Life Expectancy, Health Care, and Economics

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Abstract

In this paper I studied life expectancy, health care spending, medical resource availability, and lifestyle issues in the United States relative to other member countries in the Organization for Economic Cooperation and Development (OECD). I find the United States performs very poorly relative to its peers. While the United States spends more per capita by far than any other member country, it has a lower life expectancy and fewer medical resources than most member countries.

Life Expectancy, Health Care, and Economics

Introduction

In this paper I study life expectancy in the United States relative to other member countries in the Organization for Economic Cooperation and Development (OECD) as a function of health care spending, available health care resources, and lifestyle variables. I find the United States performs very poorly relative to its peers. While the United States spends more per capita by far than any other member country, it has a lower life expectancy and fewer medical resources than most member countries. As of 2006 the life expectancy of the average United States citizen at birth was 78 years. Japanese citizens had the longest life expectancy of any OECD country at 82 years. Turkey and Hungary were tied for the shortest life expectancy at 73 years. This relatively low life expectancy cannot be blamed on the usual culprits of tobacco and alcohol. The United States consumes less tobacco than any other member country except Canada and less alcohol than most other member countries. Also, alcohol consumption is positively correlated with longevity. America's huge obesity rate and its lack of health care resources relative to other member countries most likely cause the poor health of Americans (figure 1). While the United States spends more per capita by far than any other member country, this strangely does not lead to an abundance of heath care resources. The possible effects of government regulation on the health care industry are also discussed.

Literature Review

The standard assumptions about lifestyle issues are that smoking (CDC, 1991) and obesity (Mora, 2005) significantly shorten lifespan and that moderate drinking (Moore, 1986) is positively correlated with longevity. This cross-sectional country study strongly supports the standard conclusions about obesity. While it finds that smoking is negatively correlated with life span and that alcohol consumption is positively correlated with life span, neither of these correlations is statistically significant.

Previous researchers have come to mixed conclusions about the effect of government intervention in the health care industry. Himmelstein and Woolhandler (1986) believe that a nationalized health care system can increase life expectancy while controlling health care costs. Shortell and Hughes (1988) believe that increased competition in the health care industry would lead to a decreased quality of health care. Ohsfeldt (2003) examined survival rates of cancer patients in developed countries and showed that the United States health care system did significantly out perform other countries for those who could obtain treatment. The theory of government enterprise (Ahlbrandt 1973), and the theory of economic regulation (Stigler 1971) both suggest that government interference in the health care industry increases cost and does not increase health care quality. Friedman (2001) found that government interference in the health system decreased available health care resources while increasing costs. Santerre, Grubaugh, and Stollar (1991) found no direct effect of government intervention on infant mortality or health care costs, but concluded that government intervention in the economy will negatively impact economic growth which will then negatively impact health care. This study concludes that health care delivery is very inefficient in the United States, but can come to no conclusions as to what causes the inefficiency.

Methodology

Multiple regression analysis is used to attempt to fit the available data to the equation $y_i = \Sigma m_j x_{ji} + b_i$ by solving for the coefficients, m_j, and the y-intercept b_i. For cross-sectional analysis, y_i is the life expectancy in country i, and x_i is a data point in one of the OECD countries i from one of the proxies I wish to examine. When only one independent variable is tested using the equation $y_i = mx_i + b_i$, the method is called simple regression analysis. One of the requirements for multiple regression analysis to be valid is that all of the "independent" variables, x_i, be statistically independent of each other. When this is not the case the problem is called multicollinearity. Multicollinearity is a complication in the analysis I have attempted. I also performed time series analysis where y_i is the life expectancy in year i in the United States, and x_i is one of the independent variables in the United States in year i.

Regression analyses yields not only the best fit values for m_j and b_i, but also an indication of how good the data fit is which is reflected in the t-statistics, t, and the coefficients of determination, R^2. The t-statistic is equal to the slope, m, divided by the standard error of the slope and indicates how significant the x values are in predicting the y value. T-statistics greater than 2.6 are considered significant at the 1% confidence level, and t- statistics greater than 1.96 are considered significant at the 5% confidence level for large samples. The R^2 value is the fraction of the variation of the y value that is explained by the x values; an $R^2 = 1$ indicates an exact fit, an $R^2 = 0$ indicates no fit. For a discussion of regression analysis see Goldberger (1991).

