PAPERS on Economics & Evolution

1108

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A Vector Autoregressive Approach

by

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The *Papers on Economics and Evolution* are edited by the Evolutionary Economics Group, MPI Jena. For editorial correspondence, please contact: evopapers@econ.mpg.de

ISSN 1430-4716

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The Structure of Happiness: A Vector Autoregressive Approach[☆]

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Abstract

Subjective well-being is a complex phenomenon coevolving with events in important domains of life. Panel vector autoregressions are a suitable tool to analyze the underlying structure of changes in happiness and its coevolution with changes in income, health, worries, marital status and employment status. With this technique we can simultaneously analyze the impact of the aforementioned factors on each other for the German Socio-Economic Panel (SOEP) data set. We find that positive changes in the named life domains are followed by decreases in subjective well-being (except for health, which is followed by well-being increases). Moreover, positive changes in well-being are followed by positive changes in most life domains. These findings are robust to different model specifications and comparable to similar findings for the British populace. We also examine how the structure of happiness differs with respect to different "Big Five" personality traits. Personality plays an important role, especially with regard to high traits of Neuroticism and Extraversion.

Key words: subjective well-being, happiness, vector autoregressions, SOEP, personality traits
JEL-classification: I12, I31, C33

1. Introduction

Subjective well-being is a complex evolving phenomenon that influences many domains of life and is influenced by them in turn. Consider the example of "Miserable John",[1] who was ill and his illness depressed his subjective well-being. When he recovers from the long, cumbersome illness he will feel some relief immediately. This initial positive effect might soon erode, as he gets used to his improved health status over the following months, but at the same time various knock-on effects set in: due to his improved health he is able to get a new job and to intensify his social life. His new job in turn puts him onto a career path from

[☆]The data used in this publication were made available to us by the German Socio Economic Panel Study (GSOEP) at the German Institute for Economic Research (DIW), Berlin. Neither the original collectors of the data nor the Archive bears any responsibility for the analyses or interpretations presented here. Thanks to Alex Coad for introducing us to the VAR methodology. Errors are ours.

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[1]No preferential treatment for any gender is intended, since our data cannot reject the hypothesis of equal mean well-being for both genders.

which he can expect long-lasting income growth. In this way some time after his recovery his life circumstances have improved considerably, probably making him a happier person, which in turn makes him a more attractive person to spend time with, boosting his social life and maybe even his career ...

The above depiction hints at the rather complex coevolution of various life domains and an individual's well-being over time. Whereas, initially, happiness research has inquired into the determinants of subjective well-being (SWB; or synonymously "happiness") via cross-sectional analyses, the availability of comprehensive panel data, covering increasing spans of time has recently allowed researchers to investigate these dynamic aspects of SWB. In this vein, phenomena of anticipation and adaptation (see, e.g. Clark et al., 2008a; Frijters et al., 2011) or aspiration growth (e.g., Stutzer, 2004) have received increased attention.

The depiction above further hints at the difficulty of identifying causal relationships among SWB and related variables: on the one hand, intensification of social contact increases an individual's well-being. On the other hand, social contact intensifies in the wake of the individual's increased well-being. Analogous cases regarding the mutual dependence and coevolution of subjective well-being and income, health and employment status have come to the fore over the past few years (e.g., Graham et al., 2004; Lyubomirsky et al., 2005a).

Both of the above mentioned issues of complex coevolution and mutual endogeneity have recently been addressed using vector autoregressive methodologies (Becchetti et al., 2008; Binder and Coad, 2010a; Bottan and Truglia, 2011). This paper aims at contributing to this strand of research by adopting the approach taken by Binder and Coad (2010a) and extending it in two ways. First, we explore the robustness of their findings by applying a vector autoregression model to German panel data. This is done in order to explore whether subjective well-being has a structure that varies across cultures or countries. Depending on cultural norms or other factors, it might be the case that the *coevolution* of subjective well-being and important life events does exhibit material differences in different countries, something which has not been explored so far.[2] While replication is useful in itself to find out about the robustness of a set of results with regard to different cultural, regional, intertemporal or model specification contexts, we extend the previous analyses in a number of ways.

A second contribution of our paper thus lies in its inclusion of personality variables into the analysis. In this context we want to trace out some personality-specific differences in life paths and the structure of happiness. In doing so, we contribute to the literature on the relation between SWB-dynamics and personality, capturing the effect of personality on the coevolution of various, mutually endogenous variables. At various points in the introductory depiction an individual with a different personality might have acted or reacted differently. For example, "Cheerful Jane" might extend her social activities more strongly after recovery than "Miserable John". Other things being equal, the positive effect of social relations on subjective well-being might be expected to be stronger for extroverts. Similarly, illness might be dealt with differently by individuals with certain character traits (Bogg and Roberts, 2004):

[2]Of course, there is some research on subjective well-being which points to cultural differences in levels of well-being attained (Bjornskov, 2003, e.g.,).

subjective health assessments have been shown to be a strong predictor of subjective well-being, but this association considerably weakens when controlling for neuroticism (Okun and George, 1984). Another case would be different developments of certain diseases depending on individuals' conscientiousness (O'Cleirigh et al., 2007). Many hypotheses pointing at differences in SWB-dynamics due to differences in personality traits are conceivable and have been partly addressed by various strands of research (e.g., Larsen and Ketelaar, 1991; Lucas and Baird, 2004; Zautra et al., 2005; Clark and Georgellis, 2010). While psychological research has long established the important role of personality traits for subjective well-being, measures of personality traits have only recently been added to large-scale household panel data sets, and thus played only small roles in happiness measurements with these data sets so far (but see, e.g., Clark and Georgellis, 2010). We are examining thus how different life events differently coevolve with subjective well-being for individuals that differ with respect to personality traits, as measured by the "Big Five" personality domains (McCrae and Costa, 2003). While personality inventories are usually taken only for smaller specialized data sets, a short version of the Big Five personality inventory has recently been added to the German Socio-Economic Panel (SOEP), a large-scale, nationally representative sample of the German populace.

The paper proceeds in the following way: Section 2 gives the theoretical background and justification for the subsequent selection of indicators. Section 3 contains a discussion of our empirical strategy and a short description of the data set, before continuing with the selection of indicators. It also contains our analyses and ensuing discussion of the results. Section 4 concludes.

2. Literature background

Happiness research has inquired into the determinants of subjective well-being (SWB) for quite some time now (for reviews see Frey and Stutzer, 2002b; Dolan et al., 2008). Various empirical measures have been suggested as an approximation to the underlying concept of subjective well-being (Ryff and Keyes, 1995; Frey and Stutzer, 2002a; Diener and Seligman, 2004). Different indicators have different properties, but a broad distinction can be made between indicators of affective and cognitive aspects of well-being. Life satisfaction questions such as "In general, how satisfied are you with your life at the moment?" elicit a cognitively mediated reappraisal of an individual's situation in life, whereas answers to happiness questions such as "How happy are you these days?" elicit a rather affective evaluation.[3]

Nevertheless, meaningful analysis of SWB is possible. Satisfactory validity is indicated by many psychological studies: the correlation between answers to satisfaction questions and emotional expressions like smiling is strong (Fernandez-Dols and Ruiz-Belda, 1995). The same holds regarding brain activity (Shizgal, 1999). Predictive validity is indicated by unsatisfactory behaviours being discontinued (Kahneman et al., 1993; Shiv and Huber, 2000). It has been found that individuals are able to predict and recognise satisfaction levels of others (Sandvik et al., 1993; Diener and Lucas, 1999) and share a common understanding of how to translate internal feelings into a number scale (van Praag, 1991), indicating interpersonal

[3]Such differences have to be kept in mind, as different results may be obtained depending on which indicator is used (e.g., Kahneman and Deaton, 2010).

ordinal comparability. Krueger and Schkade (2008) find a test-retest reliability between 0.5 and 0.7 over two weeks for affective as well as cognitive indicators. Regarding life satisfaction data, Ehrhardt et al. (2000) find year to year correlations between 0.45 and 0.54. This decreases to an estimate of 0.29 for two life satisfaction scores separated by 10 years.

These results are mirrored in stability differences among different determinants of SWB. We propose the following useful classification: the most durable influences are "long-term fixed factors", usually associated with genetics (Lykken and Tellegen, 1996). Still quite stable are "mid-term fixed factors", such as education and relatively stable personality traits (e.g. Roberts et al., 2006). Rather variable are "short-term fixed factors", such as income and employment status and "flexible factors", which are even changeable in the short-term, such as happiness relevant activities or practices.[4]

The literature on the dynamic aspects of SWB is relatively young and mostly occupied with short-term fixed factors. In this vein some light has been thrown on the SWB-impact of various life events, including marriage and divorce (Lucas et al., 2003; Zimmermann and Easterlin, 2006; Lucas and Clark, 2006), social relations more general (Becchetti et al., 2008; Bruni and Stanca, 2008), income changes (Ferrer-i Carbonell and van Praag, 2008; Di Tella and MacCulloch, 2008), unemployment (Lucas et al., 2004; Clark et al., 2008b), general health (Easterlin, 2003), disability (Brickman et al., 1978; Lucas, 2007; Oswald and Powdthavee, 2008) and status (Tella et al., 2010). Recently, there has also been some interest in the effects of aspirations, expectations and life goals on subjective well-being: not only objective circumstances but also one's expectations or perceptions of them seem to have an influence on subjective well-being (Stutzer, 2004; Brown et al., 2005; Johnson and Krueger, 2006).

Despite this understanding of the determinants of happiness, it is still uncertain which way the causal arrows run: "Does marriage make people happy, or do happy people marry?" (Stutzer and Frey, 2006) Similar questions have been asked regarding life satisfaction and income (Graham et al., 2004), life satisfaction and health (Easterlin, 2003) or marriage and health (Gray, 1997; Gardner and Oswald, 2004). In all the domains mentioned in the preceding paragraph, effects of the named variable on subjective well-being are in focus and explanations point to a causal impact of this variable, say: health, on subjective well-being. But in all these domains, causality has been argued to run the opposite way as well: higher life satisfaction seems to cause better health, social success, higher incomes, and so on (see Lyubomirsky et al., 2005a, for an overview). Explanations offered for these effects are often given in terms of a broadening and strengthening of individuals' personal and social resources: positive emotions seem to foster creativity and sociability thus leading to improvements in other domains of life (e.g., Cohn et al., 2009). But in consequence, this bi-directionality of influences necessitates an econometric strategy that can take into account this endogeneity.

