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Do You Really Get What You Paid For?

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Do You Really Get What You Paid For?

Abstract

[T]he purpose of my research is to analyze the efficiency of the US health care system through a panel data analysis of the 19 OECD countries listed above (including the US) spanning the years 1990 to 2006 using an Ordinary Least Squares (OLS) regression of a Cobb-Douglas production function. I intend to improve upon previous estimates by utilizing the most recent data available, including better and more specific proxies for certain variables, and only including countries whose performance is truly comparable to that of the US by removing the low performing outliers that fall into a separate efficiency and income bracket of their own.

The format of my paper is as follows: Section II provides a review of previous literature on the topic of health care system efficiency, Section III summarizes the theoretical model I employ in my research, Section IV outlines my empirical model and data, Section V reports my results, Section VI offers a summation of my findings and Section VII suggests potential venues for further research.

Do You Really Get What You Paid For?
Analyzing the Productive Efficiency of U.S. Health Care

AMANDA CLAYTON

I. Introduction

Recent health care policy reforms proposed by President Obama have prompted an increased interest in the efficiency of the US health care system. Looking at total health expenditure and life expectancy alone, the President has good reason to be hasty in his desire for change. Comparing the US to 18 other Organization of Economic Cooperation and Development (OECD) member countries at similar levels of development; namely: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Switzerland, and the UK; one finds that the US has much to improve upon in these areas. In 2006, the US spent approximately 15.1% of its GDP on health care, more than any other OECD country and considerably larger than the 9.0% average of its peer nations (OECD Health Data, 2009). This is quite negatively juxtaposed with the fact that the US also has the lowest female and male life expectancies at birth of the same 18 OECD nations. The US female life expectancy at birth is 80.7 years (tied with Denmark), falling 2.1 years below the average of 82.8 years; the US male life expectancy at birth is 75.4 years, again, falling two years below the average of 77.4 years (OECD Health Data, 2009). This raw and partial evidence suggests that the US health care system may be performing inefficiently compared to its peer nations.

Of course, there are many factors outside of health care that effect life expectancy at birth such as lifestyle choices regarding the consumption of tobacco, alcohol, and non-nutritious foods, pollution levels, external causes of death from accidents or crime, and socio-economic factors such as GDP per capita or average education levels (Joumard, Isabelle et al., 2008). It is therefore not accurate to assume that inefficient health care is the sole cause of low life expectancies in the US without taking these other factors into account. For this reason, the purpose of my research is to analyze the efficiency of the US health care system through a panel data analysis of the 19 OECD countries listed above (including the US) spanning the years 1990 to 2006 using an Ordinary Least Squares (OLS) regression of a Cobb-Douglas production function. I intend to improve upon previous estimates by utilizing the most recent data available, including better and more specific proxies for certain variables, and only including countries whose performance is truly comparable to that of the US by removing the low performing outliers that fall into a separate efficiency and income bracket of their own.

The format of my paper is as follows: Section II provides a review of previous literature on the topic of health care system efficiency, Section III summarizes the theoretical model I employ in my research, Section IV outlines my empirical model and data, Section V reports my results, Section VI offers a summation of my findings and Section VII suggests potential venues for further research.

II. Literature Review

Several studies have sought to compare the efficiency of health care systems of OECD countries in recent years. Most empirical studies have focused on assessing and comparing the efficiency of all OECD countries without specific attention to the relative performance of a particular nation. For this reason, most studies include all OECD countries for which the desired variables are available over the desired period. Looking at the efficiency of all OECD nations however, ignores certain biases that may skew efficiency results. A recent OECD working paper used several measures to analyze the efficiency of OECD nations and found that the OECD countries could be separated into three different groups based on health outcome results. The lowest group included the Czech Republic, Hungary, Mexico, Poland, the Slovak Republic, and Turkey (Joumard et al., 2008). This group had average life expectancies at birth that were four to five years lower than the average of the second performance group and had over seven more infant mortalities per 1,000 live births on average than the second performance group (Joumard et al., 2008). The differences between the second and first performance groups were much less extreme with differences in average life expectancies of about two

years and differences in average infant mortality rates of less than one death per 1,000 live births (Joumard et al., 2008). My sample will include the first two performance groups but will exclude the third, along with Korea, in order to create a more homogenous group of nations in terms of development. This decision will be described further in Section IV.