Empirical Results

I regressed life expectancy (tables 1 and 2) against a variety of variables available for the member countries in the *OECD Health Data*. I also regressed many of the variables against each other to check for multicollinearity problems. As can be seen in table 3, t-statistics of many of the "independent variables" are strongly significant, making multiple regression analysis complicated.

As can be seen in table 1, life expectancy is positively correlated with per capita health care spending (figure 2) and the availability of health care resources (figure 3). The most statistically significant health care resources are per capita nursing staff, MRI units, and CT scanners. The lack of health care resources in the United States relative to other OECD countries likely contributes to America's low life expectancy relative to its peers (figure 1). Life expectancy is positively correlated with the percent of health care spending that comes from the public sector, but this correlation is not statistically significant. Life expectancy is negatively correlated with the percent of health care spending that goes to pharmaceuticals indicating that expenditures on this method of treatment may be less efficient than other treatment methods. Life expectancy is negatively correlated with per capita tobacco consumption and positively correlated with per capita alcohol consumption, but neither of these relationships is statistically significant. Life expectancy is negatively correlated with the obesity rate and this relationship is of borderline statistical significance (figure 4). Since the United States has by far the largest obesity rate among the OECD countries, it is likely that America's weight problem contributes to its low life expectancy relative to its peers. The usefulness of obesity data is somewhat limited since obesity is measured differently in different countries.

Table 2 shows the result of a multiple regression analysis using variables that are reasonably independent. Table 5 shows that many of the "independent" variables are correlated with each other. Since health care spending is correlated with most health care resources, it is used as a proxy for

those resources. The two variables that are shown to be of statistical significance are per capita health care spending and obesity. The United States spends more on health care per capita than any other county in the world and also has a higher obesity rate. Strangely in the United States this huge health care spending does not translate to a great abundance of health care resources.

Conclusion and Discussion

In this paper I studied life expectancy in the United States relative to the other member countries in the Organization for Economic Cooperation and Development (OECD). I found that the United States performs very poorly relative to its peers. While the United States spends more per capita by far than any other member country, it has a lower life expectancy than most other member countries. This low life expectancy is probably caused by the United States' lack of health care resources relative to other member countries and its high obesity rate.

In general increased health care spending leads to increased availability of health care resources (per capita numbers of doctors, nurses, MRI units etc.) but this does not seem to be the case in the United States. The United States has fewer medical resources than most of the of the 30 member countries of the OECD. In life expectancy at birth, the United States is ranked 21st out of the 30 member countries of the OECD. In per capita number of physicians the U.S. is ranked 23rd, in per capita number of nurses it is ranked 18^{th,} and in per capita number of acute care beds the United States is ranked 23rd. The data on CT scanners and MRI units is not as useful due to inconsistent statistics between countries, but the U.S. is ranked 15th in per capita number of CT scanners and 7th in per capita number of MRI units (figure 1).

A possible cause of this inefficiency is the United States' multiple barriers to entry such as Certificate of Need programs (Certificate 2005)(Fitzgerald 2004), efforts by the U.S. pharmaceutical

industry to limit competition (Dolinski 2004), and efforts by the American Medical Association to limit physician numbers to keep salaries high (Allen 1997)(Cauchon 2005), but a detailed analysis of this topic is beyond the scope of this paper. While life expectancy is positively correlated with the percent of health care spending that comes from the public sector this correlation is not statistically significant, so this paper can make no assertions regarding government run verses private health care systems.

