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January 2002

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## **ABSTRACT**

### **The Value of Reunification in Germany: An Analysis of Changes in Life Satisfaction**

We quantify the value of changes in life circumstances in Germany following reunification. To this end, we develop and implement a fixed-effect estimator for ordinal life satisfaction in the German Socio-Economic Panel. We find strong negative effects on life satisfaction from being recently fired, losing a spouse through either death or separation and time spent in hospital, whilst we find strong positive effects from income and marriage. Using a new causal decomposition technique, we find that East Germans experienced a continued improvement in life satisfaction after 1990 to which increased household incomes contributed around 12%. Most of the increase is explained by improved average circumstances, such as public services. For West Germans, we find virtually no change in satisfaction between 1991 and 1999.

JEL Classification: Z1, C23, C25, I31

Keywords: Life satisfaction, German reunification, random and fixed-effects, panel models, causal decomposition

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## 1. Introduction

One of the most prominent events of recent decades was the ‘fall’ of the Berlin Wall on November 9th 1989, effectively marking the collapse of socialism in East Germany. This was a time of great optimism for both East and West Germans, even though there was considerable concern about the economic impacts of unification on the West. For East Germans this optimism was reflected in popular slogans such as ‘Helmut (Kohl), take us by the hand, lead us to the economic wonderland’ (Bach and Trabold, 2000).

At the time of reunification in July 1990, politicians talked about East-West economic convergence taking at most only five years to achieve.<sup>1</sup> Complete free movement between East and West was established along with the parity conversion of the East Mark to the West Mark (DM). Expectations were high as workers from the East, perhaps for the first time in their lives, had potential access to high paying jobs and goods which were previously unavailable. Such expectations led 1.8% of East Germans to migrate to the West by 1991, increasing to an accumulated total of 4.3% by 1992, 6.2% in 1993 and 7.4% in 1994. This mobility was made easier by a common language, a similar education system, a shared cultural history and a shared political history prior to the 2nd World War (Hunt, 2000). The number of the East-to-West migrants, however, had levelled out by 1995 with around 8% of former East Germans today residing in the West. In sharp contrast to the optimism shared by many politicians about convergence, economists were far more cautious suggesting a necessary time of up to 20 years.

Despite the introduction of currency union and the massive federal transfers from West to East, in the order of hundreds of billion of DM, by 1997 GDP per capita in East Germany was still only 57% of that of the West. Moreover, wages were around 75% and unemployment was double the Western level (Hunt, 2000). Convergence with the West had essentially come to a halt and the economic miracle, which had been hoped for, failed to appear (see Bach and Trabold, 2000, for an extended discussion).<sup>2</sup>

In this paper we provide the first investigation into trends and determinants of life satisfaction (welfare) for inhabitants of East Germany in the post-reunification period starting 1991 (given our data) through to 1999. We compare these results with those for West Germans, and investigate whether there has been a convergence of life satisfaction between the two populations over the decade. The setting of German reunification is particularly interesting for such a study as it is as close to a ‘natural’ experiment as can be experienced in economics. It is well documented

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<sup>1</sup> For example, Kurt Biedenkopf, a West German member of Chancellor Kohl's Conservative Party wrote in an open letter in February 1990, ‘given the current extremely favourable conditions, the adjustment process of the East Germany economy to that of the West, will only take one or two years to reach the current West German levels.’

<sup>2</sup> See Hunt (2000) for an analysis of the apparent puzzle why net emigration by 1995 from East Germany was close to zero, given free movement and considerably better economic conditions in West Germany.

that few people anticipated the 'falling of the wall', nor the resulting rapid endowment of a former communist country with a set of market institutions. To enable this analysis we use data from the German Socio-Economic Panel (GSOEP), in which we can follow individuals over time. To analyse the correlates of life satisfaction we fit random-effects ordered probit models. However, this approach may fail to capture many individual factors that are known to affect life satisfaction, such as personality traits (see Kahneman et al., 1999). This would mean that the coefficients of the observable variables included in the models might be affected by spurious correlation with unobservables. To investigate causality we therefore implement a conditional estimator for the fixed-effect ordered logit model that allows for individual heterogeneity. We then develop a test for the existence of fixed-effects. The estimates from this new model are then decomposed, using a new technique, in order to identify the factors that drove the average changes in life satisfaction in both East and West Germany following reunification.

Apart from its focus and these methodological innovations, the paper also contributes to the existing literature on life satisfaction by using uniquely rich data that incorporate various major 'life events'. These include changes in health and marital status, family births and deaths, of internal migration, and changes in income and work status.

The paper is set out as follows. In Section 2 we review the recent economics literature that has investigated the determinants of life satisfaction and happiness. The findings from these studies provide us with the baseline individual, economic and demographic characteristics that affect individual wellbeing, and therefore need to be taken account of in our models. Our data source, the German Socio-Economic Panel, is described in Section 3, together with the derivation of our life satisfaction measure and a descriptive analysis of changes in life satisfaction since reunification. In Section 4 we introduce our econometric and decomposition methodologies. The empirical results are discussed in Section 5, and Section 6 concludes.

## **2. The Determinants of Life Satisfaction and Happiness**

The investigation of the factors affecting human happiness is central to the discipline of psychology (see Kahneman et al., 1999, for a detailed review of the relevant psychology literature). Psychologists recognise that the best method to gain information about how 'happy' a person is with their life or work is to ask them directly. In contrast, it is well known that economists have traditionally been reluctant to use self-reported subjective measures of welfare or utility such as life satisfaction, happiness and job satisfaction (Bertrand and Mullainathan, 2001). Economists are cautious about the interpretation of such variables and the validity of interpersonal comparisons (i.e. a cardinal measure). Moreover, economic theory typically provides little guidance on how to model such psychological outcomes, thus making the testing of economic theory difficult (Jahoda, 1982, 1988). Recent years, however, have seen a considerable

increase in the willingness by economists to use such variables (See Oswald 1997, for an informative review). This is partly due to the high level of explanatory power attributable to such variables in models of labour market behaviour (e.g. absenteeism and turnover) and the ‘sensible’ nature of estimated determinants of life satisfaction and happiness (Frijters, 2000). Moreover, the great advantage of these wellbeing measures is that they provide directly observable proxies for ‘utility’, which is a concept central to economic research, but is a dependent variable otherwise rarely available for empirical analysis.<sup>3</sup>

### *Unemployment*

By far the most heavily researched topic by economists (and psychologists) in this area concerns the psychological impact of unemployment. Much of this work has utilised longitudinal data that tracks an individual's self-reported happiness over time. In this respect the British Household Panel Survey (Clark et al., 1996; Clark and Oswald, 1994; Clark, 1999; Theodossiou, 1998) and the West German sample of the German Socio-Economic Panel Study (Clark et al., 2001; Gerlach and Stephan, 1996; Kraft, 2000; Winkelmann and Winkelmann, 1998) have been widely used. In addition, Ravallion and Lokshin (2001) analysed data from the Russian Longitudinal Monitoring Survey, Korpi (1997) has used panel data from the Swedish Survey of Youth, Gerdtham and Johannesson (1997) have examined cross-sectional data from Sweden's Level of Living Survey and Frey and Stutzer (2000) have used cross-sectional data from Switzerland to examine this issue. The use of panel data is important in this context since it can enable the causality running from unemployment to unhappiness to be firmly established. Moreover, the effect of unobserved individual heterogeneity (e.g. personality traits), that has been found to be important in explaining variations in reported happiness levels (see Kahneman et al., 1999), can also be tested and controlled for with longitudinal data.

Whilst the above studies have used a variety of definitions of wellbeing (i.e. life satisfaction in the German panel, symptoms of psychological distress in the British panel), there can be little doubt that, for the ‘majority population’, unemployment leads to a significant deterioration in life satisfaction. This ‘stylised fact’ is validated across countries, time periods and data sources, and has been widely used to support the belief that unemployment in Europe is predominately involuntary in nature (Clark and Oswald, 1994; Gerlach and Stephan, 1996; Oswald, 1997). The psychological cost of unemployment has been found to be higher for men than women (Kraft, 2000) and greatest for younger workers (aged less than 30 years according to Winkelmann and Winkelmann (1998) or aged 30 – 49 years according to Gerlach and Stephan (1996)).

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<sup>3</sup> A good example of a study that uses subjective measures of a happiness to examine an important economic issue is Di Tella et al., 2001. In this study the authors estimate the relative importance of inflation and unemployment in determining respondents happiness (or utility) using survey data from the Euro-Barometer Survey Series (1975-1991).

Theodossiou (1998) has found that joblessness leads to a marked rise in anxiety and depression with an associated loss of confidence and self-esteem. Winkelmann and Winkelmann (1998) found that the non-pecuniary costs of unemployment far exceed the pecuniary costs associated with loss of income. An important conclusion of these studies is that cost-benefit analyses of employment generating policies ought to take into account the non-pecuniary costs of unemployment.

### *Income and the Non-Pecuniary Value of Work*

A central component of economic theory is that utility is positively associated with income. Consequently, there has been considerable interest in the relationship between income and self-reported levels of life satisfaction or happiness. However, there exists no clear consensus that this central axiom of economic theory holds empirically. Campbell et al. (1976) and Easterlin (1974, 1995) found that income is a poor predictor of many measures of individual wellbeing. Oswald (1997) notes only a small happiness gain from economic growth in Europe and the USA in the post-war period, with this result being supported in the empirical analysis of Blanchflower and Oswald (2000). The results from studies that have used survey data from one country to investigate this relationship are also mixed. Some studies have found a small positive relationship between income and happiness (Clark et al, 2001; Frey and Stutzer, 2000; Gerdtham and Johannesson, 1997; Gerlach and Stephan, 1996; Winkelmann and Winkelmann, 1998). Kraft (2000) found an inverse U-shape relationship with life satisfaction reaching a maximum at roughly 45,000DM per month. In contrast, Clark and Oswald (1994) were unable to find any robust effect, whilst Clark (1999) noted evidence of a significant negative relationship between income and happiness using data from the BHPS. An alternative, commonly held, viewpoint is that it is 'relative' rather than 'absolute' income that drives psychological wellbeing (Blanchflower and Oswald, 2000; Van Praag and Frijters, 1999; Clark and Oswald, 1996; Easterlin, 1974, 1995; McBride, 2001; Oswald, 1997).<sup>4</sup>

Importantly, it is not just the loss of income, associated with unemployment, which leads to greater unhappiness, but rather psychologists have found that the benefits of 'work' are multi-faceted. Having a job may be a source of prestige and social recognition, and, as such, provide a basis for self-respect and self-worth. Going to work also gives structure to the day, maintains a sense of purpose and provides opportunities for social interaction (see Darity and Young, 1996).