A major matter of debate in health system efficiency analysis is what variable is best to use as the output of a health care production function. Most studies contend that health outcomes are better to use than measures of health care activity such as number of physician visits, CT scans, etc. (Garber and Skinner, 2008; Joumard et al., 2008; Or, Wang, and Jamison, 2004). Or, Wang and Jamison suggest that focusing efficiency analysis on measures of health care activity doesn't look at the goal of health care, which is to improve patient health (2004). It is also a general consensus that health care activity analysis leads to negative incentives of overuse in health care as countries try to increase the quantity of health care provided rather than the quality provided. Even though it is largely agreed upon that health outcomes are a more accurate and appropriate measure of health care outputs, the vast array of potential measures of health outcomes leads to questions of which measure is best to use.

Measures of mortality rates and average life expectancies are the most widely available measures of overall health outcomes to date. The main problem with these measures however is the lack of specificity as to the inputs that go into them. As mentioned in the introduction, a person's life expectancy is determined by many factors outside of health care such as lifestyle choices, pollution, and external causes such as accidents and murder. It is difficult to separate these non-health-care-related components from the effects of health care. For this reason, several studies have looked at specific case studies of survival rates after or treatment of specific diseases (Preston and Ho, 2009). While these measures give good data on the effectiveness of specific health care treatments across countries, they cannot be expected to provide information on the overall efficiency of a health care system (Joumard et al., 2008). Therefore, despite the over-inclusiveness of mortality measures, most studies find that they are the best proxies of health outcomes currently available (Joumard et al., 2008; Or, Wang, and Jamison, 2004). By controlling for as many of the non-health-care-related inputs to life expectancy as possible, one can ascertain a fairly accurate picture of the specific effects of the health care industry on patient life expectancy.

The most common control variables for non-health-care-related inputs used in recent studies have been tobacco and/or alcohol use, diet, pollution, education levels, and GDP (Joumard et al., 2008; Or, Wang, and Jamison, 2004). A problem area with recent studies is their choice of proxies used for diet and exercise. Or, Wang, and Jamison completely neglected this variable in their study (2004) and Joumard et al. used the number of fruits and vegetables consumed as a proxy for diet and exercise (2008). This proxy, however, does not actually account for exercise and they had problems with the significance and robustness of the variable due to time lag issues. A person's diet now is likely to have stronger effects on her future health than it does on her current health. An overweight and diabetic individual who has consumed unhealthy foods and exercised little throughout her life but has recently began to improve her diet through the increased consumption of fruits and vegetables is unlikely to see a change in her health status for some time. Simply measuring the consumption of fruit and vegetables does not account for these lagged effects. Obesity is a much better proxy for diet and exercise since it measures the current negative health effects of an extended period of poor diet and exercise.

Obesity has not been used in previous studies due to data availability, primarily because of differences in measurement techniques. Some countries use survey data to measure individuals' body mass index (BMI) while others use actual measures of individuals' height and weight creating differences in obesity rates across countries (OECD 2009 Health Data). It is hypothesized that countries using actual measures of height and weight have higher obesity rates than countries in which survey data is used since people are likely to underestimate, intentionally or not, their weight when asked. Of the countries included in my study, Australia, Japan, the UK, and the US use actual measures of height and weight rather than survey data (OECD 2009 Health Data). While Australia, the UK, and the US have higher obesity rates than the other peer nations, Japan has the lowest rates of the OECD nations, suggesting that the bias may be less extreme than is hypothesized. Also, since I am estimating the efficiency of health care in the US specifically, and since the US has the highest obesity rates of all of the countries in my analysis, the efficiency estimates of the US would most likely be biased upwards if the obesity data of other nations is truly inaccurate and biased downwards. This is because the US will experience a larger negative impact on health outcomes due to obesity, thus reducing the negative impact to be absorbed by health care inefficiency. Because most studies have found that the US lies on the low side of efficiency rankings compared to other OECD

countries (Garber and Skinner, 2008; Joumard et al., 2008; Or, Wang, and Jamison, 2004), including obesity as a control variable would only help the US in its efficiency estimates. I therefore use obesity rates in my analysis despite these differences in measurements.