From an intertemporal point of view, and largely consistent with set-point theory, the studies mentioned above find that individuals, on average, sooner or later adapt to most of these life events to a certain degree. Unemployment among men is a notable exception, with several studies indicating only incomplete adaptation and even negative long-term effects (Lucas et al., 2004). Also, the case of disability has been reassessed by Lucas (2007), who

[4]Similar categorisations along the time dimension have been proposed by other authors (e.g., Lyubomirsky et al., 2005b; Lucas and Donnellan, 2007).

finds disability to be associated with moderate to large drops in SWB, not compensated for by subsequent adaptation (see also Oswald and Powdthavee, 2008).[5] Whether adaptation to marriage is complete or not is also controversial (Zimmermann and Easterlin, 2006).

The prevalence of hedonic adaptation contrasts with findings that a considerable percentage of individuals (14%-30% according to Headey (2010); 24% according to Fujita and Diener (2005)) have experienced large long-term changes in their SWB scores over a period of about 20 years. These findings have led Diener et al. (2006) to call for a revised adaptation theory, which accounts for personality differences and (related) differences in coping strategies. Headey (2008) in turn provides some evidence that the phenomena of long-lasting SWB changes can be partly explained by differences in personality. For example, he finds high levels of Extraversion and low levels of Neuroticism to be conducive to long-lasting SWB growth (see also Soons and Liefbroer, 2009).

The domain of personality indicators of SWB just entered has first been put centre stage by the seminal contribution of Costa and McCrae (1980). They found that a set of character traits, which can be regarded as components of Extraversion, is associated with positive affect, whereas components of Neuroticism are associated with negative affect. This finding has been corroborated by subsequent research (see Diener and Lucas, 1999, for an overview). Among personality researchers, the five-factor model of personality, the so-called "Big Five", has received widespread acceptance. Five domains —Extraversion, Neuroticism, Conscientiousness, Openness to new experiences and Agreeableness— are posited to do a reasonably good job in capturing individual differences in personality.[6] As is the case with indicators of SWB, satisfactory validity is indicated by many studies: measures of the Big Five have been shown to converge with peer ratings of personality (McCrae and Costa, 1987). On a biological level trait characteristics are associated with neuroendocrine and cardiovascular functioning (Ryff et al., 2006). Predictive validity is indicated by objective behaviour being reliably related to standard personality inventories in general and the Big Five in particular (McCrae and Costa, 1999). Moreover, personality measures predict occupational performance (Hogan, 2005). As regards biological functioning, O'Cleirigh et al. (2007) present evidence that Conscientiousness is predictive of the course of a disease. Stability of personality measures is increasing in age. Starting from 0.22-0.53 in childhood test-retest reliability reaches a plateau of 0.70 - 0.79 in adulthood (Hampson and Goldberg, 2006; Roberts and DelVecchio, 2000). These findings are consistent with the above categorisation of personality variables as mid-term fixed factors (for adults; but see also Donnellan and Lucas, 2008).

In the context of subjective well-being, it is not surprising that personality traits should

[5]This contrasts with earlier findings by Brickman et al. (1978), who found strong adaptation. Their results, however, have been qualified recently due to problems regarding data collection and methodology (see Veenhoven, 1991; Diener et al., 2006).

[6]Extraversion refers to sociability, assertiveness, activity, positive emotions (etc.), while Agreeableness refers to one's quality of interpersonal relations, describing traits such as altruism, trust, cooperation and such. Conscientiousness describes goal-directed task behavior and socially mandated impulse control. Neuroticism relates to emotional instability, anxiety and irritability and Openness details traits related to creativity, flexibility, or the extent of one's experiences more general. The latter trait is probably the most vaguely described and controversial (DeNeve and Cooper, 1998, p. 199). For the remainder of the paper, we write these trait names with a capital letter when referring to their meaning as one of the Big Five personality traits.

play a significant role when one thinks about how these traits impact on individuals' lives and their experiences in important life domains. Especially Extraversion and Neuroticism should influence subjective well-being (DeNeve and Cooper, 1998). There is less theoretical conviction and empirical evidence for the other three dimensions, although it has been suggested that Agreeableness and Conscientiousness might also have a positive bearing on SWB through facilitating positive experiences and social interactions (see, e.g., Hayes and Joseph, 2003). Since Openness would facilitate positive as well as negative experiences, no expectations seem *prima facie* reasonable. Large scale evidence so far found moderate relationships between personality traits and subjective well-being (Helliwell, 2006). Using BHPS data, Clark and Georgellis (2010) found that regarding subjective well-being, extroverts suffered less over time from unemployment.

3. Empirical analysis

3.1. Empirical strategy

Whereas some studies interested in examining the development of subjective well-being over time apply lead and lag associations (e.g., Clark et al., 2008a), others have recently turned to vector autoregression-methods in order to capture the complex coevolution of SWB and its determinants over time (Becchetti et al., 2008; Binder and Coad, 2010a; Bottan and Truglia, 2011). While lead and lag associations are able to assess the impact of some life events (e.g. income or health) on one variable (usually subjective well-being), they leave the issue of disentangling the Gordian knot of the simultaneous and complex interplay of the various variables involved almost untouched.

A coevolutionary approach also suggests itself considering ambiguities regarding the question of which causes which. Virtually all of the explanatory variables seem to interact in various ways with each other and the direction of causality has been hypothesized to run in both directions for all major determinants of happiness. This substantiates the suspicion that the relationships between the variables within the subjective well-being domain are ridden by intricacies that cannot be adequately dealt with by standard multivariate regression techniques. Since there is theoretical and empirical evidence for our supposition that all of our main variables are in fact interrelated and mutually endogenous, it is crucial to take an approach that can account for this complexity. While we do not focus exclusively on well-being (since we also will have other variables as dependent variables) it is of course a major variable of interest in our regression exercise.

When viewing the different variables as inextricably linked together and coevolving over time, an appropriate statistical technique for such a system would be a reduced-form panel vector autoregression (see Stock and Watson, 2001; Coad, 2010). While a vector autoregression approach has been also employed by Becchetti et al. (2008) to analyze the interplay between happiness and social relations, we enlarge on their approach by focusing on the co-movement of more than two variables (which we deem to be the strength of the approach). Based on the literature background given in Section 2, we have identified a set of interdependent variables (life satisfaction, income, health, worries or expectations, marriage and employment status) to which we apply a vector autoregression model.

By treating several variables as mutually endogenous the VAR-methodology allows us to uncover multiple potential channels of intertemporal association between these variables.

This is not to say that our parameter results are particularly amenable to causal interpretation. Rather, the reduced-form VAR applied allows us to proceed in an exploratory manner, as it does not require any *a priori* causal hypothesizing. Our regression equation takes the following form:

$$W_{i,t} = a + \sum_{\tau=t-s}^{t-1} b_{i,\tau} W_{i,\tau} + c \cdot X_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

where $W_{i,t}$ is a $m \times 1$ vector containing the endogenous variables ($t - s$ refers to the number of lags examined). The endogenous variables are: life satisfaction, income, health, worries, marriage and employment status. a is a constant and b is a $m \times m$ matrix containing the coefficients of interest relating to our main variables. X is the vector of control variables assumed to be exogenous (i.e. age, gender, year dummies, and academic qualification, personality traits), $\varepsilon_{i,t}$ the residual error term. In the following, the coefficients in c, relating to the control variables, are included in all regressions, but for the sake of space they are not reported in our results tables.

A second issue for our empirical estimation is the existence of time-invariant individual-specific components in well-being variables (see Ferrer-i-Carbonell and Frijters, 2004). These so-called "fixed effects" tend to lead to misleading estimates if not properly accounted for. Consider the example of subjective well-being and marriage: the association between the two in a cross-section might be due to marriage making individuals happier or due to happier individuals self-selecting themselves into marriage. In consequence, marriage would be correlated with happiness in a cross-section because of this self-selection mechanism, even if marriage *per se* had no effect on happiness. In this paper, we account for fixed effects by taking a first difference approach (FD), i.e. by differencing our main variables. In this vein, each of the endogenous variables can be understood to consist of a time-invariant individual-specific component (μ_i) and a transitory component (ϵ_{it}). By taking first differences, we remove the influence of the fixed effects and its misleading influence on the regression results and can express the *change* in our variables solely in terms of change in the transitory component: $(\mu_i + \epsilon_{it}) - (\mu_i + \epsilon_{i,t-1}) = \epsilon_{it} - \epsilon_{i,t-1} = \Delta\epsilon_{it}$. We deem this quite relevant in our context, considering that subjective well-being does not only have state-like but also trait-like properties (Diener et al., 1999, pp. 279-80), thus being dependent not only on situational influences but also on personality and genes (Lykken and Tellegen, 1996). It has to be noted that taking first differences can introduce some extent of downward bias in our coefficient estimates if there is measurement error in the variables. This is caused by an amplification of the noise-to-signal ratio in the data set when taking differences.

3.2. Data set and indicator selection

For our analysis, we use the German Socio-Economic Panel (SOEP), which is an academically directed, long-running panel survey. Its aim is the development of a comprehensive database of micro-data on social and economic change in Germany. The data collection program consists of a core of questions regarding demography, dwelling, personal characteristics and values, education, employment situation, mobility, income, wealth, worries, domain and overall life satisfaction, social security and health. In addition each year's program has a set of questions which focuses on a particular topic. Starting in 1984 the GSOEP collects data from

a representative selection of households on an annual basis (selection of households followed a multistage random sampling technique). Initially it covered 6,000 households. Through subsequent inclusion of new populations and upgrading of sample size it was extended to approximately 12,000 households (approximately 20,000 persons). The sample aims at being nationally representative. In the 2008 wave there were about 2,500 individuals who had already taken part in the first wave, yielding a total of 25 waves for each individual. From age 16 on household members are given a personal questionnaire. In addition there are several other questionnaires, usually related to certain sub-groups of interest (e.g. temporary drop-outs). There are almost no telephone-interviews. Persons enter the panel by birth or moving into a SOEP household. Split-offs are followed and the members of their new household are added. Persons exit the panel by death or moving abroad (for more information see Wagner et al., 2007; Haisken-DeNew and Frick, 2005).