### *Individual Characteristics*

A number of interesting and consistent relationships have been established. It has been found that marriage leads to a welfare gain over being single, and that the experience of divorce or separation significantly reduces happiness levels (Clark and Oswald, 1994; Clark et al., 2001; Gerlach and Stephan, 1998; Theodossiou, 1998; Winkelmann and Winkelmann, 1998). In this respect, Kraft (2000) claims that a rise of 6000DM per month would be needed to produce an equivalent rise in happiness to exactly offset the loss associated with separation. It has also been universally found that measures of poor health or disability are significantly associated with lower levels of self-reported happiness (see Kahneman et al., 1999, for a review). Several studies have found that individuals may partly adapt to illness and disability over time.

The relationship between other individual characteristics and happiness is less clear. One such example is that of gender. Clark and Oswald (1994), Clark et al. (1996) and Theodossiou (1998) have found that men are more likely than women to be observed at the higher end of the happiness distribution. The latter author argues that his finding is consistent with the belief held by psychologists that women are typically more critical of themselves and devalue themselves much more than men (See Black, 1971; Lowenthal et al., 1975). However, Gerdtham and Johannesson (1997) found the opposite result using Swedish data. In contrast, Frey and Stutzer (2000) identified no gender difference using Swiss data.

Similarly, whilst some studies have found that happiness is positively related to education (Clark et al., 2000; Frey and Stutzer, 2000; Gerdtham and Johannesson, 1997), other studies have found the converse (Clark and Oswald, 1994). The latter authors argue that the more highly educated have greater life expectations, which if not realised, lead to unhappiness. It has also been shown that ethnicity plays an important role in determining wellbeing levels (Shields and Wailoo, 2001). A final interesting result is that having children does not necessary lead to a happiness gain. Clark and Oswald (1994), Gerdtham and Johannesson (1997) and Theodossiou (1998) find that being responsible for children significantly reduces reported happiness amongst British and Swedish individuals. Plug (1997) finds a positive effect of children for the GSOEP however.

In this paper we investigate the impact of a number of these variables on life satisfaction of East and West German men and women in the immediate post-reunification period. In addition to 'level' effects of these variables, we can also identify the transient effect of changes. We thus obtain new results for the impact of a number of major 'life events' on life satisfaction, such as being recently separated or divorced, having a new baby, being recently fired from work, health changes (disabilities and hospital stays) and deaths in the family.

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<sup>4</sup> See Diener and Oishi (2000) for a review of the relationship between income and happiness found in the psychology literature.

### 3. Data and Sample Characteristics

#### *Data*

To examine the impact of reunification and socio-economic characteristics on the life satisfaction of East and West German residents we use data from the German Socio-Economic Panel (GSOEP). The GSOEP is a nationally representative panel that has closely followed around 13,500 individuals (living in some 7,000 households) each year since 1984. In 1990, following reunification, the panel was extended to include residents of the former East Germany.<sup>5</sup> The focus of this paper is the men and women, aged 21-64, who resided in East or West Germany, which we follow from 1991 up to 1999.<sup>6</sup> This is the first paper to investigate the determinants of life satisfaction separately for East German men and women, and to examine these issues using data from 1996-1999.

In order to establish the potential welfare benefit of moving from the East to the West following reunification, we also include ‘movers’ to the West in the Eastern data (276 individuals). Similarly, we observe 80 individuals who moved from the West to the East over the period, which we have added back into the Western samples in order to estimate the effect of moving. The total samples we use therefore consist of 25,903 person-year observations (12,592 males; 13,311 females) on East Germans, and 63,868 person-year observations (31,895 males; 31,973 females) on West Germans. This corresponds to repeated observations on just over 4,100 Eastern and 11,365 Western individuals. The average length of time in the panel is 6.4 years (since 1991). As the data span almost a decade, all income information has been deflated by the OECD main economic indicators consumer price index (base year 1995).

#### *The Distribution of Life Satisfaction in East and West Germany, 1991-1999*

The dependent variable we use in this analysis is based on the question ‘How happy are you at present with your life as a whole?’ The response runs from 0 (very unhappy) to 10 (very happy). Table 1 shows the distribution of life satisfaction for our four sub-samples.

It can be seen that the mean level of life satisfaction reported by East German residents is significantly lower (by around 0.8) than for their Western counterparts. In particular, a considerably lower percentage of East Germans report life satisfaction above point 8 on the scale (5.6% of males, 5.9% of females) compared to West Germans (16.2% of males, 17.8% of females). This difference in average life satisfaction between Easterners and Westerners holds true

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<sup>5</sup> In this paper we use the German version of the GSOEP data (See Haisken-DeNew and Frick, 2000 for details), although the same analysis can be conducted with the international ‘scientific use’ version, albeit with around 5% fewer observations.

<sup>6</sup> We do not analyse here the 1990 data because it is used to create a number of ‘major life’ change variables included in the 1991 data for East Germans.

for both males and females, but interestingly we do not observe a large gender gap between East (6.30 versus 6.26), or Western (7.10 versus 7.13) males and females. However, the former gap is statistically significant at the 5% level ( $t=2.02$ ).

Figures 1 and 2 show the change in the average levels of life satisfaction in the post-reunification period for each of our four groups. The figures show a number of interesting patterns. Firstly, life satisfaction in the East is always observed to be significantly below that of the West in each year since 1991. Secondly, East Germans experienced a continued increase in their satisfaction levels throughout the decade, while West Germans experienced a continued (but more gradual) decline in their life satisfaction.

#### 4. Econometric Framework and Decomposition Approach

##### *Random-Effects*

Our indicator of perceived wellbeing:  $GS \in \{0...10\}$  is an ordinal indicator of life satisfaction. This measure is available for a set of individuals indexed by  $i = 1...n$  each observed over some contiguous subset  $S_i$  of years indexed by  $t = 1...T$ . For each year in which  $GS_{it}$  is observed, we also observe a (row) vector  $x_{it}$  containing a set of covariates describing the characteristics and situation of individual  $i$  in year  $t$ .

As our baseline model we begin by fitting the following ordered probit model with individual random-effects:

$$GS_{i,t}^* = x_{i,t}\beta + \delta_t + v_i + \varepsilon_{it} \tag{1}$$

$$GS_{i,t} = k \Leftrightarrow GS_{i,t}^* \in [\lambda_k, \lambda_{k+1})$$

where  $GS_{it}^*$  is latent general satisfaction;  $GS_{it}$  is observed satisfaction;  $\lambda_k$  is the cut-off point (increasing in  $k$ ) for the satisfaction answers;  $x_{it}$  are observable individual characteristics;  $\delta_t$  denotes unobserved time-varying general circumstances;  $v_i$  is an individual normally-distributed random characteristic that is orthogonal to  $x$  with unknown variance; and  $\varepsilon_{it}$  a time-varying normally-distributed error-term that is orthogonal to all characteristics with a variance equal to 1.

The associated log-likelihood function for this model is well established and can be generalised from the arguments made by Butler and Moffitt (1982), and heterogeneity is handled by using Gauss-Hermite quadrature (20-points were chosen) to integrate the effect out of the joint density. Frechette (2001) provides a derivation of the likelihood function for this model and a further discussion of the Gauss-Hermite quadrature estimation.

### Fixed-Effects

It is very likely that there are important unobservable individual traits and characteristics that are related to life satisfaction. In fact, the recent psychology literature has found that such fixed personality traits are important predictors of general satisfaction (see, for example, Argyle, 1999 and Diener et al., 1999). This is particularly problematic for the random-effects estimates if these traits are related to many of the variables contained in  $x_{it}$ . Therefore, the results from the cross-section analyses based on the above random-effects model cannot generally serve as an indicator of causality. Therefore, as our main model of causality, we also fit the following fixed-effect ordered logit model developed in Ferrer and Frijters (2001):

$$GS_{it}^* = x_{i,t}\beta + \delta_t + f_i + \varepsilon_{it} \quad (2)$$

$$GS_{it} = k \Leftrightarrow GS_{it}^* \in [\lambda_k, \lambda_{k+1})$$

where  $GS_{it}^*$  is latent general satisfaction;  $GS_{it}$  is observed satisfaction;  $\lambda_k$  is the cut-off point (increasing in  $k$ ) for the satisfaction answers;  $x_{it}$  is observable time-varying characteristics;  $\delta_t$  denotes unobserved time-varying general circumstances;  $f_i$  is an individual fixed characteristic; and  $\varepsilon_{it}$  is a time-varying logit-distributed error-term that is orthogonal to all characteristics. Our conditional estimator for  $\delta_t$  and  $\beta$  maximizes the following conditional likelihood:

$$L[I(GS_{i1} > k_i), \dots, I(GS_{iT} > k_i) | \sum_t I(GS_{it} > k_i) = c] \quad (3)$$

$$= \frac{e^{\sum_{t=1}^T I(GS_{it} > k_i) x_{it} \beta}}{\sum_{GS \in S(k_i, c)} e^{\sum_{t=1}^T I(GS_{it} > k_i) x_{it} \beta}}$$

which is the likelihood of observing which of the  $T$  satisfactions of the same individual are above  $k_i$ , given that there are  $c$  out of the  $T$  satisfactions that are above  $k_i$ . Here,  $S(k_i, c)$  denotes the set of all possible combinations of  $\{GS_{i1}, \dots, GS_{iT}\}$  such that  $\sum_t I(GS_{it} > k_i) = c$ . Also,  $GS_{it}$  is used to denote the random variable and  $GS_{it}$  the realization.

