Does "Community Social Capital" Contribute to Population Health?

by

Sherman Folland
Department of Economics
Oakland University
Rochester, MI 48309
1-586-752-5738

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Abstract

Robert Putnam showed that a social capital index, an amalgam of sociability and community-mindedness indicators, relates beneficially to important community outcome variables, such as educational skill levels, crime rates, the treatment of children, as well as to a total mortality rate. This paper extends previous research by 1) testing the applicability of this measure of social capital to a variety of health indicators prominent in population health research; 2) evaluating Putnam's claims within a multivariate production of health context more familiar to health economists; and 3) expanding the data set from a single cross section of states to a panel spanning 20 years of U.S. experience. This study also addresses the possible endogeneity of the social capital index and the problem of identification. These analyses demonstrate that community social capital holds a very strong and beneficial association with health when comparing U.S. states en panel. This pattern holds reasonably well under instrumental variables and when estimating by first differences, though, in the latter case, changes in the social capital coefficients suggest a potentially more complex dynamic structure. Overall, the research, which substantially challenges the hypothesis, nevertheless it makes a clearly supportive case that the nexus of health and social capital merits our further research at other levels of observation, samples and approaches to identification.

We know that marriage extends life, that loss of a spouse shortens it, that hospitals provide "tender loving care" and entertainment to child patients because it improves their recovery, and that joining groups helps cancer patients to cope and possibly to recover. Does a community's sociability and community-mindedness likewise help to improve the health of its population? To begin to answer this important question we must first show whether, as Robert Putnam (2001, 1995) claimed regarding a variety of community outcomes, social capital and population health are reliably associated in a manner consistent with a beneficial effect.

In the book, *Bowling Alone* (2000), Putnam demonstrated with scatter grams of community outcome indicators and his Social Capital Index (*SCI*) pronounced correlations all of which suggested a beneficial effect of social capital (*SC*) on community well-being. Across the 48 contiguous states in 1994, as social capital rises crime falls, child care improves, educational scores rise, children watch less TV, and the total mortality rate is lower. These patterns piqued substantial interest, and they naturally raise questions within health economics, such as: Do these social capital results apply widely to other health categories, do they survive in a more strenuous multivariate framework, is the social capital effect econometrically identified, and is *SCI* truly exogenous?

The potential of social capital is enormous; and even though it is still contingent on confirmation by further research, its potential has not gone unnoticed. Continuing seminars, such as the Saguaro Seminar at Harvard, the World Bank social capital seminar, and similar activities at the International Monetary Fund and OECD reflect an optimism that social capital development will help to stimulate economic, cultural and

community health development. This generated a corresponding scholarly output probing the nature and effects of social capital (Woolcock, 2001; Szreter and Woolcock, 2002; DePhilipis, 2001; and Fukuyama, 1999).

The issue is now also addressed within health economics. The two most recent biennial meetings of the International Health Economics Association (iHEA) featured papers and sessions on the subject. The National Bureau of Economic Research has devoted several recent working papers to the nature of social capital (Glaeser, Laibson and Sacerdote, 2000; Gugerty and Kremer, 2000; Case, Fertig, and Paxson, 2003; Agrawal, Cockburn, and McHale, 2003; Costa and Klein, 2001). As yet, however, there has not been a panel and multivariate investigation of Putnam's index to population health.

This paper investigates a panel of U.S. data on the 48 contiguous states. It explores the empirical relationships in a context more familiar to health economists and more econometrically challenging than done previously, the multivariate model permits tests of social capital when faced with possible confounding effects. The paper also addresses the issues of identification and the potential endogeneity regarding the social capital measures.

Section I discusses possible paths by which social capital could affect population health, providing a motivation for the statistical sections. Section II describes the 1978-1998 panel as well as the augmented cross-section for 1994. Section III examines the health impacts in a context similar to Putnam's exposition, in effect reproducing and extending his results. Section IV develops a more fully specified health equation in the style of the health production function literature, and it develops instrumental variables

for the *SCI*. Section V examines the effect of changes in health given changes in social capital and other variables, and it discusses the dynamic characteristics of the model. Section VI provides a sketch of where we are today, and it offers suggestions for further research.

Section I: How Could Social Capital Affect Population Health?

The irreducible element of social capital must be the human relationship; Robison and colleagues specifically define this relation as sympathetic (2002). Arguably one's most important sympathetic relationships are with spouse, children, close friends and community, the latter being a potentially very complex network of relationships. How could these affect our health?

