-0.072	-3.805	0.018	0.617
Z	-0.067	-0.923	-0.587	-5.041	-0.278	-3.475	-1.411	-9.986
Std Deviation v_i	0.593	66.788	0.585	38.602	0.673	58.187	0.628	34.186
Variance due to v_i as % of the total variance	0.260		0.255		0.312		0.283	
Number Observations	29636		11941		20427		8335	
Log Likelihood	-43444		-18303		-33125		-14321	
LogLik/Observation	-1.466		-1.533		-1.622		-1.718	
Num. Of Individuals	7995		3157		6353		2651	

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

Table 9: Level Effects of DS on GS

Level Effects	West Workers	East Workers	West Non-Workers	East Non-Workers
Job Satisfaction	0.352	0.429	XXX	XXX
Finan. Satisfaction	0.637	0.859	0.760	0.896
House Satisfaction	0.148	0.184	0.200	0.327
Health Satisfaction	0.501	0.445	0.658	0.659
Leis. Satisfaction	0.224	0.269	0.182	0.535
Envir. Satisfaction	0.050	0.224	0.066	0.311