	mean	sd	min	max
Δ SWB	-0.0463	1.5627	-10	10
Δ log(inc)	0.0027	0.3067	-6.7305	7.2411
Δ health	-0.0342	1.1259	-8.1743	7.0728
Δ worries	-0.0028	0.3961	-2	2
Δ marriage	0.0045	0.1534	-1	1
Δ job	-0.0026	0.2820	-1	1
d_disabled	0.0994	0.2992	0	1
d_employed	0.6387	0.4804	0	1
d_fulltime	0.4367	0.4960	0	1
d_parttime	0.1021	0.3028	0	1
d_training	0.0225	0.1484	0	1
d_marginal	0.0376	0.1902	0	1
d_unemployed	0.4003	0.4900	0	1
d_sheltered	0.0007	0.0268	0	1
d_single	0.2151	0.4109	0	1
d_married	0.6422	0.4793	0	1
d_separated	0.0165	0.1273	0	1
d_divorced	0.0717	0.2580	0	1
d_widowed	0.0544	0.2268	0	1
Neuroticism	11.9587	3.6224	3	21
Openness	13.4001	3.6157	3	21
Agreeableness	16.3900	2.9157	3	21
Extraversion	14.4281	3.3817	3	21
Conscientiousness	17.8481	2.7188	3	21
education	4.7453	2.4132	0	9
gender	0.5234	0.4995	0	1
age	46.3804	16.3790	16	99
Observations	205355			

Table 1: Summary statistics (in differences for main variables of interest)

We start out from an unbalanced panel from 1984 to 2008 and have a total of 205,355 observations after cleaning the panel: during the time period, many waves had to be deleted since not all of our variables have been asked in them (for example, health status was only elicited some years after the panel started), leaving us waves 9 and 11-25 for our regressions (these are years 1992 and 1994-2008). We will now discuss the indicators chosen for our analysis. These indicators are depicted in Table 1. While our main analysis will focus on the panel vector autoregressions methodology described above, a benchmark will be a set of preliminary regressions, where we analyze the different life events on life satisfaction. We have chosen the following main variables for the vector autoregressions: life satisfaction, income, health, worries, marital and employment status. We are interested in the mutual relations

of these variables and in which way and to what extent these relations are influenced by personality factors. We control for: personality traits, age, gender, education, disability, year- and region-specific effects. With this selection most variables argued to have an influence on subjective well-being are covered (e.g., Dolan et al., 2008).

The SOEP has contained a life satisfaction question from 1984 on. Respondents are asked how satisfied, all in all, they are with their life at the moment. The answer is given on an ordinally scaled, eleven point Likert scale ranging from 0 (lowest satisfaction) to 10 (highest satisfaction). This measure has been extensively used in the literature on subjective well-being. Although life satisfaction is an ordinal construct, we treat it as cardinal at various instances throughout our analysis. Justification for this approach is given by Ferrer-i-Carbonell and Frijters (2004), who show that assuming cardinality or ordinality for such a life satisfaction measure is relatively unimportant regarding estimator selection (OLS vs. ordered probit) and leads to largely similar results.

Our measure of income is equivalized and deflated post-government household income (i.e. income after taxes and government transfers). The choice of an equivalence scale remains arbitrary to some degree, as there is no consensus on which equivalence scale is appropriate (Coulter et al., 1992). We have decided to use the International Experts' scale, which divides household income by the square root of household size. This scale has commonly been applied in the literature (e.g., Headey et al., 2004; D'Ambrosio and Frick, 2007) and we deem it appropriate for our purpose. We use the *logarithm* of the income measure as a regressor in our analysis (Stevenson and Wolfers, 2008; Easterlin, 2001, p. 468), assuming that a given change in the proportion of income leads to the same proportional change in well-being. This assumption of a decreasing marginal utility of income, has been found to be well-corroborated and quite similar in a wide range of countries, and while the functional form of the happiness-income relationship is slightly more concave than implied by the logarithm, using log(income) seems to be a reasonable approximation (Layard et al., 2008).

As a measure for an individual's health, we aggregate the following three health indicators: (log) overnight hospital stays, (log) number of annual doctor visits and self-rated health. Self-rated health is a subjective health indicator, ordinally scaled on a five point Likert scale ranging from 1 ("very good") to 5 ("bad"). To what extent subjective health indicators reflect objective health is still somewhat unclear (Johnston et al., 2009). Especially in the context of accounting for personality traits, one should be aware that Neuroticism seems to be a personality trait that influences both self-reported health and subjective well-being (Okun and George, 1984). For this reason we added the remaining two, more objective indicators of health, to our overall measure of individual health. Because of the different scales of these three variables, a Principal Component Analysis (PCA) seems a suitable choice of aggregation procedure.[7] Our measure accounts for $\rho = 53.10\%$ of the underlying measures' variance. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.5908) is acceptable.

[7]PCA is a method by which the dimensionality of a dataset can be reduced. This is done by transforming an initial set of observations into a set of values of uncorrelated variables; so-called Principal Components (PCs). This transformation is conducted in such a way that the resulting first PC accounts for most of the variability in the dataset. The second PC then accounts for most of the remaining variance under the constraint that it is uncorrelated with the first PC, and so on. For our aggregate health measure, we have chosen the first PC resulting from a PCA of the above-mentioned health indicators.

Turning to our measure of social embeddedness we would ideally like to use a social index as the one examined by Becchetti et al. (2008). This index comprised of information about an individual's attendance to cultural events, social gatherings, church or religious events, frequency of sport or exercise and performance of voluntary work (we have also added information on going to the cinema to the index). We have recoded all these indicators to a Likert scale ranging from 1 ("Almost never or never") to 4 ("At least once a week"). Becchetti et al. (2008) have taken the unweighted average of the values of those indicators available. For comparison reasons, we do the same (instead of PCA) and use this variable in our preliminary FE regressions. Unfortunately, we cannot use this index in the vector autoregressions as the relevant questions were only asked every second year. As we are interested in year-to-year differences for all our main endogenous variables, we have to stick to a simple representation of the social domain, but one which is elicited on a yearly basis. In line with the analysis in Binder and Coad (2010a), we use marriage as (admittedly crude) approximation. For the vector autoregressions, the corresponding change in the variable is positive if an individual changes from being single, separated, divorced or widowed to married and negative vice versa.

For our employment variable, we have chosen to code "being employed" as 1, being unemployed as 0. We ignore other employment conditions an individual might find itself in. This we consider as conservative since it would be comparatively more difficult to put these other conditions in a rank ordering of betterness. Is being self-employed a positive change from being employed or not? This might be the case for some, but others go into self-employment to escape unemployment and accordingly the same change in employment status leads to opposite changes in subjective well-being (Block and Koellinger, 2009; Binder and Coad, 2010b).

In line with our discussion in Section 2 we are also interested in an individual's perceptions as something that might diverge from objective conditions but still strongly influences subjective well-being. A good proxy supplied within the SOEP are an individual's responses to a set of questions about worries regarding the future. To assess the extent to which an individual worries about the future we use answers to questions regarding worries about economic development, finances, environment, peace and job security. Each of the individual indicators is measured on a Likert scale from 1 ("very concerned") to 3 ("not concerned at all"), the order of which we have reversed so that higher values denote a higher level of worry. We construct a "worries index" similar to the above-mentioned social index. As these variables are provided on a yearly basis, we here can construct the change in worries also for our vector autoregressions.

As discussed in Section 2, personality has long been hypothesized to play a major role in influencing individuals' well-being through various complicated life channels. In the SOEP wave 2005, a short inventory for the Big Five personality traits has been included (see Gerlitz and Schupp, 2005; Gosling et al., 2003; Donnellan and Lucas, 2008). The five traits were elicited via fifteen short descriptions with which respondents can agree to varying degrees. Sample descriptions include "I see myself as someone who is sometimes rude to others" (referring to Agreeableness), "I see myself as someone who is outgoing, sociable" (Extraversion) or "I see myself as someone who worries a lot" (Neuroticism).[8] Three questions supposedly

[8] A full list and comprehensive discussion is provided by Gerlitz and Schupp (2005).

capture each of the five traits (each is answered on a 7-point Likert scale from "Does not apply" to "Does apply"). How valid and reliable can these answers measure an individual's personality traits? Psychological research has assessed this question for quite some time. While we take as given the existence of the five broad and abstract personality traits here, it is useful to explore whether a fifteen question inventory can really adequately measure them. Usually, psychological questionnaires use much larger inventories with 44 questions (e.g. the "Big Five Inventory", BFI John et al., 1991) or even more (Gosling et al., 2003). These have been established to robustly capture the Big Five personality traits over different cultural and intertemporal contexts (Benet-Martinez and John, 1998; McCrae and Costa, 1997). Empirically, a standard measure to judge the internal consistency of the scale and the items used to measure it is Cronbach's alpha. Big Five inventories here usually reach the threshold value of 0.7 that denotes satisfactory consistency and scale reliability. This is not the case for shorter versions (Gosling et al., 2003; Gerlitz and Schupp, 2005), and our calculations confirm indeed that $\alpha < 0.70$ for all of our traits as measured by the short inventory (Openness: $\alpha = 0.6300$, Conscientiousness: $\alpha = 0.6067$, Extraversion: $\alpha = 0.6525$, Agreeableness: $\alpha = 0.5062$, Neuroticism: $\alpha = 0.5991$).[9] This does not necessarily need to invalidate the measures, however. Several considerations mitigate the low alphas. First, shorter inventories were used and analyzed in several studies and have proven to be reliable despite lower alphas (Gosling et al., 2003; Gerlitz and Schupp, 2005; Donnellan and Lucas, 2008). Second, one has to be aware of the fact that higher alphas are generally reached just by increasing the number of items for a construct, so that larger inventories imply higher alphas (Cortina, 1993). This caveat has prompted an analysis of the short inventory in terms of a different measure of goodness of fit and a comparison between the short and long version for the SOEP data set, which proved to be satisfactory despite low alphas (Gerlitz and Schupp, 2005). A last rationale is somewhat pragmatic: eliciting personality traits in large-scale repeated surveys via long inventories is just impractical and quicker (more dirty) inventories are needed if one wants to measure personality traits on such a large scale. This clearly means that one has to make trade-offs between very high scale reliability and availability of any measures at all.

In Table 1 we present means and s.d. for the Big Five, which are in the range of 11.96 (Neuroticism) to 17.85 (Conscientiousness). These variables were coded by adding up the ordinal responses to the three questions relating to each personality trait.[10] Figure 1 shows a comparison of mean life satisfaction for high versus low personality traits. All differences of means are highly significant (a Levene's test for unequal variances of the pairs was conducted in each case, prompting to use t-tests with unequal variances for this exercise).

A final caveat should be noted here as regards our assumption of stable personality traits over our sample horizon. There is some controversy about how stable the Big Five

[9] A better measure of fit might be the interitem correlations for standardized items, which are: $r = 0.3717$ (Openness), $r = 0.3706$ (Conscientiousness), $r = 0.3979$ (Extraversion), $r = 0.2794$ (Agreeableness), $r = 0.3318$ (Neuroticism).

