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Happiness and Unemployment: A Panel Data Analysis for Germany

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Abstract

We use data from the German Socio-Economic Panel to investigate how individual happiness is affected by unemployment. Unemployment has a large and negative effect even after controlling for individual specific fixed effects. Non-participation, in contrast, is much less harmful to happiness. Further, we decompose the total well-being costs of unemployment and find that well above three quarters are non-pecuniary, and below one quarter pecuniary. One implication is that income support programs for the unemployed do very little at mitigating the adverse effects of unemployment, and such transfers are unlikely to generate unemployment.

JEL Classification: D6, J6

Keywords: Happiness, Panel Data, Costs of Unemployment

When men are employed, they are best contented.

Benjamin Franklin

1 Introduction

Standard economic reasoning asserts that the impact of unemployment on welfare is a derivative of the impact exerted on welfare by the inadequate income (and/or output) that unemployment brings about. Unemployed individuals are willing to work at the going wage but are unable to find a job. Individuals want to work since to them the value of the next best alternative use of time is lower than the value of their work, and hence, society as a whole foregoes output. These are the economic, or pecuniary, costs of unemployment. However, these costs are not the only costs of unemployment. Social, or non-pecuniary, costs arise since unemployment deprives individuals not only of wages, but also of the non-pecuniary benefits of work. These include fringe benefits, and, more importantly, the status and recognition related rewards of work.

Clearly, the level of non-pecuniary costs incurred by an individual depends on a variety of factors: the reasons for becoming unemployed; the duration of unemployment; the overall unemployment rate; and age, to name but a few. An early study of the social cost of unemployment is Junankar (1987). He expresses the view that the social cost exceed the economic cost of unemployment, though he concedes that social costs are difficult to quantify. Attempts of measuring the social costs have dealt with unemployment and mortality (Junankar 1991), unemployment and divorce rates (Sander

1992), unemployment and crime (Junankar 1987), and unemployment and mental illness (Björklund 1985).

Here we take the view that the non-pecuniary costs of unemployment can be measured more directly through the impact of unemployment on happiness. The happiness data we use come from the first six wave of the *German Socio-Economic Panel* (GSOEP). We run ordered probit and fixed effects panel regressions. The results establish that the non-pecuniary costs of unemployment are well above the pecuniary costs. Part of these non-pecuniary costs arise as external costs imposed on other family members. Moreover, we find that non-participation and unemployment are empirically distinguishable by their differential impact on happiness.

While the use of subjective well-being responses is usually met with some skepticism in economics, this is not the first study of its kind. Previous studies include Easterlin (1974) and, more recently, Clark and Oswald (1994). However, in contrast to these previous studies, we can use panel data. This allows us to overcome some of the problems related to such data.

2 Happiness Data in the GSOEP

The empirical analysis is based on data from the first six waves (1984-1989) of the public usage version (95% sample) of the German Socio-Economic Panel (GSOEP). The dataset provides repeated measurements on various socio-economic and demographic characteristics for a pool of (initially) about 10.000 individuals. In the original dataset, foreigners are oversampled to a considerable degree. To circumvent the problem associated with the non-representativeness of the sample, we only use observations on

Germans. Further, individuals aged 24 or below are excluded to separate potential training and education effects from the labor market effects we are interested in. Using the longitudinal structure of the data and excluding records with missing values, we are left with a sample of 27846 observations.

Our variable of main interest is the individuals' subjective evaluation of their general well-being at the time of the interview. The response to the question

How happy are you at present with your life as a whole?

is given on an ordinal scale from 0 to 10, where 0 means "completely unhappy" and 10 means "completely happy". We use these answers to a) test whether unemployed individuals are happy or unhappy relative to individuals out of the labor force and employed individuals, b) establish the size of the non-pecuniary costs of unemployment relative to the pecuniary costs, and c) test for the presence of externalities of unemployment in a family context.

Easterlin (1974) gives an account of some of the measurement issues arising for such self-reported happiness data. For instance, individuals might "anchor" their scale at different levels, making the intra-personal comparison of responses meaningless. Note, that this problem bears close resemblance to the issue of cardinal versus ordinal utility. (One might even go as far as to think of the happiness responses as utility measurements. While this equivalence is not spelled out explicitly, it is certainly implied in the papers by Clark and Oswald (1994) and Oswald (1994).) Any statistic that is calculated from a cross-section of individuals, e.g. an average happiness, or an OLS regression coefficient, requires cardinality of the measurement scale. In contrast, using the information provided through variations in individual happiness over time avoids this assumption and only requires a time-invariant ordering scheme conditional on the

observed covariates. While there is some evidence that scaling changes as individuals learn about subjective questions in repeated surveys (Landua, 1993), we assume that these effects are of minor magnitude when compared to effects of major life-cycle events.