As we see, the fixed-effects have dropped out of this likelihood. It therefore yields estimates only for  $\delta_t$  and  $\beta$ . This model is an extension of the fixed-effect logit model by Chamberlain

(1980). Unlike the Chamberlain methodology that recodes the data such that only crossing over a barrier that is the same for everyone (say,  $k$ ) can be used, our model uses crossings over person specific barriers (say,  $k_i$ ). When some individuals for instance only report values between 3 and 5, and others only between 6 and 8, then using the same barrier for everyone cannot record changes for both groups of individuals. Those individuals then have to be dropped from the estimation procedure. With individual specific barriers all individuals whose satisfactions differ over time, can be included. The most important advantage is therefore that it allows us to use more than 90% of the observations. In comparison, the loss of data in applications with the Chamberlain method is usually over 50% (e.g. Winkelman and Winkelman 1998, Hamermesh 2001, Clark et al. 2001). Furthermore, the log-likelihood is greatly increased by choosing  $k_i$  optimally (see Ferrer and Frijters, 2001). The model is estimated by Maximum Likelihood in GAUSS.

One important methodological point concerns the use of this fixed-effect estimator. One cannot simultaneously include age, time and fixed-effects in the analyses. To see this note that  $age_{it} * \beta_{age} = age_{i0} * \beta_{age} + t * \beta_{age}$ . Now, the effect of  $age_{i0} * \beta_{age}$  is time-invariant and will therefore be in the individual fixed-effect, and  $t * \beta_{age}$  will be the same for everyone at  $t$  and hence picked up by time dummies. We therefore drop (linear) age as a covariate and note that the time dummies will include age effects.

#### *Specification Testing: Random or Fixed-Effects*

In order to be able to judge the added value of the fixed-effects framework, we here develop a test of the power of the fixed-effect model compared to the random-effects model.

We denote the estimated coefficients of the random-effects model for the variables that overlap with the fixed-effects model by  $\hat{\beta}^{RE}$ . If there are fixed-effects that are related to individual characteristics, then the coefficients of the fixed-effects model should be different. We can hence judge the value of the fixed-effects model by seeing whether the coefficients are significantly different. Our null-hypothesis is that there are no fixed-effects, i.e.:

$$H_0: \quad \beta^{FE} = \alpha \hat{\beta}^{RE} \quad (4)$$

where  $\alpha$  is an unknown positive constant that arises because  $\hat{\beta}^{RE}$  is estimated under a different normalisation.<sup>7</sup> For a proper comparison, we only include for  $\hat{\beta}^{RE}$  those variables that are shared between the random-effects and fixed-effects models. This includes all the variables in the fixed-effect model apart from the time dummies: because time dummies represent unobservable characteristics that will pick up level effects in variables in the random-effects model, they essentially represent different variables for the two models and should therefore not be in a specification test.

Under the null hypothesis, we can use the following likelihood ratio test:

$$2L(\hat{\beta}_{ML}^{FE}) - 2L(\alpha \hat{\beta}^{RE}) \sim \chi(k) \quad (5)$$

Where  $\hat{\beta}_{ML}^{FE}$  denotes the vector of coefficients from the unrestricted maximum likelihood estimate of the fixed-effects model;  $k$  denotes the number of restricted parameters; and  $L(\alpha \hat{\beta}^{RE})$  denotes the likelihood of the fixed-effect model when the appropriate parameters are set at  $\alpha \hat{\beta}^{RE}$ . Two practical problems appear here. The first is that  $L(\alpha \hat{\beta}^{RE})$  requires re-fitting the free parameters and hence re-estimation of the model. The second is that  $\alpha$  is unknown. To circumvent this, we can note that:

$$2L(\hat{\beta}_{ML}^{FE}) - 2L(\alpha \hat{\beta}^{RE}) > 2L(\hat{\beta}_{ML}^{FE}) - \max_{\hat{\alpha}} \{2L(\hat{\alpha} \hat{\beta}^{RE})\} \quad (6)$$

Hence, by using the  $\hat{\alpha}$  that maximises  $L(\hat{\alpha} \hat{\beta}^{RE})$ , we get a lower bound for  $2L(\hat{\beta}_{ML}^{FE}) - 2L(\alpha \hat{\beta}^{RE})$ .

If we thus find that we can reject the null using  $2L(\hat{\beta}_{ML}^{FE}) - \max_{\hat{\alpha}} \{2L(\hat{\alpha} \hat{\beta}^{RE})\}$  as our test statistic, we know that the true statistic will reject the null also.

### *Explanatory Variables*

In order to get a baseline specification for the covariates in our life satisfaction models we follow the previous studies of life satisfaction and happiness described in Section 2. Therefore, in the random-effects models we control for age (and its quadratic), immigrant status, marital status, physical disability, years of schooling, number of children, having an invalid in the household

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<sup>7</sup>  $\hat{\beta}^{RE}$  is estimated with the full sample of all individuals and has  $\text{var}(\varepsilon_{it})=1$ . In contrast, the fixed-effects model uses only a selective subset of individuals that are partly selected on  $\varepsilon_{it}$  and hence does not share the same normalisation.

(usually a spouse or parent), employment status (particularly unemployment), household income and broad region of residence.

Variables not used previously in the economic literature include a number of major life changes that took place over the previous 12 months. These are: becoming separated, becoming divorced, death of spouse, death of another family member, birth of a child, number of in-patient days in hospital, being fired from your job and moving house (either within East or West Germany). We would expect that each of these major life events would have a significant impact on an individual's level of life satisfaction.

Given our focus on the impact of reunification of East and West Germans we also include year controls to capture general changes in life satisfaction in the years following reunification. An important question is whether or not movers from the East to the West (and visa-versa) experienced a gain (loss) in life satisfaction relative to stayers, and consequently we include dummy variables in the respective models to capture this change. We have also, uniquely, derived and included a "Border" variable equalling one (0 otherwise) if the respondent lives on the border of East and West Germany, as we might expect that the immediate impact of reunification on life satisfaction would affect those living on the border to the greatest extent. Given the large transitional nature of German reunification from a socialist to a capitalist system, we have also include a "Communist" variable in the East German models, to capture the expected negative impact of reunification on individuals who used to be members of the Communist Party (i.e. those we might expect to have the greatest attachment to the old system). Finally, to capture any possible panel effects on individuals' reports of their life satisfaction, we have included a length of time variable in the panel variable in each of the models (see Landau, 1993, for further justification). This is an innovation in the literature and turns out to be statistically significant in each of our random-effects models.<sup>8</sup>

For the fixed-effects models the effect of the individual time-invariant variables cannot be estimated, thus no estimates are provided for age, immigrant status, years of education and numbers of years in the panel. Throughout this paper, given that we might expect that the determinants of life satisfaction (e.g. with respect to say, children and employment status) to differ by gender and between East and West Germans, we fit separate models for males and females as well as for East and West Germans.

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<sup>8</sup> It has been found that individuals' responses to subjective variables, such as life satisfaction, may change with repeated questioning independently of changes in economic, social and demographic factors. For example, giving that the same interviewer (in most cases) visits the same individuals each year of the panel, over time respondents may become more familiar with the interviewer which may change their responses (Landau, 1993).

### *Causal Decomposition Analysis*

Given our particular interest in evaluating the potential welfare benefits of reunification for East Germans, we decompose changes in expected latent satisfaction for East German men and women separately in the post-reunification period using the estimates from the fixed-effects models. This means we analyse:

$$E\{\widehat{GS_{e,t+1}^* - GS_{e,t}^*}\} = (\bar{x}_{e,t+1} - \bar{x}_{e,t})\widehat{\beta} + (\widehat{\delta}_{t+1} - \widehat{\delta}_t) + (E_{e,t+1}f - E_{e,t}f) \quad (7)$$

Denote the set of East Germans who are in the sample at time  $t$  and at time  $t+1$  as  $S_t^e$ . For the individuals in  $S_t^e$ , this decomposition is straightforward, because for them  $(E_{e,t+1}f - E_{e,t}f) = 0$ . A complicating factor arises when we consider the importance of those individuals whom are only observed in either  $t$  or  $t+1$ , i.e. the inflows and outflows of the GSOEP. For them  $(\bar{x}_{e,t+1} - \bar{x}_{e,t})\widehat{\beta} + (\widehat{\delta}_{t+1} - \widehat{\delta}_t)$  is still easily computed, but the unknown component  $(E_{e,t+1}f - E_{e,t}f)$  poses a problem. This term is only 0 when the distribution of the unknown characteristics is constant over time. This is clearly very improbable because, for instance, education levels and expectations will differ. From the fixed-effect ordered logit results alone, there is no information on  $(E_{e,t+1}f - E_{e,t}f)$ . We hence have to use extra information in order to get an estimate of this term.

In order to get an estimate of  $(E_{e,t+1}f - E_{e,t}f)$ , we make the following assumption:

$$E\{GS(GS^* + \Delta) - GS(GS^*)\} = \Delta\mu + \sigma(\Delta) \quad (8)$$

This assumption implies that the change in observed satisfaction is (by approximation) linear in the change in latent satisfaction. The responsiveness itself,  $\mu$ , is taken to be constant over time. This first-order approximation can now be used, by noting that we can estimate  $\mu$  by calculating, for those individuals whom we observe in all time-periods, what the response is of the observed satisfaction levels to the estimated changes in latent satisfaction. A consistent estimator for  $\mu$  is hence:

$$\widehat{\mu} = \frac{\sum_t \sum_{S_t} (GS_{t+1} - GS_t)}{\sum_t \sum_{S_t} (x_{t+1} - x_t)\widehat{\beta}} \quad (9)$$

where we have dropped the subscript  $e$ .



