# Are Regional Differences in Utility Eliminated over Time? Evidence from Germany [1]

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## Abstract

Hedonic theory assumes that changes in land prices and wage rates eliminate the utility advantages of differing locations. Using happiness data from the German socio-economic panel this paper empirically tests whether regional utility differences exist and if so whether utility levels show any tendency to converge over time. Empirical analysis reveals substantial differences in utility over different regions of Germany. Analysing a panel of data indicates that even if individual utility levels are at any one moment in disequilibrium they are rapidly converging over Germany for all types of individuals.

**Keywords**: Convergence; Hedonic Analysis; Happiness; Migration; Germany

## 1 Introduction

The hedonic technique is a widely used method of valuing non-market goods applicable when their relative abundance varies geographically (e.g. Rosen, 1974; Roback, 1982; and Palmquist, 1991). The technique is based on the assumption that through movements in population and associated changes in wage rates and land prices, the net utility advantages of different locations are eliminated. This does not mean that all individuals attain the same level of utility but rather that individuals with identical characteristics must obtain the same level of utility irrespective of where they live otherwise they would move (Roback, 1988).[2]

Empirically there is considerable evidence that variations in land prices and wage rates are indeed associated with differences in amenities such as climate which vary significantly only at the regional level (e.g. Hoehn et al, 1988; and Gyourko and Tracy, 1989). By contrast other theorists regard the process of adjustment to hedonic disequilibrium in land and labour markets as being extremely slow and concentrate instead on analysing patterns of migration.

[1] The authors would like to thank Richard Tol for comments on an earlier draft of this paper. Any remaining errors are the sole responsibility of the authors.

[2] Roback's model includes results for different types of individuals including working and not-working as well as those offering different types of labour. Her model developed for different types of land and labour illustrates how land prices and wage rates vary with respect to the level of amenities. She illustrates also how the derivation of the marginal value of amenities depends upon the assumption that utility differences have been eliminated. Different sorts of workers compete in different markets. There may be different proportions of different types of workers in each area each type enjoying a differing level of utility.

In these studies, gross or net migration rates are typically regressed on terms representing regional differences in wage rates, land prices, unemployment rates and the levels of environmental amenities (Greenwood, 1985; and Greenwood and Hunt, 1986).

But despite these and indeed numerous other studies there is little direct evidence to indicate whether hedonic land and labour markets are ever in significant utility disequilibrium.[3] More importantly, neither is there any direct evidence as to whether regional utility-differences are ultimately eliminated through migration or price changes; much less the speed with which any such process occurs.[4] Van Praag and Baarsma (2005) are alone in claiming that hedonic land markets sometimes fail to eliminate utility differences in the context of a study looking at noise nuisance from Schipol airport.

The reason why the elimination of utility differences has not been investigated is because of economists' traditional reluctance to believe that utility is a measurable concept. Nowadays however there is a growing consensus that data on subjective wellbeing are valid and can be used for formal analysis and the number of economic analyses investigating determinants of subjective well-being is growing rapidly. It appears that economic variables like income, unemployment and inflation have a strong impact on people's subjective wellbeing (e.g. Di Tella et al, 2001; Easterlin, 2001; Frey and Stutzer, 2002; and Di Tella et al, 2003). The availability of geographically referenced survey data on subjective wellbeing makes it possible both to observe and analyse the evolution of regional differences in utility in a way hitherto impossible.[5]

This paper addresses itself to the following questions: Are there significant utility differences across regions for like individuals? Do these geographical differences in utility show signs of diminishing over time? This is important not only for establishing the validity of the hedonic technique but because equality in the standard of living between regions of a country is an imperative for policy makers in many different countries. We attempt to answer these questions using data on happiness from Germany. This country represents a particularly interesting case study given its recent history. It offers the possibility of watching quite significant utility differences disappear over time.

There have of course been numerous studies of regional migration within Germany following reunification (for an overview on internal migration since the reunification of Germany see Kemper, 2004; Schlömer, 2004; and Berentsen and Cromley, 2005). Consistent with the hedonic hypothesis both wages and land prices converged fast at least in the early years after reunification. Frijters et al (2004) use German data on happiness in order to examine whether the increases in income that accompanied reunification led to increases in utility whilst simultaneously controlling for individual specific effects.

