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Technology as the Driving Force Behind Rising Healthcare Costs An Analysis of Why Americans Pay So Much for Healthcare

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Table of Contents

1. Introduction

Over the last four decades, healthcare costs in the United States have increased 31-fold from $351 per person in 1970 to $11,582 in 2019.[1] U.S. expenditures on healthcare are higher than other developed countries. According to a study conducted by the Johns Hopkins Bloomberg School of Public Health, the central reason for the larger expenditures in the United States is not due to greater healthcare utilization, but rather, because of higher healthcare prices. U.S. healthcare expenditures are expected to increase substantially, however, are likely to yield no better results and in fact, could result in worse outcomes for consumers. [2] This trend will intensify healthcare spending as well as the U.S. national debt and proves to be problematic because the increase in spending has not yielded better health outcomes. National expenditures are estimated to reach a whopping $6.2 trillion by 2028[3], leaving healthcare experts, public policy economists, government officials, and American citizens concerned about the country's ability to provide acceptable levels of healthcare equitably and efficiently.

In addition to the dramatic rise in healthcare costs in the U.S., there has been an incredible influx of healthcare technology which has contributed enormously to innovative and lifesaving healthcare practices. The United States ranks fourth in the World Index of Healthcare Innovation behind only Switzerland, Germany, and the Netherlands.[4] Additionally, the United States is almost always first in line to access new medical technology which is often pioneered by American Universities and American companies. Yet, the U.S. ranks second to last in Fiscal

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[1]Kamal, Rabah, et al. "How Has U.S. Spending on Healthcare Changed over Time?" *Peterson-KFF Health System Tracker*, 16 Nov. 2021, https://www.healthsystemtracker.org/chart-collection/u-s-spending-healthcare-changed-time/.
[2] "Why Are Americans Paying More for Healthcare?" *Peter G. Peterson Foundation*, 20 Apr. 2020, https://www.pgpf.org/blog/2020/04/why-are-americans-paying-more-for-healthcare.
[3] "NHE Fact Sheet." *CMS*, 16 Dec. 2020, https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and Reports/NationalHealthExpendData/NHE-Factsheet.
[4] Roy, Avik. "United States: #4 in the 2020 World Index of Healthcare Innovation." *Medium*, FREOPP.org, 25 June 2021, https://freopp.org/united-states-health-system-profile-4-in-the-world-index-of-healthcare-innovation-b593ba15a96.

Sustainability in terms of healthcare because the U.S. is the country with the largest amount of government spending on healthcare per capita as seen through Medicare and Medicaid.[5] The 2020 COVID-19 pandemic only exacerbated this issue as the U.S. government spent trillions of dollars to support Americans battling the virus as well as Americans displaced from work. The United States ranked number one in choice because of American's access to leading medical care technologies and high success rates despite being ranked fourteenth in terms of quality.[6]

This phenomenon of high healthcare costs and high technological innovation presents an interesting problem. Popular economic theory teaches us that technological advancement improves production efficiency, which shifts the supply curve to the left. As the costs of production go down, consumers will demand more of the good or service at lower prices. In other words, as technology increases, prices tend to go down resulting in lower prices and higher demand for consumers. However, in the healthcare industry we are seeing the opposite occur. Technological advancements are raising costs, which ultimately raises prices for consumers. At the same time, consumers demand for healthcare is dramatically increasing. Many medical professionals highlight progress in the medical field stemming from increasing usage of sophisticated technology. However, such technology has proven to be expensive and beyond the reach of everyday Americans. These patterns of rising costs and inefficiencies in healthcare exist despite a robust push towards innovation, which implies that technology alone is unable to shift the healthcare cost curve. Thus, the focus of my research will aim to provide an economic analysis of the healthcare industry in the United States in terms of technological innovation, transaction costs, and inefficiencies. If inefficiencies can be solved and more effective technology implemented, I believe there is a way to advance modern medicine while

[5] Ibid. 3
[6] Ibid. 3

simultaneously cutting costs for healthcare consumers and providers. Additionally, my research will try and answer the question of whether the United States is unfairly bearing the burden of healthcare technology costs? And if so, is the rest of the world free riding on U.S. healthcare advancements?

1.1. Historical Development of Healthcare Costs

The modern healthcare system was created during World War II when President Theodore Roosevelt regulated what U.S. employers could pay their workers by implementing wage controls. However, the wage controls did not apply to work benefits such as health insurance, so businesses began to offer much more competitive healthcare benefits to attract high quality workers since they were limited with the Roosevelt wage controls. Moreover, in the 1950s the Internal Revenue Service (IRS) excluded employer-based health insurance from federal, state, and local taxation.[7] Rapid adoption of health insurance followed and in turn, health care price inflation skyrocketed. In 1965, the U.S. Congress passed the Social Security Act which created Medicare and Medicaid, two medical care programs to help the elderly and the poor. The combination of Roosevelt price controls, IRS tax codes, and the Social Security Act made American consumers extremely price insensitive. The reason is that workers did not pay the healthcare costs they used in the employer-based market, nor did they pay for the medical insurance since it was purchased on their behalf by their employers. Therefore, they had no incentive to limit their healthcare consumption which allowed for healthcare prices to start increasing tremendously, without a reduction in demand.

On a per capita basis, health care spending has grown precipitously over the last half century. In 1970, health spending totaled at $74.1 billion. By 2000, U.S. health expenditures reached $1.4

[7] Ibid, pg. 4

trillion and as of 2019, the amount spent reached $3.8 trillion.[8] This is a 31-fold increase and marks one of the largest healthcare increases globally. Additionally, healthcare spending has outpaced the growth of the U.S. economy. In 1970, 6.9% of GDP was allocated towards healthcare spending according to data from both the Peterson Center on Healthcare and the Kaiser Family Foundation. As of 2019, the amount of GDP spent on healthcare was 17.7%. [9] It is common for health spending to increase during periods of economic downturn and has shown to remain relatively constant during expansionary periods. Between the years of 2016 and 2019, healthcare spending decreased slightly from 17.9% to 17.7% of GDP. This is likely attributed to the economic expansion that the United States underwent during the Trump administration. What's more is that health spending also decreased throughout 2020 and the onset of the Coronavirus pandemic. Several factors caused both spending and utilization to be driven down as the pandemic hit the U.S. The primary factor is that in the spring of 2020, healthcare spending decreased as elective surgeries and doctors' appointments were cancelled. The push toward telehealth did increase costs, but spending did not nearly increase as much as it would have had the appointments been in-person. This trend continued throughout 2020, and the data has shown that for the first time in history, health spending had dropped.[10] However, as government restrictions have been lifted, hospitals and healthcare facilities have begun to reopen and started to conduct more elective surgeries which has brought healthcare spending up again.

Given the decrease in healthcare spending throughout 2020, data from the Kaiser Family Foundation suggests that health spending is now on pace with economic growth in the United States. Between 1970 and 1980, healthcare spending was growing at about 12% annually

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[8] Kamal, Rabah, et al. "How Has U.S. Spending on Healthcare Changed over Time?" *Peterson-KFF Health System Tracker*, 16 Nov. 2021, https://www.healthsystemtracker.org/chart-collection/u-s-spending-healthcare-changed-time/.
[9] Ibid. pg. 4
[10] Twitter, Cynthia Cox, et al. "How Have Health Spending and Utilization Changed during the Coronavirus Pandemic?" *Peterson-KFF Health System Tracker*, 22 Mar. 2021.

compared to an average annual growth of 9.3% of the U.S. economy.[11] This is a large gap which highlights the large increases in healthcare spending in the decades after the Roosevelt reforms and Social Security Act. Following the 1980s, healthcare spending was still outpacing U.S. economic growth, but at a smaller rate than in the 1970s. Looking to the periods between 2010 and 2013 as well as 2016 through 2018, the data shows that health spending growth was homogenous to growth in GDP. Health spending did outpace GDP growth between 2014 and 2015, likely because of expansions to the Affordable Care Act by President Obama. [12] As of the writing of this paper, healthcare spending is more on track with growth in U.S. GDP. Yet, the issue of rising healthcare costs for both consumers and providers are still at the forefront of news and a major talking point of politicians in Washington D.C.