[10] Some questions had to be reverse-coded, as they negatively measure the trait. It is still an open question whether one would best add up these components or use averages (Heineck, 2011). Moreover, there is no clear answer as to what constitutes high trait expressions. We follow Clark and Georgellis (2010) in interpreting values of greater than five for each question as expression of a high prevalence of the personality trait and values below 3 as low. When adding up the three measures each, we are left with thresholds of > 15 and < 6 for high or low Agreeableness etc.

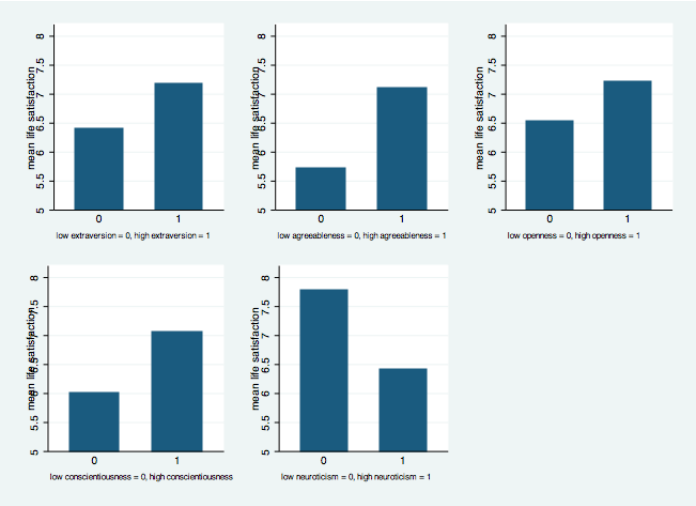

Figure 1: Comparison of mean life satisfaction for high and low personality trait expressions (1="high" vs. 0="low" personality trait).

personality traits are in adults. While the high level of abstraction and great degree of heritability makes a plausible case that personality is quite stable over the short run, it has become disputed that these traits are completely invariant. Some evidence points to the fact that personality is subject to change also if one is over thirty years (*pace* Costa and McCrae, 1994). This is not altogether implausible if one considers how important or scarring life events can alter the trajectories of human (well-)being (Srivastava et al., 2003). What also seems clear is that stability of personality traits is increasing in age: test-retest reliability in childhood ranges between 0.22-0.53 and increases to 0.70-0.79 for adults (Hampson and Goldberg, 2006; Roberts et al., 2006; Roberts and DelVecchio, 2000). Since the Big Five were only asked once in the SOEP up to 2008, we are forced by data limitations to consider personality traits to be fixed in the individuals over the course of our sample horizon. Note that Donnellan and Lucas (2008) used the SOEP cross-section personality data and found age effects (Extraversion and Openness decrease with age, while Agreeableness increases with age. Conscientiousness seems to peak at middle ages. Perhaps not surprisingly, Neuroticism increases with age for the German sample, while the opposite is found in other samples.) Strictly speaking, their cross-sectional analysis, however, cannot distinguish between age and cohort effects.

Lastly, we have included a number of ordinary control variables (see Table 1) which comprise gender, age, and age^2 (we use the squared difference between age and mean-age instead of age^2 to avoid problems of multicollinearity). We control for regions (German "Bundeslaender" and East vs. West-Germany, which we do not report, however). Of our sample, 52.34% were female (the gender variable is one if female, zero if male). The mean age is 46.38 years (s.d. 16.38) with maximum age at 99 years and minimum age at 16. Also included is an educational control variable, viz. an individual's highest level of education, as measured by the CASMIN scale. This is measured ordinally, ranging from zero ("In School") to nine ("Higher Tertiary Education").

To get a first impression of our data, Table 2 reports pairwise correlations in differences between the variables of interest (in the Appendix, we also present correlations in levels as

well as correlations between life satisfaction and personality traits in Tables 5 and 6). The correlations of most of our indicators are highly statistically significant. The correlations in differences are rather small in effect, the highest correlation being between change in health and change in well-being ($r = 0.1321$). It is noteworthy that all (significant) correlations between our main variables are positively associated (changes in life satisfaction, health, income, marriage, and employment status) except for the relation of life satisfaction and worries (-0.0899, which is rather strongly negatively associated with life satisfaction). This is different with the control variables, where age is negatively correlated with most of the main variables (except for change in worries, where the correlation is not significant). Education is positively correlated with the main variables (again, except for change in worries, where the association is negative). Pairwise correlations of *levels* of subjective well-being and the other variables are quite similar to what has been reported in the literature.[11]

	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	education	gender	age
ΔSWB	1.0000								
Δincome	0.0279***	1.0000							
	(0.0000)								
Δhealth	0.1321***	0.0147***	1.0000						
	(0.0000)	(0.0000)							
Δworries	-0.0899***	-0.0105***	-0.0379***	1.0000					
	(0.0000)	(0.0000)	(0.0000)						
Δmarry	0.0271***	0.0686***	-0.0054*	-0.0057*	1.0000				
	(0.0000)	(0.0000)	(0.0243)	(0.0157)					
Δjob	0.0192***	0.0976***	-0.0191***	-0.0172***	0.0025	1.0000			
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.2955)				
education	0.0087***	0.0146***	0.0027	-0.0093***	0.0259***	0.0051*	1.0000		
	(0.0002)	(0.0000)	(0.2515)	(0.0001)	(0.0000)	(0.0315)			
gender	0.0002	-0.0020	0.0049*	0.0020	-0.0112***	0.0099***	-0.0571***	1.0000	
	(0.9232)	(0.3983)	(0.0410)	(0.4051)	(0.0000)	(0.0000)	(0.0000)		
age	-0.0043	-0.0193***	-0.0120***	0.0012	-0.0764***	-0.0760***	-0.0429***	0.0059**	1.0000
	(0.0706)	(0.0000)	(0.0000)	(0.5996)	(0.0000)	(0.0000)	(0.0000)	(0.0072)	
Observations	205355								

P-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Contemporaneous correlations in differences

It is also instructive to see how personality traits are correlated with some of our variables (see Table 6 in the Appendix). There is a positive correlation between life satisfaction and Openness ($r = 0.1104$), Agreeableness ($r = 0.1015$), Extraversion ($r = 0.1067$) and Conscientiousness ($r = 0.0950$). Neuroticism is strongly negatively related with life satisfaction ($r = -0.2201$), in line with the psychological findings discussed in Section 2. Agreeableness and Neuroticism are strongly related to gender ($r = 0.1765$ and $r = 0.1914$; to being female, the way gender is coded). Note that these are simple correlations, so that high Neuroticism in females as exhibited in the correlation table neglects findings that Neuroticism declines in females with age, while it remains on the same level for males (Srivastava et al., 2003).

[11] There is positive correlation between *levels* of life satisfaction and income ($r = 0.2178$), health ($r = 0.3065$), the social index ($r = 0.2321$), marriage ($r = 0.0493$), being employed ($r = 0.0512$) and being better educated ($r = 0.0724$), all highly significant. Negative correlations exist between well-being and worries ($r = -0.2630$), disability ($r = -0.1437$) and age ($r = -0.0455$), also all highly significant.

Finally, Neuroticism is negatively associated with health ($r = -0.2235$), while Openness ($r = 0.2063$) and Extraversion ($r = 0.1419$) are highly positively associated with the social index.

The reader should probably not put too much emphasis on these correlations (since no relevant control variables are included here) and rather see them as a first orientation to the data set. As an additional investigation of potential multicollinearity, we inspected the VIF diagnostics for our main VAR(2) model, which were all satisfactory.

3.3. Results and discussion

Our results consist of two main parts and several robustness checks. A preliminary baseline regression exercise is depicted in Table 3 (these regressions are repeated for high personality trait characteristics in Table 13 in the Appendix). The central results of our vector autoregressions are then presented in Table 4. Since we are also interested in exploring whether these structural properties of subjective well-being differ with respect to personality traits, we have repeated the analysis for high personality traits of Extraversion (Table 7), Neuroticism (Table 8) and Conscientiousness (Table 9). We also have disaggregated our sample by gender (Tables 10 and 11) and for the age group 30-60 (Table 12), where personality traits should be more stable. The regression tables of the models for the subgroups analyses can be found in the Appendix. We discuss these results in turn.

Table 3 presents four different models that give a first orientation of the determinants of subjective well-being. Model (1) is an ordered probit regression that pools the data over all waves and treats the observations as one large cross-section (standard errors are clustered on the individual, though). This does, of course, neglect important structural facts about the data, such as individual-specific time-invariant components and the like. Nevertheless, it serves as a baseline. The results are fairly unsurprising, with positive associations between life satisfaction and health, (log) income, being married, the social index and a negative association with the worries index, marginal employment, being separated, divorced or having the spouse living in the home country abroad, and being disabled. Life satisfaction is positively associated with being female and negatively associated with living in Eastern Germany, but both findings are neither robust to more refined model specifications nor borne out in the literature on subjective well-being (Plagnol and Easterlin, 2008; Binder and Coad, 2011). Moreover, a t-test cannot reject the hypothesis of equal means for life satisfaction for both genders. There are also slightly positive effects of the personality traits with the exception of Neuroticism, where the effect is negative.

The middle columns (models (2), (3) and (4)) now repeat this analysis within a fixed-effects (FE) regression framework, controlling for time-invariant individual-specific components (we use standard errors clustered on the individual; clustering standard errors should be considered "de rigeur" in panel models, see, e.g. Nichols, 2007). Accounting for fixed effects in happiness regressions does substantively alter regression results, a fact happiness researchers become increasingly more aware of (Ferrer-i-Carbonell and Frijters, 2004). But due to the fact that happiness is partly determined by genes and stable personality traits (Lykken and Tellegen, 1996; Diener et al., 1999), accounting for fixed effects is nevertheless the preferable model choice. Model (2) here depicts the FE-version of model (1) and model (3) and (4) disaggregate the analysis by gender. The fixed effects model corroborates many effects from the baseline model (positive effects of our main explanatory variables except, of