Having this estimate of  $\mu$ , we can now use (5) to get a consistent estimator of  $(E_{e,t+1}f - E_{e,t}f)$ :

$$\widehat{(E_{e,t+1}f - E_{e,t}f)} = \frac{\overline{GS}_{t+1} - \overline{GS}_t}{\widehat{\mu}} - (\bar{x}_{t+1} - \bar{x}_t)\widehat{\beta} \quad (10)$$

In order to provide additional insight in the factors affecting life satisfaction we further decompose  $(x_{t+1} - x_t)\beta$  into separate groups of variables. In particular, we decompose the total changes in latent satisfaction into changes in:

1. Household Income.
2. Job related variables: fired, employed, non-participation, part-time employed, on parental leave, spouse fired.
3. Family related variables: the number of children, birth, marital status, divorced, separated.
4. Health related variables: the number of days in hospital, the death of a partner, the presence of someone disabled in the household.
5. Moving from East to West.
6. Unobserved average variables: age\*age (which cannot by itself have an effect) and time parameters.
7. The unobserved individual effects distribution.

It is possible to attach a causal explanation to the changes due to groups 1 to 5. Given the changes in characteristics, they explain a part of the changes in latent satisfaction levels. The changes due to groups 6 and 7 are not explained by anything observed and hence form the ‘true’ unexplained part of the changes over time. The higher these terms, the less well our variables capture the important aspects of the changes over time.

We can construct confidence intervals for most elements in the decomposition by noting that, because  $\widehat{\beta} \sim N(\beta, \Sigma)$ , it holds that  $(\bar{x}_{t+1} - \bar{x}_t)\widehat{\beta} \sim N(\beta, (\bar{x}_{t+1} - \bar{x}_t)\Sigma(\bar{x}_{t+1} - \bar{x}_t)')$ . When we replace  $\Sigma$  with its Maximum Likelihood estimate, this yields confidence intervals. Since the term  $\frac{\overline{GS}_{t+1} - \overline{GS}_t}{\widehat{\mu}}$  in the formula  $\widehat{(E_{e,t+1}f - E_{e,t}f)}$  is not well behaved (i.e. there is no a priori reason for it to have a bounded mean or variance), we cannot use standard inference or bootstrapping methods to compute confidence bands for  $\widehat{(E_{e,t+1}f - E_{e,t}f)}$ . What we hence report is whether

$\widehat{(E_{e,t+1}f - E_{e,t}f)}$  contains 0 in the set of values when each of the stochastic elements in  $\widehat{(E_{e,t+1}f - E_{e,t}f)}$  can range in its 95% confidence interval.

As a final exercise we use the causal model to decompose the differences between East and West. We use the following decomposition:

$$E\{GS_{e,1999}^*(x_{w,1999}) - GS_{e,1999}^*(x_{e,1999})\} = (\bar{x}_{w,1999} - \bar{x}_{e,1999})\widehat{\beta}_e \quad (11)$$

which tells us how much latent satisfaction changes East Germans would experience if they moved to the West and attained West characteristics.

The above decomposition does not yet quantify what would have to happen for East Germans to become equally satisfied or happy as West Germans. Therefore, we also compute how much the unobserved characteristics would have to change in order for East Germans (who now have all become West-Germans) to get the same satisfaction levels as current West Germans. This means calculating:

$$E\{GS_{e,1999}^*(x_{w,1999}) - GS_{w,1999}^*\} = E_{e,1999}f - E_{w,1999}f \quad (12)$$

Having estimated  $\mu$  already, we can apply the same methodology as described above to estimate this difference.

If  $E_{e,1999}f - E_{w,1999}f$  is small, then the factors that explain the difference between East and West Germans are included in our model. This would mean that the difference is not then attributable to different unobserved individual characteristics of East Germans. However, if we find that this term is large, then there is something fixed about the characteristics of the East Germans that make them less (or more) satisfied. It would mean that if the observed population characteristics of East Germany would coincide with that of West Germany *and* the unobserved general characteristics of West Germany would apply in East Germany also (general culture, public good provisions, etc.), East Germans would still not be equally satisfied as West Germans.

## 5. Empirical Results

### *Random-Effects Results*

We begin by discussing the parameter estimates from the Ordered Probit models with random-effects for East (Table 2) and West (Table 3) Germans. Following convention, given the non-linear nature of the model, we also provide marginal effects (ME) estimated at the mean values of the explanatory variables and setting  $\nu_i$  and  $\varepsilon_{it} = 0$  to ease quantitative interpretation (see

equation 1). The ME's are calculated as the change in the probability of reported high life satisfaction (either 9 or 10) relative to values 8 and below.

For both East and West Germans we find a significant U-shaped relationship between age and life satisfaction. The minimum is at about 45 years of age for all groups, except for Eastern Females, who experience their minimum at about 54. With the exceptions of Eastern Females, being an immigrant is associated with a significant decline in reported satisfaction, with the ME being particularly large for East German male immigrants (ME= -0.268). Being married is universally found to correlate with high life satisfaction, with the ME being roughly the same magnitude for each of the four groups (ME ranges from 0.029 to 0.045). As expected having separated in the last 12 months is associated with a significant fall in life satisfaction for East and West Germans. However, the quantitative impact of separation is greater for Eastern men (ME=-0.052) and women (ME=-0.177) compared to West Germans (ME= -0.040 and -0.031). Perhaps due to the typical lengthy period between separation and legal divorce in Germany, we find little evidence that having experienced a divorce in the last 12 months (with the tentative exception of Eastern Females) is correlated negatively with life satisfaction. As expected, the death of spouse in the previous year is associated with a very large decline in life satisfaction, this particular major life event having the largest quantitative effect (combined with unemployment) of all the variables included in the models. The effect is particularly large for East German men (ME=-0.290) and women (ME=-0.163). In agreement with previous studies, having a physical disability is universally associated with a decline in life satisfaction, with the magnitude of this effect being similar for East and West Germans. In addition, we find new evidence that, conditional on disability, having been in hospital in the last year leads to a continuing fall in satisfaction as the number of days in hospital increase.<sup>9</sup>

Interestingly, we find that having children is associated with higher life satisfaction for East German males and females, the converse, however, appears to be true for West Germans. In particular, the ME associated with an additional child is 0.023 for Eastern males and 0.015 for Eastern females, compared to -0.004 and -0.007 for their respective Western counterparts. In contrast, having a baby in the last year is associated with increased life satisfaction only for West German men and women. Having an invalid in the household (usually your spouse or parent) correlates with lower satisfaction, the ME's being larger for East than West Germans. Years of schooling is found to be positively related to life satisfaction for West German men and women, but no significant correlation is found for East or West Germans.

In line with the results from previous studies of life satisfaction in West Germany, we find that being employed is associated with a large and significant life satisfaction gain relative to

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<sup>9</sup> This variable is entered in the models as a logarithmic in order to capture the diminishing effects of extra days in a hospital.

unemployment. However, we also provide new evidence that this is also the case for both East German men and women. In fact, the ME's associated with being employed are at least twice as large for East than West Germans, suggesting that the detrimental effect of being unemployed is particularly large in the East. Since we have also controlled for household income in our models, this also implies that the non-pecuniary costs associated with being unemployed might be higher in the East than the West. This could reflect the poor re-employment chances of laid-off East German workers and the stress of long-term unemployment there. For females, we additionally find that both full-time and part-time employment are more favourable labour market states than being unemployed. This is not that surprising, given the particularly strong traditional attachment of East German women to the labour market. As Clark and Oswald (1994) argue, these findings suggest that unemployment in both East and West Germany is predominantly involuntary in nature (Gerlach and Stephan, 1996; Winkelmann and Winkelmann, 1998). For all our groups, we find that being a non-participant in the labour market is preferable to being unemployed (but not as good as being employed). However, the welfare gain is once again largest for East Germans. We have also found new evidence that being on maternity leave is significantly better than unemployment for both females groups (but not employment for East German females), reflecting the more voluntary nature of this life choice. Finally, we find that being fired from your job in the last 12 months is associated with a significant decline in life satisfaction for all of the groups. The quantitative impact is greater for East than West Germans. However, whether or not these effects are indeed causal can only be truly ascertained by the fixed-effect models.

Household income is found to be positively and significantly related to life satisfaction for all groups, but the gain in satisfaction from increased income is greater in the East than the West. Finally, it is often said that moving house is one of the most stressful life events, however, we find no evidence to support this for either East or West Germans. Perhaps this stress is very short lived, and is not captured in our yearly change variable.

Turning to our reunification-related variables, we find significantly higher life satisfaction for individuals who, following reunification, moved from the East to the West. This effect is quantitatively large, increasing the probability of reporting high life satisfaction (i.e. 9 or 10) by 0.161 for males and 0.143 for females. In sharp contrast, moving from the West to the East is associated with a significant decline in life satisfaction, relative to those who stayed in the West. Whether this is due to better circumstances in West Germany, or due to the possibility that the happier move to West Germany, needs to be determined by the fixed-effects model. Contrary to our expectations, we have found no evidence that living on the border of East and West Germany had any differential effect on life satisfaction compared to those living away from the border.

Importantly, turning to the year dummies, we see a continued increase in life satisfaction between 1991 and 1999, with the large ME of 0.259 and 0.285 for 1999, relative to 1991, for East

German men and women, respectively. This suggests that Eastern males, for example, had a 0.259 increased probability of reporting high life satisfaction in 1999 relative to 1991, conditional on controlling for economic and demographic characteristics. Therefore, there existed some unobservable change, captured in our year variables, which lead to an increased level of life satisfaction for East Germans in the post-reunification period. A very different time profile is found for West Germans. The time dummies are negative and significant for both West German males and females, relative to 1991, suggesting that life satisfaction declined in West Germany between 1991 and 1997. It then improved slightly up until 1999 (but had not returned to 1991 level by 1999). Some of this might be explained by the massive increase in German public debt and the "Solidarity Payroll Tax" to finance the reconstruction of the East by the West. This implies that reunification had some cost in terms of life satisfaction for West Germans. Thus, reunification cannot be seen as a pure Pareto improvement, although appropriate counterfactuals are difficult to identify.