The primary purpose of the present paper is empirical. For this purpose the Hypothesis to be tested is simply that, *ceteris paribus*, community social capital improves a variety of community health status indicators. Is there sufficient theory, even if informal theory, to justify this hypothesis? The search for justification is not difficult. Plausible connections of *SC* to health can be seen without effort.

Four are described here:

1. Reducing Stress: Human relationships reduce stress for many people. This idea is also common to both folk wisdom and literature. It is a principal basis for psychological therapies both individual and group. The benefit to health from stress reduction is suggested in studies of the role of family in recovery rates (e.g. Cohen et al., 1997), and it is a principal finding of recent brain research (Sapolsky, 1998). That these ideas might also apply to communities is suggested by recent research by Kawachi et al.

(1997), in which social capital was proxied by a measure of income inequality. Within the context of health economic modeling, stress reduction from social capital might act as an input in the production of health function. LaPorte and Ferguson (2004) used an approach similar to the role of efficiency in health production, an idea developed from Grossman's (1972) model of the demand for health capital.

2. Encouraging Healthful Behaviors: A related avenue for the effect of social capital is that spouse, children and friends may function as coaches urging healthful practices. Some writers, noting these benefits have called it "nagging" (Waite and Gallagher, 2000). People now often hire trainers for a constructive health and fitness purpose. Its role in the production of health function might be to enhance the productivity of the individual's own health input efforts.

3. Providing Information. One's social network expands one's knowledge base regarding the production possibilities. This applies, for example, to knowledge of the effectiveness of prescription drugs, the role of alcohol in health, patterns and effects of physical activities and more. Enhanced information might work to improve health by eliminating mistaken perceptions of the production of health function in consumer decision making (Phelps, 2000).

4. Growing Responsibility: One's roles as spouse, parent or community participant often involve the perception of responsibility for the well-being of others. For example, to take responsibility for one's children requires at a minimum that one stay alive and healthy. Folland (2006) showed that an expected utility maximizer when adding social capital tends to shift away from risky health behaviors (see also Robison and Hanson, 1995). Additional support for this comes from DeLiere and Levy (2001)

who showed that workers adopt less risky jobs on the margin when getting married or having children. Likewise Akerlof (1998) demonstrated similar responses to marriage and children with data from the National Longitudinal Survey of Youth.

Section II: The Data

A panel over 1978 through 1998 by four year intervals was created for the 48 contiguous states. The 1994 cross-section was augmented to include the *SCI* devised by Putnam. He derived the *SCI* from a factor analysis providing a weighted sum of the 14 social indicators described in Appendix A of this paper. Six of these indicators were available to the present study not only for Putnam's year, 1994, but also for the entire panel. These derived from the DDB Life Style Data 1975-1998 database generated by DDB Worldwide of Chicago. These six indicators correlate well with Putnam's original index; with the *SCI* as the dependent variable and the six indicators as independent variables, over 80 percent of the variation in the *SCI* is explained for the 1994 cross-section (Appendix B). Population data were provided by the *Current Population Reports* for the various years. Table 1 presents descriptive statistics on these indicators for the 1994 cross-section. Table 2 describes the six social indicators used in the panel, and reports their average annual percentage change. Putnam showed that many social capital indicators declined in America between the 1950s and the 1990s, and we notice that most of the individual indicators in this panel declined as well. The descriptive statistics for the panel are reported in Table 3. The remaining variables are in two groups: Economic measures and population health status indicators.

Table 1 About Here

Table 2 About Here

Table 3 About Here

The several economic variables are derived from standard sources. Personal income per capita, percent of population in poverty, percent of population holding the BA degree, and percent of labor force unemployed came from the Census Bureau reports various years (see also the *Statistical Abstract*). Personal health care expenditures per capita are from the Center for Medicare and Medicaid Services, various years.

Several population health status variables are from the *Monthly Vital Statistics Report* various years and are defined as follows: The *Infant Mortality Rate* is the ratio of deaths to infants 0 to 1 year old to the total number of live births; and the percent of *Low Weight Births* is based on the reported total low weight (under 2500 grams) births as a ratio to the total live births. *Life Expectancy* is calculated from birth. The remaining six mortality rates are each age-standardized to the 2000 population distribution and are derived from the "CDC Wonder" on line program provided by the Center for Disease Control. Mortality rates included are *Total Mortality*, *Heart* (cardiovascular rate), *Cancer* (malignant neoplasms), *Accident* (including motor vehicle), and *Suicide*, each calculated per 100,000 population.