1.2. Advancements in Medical Technology in Recent Years

Medical technology advancements over the last fifty years have entirely reshaped the practice of medicine in the United States. It has also saved countless lives, increased access to care, and improved the quality of life for Americans. Traditional healthcare systems have faced heavy criticisms for a reactionary approach to healthcare. The U.S. indeed maintained a reactionary healthcare approach for much of the early 1900s and through the industrial revolution. That is, health issues are not addressed until they become problematic. However, as the U.S. began to implement increased accessibility of healthcare during the 1960s the focus of medicine changed to a more proactive approach. This proactive approach paired with advancements in healthcare technology allowed doctors to treat patients at the onset of their illnesses rather than wait until it was too late. For example, the creation of the full-body MRI has allowed doctors to detect bodily abnormalities before symptoms occur and begin to treat the problem before it gets out of control.

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[11] "KFF Analysis of National Healthcare Expenditures (NHE) Data." *CMS*, 16 Dec. 2020, https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.
[12] Ibid. pg 6

Similarly, new cancer blood tests can detect over fifty different forms of cancer. Innovations like these have allowed the U.S. healthcare system to begin taking a proactive approach to healthcare and undoubtedly has contributed to the U.S. success rate in curing patients. Another advancement in the U.S. healthcare system has been a push for more personalized healthcare. Given that medical technology can capture billions of data points, doctors are becoming much better at creating individual pictures of a person's health and able to take a better approach at tackling health issues. This advancement in data collection highlights the U.S. healthcare shift to a more holistic and individualistic approach to medicine.

A third healthcare advancement is the convenience of care patients experience. Early in the United States healthcare system, there were long wait times to meet with a physician or have surgery done. The same can be said about countries like Canada and Sweden who operate on a socialized healthcare systems that causes wait times to be much longer, and the quality of care to be much worse for patients. In the U.S., healthcare companies operate on the same incentives that companies in other sectors do. Time is money, so healthcare providers have begun to look for more efficient and effective ways to see patients. A great example is greater hospital turnover rates. Patients are no longer burdened by long wait times or piles of confusing paperwork. Evidence of this has been a shift towards telemedicine. Telemedicine has allowed providers to have greater turnover times, see more patients, and has limited the congestion of hospitals and waiting rooms with an influx of patients. Telemedicine has also made it easier on patients to see a doctor faster and reduce travel costs associated with getting to a hospital or care center. The United States has come incredibly far in their healthcare advancements which has been no small feat. These technological advancements will continue to develop and advance, giving patients and doctors better resources to fight the illnesses and diseases they face. But again, despite the

wonderful advancements we're seeing in the U.S. healthcare system, the cost of healthcare is still an issue which makes us question if the technological advancements are growing too fast?

2. Literature Review

Thomas Bodenheimer, professor of Family Community Medicine at the University of California, San Francisco, offers several explanations for rising healthcare costs: (1) high and rising costs are created by forces outside the healthcare system. (2) the weakness of a competitive free market within the health system. (3) the rapid diffusion of technology. (4) the absence of strong cost-containment strategies. And (5) undue market power of health care providers. In this article, Bodenheimer aims to answer, "Are high and rising health care costs a serious problem?" "Are rising costs explained by factors outside the health care system?" And "does the absence of a free market in health care explain why costs are high and rising?" These are great questions to ask and answer in understanding the flaws of the U.S. healthcare system and how we can fix the flaws that contribute to rising healthcare costs. A follow-up article by Bodenheimer addresses medical technology and innovation in the United States and how it applies to rising healthcare costs. Bodenheimer posits that technologic innovation, in combination with weak cost-containment strategies is a major factor in rising healthcare costs in the United States. He goes on to contrast different health systems globally and the effects technology plays across the world.

Gail R. Wilensky, an economist and senior fellow at Project HOPE, published an article titled *Technology as a Culprit and Benefactor* in the healthcare sector. For Wilensky, medical technology can be seen as a mixed blessing: on the one hand, rising costs. On the other hand, improved diagnosis, treatment, and health status. Wilensky's article discusses the influence of key factors on the demand for healthcare technology and its utilization. According to Wilensky, such factors include rising health expenditures, changes in populations, and the development of

cost containment strategies. Additionally, shifts in consumer incentives and utilization are examined. Similar to Wilensky's article, an article from Paul Wallner and Andre Konski, both medical doctors, looks at the impact of technology on healthcare costs and policy development. This article references that some health care economists have suggested that "the rapid introduction of new technologies has also played a major role" in the rising cost of health care. Medical equipment vendors often have the desire to for early market penetration of their products which is often accomplished before any cost-benefit analysis can be performed on the new technology. The current system of technology approval has produced further disruptions to cost inflations. The nature of this problem will be covered in this article as well as the various factors in the introduction, implementation, and evaluation of new medical technology.

In recent years, concerns have risen in the United States over rising health care costs has led to reductions in the lengths of hospital stays for patients. Perceptions of this compromised medical care phenomena have led to regulators to call for more strict regulation of insurance companies. Yet little attention has been paid to the actual benefits and costs of reducing the lengths of hospital stays for patients and therefore decreasing hospital costs. This paper by Kathleen Carey provides empirical evidence on how shorted hospital stays can lead to declining costs for hospitals. Carey's method utilizes a total operating cost function of 2,792 different hospitals in the United States between 1987-1992. There are three different estimating techniques including a random effects model, circumventing inconsistency problems, and the cost elasticity of the hospital stay. Carey's findings suggest that common perceptions regarding the extent of cost savings resulting from length of stay reductions have been overestimated.

Mark McClellan, director for the Engelberg Center for Health Care Reform, focuses on the movement towards a radically different approach to paying healthcare providers in his paper

Reforming Payments to Healthcare Providers: The Key to Slowing Healthcare Cost Growth While Improving Quality? McClellan suggests "these reforms seek to create direct linkages between payments to healthcare providers and measures of the quality and efficiency of care" (70). McClellan gives an overview of payment reforms for healthcare providers and their welfare implications through a wide range of empirical studies. The small-scale studies cited in this paper suggest that provider payment reforms in accordance with greater attention to improving measurements of care quality, can have a substantial impact on the quality of care and in some cases even reduce the resources and costs to such care.

Lastly, an article by Stuart Butler, senior fellow in Economic Studies at The Brookings Institution, titled, *Containing Health Costs in a Consumer-Based Model* takes a defensive argument against the idea that consumer choice is not relevant in the healthcare system cost structure. Butler argues that "the assumption that consumer choice cannot be used to achieve cost control in health care is invalid. It does not do so today because the tax treatment of health care leads to perverse consumer incentives that encourage cost escalation" (21). Stuart believes that it is possible to design a universal system that is efficient and allows for consumer choice to be a powerful constraint on healthcare costs which could be a powerful means for reforming the healthcare system in the United States.