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STATISTICAL RESULTS FROM REGRESSION ANAYSIS

(t-statistics are in parenthesis)

Cross Sectional Analysis

Single Regression Analysis

Life Expectancy (in years) vs

Table 1	Y - Intercept (t-stat)	Slope (t-stat)	Observations	R^2
Total Health Care Spending	74.37 (71.78)	0.001664 (3.75)	29	0.3423
Physicians per Capita	75.29 (40.15)	0.9109 (1.46)	29	0.0727
Nurses per Capita	74.57 (63.65)	0.4173 (3.09)	29	0.2612
Acute Care Beds	77.18 (53.50)	0.1395 (0.44)	28	0.0074
MRI Units	76.33 (114.86)	0.2177 (3.04)	28	0.2622
CT Scanners	76.56 (111.75)	0.0724 (2.43)	29	0.1832
% Public	75.65 (24.05)	0.02982 (0.70)	29	0.0176
% Pharmaceutical	82.20 (65.24)	-0.2471 (-3.70)	30	0.3278
Tobacco Consumption	80.72 (28.74)	-0.1037 (-1.01)	29	0.0366
Alcohol	76.15 (44.87)	0.1846 (1.10)	29	0.0426
Obesity	79.68 (67.48)	-0.1266 (-1.64)	29	0.0906

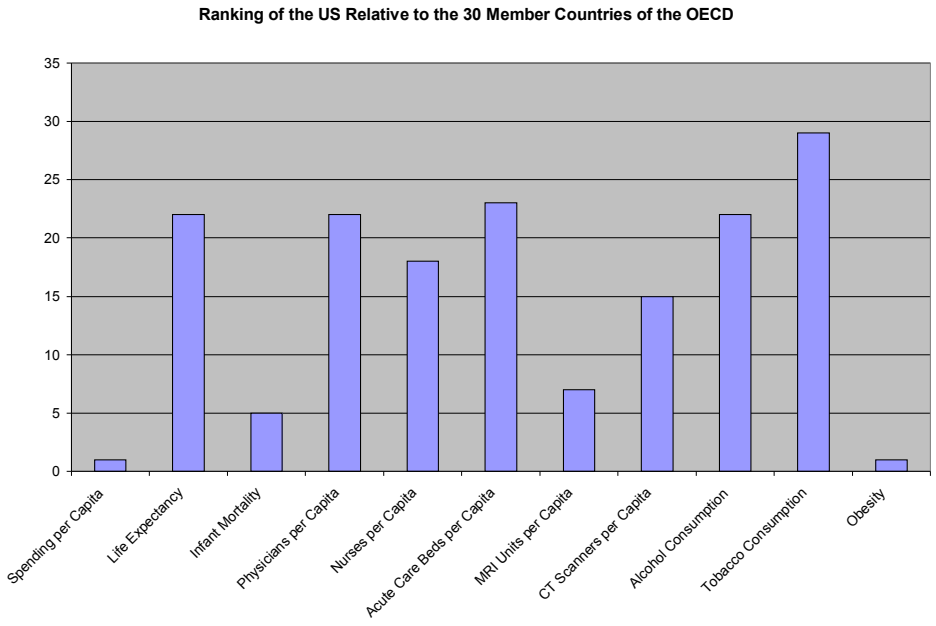
Multiple Regression Analysis

Life Expectancy (in years) vs.

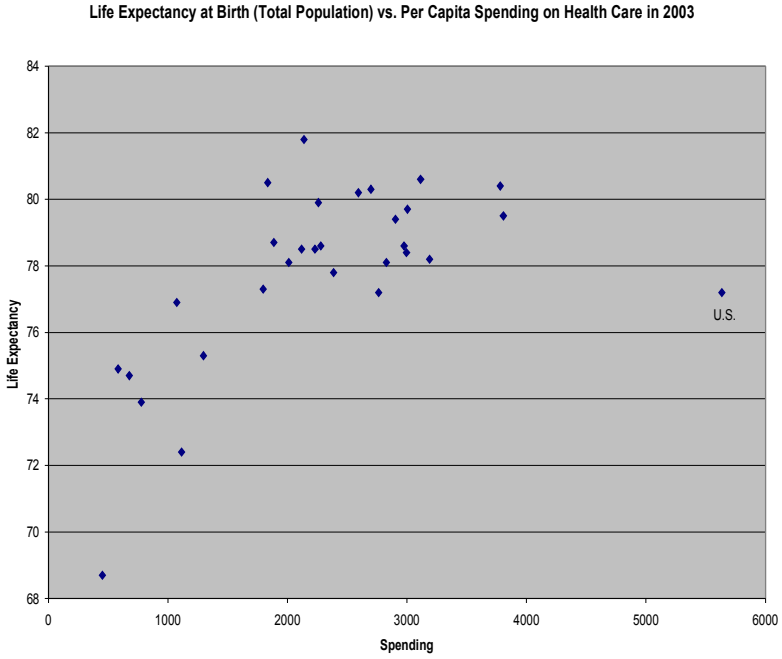
Table 2	Coefficient (t-stat)		Observations	R^2
Y - Intercept	77.63 (16.08)		28	0.4771
Total Health Care Spending	0.001516 (3.18)			
% Public	0.006536 (0.18)			
Tobacco Consumption	-0.0851 (-0.89)			
Alcohol	0.1037 (0.07)			
Obesity	-0.1506 (-2.10)			