#### *Fixed-Effects Results*

Tables 4 and 5 provide the causal estimates from the Ordered Logit model with fixed-effects for East and West German, males and females, respectively. The Tables also show the values of our test-statistic for the appropriateness of the fixed-effects model relative to the random-effects specification. For men, the number of restricted parameters is 18, for which the 1% critical value of the chi-squared distribution is 34.81. For men in West Germany, this means the null of no difference between the random-effects and fixed-effects model is rejected. In East Germany, the null is not rejected, though for men in East and West combined it is rejected. For females, the number of restricted parameters is 20 and the appropriate 1% chi-square critical value is 37.6, from which we can see that the null hypothesis is strongly rejected for females in West Germany and even more strongly for females in East Germany. As a test of total changes with the fixed-effects, it holds that the sum of the test statistics is under the null chi-square distributed with 76 degrees of freedom. The sum of the test-statistics is 185.5 and the 0.1% critical value of the chi-square distribution with 76 degrees of freedom is 119.9. Bearing in mind that the test statistic was biased towards accepting the null, our specification tests hence clearly point to the presence of fixed-effects.

Unfortunately, the fixed-effect model does not provide estimates of the probabilities of having a particular level of life satisfaction, thus it has no Marginal Effects (ME) proper. By approximation, however, an increase of 1 in a variable with coefficient  $\beta$  has an effect of  $\hat{\mu}\beta$  on *expected* life satisfaction. The coefficients from the fixed-effect model can furthermore be compared with the coefficients from the random-effects model multiplied by the estimate of  $\alpha$ .

Importantly, many of the key relationships found from the random-effects model hold qualitatively for the models allowing for fixed-effects. In particular, we find that the effect of a recent separation, death of spouse or some other family member still have a negative impact on life satisfaction (although some of these effects are no longer strongly significant). Similarly, being disabled, spending time in hospital, having an invalid in the household and getting fired are all estimated to reduce life satisfaction. Importantly, our results with respect to the detrimental effect of unemployment and the positive effect of employment on life satisfaction remain statistically robust for both East and West Germans. This clearly points to the involuntary nature of unemployment in both locations (Clark and Oswald, 1994).

Moving from the East to the West of Germany increases expected satisfaction of East German males by about  $\hat{\mu} * 0.744 \approx 0.40$ . This implies that it is not the (unobserved) happy who moved from East to West. There is a genuine satisfaction gain from living in West Germany, which is independent of the possible associated changes in income and other variables included here. However, we no longer find any evidence that moving from the West to the East had an unfavourable effect on life satisfaction, which suggests that was the relatively unhappy who moved to East Germany.

A major difference with the random-effects results is that the effect of marriage is much smaller, especially in West Germany. This suggests that being married is related to individual fixed characteristics that increase satisfaction. Apparently, the happier West Germans are more likely to get married, perhaps because they have characteristics that make them both happier and more desirable partners. Conversely, having children in East Germany is found to have a much greater positive effect with the fixed-effect model than with the random-effects model. The fact that the random effect model did not pick up the positive effect of children implies that it is the relatively less happy in East Germany who had many children. The results with respect to having a newborn also suggest that the random-effects model underestimates the positive effect of children in East Germany especially, indicating a propensity of the less happy to get more children.

A slight difference occurs with respect to the impact of income: the coefficient for household income (which is identified from income changes) in East Germany has about double the satisfaction effect in the fixed-effect case, than it has in the random effect case, and it is much higher in the East than in the West. An increase of 1 in  $\ln(\text{income})$  increases expected satisfaction of East German males by about  $\hat{\mu} * 0.430 \approx 0.23$  (and  $\approx 0.33$  for females). The large effect concurs much more with the economists' intuition that money must surely matter a lot, even though many other studies find only small effects (e.g. Clark and Oswald 1994). The coefficient (in comparison to the coefficients of other variables) is amongst the highest found in this literature, even with the same data (see Ferrer and Frijters, 2001). A potential reason is that our

data is very "clean": measuring incomes by surveys is notoriously difficult because respondents under-report transient elements of income, such as bonuses, side-benefits, holiday payments, etc. However, the GSOEP contains information on more than 50 sources of income, detailed at the monthly level. See Burkhauser et al. (1999) for more information on this.

Finally, it is important to note that the year dummies are quite different to those for the random-effect case, because year effects in the fixed-effects case include age effects and unobservable variables, making them incomparable. We further investigate the importance of general changes (captured by our year and age variables) in the post-reunification period, impacting on the life satisfaction of East Germany, in the following decomposition analysis using the estimates from the fixed-effects models highlighted in Section 4.

### *Decomposition Results*

The results from our decomposition experiments for East German males and females are provided in Tables 6 and 7, respectively.

Beginning with females, we see that in the four years after transition (Total Change, 1991-1995) average latent life satisfaction increased by a 0.715. Changes in the general circumstances for this group over these years, captured by our year/age variables, accounted for the largest component of improved wellbeing (i.e. 0.370). In addition, increases in real household income following reunification additionally accounted for a 0.147 increase in average life satisfaction (average real household income increased from 40,320 DM to 52,530 DM per year between 1991 and 1995). These gains were somewhat offset by negative changes in job status (the unemployment rate increased from 10.4% in 1991 to 16.1% in 1995). Family circumstances and health circumstances seem on average to have become somewhat worse over the entire period, but their total effects are small compared to income, job and year effects. The unobserved fixed characteristics of new people in the sample are higher than those for people already in the sample, explaining about 30% (0.292) of the life satisfaction gain. This might suggest that younger females (newly entering the panel) were structurally happier than the older female cohorts. A possible explanation is that younger females might have had less human capital (sunk cost) written-off in the reunification process and were more flexible, thus able to gain from reunification.

The decomposition results differ considerably for the later years following reunification (i.e. 1995-1999). Although average life satisfaction increased by 0.339 between 1995 and 1999, this can mostly be attributed to the higher unobserved fixed-effect of new entrants into the panel. In sharp contrast to the earlier period, the general change in life satisfaction captured by the year/age variables was large and negative (-0.428) suggesting that changes to the general living environment (e.g. political and social, since we capture economic changes through the income

and job variables) for East German females worsened after 1995. However, there was a small improvement due to rising real household income (up to 54,780 DM per year by 1999), as well as for jobs (unemployment fell to 12.5% by 1999), health and residential mobility within East Germany. A small negative factor affecting life satisfaction was a slight worsening of family circumstances.

Looking at the hypothetical assimilation of the entire East German population into West Germany, we see a large increase in average latent life satisfaction of 1.062. About 6% of this welfare gain can be attributed to increases in household income, whilst a very small loss in satisfaction is accounted for by the job variables. Importantly, we find that about 40% of the total gain in  $E\{GS_{e,1999}^* - GS_{w,1999}^*\}$  is due to average circumstances in West Germany, picked up by the moving category (0.419). We find no large change due to differences in job, family or health characteristics. Finally, around 60% of  $E\{GS_{e,1999}^* - GS_{w,1999}^*\}$  consists of differences in the fixed-effects distribution. This suggests that West German females are generally (in unobservables) 'happier' than their East German counterparts. Hence for females, the model does seem to miss out on individual characteristics (e.g. level of optimism) that differ over East and West that explain satisfaction levels.

Turning to East German males, we find that average latent life satisfaction in East Germany rose by 1.014 over the period 1991 to 1999. However, about 80% of this gain occurred in the first four years of the data (1991-1995). Of this latter increase in satisfaction (0.829), about 50% can be attributed to improvements in the general living environment in East Germany following reunification and are captured by our year/age variables. We also see clear evidence of a gain in satisfaction resulting from increases in real household income (average household income was 42,880 DM per year in 1991, compared to 54,260 DM per year in 1995), but a small fall attributable to worsening job outcomes (unemployment rose from 7.0% in 1991 to 10.0% by 1995). The satisfaction gain due to improving general living environment and higher incomes, however, was partly offset by worsening job status, family circumstances and health. A slight welfare gain is attributable to residential mobility within East Germany. It is also clearly the case that new entrants into the panel between 1991 and 1995 had a higher unobservable fixed-effect, accounting for 0.292 of the total satisfaction increase.

As was the case for females, the second half of the period (1995-1999) witnessed a smaller increase in average male life satisfaction (0.185) than in the immediate years following reunification (0.829). We also find evidence of a worsening of the general environment (captured by the year/age variables) after 1995 causing a modest (0.105) decline in average life satisfaction. In comparison to the immediate year following reunification, only a very small increase in satisfaction can be attributed to rises in household income (household income only increased from 54,260 DM per year in 1995 to 56,930 DM per year by 1999). We also find evidence of a



slight worsening of job, family and health circumstances impacting negatively on satisfaction levels. As with the earlier years, the decomposition analysis points to the importance of changes in the fixed-effects in explaining improvements in life satisfaction, resulting from entrants and exits into the panel.

Finally, we again see a modest satisfaction increase due to real income increases from our hypothetical assimilation of East Germans into West Germany. Contrary to the female results, although we see that satisfaction would also increase due to improving job status. This probably reflects the fact that work participation levels in the East compared to the West are higher for females but lower for men. In terms of work status men have something to gain from moving to the West but females do not. Almost the entire gain for East Germans becoming West Germans (0.939) would, however, be in the general circumstances in West Germany (the effect of moving). Contrary to the females, the difference in fixed characteristics is considerably smaller:  $E_{e,1999}f - E_{w,1999}f$  is only 0.137, which is less than 15% of  $E\{GS_{e,1999}^* - GS_{w,1999}^*\}$ . Hence, the difference in satisfaction between East and West German males is almost entirely explained by differences in observed characteristics and by the not-individual-specific satisfaction gain of moving to West Germany. There are apparently no important individual specific variables that we seem to have left out of our model for males that affect the difference between East and West satisfaction levels.