A second potential problem in the interpretation of an observed correlation between reported happiness and other variables is that of inverse causation. Individuals have poor health, divorce, or become unemployment because they are inherently unhappy. As Clark and Oswald (1994) point out, this objection may be overturned by observing the same individuals over time. Here, inference can made by relating *changes* in the life circumstances to *changes* in happiness for a given individual. Assuming that the "inherent" level of happiness is constant over time we can establish an unambiguous direction of causation. Longitudinal evidence has been previously used in the psychological literature. However, these studies involve much smaller samples and non-representative sampling schemes (Warr, Jackson and Banks, 1988). Thus, the present study is the first large scale panel study of happiness data. By relating changes in happiness to changes in the socio-economic environment of the individual, the panel study effectively deals with both the cardinality problem and the argument of reversed causation.

Table 1 tabulates the relative frequencies of the answers to the happiness question for the year 1984. The frequency distribution is skewed to the right with a mean response of 7.5 and a modal response of 8. The middle response 5 exhibits a local mode, which might reflect a focal choice for those individuals who perceive themselves as neither particularly happy nor particularly unhappy. Accordingly, we classify individuals with responses 4 or below as having "low" happiness, or being unhappy. The proportion of unhappy individuals in the 1984 wave is 5.8 percent. The first two rows of Table

2 show that the average happiness slightly drops (from 7.5 to 7.1) during the six year period. Also, the proportion of individuals with low happiness increases by almost three percentage points.

How variable is the happiness response over time at the individual level? The second part of Table 1 shows the distribution of the maximum spread over the six years for individuals with uninterrupted presence. We find that for 17 percent of the individuals the responses vary by at most one point. 1 out of 2 individuals respond within a range of 2 to 4, whereas 32 percent of individuals experienced ups and downs of 5 or more.

To approach the question of how (a change in) individual happiness is related to labor market status, we start with some cross tabulations. Table 2 gives the mean happiness and the proportion of individuals with low happiness by current labor market status, based on annual cross-sections including all individuals aged between 25 and 65 in the year of the interview. The states are *employment* (which is full-time employment excluding self-employment), *unemployment*, and *out of labor force*. The following pattern emerges: *employment* is associated with the highest (though falling) average happiness levels in all the years, closely followed by *out of labor force*. *Unemployment*, by contrast, is associated with much lower happiness levels increasing from 5.9 in 1984 to 6.3 in 1989. It is noteworthy that the same secular increase in the relative well-being of the unemployed during this period has been documented in Oswald (1994) using an independent data source, the *Eurobarometer Survey Series* covering 1973 to 1992. However, the Eurobarometer data also show that this trend was only temporary and reverted in 1990. The differences in the means are significant at any conventional significance level in all years. For instance, in 1984 the difference in the average happiness between employed and unemployed is 1.78, with an estimated standard error of 0.23. The difference in the average happiness between non-participants and unemployed is

1.54, with an estimated standard error of 0.24.

Comparing the percentage of individuals with low happiness for the various labor market states, we find that between 6 and 9 percent of the employed, 8 and 10 percent of the non-participants, but between 18 and 25 percent of the unemployed report a low happiness. In other words, a randomly selected unemployed is much more likely to be unhappy than a randomly selected employee or non-participant. The overall evidence suggests that

i) a persistent happiness gap for the unemployed exists, confirming the results by previous research using different data sources, and

ii) it is not 'joblessness' that lowers individuals' happiness, but only unemployment in contrast to non-participation.