Studies vary in their choices of medical inputs as well. Most use either the number of physicians, hospital beds, or CT scanners as physical measures of inputs or use total, public, or private health expenditure as monetary measures of inputs, but few have used both physical and monetary measures simultaneously. Physical and monetary input measures are generally seen as substitute proxies for health care inputs. For example, Wang, Jamison, and Or used the number of practicing physicians per 1,000 people because they did not feel that adequate measures of health expenditure were available (2004). Joumard et al. ran separate regressions using the number of practicing physicians in one set of regressions and total health expenditure in the other set (2008). Joumard et al. claim that increases in total health expenditure leads to more practicing physicians but I feel that this assumption only holds under the assumption that the wages paid to physicians are equal across countries, which is not the case. An increase in total expenditure of 155,000 US$ would buy Germany two more physicians while it would not even pay for one extra physician in the United States according to the average physician incomes reported by Garber and Skinner from the OECD 2007 Health Data (2008). I therefore believe that it would be acceptable to use the number of practicing physicians as a proxy for labor inputs and total health expenditure as a proxy for other health care inputs as well as the emphasis placed on healthcare by each country.

III. Theory

I use a Cobb-Douglas production function in my research to analyze the efficiency of the US health care system compared to its peer nations. A production function allows me to, in theory, asses the efficiency with which a nation uses its health care inputs to produce an optimal level of health output. A Cobb-Douglas production function is of the generic form

$$Y = AL^{\beta_1}K^{\beta_2}$$

where Y represents output, L represents labor inputs, K represents capital inputs, and A is a technological parameter. In the context of health care efficiency, the theoretical model that I regress is

$$\textit{Health Outcomes} = \alpha(L)^{\beta_1}(K)^{\beta_2}(\textit{socioeconomic})^{\beta_3}(\textit{lifestyle})^{\beta_4}$$

where *socio economic controls* include income levels and equality, institutional parameters, and education and *lifestyle controls* include tobacco and alcohol use, diet, and exercise. Representing *Health Outcomes* as HO, *socio economic controls* as SC, and *lifestyle controls* as LC, and transposing the equation into log linear form for the sake of running an OLS regression, I have

$$\ln HC_{it} = \alpha + \beta_1 \ln L_{it} + \beta_2 \ln K_{it} + \beta_3 \ln SC_{it} + \beta_4 \ln LC_{it} + \varepsilon_{it}$$

where ε_{it} is the error term of country *i* in time *t*.

IV. Empirical Model

My data come from the OECD 2009 Health Data set. I use cross-sectional data analyzed over time and include dummy variables for each country in order to absorb the country effects which are otherwise unaccounted for in my model. The 19 OECD countries I analyze are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Switzerland, the United Kingdom, and the United States. I chose to eliminate the six countries mentioned in Section II as being in the lowest performance group among the OECD nations, along with Korea, from my analysis due to their GDP per capita income levels which were all below 20,000 US$ in 2007(OECD 2009 Health Data). The average GDP per capita of the 19 OECD countries I have chosen to analyze was a little under 44,000 US$ in 2007 (OECD 2009Health Data). It does not seem accurate to include nations with less than half of the income level of the average of the other countries in the analysis. Furthermore, the GDP per capita of the US in 2007 was a little over $45,000, implying that removing these lower income nations creates a less biased cross country comparison of the efficiency of the United States compared to its peer nations. Because of the income levels of these seven nations and further because of the findings in the OECD working paper cited in Section II, the Czech Republic, Hungary, Mexico, Poland, the Slovak Republic, Turkey, and Korea will excluded from my comparative analysis.