To anticipate the main findings of this paper, it appears that whilst there are often significant interregional differences in utility in Germany there is at he same time a tendency for utility differences to be rapidly eliminated. Such findings are borne out by both parametric and nonparametric analyses and contradict the findings contained in the only other published research paper in this area.

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[3] Migration can also be viewed as a response to changes in consumption amenities and lifecycle events as well as real utility differences.

[4] Researchers employing the hedonic technique are careful to confine their analyses to areas across which the hedonic price regression is structurally stable. This implies restricting the geographical areas to those over which the net benefits of different locations have been eliminated for all classes of individuals. Researchers frequently test the geographic and temporal stability of the hedonic price regression by pooling data from different regions and time periods (Straszheim, 1974).

[5] Like other researchers we interpret 'subjective well-being', 'happiness' and 'utility' as meaning essentially the same thing.

## 2 Data

Data on 'subjective wellbeing' is available from the German annual socio-economic panel (SOEP). The SOEP is based around a set of questionnaires for both households and individuals. It was extended to include former East Germany in 1990. Since 1994 information on respondents' current health status has been included.[6] To take advantage of this latter information the analysis relies on the surveys of 1994 through to 2005. Data on individual happiness is measured on an integer 0 to 10 scale.[7]

Examining the data it appears that average utility has not changed much in Germany (see Table 1). This is consistent with the fact that the German economy has in recent years performed very badly hardly growing at all.

**Table 1. Average utility over time in Germany**

| Year | Mean | Std Dev |
|---|---|---|
| 1994 | 6.85 | 1.8456 |
| 1995 | 6.88 | 1.8324 |
| 1996 | 6.90 | 1.7856 |
| 1997 | 6.79 | 1.7941 |
| 1998 | 6.94 | 1.7768 |
| 1999 | 6.97 | 1.7830 |
| 2000 | 7.09 | 1.7776 |
| 2001 | 7.11 | 1.7357 |
| 2002 | 7.05 | 1.7423 |
| 2003 | 6.97 | 1.7706 |
| 2004 | 6.81 | 1.8201 |
| 2005 | 6.95 | 1.8303 |

[6] How would you describe your current health? Very good, good, satisfactory, poor or bad?
[7] How satisfied are you with your life, all things considered? "0" means completely dissatisfied ,"10" means completely satisfied.

Table 2 contains information on average utility levels by region. Marked differences are observed with regions in the former West Germany displaying higher levels of utility than those in the former East. It might seem that if hedonic theory were true that this would result in average utility levels being more or less the same across all regions. But as Roback's (op cit) analysis shows, regions may contain differing proportions of individual types.

**Table 2. Average utility over space 1994-2005**

| Federal States | Mean | Std Dev |
|---|---|---|
| Schleswig-Holstein | 7.31 | 1.6701 |
| Hamburg | 7.27 | 1.7041 |
| Lower Saxony | 7.17 | 1.7871 |
| Bremen | 7.24 | 2.1409 |
| North Rhine-Westphalia | 7.12 | 1.7359 |
| Hesse | 7.16 | 1.7928 |
| Rhineland-Palatinate and Saarland[1] | 7.15 | 1.7816 |
| Baden-Wuerttemberg | 7.04 | 1.7441 |
| Bayern | 7.15 | 1.7637 |
| Berlin-West | 6.74 | 1.9120 |
| Berlin-East | 6.49 | 1.8998 |
| Mecklenburg-Western Pommerania | 6.58 | 1.7365 |
| Brandenburg | 6.43 | 1.7788 |
| Saxony-Anhalt | 6.45 | 1.7983 |
| Thuringia | 6.37 | 1.7706 |
| Saxony | 6.54 | 1.7434 |

[1] Note that the SOEP aggregates the two Federal States Rhineland-Palatinate and Saarland to one region.

Table 3 presents average utility levels in Germany stratifying individuals into one of 16 different groups. These groups are defined according to gender, age, educational attainment and health status. This is similar to the disaggregation employed by Frijters et al (2004). Membership with respect to age and educational attainment is determined according to the sample mean values.[8] Unemployment rates differ markedly between the different regions of Germany and unemployment is known to be an important influence on utility. We have chosen not to stratify individuals according to whether they are unemployed. Germany has a system of national wage bargaining covering many occupations meaning that wage rates do not adjust to equalise utility across regions but rather the probability of finding employment. Employment status is not therefore a characteristic of the worker.