The main conclusions from the decomposition analyses are that higher real household incomes and improved average circumstances, picked up by year/age controls, led to significant gains in satisfaction levels in East Germany after the transition. The largest effects, however, were clearly seen in the immediate years following reunification. These were somewhat offset by job-losses and worsening family and health circumstances, but not to any great extent. The remaining and dominant differences in satisfaction between East and West Germans seem largely attributable to average circumstances, such as the environment, general attitudes, or public services. For females, unobserved individual differences are also important in explaining the remaining difference between East and West German satisfaction levels. Finally, our results emphasise the importance of controlling for changes in the fixed-effect distribution when using an unbalanced panel data for econometric analysis.

## 6. Conclusion

We have used nine waves of the German Socio-Economic Panel to investigate the patterns and determinants of life satisfaction for residents of both East and West Germany, in the years following reunification (1991-1999). Life satisfaction is often taken as a direct proxy for utility or welfare, so studying the welfare outcomes of one of the last century's largest economic and political changes is particularly interesting. Reunification in Germany is also as close to a 'natural'

experiment as is typically experienced in economics, as it is well documented that few commentators anticipated the 'falling of the wall', nor the resulting rapid endowment of a former communist country with a set of market institutions. The raw data suggests that East Germans experienced a continued improvement in life satisfaction, whilst West German satisfaction levels gradually fell, in the years following reunification. However, it remained the case that even by 1999, life satisfaction levels in East German continued to be below those of West Germans.

Given the ordinal nature of the life satisfaction (ranging 0 → 10) measure included in the data, we estimate ordered probit models with random-effects (RE), but also develop a conditional estimator for the fixed-effect ordered logit model (FE) to establish causality and allow for individual heterogeneity. Separate models are fitted for East and West Germans, males and females. A test for equality of the estimated parameters of the RE and FE models is then proposed. We find strong evidence of fixed-effects, which supports the findings in the psychological literature that (typically unobserved) individual personality traits are important predictors of life satisfaction (see Diener and Lucas, 1999, for a review). The use of the fixed-effect ordered logit model is an improvement on previous studies, who have arbitrarily collapsed the life satisfaction scale into a binary measure in order to estimate conditional fixed-effect binary logit models. Using the full ordering of the life satisfaction measure allows us to use around 90% of observations, compared to around 50% for the binary logit model (see, for example, Clark et al., 20001 and Winkelmann and Winkelmann, 1998).

We have also contributed to the general life satisfaction and happiness literature by exploring the role of both socio-economic factors and major 'life-events' in determining life satisfaction levels. As with previous studies of Germany we find that unemployment leads to a large decline in life satisfaction, whilst satisfaction is positively related to household income. These findings are robust to controls for individual heterogeneity. The former finding supports the belief that unemployment is predominantly involuntary in West Germany (Gerlach and Stephan, 1996; Winkelmann and Winkelmann, 1998), but also provides new evidence that this is also the case in East Germany. Moreover, we find new evidence of the negative impact on life satisfaction of major 'life-events' such as death of a spouse, death of another family member, marital separation, illness captured by time spend in hospital and being fired from your job, all in the previous twelve months. The latter finding, combined with our general finding concerning unemployment, suggests that people may partly adapt to unemployment with the first twelve months of unemployment leading to the largest welfare loss. Importantly, we find that movers from the East to the West of Germany following reunification experienced a large satisfaction gain over those who stayed in the East. In contrast, we find no significant difference in life satisfaction between those residing on the borders of the East and West Germany, compared to those living away from the border.

Finally, using the estimates from the FE models, we have developed a new causal decomposition technique that decomposes changes in latent satisfaction over the years following reunification. We find evidence for East Germans that average life satisfaction significantly increased, particularly in the immediate period after reunification, due to increases in real household incomes and general improvements such as the political and social environment. In contrast, worsening of employment outcomes, principally due to increasing unemployment, led to a small decline in satisfaction levels. We also find that the changing distribution of fixed-effects resulting from entries and exits in the panel were important in explaining the observed increases in life satisfaction reported by East Germans.

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Figure 1: Average Life Satisfaction for East and West German Men by Year

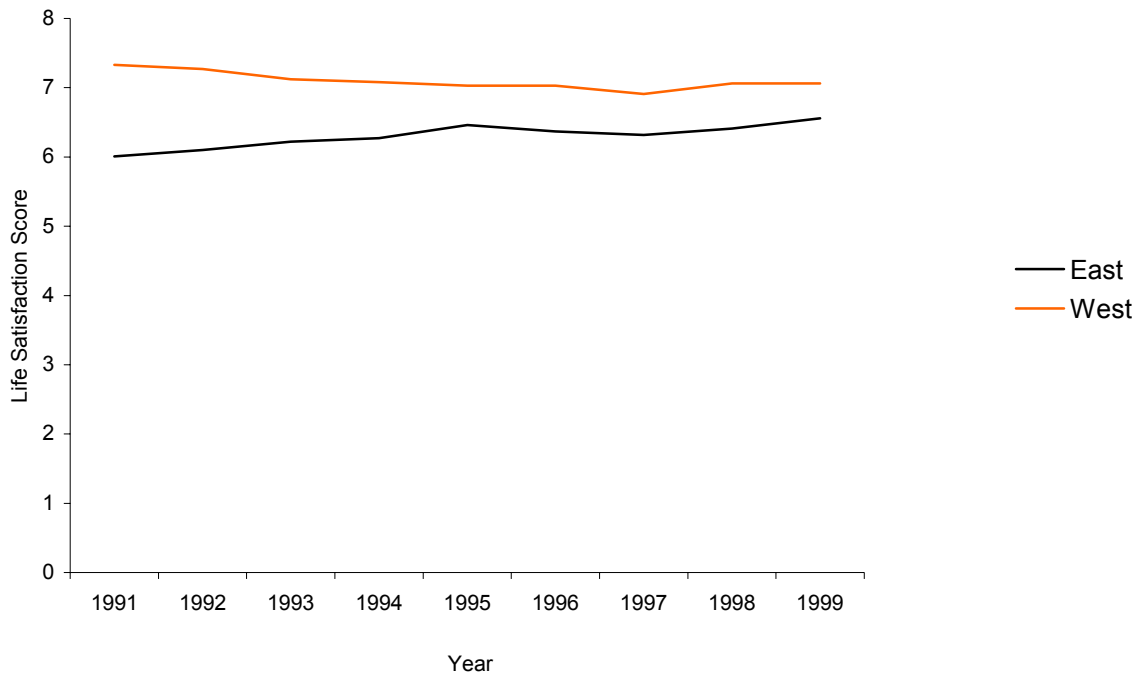


Figure 2: Average Life Satisfaction for East and West German Women by Year

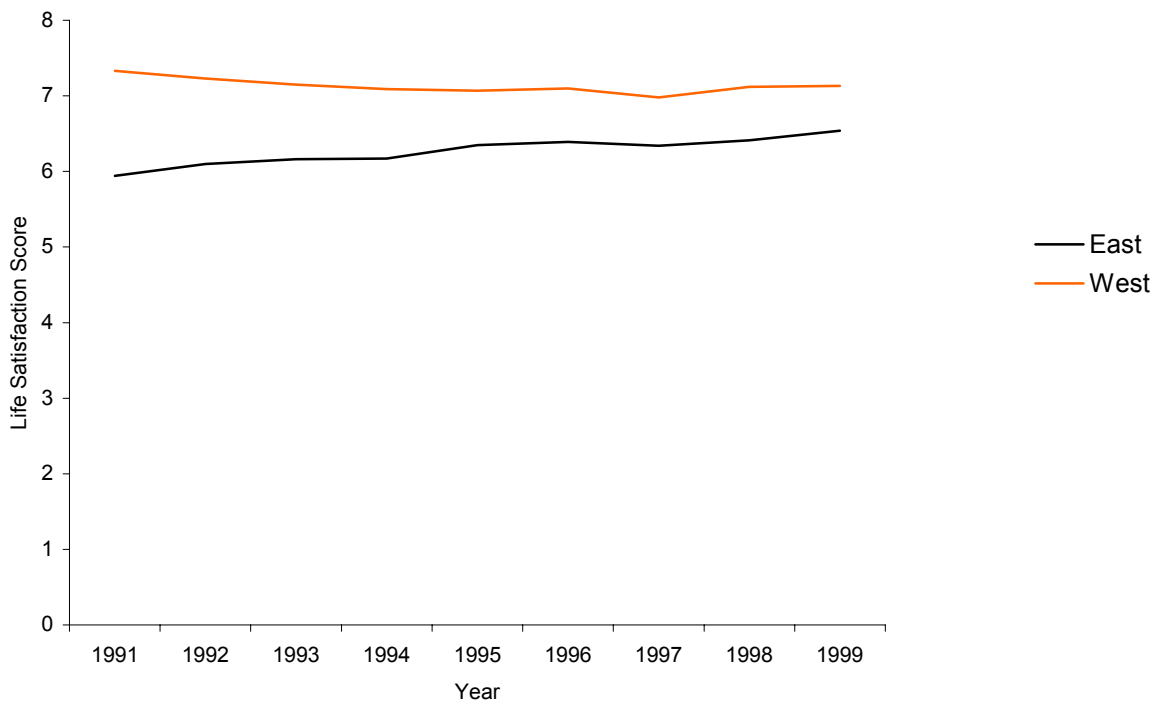


TABLE 1: The Distribution of Life Satisfaction for East and West Germans by Gender:  
(1991-99)

Percentage	East		West	
	Males	Females	Males	Females
10 (very happy)	1.2 (0.09)	1.7 (0.11)	4.9 (0.12)	5.7 (0.13)
9	4.4 (0.18)	4.2 (0.17)	11.3 (0.18)	12.1 (0.18)
8	21.8 (0.37)	21.4 (0.35)	32.1 (0.26)	32.0 (0.26)
7	24.8 (0.38)	23.5 (0.37)	23.0 (0.24)	21.6 (0.23)
6	16.1 (0.33)	15.3 (0.31)	11.3 (0.18)	10.9 (0.17)
5	18.8 (0.35)	20.7 (0.35)	10.3 (0.17)	11.1 (0.18)
4	5.5 (0.20)	5.9 (0.20)	3.1 (0.10)	2.9 (0.09)
3	4.3 (0.18)	4.4 (0.18)	2.2 (0.08)	2.1 (0.08)
2	1.9 (0.12)	1.7 (0.11)	1.0 (0.06)	0.9 (0.09)
1	0.5 (0.06)	0.5 (0.06)	0.4 (0.03)	0.3 (0.03)
0 (very unhappy)	0.7 (0.07)	0.7 (0.07)	0.4 (0.04)	0.5 (0.04)
Mean	6.30*	6.26*#	7.10	7.13

Notes: Standard errors are in parentheses. \* indicates that the average levels of life satisfaction are significantly lower at the 5% level of significance for East German men and women compared to their West German counterparts. # indicates that the average levels of life satisfaction are significantly difference at the 5% level of significance for East German men compared to East German women (this differential is not significant between West German men and women).