	(1) (pooled)		(2) (FE)		(3) males (FE)		(4) females (FE)		(5) disaggregation (FE)	
log(income)	0.267***	(23.62)	0.240***	(12.48)	0.243***	(8.27)	0.248***	(9.69)	0.198***	(10.61)
health	0.223***	(54.13)	0.221***	(36.43)	0.217***	(24.68)	0.226***	(26.98)		
worries	-0.453***	(-37.17)	-0.479***	(-27.11)	-0.496***	(-19.60)	-0.463***	(-18.83)		
social	0.267***	(25.24)	0.270***	(15.81)	0.267***	(11.07)	0.278***	(11.52)		
d_fulltime	0.00401	(0.30)	0.216***	(9.95)	0.337***	(10.38)	0.113***	(3.78)	0.323***	(12.88)
d_parttime	-0.0131	(-0.74)	0.0549*	(2.07)	0.199**	(2.99)	-0.00572	(-0.19)	0.177***	(6.12)
d_training	0.0182	(0.66)	0.182***	(4.41)	0.324***	(5.63)	0.0516	(0.87)	0.289***	(6.76)
d_marginal	-0.0805***	(-3.40)	-0.0614	(-1.81)	0.0687	(0.99)	-0.123**	(-3.15)	0.0590	(1.73)
d_sheltered	0.230	(1.04)	0.188	(0.62)	0.428	(1.58)	-0.185	(-0.31)	0.199	(0.66)
d_married	0.181***	(10.21)	0.258***	(7.67)	0.197***	(4.12)	0.277***	(5.81)	0.217***	(6.64)
d_separated	-0.224***	(-5.69)	-0.189**	(-2.87)	-0.427***	(-4.37)	-0.0264	(-0.30)	-0.171**	(-2.71)
d_divorced	-0.0538*	(-2.01)	0.155**	(2.82)	0.0870	(1.06)	0.195**	(2.63)	0.129*	(2.44)
d_widowed	-0.00614	(-0.19)	-0.0443	(-0.59)	-0.226	(-1.75)	0.0339	(0.36)	-0.106	(-1.46)
d_spouseaway	-0.759*	(-2.06)	-1.056*	(-2.19)	-1.416*	(-2.16)	-0.733	(-1.07)	-0.982	(-1.87)
d_disabled	-0.107***	(-5.62)	-0.155***	(-4.32)	-0.118*	(-2.39)	-0.187***	(-3.57)	-0.117***	(-3.39)
d_female	0.132***	(10.32)								
age	0.00226***	(4.45)	-0.0263***	(-16.38)	-0.0235***	(-9.98)	-0.0280***	(-12.73)	-0.0113***	(-7.12)
age^2	0.000453***	(18.17)	0.000165**	(3.26)	0.000266***	(3.45)	0.000115	(1.69)	0.0000250	(0.52)
education	-0.0103***	(-4.09)	-0.0147	(-1.96)	-0.0409***	(-3.83)	0.00925	(0.88)	-0.0183*	(-2.54)
d_EastGermany	-0.189***	(-3.98)	-0.0554	(-0.26)	-0.504	(-1.69)	0.112	(0.34)	-0.0635	(-0.31)
Extraversion	0.0117***	(6.06)								
Neuroticism	-0.0309***	(-17.39)								
Openness	0.0139***	(7.55)								
Conscientiousness	0.0199***	(8.50)								
Agreeableness	0.0257***	(11.63)								
subj. health									0.452***	(50.05)
log(hospital days)									-0.0396***	(-5.36)
log(doc visits)									0.0000233	(0.00)
Social: Culture									0.0772***	(7.70)
Social: Sports									0.0203***	(3.51)
Social: Gathering									0.0839***	(10.02)
Social: Volunteer									-0.00115	(-0.15)
Social: Church									0.0372***	(3.74)
Social: Cinema									0.0131	(1.50)
Worry: Economy									-0.0395***	(-3.92)
Worry: Finances									-0.425***	(-40.04)
Worry: Environment									0.0475***	(4.32)
Worry: Peace									0.0316**	(3.11)
Worry: Job Security									-0.0471***	(-4.82)
Observations	87636		87636		41752		45884		87722	
Pseudo R^2	0.073									
R^2_within			.0805		.089		.0757		.1289	
R^2_between			.125		.1242		.1311		.318	
R^2_overall			.1089		.1162		.1069		.2465	

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Preliminary regressions: dependent variable life satisfaction

course, worries). Surprisingly, we find a positive effect of divorce on life satisfaction (albeit a negative one of separation). Maybe this captures a rebound effect that after a painful separation, finalizing the parting of ways via the official divorce marks a low point for the individuals after which their subjective well-being can increase again. Note also the very strong negative effect of having a spouse living in a different country. Finally, the negative effect of our worries index is stronger in coefficient size than the effect of more objective circumstances of one's life, such as income, health and social participation. Disaggregating the analysis by gender rather confirms these insights. There are some marked differences, however, for example that marriage has a stronger positive effect on females than on males, whereas being in full time employment is much more well-being-increasing for males than for females. It seems that in our German sample, we find some evidence for the adherence to classical gender roles.

A further check on the robustness of these FE regressions is model (5), where we use the components of the health, social and worries variables instead of the composite variable. We see that participation in various activities such as sports, meeting friends, attending cultural events or going to church has a small but positive effect on life satisfaction. More interesting here is the disaggregation of worries: while "personal" worries about the economic

situation, the own financial situation and one's job security have negative effects on one's life satisfaction, worrying about "global" subjects such as the environment or peace increases one's life satisfaction. It seems that "selfish" worries decrease one's life satisfaction while "caring" or altruistic worries increase it. Somewhat related to this, Headey (2008, 2010) finds altruistic and family goals to be positively and success goals negatively associated with life satisfaction. These are certainly findings that deserve future research attention. Most noteworthy, however, is the extremely strong negative effect of worrying about one's financial situation, which has a coefficient twice the size than actual income has on life satisfaction.

Of note here is the very strong positive effect that subjective health has on life satisfaction. However, there is some suspicion that both, one's subjective rating of health and life satisfaction, were driven by a third omitted variable, such as Neuroticism (Okun and George, 1984). To explore the influence of personality traits on life satisfaction, we have also conducted a disaggregated analysis by certain high personality traits (see Table 3 in the Appendix).[12] We do not want to go into these regressions in much detail here for lack of space, but note that indeed highly neurotic individuals exhibit a higher coefficient for the effect of health on life satisfaction. Interestingly, here the social index and being married has a larger positive effect on life satisfaction than it is the case for extroverts. The latter subgroup in contrast also exhibits much stronger negative effects for social and health related domains (e.g. separation, spouse being abroad, being disabled). It seems that in a certain sense, individuals with high scores in Extraversion are experiencing decreasing returns to their outgoing nature, i.e. being already (comparatively) very happy and outgoing, further social contact does not have such strong effects. Even more so, experiencing negative life events in these domains seems to hurt extroverts comparably stronger. This interpretation is in line with findings that already (very) happy individuals show no significant association between their happiness and these life domains (Binder and Coad, 2011), while unhappy individuals show much stronger associations than what is usually found in regressions that are conditional on the mean happiness.

We now turn to the discussion of our main vector autoregression model in Table 4. While these vector autoregressions tables seem complicated and daunting at a glance, they are actually easy to read. Each row of the table depicts a regression of which the dependent variable is given in the first column. The reduced-form VAR effectively corresponds to a series of regressions for all endogenous variables (Stock and Watson, 2001). The column headings then show the names of the exogenous variables (the lagged values for the first and second lags to be precise). The first line of results thus shows the changes in subjective well-being in t associated with changes in the explanatory variables in $t-1$ and $t-2$. The dependent variable for the second row is change in income, and so on. At the end of the row the corresponding (Pseudo-)R^2 statistic can be found. Due to the exploratory nature of our study, focusing on the signs instead of the absolute coefficient magnitudes seems to be a prudent choice (see also Moneta, 2005). Also note that the regressions for changes in life satisfaction, income, health and worries are standard OLS estimators while changes in marriage and employment can only have three distinct values due to the nature of the

[12] We would have liked to carry out the analysis also for low trait expressions, however, for these models we could not reject the overall null hypothesis of coefficients equal to zero. This was probably due to very small subsample sizes.

	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5620***	-.0018	.0318***	-.0443***	-.1320***	-.0074	-.2626***	-.0355*	.0128**	-.0544***	-.1841***	-.0238	0.2544
	(.0035)	(.0140)	(.0040)	(.0115)	(.0262)	(.0148)	(.0031)	(.0143)	(.0040)	(.0115)	(.0255)	(.0147)	
Δincome	.0047***	-.4111***	.0025**	-.0112***	-.0274***	.0444***	.0037***	-.1686***	.0015*	-.0088***	-.0227***	.0159***	0.1570
	(.0006)	(.0061)	(.0008)	(.0023)	(.0063)	(.0038)	(.0006)	(.0045)	(.0008)	(.0023)	(.0051)	(.0035)	
Δhealth	.0118***	-.0148	-.5257***	-.0069	-.0471*	-.0545***	.0077***	-.0167	-.2675***	-.0013	-.0612***	-.0655***	0.2315
	(.0022)	(.0103)	(.0031)	(.0083)	(.0183)	(.0107)	(.0021)	(.0101)	(.0027)	(.0082)	(.0184)	(.0106)	
Δworries	-.0030***	-.0077*	-.0024**	-.5751***	.0054	-.0160***	-.0017*	.0034	-.0012	-.2656***	.0021	.0023	0.2979
	(.0007)	(.0035)	(.0009)	(.0029)	(.0064)	(.0035)	(.0007)	(.0033)	(.0009)	(.0027)	(.0060)	(.0035)	
Δmarry	.0512***	.0514*	-.0197**	.0186	-.9437***	-.0792**	.0390***	.0990***	-.0126	-.0008	-.6087***	-.0017	0.0520
	(.0056)	(.0253)	(.0071)	(.0208)	(.0389)	(.0269)	(.0055)	(.0239)	(.0071)	(.0208)	(.0406)	(.0260)	
Δjob	.0078	.1730***	.0595***	-.1263***	-.3043***	-1.5697***	-.0048	.0797***	.0613***	-.0734***	-.1766***	-1.0092***	0.1449
	(.0040)	(.0214)	(.0052)	(.0154)	(.0372)	(.0178)	(.0038)	(.0193)	(.0052)	(.0149)	(.0339)	(.0183)	
	135,367 observations												

Table 4: Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

dummies we were forced to use in these cases. Therefore, we used ordered probit regressions in these two cases (in all cases, we report coefficients and standard errors, which are clustered on the individual level). While we have included control variables in these vector autoregressions (age, gender, year and regional dummies, as well as our personality measures and a dummy for disability), we do not report these for space reasons.

Throughout our data, we also observe negative autocorrelation for each of our variables. This phenomenon has been also observed for British data (Binder and Coad, 2010a).[13] It is exhibited on the diagonals of the tables. If, for example, well-being increased the previous period, it is less likely to increase this period. This can be interpreted as evidence for adaptation effects, where individuals adjust to their new sources of well-being so that further increases are less likely (Frederick and Loewenstein, 1999; Clark et al., 2008a). But negative autocorrelation is also found for the other variables of interest, which points to an explanation in terms of regression to the mean at least for employment or marriage variables. Obviously, once the extreme value is reached in these cases, the values can only fall back towards the mean.