Finally Putnam's results for several other variables are reproduced to verify the compatibility for comparisons of the two frameworks. These included measures of the crime rate, percent voting in the most recent presidential race, and average educational outcome scores; these results corresponded closely to Putnam's published results.

Section III. Testing the Hypothesis by Extending Putnam's Framework

Robert Putnam, the person most closely associated with social capital, published predominantly bivariate analysis in his book, *Bowling Alone*. Let us begin the same way, by exploring bivariate regressions on the 1994 cross-section of the 48 contiguous states but with a variety of health indicators. Table 4 presents the results, which strongly support the Putnam result by extending it in this way.

TABLE 4 ABOUT HERE

TABLE 5 ABOUT HERE

Table 5 selects two of the most prominent health status indicators, the total age-adjusted mortality rate and the infant mortality rate. These are then each tested on each of the six cross-sections available to this study. To do this, we need to depart from Putnam's index, which is available only for 1994 and instead employ the six social capital indicators described earlier. These six were included as independent variables and their sum of their mean values weighted by the estimated coefficients was calculated and this sum was proposed to equal zero as a side null hypothesis. For convenience, Table 5 presents a single probability value to assess this side hypothesis. This is defined so that a stated probability less than 0.05 indicates the rejection of the null. The value of the aggregate impact of social capital on the dependent variable is also presented, and by hypothesis its sign should be negative. As is seen, the social capital impact supports the

hypothesis; it is generally negative and the probability values are usually quite low. The regression over all years supports the hypothesis strongly.

Section IV. Social Capital in the Production of Health

These results look good, but we can still ask: Is it the social capital that leads to better health? For example, do maternity outcomes improve when there is more social activity and community-mindedness in the local environment, or are social capital variables standing in for other more important factors? The bivariate specifications while provocatively supportive of the hypothesis, invoke questions of whether omitted variables exist that bias the social capital coefficients away from zero.

A multivariate specification provides a needed challenge, one familiar to the health economist's production of health analysis. Potentially confounding variables, for example, per capita income, unemployment rates and poverty rates might affect mortality by creating greater stress, and health expenditures might affect mortality where prominent diseases are amenable to health care interventions. Likwise, education has proved to be a significant correlate of health in many studies; education plausibly improves the individual's effectiveness in bettering his own health (Lleras, 2002).

Tables 6A&B, provide the results of regressions on the panel with period effects, and these are done for each of the seven health status measures. These show that social capital enters with a negative coefficient in all seven equations, it is easily significant for Total, LowWeight, Infant Mortality, and Accidents, fairing poorly only for Heart and

Cancer. The issues of heart and cancer may be complex; these mortality rates also respond differently from the other independent variables.

TABLES 6A AND 6B ABOUT HERE

The equations were then rerun by adding fixed effects for the states. The resulting social capital impacts and their probability values are shown in the last row of Tables 6A&B. The loss of precision and occasional changes in sign probably indicate that social capital taps into the same slow changing characteristics of each state that associate with the fixed effect dummy. With few exceptions, the six indicators do change slowly among the states over the six periods, and these generally show a downward trend. It is likely that the inability to distinguish between state social capital and other state fixed effects is simply a limitation of the present data.

Econometric Issues

Durlauf (2002) showed that the greatest threats to econometric validity of social capital estimates, issues that challenge the implicit claim of causality, are questions of the endogeneity of social capital and identification of that variable's structural coefficient. The problems are known to be especially challenging for studies, such as Putnam's and the present study as well, which use group data aggregates as measures. I will describe Durlauf's framework for identification in the face of endogeneity when using aggregate data and his statement of how these problems can be resolved.

Let two equations describe the outcome of the study, ω, (here each candidate ω is a health status indicator at the state aggregate level) and social capital, *SC*, be defined as over state level groups by the following two equations:

(1) $\omega = k + \boldsymbol{dY} + J_1\mathrm{E}(\ \omega \mid F) + J_2\mathrm{E}(\ SC \mid F) + \varepsilon$

(2) $SC = k' + \boldsymbol{d'Y} + J'_1\mathrm{E}(\ \omega \mid F) + J'_2\mathrm{E}(\ SC \mid F)\ + \eta$

where k, k', $\boldsymbol{d}$, $\boldsymbol{d'}$, J_1, J'_1, J_2, and J'_2, are constants to be estimated. F is an information set available to all. Thus Durlauf poses here the possibility that expectations about ω and *SC* by the people whose decisions work to effect the outcomes of ω and *SC* may codetermine those outcomes. These possibly severe complications are entered as the expectation terms $\mathrm{E}(\ \omega \mid F\ )$ and $\mathrm{E}(\ SC \mid F)$. He describes a path to identification as follows; this requires two steps.