3. Analysis

The first question we must answer in our investigation of rising medical costs in the United States is, "should rising healthcare expenditures be a serious concern? Or are American's over analyzing the state of healthcare in the U.S?" The answer lies in how you approach the question. Many medical professionals as well as healthcare economists have taken the position that rising healthcare costs are not as serious of a problem as popular media has made it out to be. Mark V.

Pauly, an American Economist, has been particularly vocal about healthcare costs being less worrisome than other economic forces. His work has often cited that high healthcare expenditures correlate to better health outcomes for patients, more jobs, higher incomes for providers, and most importantly, it reflects a high demand from consumers who are willing to pay.[13] While this may be true in some respects, it does not reflect the opinion of the millions of payers whether that be organizations or individuals. Most employers want to see a reduction in healthcare costs because they are responsible for providing healthcare benefits to their workers. As healthcare gets more expensive, firms hire less workers, give less bonuses and raises, and in the worst cases, must lay off workers because they cannot afford the increased costs of healthcare benefits.[14] If healthcare costs were lower, it would make sense that firms would be able to increase employee salaries, reduce prices of their goods and services, or increase profits for shareholders. All three of these events have a greater impact on the overall economy than increased healthcare costs.[15] What's more is that increased federal expenditure on healthcare creates massive budget deficits, and leads to reduced spending for education, infrastructure, technology, police, and other public goods.[16] Therefore, increased health expenditures can create negative externalities for employers, employees, and governments that affect not only individuals, but also the economy as a whole. Thus, this paper proceeds with the belief that rising healthcare expenditures are a serious concern and should be dealt with accordingly.

Knowing that rising medical costs are a serious problem, it's important we analyze the determinants of rising medical costs so we can better understand the root causes, to then be able

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[13] Pauly MV. Should we be worried about high real medical spending growth in the United States? Health Aff (Millwood). 2003 Jan-Jun;Suppl Web Exclusives:W3-15-27. doi: 10.1377/hlthaff.w3.15. PMID: 14527232.
[14] Gabel J, Levitt L, Holve E, Pickreign J, Whitmore H, Dhont K, Hawkins S, Rowland D. Job-based health benefits in 2002: some important trends. Health Aff (Millwood). 2002 Sep-Oct;21(5):143-51. doi: 10.1377/hlthaff.21.5.143. PMID: 12224876.
[15] Davis, K., Anderson, G., Renn, S. C., Rowland, D., Schramm, C. J., & Steinberg, E. (1985). Is cost containment working? *Health Affairs*, *4*, 81–94.
[16] Ibid. pg. 9

to offer solutions. A 2017 *Journal of the American Medical Association* (JAMA) study listed five determinants of rising healthcare costs: (1) population growth, (2) population aging, (3) disease prevalence or incidence, (4) medical service utilization, and (5) service price and intensity.[17] Results from the study cited that each determinant played a considerable role in rising expenditures between 1996 and 2013. Yet, the strongest determinant out of the five was service price and intensity which had the largest impact on healthcare costs over the seventeen-year study. Service price and intensity essentially looks at the price of service and the intensity or rate at which patients seek care. The study undoubtedly gives us good insights into key determinants of healthcare costs but fails to include technology as a major source of rising costs. In terms of this paper, I will prove that technology is a key determinant of rising healthcare costs and investigate why technological advancements have led to higher costs for healthcare while not simultaneously lowering prices.

3.1. Technology as the Key Determinant of Rising Healthcare Costs

The American healthcare system has a difficult relationship with technological advancements. On the one hand, technology is praised for saving lives, improving health outcomes, and improving quality of care. While on the other hand, technology has been villainized as a proponent in the increased cost of healthcare. Major medical technologies such as magnetic resonance imaging (MRI) systems are both hailed for their medical success and blamed for their cost basis. It's clear that technology in the medical field teeters on a fine line between good and evil and for good reason. Peter Neumann and Milton Weinstein emphasize this point in their book *The Changing Economics of Medical Technology* which outlines five facts of medical technology that helps illustrate the causes and effects technology plays in increased healthcare

[17] JAMA: Journal of the American Medical Association. "Factors Associated with Increases in US Health Care Spending, 1996–2013." Accessed March 9, 2021.

costs. The first fact is that new technologies do improve healthcare outcomes.[18] It is true that better medical technologies lead to quicker diagnoses of illnesses and diseases and can lead to better preventative measures to keep people healthy and living longer. The second fact is that a lot of new technologies are either redundant or ineffective when they are introduced.[19] Meaning some new technologies are technologies that already exist but are marketed as new and improved devices that serve no real purpose and don't lead to significantly better health outcomes.

The third fact is that on average, new technologies do add to healthcare costs.[20] While it's important to note that some technologies do decrease costs, the average technology when brought to market raises healthcare costs. This is a simple concept to understand. New technologies are more expensive because one, their new and improved and thus have greater value, and two they tend to provide better results, which also reflects greater value and ultimately a higher price. However, this higher price is not borne by the providers, rather it is passed off onto patients and payers who in most cases have no choice but to use the technology. This has a compounding effect as millions of patients seek such technologies and contributes to a tremendous increase in healthcare spending. The fourth fact is that the healthcare sector encompasses an inadequate diffusion of technologies.[21] In other words, the American healthcare sector has an underdiffusion of cost-effective technologies and an overdiffusion of ineffective technologies. And the fifth fact highlighted by Neumann and Weinstein is that Americans cannot get enough of new medical technologies.[22] The demand for new and improved technology lies at the heart of the American consumer and the healthcare system is no exception to that.

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[18] Institute of Medicine (US) Committee on Technological Innovation in Medicine. *The Changing Economics of Medical Technology*. Edited by Annetine C. Gelijns et. al., National Academies Press (US), 1991. doi:10.17226/1810
[19] Ibid. pg. 21
[20] Ibid. pg. 22
[21] Ibid. pg. 23
[22] Ibid. pg. 23

So how much does technology add to healthcare expenditures? Research has shown that new and existing medical technology is a contributing factor to rising medical costs.[23] However, many researchers have had trouble identifying the extent to which technology raises costs. The difficulty lies in defining and categorizing medical technology. Medical technology has historically encompassed drugs, devices, surgeries, and hospital support systems.[24] Yet identifying the advancements in technology and attributing them in an economic sense is incredibly difficult to do. Another important aspect of medical technology is that the economic impact of medical technology is often misconstrued to mean the purchase price of the piece of equipment or the cost of the surgery. This is not the case. The total impact of medical technology on healthcare prices reflects the both the initial capital costs of producing and implementing the technology as well as the operating costs it takes to continue to use the technology. Quantifying the capital costs of technology is easy, and studies have shown that capital costs of medical technology make up a good portion of healthcare costs.[25] The difficulty of quantifying costs comes from operating costs of technology which varies across virtually every hospital, clinic, or facility in the country. But it's reasonable to assume that the operating costs of health technology is more than capital costs given the need for operating staff, supervisors, advanced training, and maintenance. To make the issue even more complex, technology costs are not only a function of their capital and operating costs. They also include the utilization of other health services and technologies. For example, a new body scanning technology may lead doctors to diagnose an

[23]Altman, Stuart H., and Robert Blendon. *Medical Technology -- the Culprit behind Health Care Costs : Preoceedings of the 1977 Sun Valley Forum on National Health.* Dept. of Health, Education, and Welfare, Public Health Service, Office of Health Research, Statistics, and Technology, National Center for Health Services Research, 1979. *EBSCOhost*, search.ebscohost.com/login.aspx?direct=true&db=cat02507a&AN=ohiolink.b13167143&site=eds-live.
[24]U.S. Congress, Office of Technology Assessment. Strategies for Medical Technology Assessment. GPO Stock No. 052-003-00887-4, Washington, D.C.: U.S. Government Printing Office, 1982.
[25]Altman, Stuart H., and Robert Blendon. *Medical Technology -- the Culprit behind Health Care Costs: Preoceedings of the 1977 Sun Valley Forum on National Health*. Dept. of Health, Education, and Welfare, Public Health Service, Office of Health Research, Statistics, and Technology, National Center for Health Services Research, 1979. *EBSCOhost*, search.ebscohost.com/login.aspx?direct=true&db=cat02507a&AN=ohiolink.b13167143&site=eds-live.

illness that requires other technologies to heal or confirm the original diagnosis.[26] Technological procedures may lead to further tests or procedures that have a compounding effect on healthcare costs.