Beside negative autocorrelation, a strong finding lies in the asymmetric intertemporal relationship between subjective well-being and the other life domains. While we clearly see that increases in well-being (in both time lags) are positively associated with increases in other life domains (subjective well-being thus seems to play a positive role for these domains), previous increases in the other life domains examined are associated with decreases in subjective well-being in the following years. The same intertemporal structure was found for the British populace (Binder and Coad, 2010a) and is probably a robust finding irrespective of cultural context. In more detail, we find that recent increases in well-being are positively associated with subsequent increases in (log) income, marriage probability, employment status, and health and with decreases in worries. These effects we have found to be significant mostly independent of model specification (but see below), and they persist for the second lag also. It seems that happy Germans are more successful in terms of health, social relations, job success and income, and they worry less (such positive relationships are stressed by Lyubomirsky et al., 2005a,b). However, the positive relationship between subjective well-being and employment is not as robust: it holds for the male subsample (Table 10) as well as the age 30-60 subsample (Table 12), but not for extrovert, neurotic and female individuals (Tables 7, 8 and 11). Especially the cases where this strong influence of subjective well-being on life domains is absent are also noteworthy: only marriage (the social domain) and income seem to profit from increased subjective well-being for individuals who score high in Extraversion. In line with our interpretation above, extroverts probably experience decreasing returns to happiness for their already high levels of well-being.

The reverse relationship from life domains on subjective well-being could be interpreted in terms of hedonic adaptation (Frederick and Loewenstein, 1999): positive changes in most life domains in a previous period are associated with decreasing well-being in the present period. The one notable exception to this rule is health, where increases are also followed by increases in subjective well-being. We here have evidence for a structural peculiarity: the

[13]Negative autocorrelation in differenced variables in VAR models has also been observed in other cases outside of subjective well-being research, such as firm growth (e.g. Coad, 2010).

health domain seems of paramount importance for subjective well-being: increasing health might lead to lasting increases in subjective well-being (a relationship that might be driven more through the reversed interpretation, viz. through decreasing the suffering from ill health). Note also that this finding is peculiar to the German data set and was not found in a similar analysis for the British population.

Our complex coevolutionary analysis yields also interesting insights about the interactions between other life domains. Consider for example the relationship between health and employment. A very robust effect across our models is that increases in health are followed by increases in job success (as measured by getting employed). It is no news that good health is important for job success (e.g., Arrow, 1996). Consider now the reversed relationship: over all models and all lags, we find that a positive change in employment is followed by a decrease in health. While there is much evidence in the literature that (the opposite case of) unemployment is detrimental to individuals' health, we find for the German populace that being employed seems to be followed by decreases in health, as well. This probably reflects the ever-increasing demands that jobs have on an individual.

Less surprising is our finding that improvements in the job and health domain are followed by increases in income (compare Smith, 1999). Also, in most models, increases in worries are followed by decreases in income. Since part of the worry index are worries about one's financial situation and job security, this finding might be explained by anticipation effects. While many changes in life domains are not easily to anticipate, one might have clues as to the development of job situation and income or the advent of formal marriage in a relationship. Our interpretation is further supported by the fact that increases in worries are also followed by decreases in employment in most of our model specifications. Could a similar explanation not also be put forward for the positive association between increases in subjective well-being and subsequent improvements in other life domains? An explanation why positive changes in happiness are followed by improvements of other life domains in terms of anticipation is —in our view— not plausible, as most life changes are not so easy to anticipate, especially regarding time lags of one or two years in advance (can we really be happy today because we expect to be healthier in two years?). Finally note that increases in marriage probability are followed by a decrease in income.

In order to further explore the robustness of our results, we have conducted a series of robustness tests. These include a disaggregation by gender to see whether there are systematic differences between males and females that would justify our quipping about "Cheerful Janes" and "Miserable Johns" (a t-test, however, cannot reject the hypothesis of equal means for Johns and Janes).[14] Indeed we can see some systematic gender differences in the structure of subjective well-being (see Tables 10 and 11 in the Appendix). Besides the above-mentioned smaller relevance of employment for females, marriage seems to be followed by decreases in health, an effect that is more persistent in the male subsample. While one would *prima facie* stipulate that marriage might improve males' health-promoting behaviour, it seems some different effect contravenes this. Further research could explore why males' health suffers comparably more from marrying. Secondly, we find that increases in income are followed by higher marriage probability, an effect that is absent for males but persists

[14]Mean life satisfaction for males is 6.99 (s.d. 1.72), for females 6.99 (s.d. 1.75).

for the female subsample and the age group of 30-60 year-olds. Interestingly enough, this contradicts the hypothesis that income of males determines mating value for females (Smock and Manning, 1997) and has been also found for a British sample (Binder and Coad, 2010a). Probably there is some career ceiling (marked by a certain level of income) after which females prioritize marriage and family as new and more important life goals. The association between increase in employment and subsequent decrease in the marriage domain, which is found for females but not for males, does support this hypothesis: as long as a career is pursued, marriage does not seem to play a big role for females. Of course we should be careful with overstressing this relationship as marriage and employment are both variables coded quite crudely due to data limitations.

A second robustness exercise has been the analysis of the subgroup of ages 30 to 60. This has two reasons. First, personality traits are more variable in adolescents and the elderly. Our (forced) assumption of stability in personality traits might thus lead to bias in our estimates. Focussing on a subgroup where personality traits can be more reasonably assumed to be quite stable helps us in assessing potential bias. The second reason is that the group of adults aged 30-60, representing the "working populace", might exhibit interesting peculiarities regarding the coevolution of subjective well-being and life domains. We have already noticed some differences in passing above, but find otherwise that, by and large, this subsample is quite similar to our main sample (see Table 12 in the Appendix).

Before concluding, we want to highlight specifically how personality differences change the structural picture painted so far. Individuals showing high levels of Neuroticism exhibit higher levels of worry (high Neuroticism: mean worries 2.22 (s.d. 0.43) vs. rest of the sample: 2.08 (s.d. 0.43); t-test highly significant). But opposed to the other model specifications, we find no significant associations of worries and other life domains (one exception: job). In a sense, individuals with high Neuroticism worry without corresponding cause as compared to the whole sample. Moreover, increases in worries for the neurotic subsample are followed quite consistently with deteriorations in the other life domains. The worries of neurotic individuals thus seem to translate into decreases that manifest in objective life conditions. These negative effects on other life domains are consistently higher in coefficient size than for our main model. It has been argued that high Neuroticism leads to decreased life satisfaction over time (e.g., Soons and Liefbroer, 2009; Headey, 2010). Our analysis sheds light on a possible channel through which this happens, namely the extreme (negative) importance of worries and their mutual interaction with more objective life domains.

Worries also play a (contrasting) role for individuals with high Extraversion. The picture here is reversed as worries seem to have much less influence on other life domains. However, improvements in other life domains are followed by decreased worries (Zautra et al., 2005, show that Extraverts are better able to see objectively positive events as what they are). In a (somewhat speculative) sense one could argue that extroverts worry with reason and improvements in their circumstances decrease their respective worries. They might possess more effective coping strategies (McCrae and Costa, 1986) to deal with concrete reasons for worries and alter their life conditions in order to no longer have to worry about their situation (this positive effect, i.e. the comparatively strong negative coefficients for worries as dependent variable, supports our interpretation).

4. Conclusion

Subjective well-being coevolves in various complex ways with important life events. In our paper, we have sought to better understand the complex trajectories of this process by applying a panel vector autoregressions model to the German Socio-Economic Panel (SOEP) data set to examine the coevolution between changes in life satisfaction and changes in income, health, worries as well as marital and employment status. We have used this approach to start from the data without having to impose *a priori* theoretical prejudice on the structure of causal relationships between our variables. Guided by theory in the selection of relevant life domains, we have considered variables such as job, one's worries, health, marriage and social life, well-being, and income all to be interdependent and mutually endogenous. Our model has allowed us to look at the coevolution of a relatively large number of variables, allowing all to be associated with each other over a number of time lags, where we have analyzed how changes in these variables are associated with changes in the other variables.

In sum, our findings are quite robust to different model specifications which our robustness tests have shown. Our most salient finding is the asymmetric intertemporal relationship between subjective well-being and the other life domains. We clearly see that increases in well-being (in both time lags) are positively associated with increases in other life domains (subjective well-being thus seems to play a positive role for these domains), previous increases in the other life domains examined are associated with decreases in subjective well-being in the following years. In more detail, we find that recent increases in well-being are positively associated with subsequent increases in (log) income, marriage probability, employment status, and health and with decreases in worries. These effects we have found to be significant mostly independent of model specification and persist for the second lag also. The (asymmetric) reverse relationship from life domains on subjective well-being could be interpreted in terms of hedonic adaptation (Frederick and Loewenstein, 1999): positive changes in most life domains in a previous period are associated with decreasing well-being in the present period. (The one notable exception to this rule is health, where increases are also followed by increases in subjective well-being.) From a dynamic point of view, our results thus support hedonic adaptation phenomena. While increases in well-being may be a short-lived phenomenon, our results show that there can exist longer-term effects through the particular channels analyzed. A vector autoregressive approach is able to identify these effects whereas a narrow focus on the determinants and consequences of changes in well-being would not be able to do so.

We see another contribution of this paper in that we have extended our understanding of the structure of subjective well-being by further accounting for different personality traits and examining how extremes in these traits change the interplay between subjective well-being and our variables. The importance of accounting for personality in subjective well-being research has long been known (DeNeve and Cooper, 1998; Gutiérrez et al., 2005, p. 1565), but only recently have large-scale data sets started to elicit information on respondents' personality traits. Our results show that the structure of well-being is sensitive to personality in various subtle ways. One example is how worries differently interact with subjective well-being and other life domains for highly neurotic and highly extravert individuals.

Finally, our analysis is a first step in ascertaining whether the structure of subjective well-being is universal and exhibits the same interdependencies over different cultures and

locations. By comparing the German case with evidence from the British populace, we were led to conclude that several commonalities exist in the structure and co-evolution of subjective well-being and important life domains, ranging from hedonic adaptation in most life domains to the comparatively strong importance of subjective well-being for other life domains examined. While in Germany there seems to be a positive health-happiness relationship in both directions, this was not found in the British populace.

Subjective well-being might be a complex, evolving phenomenon that interacts with many domains of life in different ways for "Miserable John" and "Cheerful Jane". Nevertheless, by accounting for differences in personality and examining the underlying structure of these complex interdependencies, we find commonalities and regularities.