TABLE 2: The Determinants of Life Satisfaction for East German Males and Females:  
Ordered Probit Models with Random-Effects

Covariates	Males			Females		
	$\beta$	<i>t</i> -stat	ME	$\beta$	<i>t</i> -stat	ME
Age	-0.094	-7.99	-0.034	-0.103	-9.32	-0.037
Age squared/100	0.108	7.92	0.001	0.121	9.26	0.001
Foreigner-born	-0.736	-1.99	-0.268	-0.062	-0.12	-0.023
Married	0.124	2.70	0.045	0.087	2.20	0.031
Separated in last 12 months	-0.143	-1.65	-0.052	-0.491	-6.15	-0.177
Divorced in last 12 months	0.106	0.58	0.039	-0.214	-1.64	-0.077
Spouse died in last 12 months	-0.795	-3.79	-0.290	-0.451	-2.55	-0.163
Death of other family member in last 12 months	-0.089	-0.73	-0.033	-0.177	-1.17	-0.064
Disabled	-0.152	-2.44	-0.056	-0.139	-2.65	-0.050
Ln(1+number of days in hospital in last year)	-0.007	-4.72	-0.003	-0.008	-4.89	-0.003
Number of children	0.064	3.33	0.023	0.042	2.09	0.015
Had a baby in last 12 months	-0.005	-0.07	-0.002	0.120	1.33	0.043
Invalid in household	-0.270	-3.20	-0.098	-0.484	-6.02	-0.175
Years of schooling	0.017	1.57	0.006	-0.006	-0.53	-0.002
Employed (all employed for males, full-time only for females)	0.636	17.86	0.232	0.567	17.42	0.205
Employed part-time	-	-	-	0.489	11.63	0.177
Maternity leave	-	-	-	0.369	4.66	0.133
Non-participant	0.424	8.46	0.154	0.302	6.60	0.109
Fired in last 12 months	-0.115	-2.61	-0.042	-0.098	-1.98	-0.035
Log household income (post tax)	0.209	8.18	0.076	0.195	8.01	0.070
Moved home within East Germany in last 12 months	-0.076	-1.12	-0.028	-0.058	-0.94	-0.021
Moved to West Germany following reunification	0.441	5.05	0.161	0.397	4.94	0.143
Live on the border of East and West Germany	0.045	0.79	0.017	0.256	4.65	0.092
Member of the Communist Party before reunification	-0.068	-1.13	-0.025	0.023	0.45	0.009
1992	0.105	2.38	0.038	0.174	3.95	0.063
1993	0.225	4.23	0.082	0.263	4.92	0.095
1994	0.290	4.48	0.106	0.313	4.75	0.112
1995	0.491	6.19	0.179	0.478	5.99	0.172
1996	0.465	5.03	0.169	0.560	5.88	0.202
1997	0.470	4.34	0.171	0.564	5.10	0.203
1998	0.544	4.44	0.198	0.660	5.26	0.238
1999	0.711	5.15	0.259	0.790	5.56	0.285
Years in panel	-0.036	-2.08	-0.013	-0.050	-2.80	-0.018
Std. Deviation of the random effect	0.919	45.80	-	0.873	45.76	-
Log likelihood	-13489			-14459		
Sample (observations)	12817			13500		

Notes: Constant threshold parameters were also estimated. ME refers to the change in the probability of having high satisfaction (9 or 10) as opposed to 8 or lower.

TABLE 3: The Determinants of Life Satisfaction for West German Males and Females:  
Ordered Probit Models with Random-Effects

Covariates	Male			Female		
	$\beta$	<i>t</i> -stat	ME	$\beta$	<i>t</i> -stat	ME
Age	-0.053	-6.89	-0.008	-0.051	-7.08	-0.006
Age squared/100	0.061	6.80	0.000	0.056	6.57	0.000
Foreigner-born	-0.081	-2.30	-0.012	-0.171	-4.65	-0.021
Married	0.222	8.13	0.032	0.232	9.29	0.029
Separated in last 12 months	-0.279	-4.81	-0.040	-0.233	-4.95	-0.031
Divorced in last 12 months	-0.012	-0.13	-0.002	-0.061	-0.74	-0.008
Spouse died in last 12 months	-0.734	-4.20	-0.106	-0.822	-7.32	-0.103
Death of other family member in last 12 months	-0.262	-2.41	-0.038	-0.033	-0.21	-0.004
Disabled	-0.267	-7.99	-0.039	-0.374	-9.91	-0.047
Ln(1+number of days in hospital in last year)	-0.009	12.36	-0.002	-0.006	-7.97	-0.001
Number of children	-0.031	-2.59	-0.004	-0.054	-4.50	-0.007
Had a baby in last 12 months	0.153	4.12	0.022	0.214	5.26	0.027
Invalid in household	-0.307	-6.15	-0.044	-0.390	-7.47	-0.049
Years of schooling	0.024	3.86	0.003	0.032	4.79	0.004
Employed (all employed for males, full-time only for females)	0.707	24.82	0.102	0.428	13.18	0.053
Employed part-time	-	-	-	0.405	11.35	0.051
Maternity leave	-	-	-	0.389	8.20	0.049
Non-participant	0.557	15.68	0.081	0.393	11.75	0.049
Fired in last 12 months	-0.158	-3.51	-0.023	-0.088	-1.64	-0.012
Log household income (post tax)	0.139	8.73	0.020	0.147	10.15	0.018
Moved home within West Germany in last 12 months	-0.052	-1.10	-0.008	0.002	0.04	0.000
Moved to East Germany following reunification	-0.392	-3.39	-0.057	-0.430	-4.17	-0.054
Live on the border of East and West Germany	-0.027	-0.60	-0.004	-0.042	-0.94	-0.005
1992	-0.044	-1.50	-0.006	-0.060	-2.01	-0.008
1993	-0.139	-4.67	-0.020	-0.091	-3.06	-0.011
1994	-0.141	-4.70	-0.020	-0.140	-4.72	-0.018
1995	-0.164	-5.28	-0.024	-0.127	-4.14	-0.016
1996	-0.158	-5.00	-0.023	-0.109	-3.42	-0.014
1997	-0.254	-7.37	-0.037	-0.189	-5.56	-0.024
1998	-0.136	-4.00	-0.020	-0.096	-2.90	-0.012
1999	-0.113	-3.18	-0.016	-0.059	-1.67	-0.007
Years in panel	-0.027	-7.77	-0.004	-0.030	-8.68	-0.004
Std. Deviation of the random effect	0.999	76.38	-	0.981	74.68	-
Log likelihood	-31963			-32816		
Sample (observations)	31895			31973		

Notes: Constant threshold parameters were also estimated. ME refers to the change in the probability of having high satisfaction (9 or 10) as opposed to 8 or lower.

TABLE 4: The Determinants of Life Satisfaction for East German Males and Females:  
Ordered Logit Models with Fixed-Effects

Covariates	Males		Females	
	$\beta$	<i>t</i> -stat	$\beta$	<i>t</i> -stat
Age squared/100	0.080	1.74	0.170	5.03
Married	0.152	1.01	0.025	0.15
Separated in last 12 months	-0.341	-1.65	-0.593	-3.14
Divorced in last 12 months	0.560	1.34	-0.581	-1.89
Spouse died in last 12 months	-1.838	-3.57	-1.073	-3.02
Death of other family member in last 12 months	-0.050	-0.18	-0.073	-0.25
Disabled	-0.093	-0.63	-0.058	-0.38
Ln(1+number of days in hospital in last year)	-0.073	-2.00	-0.088	-2.67
Number of children	0.236	3.70	0.105	1.63
Had a baby in last 12 months	0.124	0.76	0.225	1.19
Invalid in household	-0.165	-0.74	-0.346	-1.69
Employed (all employed for males, full-time only for females)	0.838	9.60	0.876	10.41
Employed part-time	-	-	0.711	6.55
Maternity leave	-	-	0.551	3.15
Non-participant	0.584	4.50	0.317	2.70
Fired in last 12 months	-0.037	-0.37	-0.077	-0.72
Log household income (post tax)	0.430	4.62	0.586	6.75
Moved home within East Germany in last 12 months	-0.022	-0.19	0.101	0.88
Moved to West Germany following reunification	0.744	2.90	0.538	2.07
Live on the border of East and West Germany	-0.047	0.18	0.330	1.47
1992	0.111	1.24	0.148	1.88
1993	0.265	2.27	0.103	1.11
1994	0.198	1.35	0.046	0.43
1995	0.415	2.30	0.201	1.54
1996	0.351	1.64	-0.002	-0.01
1997	0.141	0.57	-0.189	-1.08
1998	0.203	0.71	-0.247	-1.23
1999	0.273	0.85	-0.309	-1.39
Mean Log likelihood		-2.308		-2.330
$2L(\hat{\beta}_{ML}^{FE}) - \max_{\hat{\alpha}} \{2L(\hat{\alpha}\hat{\beta}^{RE})\}$		22.18		40.13
$\hat{\alpha}$	1.39		1.52	
$\hat{\mu}$	0.533		0.561	
Sample (individuals)		1777		1834

Notes: By approximation an increase of 1 in a variable with coefficient  $\beta$  has an effect of  $\hat{\mu} \beta$  on latent life satisfaction - proving a 'Pseudo Marginal Effect'. Due to the different normalisations of the random and fixed-effects models the fixed estimates estimate should be multiplied by  $\hat{\alpha}$  to allow direct comparison with the random-effects estimates.