As previously stated, placing an amount on cost of healthcare from technology is difficult. However, some researchers have been able to estimate the costs of healthcare from other easily identifiable factors, such as population growth or population aging to then give a better estimate of the role technology plays. Similar to how the *Journal of the American Medical Association* highlights the five determinants of rising healthcare costs, Karen Davis, a professor of Health Policy and Management at Johns Hopkins Bloomberg School of Public Health, hypothesizes that the portion of medical expenditures not accounted for by the five factors JAMA highlights can be attributed to technology.[27] Davis's work helps us pinpoint the area for which technology costs should be reflected. Davis also concluded that technology led to a 25 percent increase in hospital expenses between 1962 and 1968.[28] Additionally, a study conducted by researchers at the Sun Valley Forum on National Health used empirical evidence to suggest that technology accounts for 10 to 40 percent of increased medical costs over time.[29]

It's worth noting that a contradicting view from authors Thomas W. Moloney and David E. Rogers, M.D. who published an article in the *New England Journal of Medicine* arguing that major technologies such as MRI's or CT scans account for much less growth in health costs than

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[26]Weinstein MC, Read JL, MacKay DN, Kresel JJ, Ashley H, Halvorsen KT, Hutchings HC. Cost-effective choice of antimicrobial therapy for serious infections. Journal of General Internal Medicine 1986; 1 351-363.
[27] Mark Perlman (ed.), 1974. "The Economics of Health and Medical Care," International Economic Association Series, Palgrave Macmillan, number 978-1-349-63660-0, September.
[28] Ibid. 283
[29]Altman, Stuart H., and Robert Blendon. *Medical Technology -- the Culprit behind Health Care Costs: Proceedings of the 1977 Sun Valley Forum on National Health*. Dept. of Health, Education, and Welfare, Public Health Service, Office of Health Research, Statistics, and Technology, National Center for Health Services Research, 1979. *EBSCOhost*, search.ebscohost.com/login.aspx?direct=true&db=cat02507a&AN=ohiolink.b13167143&site=eds-live.

smaller tests and procedures.[30] Empirical evidence shows that a 50 percent reduction in operating costs of major medical equipment would only yield between a 1 and 2 percent reduction in national healthcare expenditures. [31] While the authors make the 1-2 percent decline in expenditures out to be a small number, in reality, the cost savings would equate to between $12 and $25 billion in national expenditure savings. So, while technology costs may not seem as large in percentage terms, monetarily the savings could be huge.

3.2 The Efficient Level of Technology

Knowing that technology increases healthcare expenditures and costs for consumers, even if by only a few percentage points, it's important to attempt to find an optimal level of technological output that helps to promote health outcomes while also reducing health costs. First, in order to be able to determine the optimal amount of medical technology, it's important to first have a clear assumption to the goal of healthcare technology. For this paper, I am assuming the goal of technology to be improved healthcare outcomes. Neumann and Weinstein share this assumption in their book, which has helped me base my argument. Second, it's important to note the diminishing marginal returns to medical technology. Just as economic theory cites, diminishing marginal returns tells us that each additional unit of production results in smaller increases in output. For example, the first investment in medical technology will yield better health outcome than the tenth investment. Thus, it's important for us to find the point of maximum yield for technology in hopes that it will drive down healthcare expenditures and pass that savings off to consumers. Milton Weinstein in a separate work titled *Foundations of Cost-effectiveness for Health and Medical Practices* devises a formula for measuring the optimal level

[30] Moloney, T W, and D E Rogers. "Medical technology -- a different view of the contentious debate over costs." *The New England journal of medicine* vol. 301,26 (1979): 1413-9. doi:10.1056/NEJM197912273012603
[31] Ibid. 61

of medical technology. In his cost-effectiveness analysis, Weinstein compares net healthcare costs to net healthcare benefits. He concludes that if a new technology produces better health outcomes at lower costs per unit than current technologies, then the new technology should be adopted, if not, then it should be rejected

.[32] Weinstein's cost-effectiveness analysis shows promise in the health community as an oversupply of ineffective technology plagues the system and leads to incredible inefficiencies which correlates to wasted costs. Yet, Weinstein hasn't been the only proponent of implementing a cost-effectiveness analysis to healthcare technologies. Cost-effectiveness analyses have been a growing practice and has gained widespread acceptance in the healthcare community as the appropriate mechanism for analyzing technology costs.[33]

One of the pioneering examples of this cost-effectiveness analysis in healthcare was done by a group of researchers on the cost-effectiveness of hemodialysis in end-stage renal failure.[34] The study was able to project a low cost per year of hemodialysis compared to other technologies that fight end-stage renal failure. Researchers also inferred that the study was probably the deciding factor for Congress to include end-stage renal failure under universal coverage for Medicare.[35] Yet, cost-effectiveness analyses do present some challenges and limitations. The primary limitation being that most new medical technologies are adopted before significant data is available for cost-effectiveness analyses. [36] A larger limitation to widespread adoption of cost-effectiveness analyses is that the diffusion of medical technologies often leads to ineffective

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[32] Weinstein, M C, and W B Stason. "Foundations of cost-effectiveness analysis for health and medical practices." *The New England journal of medicine* vol. 296,13 (1977): 716-21. doi:10.1056/NEJM197703312961304
[33] Eisenberg, J M. "Clinical economics. A guide to the economic analysis of clinical practices." *JAMA* vol. 262,20 (1989): 2879-86. doi:10.1001/jama.262.20.2879
[34]Klarman, Herbert E., et al. "Cost Effectiveness Analysis Applied to the Treatment of Chronic Renal Disease." *Medical Care*, vol. 6, no. 1, Lippincott Williams & Wilkins, 1968, pp. 48–54, http://www.jstor.org/stable/3762651.
[35] Ibid. 23
[36] Institute of Medicine (US) Committee on Technological Innovation in Medicine. *The Changing Economics of Medical Technology*. Edited by Annetine C. Gelijns et. al., National Academies Press (US), 1991. doi:10.17226/1810

health outcomes. That is, a cost-effective technology will diffuse into other areas of healthcare where the technology is obsolete or ineffective. This in turn presents challenges for developers, utilizers, practitioners, and patients of new technology. The challenge becomes allowing for the adoption of cost-effective technologies in areas where they create net positive health outcomes, without letting the technologies bleed over into areas where they become cost ineffective.[37]