In the case of holes in data availability, I assume that the change from one available point to the next is linear which is generally evinced through the adjacent, complete strings of data. In a few instances, I continue to increase or decrease variables beyond the given endpoints following the same linear pattern of the preceding data points. To extend the endpoints of strings of data that are otherwise fully complete, I run regressions of the variable against time to find the average increase or decrease in the variable per year, and fill in the missing data accordingly.

As a proxy for health outcomes, I run separate regressions using the average life expectancies of men and women at birth and at age 60 since a large portion of health expenditure is spent on senior citizens (Joumard et al., 2008). The OECD 2009 Health Data includes a unique measure of *potential life years lost* which weights deaths of younger individuals higher than those of older individuals. Included in these measures is *potential life years lost due to external causes* which includes deaths from accidents and murder. As suggested by Joumard et al., I obtain a measure for potential life years lost due to health related issues by subtracting *potential life years lost due to external causes* from *potential life years lost from all causes*. This removes a small amount of bias in the health outcome measure used. To further reduce the bias of non-health-care related variables, I include several control variables that account for outside effects on health outcomes.

$$lnLE_{it} = \alpha + \beta_1 \ln Phys_{it} + \beta_2 \ln HealthExp_{it} + \beta_3 \ln Tob_{it} + \beta_4 \ln Alc_{it} + \beta_5 \ln Obese_{it} + \beta_6 \ln GDP_{it} + \beta_7 CountryDummy + \varepsilon_{it}$$

For the variable *Phys* I run separate regressions using both the total number of practicing physicians and the number of practicing general practitioners. Likewise, for the variable *HealthExp* I run separate regressions using both total health expenditure per capita and total health expenditure as a percentage of GDP. *CountryDummy* represents separate dummy variables for each country with the US as the excluded case. The coefficients of these dummy variables will give me an indication of the performance of the other peer nations, relative to that of the US, holding the effects of the other variables constant. The brunt of my analysis will be formed from the values of these coefficients.

As socio-economic controls, I include GDP per capita which has been found to be significant in previous studies. Unfortunately, due to data availability, I am unable to include a proxy for educational attainment which has also been found to be significant in previous studies. I do not include parameters for institutional differences because it is too difficult to disentangle the combinations of institutional frameworks enacted by individual countries (Joumard et al., 2008). As lifestyle controls, I include the percentage of the population over age 15 who smoke daily, alcohol consumption in liters per capita, and the percentage of the population that is obese. I use the number of practicing physicians as well as the total expenditure on health as measures of health care inputs for the reasons stated in the literature review. I also run a slightly more limited regression removing Japan due to data unavailability, using the number of practicing general practitioners in the place of the number of practicing physicians. I do this because of the growing international concerns that there will be shortages of general practitioners in the near future. I also feel that the ratio of general practitioners to specialists contributes significantly to improving the health outcomes as well as the cost effectiveness of a health care system.

My empirical model is shown below along with Table 1 which provides the descriptive statistics of my dependent and independent variables.

Table 1: Descriptive Statistics

Variable	Description	N	Min	Max	Mean	Std. Deviation
Dependent Variables						
LEFbirth	Life expectancy of females at birth (Years)	367	77	86	80.93	1.699
LEMbirth	Life expectancy of males at birth (Years)	367	70	80	74.93	1.980
LEF60	Life expectancy of females at age 60 (Years)	363	20	28	23.75	1.376
LEM60	Life expectancy of males at age 60 (Years)	363	17	23	19.58	1.332
PotLifeLostMed	Potential years of life lost minus those due to external causes (years per 100,000 people 0-69)	353	1679	5220	3111.15	655.622
Independent Variables						
HealthExpGDP (+ LE, - PLL)	Total expenditure on health (% of GDP)	362	5	15	8.42	1.734
HealthExpCap (+ LE, - PLL)	Total expenditure on health per capita (US$ exchange rate)	376	341	7290	2368.10	1216.764
GDP (+ LE, - PLL)	GDP per capita (US$ exchange rate)	380	5398	64135	26225.46	10166.138
Alcohol (- LE, + PLL)	Alcohol consumption of those 15+ (liters per capita)	354	5	16	10.61	2.369
Tobacco (- LE, + PLL)	Tobacco consumption of those 15+ (% of population who smoke daily)	352	15	45	27.44	5.897
Obese (- LE, + PLL)	Body weight and composition (% of population who are obese)	291	2	34	12.12	6.190
GenPract (+ LE, - PLL)	Practicing General Practitioners (Density per 1,000 people)	303	0	2	1.02	.499
TotalPhys (+ LE, - PLL)	Practicing Physicians (Density per 1,000 people)	345	2	12	2.93	.855