Next, we consider the argument of inversed causation: individuals experience unemployment because they are unhappy. In Table 2, we report the happiness levels of those employed individuals that are unemployed in at least one of the other years. These employed individuals have almost the same happiness than the average employee (the difference is insignificant). We might expect that these individuals have unsecured jobs and their fear of a potential future job-loss reduces their present happiness. Indeed, Schwarze (1994), using the same datasource, has shown that happiness responses are highly responsive to risk and insecurity. However, this effect does not show up here, nor are individuals with unemployment experience *intrinsically* less happy. In contrast, individuals who actually are unemployed are much less happy. For instance, the average happiness of those individuals who later will become unemployed is 7.62 in 1984, as compared to an average happiness of 7.66 of all the employed. The average

happiness of the unemployed, however, is 5.8 . As a preliminary conclusion, there is no evidence that unemployed individuals are intrinsically unhappy. The drop in happiness is caused by the actual experience of unemployment.

Why does unemployment cause such a drop in happiness? We discern two main channels. First, unemployment is associated with an income loss, the size of which depends on various factors such as previous income, family status, unemployment duration and the like. It has been estimated to amount to 40 to 50 percent of the pre-unemployment income. Second, unemployment creates non-pecuniary costs since it deprives the individual of the social rewards of employment.

3 Regression Specification

To assess the relative magnitude of these two potential channels, we turn to a multiple regression analysis by specifying a regression of the type

$$\mathrm{E}(S_{it}|x_{it}) = f(x'_{it}\beta) \tag{1}$$

where S_{it} is individual i's happiness in period t, x_{it} is a vector of regressors and β a conformable parameter vector. In this framework, we control for the pecuniary aspects using a measure of (the log of) household income that includes all types of government transfers and is net of taxes. We use logarithmic income in correspondence to the assumption commonly made in household theory that utility is logarithmic in income. It follows that the linear predictor $x'_{it}\beta$ depends on relative income changes rather than absolute changes, and the estimated slope coefficient β_{inc} gives the change in the predictor caused by a 100 percent increase in income. While income and unemployment

are likely to be negatively correlated, there is no functional relationship. Estimation of the specific effect β_{inc} is based on independent variation in income and the only consequence of the correlation is an increase in the standard errors.

In choosing an appropriate econometric model we have to take into account that the dependent variable is ordinal. We use the ordered probit model (see Greene, 1993) for which

$$P(Y_{it} = j|x_{it}) = \Phi(\alpha_j - x'_{it}\beta) - \Phi(\alpha_{j-1} - x'_{it}\beta) \qquad j = 0, 1, \ldots, 10 \qquad (2)$$

where α_j are threshold parameters with $\alpha_{-1} = -\infty$ and $\alpha_{10} = \infty$, and Φ is the cumulative density function of the standard normal distribution. Since we have panel data we would like to allow for individual specific effects u_i. However, appropriate panel models are still under development (though, see Hamerle and Ronning, 1995). Hence, we resort to a linear fixed effects model. The fixed effects estimator has an intuitive appeal since it uses only intra-individual, rather than inter-individual, comparisons of happiness levels.

We estimate both a pooled regression using an ordered probit specification and a fixed effects panel model. Since we expect quite substantial differences in behavior and in social conditioning for females and males we run all the regressions for split samples. Our main interest is to test whether or not there is a specific negative effect of unemployment on well-being after controlling for the associated income loss as well as other effects.

4 Regression Results

First, we re-estimate the type of equation previously estimated in Clark and Oswald (1994) for U.K. data on mental well-being, and in Blanchflower, Oswald, and Warr (1993) for U.S. data on happiness. Table 3 shows the results for the ordered probit equations using pooled data. The dependent variable is the individual level of happiness. The results confirm the previous findings for different data sets and different countries. The effect of unemployment is negative, quantitatively large, and well determined. The coefficient is close to -0.47 for the equation that pools male and female observations, -0.66 for the male-only sample, and -0.24 for the female-only sample.

Given the non-linear nature of the model, it is not straightforward to assess the magnitude of the effects. One possibility is to compare the unemployment coefficient to other coefficients. We find that f or men, being unemployed is the single most important source of low happiness, the effect being almost twice as large as the effect of a lack of good health (-0.36). Alternatively, we can compare the coefficient to the threshold parameters. Unemployment is sufficient, to lower the response by between 1 and 2 categories. A final possibility is to predict the effect of unemployment on the probability of unhappiness for an otherwise average individual. Individuals are classified as unemployed if they chose a value of 4 or less on the 0-10 scale. The probability of unhappiness is given by

$$P(\widehat{\text{unhappy}}) = \Phi(\hat{\alpha}_4 - x'_{it}\hat{\beta}) \tag{3}$$

This probability is 0.052 for an employed, and 0.168 for an unemployed male with otherwise average characteristics. Hence, unemployment increases the probability of unhappiness by 12 percentage points. Unemployment is very harmful for men. For

women, unemployment is much less harmful. For instance, the negative effect of unemployment is one third smaller than the effect of bad health.