How then can the medical community achieve better health outcomes in the future while simultaneously reducing healthcare expenditures? Research suggests that cost-effectiveness analyses be the determining criteria for the adoption of new healthcare technologies. That's not to say other criteria such as population growth, population aging, disease prevalence, medical service utilization, and service price intensity be excluded, they too need to be analyzed. But a strong cost-benefit analysis of technology must also be in the conversation around rising health expenditures. Implementing cost-benefit structures will be no small feat of course but is necessary for the future of healthcare. Currently there is no strict funding allocated towards this type of research in the United States. The first step towards improvement is to allocate sufficient funding towards cost-effectiveness research to help gain better perspectives on the types of technology that are leading the medical industry and whether they are worthy of their costs. Second, as Neumann and Weinstein describe, the incentive structure facing healthcare providers, insurers, and consumers all need to shift towards cost-reduction and resource constraints.[38] Most providers have begun to move towards better cost-reducing technologies or systems, but insurers and consumers are still facing disconnect. Thus, a unilateral shift towards cost-prevention and increased health outcomes must be put in place if this country wants to get any sort of grip on radical healthcare costs. Lastly, we cannot ignore the demand of the American public. Americans

[37] Ibid. 26
[38] Ibid. pg. 31

want newer and better technologies to improve health status, but at lower prices. Therefore, being able to improve the system to reward cost-effective healthcare and promote new cost-effective technologies could dramatically improve these goals.[39]

3.3 Why Does Healthcare Cost So Much for Americans?

The United States has historically spent significantly more on healthcare than comparable OECD countries. In 2018, the U.S. spent nearly twice as much per person as other OECD countries according to data from the Kaiser Family Foundation.[40] Researchers from Health Systems Tracker analyzed data from 2018 on 10 OECD countries to come up with figures on health spending, and percentages of spending by health category.[41] The largest category of health spending came from spending on inpatient and outpatient care. This includes payments to hospitals, clinics, and physicians. Looking at country by country comparisons, health costs in the U.S. were $5,110 more per person in comparison to other OECD countries. It's clear that inpatient and outpatient care represent a much larger share of spending than other similar countries.[42] Figure 1 represents this spending discrepancy. Moreover, the growth rates in spending the U.S. have seen over the past decade reflect similar rates across the board, but widely different amounts of money. Figure 2 represents this.

Popular economic literature surrounding rising healthcare costs has attributed some of the blame towards the presence of market power for healthcare providers and insurers. The American healthcare system since its inception has had strong barriers to entry. It's no secret that providers must go through nearly a decade of schooling, amass on average a quarter of a mullion

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[39] Ibid. pg. 31
[40] Cox, Nisha Kurani and Cynthia, et al. "What Drives Health Spending in the U.S. Compared to Other Countries." *Peterson-KFF Health System Tracker*, 20 July 2021, https://www.healthsystemtracker.org/brief/what-drives-health-spending-in-the-u-s-compared-to-other-countries/.
[41] Ibid. pg. 2
[42] Ibid. 3

dollars of debt, and still be required to meet certain criteria just to practice in the United States. These high barriers to entry create a systematic issue that causes fewer Americans to pursue careers in healthcare and ultimately gives universities, providers, and insurers the power to charge high prices for education and medical care.

In July of 2021, the International Monetary Fund published an article by Li Lin and Mico Mrkaic titled *U.S. Healthcare: A Story of Rising Market Power, Barriers to Entry, and Supply Constraints*. The authors cite evidence of market power and competition in the U.S. healthcare industry though estimating the true strength of market power, the impact of market power on healthcare spending, and an analysis of the Affordable Care Act (ACA) and its role in defining healthcare wages. According to the article, price markups for publicly listed healthcare providers have nearly doubled since 1980.[43] Using data from over 81,000 publicly listed firms, which accounts for 99% of the global healthcare market capitalization, the authors found that U.S. healthcare firms have been able charge much larger markups than other firms across the globe. The U.S. markup has been nearly 70% since 1980 compared to 40% in other healthcare sectors. Figure 4 of the Appendix highlights their findings.

The dramatic increase in markups in the U.S. has had a resounding effect on the healthcare spending throughout the country. Based on the authors regression models, markups account for roughly a quarter of annual increased in U.S. real health spending since 1980.[44] What's more is the role the ACA has had in recent years on real healthcare wages. Gruber and Sommers (2019) find strong evidence that the positives of the ACA have been increased insurance coverage for Americans.[45] This has also correlated to a positive relationship between

[43] Lin, Li, et al. "U.S. Healthcare: A Story of Rising Market Power, Barriers to Entry, and Supply Constraints." *IMF Working Papers*, vol. 2021, no. 180, 2021, p. 1., https://doi.org/10.5089/9781513585451.001.
[44] Ibid. 23
[45] Gruber, Jonathan, and Benjamin Sommers. "The Affordable Care Act's Effects on Patients, Providers and the Economy: What We've Learned so Far." *National Bureau of Economic Research,* June 2019, https://doi.org/10.3386/w25932.

access and consumption. I.e., a larger number of Americans being insured has led to greater access to care and therefore, greater utilizations. Given the expansions provided by the ACA, Lin and Mrkaic found that between 2016 and 2019 average wages in Medicaid expansion states grew by 75% faster than non-expansion states.[46] Real wages had a compounding effect for providers in expansion states compared to non-expansion states. But with that came higher prices for service and care. Figure 5 of the Appendix highlights the researchers' findings. So again, we see a relationship between wages and prices which benefit providers but hurt consumers. It also reaffirms the role of market powers and how public policy can exacerbate these issues despite campaigning to cut healthcare costs.

While market power and barriers to entry are certainly a defining force behind medical costs, a lot of the cost born by Americans comes from the innovations that the American healthcare system makes. Most health economists believe that technological advancements are correlated to higher health expenditures.[47] But the price Americans pay for healthcare is also largely a function of the innovations that take place within U.S. borders and how that innovation affects the price of healthcare. Medical innovations require more capital, labor, and higher expenses.[48] All of these inputs to medical innovation cost money, and lots of it which leads to higher prices for consumers especially in the United States. Moreover, greater innovation leads to greater access, which is undoubtedly a positive for Americans seeking care. But with increased access comes increased utilization. Higher levels of utilization lead to higher costs. That is, greater accessibility for Americans leads to greater per capita use and greater per capita

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[46] Lin, Li, et al. "U.S. Healthcare: A Story of Rising Market Power, Barriers to Entry, and Supply Constraints." *IMF Working Papers*, vol. 2021, no. 180, 2021, p. 1., https://doi.org/10.5089/9781513585451.001.
[47] Chernew ME, Hirth RA, Sonnad SS, Ermann R, Fendrick AM. Managed care, medical technology, and health care cost growth: a review of the evidence. Med Care Res Rev. 1998; 55:259-88. [PMID: 9727299]
[48] Bodenheimer, Thomas. "High and rising health care costs. Part 2: technologic innovation." *Annals of internal medicine* vol. 142,11 (2005): 932-7. doi:10.7326/0003-4819-142-11-200506070-00012

spending on healthcare.[49] Thomas Bodenheimer, MD author of *High and Rising Health Care Costs*, writes "innovation has spread more widely and has commanded higher prices per unit of service in the United States compared with most other developed nations."[50] Take for example the fact that the U.S. houses twice as many MRI machines per capita compared to every other developed nation. Or what about the fact that by the turn of the 21st century, the United States had twice as many coronary bypass surgeries per capita than the top 15 developed nations.[51]