V. Results

As is shown by Table 2, the US spends a larger portion on health care as a percentage of GDP than the mean of its peer nations by over one and a half times throughout the period of regression. High health expenditure in the US is accompanied by a lower mean number of practicing general practitioners and total physicians, lower mean life expectancies, as well as more mean potential life years lost than the means of its peer nations. The areas in which the US has a more favorable mean over the period than its peer nations is in the use of alcohol and tobacco while the mean obesity rate of the US relative to its peer nations is over twice as large. In combination, these raw data suggest that the US performs less efficiently than its peer nations over the period of regression.

Table 2: Comparison of Means: US vs. Peer Nations

	Peer Nations	US
HealthExpGDP	8.136	13.215
GDP	25927.66	31585.85
Alcohol	10.725	8.558
Tobacco	27.867	20.275
Obese	11.147	28.838
GenPract	1.0286	.9253
TotalPhys	2.9544	2.2980
LEFbirth	81.010	79.395
LEMbirth	75.011	73.384
LEF60	23.780	23.205
LEM60	19.585	19.500
PotLifeLostMed	3061.10	4042.56

The strongest models in my regression include total health expenditure as a percentage of GDP rather than total health expenditure in per capita terms. This is because including *lnHealthExpCap* made *lnGDP* insignificant and because *lnHealthExpCap* and *lnGDP* have a Pearson Correlation of .951 that is significant at the .01 level while *lnHealthExpGDP* and *lnGDP* have a Pearson Correlation of only .521 though it is still significant at the .01 level. I also exclude *Obese* because it is found to be insignificant and to have the wrong sign, implying that an increase in obesity leads to an increase in life expectancy and a decrease in potential life years lost. This is likely due to the poor quality of the data and removing this variable seems to be the appropriate decision to improve the model. Table 3 displays the results of the five separate dependent variables regressed against *lnTotalPhys*.

Almost all coefficients are significant at the .001 level and all have the expected signs. The adjusted R^2 values are all between 86.5% and 91.9% suggesting a good fit of the data. While all of the coefficients are significant, some are larger than others. It is important to note that the mean value of potential life years lost due to medical or health related causes in the nations included in the regression is 3,111.15 years per 100,000 people. Thus, coefficients of the independent variables regressed against *lnPotLifeLostMed* are expected to be larger than those regressed against life expectancy. The results consistently suggest that decreasing smoking has the largest positive effect on health outcomes while increasing the number of total practicing physicians has the smallest positive impact on health outcomes.

The coefficients of the country dummy variables are of extreme importance in the model. These coefficients show the difference in health outcomes between a given country relative to that of the US holding all other effects in the model constant. All of the country coefficients are significant at the .001 level and all have signs suggesting better health outputs than that of the US. The largest positive difference is almost always held by Japan with the exception of male life expectancy both at birth and at age 60 in which Japan has the second and third highest difference from that of the US respectively. The country with the smallest difference from the US varies from measure to measure with the smallest overall difference being a higher female life expectancy at birth in Denmark of .031 years or about 4 months holding all else constant. The main issue in interpretation of the country coefficients is that it is impossible to tell what each coefficient is picking up. The difference cannot be entirely attributed to inefficiency, particularly since measures for obesity, pollution levels and education rates which are likely to have significant effects on health outputs are not included.