TABLE 5: The Determinants of Life Satisfaction for West German Males and Females:  
Ordered Logit Models with Fixed-Effects

Covariates	Males		Females	
	$\beta$	<i>t</i> -stat	$\beta$	<i>t</i> -stat
Age squared/100	-0.058	-1.95	-0.018	0.60
Married	0.050	0.62	0.043	0.54
Separated in last 12 months	-0.480	-3.94	-0.475	-4.32
Divorced in last 12 months	-0.433	-2.19	0.163	0.83
Spouse died in last 12 months	-1.052	-2.55	-1.026	-4.33
Death of other family member in last 12 months	-0.355	-1.69	0.033	0.12
Disabled	-0.012	-0.13	-0.274	-2.46
Ln(1+number of days in hospital in last year)	-0.149	-7.03	-0.104	-5.54
Number of children	-0.010	-0.28	-0.083	-2.25
Had a baby in last 12 months	0.200	2.58	0.486	5.54
Invalid in household	-0.310	-2.33	-0.507	-3.95
Employed (all employed for males, full-time only for females)	0.786	10.50	0.571	7.11
Employed part-time	-	-	0.547	6.26
Maternity leave	-	-	0.592	5.32
Non-participant	0.743	8.17	0.517	6.26
Fired in last 12 months	-0.156	-1.58	-0.261	-2.24
Log household income (post tax)	0.186	3.30	0.218	4.43
Moved home within West Germany in last 12 months	0.029	0.34	0.063	0.76
Moved to East Germany following reunification	0.159	0.44	0.153	0.38
Live on the border of East and West Germany	-0.130	-0.80	-0.017	-0.10
1992	-0.043	-0.65	-0.179	-2.75
1993	-0.206	-2.61	-0.226	-2.85
1994	-0.247	-2.57	-0.360	-3.74
1995	-0.170	-1.47	-0.343	-2.97
1996	-0.185	-1.35	-0.327	-2.40
1997	-0.351	-2.21	-0.483	-3.06
1998	-0.270	-1.49	-0.380	-2.12
1999	-0.235	-1.15	-0.453	-2.25
Mean Log likelihood		-2.1919		-2.1780
$2L(\hat{\beta}_{ML}^{FE}) - \max_{\hat{\alpha}} \{2L(\hat{\alpha}\hat{\beta}^{RE})\}$		70.23		52.95
$\hat{\alpha}$	1.06		1.23	
Sample (individuals)		4745		4770

Notes: By approximation an increase of 1 in a variable with coefficient  $\beta$  has an effect of  $\hat{\mu} \beta$  on latent life satisfaction - proving a 'Pseudo Marginal Effect'. Due to the different normalisations of the random and fixed-effects models the fixed estimates estimate should be multiplied by  $\hat{\alpha}$  to allow direct comparison with the random-effects estimates.

TABLE 6: Decomposition Results for East German Males

<b>From → To</b>	<b>Year/Age</b>	<b>Income</b>	<b>Job</b>	<b>Family</b>	<b>Health</b>	<b>Moving</b>	<b>f</b>	<b>Total</b>
1991 → 1992	0.137 (0.085)	0.039 (0.008)	-0.042 (0.007)	-0.018 (0.006)	-0.018 (0.013)	0.012 (0.004)	0.057	0.166
1992 → 1993	0.202 (0.087)	0.045 (0.010)	-0.012 (0.003)	-0.008 (0.002)	0.001 (0.002)	0.004 (0.002)	-0.012	0.219
1993 → 1994	-0.080 (0.101)	0.005 (0.001)	0.003 (0.003)	-0.023 (0.006)	0.004 (0.002)	0.015 (0.005)	0.179	0.102
1994 → 1995	0.231 (0.097)	0.003 (0.001)	0.017 (0.002)	-0.002 (0.004)	-0.006 (0.002)	0.008 (0.005)	0.091	0.342
<b>Total Change 1991 → 1995</b>	<b>0.490</b>	<b>0.092</b>	<b>-0.034</b>	<b>-0.051</b>	<b>-0.019</b>	<b>0.039</b>	<b>0.315</b>	<b>0.829</b>
1995 → 1996	-0.057 (0.102)	0.018 (0.004)	-0.020 (0.002)	-0.010 (0.004)	-0.001 (0.001)	0.003 (0.003)	-0.087	-0.155
1996 → 1997	-0.199 (0.100)	-0.012 (0.002)	-0.003 (0.001)	-0.016 (0.005)	-0.003 (0.002)	-0.003 (0.001)	0.134	-0.103
1997 → 1998	0.076 (0.099)	0.005 (0.001)	-0.017 (0.002)	-0.011 (0.003)	0.000 (0.001)	0.003 (0.003)	0.121	0.177
1998 → 1999	0.075 (0.102)	0.019 (0.004)	0.021 (0.003)	-0.008 (0.003)	0.000 (0.001)	0.003 (0.001)	0.155	0.265
<b>Total Change 1995 → 1999</b>	<b>-0.105</b>	<b>0.030</b>	<b>-0.019</b>	<b>-0.045</b>	<b>-0.004</b>	<b>0.006</b>	<b>0.323</b>	<b>0.185</b>
<b>Total Change 1991 → 1999</b>	<b>0.385</b>	<b>0.122</b>	<b>-0.053</b>	<b>-0.096</b>	<b>-0.023</b>	<b>0.045</b>	<b>0.638</b>	<b>1.014</b>
<b>East 1999 → West 1999</b>	<b>-0.036</b> <b>(0.021)</b>	<b>0.051</b> <b>(0.011)</b>	<b>0.044</b> <b>(0.005)</b>	<b>0.035</b> <b>(0.008)</b>	<b>0.003</b> <b>(0.005)</b>	<b>0.705</b> <b>(0.229)</b>	<b>0.137</b>	<b>0.939</b>

Notes: Standard errors in parentheses. For **f** an \* indicates statistically significant at the 95% confidence level. Some rounding-up error may be present in the calculations of the Total Changes.

TABLE 7: Decomposition Results for East German Females

<b>From → To</b>	<b>Year/Age</b>	<b>Income</b>	<b>Job</b>	<b>Family</b>	<b>Health</b>	<b>Moving</b>	<b>f</b>	<b>Total</b>
1991 → 1992	0.203 (0.078)	0.057 (0.009)	-0.078 (0.008)	-0.008 (0.007)	-0.028 (0.013)	0.006 (0.005)	0.120	0.271
1992 → 1993	0.020 (0.085)	0.061 (0.009)	-0.001 (0.003)	-0.005 (0.002)	0.007 (0.003)	-0.001 (0.003)	0.029	0.109
1993 → 1994	-0.058 (0.090)	0.012 (0.002)	-0.011 (0.004)	-0.007 (0.004)	-0.001 (0.001)	0.007 (0.004)	0.074	0.016
1994 → 1995	0.205 (0.094)	0.017 (0.003)	0.029 (0.004)	-0.005 (0.003)	-0.006 (0.002)	0.009 (0.004)	0.069	0.319
<b>Total Change 1991 → 1995</b>	<b>0.370</b>	<b>0.147</b>	<b>-0.061</b>	<b>-0.025</b>	<b>-0.028</b>	<b>0.021</b>	<b>0.292</b>	<b>0.715</b>
1995 → 1996	-0.177 (0.093)	0.022 (0.003)	-0.007 (0.002)	-0.004 (0.004)	0.000 (0.002)	0.001 (0.002)	0.244	0.077
1996 → 1997	-0.176 (0.100)	-0.016 (0.002)	0.006 (0.002)	-0.006 (0.003)	0.003 (0.002)	0.003 (0.002)	0.093	-0.093
1997 → 1998	-0.037 (0.097)	-0.001 (0.000)	-0.006 (0.002)	-0.001 (0.005)	-0.002 (0.001)	0.005 (0.002)	0.179	0.136
1998 → 1999	-0.038 (0.097)	0.040 (0.006)	0.023 (0.003)	-0.011 (0.003)	0.002 (0.001)	0.001 (0.001)	0.202	0.219
<b>Total Change 1995 → 1999</b>	<b>-0.428</b>	<b>0.045</b>	<b>0.016</b>	<b>-0.022</b>	<b>0.003</b>	<b>0.010</b>	<b>0.718</b>	<b>0.339</b>
<b>Total Change 1991 → 1999</b>	<b>-0.058</b>	<b>0.192</b>	<b>-0.045</b>	<b>-0.047</b>	<b>-0.031</b>	<b>0.031</b>	<b>1.010</b>	<b>1.054</b>
<b>East 1999 → West 1999</b>	<b>-0.111 (0.022)</b>	<b>0.060 (0.009)</b>	<b>-0.018 (0.015)</b>	<b>0.022 (0.009)</b>	<b>-0.001 (0.001)</b>	<b>0.419 (0.233)</b>	<b>0.690*</b>	<b>1.062</b>

Notes: Standard errors in parentheses. For f an \* indicates statistically significant at the 95% confidence level. Some rounding-up error may be present in the calculations of the Total Changes.

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