Subjective Well-being and Migration in the United States

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Abstract

By merging various state-level subjective well-being data drawn from the Behavioral Risk Factor Surveillance System and the 2010 American Time Use Survey Well-Being Module to individual data drawn from the American Community Survey, this paper investigates how various measures of state-level subjective well-being—global life satisfaction, U-index, net affect, and meaningfulness—affect net migration of individuals across states in the United States. The results show that while the differences in global life satisfaction and in meaningfulness between states significantly increase net migration, the differences in U-index and net affect between states do not increase net migration.

Key words: u-index, net affect, meaningfulness, life satisfaction, migration

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1. Introduction

Previous research has shown that the quality of life affects net migration across states in the United States (Liu 1975; Cebula and Alexander 2006). Recently, Song (2014) has shown that meaningfulness—a measure of subjective well-being based on time-use data—is significantly correlated with the objective quality-of-life ranking of the fifty states in the United States, whereas the measures of affect—net affect and the U-index—are uncorrelated with the objective measure of well-being. This paper extends this line of research by examining how various measures of state-level subjective well-being—global life satisfaction, U-index, net affect and meaningfulness—affect net migration of individuals across states in the United States. This analysis would provide more empirical evidence to sort out, among various measures of subjective well-being, what measures are suitable indicators of the differences in the quality of life across states.

This research is important because one of the main reasons economists and policy makers have recently increased their interests in measures of subjective well-being is to better monitor progress in quality of life beyond simple measures of income and to better guide public policy (Di Tella and MacCulloch 2006; Dolan and Metcalfe 2012; Frey and Stutzer 2002; Stiglitz, Sen, and Fitoussi 2009). Furthermore, by providing first empirical evidence based on the migration data from the United States, this paper contributes to the burgeoning literature on the effect of subjective well-being on migration (Polgreen and Simpson 2011; Simpson forthcoming). Finally, this paper is the first one that employs the inverse hyperbolic sine (IHS) transformation (Burbidge, Magee and Robb 1988) to handle nonpositive values of net migration.

The remainder of the paper is organized as follows. In Section 2, we summarize the literature on migration and subjective well-being. Section 3 describes the econometric model.

Section 4 describes the data. In Section 5, we present the empirical results and discuss the findings. Finally Section 6 provides concluding remarks.

2. Literature Review

According to economic theory, decisions of migration are made by comparing monetary and non-monetary costs and returns to migration (Sjaastad 1962), which is often formulated in the context of utility maximization. In empirical estimations, economic variables that are expected to importantly influence the utility of migrants, such as wages and unemployment rates, have been included in the model as control variables. Also included as control variables are the origin and destination populations and the distance, based on the gravity model which hypothesizes that migration is directly related to the size of the relevant origin and destination populations, and inversely related to distance (Greenwood 1975).

In addition to economic costs and returns, the quality of life could affect migration decisions. For example, Liu (1975) examined interstate net migration on the basis that migrants attempt to maximize their quality of life.[1] He developed the indicators of quality of life based on the nine components: i) individual status (labor force participation rate, percent of labor force employed, mean family income, federal/state/local expenditures on education, motor vehicle registrations, and percent of population subscribing to daily newspapers); ii) individual equality (ratio of nonwhite to white median family income, ratio of nonwhite to white and male to female unemployment rate, and percent of 7 to 13 year olds enrolled); iii) living conditions (percent of families with income more than the poverty level, crime rate, state and local park and recreational areas, hospital beds, number of public libraries, marriage-divorce rate, and average

[1] Cebula and Vedder (1973) first examined the effect of the quality of life on migration across 39 large Standard Metropolitan Statistical Areas in the United States.

of possible sunshine days); iv) economic status (personal income per capita, average weekly hours worked, and real value added per production worker); v) technological development (federal grants, per capita industrial expenditures on R&D, and number of scientists); vi) agricultural production (median income of farmers, and average value of land and building per farm); vii) health and welfare provision (number of physicians, dentists, and nurses, infant death rates, number of lawyers, and state/local expenditures on public welfare); viii) educational development (median school years completed, public school expenditures, and public school pupil-teacher ratio); and ix) state and local governments (percent of voting age population registered, full-time government employees, and per capita tax revenues).[2] His results showed that improved quality of life indexes increased cross-state net migration rates between 1960 and 1970 in the United States.