Table 3: Regression Results Including lnTotalPhys as an Independent Variable

	lnPotLifeLostMed	lnLEFbirth	lnLEF60	lnLEMbirth	lnLEM60
(Constant)	8.562***	4.264***	2.815***	4.190***	2.485***
LnHealthExpGDP	-.288***	.026***	.051**	.033***	.088***
LnGDP	-.163***	.019***	.057***	.028***	.085***

LnTobacco	.577***	-.040***	-.100***	-.071***	-.172***
LnAlcohol	.256***	-.021***	-.056***	-.037***	-.073***
LnTotalPhys	-.132***	.012***	.031***	.020***	.055***
AUS	-.709***	.056***	.117***	.075***	.144***
AUSL	-.656***	.047***	.085***	.061***	.096***
BELG	-.648***	.049***	.101***	.060***	.096***
CAND	-.583***	.049***	.104***	.065***	.124***
DEN	-.649***	.031***	.039***	.065***	.084***
FIN	-.661***	.046***	.079***	.039***	.059***
FRAN	-.638***	.070***	.170***	.068***	.155***
GERM	-.478***	.037***	.062***	.046***	.057***
GRE	-.970***	.069***	.132***	.114***	.254***
ICE	-.711***	.036***	.049***	.061***	.099***
IRE	-.838***	.051***	.078***	.085***	.126***
ITALY	-.630***	.063***	.127***	.074***	.131***
Table 3 Continued					
JAPAN	-1.066***	.098***	.223***	.109***	.224***
NETH	-.774***	.055***	.107***	.085***	.124***
PORT	-.339***	.042***	.085***	.044***	.107***
SPAIN	-.907***	.092***	.206***	.107***	.243***
SWITZ	-.665***	.057***	.122***	.070***	.120***
UK	-.685***	.048***	.081***	.083***	.137***
R^2	.906	.919	.913	.879	.865

*** significant at the .001 level ** significant at the .01 level

Upon replacing the independent variable *lnTotalPhys* with *lnGenPract* some interesting results are found. Table 4 displays these results. Due to data availability of the number of practicing general practitioners, Japan has been removed from this series of regressions.

Table 4: Regression Results Including lnGenPract as an Independent Variable

	lnPotLifeLostMed	lnLEFbirth	lnLEF60	lnLEMbirth	lnLEM60
(Constant)	8.606***	4.252***	2.777***	4.163***	2.431***
LnHealthExpGDP	-.379***	.031***	.064**	.053***	.134***
LnGDP	-.166***	.020***	.061***	.029***	.086***
LnTobacco	.569***	-.037***	-.091***	-.067***	-.163***
LnAlcohol	.314***	-.026***	-.073***	-.047***	-.096***
LnGenPract	-.172	.025**	.058*	.041***	.121***
AUS	-.719***	.052***	.108***	.074***	.134***
AUSL	-.688***	.045***	.084***	.062***	.091***
BELG	-.636***	.038***	.079**	.048***	.052
CAND	-.586***	.047***	.099***	.065***	.122***
DEN	-.779***	.043***	.068***	.091***	.152***
FIN	-.764***	.056***	.102***	.062***	.118***
FRAN	-.646***	.064***	.159***	.063***	.130***
GERM	-.482***	.031***	.051**	.041***	.037
GRE	-1.337***	.108***	.220***	.180***	.440***

ICE	-.837***	.048***	.078***	.086***	.168***
IRE	-1.062***	.075***	.138***	.133***	.256***
ITALY	-.737***	.071***	.148***	.095***	.183***
NETH	-.986***	.078***	.162***	.131***	.249***
PORT	-.363***	.038***	.082***	.043***	.094**
SPAIN	-.989***	.094***	.210***	.121***	.266***
SWITZ	-.893***	.084***	.185***	.118***	.255***
UK	-.799***	.059***	.108***	.110***	.207***
R^2	.896	.893	.884	.882	.863

*** significant at the .001 level ** significant at the .01 level * significant at the .02 level

The coefficient to the number of practicing general practitioners is not found to be statistically significant when regressed against potential life years lost due to medical or health related causes and the adjusted R^2 value decreases for most of the new regressions. However, the values of the adjusted R^2 terms are all still between 86.3% and 89.3% suggesting good overall explanatory power. Furthermore, the coefficients for *lnGenPract* are all still significant at the .02 level or lower when regressed against the measures of life expectancy. Table 5 shows the important difference in the values of the coefficients for *lnTotalPhys* versus *lnGenPract*. While the significance level of the coefficients for *lnGenPract* is generally smaller, the size of the coefficients regressed against various measures of life expectancy are approximately twice that of the coefficients for *lnTotalPhys*. This implies that increasing the number of practicing general practitioners could have a stronger positive impact on life expectancy than increasing the total number of practicing physicians without regard to their field of practice. There were slight increases and decreases in the coefficients of the other variables, but none of the differences were as large as the change in effect of the number of physicians.