**Table 3. Average utility in Germany by type 1994-2005**

| Age | Education | Health | Sex | Mean | Std Dev |
|---|---|---|---|---|---|
| Young | Low | Good | Male | 7.42 | 1.5874 |
| Young | Low | Good | Female | 7.49 | 1.5588 |
| Young | Low | Poor | Male | 6.10 | 1.8933 |
| Young | Low | Poor | Female | 6.24 | 1.9118 |
| Young | High | Good | Male | 7.40 | 1.4320 |
| Young | High | Good | Female | 7.49 | 1.4533 |
| Young | High | Poor | Male | 6.17 | 1.7582 |
| Young | High | Poor | Female | 6.28 | 1.8216 |
| Old | Low | Good | Male | 7.66 | 1.4983 |
| Old | Low | Good | Female | 7.70 | 1.5591 |
| Old | Low | Poor | Male | 6.38 | 1.9118 |
| Old | Low | Poor | Female | 6.41 | 1.9274 |
| Old | High | Good | Male | 7.67 | 1.4232 |
| Old | High | Good | Female | 7.68 | 1.4906 |
| Old | High | Poor | Male | 6.50 | 1.8519 |
| Old | High | Poor | Female | 6.51 | 1.8325 |

It is to be anticipated that some groups enjoy higher utility levels than others. Consistent with the literature it appears that poor health causes unhappiness. It also appears that females are generally happier than males and that the old are happier than the young. The impact of high educational status on utility is by contrast more mixed.

Do regional utility differences exist? Our analysis suggests that if one compares like individuals then regional differences in utility indeed exist and there is significant disequilibrium. As an illustration we present in Table 4 tests of the homogeneity of average

[8] More precisely individuals are classified according to their gender; whether they are older than the sample mean of 46 years of age; whether they possess the sample mean 11.5 years of education or more; and whether their health condition is good or very good (versus satisfactory, poor or bad).

utility levels across all the different regions of Germany for the year 2005. For only one group of individuals is it impossible to reject the hypothesis of parameter homogeneity. Dividing the data further into former East and West the hypothesis of parameter homogeneity is rejected much less often. We present those tests for the year 2005 in Appendix 1.

**Table 4. Test of equality in utility across regions by type 2005**

| Age | Education | Health | Sex | $\chi^2$ statistic | Prob. |
|---|---|---|---|---|---|
| Young | Low | Good | Male | 70.36 | 0.000 |
| Young | Low | Good | Female | 66.64 | 0.000 |
| Young | Low | Poor | Male | 36.67 | 0.001 |
| Young | Low | Poor | Female | 47.35 | 0.000 |
| Young | High | Good | Male | 44.60 | 0.000 |
| Young | High | Good | Female | 40.02 | 0.000 |
| Young | High | Poor | Male | 14.84 | 0.463 |
| Young | High | Poor | Female | 30.04 | 0.012 |
| Old | Low | Good | Male | 47.83 | 0.000 |
| Old | Low | Good | Female | 71.26 | 0.000 |
| Old | Low | Poor | Male | 53.60 | 0.000 |
| Old | Low | Poor | Female | 83.70 | 0.000 |
| Old | High | Good | Male | 53.46 | 0.000 |
| Old | High | Good | Female | 53.14 | 0.000 |
| Old | High | Poor | Male | 47.90 | 0.000 |
| Old | High | Poor | Female | 60.42 | 0.000 |

## 3 Econometric analyses

Given that there are often significant differences in regional utility levels in Germany the key question is whether these diminish over time or whether they persist. This requires a panel based analysis. The following equation is used to test for the elimination of regional utility differences in which the variable $UTILITY_{it}$ represents average utility levels in region *i* in period *t* and $\overline{UTILITY_t}$ is nationally averaged utility levels

$$UTILITY_{it} - UTILITY_{it-1} = \sum_i \alpha_i + \sum_t \beta_t + \gamma\left(\overline{UTILITY}_{t-1} - UTILITY_{it-1}\right) + \varepsilon_{it}$$

The equation is estimated with 16 region-specific intercepts and 10 year-specific dummy variables. Separate regressions are run for each of the 16 types of individual. Some comment is in order regarding the interpretation of the dummy variables. A statistically significant value for any time dummy means that all members of a particular group of individuals experienced a common increase or decrease in their utility levels.[9] A statistically significant dummy variable for any of the regions would indicate that the region's attractiveness is continually changing leading to temporary utility differences.