Furthermore, the regression results reveal that being out of the labor force has no clear cut effect on well-being. While the effect is negative and significant for men, it is small. Unemployment and non-participation have indeed very different consequences for individual happiness. For females, the effect is even positive, reflecting the social acceptability of non-participation for women.

The relationship between well-being and age is U-shaped with a minimum at the age of 42-45, and married people have higher levels of happiness. The same result are found in Clark and Oswald (1994). In contrast to Clark and Oswald, who use a different measure of well-being (mental distress scores), we find that family income influences happiness positively. The coefficient in the complete sample is 0.28 and statistically significant. A 100 percent increase in income is associated, on average, with a 0.28 increase in $x_{it}\beta$. Recalling that the effect of unemployment is -0.47, we conclude that well-being is *relatively* insensitive to income. To compensate for the negative effect of unemployment (so as to keep $x'_{it}\beta$ constant), income would need to be increased by $0.47/0.28 * 100 = 168$ percent.

What is, then, the overall cost of unemployment in terms of reduced individual happiness? The average pecuniary costs can be calculated by multiplying the income coefficient of 0.28 with the average income reduction (which is one minus the replacement ratio) of 40%. This yields a pecuniary contribution to reduced well-being of -0.11. (This estimate might overstate the true pecuniary cost because it neglects contributions to family income by second earners as well as other non-wage income). Adding these -0.11 to the non-pecuniary cost of -0.47, we obtain a total well-being cost of

unemployment of -0.58, 19% of which are pecuniary and 81% non-pecuniary.

We now turn to the results from the panel estimations. We use an unbalanced panel design. However, individuals with a survey presence of one wave only are excluded and we are left with 27025 observations. The schooling variables are excluded from the set of regressors, since they have no temporal variation. The results for four estimated regressions are given in Table 4. We use two specifications and estimate separately for men and women. A first specification includes the same individuals as in the above ordered probit regressions, given that they have a repeated sample presence. A second specification uses a subsample of individuals living in a household for which a partner (spouse or living companion) and its employment status can be identified. We use F-tests to test for the presence of individual specific fixed effects. The null hypothesis of no fixed effects can be rejected in all four estimated models.

The first two columns of Table 4. show that, as for the ordered probit regression, unemployment is again by far the most important source of low happiness. Becoming unemployed reduces expected happiness by 1.08 for men, and by 0.32 for women. Since this is a linear model, coefficients have a direct interpretation as marginal effects. The unemployment effect is again much larger than (and significantly different from) the effect of non-participation and strong enough to cause happiness to drop by one category for men. This specification uses intra-individual variation in happiness only and we conclude that it is not intrinsic unhappiness that causes unemployment, but rather the actual experience of unemployment that reduces happiness (after controlling for income).

While the estimated coefficients are not directly comparable to the coefficients of the ordered probit regressions, we can compute again the estimated income increase re-

quired to keep $x'_{it}\beta$ constant. The estimated (and significant) income effects are 0.26 and 0.29 for men and women, respectively. For men, income would need to increase by $1.08/0.26 * 100 = 415$ percent to compensate for the negative effect of unemployment. Thus, the fixed effect panel model estimates an even larger effect of unemployment for males. Assuming, as above, a 40 percent drop in income due to unemployment, the decomposition of the total well-being costs of unemployment into pecuniary and non-pecuniary cost is as follows: For men, 9 percent are pecuniary and 91 percent non-pecuniary, whereas for women, 27 percent are pecuniary and 73 percent non-pecuniary.

In the next pair of regressions we have tried to capture the concept of *externalities* arising from unemployment. We consider that an externality is present if a change in labor market status of the partner causes a change in happiness. The reported results in the third and fourth column of Table 4 refer to individuals for whom a partner (not necessarily, but mostly, spouse) can be identified in the sample. Again, the sample was split for men and women. For men, conditioning on a subset which lives with a partner and including her labor market status does not lead to major changes. Own unemployment is the major source for decreases in happiness. Also, the male happiness level is largely unaffected by the labor market status of the partner. This stands in striking contrast to women, who experience a large drop in happiness if the partner becomes unemployed (controlling for income), a drop that by far exceeds the one associated with own unemployment. This asymmetry between the gender specific reactions mirrors the traditional role distribution within the household. We conclude that male unemployment causes not only a major reduction in happiness for men, but also imposes a negative externality on the partner.

