What is Driving Up Health Care Costs? Does Pollution Play a Role: OECD Country Panel Data Analysis

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Abstract:

This study investigates the rising health care costs among nine OECD nations from 1990 to 2014. A panel data analysis was conducted to analyze specific causes for these rises. Total health care expenditure is the dependent variable with carbon dioxide emissions being the main variable of interest. Analysis finds that the economy has grown faster than health care expenditures, and a negative relationship between CO_2 emissions, elderly populations, urban population growth rates and health care expenditure.

1.0 INTRODUCTION

This study aims to enhance the understanding of rising healthcare costs around the globe. Countries have continued to increase spending on health care. Since the 1970s health care cost have continually grown, especially in the United States (Sawyer and Cox, 2018). The goal of the study is to try and find links between the increasingly large healthcare costs among developed nations. A panel data analysis will be conducted across 25 years and 9 countries.

In the modern age access to healthcare is an important human right. Setting this fact aside there is significant economic importance to finding the ability to reduce healthcare costs. When a large percentage of funds are being spent on healthcare that takes money away from the rest of the economy.

Health care costs and expenditure in the United States are much higher than the rest of the developed world (Sawyer and Cox, 2018). In America, legislation is heavily influenced by corporations. Corporations gain market power and use it to gain political power (Reich, 2015). This is no different in the healthcare industry. In the past 20 years health companies such as pharmaceuticals, insurance, hospitals and other care facilities have spent hundreds of billions of dollars influencing United States health policy (OpenSecrets). This is likely a highly contributing factor to America's high health care costs. In America, unlike Europe, pharmaceutical companies are allowed to advertise their products, this may lead to consumers spending more unnecessarily, and higher expenditure.

In Europe and other developed nations health care is covered by governments, or insurance companies that are not allowed to make profits on necessary healthcare. On average American consumers spend more for healthcare privately than foreign governments do. OECD nations have different healthcare structures, while the insurance is government sponsored the actual care is not always public. Hospitals and doctor remain private in many OECD countries, but there are fully public countries (Sanger-Katz, 2019).

Climate change has been directly linked to the human population (NASA). There are enormous social and economic effects as a result of the changes to Earth's environment. There is the simple fact that if the climate dies humans will as well, in the event of this happening nothing really matters and the effects would obviously be extreme. Environmental damage will not only

impact humans but it effects every living thing on Earth. Humans are a direct link to mass extinctions that have occurred recently, and in the past thousands of years (Johnston, 2017). Drastic effects to the food change will occur and thousands of economic problems will arise. When fish and other wild life populations are depleting, not only will this cause poverty problems, but it will affect entire industries. By 2060 dirty air is projected to cause one premature death every four or five seconds, effecting children and elderly the most. Outdoor air pollution is predicted to cause 6 to 9 million premature deaths a year by 2060. Pollution will cost 1% of global GDP, around USD 2.6 trillion annually. Air pollution will effect economics, causing more sick days, medical bills and reduced agricultural output (OECD).

This paper was guided by a research objective surrounding pollution which differs it from other studies. There are not many studies that analyze the rising cost of healthcare. This study differs from the few that exist by analyzing the role that carbon dioxide emissions have on health spending. The use of panel data also differs this study from others that are similar.

The rest of the paper is organized as follows: Section 3 gives a brief literature review. Section 4 outlines the empirical model, data and estimation methodology are discussed in this section as well. Finally, section 5 presents and discusses the empirical results. This is followed by a conclusion in section 6.