The key explanatory variable is the one measuring the difference between average utility levels across all regions minus utility levels in a specific region. The parameter γ is expected to be between 0 and 1 depending on the speed with which utility differences are eliminated. This variable is potentially correlated with the error term so that it is instrumented using utility differences for all other types of individuals.[10] Analytical weights are attached to the observations reflecting the fact that there are markedly differing numbers of individuals in each region sharing a particular set of characteristics.[11]

The results are presented in Table 5. These indicate that in almost all cases utility levels are drawn to the national average. There are two cases where the parameter γ, although within the unit interval, is not statistically significant at the 5 percent level of confidence. These cases are for young males with high levels of education and poor health and for older males with low levels of education and good health. There are also two cases in which the parameter exceeds unity, but not to a statistically significant extent. These are the cases of young females with high levels of education and poor health and old males with high levels of education and good health. The remaining 12 cases point unambiguously to a surprisingly rapid convergence of utility to the national average.

[9] The Easterlin paradox refers to the fact that although incomes have sharply increased over time average levels of subjective well-being have not measured.

[10] Note finally that these results are largely unaffected by choosing a different set of instruments. In particular, using lagged values of utility differences does not alter the results. We also conduct Sargan's test of instrument validity. The results almost without exception uphold the assumption of exogeneity.

[11] In 1994 and 1996 there were no old, poorly educated male individuals in good health in East Berlin sampled. The size of the sample has been increasing over time.

**Table 5. Evidence on utility convergence for different types of individuals**

| Age | Education | Health | Sex | Parameter | (T-statistic) |
|---|---|---|---|---|---|
| Young | Low | Good | Male | 0.480 | (2.19) |
| Young | Low | Good | Female | 0.807 | (3.85) |
| Young | Low | Poor | Male | 0.702 | (4.33) |
| Young | Low | Poor | Female | 0.790 | (3.47) |
| Young | High | Good | Male | 0.717 | (4.06) |
| Young | High | Good | Female | 0.847 | (4.47) |
| Young | High | Poor | Male | 0.665 | (1.96) |
| Young | High | Poor | Female | 1.029 | (5.94) |
| Old | Low | Good | Male | 0.424 | (1.91) |
| Old | Low | Good | Female | 0.708 | (3.21) |
| Old | Low | Poor | Male | 0.614 | (4.83) |
| Old | Low | Poor | Female | 0.546 | (3.92) |
| Old | High | Good | Male | 1.130 | (5.87) |
| Old | High | Good | Female | 0.908 | (4.88) |
| Old | High | Poor | Male | 0.625 | (3.60) |
| Old | High | Poor | Female | 0.751 | (3.43) |

*Source: Own calculations.*

## 4 Nonparametric tests

We have also assessed the hypothesis that utility differences are eliminated using a nonparametric approach. This test is based on a 2x2 contingency table. For every individual-type this approach divides regions into those currently enjoying above average utility levels and those with below average utility levels. These groups are then further divided into those whose utility grew faster than average in the next time period and those whose utility grew more slowly or did not grow at all (see Table 6 for an example). If utility differences are to be eliminated over time then we would expect to find that those regions where utility is above average to exhibit below average growth next time period.

**Table 6. The 2x2 contingency table for young males with low educational attainment and good health**

| | Next period greater than average change in utility | Next period below average change in utility |
|---|---|---|
| Above average utility | 29 | 51 |
| Below average utility | 62 | 34 |

*Source: Own calculations.*

The results of the nonparametric tests suggest that on the whole regions with above average utility levels are indeed more likely to experience below average utility growth in the subsequent time period (see Table 7). There are only three groups in which the exact Fisher test statistic for statistical independence is not significant at the one percent level of confidence. Interestingly, all these cases involve elderly females.