If $J_1 = 0$, then identification requires at least one variable in $\boldsymbol{Y}$ to have a nonzero coefficient in Equation (2) and to have a zero coefficient in Equation (1). Durlauf understandably adds that the theory must explain this. I wish to show that social capital is plausibly identified by this route, that is, the results in this paper, given our state of knowledge, cannot be dismissed on the grounds of Durlauf's cautions.

First, $J_1 = 0$ is an acceptable assumption here. For example, people's expectations on the group total mortality rate, very likely do not influence their health behaviors. Contrast this with the role of expectations for the behavior of epidemics due to contagious disease: One hears that measles prevalence is high, one takes preventive

measures. But beliefs about aggregate rates, if even known, are unlikely to affect behaviors related to the health measures studied here.

Second, I propose that geographic latitude suffices as an identifying variable. The variable is insignificantly different from zero in all but two of the seven regression equations and it is uncorrelated with the error term of each of those equations. Theoretically, higher latitudes, especially regions along the northern belt beneath the Canadian border were disproportionately populated by Scandinavian and German ethnic groups, both of which would be included in any list of community oriented subcultures. Putnam in fact claims that the variable most highly correlated with his Social Capital Index is the fraction of population of Scandinavian ethnicity.

It is reasonable to assume here that these populations were physically and innately no less prone to disease than other ethnicities. I argue that these assumptions fit our knowledge, and they are acceptable. As a minimum, together they describe a plausible path to identification of the social capital coefficients.

This process also discovered another variable the can be applied to instrument Social Capital. This second variable, *Employment per Capita*, is also uncorrelated with the error terms of the original health status measure equations. Tables 7A&B present the mortality equations using instrumental variables. This results format differs in appearance from those prior because it was necessary to reduce the six social capital measures to a scalar *SC* measure. This was done by weighting each of the six indicators by their estimated coefficients in the equation (see Appendix B) by which these indicators were tested against Putnam's *SCI* for 1994 data. It is clear in Tables 7A&B that instrumenting social capital causes little or no reduction in its apparent significant role.

TABLE 7 A AND B ABOUT HERE

Section V. Changes in Social Capital and Other Variables

Differencing both sides of the regression equations offers some advantages. We can cancel out the effects of any omitted variables that remain relatively constant between periods. Also, by comparing with the levels regressions we may be able to indicate the presence of a more complex dynamic pattern.

It should be noted that the regressions only derive evidence of the effects of changes in social capital, this in no case implies that social capital can be changed by an intervention policy. *SC* might prove very difficult to change by policy. Research in fact suggests that changing a community's social capital is a complex and difficult task (Gugerty and Kremer, 2000).

Table 8 reports the net impact of changes in the *SC* indicators on the various health status measures and the probability test of the null hypothesis that the result of ten percent increase in each social capital indicator is no effect. With the exception of having weakened the precision of estimates, which is natural to first differenced equations, the results tend to corroborate the regressions on levels. The impacts are generally negative, with the exceptions of heart and total mortality. Yet, these two may suggest a different sort of dynamic. It has been noted by Cutler (2004) that substantial reductions in heart mortality in recent decades have come largely from improvements in health care technology. These plausibly owe little to credit social capital change. Heart mortality is

the top killer in the United States, and it accounts for much of the decline in total mortality.

TABLE 8 ABOUT HERE

We can get a glimpse across the various results shown thus far by comparing a split of the means of the variables for a single period, here 1998 is chosen. We gain this glimpse at a cost, of course, the comparison of means is a weaker design; but the advantage is to get a broader look. Table 9 provides two contrasts, one between "high" *SC* states and "low" states; the other contrast presents "high" *SC* growth states and "low" growth states. In the table, "high" or "low" is defined as above or below the sample mean value for *SC* and change in *SC* respectively. The social capital effect is apparent if somewhat modest in the levels column. Changes in the measure yield similar effects though not as consistent.