Date: June 11, 2011; 9,400 words

Appendix

	life satisfaction	log(income)	health	social	worries	d_disabled	d_employed	d_single	d_married	education	gender	age
life satisfaction	1.0000											
log(income)	0.2178*** (0.0000)	1.0000										
health	0.3065*** (0.0000)	0.0942*** (0.0000)	1.0000									
social	0.2321*** (0.0000)	0.2513*** (0.0000)	0.1682*** (0.0000)	1.0000								
worries	-0.2630*** (0.0000)	-0.1918*** (0.0000)	-0.1419*** (0.0000)	-0.0891*** (0.0000)	1.0000							
d_disabled	-0.1437*** (0.0000)	-0.0488*** (0.0000)	-0.3626*** (0.0000)	-0.1185*** (0.0000)	0.0588*** (0.0000)	1.0000						
d_employed	0.0512*** (0.0000)	0.2522*** (0.0000)	0.2308*** (0.0000)	0.1150*** (0.0000)	-0.0798*** (0.0000)	-0.2069*** (0.0000)	1.0000					
d_single	0.0239*** (0.0000)	-0.0404*** (0.0000)	0.1842*** (0.0000)	0.2239*** (0.0000)	-0.0360*** (0.0000)	-0.1028*** (0.0000)	0.0362*** (0.0000)	1.0000				
d_married	0.0493*** (0.0000)	0.1398*** (0.0000)	-0.0832*** (0.0000)	-0.1222*** (0.0000)	0.0030 (0.1742)	0.0429*** (0.0000)	0.0418*** (0.0000)	-0.7015*** (0.0000)	1.0000			
education	0.0724*** (0.0000)	0.3217*** (0.0000)	0.0944*** (0.0000)	0.2089*** (0.0000)	-0.0826*** (0.0000)	-0.0928*** (0.0000)	0.2482*** (0.0000)	-0.0051* (0.0216)	0.0518*** (0.0000)	1.0000		
gender	-0.0013 (0.5609)	-0.0666*** (0.0000)	-0.1079*** (0.0000)	-0.0395*** (0.0000)	0.0829*** (0.0000)	-0.0390*** (0.0000)	-0.1504*** (0.0000)	-0.0541*** (0.0000)	-0.0394*** (0.0000)	-0.0571*** (0.0000)	1.0000	
age	-0.0455*** (0.0000)	0.0222*** (0.0000)	-0.3462*** (0.0000)	-0.2361*** (0.0000)	0.0104*** (0.0000)	0.2661*** (0.0000)	-0.3634*** (0.0000)	-0.5455*** (0.0000)	0.2874*** (0.0000)	-0.0429*** (0.0000)	0.0059** (0.0072)	1.0000
Observations	205355											

P-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Contemporaneous correlations

	life satisfaction	log(income)	health	social	Extraversion	Agreeableness	Openness	Neuroticism	Conscientiousness	worries	education	gender	age
life satisfaction	1.0000												
log(income)	0.2178***	1.0000											
	(0.0000)												
health	0.3065***	0.0942***	1.0000										
	(0.0000)	(0.0000)											
social	0.2321***	0.2513***	0.1682***	1.0000									
	(0.0000)	(0.0000)	(0.0000)										
Extraversion	0.1067***	0.0500***	0.0637***	0.1419***	1.0000								
	(0.0000)	(0.0000)	(0.0000)	(0.0000)									
Agreeableness	0.1015***	-0.0587***	0.0085***	-0.0040	0.0918***	1.0000							
	(0.0000)	(0.0000)	(0.0001)	(0.2390)	(0.0000)								
Openness	0.1104***	0.1141***	0.0589***	0.2063***	0.3939***	0.1253***	1.0000						
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)							
Neuroticism	-0.2201***	-0.0997***	-0.2235***	-0.1254***	-0.1593***	-0.1191***	-0.0799***	1.0000					
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)						
Conscientiousness	0.0950***	0.0142***	0.0482***	-0.0218***	0.1979***	0.3209***	0.1872***	-0.1006***	1.0000				
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)					
worries	-0.2630***	-0.1918***	-0.1419***	-0.0891***	0.0079***	0.0238***	0.0350***	0.2019***	0.0286***	1.0000			
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0000)	(0.0000)				
education	0.0724***	0.3217***	0.0944***	0.2089***	0.0586***	-0.0080***	0.1896***	-0.1015***	0.0230***	-0.0826***	1.0000		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0000)	(0.0000)			
gender	-0.0013	-0.0666***	-0.1079***	-0.0395***	0.0856***	0.1765***	0.0546***	0.1914***	0.0509***	0.0829***	-0.0571***	1.0000	
	(0.5609)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
age	-0.0455***	0.0222***	-0.3462***	-0.2361***	-0.1032***	0.0744***	-0.0900***	0.0545***	0.0736***	0.0104***	-0.0429***	0.0059**	1.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0072)	
Observations	205355												

P-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Contemporaneous correlations with personality traits

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	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5663***	.0110	.0254***	-.0238	-.1692***	.0114	-.2640***	-.0324	.0132*	-.0430*	-.1592***	.0026	0.2596
	(.0057)	(.0207)	(.0065)	(.0187)	(.0385)	(.0236)	(.0052)	(.0226)	(.0064)	(.0190)	(.0393)	(.0233)	
Δincome	.0046***	-.4084***	.0033*	-.0070	-.0110	.0441***	.0031**	-.1693***	.0024	-.0072	-.0184*	.0153*	0.1578
	(.0010)	(.0092)	(.0013)	(.0039)	(.0099)	(.0059)	(.0010)	(.0068)	(.0014)	(.0039)	(.0079)	(.0060)	
Δhealth	.0070	-.0052	-.5228***	-.0021	-.0702*	-.0402*	.0075*	-.0377*	-.2665***	.0146	-.0435	-.0724***	0.2318
	(.0036)	(.0167)	(.0051)	(.0137)	(.0282)	(.0172)	(.0035)	(.0158)	(.0044)	(.0133)	(.0282)	(.0165)	
Δworries	-.0023	-.0148**	-.0030*	-.5711***	-.0006	-.0171**	-.0025*	-.0010	-.0010	-.2660***	.0036	.0019	0.2971
	(.0012)	(.0051)	(.0015)	(.0048)	(.0100)	(.0056)	(.0012)	(.0050)	(.0015)	(.0043)	(.0095)	(.0055)	
Δmarry	.0469***	.0591	-.0053	-.0214	-.8737***	-.0558	.0420***	.1097**	.0012	-.0079	-.5900***	.0128	0.0482
	(.0087)	(.0359)	(.0108)	(.0330)	(.0598)	(.0388)	(.0087)	(.0343)	(.0111)	(.0329)	(.0627)	(.0361)	
Δjob	.0048	.1548***	.0620***	-.1181***	-.3617***	-1.5458***	-.0101	.0667*	.0609***	-.0855***	-.1278*	-.9894***	0.1467
	(.0064)	(.0317)	(.0082)	(.0245)	(.0562)	(.0276)	(.0062)	(.0299)	(.0082)	(.0240)	(.0509)	(.0279)	
	50,658 observations												

Table 7: Subgroup: high Extraversion. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5684***	-.0342	.0503***	-.0854*	-.0775	.0045	-.2608***	-.0322	.0172	-.0505	-.3356***	-.0248	0.2586
	(.0083)	(.0397)	(.0103)	(.0340)	(.0698)	(.0389)	(.0076)	(.0385)	(.0106)	(.0320)	(.0694)	(.0371)	
Δincome	.0032*	-.4612***	.0011	-.0158**	-.0330*	.0570***	.0045***	-.1822***	.0006	-.0283***	-.0513***	.0179*	0.1854
	(.0014)	(.0122)	(.0019)	(.0060)	(.0158)	(.0091)	(.0013)	(.0096)	(.0019)	(.0058)	(.0136)	(.0083)	
Δhealth	.0127*	-.0004	-.5134***	-.0522*	-.1001*	-.0961***	.0137**	.0104	-.2730***	-.0418*	-.1113*	-.0852**	0.2248
	(.0052)	(.0270)	(.0079)	(.0226)	(.0503)	(.0258)	(.0048)	(.0253)	(.0067)	(.0212)	(.0452)	(.0261)	
Δworries	-.0012	-.0078	-.0016	-.5718***	-.0016	-.0208**	.0015	.0023	.0034	-.2750***	.0101	.0017	0.2980
	(.0016)	(.0080)	(.0022)	(.0074)	(.0145)	(.0079)	(.0015)	(.0081)	(.0022)	(.0064)	(.0142)	(.0080)	
Δmarry	.0378**	.1224*	-.0275	-.0512	-.9536***	-.0389	.0274*	.0991	.0014	-.0699	-.8059***	.0594	0.0584
	(.0121)	(.0619)	(.0168)	(.0504)	(.0940)	(.0639)	(.0120)	(.0622)	(.0173)	(.0494)	(.0886)	(.0618)	
Δjob	.0067	.1461**	.0811***	-.1389***	-.3978***	-1.4775***	-.0058	.0544	.0825***	-.0658	-.1623	-1.0228***	0.1425
	(.0084)	(.0487)	(.0114)	(.0366)	(.0843)	(.0400)	(.0077)	(.0458)	(.0112)	(.0348)	(.0861)	(.0419)	
	21,725 observations												

Table 8: Subgroup: high Neuroticism. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

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	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5592***	-.0012	.0296***	-.0504***	-.1490***	-.0097	-.2636***	-.0425**	.0093*	-.0603***	-.1825***	-.0169	0.2533
	(.0039)	(.0158)	(.0045)	(.0127)	(.0287)	(.0168)	(.0034)	(.0160)	(.0044)	(.0126)	(.0284)	(.0166)	
Δincome	.0048***	-.4103***	.0026**	-.0093***	-.0270***	.0410***	.0037***	-.1691***	.0014	-.0073**	-.0242***	.0120**	0.1560
	(.0006)	(.0069)	(.0009)	(.0025)	(.0070)	(.0042)	(.0006)	(.0048)	(.0009)	(.0026)	(.0055)	(.0039)	
Δhealth	.0115***	-.0151	-.5233***	-.0103	-.0539**	-.0553***	.0082***	-.0216	-.2668***	.0004	-.0666***	-.0681***	0.2299
	(.0025)	(.0117)	(.0035)	(.0092)	(.0202)	(.0119)	(.0024)	(.0114)	(.0030)	(.0090)	(.0202)	(.0120)	
Δworries	-.0027***	-.0064	-.0028**	-.5723***	.0039	-.0176***	-.0013	.0044	-.0020	-.2646***	.0038	.0010	0.2959
	(.0008)	(.0040)	(.0010)	(.0033)	(.0070)	(.0040)	(.0008)	(.0038)	(.0010)	(.0030)	(.0067)	(.0040)	
Δmarry	.0480***	.0637*	-.0249**	.0212	-.9285***	-.1110***	.0390***	.1074***	-.0138	-.0120	-.6332***	-.0139	0.0532
	(.0063)	(.0276)	(.0079)	(.0233)	(.0434)	(.0298)	(.0062)	(.0275)	(.0079)	(.0233)	(.0454)	(.0299)	
Δjob	.0094*	.1844***	.0679***	-.1232***	-.3083***	-1.5784***	-.0057	.0763***	.0639***	-.0651***	-.1616***	-1.0249***	0.1454
	(.0045)	(.0241)	(.0058)	(.0174)	(.0411)	(.0203)	(.0043)	(.0219)	(.0058)	(.0168)	(.0381)	(.0210)	
	109,796 observations												