Using more recent migration data from 2000-2004, Cebula and Alexander (2006) also showed that net state inmigration is an increasing function of positive quality-of-life factors such as warmer temperatures and education expenditures, and a decreasing function of negative quality-of-life indicators such as the presence of hazardous waste sites and pollution, and higher income tax burden. Given that the measures of the quality of life include state expenditures on public good, the findings in both Liu (1975) and Cebula and Alexander (2006) are also consistent with the Tiebout model that individuals move to the community where their preference pattern for public goods are best satisfied (Tiebout 1956).

Oswald and Wu (2010) have recently shown that one measure of subjective well-being, global life satisfaction, contains objective information about the quality of life across states. Using a large set of individual data from the Behavioral Risk Factor Surveillance System, they first estimated the state-level measures of global life satisfaction, controlling for various

[2] This is a partial list of all the variables used by Liu (1975).

respondents' characteristics. They then showed that these state-level measures are substantially correlated with the state-by-state quality-of-life rankings in the United States from Gabriel, Mattey, and Wascher (2003), generated by compensating differential approach based on objective state-level indicators.[3]

In a similar approach, Song (2014) examined the relationship between the three measures of subjective well-being—net affect, the U-index, and meaningfulness—from the 2010 American Time Use Survey Well-Being Module and the objective quality-of-life ranking of the fifty states in the United States. His results showed that whereas the measures of affect—net affect and the U-index—are uncorrelated with the objective measure of well-being, the measure of meaningfulness has a significant correlation with the objective ranking.

This paper examines how various measures of state-level subjective well-being—global life satisfaction, U-index, net affect and meaningfulness—affect net migration of individuals across states in the United States. Since Liu (1975) and Gabriel, Mattey, and Wascher (2003) have used many of the same variables in constructing the quality of life indicators, it is expected that the measures of subjective well-being found to be correlated with the state-by-state quality-of-life rankings, such as global life satisfaction and meaningfulness, will affect net migration across states.

While many economists and policy makers have increased their interests in measures of subjective well-being (Di Tella and MacCulloch 2006; Dolan and Metcalfe 2012; Frey and

[3] The following state-level indicators, including many policy indicators, are used: precipitation; humidity; heating degree days; cooling degree days; wind speed; sunshine; coast; inland water; federal land; visitors to national parks; visitors to state parks; number of hazardous waste sites; environmental regulation leniency; commuting time; violent crime rate; air quality-ozone; air quality-carbon monoxide; student-teacher ratio; state and local taxes on property, income and sales and other; and state and local expenditures on higher education, public welfare, highways, and corrections. Relying on the concept of a compensating differential that pecuniary differences across locations in wages, housing, and other costs of living should compensate for the differences in nonpecuniary characteristics that affect the quality of life, the weights on these indicators were estimated in three price equations (wage, housing, and non-housing cost-of-living). Then the weighted average of these indicators determined the quality-of-life rankings.

Stutzer 2002; Stiglitz, Sen, and Fitoussi 2009), Polgreen and Simpson (2011) is the only paper that examined the effect of a measure of subjective well-being on migration. By merging country-level happiness indices calculated from the World Values Survey to various migration data sets, they found that happiness has a U-shaped association with emigration rates across countries: Individuals from very happy countries and very unhappy countries are more likely to emigrate than individuals from the middle of the happiness distribution. However, considering that freedom of movement is not uniformly distributed among countries, their results are not directly applicable to migration within the United States. Furthermore, comparing happiness across countries is complicated by difference in language and culture.

3. Econometric Model

This paper estimates the following net migration model

$$Net\ migration_{ij} = f(SWB_{ij}, W_i, W_j, UR_i, UR_j, Dist_{ij}, Pop_i, Pop_j, Stock_{ij}, Stock_{ji}) \qquad (1)$$

The dependent variable ($Net\ migration_{ij}$) is the number of people residing in state *i* in 2011, who resided in state *j* a year ago, minus the number of people residing in state *j* in 2011, who resided in state *i* a year ago. The following independent variables are included: SWB_{ij} is the difference in the measures of subjective well-being between state *i* and state *j* in 2010; W_i and W_j are the mean wages in state *i* and *j*, respectively, in 2010; UR_i and UR_j are the unemployment rates in state *i* and *j*, respectively, in 2010; $Dist_{ij}$ is the distance between the state capitals of state *i* and state *j*; Pop_i and Pop_j are the population of state *i* and *j*, respectively, in 2010; $Stock_{ij}$ is the number of people born in state *j* and living in state *i* in 2010; and $Stock_{ji}$ is the

number of people born in state *i* and living in state *j* in 2010. To avoid reverse causality, the dependent variable is from 2011, while all independent variables are from 2010.