TABLE 9 ABOUT HERE

Section VI. Discussion and Conclusions

The social capital concept has drawn criticism (Arrow, 1999; Solow, 1999). Objections often focus on the use of "capital" as a metaphor for the social phenomena of interest. Social capital was not developed as a measure of something tangible, instead for example, Putnam's measure stems from a factor analysis of a large number of marketing firm interview responses. One's confidence that the underlying construct exists, that it is adequately measured by our variables, and that it is identified by our theory introduces

judgment. To be meaningful as capital, it must be durable, exchangeable and open to investment. Yet, to others, whether that metaphor is apt or not is not the central issue because measures of social phenomena have shown to be empirically associated with outcomes of interest across the social sciences. Meanwhile recent theoretical research suggests that social capital serves the capital role just as well as does human capital (Glaeser, Laibson, and Sacerdote, 2000).

The present study, more or less in the spirit of Popperian science, is aimed at providing tests of the social capital hypothesis as applied to health, tests that the hypothesis could fail. Putnam's exposition, which treats community health only in a minor way, need not have proved successful when applied to a broader array of health indicators. It could have failed to work for other time periods or in the panel constructed here. It could have failed instrumental variables or regression and other statistical studies of change in the variables. But, despite several exceptions, the overall impression has to be that the hypothesis works well in its applications to health.

Studying social capital at the aggregate level has both advantages and disadvantages. The main advantages are the quality of available data, the fact that Putnam posed his hypothesis at this observation level, and the opportunity to pose several tests that potentially could falsify either his claim of *SC* effects generally or its application to community health.

The disadvantages are mainly two. First, although it is argued here that the social capital effect can be identified in these aggregate data, it nevertheless is known that it is more difficult to do so with confidence in a group aggregate framework. Second, results, even if they are true at the aggregate level, may not be true at the individual level; this is

the so-called ecological fallacy, a proposition that is deductively true. Please note that these drawbacks do not rule out group aggregate methods, in fact it is common in health economics to progress by studying both aggregates and individuals, often beginning with the former. Today we often see useful cross-national studies, a very high level of aggregation indeed.

Nevertheless, the study of social capital at the individual level and the development of new ways to identify its effect present potentially very fruitful areas for research. Likewise continued efforts to integrate medical studies with health economic studies in this area could prove important, medical reports will sometimes support and sometimes debunk claims regarding the positive effects of social relationships on individual health. Studies linking the SC concepts to human behaviors whether healthful or risky would further the effort of building more complete and coherent models. The variety and volume of positive results presented here suggest that there is easily enough signal out of the noise to justify such further research.

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Appendix A:

Indicators composing Robert Putnam's Social Capital Index:

Measures of community organizational life:
- Served on committee of local organization in last year (pct).
- Served as officer of some club or organization last year (pct).
- Civic and social organizations per 1,000 population.
- Mean number of club meetings attended last year.
- Mean number of group memberships.

Measures of engagement in public affairs:
- Turnout in presidential elections.
- Attended public meeting on town or school affairs in last year (pct)

Measures of community volunteerism:
- Number of nonprofit (501c3) organizations per 1,000 population.
- Mean number of times worked on community projects in last year.
- Mean number of times did volunteer work in last year.

Measures of informal sociability:
- Agree that "I spend a lot of time visiting friends."
- Mean number of times entertained at home in last year.

Measures of social trust:
- Agree that "Most people can be trusted."
- Agree that "Most people are honest."

Source: Putnam, Bowling Alone, 2001, p. 291

Appendix B:

Appendix Table 1. Regression of Six Social Capital Measures on Putnam's Index

Variable	Coeff (t value)
Constant	-6.604 (7.61)
Club Meetings	0.265 (3.89)
Community Projects	0.462 (3.16)
Entertained	0.180 (2.70)
Volunteered	0.163 (2.24)
Most are Honest	0.013 (0.37)
Visited Friends	0.098 (0.33)
R Square (probability of F)	0.802 (0.000)