2.0 Trend Analysis of Health Care & Pollution

Figure 1 shows the yearly change of health consumption expenditures as a percent of GDP in similar developed economies over the past five decades. The United States has spent more on health care than the average of developed nations for a long time. While the gap was relatively large in the early 1970s, it was only 1% more than the average of comparable countries. This spending gap started to grow increasingly near the start of the 1980s. Today the United States has the most expensive health care system of any developed nation, and is one of the only developed economies without a universal system. In 2017, 17% of the United States GDP was spent on healthcare. The next highest spending nation, Switzerland spent 12%, and the comparable country average was 11%.
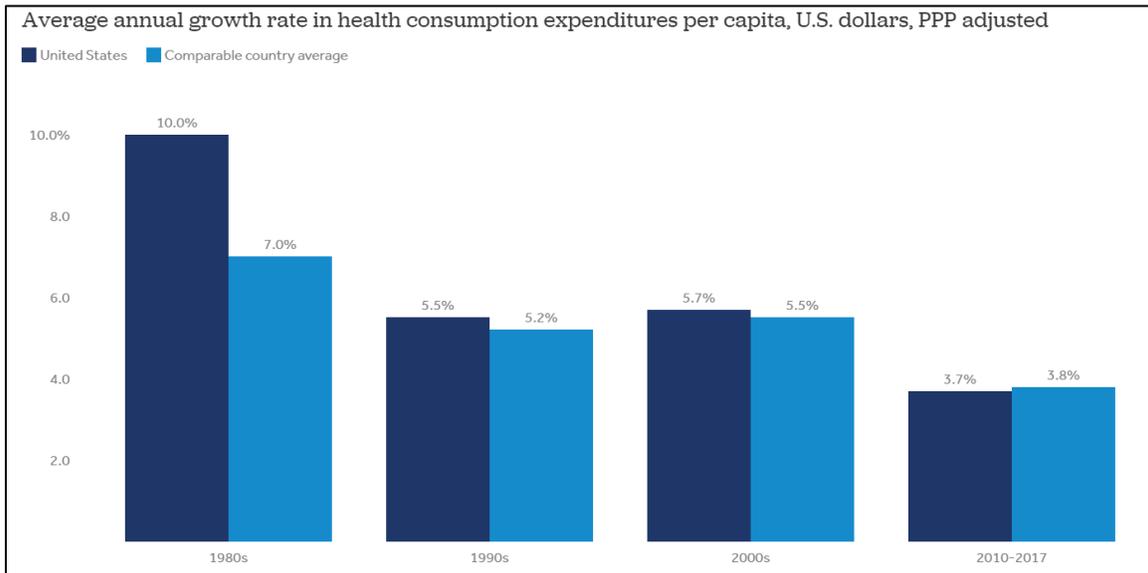
Figure 1: Health Consumption as percent of GDP

Health consumption expenditures as percent of GDP, 1970 – 2017
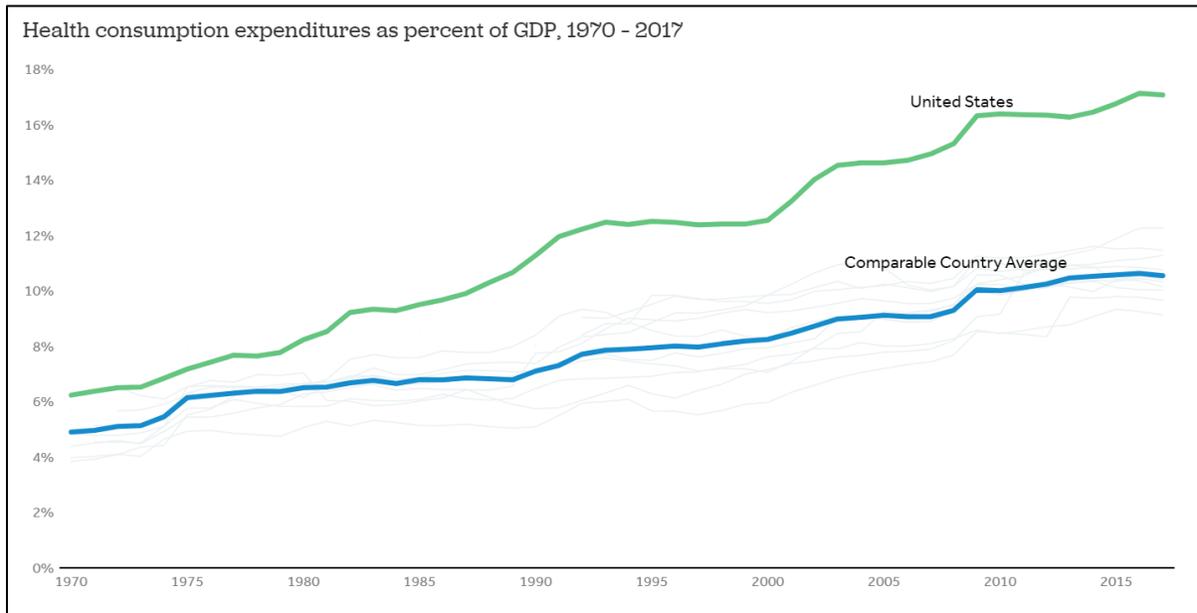
Source: KFF analysis of OECD and National Health Expenditure Data