5 Conclusions

So, where does it hurt after all? A panel analysis of happiness data reveals - much above the pocket. The main implication of our study is, as long as the common good is not a meaningless abstraction, to call for employment generating policies *and for them* rather than for alternative redistributive mechanisms designed to mitigate the (insufficient) income effects of unemployment exclusively.

Our results suggest that the harm inflicted on efficiency (in terms of wasted happiness) by high unemployment has been inadequately appreciated. We reject the corollary of the natural rate hypothesis that unemployment and non-participation are two empirically indistinguishable labor market states: unemployment does cause a substantial drop in happiness (whereas non-participation does not). The unemployment problem, hence, does exist and its impact on human well-being is to be accounted for in the cost-benefit analysis of any unemployment program.

The data reveal that the non-pecuniary costs of unemployment (in addition to its substantial negative externalities generated within a household) exceed the pecuniary costs by far: They constitute above 75 percent of the total well-being costs to the individual. These costs are expected to be subject to social conditioning and the data exhibit the patterns pointing that out - the non-pecuniary costs are higher for men than for women.

Table 1. Happiness-Relative Frequencies

Happiness 1984[1]			Δ happiness 84-89[2]		
Value	N	percent	Max-Min	N	percent
0	46	0.008	0	64	0.023
1	26	0.004	1	405	0.149
2	56	0.010	2	665	0.244
3	72	0.013	3	627	0.230
4	104	0.019	4	364	0.133
5	584	0.112	5	325	0.119
6	440	0.084	6	129	0.047
7	851	0.163	7	73	0.026
8	1367	0.262	8	41	0.015
9	671	0.128	9	16	0.005
1	993	0.190	10	9	0.003
	5210			2718	

Notes:

[1] 0: completely unhappy; 10: completely happy.

[2] individuals with 6 years of continued presence only.

Table 2.	**Average happiness and Proportion of Individuals with Low happiness**					
	1984	1985	1986	1987	1988	1989
All						
Average happiness	7.522	7.311	7.316	7.150	7.055	7.099
Low happiness (in %)	0.058	0.069	0.064	0.073	0.086	0.086
N	5210	4885	4636	4586	4356	4173
Employed						
Average happiness	7.657	7.416	7.474	7.246	7.105	7.176
Low happiness (in %)	0.040	0.049	0.041	0.058	0.072	0.074
N	2630	2425	2332	2329	2213	2147
Unemployed						
Average happiness	5.881	5.865	6.204	6.212	6.112	6.280
Low happiness (in %)	0.230	0.250	0.182	0.196	0.208	0.180
N	135	192	181	179	178	150
Employed with Unemployment Experience						
Average happiness	7.621	7.413	7.473	7.000	6.853	6.869
Low happiness (in %)	0.022	0.077	0.035	0.057	0.101	0.086
N	132	116	112	105	89	92
Out of labor force						
Average happiness	7.418	7.293	7.260	7.177	7.116	7.105
Low happiness (in %)	0.079	0.080	0.087	0.081	0.086	0.096
N	1691	1506	1452	1365	1273	1216

Note:
Data include Germans aged 25-65.