Tables

Table 1. Social Capital, Economic and Health Variables: 1994 Cross-Section

Variable	Mean	Std. Dev	Minimum	Maximum
Social Capital Index (Putnam)	0.059	0.790	-1.430	1.710
Baccalaureates, pct	21.644	4.266	11.400	30.100
Personal Income per capita	14139	1980.8	10694.0	19841.1
Poverty, pct	0.131	0.039	0.076	0.259
Unemployment, pct	5.634	1.279	2.900	8.900
Health expenses per capita	16528	18902	1087	96726
Total mortality rate (age adj)	8.236	0.7631	6.341	10.245
Life expectancy from birth	75.641	1.310	73.030	78.210
Infant mortality rate	7.924	1.341	5.000	11.000
Low weight births, pct	7.462	1.307	5.200	10.200
Heart mortality rate, (age adj)	273.02	59.987	88.000	377.00
Cancer mortality rate,(age adj)	193.77	20.588	130.377	226.30
Accident mort. rate,(age adj)	37.398	8.459	21.051	62.562
Suicide rate (age adj)	13.099	3.464	7.228	23.564

Note: Variable definitions and sources are described in the text. For each of these variables, the number of observations is 48, one for each of the contiguous 48 states. In several cases, the variable value was not available for 1994, and the nearest available year was substituted.

Table 2. Definitions of the DDB Social Capital Indicators Used en Panel

Indicator	Ave % Change	DDB Definition
Social Capital "Index"*	-5.300	Weighted sum of the effects of the listed indicators (See note below).
Club Meetings	-7.117	Went to club meetings (frequency in the past 12 months)
Community Projects	-2.031	Worked on community projects (frequency in the past 12 months)
Entertained	-7.421	Entertained people in my home (frequency in the past 12 months)
Most are Honest	-0.311	*'Most people are honest'*: 1. definitely disagree; 2. generally disagree; 3. moderately disagree; 4. moderately agree; 5. generally agree; 6. definitely agree.
Volunteered	7.684	Did volunteer work (frequency in the past 12 months)
Visited Friends	0.426	'I spend a lot of time with friends': 1. definitely disagree; 2. generally disagree; 3. moderately disagree; 4. moderately agree; 5. generally agree; 6. definitely agree.

Note: These were available for nearly all years from 1975 to 1998 from the DDB Worldwide, Inc. Chicago, also on-line. *Putnam's social capital index does not exist for years other than 1994. To simulate the progress over time of such an index, this social capital row defines an index by application of the regression coefficients of the six indices as generated in their regression on Putnam's published index for 1994. See Appendix B for this regression.

Table 3. Social Capital Indicators, Economic and Health Variables: Panel

Variable	Mean	St. Dev.	Minimum	Maximum
Club Meetings	7.501	1.944	1.750	14.870
Community Projects	2.461	0.830	0.329	6.900
Entertained	11.926	2.572	6.480	20.450
Volunteered	7.237	1.764	1.540	13.500
Most Are Honest	3.866	0.686	3.300	4.61
Visited Friends	3.012	0.222	2.000	3.84
Baccalaureates, percent	18.975	4.891	9.100	34.000
Personal Income per capita	13634	2429.9	8611.8	22898.3
Poverty, fraction of population	0.127	0.038	0.047	0.329
Unemployment rate, percent	6.198	2.264	2.200	15.500
Health expenses in ratio to pop.	206.06	108.77	3.75	491.26
Total mortality rate	939.7	83.83	692.7	1127.6
Infant mortality rate	9.975	2.667	4.500	18.200
Low weight births, percent	7.052	1.031	4.300	10.800
Heart mortality rate	113.8	36.9	41.0	213.0
Cancer mortality rate	186.2	18.2	132.0	283.0
Accident mortality rate	41.5	10.2	20.0	93.0
Suicide rate	13.38	3.46	7.0	30.0

Notes: For "Club Meetings" through "Visited Friends", see Table 2 explanations; "Health Expenditures per Capita" is defined as inflation adjusted personal health care expenditures in millions per population (reduced by a factor of ten); "Total Mortality" and "Infant Mortality" are crude deaths per 100,000 people and crude deaths per 1,000 live births respectively; "Heart Mortality" through "Suicide Rate" are crude deaths per 100,000 population.

Table 4. Health Status and Putnam's Social Capital Index in a 1994 Cross-Section of the 48 Contiguous States.

Health Status Indicator	Soccap Coeff.	| t |
Total mortality rate	-0.531	5.08
Percent LowWeight Births	-0.917	4.42
Infant mortality rate	-0.748	3.29
Heart mortality rate	-21.284	3.37
Cancer mortality rate	-10.485	3.38
Accident mortality rate	-2.812	1.98
Suicide rate	-0.372	0.22
Life expectancy at birth	1.394	11.58

Note: Total mortality, heart, cancer, accident, and suicide rates are each adjusted for the population's age distribution using the U.S. 2000 as the standard. The center column reports the regression coefficient for Putnam's social capital index.