Table 9: Subgroup: high Conscientiousness. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$

	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5628***	-.0163	.0340***	-.0492**	-.1064**	.0027	-.2654***	-.0423*	.0173**	-.0630***	-.1479***	-.0557*	0.2546
	(.0051)	(.0226)	(.0058)	(.0168)	(.0381)	(.0245)	(.0046)	(.0213)	(.0058)	(.0166)	(.0366)	(.0238)	
Δincome	.0045***	-.4111***	.0017	-.0117***	-.0209*	.0459***	.0044***	-.1655***	-.00009	-.0097**	-.0115	.0215***	0.1538
	(.0008)	(.0090)	(.0011)	(.0032)	(.0084)	(.0063)	(.0008)	(.0067)	(.0010)	(.0031)	(.0070)	(.0056)	
Δhealth	.0168***	-.0138	-.5231***	.0021	-.0565*	-.0616***	.0099**	-.0034	-.2692***	-.0042	-.0621*	-.0543**	0.2288
	(.0033)	(.0161)	(.0046)	(.0119)	(.0268)	(.0171)	(.0032)	(.0157)	(.0041)	(.0118)	(.0261)	(.0176)	
Δworries	-.0032**	-.0033	-.0019	-.5753***	.0058	-.0138*	-.0014	.0043	-.0019	-.2652***	-.0035	-.0013	0.2998
	(.0011)	(.0054)	(.0013)	(.0042)	(.0095)	(.0057)	(.0011)	(.0051)	(.0014)	(.0039)	(.0090)	(.0058)	
Δmarry	.0479***	-.0214	-.0082	.0138	-1.0104***	-.0285	.0336***	.0490	-.0121	.0145	-.5664***	.0544	0.0504
	(.0086)	(.0403)	(.0103)	(.0305)	(.0574)	(.0408)	(.0084)	(.0387)	(.0105)	(.0310)	(.0584)	(.0406)	
Δjob	.0343***	.1520***	.0359***	-.1228***	-.0772	-1.8262***	.0148*	.0808*	.0406***	-.0576*	-.0195	-1.0782***	0.1708
	(.0064)	(.0342)	(.0079)	(.0242)	(.0515)	(.0299)	(.0060)	(.0320)	(.0081)	(.0234)	(.0487)	(.0318)	
	64,372 observations												

Table 10: Subgroup: male. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

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	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5615***	.0101	.0299***	-.0401*	-.1568***	-.0144	-.2604***	-.0270	.0091	-.0462**	-.2149***	-.0031	0.2546
	(.0048)	(.0178)	(.0055)	(.0159)	(.0360)	(.0186)	(.0042)	(.0194)	(.0055)	(.0159)	(.0355)	(.0187)	
Δincome	.0048***	-.4110***	.0032**	-.0107**	-.0326***	.0432***	.0031***	-.1704***	.0030**	-.0080*	-.0316***	.0122**	0.1598
	(.0008)	(.0083)	(.0011)	(.0033)	(.0092)	(.0047)	(.0009)	(.0060)	(.0011)	(.0034)	(.0073)	(.0046)	
Δhealth	.0076**	-.0159	-.5279***	-.0143	-.0379	-.0508***	.0059*	-.0274*	-.2662***	.0019	-.0577*	-.0735***	0.2345
	(.0029)	(.0136)	(.0042)	(.0117)	(.0253)	(.0137)	(.0028)	(.0132)	(.0036)	(.0113)	(.0259)	(.0132)	
Δworries	-.0029**	-.0108*	-.0030*	-.5750***	.0061	-.0175***	-.0019*	.0025	-.0006	-.2660***	.0067	.0051	0.2969
	(.0010)	(.0046)	(.0013)	(.0041)	(.0086)	(.0045)	(.0009)	(.0043)	(.0013)	(.0037)	(.0081)	(.0044)	
Δmarry	.0534***	.0910**	-.0287**	.0233	-.9035***	-.1049**	.0426***	.1313***	-.0126	-.0143	-.6527***	-.0308	0.0546
	(.0074)	(.0320)	(.0097)	(.0285)	(.0528)	(.0350)	(.0073)	(.0302)	(.0097)	(.0281)	(.0563)	(.0333)	
Δjob	-.0084	.1924***	.0748***	-.1287***	-.4159***	-1.4182***	-.0161**	.0834***	.0733***	-.0848***	-.2430***	-.9730***	0.1323
	(.0050)	(.0272)	(.0068)	(.0201)	(.0494)	(.0222)	(.0049)	(.0243)	(.0067)	(.0194)	(.0453)	(.0223)	
	70,995 observations												

Table 11: Subgroup: female. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

	t-1						t-2						
	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	ΔSWB	Δincome	Δhealth	Δworries	Δmarry	Δjob	(Pseudo)-R^2
ΔSWB	-.5563***	.0183	.0306***	-.0536***	-.1224***	.0005	-.2634***	-.0548**	.0168***	-.0570***	-.1694***	-.0396	0.2506
	(.0045)	(.0201)	(.0051)	(.0150)	(.0327)	(.0211)	(.0039)	(.0198)	(.0051)	(.0147)	(.0311)	(.0213)	
Δincome	.0068***	-.4227***	.0041***	-.0108***	-.0062	.0538***	.0048***	-.1827***	.0023*	-.0105***	-.0158**	.0214***	0.1644
	(.0007)	(.0079)	(.0010)	(.0029)	(.0070)	(.0049)	(.0007)	(.0055)	(.0010)	(.0029)	(.0058)	(.0046)	
Δhealth	.0083**	-.0210	-.5251***	-.0018	-.0559*	-.0652***	.0071**	-.0168	-.2669***	.0103	-.0367	-.1051***	0.2326
	(.0028)	(.0136)	(.0040)	(.0107)	(.0225)	(.0152)	(.0027)	(.0140)	(.0035)	(.0106)	(.0220)	(.0150)	
Δworries	-.0043***	-.0107*	-.0018	-.5675***	-.0046	-.0223***	-.0027**	.0033	-.0007	-.2648***	-.0070	.0055	0.2960
	(.0009)	(.0046)	(.0012)	(.0037)	(.0076)	(.0048)	(.0009)	(.0044)	(.0011)	(.0034)	(.0071)	(.0048)	
Δmarry	.0522***	.1167***	-.0122	.0434	-.8347***	-.1055**	.0360***	.1135***	-.0123	.0252	-.5735***	-.0103	0.0404
	(.0071)	(.0339)	(.0090)	(.0271)	(.0471)	(.0387)	(.0069)	(.0335)	(.0090)	(.0275)	(.0457)	(.0362)	
Δjob	.0252***	.1358***	.0821***	-.1517***	-.2813***	-1.6509***	.0004	.0238	.0817***	-.0996***	-.0926*	-1.0832***	0.1518
	(.0056)	(.0300)	(.0072)	(.0216)	(.0483)	(.0251)	(.0053)	(.0279)	(.0073)	(.0208)	(.0440)	(.0255)	
	83,643 observations												

Table 12: Subgroup: age 30-60. Regression results of a two-lag vector autoregression estimated via OLS (the equations for marriage and employment are estimated via ordered probit). We report coefficients and clustered SE. $^{*}p < 0.05,^{**}p < 0.01,^{***}p < 0.001$

	(1) E: high		(2) N: high		(3) C: high		(4) A: high	
log(income)	0.206***	(6.78)	0.239***	(4.42)	0.245***	(11.18)	0.259***	(10.70)
health	0.203***	(20.14)	0.263***	(16.68)	0.215***	(31.71)	0.217***	(27.80)
worries	-0.467***	(-16.27)	-0.483***	(-9.90)	-0.492***	(-25.22)	-0.477***	(-21.28)
social	0.215***	(7.94)	0.419***	(8.75)	0.264***	(14.13)	0.265***	(12.24)
d_fulltime	0.198***	(5.57)	0.183**	(3.02)	0.219***	(8.98)	0.191***	(6.88)
d_parttime	0.0409	(1.01)	0.131	(1.95)	0.0468	(1.59)	0.0332	(1.01)
d_training	0.0897	(1.44)	0.127	(1.02)	0.107*	(2.24)	0.124*	(2.33)
d_marginal	-0.100	(-1.95)	-0.00823	(-0.09)	-0.0585	(-1.57)	-0.0625	(-1.47)
d_sheltered	0.849**	(2.79)	0.306	(0.76)	0.244	(0.57)	0.523**	(3.03)
d_married	0.195***	(3.79)	0.271**	(2.73)	0.201***	(5.44)	0.201***	(4.72)
d_separated	-0.247**	(-2.60)	-0.0420	(-0.26)	-0.205**	(-2.81)	-0.222**	(-2.67)
d_divorced	0.0174	(0.20)	0.141	(0.89)	0.169**	(2.79)	0.141	(1.96)
d_widowed	-0.0142	(-0.11)	-0.114	(-0.71)	-0.0978	(-1.18)	-0.121	(-1.34)
d_spouseaway	-2.835***	(-10.33)	-1.605	(-1.44)	-1.715**	(-2.92)	-0.520	(-0.64)
d_disabled	-0.260***	(-3.96)	-0.206*	(-2.55)	-0.126**	(-3.20)	-0.155***	(-3.44)
age	-0.0263***	(-9.89)	-0.0356***	(-7.71)	-0.0241***	(-13.71)	-0.0240***	(-11.88)
age^2	0.000137	(1.60)	0.00000585	(0.04)	0.000197***	(3.52)	0.000155*	(2.50)
education	0.000618	(0.06)	0.00140	(0.06)	-0.0107	(-1.22)	-0.00397	(-0.41)
d_EastGermany	-0.234	(-0.66)	0.500	(0.78)	-0.0683	(-0.28)	-0.196	(-0.72)
Observations	32821		14239		70488		54830	
R^2_within	.0709		.1084		.0777		.0755	
R^2_between	.1065		.091		.1319		.128	
R^2_overall	.096		.0819		.1124		.1075	

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: Fixed effects regressions for a selection of (high) personality traits

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