**Table 7. Nonparametric tests of utility convergence for different types of individuals**

| Age | Education | Health | Sex | Probability |
|---|---|---|---|---|
| Young | Low | Good | Male | 0.000 |
| Young | Low | Good | Female | 0.000 |
| Young | Low | Poor | Male | 0.000 |
| Young | Low | Poor | Female | 0.001 |
| Young | High | Good | Male | 0.001 |
| Young | High | Good | Female | 0.003 |
| Young | High | Poor | Male | 0.001 |
| Young | High | Poor | Female | 0.004 |
| Old | Low | Good | Male | 0.010 |
| Old | Low | Good | Female | 0.004 |
| Old | Low | Poor | Male | 0.004 |
| Old | Low | Poor | Female | 0.131 |
| Old | High | Good | Male | 0.007 |
| Old | High | Good | Female | 0.225 |
| Old | High | Poor | Male | 0.048 |
| Old | High | Poor | Female | 0.296 |

*Source: Own calculations.*

## 5 Meta-analysis

The final analysis takes the estimated parameters measuring the speed of convergence and uses them in a meta-regression. We speculate that particular types of individuals are in a position to respond more quickly to the existence of utility differences than others.

The estimated coefficients presented in Table 5 detailing the speed of convergence are regressed on four dummy variables. The variable MALE takes the value unity if the individual type is male and is zero otherwise. The variable YOUNG takes the value unity if the individual type is young and is zero otherwise. The variable HIGH EDUCATION takes the value unity if the individual type is highly educated and is zero otherwise. The variable GOOD HEALTH takes the value unity if the individual type has good health and is zero otherwise. The regression is estimated using weighted least squares where the weights are defined by the standard errors of the parameter estimates.

Results of the meta-analysis are presented in Table 8 and appear to indicate that utility differences among highly educated individuals are eliminated significantly faster than utility

differences for less well educated individuals. This might be indicative of the fact that more highly educated individuals are better aware of the existence of regional utility differences or alternatively are better able to meet the costs of relocation. There are no other statistically significant variables. This finding resonates with the empirical evidence suggesting that migrants seem to be more educated and better qualified than non-migrants (Gans and Kemper, 2003; Hunt, 2000; and Hunt 2004).

**Table 8. Determinants of the speed of utility convergence**

| Variable | Coefficient | (T-statistic) |
|---|---|---|
| CONSTANT | 0.643 | (8.11) |
| MALE | -0.088 | (1.13) |
| YOUNG | 0.057 | (0.72) |
| HIGH EDUCATION | 0.206 | (2.56) |
| GOOD HEALTH | 0.025 | (0.31) |

*Source: Own calculations.*

## 6 Conclusions

In any one year there may be large differences in average utility between regions even when stratifying by different individual types. Surprisingly quickly however, these utility differences tend to be eliminated especially when they relate to highly educated individuals. Such results support the idea that at least in the context of Germany, migration and the ensuing pressure on wage rates and land prices rapidly eliminate utility differences over large geographical areas.