U.S. acceptance of major medical technologies is major reason for the rapid diffusion of technology across health systems throughout the country. Physicians in the U.S. qualify patients ready for treatments by major medical technologies and new procedures at a much faster rate than comparable countries. This is partly due to the fact that providers are paid on a fee-for-services basis, so doctors have an incentive to use the latest technologies and run the most tests so they can get the highest payouts. However, the rate at which innovation is spreading is also correlated with the number of specialists in an area.[52] Specialists demand the latest and greatest technology to attract more clients and thus more income. So, specialists will seek out more technology and spending from their hospitals which leads to higher spending per capita and thus higher costs per capita. A leading question we might ask is whether this rapid diffusion of innovation is being pioneered by physicians, hospitals, and technology entrepreneurs, or is this being demanded by the American public? A survey between American and Canadian citizens found that citizens of both countries had greater expectations and awareness to medical

[49] Ibid. pg. 932
[50] Ibid. pg. 932
[51] Reinhardt, Uwe E et al. "Cross-national comparisons of health systems using OECD data, 1999." *Health affairs (Project Hope)* vol. 21,3 (2002): 169-81. doi:10.1377/hlthaff.21.3.169
[52] Gelijns, A, and N Rosenberg. "The dynamics of technological change in medicine." *Health affairs (Project Hope)* vol. 13,3 (1994): 28-46. doi:10.1377/hlthaff.13.3.28

innovations than did citizens of Western European nations.[53] It's clear that public sentiment plays a large role in the access and diffusion of medical technologies in the U.S. which may be yet another reason for the U.S. being the highest payer for healthcare in the world. However, it may also allude to the vast amounts of media and marketing for medicine that take place in the U.S. and suggest that a lack of regulation around medical advertising may play a larger role in the diffusion of technology and innovation. Regardless, the U.S. remains at the top of global charts for healthcare spending per capita. This high spending is largely a function of high consumer demand for healthcare, technological innovations, and diffusion of technologies. Most Americans have access to revolutionary medical technology which they are certainly paying for. Which poses the last question of my thesis. And is the rest of the world free riding on U.S. innovations while Americans get left with the bill?

3.4 Foreign Free-Riders?

Prior to the 2020 COVID-19 pandemic Albert Bourla, chairman and CEO of Pfizer, petitioned to former U.S. President Donald Trump to fight harder for price controls of prescription drugs in foreign countries. More so, Bourla said that foreign nations are "free-riding on American innovation" during a U.S. Senate hearing regarding high U.S. drug prices. Bourla's proposal was one of many put forth by the pharmaceutical industry but fell on deaf ears when Senators fired back stating that the pricing set by drug companies are "unacceptable."[54]

However when before a Senate judiciary hearing, top drug makers defended their pricing strategies citing that they've actually been receiving less in recent years for their drugs than they have historically.[55] Yet study from the research firm IQVIA found that between 2012 and 2017,

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[53] Kim M, Blendon RJ, Benson JM. How interested are Americans in new medical technologies? A multi-county comparison. Health Aff (Millwood). 2001; 20:194-201. [PMID: 11558703

[54] "Pfizer: Countries Free-Riding on US Innovation." *BBC News*, BBC, 26 Feb. 2019, https://www.bbc.com/news/business-47377427.

[55] Ibid. 3

prices of brand name prescriptions rose by 60%.[56] In an attempt to ease this burden on consumers, lawmakers have begun to focus on easing the approval of rival drugs to drive down prices or consider importing from different countries. This came with some pushback from Bourla and other executives in the pharmaceutical industry with Bourla stating, "the [Trump] administration should try for trade agreements to protect American innovation. These price control mechanisms of multiple well-developed countries is in reality a free riding on American innovation."[57] It is true that prices of drugs in many well-developed European nations are cheaper than in the United States. This is mostly attributed to government regulation and intervention matched with greater competition across the industry. But the case still needs to be made whether Americans are getting the short end of the medical innovation stick.

There has been a campaign going on since the early 1990's advocating for U.S. protection from foreign free-riders.[58] This movement, while heavily backed by the pharmaceutical industry, has grown in favor from millions of Americans and been the focal point of numerous Senate Committee hearings on Health. The movement has urged U.S. policymakers to step in and demand foreign countries pay more for the drugs and technologies founded in America. The primary argument from supporters of foreign countries paying more is that foreign countries do not have to pay for the research and development costs that are associated with the development of drugs and medical technology which gives these countries the ability to put price controls on medicine into place. Thus, Americans have to pay the costs of innovation through

[56] "Medicine Use and Spending in the U.S." *IQVIA*, https://www.iqvia.com/insights/the-iqvia-institute/reports/medicine-use-and-spending-in-the-us-review-of-2017-outlook-to-2022.
[57] "Pfizer: Countries Free-Riding on US Innovation." *BBC News*, BBC, 26 Feb. 2019, https://www.bbc.com/news/business-47377427.
[58] Safire W. The donut's hole. *New York Times* 2003. Oct 27: A21.

higher healthcare prices so the rest of the world can continue to be supplied with the latest and greatest American technology and drugs. [59]

Donald W. Light, a researcher and professor of Comparative Health Care at Rowan University School of Osteopathic Medicine, seems to take an opposing view to the idea that Americans are getting scammed by the rest of the developed world. In his article, *Foreign Free Riders and the High Price of US Medicines*, Light suggests that there is no data supporting the idea that foreign countries do not pay for research and development of new drugs. [60] In fact, in the latest available report from the United Kingdom Pharmaceutical Price Regulation Scheme, data suggests that drug companies in the UK invest considerably more of their revenues in research and development than companies in the U.S.[61] This suggests that lower prices in affluent foreign nations many not necessarily mean less research and development. Yet, Mark McClellan, former commissioner of the FDA has claimed that low prices in foreign nations are slowing the growth of drug development around the world. [62] Light presses McClellan's claim citing data from the European Federation of Pharmaceutical Industries and Associations that showed from 1990 to 2003 members of the European Federation increased R&D spending over two-fold while the U.S. increased spending four-fold.[63] This directly contradicts McClellan's claim that R&D is slowed by lower prices in foreign nations. It does however show that R&D spending grew at a larger rate in the U.S., but researchers from the European Federation

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[59] Aldonas G. *International trade and pharmaceuticals*. Washington, DC: US Senate Finance Committee, Subcommittees on Health and Trade, 2004: 1-17.
[60] Light, Donald W, and Joel Lexchin. "Foreign free riders and the high price of US medicines." *BMJ (Clinical research ed.)* vol. 331,7522 (2005): 958-60. doi:10.1136/bmj.331.7522.958
[61]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/300301/PPRS_Twelfth_Report_to_Parliament_-Final.pdf
[62] McClellan MB. *Speech before first international colloquium on generic medicine*. Washington, DC: US Food and Drug Administration, 2003. www.fda.gov/oc/speeches/2003/genericdrug0925.html (accessed 15 Aug 2005).
[63] European Federation of Pharmaceutical Industries and Associations. *The pharmaceutical industry in figures*. Brussels: EFPIA, 2004.

explained this to be a function of the regulatory framework around medicine in Europe, spending conditions, and societal perspectives on new medical technologies.