Figure 2 shows the annual growth rate of health expenditure per capita in the United States compared to the average rate of similar countries, adjusted for inflation. It can be seen that in the past three decades, growth rates between the two have been almost identical with only tenths of a percent difference each decade. The main difference is in the 1980s. In the 1980s United States health care consumption grew on average 3% more each year than OECD countries. This jump in the 1980s could be attributed to corporations being granted more power around the same time. In the 2010s, for the first time, United States health care consumption rose less than OECD nations. This may be attributed to the Affordable Care Act, passed in 2010, and more people having insurance.

Figure 2: Health Care Cost Growth Rate

Average annual growth rate in health consumption expenditures per capita, U.S. dollars, PPP adjusted

■ United States ■ Comparable country average

	1980s	1990s	2000s	2010-2017
United States	10.0%	5.5%	5.7%	3.7%
Comparable country average	7.0%	5.2%	5.5%	3.8%

Source: KFF analysis of OECD and National Health Expenditure

Figure 3 shows the total health expenditure as a percent of GDP of the United States and the average of comparable countries broken down by public and private spending. The United States consumers spend more than the most countries governments paying for their healthcare. Other countries private health spending has remained fairly consistent and low over the past 40 years. In countries outside of the United States private health expenses are generally made on cosmetic, not serious surgeries. Not only does United States private spending outspend other countries public spending, but its public spending is greater as well. Even with less people's health cost being covered by the government in America, its government still pays more than countries that cover all of its citizens.

Figure 3: Health Expenditure by Public and Private Expenses

Total health expenditures as % of GDP, 1970 - 2016
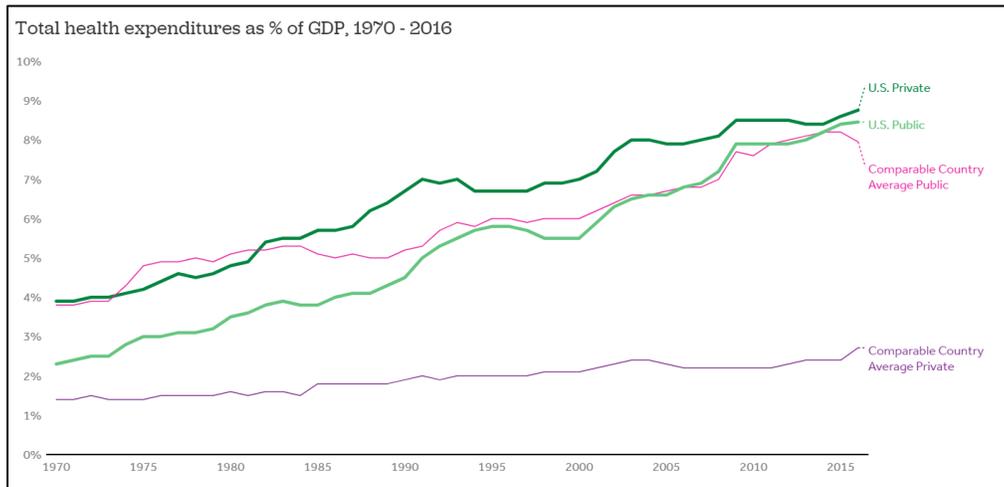
Source: KFF analysis of data from OECD

Figure 4 shows a relationship between green lands and health care expenditure. With increased forests and shrub coverage United States counties would expect lower Medicare and health spending. This reasoning behind this may be due to the fact that plants consume carbon dioxide and remove the greenhouse gasses from the environment. By removing carbon dioxide, the environment is less polluted. Pollution is extremely detrimental to human health and is seen to be a leading cause of premature death.