Table 5. Does the Social Capital Hypothesis Work in Other Periods?

Health Status Indicator	Period	Social Capital Impact	Signif. Test
Total mortality rate	1978	-583.7	0.001
Infant mortality rate	1978	-12.33	0.052
Total mortality rate	1982	-337.5	0.075
Infant mortality rate	1982	-2.238	0.178
Total mortality rate	1986	-383.4	0.031
Infant mortality rate	1986	-9.84	0.020
Total mortality rate	1990	-1237.9	0.000
Infant mortality rate	1990	-9.45	0.036
Total mortality rate	1994	-585.8	0.002
Infant mortality rate	1994	-14.95	0.002
Total mortality rate	1998	-1289.0	0.000
Infant mortality rate	1998	-20.23	0.000
Total mortality rate	All years	-573.5	0.000
Infant mortality rate	All years	-8.93	0.022

Note: The "Social Capital Impact" column reports the linear sum of the mean values of the six social capital indicators each weighted by their regression coefficients. The "Significance Test" column gives the estimated probability that the mean of the true value of the social capital impact is zero.

Table 6 A. Social Capital as an Input to the Production of Health

Independent Variable	Dependent Variable: Total mortality rate (t*)	Dependent Variable: Infant Mortality rate (t*)	Dependent Variable: Low Weight Birth rate (t*)
Social capital impact	-111.14 (0.000)	-6.161 (0.007)	-10.26 (0.000)
Baccalaureate percent	-8.42 (7.62)	-0.166 (5.14)	-0.082 (3.78)
Personal inc. per capita	0.013 (5.40)	0.0004 (5.24)	0.0003 (4.13)
Poverty rate	488.6 (4.53)	19.63 (6.10)	59.2 (4.33)
Unemployment rate	3.63 (2.20)	-0.0002 (0.33)	-0.0006 (0.29)
Health expend. per cap.	-0.333 (6.12)	-0.016 (10.26)	0.002 (2.15)
Constant	1366.3	8.819	8.556
R Square (p value for F)	0.624 (0.000)	0.715 (0.000)	0.372 (0.000)
Soc. Cap. Impact with state effects	10.586 (0.760)	-1.305 (0.268)	-2.473 (0.009)

Note*: Absolute values of the t statistic are reported in parentheses, except in the case of the social capital impact , in which case the probability value is given for the chance that the mean value of the true impact is zero. The number of observations in each regression is 288.

Table 6B. Social Capital as an Input to the Production of Health Continued.

Independent Variable	Dependent Variable: Heart mort. rate (t*)	Cancer mort. rate (t*)	Accidents mort. (t*)	Suicide rate (t*)
Social capital impact	-5.878 (0.703)	-60.652 (0.003)	-19.433 (0.007)	-2.680 (0.252)
Baccalaureate percent	-3.763 (8.87)	-1.613 (4.55)	0.131 (1.04)	0.125 (1.83)
Personal inc. per cap	0.001 (1.07)	0.003 (3.63)	-0.001 (3.66)	-0.0004 (2.83)
Poverty rate	-18.052 (0.43)	28.650 (0.81)	102.83 (8.09)	0.762 (0.11)
Unemployment rate	0.012 (1.88)	0.033 (0.61)	-0.011 (5.85)	-0.003 (2.56)
Health expnd. per cap.	-0.092 (4.44)	0.025 (1.44)	-0.029 (4.73)	-0.009 (2.82)
Constant	183.18	234.74	69.739	24.356
R Square (prob. for F)	0.743 (0.000)	0.232 (0.000)	0.609 (0.000)	0.213 (0.000)
Soc. Cap. Impact with state effects	14.652 (0.352)	8.075 (0.529)	-7.939 (0.033)	0.835 (0.895)

Note*: Absolute values of the t statistic are reported in parentheses, except in the case of the social capital impact , in which case the probability value is given for the chance that the mean value of the true impact is zero. The number of observations in each regression is 288.