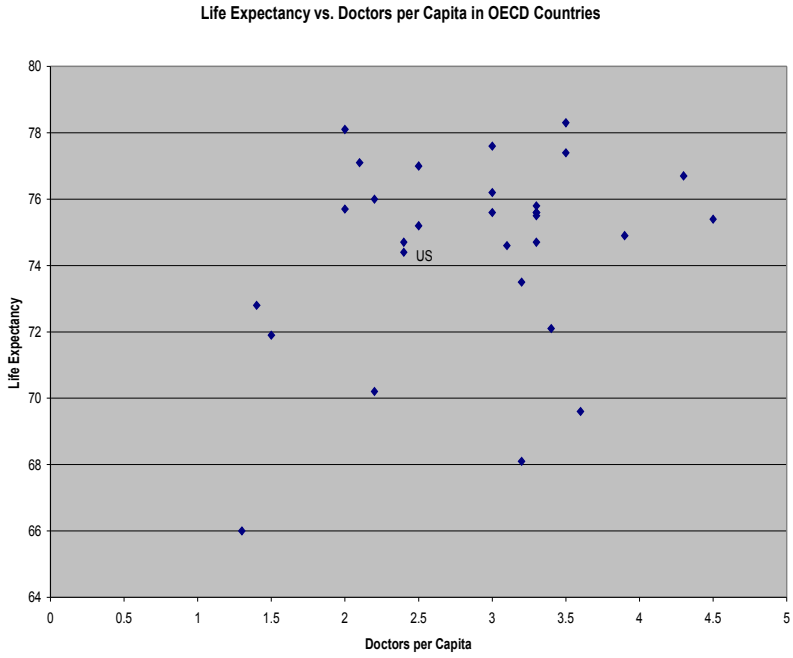
Cross t-statistics for "independent" variables

Table 3	Physicians	Nurses	Acute Care Beds	MRIs	CTs	%Public	%Pharm	Tobacco	Alcohol	Obesity
Spending	1.10	3.46	-0.13	1.54	0.82	-0.20	-6.09	-1.67	1.59	0.35
Physicians		0.99	0.65	-0.07	-0.44	2.09	-0.72	0.16	2.18	-0.42
Nurses			0.64	1.11	0.36	2.03	-4.95	-0.80	1.41	-0.13
Acute Care Beds				2.69	4.00	2.27	1.16	1.75	1.70	-1.33
MRIs					9.81	0.64	-1.27	0.86	-0.70	-2.69
CTs						0.73	-0.48	1.26	-0.16	-2.40
%Public							0.18	-0.21	1.32	-0.87
%Pharm								0.67	-0.66	0.13
Tobacco									0.72	-1.94
Alcohol										-0.12