Figure 4: Forest and Shrub Coverage Association with Health Expenditure
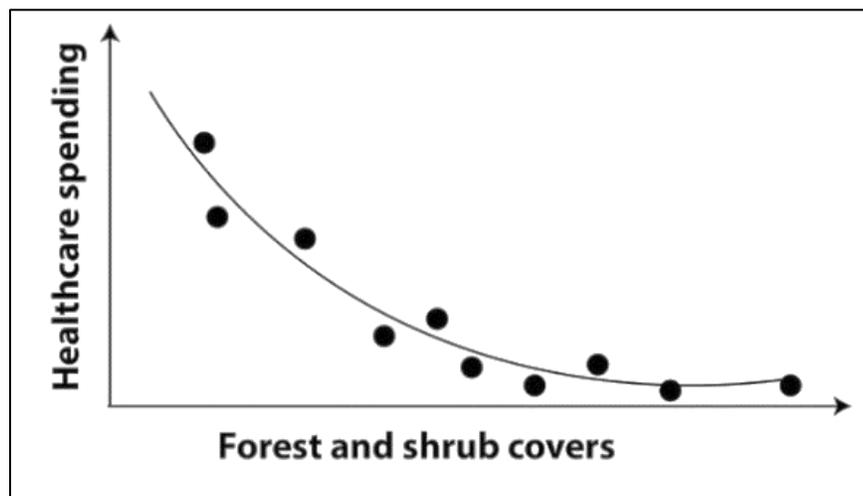
Source: Is green land cover associated with less health care spending? (2019)

Figure 5 shows how detrimental air pollution will be to human health over the upcoming decades. Pollution is seen to be one of the most dangerous occurrences to humans. Poor air quality is projected to be the leading cause of death in the near future. This figure shows that many millions of people are projected to die in the coming years, due to air pollution. Some of the most populous countries are going to feel the consequences the most out of these OECD countries. Countries who are actively polluting with purpose, like Russia, and those that are focused more on growth like China and India will see the most deaths. Countries with strict environmental protection laws will see the least deaths.

Figure 5: Air Pollution Death Projection
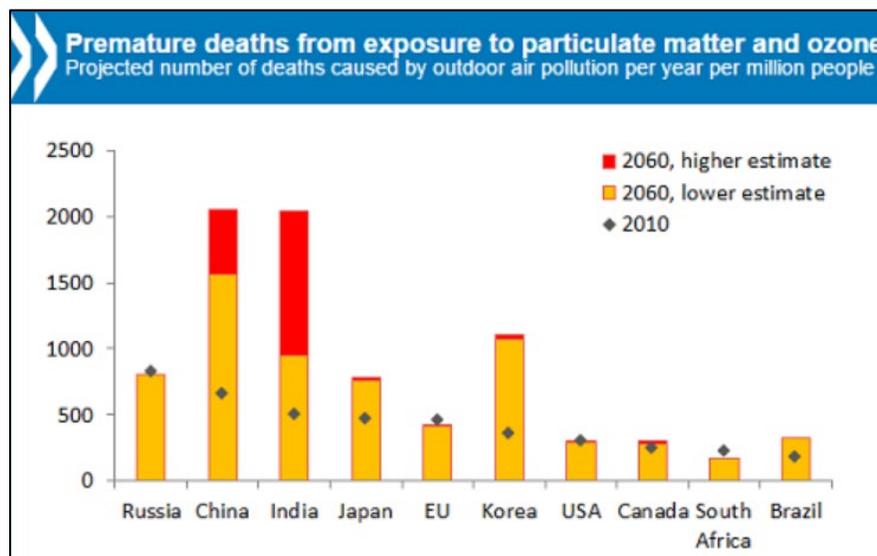
Source: OECD (2016) The Economic Consequences of Air Pollution

3.0 LITERATURE REVIEW

Sagarik (2016) uses data on Association of Southeast Asian Nations countries to examine the factors may effect healthcare expenditure. The study uses a two-stage least squares regression. Sagarik finds that health expenditures as percentage of GDP are not significantly determined by the number of elderly. They increase significantly with industrialization and foreign direct investment. Lastly Sagarik found that economy and urbanization grow faster than health expenditures.