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Table 3

Happiness 1984 - 1989: Ordered Probit

	ALL		MALE		FEMALE	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	1.3376	8.986	2.1868	9.884	0.8891	4.346
Male	-0.0812	-5.420				
Unemployed	-0.4669	-15.515	-0.6631	-16.861	-0.2474	-5.157
Out of labor force	-0.0698	-3.945	-0.2792	-8.988	0.0422	1.729
Self-employed	-0.1813	-6.767	-0.2474	-8.033	-0.0176	-0.340
Part-time employed	-0.0988	-4.016	-0.1779	-1.823	-0.0253	-0.875
Age	-0.0554	-11.246	-0.0838	-11.371	-0.0450	-6.601
Age squared	0.0006	12.766	0.0010	12.740	0.0005	7.494
Good health	0.3775	27.819	0.3627	18.279	0.3833	20.326
Married	0.1248	5.646	0.1245	4.231	0.0634	1.806
Divorced	-0.1481	-4.823	-0.1596	-3.640	-0.1532	-3.496
Widowed	-0.0826	-2.192	-0.1370	-1.978	-0.1022	-2.077
10 Years of schooling	0.0201	1.198	0.0262	1.036	0.0208	0.915
12 Years of schooling	-0.0202	-0.616	0.0467	1.148	-0.1182	-2.104
13 Years of schooling	0.0240	1.077	0.0509	1.742	0.0260	0.744
Log family income	0.2808	18.870	0.2389	11.132	0.3081	14.579
1985 year dummy	-0.1620	-8.356	-0.1638	-5.888	-0.1584	-5.833
1986 year dummy	-0.1796	-8.845	-0.1476	-5.108	-0.2075	-7.239
1987 year dummy	-0.2906	-14.003	-0.2758	-9.361	-0.3040	-10.387
1988 year dummy	-0.3689	-17.505	-0.3899	-13.025	-0.3477	-11.675
1989 year dummy	-0.3477	-16.280	-0.3446	-11.486	-0.3477	-11.416
Threshold values						
a1	0.1867	10.567	0.1788	7.235	0.1965	7.684
a2	0.4884	20.448	0.4806	14.140	0.5019	14.722
a3	0.8228	31.133	0.8286	21.865	0.8274	22.074
a4	1.0919	39.866	1.0984	27.953	1.0982	28.306
a5	1.7140	60.678	1.7021	41.963	1.7416	43.589
a6	2.0273	71.229	2.0272	49.570	2.0459	50.855
a7	2.5523	88.831	2.5901	62.730	2.5369	62.500
a8	3.3521	115.016	3.4281	81.921	3.3029	80.230
a9	3.8769	130.623	3.9712	93.034	3.8131	91.176
Log-Likelihood	-53089.6		-25938.0		-27061.2	
Log-Likelihood H0	-54165.1		-26547.9		-27579.6	
Observations	27846		13771		14075	

Table 4
Happiness: Fixed Effect Panel Regressions

	ALL		WITH PARTNER	
	Male	Female	Male	Female
Unemployed	-1.0836	-0.3162	-1.0183	-0.0981
	(-11.692)	(-3.131)	(-9.878)	(-0.801)
Out of labor force	-0.2177	-0.1266	-0.1862	-0.0569
	(-2.513)	(-1.676)	(-1.872)	(-0.640)
Self-employed	-0.2558	-0.1122	-0.2384	-0.0668
	(-2.193)	(-0.845)	(-1.802)	(-0.438)
Part-time employed	-0.1933	-0.1298	-0.0843	-0.0272
	(-1.041)	(-1.765)	(-0.388)	(-0.318)
Partner unemployed			0.1349	-0.5433
			(0.728)	(-4.696)
Partner out of labor force			-0.0305	-0.1508
			(-0.568)	(-1.392)
Partner self-employed			0.0750	-0.2648
			(0.362)	(-1.795)
Partner part-time employed			0.0562	0.0232
			(0.724)	(0.096)
Age	-0.2102	-0.1873	-0.2637	-0.2113
	(-6.080)	(-5.549)	(-6.716)	(-4.993)
Age squared	0.0010	0.0007	0.0013	0.0007
	(2.750)	(1.997)	(3.192)	(1.655)
Good health	0.2235	0.2686	0.1860	0.2214
	(5.672)	(6.876)	(4.393)	(4.906)
married	0.3429	0.4431		
	(2.938)	(2.812)		
Divorced	-0.0254	0.2896		
	(-0.173)	(1.587)		
Widowed	-0.5404	0.0471		
	(-2.047)	(0.206)		
Log family income	0.2556	0.2938	0.2969	0.2288
	(4.616)	(5.035)	(4.472)	(3.072)
Number of observations	13403	13622	10806	9548
R-squared	0.571	0.575	0.579	0.587
F-test (no fixed effects)	4.249	4.346	4.354	4.485

Note: 1.The F-test tests the model with x-variables only against the model with x and fixed effects. Let g be the number of individual specific effects and n be the number of observations. The degrees of freedom of the F-statistic are n1 = g – 1 and n2 = n – g – k. Since n1 and n2 are large, the critical value approaches 1.
2.t-values in parentheses.