In fact, several developed countries spend nearly as much as the U.S. does on R&D. Figure 3 highlights spending on research and development as a percentage of gross domestic product across well-developed countries as of 2020. Pharmaceutical companies in Europe allocate large percentages of revenue towards R&D just as in the United States. This has been ignored by the foreign free-rider campaign and contradicts their claim that somehow major developed countries are deliberately using the U.S. for healthcare innovation. The campaign's ideas of foreign free riders may come from a lack of understanding of the truth behind the economics of drug development. I myself am guilty of believing and trying to prove that foreigners are free riding on U.S. medical innovations. However, I've been proven wrong. Donald Light cites three different ways of why foreign free riding is a myth.[64] The first being that the development of most pharmaceutical drugs as well as healthcare technologies comes from innovations in multiple countries, not just the United States. Second, fixed costs, like R&D, do not determine market prices. [65] Prices are set by the market, therefore the issues like R&D and innovation, while they are relevant to development, are not relevant to prices. The reason that prices are high are because of patents that major drug companies get which gives them monopoly power over the competition and thus the ability to mark prices much higher. Therefore, the blame should be placed on the massive drug companies pushing the foreign free-rider narrative. If costs are to come down, it starts with regulating and investigating major drug and technology companies. And third, the "free-rider problem" is easily misconstrued and can easily get media

[64] Light, Donald W, and Joel Lexchin. "Foreign free riders and the high price of US medicines." *BMJ (Clinical research ed.)* vol. 331,7522 (2005): 958-60. doi:10.1136/bmj.331.7522.958
[65] Gregson, Nigel et al. "Pricing medicines: theory and practice, challenges and opportunities." *Nature reviews. Drug discovery* vol. 4,2 (2005): 121-30. doi:10.1038/nrd1633

attention because people, especially Americans, don't like to feel like they've been beaten or one-upped. Thus, its easily to convince people of the narrative that the problems we face here with high medical prices is because of foreigners stealing our innovation. It's a much easier pill to swallow than the idea that the companies in the U.S. are responsible for one-upping Americans into paying steeper prices for drugs and technology.

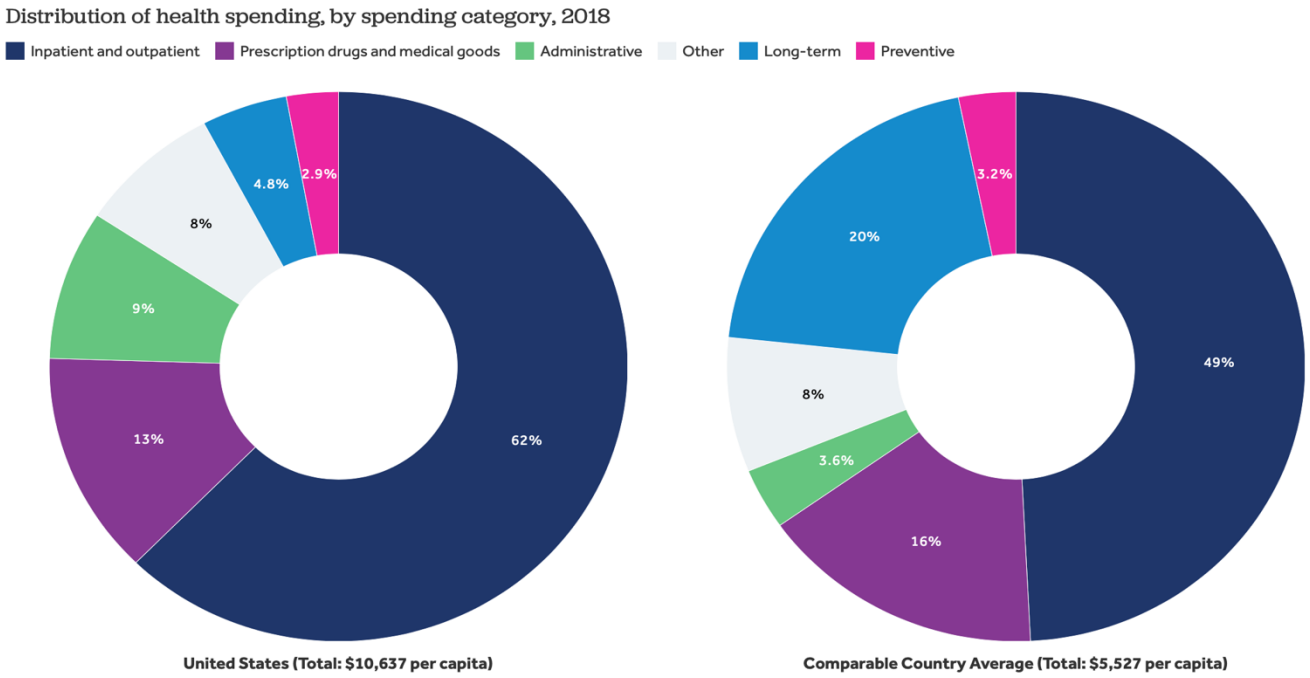
4. Conclusion

The healthcare industry has provided unimaginable amounts of invaluable medicines, technologies, and innovations that have saved tens of millions of lives since the inception of modern medicine. The introduction of technology has skyrocketed innovation and led to rapid growth in development which has led to the curing and improvement of many diseases and illnesses. The immense good that healthcare has brought for humans has been an incredible feat for mankind. But the industry is not without its flaws. While technology has played a large role in the growth of the healthcare industry in the United States, it's also operating at an inefficient level. The U.S. is not producing technology in a cost-effective way which is leading to an oversupply of technology, inefficiencies, and wasted costs. Looking through a lens that identifies technology as being the key determinant of rising healthcare costs, we've seen that an inefficient level of technology leads to massive costs which get passed off onto the consumer in the form of higher drug prices. Moreover, monopoly power from major drug and tech companies has given them the ability to price drugs and medical technologies as they see fit which has caused prices for Americans to become out of control. All of this is happening while a narrative of foreign free riders gets pushed, primarily from drug and tech companies setting prices, to convince Americans the problem resides elsewhere. What I've concluded is that the U.S. healthcare system is incredibly complex and faces lots of uphill battles in the fight against high prices. But

it's not unachievable. The first step would be to utilize a cost-effectiveness approach when implementing new technologies. This would help cut out cost-absorbing technologies and promote cost-cutting ones. The second step would be to get a better grasp on the diffusion of technology and innovation, so it does spiral out of control. And third, drug and tech companies need to be regulated more and medical monopolies need to be broken up so that competition can flourish and drive down real prices of drugs and medical technology. If these objectives can be met, I believe that Americans would see a reduction in the price they pay for healthcare. Moreover, the market for healthcare can begin to push back towards market equilibrium so efficiency can be achieved for all parties involved.

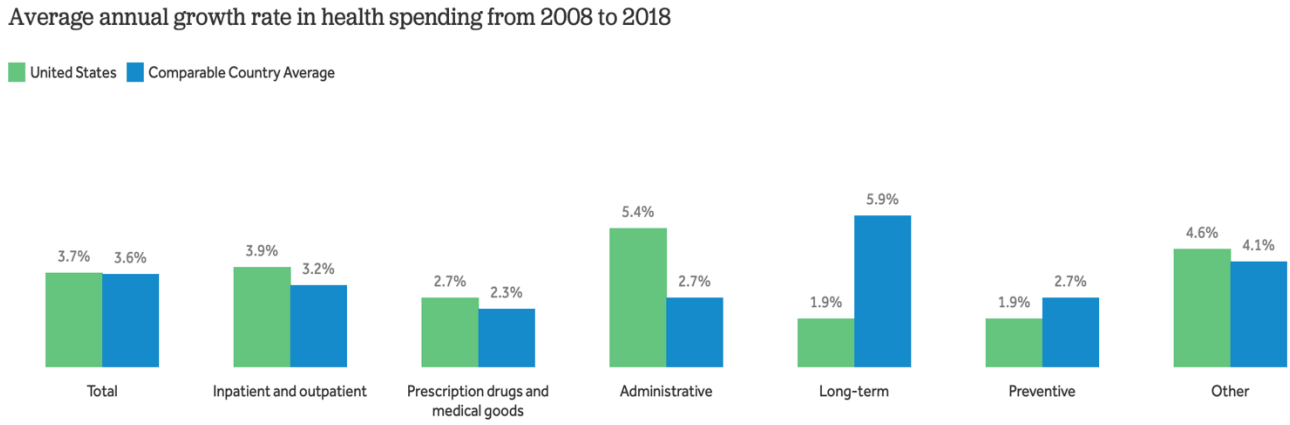
Appendix

Figure 1:



Note: Values are normalized to 100%. Comparable countries include Austria, Belgium, Canada, France, Germany, Netherlands, Sweden, Switzerland, and the United Kingdom.