All independent variables are the usual variables in the gravity-type migration models, except for the migrant stock variables. The migrant stock variables, $Stock_{ij}$ and $Stock_{ji}$, measure the past migration, as well as the potential source of information flow from one state to another (Greenwood 1969). Greenwood (1969) showed that exclusion of these migrant stock variables would bias other estimated coefficients.

In the migration literature, the logarithm transformation of the dependent and independent variables is usually used, after discarding nonpositive values. Instead of throwing away observations with nonpositive values, this paper employs the inverse hyperbolic sine (IHS) transformation of all variables, except SWB_{ij}, UR_i and UR_j. The IHS transformation has been suggested as an alternative to the logarithm transformation when the dependent variable assumes nonpositive values (Burbidge, Magee and Robb 1988). The IHS takes the following functional form

$$sinh^{-1}(y) = \ln\left(y + \sqrt{y^2 + 1}\right) \tag{2}$$

This IHS function is symmetric and approximates the logarithm in its right tail. Furthermore, its derivative is $1/\sqrt{y^2 + 1}$, which approximates the derivative of the log, $1/y$, for positive values of y. The IHS transformation has been often used in the literature on wealth (Cobb-Clark and Hildebrand 2006, Pence 2006) but this is the first time being used in the analysis of migration. By using the IHS transformation, this paper fully utilizes the observations that have nonpositive values for the dependent and independent variables.

4. Data

This study uses data drawn from the 2010 and 2011 American Community Surveys (ACS), the 2010 Behavioral Risk Factor Surveillance System (BRFSS) and 2010 American Time Use Survey Well-Being (ATUS WB) Module. The net migration data used in this paper is from the one-percent Public Use Microdata Sample (PUMS) of the 2011 ACS. The ACS is the largest survey other than the decennial census conducted by the U.S. Census Bureau in every county of the United States every year. Each one-percent PUMS data contains about 3 million person records and, when weighted, represents the whole population of the United States. The ACS gives data for current place of residence of the respondents and whether or not they resided in that residence one calendar year ago. If the respondent moved into that residence within that year, the survey asks where the place of residence was in the previous year. These two questions provide us with the number of people who migrated into that state in the previous year, and where those people came from. The 2010 ACS provides the information for state population, mean wage, and migrant stock. Unemployment rate was found for each state for 2010 from the Bureau of Labor Statistics. Distance was calculated using Google Maps driving directions. We used the driving distance between each state capital to each other state capital.

Similar to Oswald and Wu (2010), we have calculated the state-level average life satisfaction from the 2010 BRFSS. The BRFSS is a large health-related telephone survey that collects data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. It also asks a single survey question about global life satisfaction, “In general, how satisfied are you with your life?” The four valid responses to the

question—very satisfied, satisfied, dissatisfied, and very dissatisfied—are usually treated in a cardinal way by assigning 1 to 4, where "very satisfied" is assigned 4.

The focus here is not on the simple differences in the well-being measures across various people from different states, but rather on the differences due to socio-economic, institutional and geographic characteristics of states, net of other differences among the respondents. In order to net out the differences in the characteristics of individual respondents, using these responses as the dependent variables, we first ran a regression, controlling for the same set of variables used by Oswald and Wu (2010). Then the residuals from the regression are averaged to produce state-level average residuals. The number of observations used in the regression is 413,159 respondents.

Using the responses available in the 2010 ATUS WB Module, we have constructed three measures of state-level subjective well-being: the U-index, net affect, and meaningfulness. The ATUS is a time-diary study based on a nationally representative sample of the U.S. population and has been conducted continuously since 2003 by the U.S. Census Bureau. Through computer-assisted telephone interviewing, it collects a detailed account of respondents' activities on a 24-hour, preassigned day of the week (the diary day), starting at 4 A.M. on the day before the interview and ending at 4 A.M. on the day of the interview. The diary days of the ATUS are inclusive of all days in a year: weekdays, weekends, and holidays, except Thanksgiving Day and Christmas Day. In the 2010 ATUS WB Module, the survey randomly selected three activities reported by each respondent. For each selected activity, respondents were asked seven questions: five affect questions (happy, pain, sad, stressed, and tired)[4], one question about how meaningful the activity was, and one question about whether the respondent was interacting with anyone during the activity. For the five affect questions and the one question about how meaningful the