Table 5: Coefficients for *lnTotalPhys* and *lnGenPract*

lnPotLifeLostMed		lnLEFbirth		lnLEF60		lnLEF60		lnLEM60	
TotPhys	GenPract	TotalPhys	GenPract	TotalPhys	GenPract	TotalPhys	GenPract	TotalPhys	GenPract
-.132***	-.172	.012***	.025**	.031***	.058*	.020***	.041***	.055***	.121***

*** significant at the .001 level ** significant at the .01 level * significant at the .02 level

The explanation of the country dummy coefficients when *lnGenPract* is included is similar to the results found in the previous regressions The country coefficients regressed against measures of life expectancy and potential life years lost are again mostly significant at the .001 level and have signs suggesting that each peer nation has better health outcomes than that of the US holding all other effects constant. The exception is in the life expectancy of males at age 60 in which the coefficients for Belgium and Germany are found to be insignificant meaning that, holding the other effects of the model constant, Belgium and Germany do not experience significantly higher life expectancies for males at age 60 than that of the US.

VI. Conclusion

As a whole, the regressions explain a large portion of the variation in health outcomes, as measured by life expectancy and potential life years lost, among the OECD nations studied. The findings suggest that, holding other effects constant, the US experiences worse health outcomes than its peer nations. The number of practicing general practitioners is found to have approximately two times the positive effect on life expectancy than the number of total practicing physicians has, suggesting that increasing the number of general practitioners relative to specialists would have a positive effect on health outcomes. Smoking is found to have the largest impact on health outcomes suggesting that smoking may outweigh the positive effects of health care. The policy implications of these results are often considered unappealing in the political world as they involve increasing government regulation and programs in health care.

If these results are correct, then the US needs to seriously analyze its productive efficiency in health care relative to that of other nations. It is likely that a change in the system to one that is more generally followed in other nations may be appropriate. While obesity, pollution, and education levels are unaccounted for in my model, the variables that are accounted for do not absorb enough of the negative health outcomes experienced by the US relative to its peers to remove the blame from an inefficient health care system. It also seems that it would be beneficial for all nations to create incentives for medical students to choose careers as general practitioners rather than specialists which may mean alterations in the salary levels of specialists relative to those of general practitioners. The models also show that the negative effects of smoking greatly decrease health outcomes, even when taking health care factors into consideration. This implies that stricter regulation on the contents of tobacco products as well as the ease of purchase of these products may be necessary to improve the health outcomes of a nation. The significance levels of my variables as well as the R^2 values of the models suggest that this information is at least headed in an appropriate and accurate direction.

VI. Venues for Further Research

Significance levels and R^2 values aside, there is much room for improvement to be had in the regression models and analysis used here. Main data issues involve the lack of available proxies for obesity, pollution, and education levels. Taking these variables into account explains more of the variation in health outcomes, which will likely reduce the size and possibly the significance of the country coefficients. Including measures for these factors will thus offer a better approximation of the differences in health outcome due to the inefficiency of a country's health care system rather than the socio-economic differences among nations. It has also been shown effective in previous studies to analyze the residuals of the regressions along with specific country effects in order to get a better approximation for inefficiency which often involves rather advanced econometric techniques. I would also like to check my models for the typical model errors such as multicollinearity, autocorrelation, and heteroscedasticity. I feel that, in finding additional proxies for socio-economic and lifestyle factors, increasing the econometric level of my analysis and addressing potential issues in the models, I can create stronger results that will continue to support the current findings of my research.

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