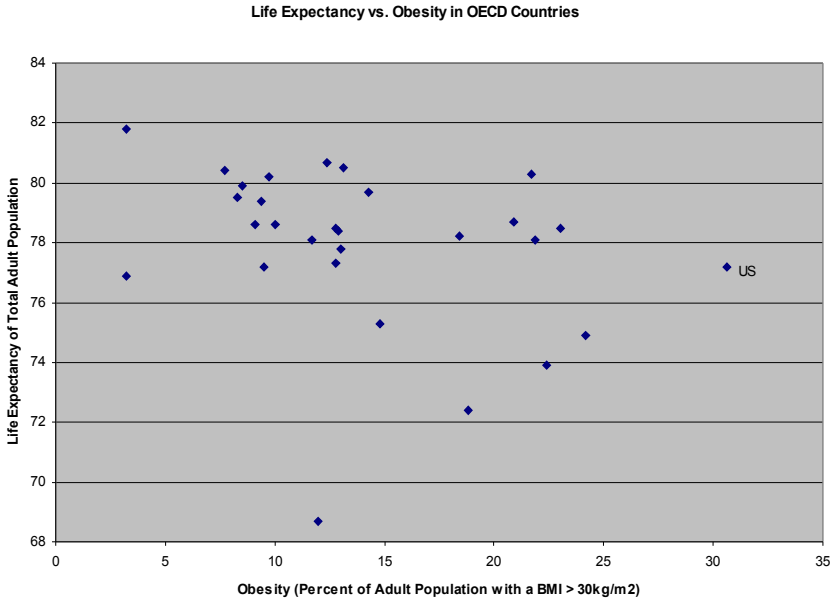


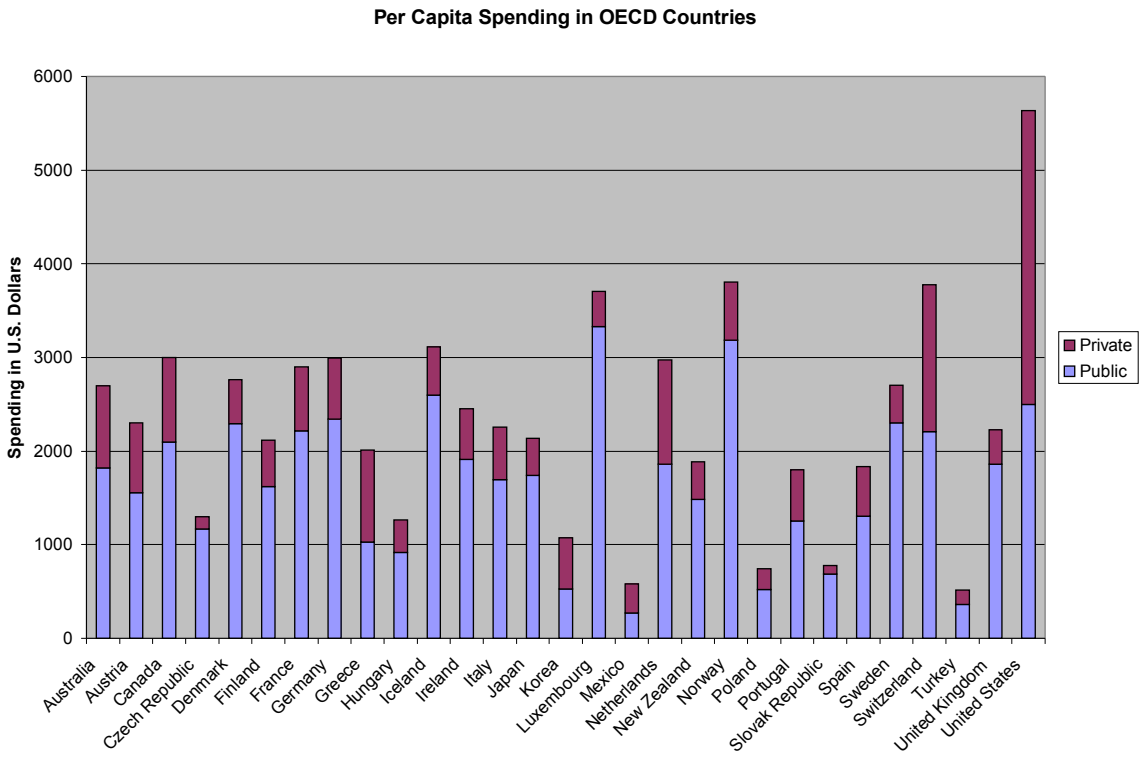
(figure 1) and (figure 2)





(figure 3) and (figure 4)




Per Capita Spending in OECD Countries
Spending in U.S. Dollars
6000
5000
4000
3000
2000
1000
0
Private
Public
Australia
Austria
Canada
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States

(figure 5)