[4] The order of the five affect questions was randomly determined for each respondent.

activity was, the respondent was asked to use a scale from 0 to 6, where a 0 means he/she did not experience the feeling at all and a 6 means the feeling was very strong.[5]

Following Kahneman and Krueger (2006) and Krueger, Kahneman, Schkade, Schwarz, and Stone (2009), we classified an episode as unpleasant if the highest rating on any of the three negative affect dimensions (pain, sad, and stressed) is strictly greater than the rating of the positive affect dimension (happy). Then the U-index for state j, U_j, is constructed as the weighted average of these classifications over the episodes from the respondents in the state as follows

$$U_j = \frac{\sum_i \sum_k w_{ikj} U_{ikj}}{\sum_i \sum_k w_{ikj}} \quad (3)$$

where i denotes the respondent, k denotes the sampled activity, U_{ikj} denotes an indicator variable for an episode k being unpleasant for the respondent i in state j, and w_{ikj} denotes the WB Module activity weight (WUFNACTWT) attached to activity k for respondent i in state j. The WB Module activity weights account for both i) differences between activities in the fraction of time spent in eligible activities and ii) differences between persons in the probability of having a specific eligible activity selected due to variation in the number of eligible activities. This U-index is an estimate for the fraction of time the individual in the state spends in an unpleasant state.

We defined net affect for each episode as the difference between the positive emotion (happy) and the average of the negative ones (pain, sad, and stressed) for the episode

[5] The ATUS WB Module data files also contain four general health questions: general health status (excellent, very good, good, fair, and poor); whether the respondent was ever told he/she has hypertension by a doctor in the last five years; whether the respondent took any pain medication on the diary day; and how well rested the respondent felt on the diary day. A small number of ATUS respondents (431 out of 13,260) who do not meet the following criteria are not counted in the WB Module: i) Answer at least four of the seven questions about the activity for at least one of the three activities selected, and ii) Answer at least one of the final four general health questions.

(Kahneman, Krueger, Schkade, Schwarz, and Stone 2004). Using a formula similar to Equation 3, we define net affect for each state as the weighted average of net affect over the activities from the respondents in the state. We also constructed meaningfulness for each state as the weighted average of the responses to the question about how meaningful the episode was over the episodes from the respondents in the state. After excluding the episodes with missing responses, and respondents below the age of 18, there are 35,813 episodes of activities from 12,167 respondents.

Using each of these three *unweighted* measures of well-being for each episode (for example, U_{ikj} for the U-index) as the dependent variable, we first estimated episode regressions controlling for the following respondents' characteristics: age and its square; a female dummy; five dummies for respondent's race/ethnicity; five education dummies; two marital-status dummies; three employment-status dummies; a dummy for interacting with anyone; eight dummies for family income during the last 12 months; a holiday dummy; six dummies for the days of the week; and eleven month dummies. Then similar to Equation 3, the residuals from these regressions are weighted to produce state-level average residuals.

The differences in each of these measures of subjective well-being between states are the key independent variables. It is expected that larger differences in global life satisfaction, in net affect, and in meaningfulness would *increase* net migration between states, while a larger difference in U-index would *decrease* net migration between states.

5. Results

Table 1 shows the descriptive statistics of the variables. Of the 2,256 possible combinations of net migration between each of the 48 contiguous states, excluding Alaska and Hawaii, and each of the other 47 states, 1,128 combinations are analyzed to avoid double-counting.

Table 2 reports the results of the regression. Because the four measures of subjective well-being have various ranges, as seen in Table 1, for comparability Table 2 reports standardized coefficients, which were obtained by first standardizing all variables to have a mean of 0 and a standard deviation of 1. T-statistics are reported in parentheses. When only the differences in four measures of subjective well-being between states are included in Column 1 of Table 2, the standardized coefficients on the differences in global life satisfaction and in meaningfulness are positive and statistically significant. The standardized coefficient of .150 on the difference in global life satisfaction indicates that as the difference in global life satisfaction between states increases by one standard deviation, net migration increases on average by about 15 percent. The standardized coefficient of .082 on the difference in meaningfulness suggests that as the difference in meaningfulness between states increases by one standard deviation, net migration increases on average by about 8.2 percent. The coefficients on the differences in U-index and net affect are insignificant but also have the wrong signs.