Booker et al. (2019) studied the effects of plant growth and health care spending. The researchers examined health care expenditure along with plant growth across nearly every United States county. The results found that counties with more forests and shrub lands had lower Medicare costs than counties with a large degree of other types of land cover. This relationship was still prevalent after economic and geographic factors that could possibly influence health care costs. Counties with the lowest socioeconomic status benefited the most from increases in forests and shrubs. The study shows that a better environment leads to better health. In turn, a healthier vibrant environment will lead to less expenses and a better economy.

Maji et al. (2017) study the health impact of particulate matter in India's most populated Mumbai City and most polluted Delhi City. They report the attributable number of mortality due to particulate matter in Mumbai and Delhi increased to 32,014 and 48,651 in 2015 compared with 19,291 and 19,716 in year 1995. The annual average mortality due to particulate matter in Mumbai and Delhi was 10,880 and 10,900. Common health issues related to particulate matter were premature cerebrovascular disease, ischemic heart disease, and chronic obstructive pulmonary disease. Maji et al. estimate the total economic cost, (2005 US$) increased from 2680.87 million to 4269.60 million for Mumbai City and 2714.10 million to 6394.74 million for Delhi City, from 1995 to 2015. These numbers account for about 1.01% of India's gross domestic product.

Wolfe (1986) is an older study, but I believe it holds some insight into rising health costs, although I am skeptical that the United States may be an outlier in the results of the study. In the 1980s it was argued that cutting expenditures will not have a negative effect upon health status. Wolfe used health and life-style data from the OECD for Germany, the United Kingdom, The Netherlands, France, Sweden and the United States. Wolfe's study concluded that when changes in life style that have an impact upon health such as; smoking, drinking, traffic accidents, dangers on the job are held constant, and adjusts for inflation and population size, health care expenditures do bear a positive relationship to health status. These results suggest that reductions in health care expenditures may well have some cost in terms of overall health.

Reich (2015) discusses the deep flaws of the American healthcare system. America is one of the few advanced nations that allow direct advertising of prescription drugs to consumers. It is illegal for Americans to shop at foreign pharmacies for cheaper versions of the same drugs sold

in the United States.   The stated reason is that this protects the public from dangerous counterfeit drugs. Counter to this, for least a decade before then, during which time tens of millions of prescriptions were filled over the Internet, no case was reported of Americans having been harmed by medications bought online from a foreign pharmacy. The real threat to the public's health is drugs priced so high that an estimated fifty million Americans—more than a quarter of them with chronic health conditions—did not fill their prescriptions in 2012, according to the National Consumers League. US laws allow pharmaceutical companies to pay doctors for prescribing their drugs.

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data

The study uses annual panel data from 1990 to 2014. Data were obtained from the Organization for Economic Co-operation and Development (OECD) data website and World Development Indicators. Summary statistics for the data are provided in Table 1.

Table 1: Summary Statistics

Variable	Observations	Mean	Standard Deviation	Min	Max
CountryCode	225	-	-	1	9
Year	225	-	-	1990	2014
HEALTH	225	9.408356	2.204629	5.09	16.44
EMISS	225	11.46191	4.577107	4.311563	20.17875
GDP	225	2.07554	1.777491	-5.61886	5.255
POP	225	15.0065	2.154365	11.06252	20.98196
URBAN	225	0.976979	0.5226048	-1.60197	2.273314

4.2 Empirical Model

This study adapted and modified the model used by Sagarik (2016).   I have added pollution to the model as well as removed other variables. Health expenditure is being evaluated on the total level instead of private spending.

The model could be written as follows:

HEALTH= β0 + β1EMISS +β2POP + β3URBAN + β4GDP

HEALTH is the annual amount of spending each country makes towards health care. Health care spending is defined using the OECD definition as a measure of the final consumption of health care goods and services including personal health care and collective services and public, but excluding spending on investments. My model used total health care expenditure including public and private spending. HEALTH is being used as the dependent variable in the model.

The model consists of four independent variables obtained from various sources. Appendix A and B provide data source, acronyms, descriptions, expected signs, and justifications for using the variables. First, EMISS represents the total tons of carbon dioxide a country emits each year. Second, POP represents the percentage of the total population aged 65 or older. Third, URBAN represents the annual population growth of urban communities in the country. Lastly, GDP represents each countries annual GDP growth rate.