Table 7A. The Production of Health with Instrumental Variables

Independent Variable	Dependent Variable: Total mortality rate (t*)	Dependent Variable: Infant Mortality rate (t*)	Dependent Variable: Low Weight Birth rate (t*)
SC Instrumental Variables	-41.06 (6.02)	-0.806 (4.25)	-1.207 (10.21)
Baccalaureate percent	-9.23 (8.63)	-0.184 (6.22)	-0.061 (3.29)
Personal inc. per capita	0.013 (5.51)	0.0003 (5.47)	0.0003 (2.58)
Poverty rate	442.8 (3.94)	14.963 (4.79)	11.013 (5.65)
Unemployment rate	6.85 (4.27)	-0.011 (0.24)	0.019 (0.71)
Health expend. per cap.	-0.284 (6.25)	-0.019 (15.24)	0.001 (1.80)
Constant	904.88	10.811	5.115
R Square (p value for F)	0.592 (0.000)	0.718 (0.000)	0.479 (0.000)

Note*: Absolute values of the t statistic are reported in parentheses, except in the case of the social capital impact , in which case the probability value is given for the chance that the mean value of the true impact is zero. The number of observations in each regression is 288.

Table 7B. The Production of Health with Instrumental Variables cont.

Independent Variable	Dependent Variable: Heart mort. rate (t*)	Cancer mort. rate (t*)	Accidents mort. (t*)	Suicide rate (t*)
SC with instrument variables	2.347 (0.89)	-2.741 (1.29)	-2.974 (3.54)	-0.762 (1.75)
Baccalaureate percent	-4.235 (10.37)	-1.985 (5.98)	0.221 (1.74)	0.153 (2.24)
Personal inc. per cap	0.003 (2.92)	.003 (5.68)	-0.002 (7.04)	-0.0006 (4.19)
Poverty rate	-1.943 (0.05)	22.385 (0.64)	81.496 (6.09)	-7.062 (0.98)
Unemployment rate	0.347 (0.56)	2.498 (5.02)	-0.387 (2.03)	-0.052 (0.52)
Health expend. per capita.	-0.154 (8.83)	0.037 (2.64)	-0.003 (1.24)	-0.003 (1.24)
Constant	188.78	141.40	59.474	21.225
R Square (prob. for F)	0.712 (0.000)	0.215 (0.000)	0.539 (0.000)	0.106 (0.000)

Note*: Absolute values of the t statistic are reported in parentheses, except in the case of the social capital impact , in which case the probability value is given for the chance that the mean value of the true impact is zero. The number of observations in each regression is 288.

Table 8. Changes in the Variables as Predictors of Changes in Health Status Rates: Dependent Variable is Change in the Given Health Status Rate

Level Changes, Regression Results

Independent Variable	Total Mort.	Infant Mort.	Low Wt Birth	Heart Mort.	Cancer Mort.	Accident Mort.	Suicide Rate
Impact of social capital	3.62	-3.03	-1.07	28.95	-14.82	-10.29	-2.39
p value of null for the impact	(0.926)	(0.124)	0.286)	(0.124)	(0.387)	(0.120)	(0.411)
p value of F for equation	(0.001)	(0.021)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: All dependent and independent variables in the first set of regression reports are calculated as changes in the levels of each variable. The middle row in each set contains the probability for the null hypothesis, that social capital changes have no effect on the changes in the relevant mortality rate. The bottom row in each set contains the probability of the null hypothesis that the equation as a whole has no effect on the changes in the relevant mortality rate. To permit more change in the slow moving social capital indicators, the variables were differenced over two periods. This required the deletion of the first two periods from this analysis.

Table 9. The Mean Health Experience of States Differs by Whether They Have High or Low Levels of and/or Changes in Social Capital

	Levels of Mortality		Changes in Mortality	
Health category	High level states	Low level states	High growth states	Low growth states
Social Capital	-0.101	-1.341	0.432	-0.968
Total Mortality	859.4	890.2	-53.52	-52.86
Infant Mortality	7.22	7.37	-1.87	-1.67
Low weight birth percentage	7.41	7.58	0.385	0.426
Heart mortality	70.73	77.84	-30.30	-29.25
Cancer mortality	176.409	186.34	-14.65	-9.57
Accident mortality	39.86	38.96	-1.70	0.21
Suicide rate	12.5	12.69	-0.95	-1.21
Number of Cases	22	26	20	28

Notes: Each mortality rate is defined as deaths per 100,000 population. The columns marked "Levels" are distinguished by high (greater than the mean) or low (less than the mean) social capital for the sampled states. The columns marked "Changes" are distinguished by higher or lower than the mean change from the previous period in social capital for these states. The data are for the 1998 period.