When all other independent variables are included in Column 2 of Table 2, the standardized coefficients on the differences in global life satisfaction and in meaningfulness still remain positive and statistically significant. And compared with the results in Column 1, the magnitudes of the standardized coefficients of these two variables became similar to each other in Column 2. An interesting change in Column 2 is that the standardized coefficient on the difference in U-index between states became now statistically significant, though still with the wrong sign.

Among other independent variables, the only statistically significant ones are those for the unemployment rate from state *j* and the migrant stock variables, with the expected signs. It seems that the inclusion of the migrant stock variables reduced the effect of other economic

variables, such as wage and unemployment rate (Greenwood 1969). Also the fact that the coefficients on distance and population are insignificant is consistent with the explanation by Greenwood (1975) that any variable expected to have the same sign in gross migration equations, such as distance or population, would tend to wash out in the net migration equation.

6. Conclusions

In an effort to further sort out what measures of subject well-being are suitable indicators of the differences in the quality of life across states, this paper has examined how various measures of state-level subjective well-being—global life satisfaction, U-index, net affect and meaningfulness—affect net migration of individuals across states in the United States. The results indicate that while the differences in overall life satisfaction and in meaningfulness between states significantly increase net migration, the differences in U-index and net affect between states do not increase net migration.

The results in this paper provide more empirical evidence that subjective well-being indeed affects individuals' migration decision. Furthermore, these results more or less confirm the findings in Oswald and Wu (2010) and Song (2014) that global life satisfaction and meaningfulness are correlated with the objective quality-of-life ranking of the fifty states in the United States, suggesting that these two measures are better suited to monitor progress in quality of life beyond simple measures of income and to better guide public policy.

Because only one year of data are available for all measures of subjective well-being, this paper could only carry out a cross-sectional analysis. The ATUS WB Module was collected again in 2012. When the 2012 ATUS WB Module data are available, it would allow panel data

analyses and more robust tests of the relationship between measures of subjective well-being and migration.

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Table 1 Descriptive Statistics

Variables	Mean	Standard deviation	Minimum	Maximum
Net migration (people)	155.8	2,441	-34,101	20,843
Difference in subjective well-being				
Global life satisfaction	.0017	.043	-.138	.118
U-index	.0094	.059	-.156	.229
Net affect	-.0235	.443	-1.574	1.528
Meaningfulness	.0332	.333	-.940	1.025
$Wage_i$ (in dollars)	37,475.7	5,069	31,270.5	52,036.9
$Wage_j$ (in dollars)	38,199.9	5580	31,270.5	52,036.9
Unemployment $rate_i$	8.53	2.08	3.8	13.8
Unemployment $rate_j$	9.04	1.97	3.8	13.8
Distance (in miles)	1,244.7	733	50.3	3,285.3
$Population_i$ (people)	5,829,045	5,869,079	564,460	37,349,363
$Population_j$ (people)	6,948,773	7,677,482	625,960	37,349,363
$Stock_{ij}$ (people)	33,159.6	64,836	0	656,166
$Stock_{ji}$ (people)	38,108.6	86,945	0	1,590,637
Number of observations		1,128		

Table 2 Net migration, 2011: Standardized beta coefficients and t-statistics

Dependent variable: Inverse hyperbolic sine transformation of $Net\ migration_{ij}$

Variables	(1)	(2)
Difference in subjective well-being		
Global life satisfaction	.150***	.106***
	(4.99)	(2.94)
U-index	.056	.093**
	(1.31)	(1.96)
Net affect	-.045	-.030
	(-.92)	(-.57)
Meaningfulness	.082**	.102***
	(2.25)	(2.73)
IHS ($Wage_i$)		-.044
		(-1.31)
IHS ($Wage_j$)		.042
		(1.26)
Unemployment $rate_i$		-.010
		(-.28)
Unemployment $rate_j$		.083**
		(2.13)
IHS (Distance)		.027
		(.67)
IHS ($Population_i$)		.019
		(.33)
IHS ($Population_j$)		-.081
		(-1.52)
IHS ($Stock_{ij}$)		.347***
		(5.70)
IHS ($Stock_{ji}$)		-.226***
		(-3.81)
R-squared	.0322	.0745
Number of observations	1,128	1,128

Note: T-statistics are reported in parentheses. * Statistically significant at the .10 level; ** Statistically significant at the .05 level; *** Statistically significant at the .01 level.