Figure 2:



Note: Comparable countries include Austria, Belgium, Canada, France, Germany, the Netherlands, and Sweden.

Figure 3:

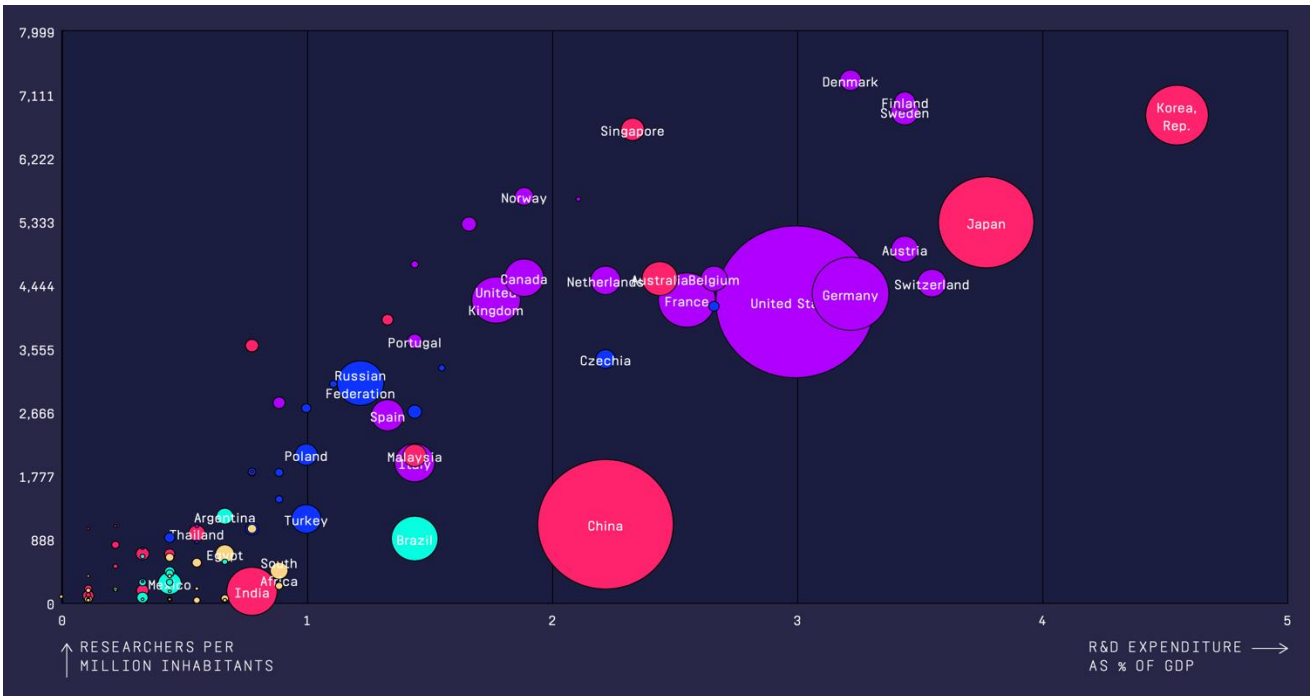
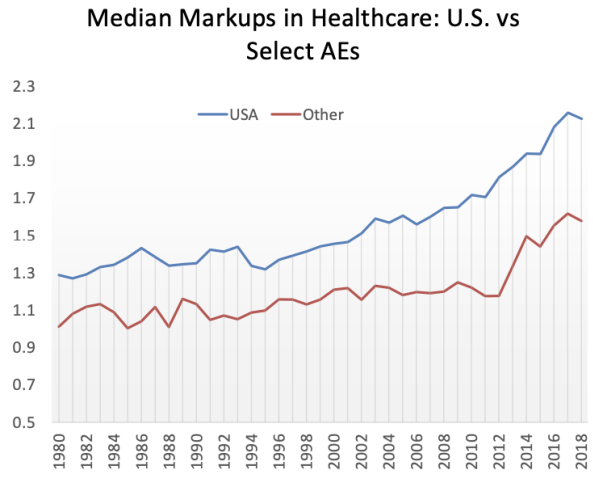
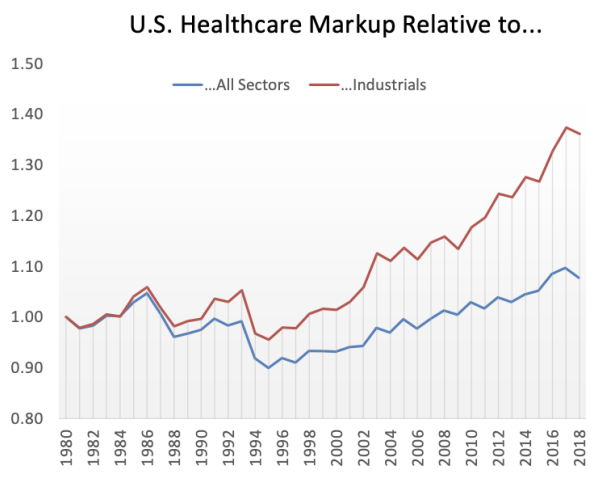


Figure 4:

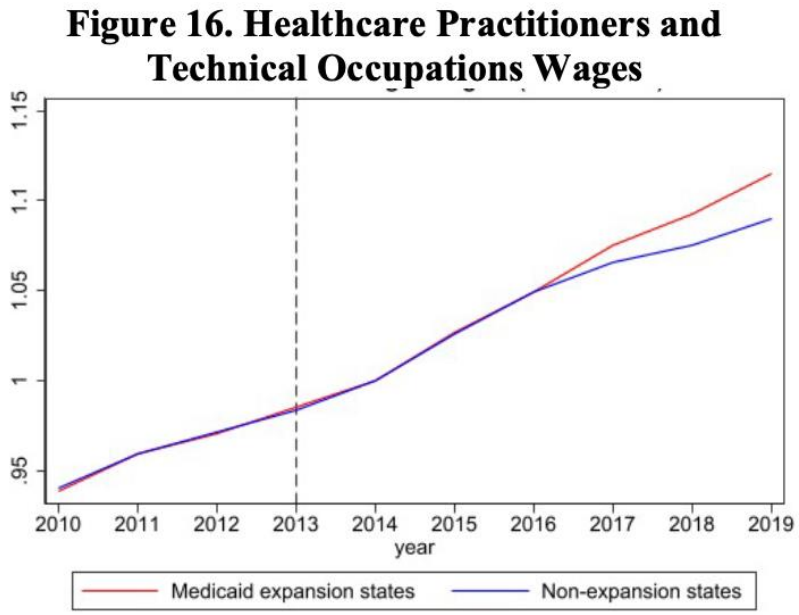
Figure 8. Comparing Markups in the U.S. and Select Advanced Economies





Sources: Thomson Reuters, OECD, IMF staff calculations.

Figure 5:



Source: IMF staff calculations.

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