5.0 EMPIRICAL RESULTS

The empirical estimation results are presented in Table 2. The empirical estimation shows the negative relationship between total health expenditure and annual GRP growth, percent of population 65 and older, carbon dioxide emissions, and urban population growth rate.

Table 2: Regression Results for OECD Nations

	Fixed Effect	Random Effect
HEALTH		
Constant	16.05479	16.24422
EMISS	-0.2569503***	-0.2268477***
GDP	-0.0590054**	-0.0617977**
POP	-0.3677393***	-0.3785376***
URBAN	-0.4276328***	-0.4389979***
R2	0.908	0.9077
F-Statistic	66.25***	-
# of obs.	225	225

Note: *** and ** denote significance at the 1%, and 5% level respectively.

The emissions variable is significant at 1% level. GDP growth is significant at the 5% level. Population variable is significant at 1% level. Lastly, Urban growth rate is also significant at 1% level. All the signs are negative meaning that when each means as each variable goes up total health expenditure in each country will go down.

With GPD growth being negative, it shows that the GDP outgrows health care spending. The model demonstrates that as the elderly population grows health care expenditure decreases. This is opposite of what I hypothesized. It would make sense that elderly will need more health care due to the weakened health as a result of aging. The results contradict this. The elderly population variable may be negative because while the elderly may need more care, they just are not seeking it due to access or cost. As emissions increase public health expenditure will decrease. This is unexpected because pollution is known to result in health issues. The results may be this way because OECD nations have been cutting their emissions over the past five decades, while health spending has gone up. Lastly as urban population grows health expenditure increases. This is contrary to what I had expected, as people are more concentrated illness will spread faster. The data shows it to opposite of this. This may be because in cities you can access hospitals and health care faster, and prevent illness from becoming more severe. Based purely on the regression results I would recommend governments issuing property tax breaks for households in urbanized areas. This policy would attract more people to cities and result in lower expenditure.

The results of the regression in this study are similar to the results produced by Sagarik. In the regressions run in this study as well as Sagarik's both the GDP growth and urban population growth variables were found to be negative. The results of the old age population variable are where the two studies differed. In the model I ran, increased elderly population was found to have a decrease in medical spending, where Sagarik's model shows a positive response.

My study did face limitations. Accessing data was difficult, it is hard to find the data needed as a lot of countries do not report certain statistics. In the future with more time and recourses to find data I would like to shift the observations of the study towards developing nations. I also feel my model is limited by the number of variables. In the future I would additional independent variable for increased explanatory power.

5.0 CONCLUSION

In conclusion, pollution, GDP growth, elderly populations, and urban populations all have an effect on the level of spending a country makes towards healthcare. Many of the study's results were opposite of what was hypothesized. The results of the study imply that urbanized areas with large elderly populations spend less on care those of an opposite demography. The analysis of the determinants of health care expenditure, OECD nations should consider implementing policies that bring individuals into urbanized areas. The results also show that countries have taken measures to reduce carbon emissions and they are not effecting the rising cost of healthcare. Optimization of health care expenditure will allow for consumption in markets that have trickle down effects and boost overall economic health.

Appendix A: Variable Description and Data Source

Acronym	Description	Data Source
HEALTH	Total country consumption on health care as a percentage of Gross Domestic Product, not including investments	OECD Health Statistics
EMISS	Total carbon dioxide emissions measure in metric tons per capita	World Development Indicators
GDP	Annual percentage change in Gross Domestic Product	World Development Indicators
POP	Percentage of the population which is of the age 65 or greater	World Development Indicators
URBAN	Annual percentage change of population moving to urban areas	World Development Indicators

Appendix B: Variables and Expected Signs

Acronym	Variable Description	What it captures	Expected sign
HEALTH	Total country consumption on health care as a percentage of Gross Domestic Product, not including investments	The total amount being spent on health care, which could be spent in more productive areas	+
EMISS	Total carbon dioxide emissions measure in metric tons per capita	The amount of pollution faced by the population	+
GDP	Annual percentage change in Gross Domestic Product	Change in overall economy	-
POP	Percentage of the population which is of the age 65 or greater	Number of people who are older, hypothetically needing more medical care	+
URBAN	Annual percentage change of population moving to urban areas	The change in the number of people living closer together, hypothetical making disease spread easier	+

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