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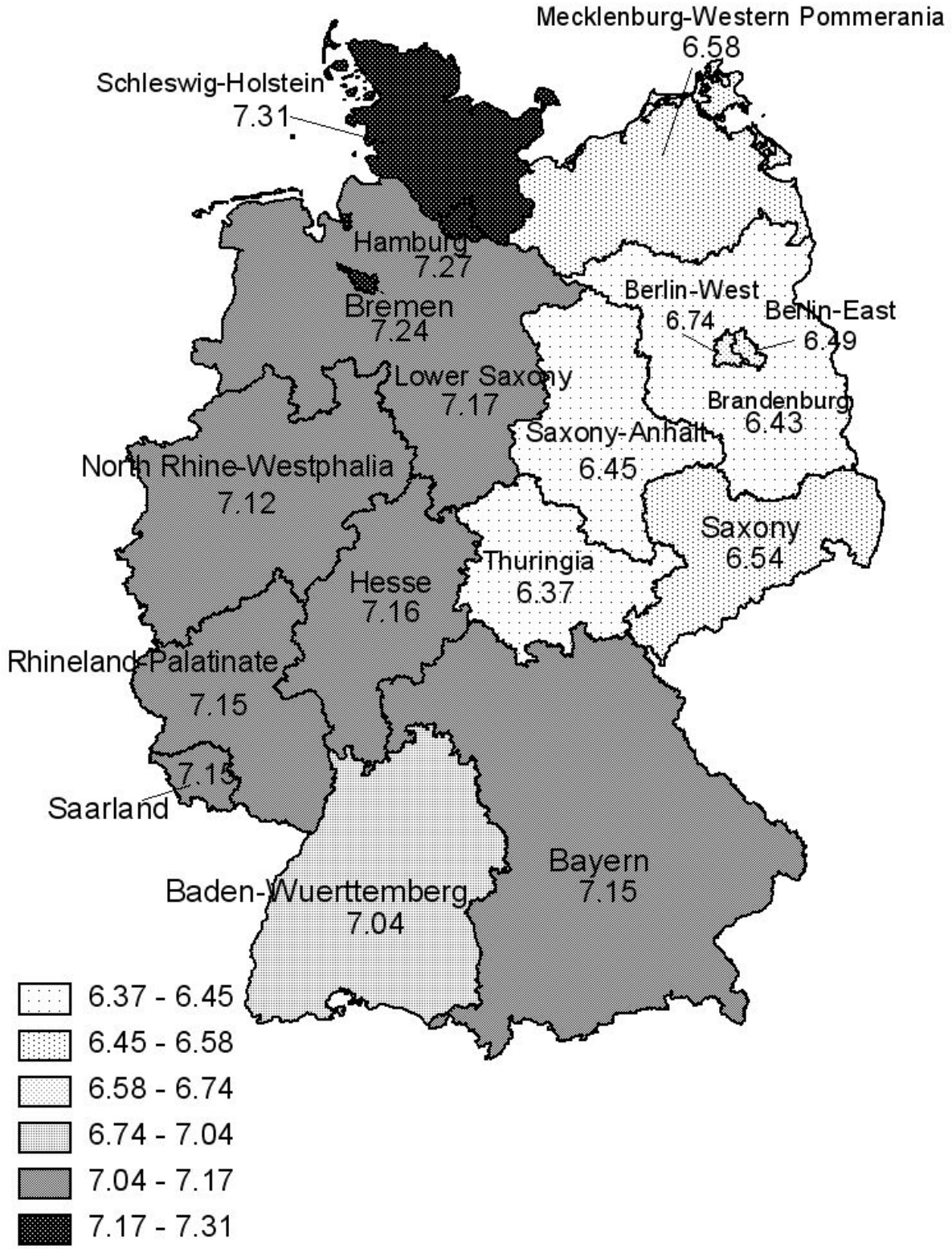
**Figure 1. Average Happiness in the Federal States of Germany 1994-2005**



**Appendix 1 Test of equality in utility across regions by type 2005**

| Age | Education | Health | Sex | Region | $\chi^2$ statistic | Prob. |
|---|---|---|---|---|---|---|
| Young | low | good | male | East | 18.85 | 0.002 |
| | | | | West | 14.04 | 0.121 |
| Young | low | good | female | East | 8.01 | 0.156 |
| | | | | West | 12.80 | 0.172 |
| Young | low | poor | male | East | 4.65 | 0.461 |
| | | | | West | 10.47 | 0.314 |
| Young | low | poor | female | East | 2.60 | 0.762 |
| | | | | West | 19.40 | 0.022 |
| Young | high | good | male | East | 5.99 | 0.307 |
| | | | | West | 9.58 | 0.385 |
| Young | high | good | female | East | 9.92 | 0.077 |
| | | | | West | 7.88 | 0.547 |
| Young | high | poor | male | East | 3.56 | 0.614 |
| | | | | West | 7.55 | 0.580 |
| Young | high | poor | female | East | 3.21 | 0.667 |
| | | | | West | 8.02 | 0.532 |
| Old | low | good | male | East | 10.73 | 0.057 |
| | | | | West | 11.16 | 0.265 |
| Old | low | good | female | East | 2.19 | 0.822 |
| | | | | West | 11.61 | 0.236 |
| | | | | Germany | 71.26 | 0.000 |
| Old | low | poor | male | East | 3.17 | 0.674 |
| | | | | West | 9.48 | 0.394 |
| Old | low | poor | female | East | 9.91 | 0.078 |
| | | | | West | 28.97 | 0.001 |
| Old | high | good | male | East | 0.50 | 0.992 |
| | | | | West | 12.69 | 0.177 |
| | | | | Germany | 53.46 | 0.000 |
| Old | high | good | female | East | 2.62 | 0.759 |
| | | | | West | 9.37 | 0.404 |
| Old | high | poor | male | East | 4.59 | 0.468 |
| | | | | West | 7.21 | 0.615 |
| Old | high | poor | female | East | 9.48 | 0.091 |
| | | | | West | 9.80 | 0.367 |

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