WP/21/180

IMF Working Paper

U.S. Healthcare: A Story of Rising Market Power, Barriers to Entry, and Supply Constraints

by Li Lin, Mico Mrkaic and Anke Weber

INTERNATIONAL MONETARY FUND

 WP/21/180

IMF Working Paper

Western Hemisphere Department

U.S. Healthcare:
A Story of Rising Market Power, Barriers to Entry, and Supply Constraints

Prepared by Li Lin, Mico Mrkaic and Anke Weber[1]

Authorized for distribution by Nigel Chalk

July 2021

Abstract

Healthcare in the United States is the most expensive in the world, with real per capita spending growth averaging 4 percent since 1980. This paper examines the role of market power of U.S. healthcare providers and pharmaceutical companies. It finds that markups (the ability to charge prices above marginal costs) for publicly listed firms in the U.S. healthcare sector have almost doubled since the early 1980s and that they explain up to a quarter of average annual real per capita healthcare spending growth. The paper also finds evidence that the Affordable Care Act and Medicaid expansion were successful in raising coverage and expanding care, but may have had the undesirable side-effect of leading to labor cost increases: Hourly wages for healthcare practitioners are estimated to have increased by 2 to 3 percent more in Medicaid expansion states over a five-year period, which could be an indication that the supply of medical services is relatively inelastic, even over a long time horizon, to the boost to demand created by the Medicaid expansion. These findings suggest that promoting more competition in healthcare markets and reducing barriers to entry can help contain healthcare costs.

JEL Classification Numbers: I11, I13, I18, D43

Keywords: Healthcare, Market Power, Affordable Care Act.

Author's E-Mail Address: aweber@imf.org, llin@imf.org, mmrkaic@imf.org

[1] We thank Keith Branham, Piergiorgio Carapella, Nigel Chalk, Federico Diez, Kenneth Finegold, Daniel Leigh, Rui Mano, Nguyen, Steven Sheingold, Joel Ruhter, Benjamin Sommers, Suchanan Tambunlertchai, Yannick Timmer, Jeromin Zettelmeyer and IMF seminar participants for helpful comments and discussion. Peter Williams provided excellent research assistance. We are grateful to Federico Diez, Daniel Leigh and Suchanan Tambunlertchai for sharing their codes on computing markups. All remaining errors are our own.

Contents

Abstract ... 2
I. Introduction ... 4
II. Key Institutional Arrangements of the U.S. Healthcare System ... 6
III. A Few Observations on U.S. Healthcare and Comparison To Other Countries ... 9
IV. Market Power ... 13
A. Overall Healthcare Sector Markups ... 14
B. Hospitals ... 16
C. Healthcare Practitioners ... 16
D. Insurers ... 17
E. Correlations ... 19
V. Market Power and Healthcare Cost Determinants ... 19
A. Data and Methodology ... 20
B. Results ... 22
VI. The Impact of the Patient Protection and Affordable Care Act on Healthcare Sector Wages ... 24
A. Empirical Strategy ... 26
B. Data ... 29
C. Results ... 29
VII. Conclusion ... 33
References ... 47

I. INTRODUCTION

1. **Healthcare in the U.S. is the most expensive in the world, both in absolute dollar terms and as a share of GDP.** In 2019, the United States spent about $3.8 trillion on healthcare or about $11,000 per person. Furthermore, the share of healthcare costs in GDP has increased from 5 percent in 1960 to about 18 percent in 2019.[2]

2. **Effective provision of healthcare has become a macro-critical issue for three reasons.** First, as argued by Case and Deaton (2020), the U.S. healthcare system has long underperformed in ensuring the effective delivery of services, particularly to the poor and vulnerable, producing results (for example, measured by lifespan, infant mortality, burden of chronic diseases and other health indicators) that are significantly below countries that spend less per capita. This underperformance increases inequality and consequently weighs on economic growth.[3] Second, the large and increasing cost of healthcare has important fiscal consequences. Curbing the excessive growth of healthcare cost is a necessary condition to rein in the unsustainable growth of U.S. fiscal entitlement spending. Finally, given the predominance of employer funded health insurance in the U.S., increasing healthcare costs could crowd out wage growth and shift more and more compensation to non-cash benefits.

3. **The literature has proposed several reasons for the high cost of U.S. healthcare, which include both market failures and bad policies.** The typical candidates are:

- Luxury good hypothesis: consumption of healthcare will increase more than proportionally as income rises.
- Supplier driven demand: doctors suggest or prescribe tests and procedures with unproven medical benefits; consumers/patients comply with the suggestions due to asymmetric information, combined with lack of a user pay incentive for those with coverage and low pricing transparency.
- Baumol's cost disease: due to the equalization of wages across industries and sectors, the sectors with slower productivity growth see their unit costs increase. Healthcare is typically considered a non-progressive (less productive) sector.
- Market power of the main players, that is providers and insurers. For example, U.S. medical doctors limit the entry into the profession, thereby increasing the cost of labor. In addition, mergers of hospitals have increased their market power and prices (and also reduced the quality of care).

---

[2] Source: Center for Medicare and Medicaid Services (CMS), National Health Expenditure Accounts.

[3] A large and growing literature documents the central role of health status in shaping economic outcomes both within and between generations (Haas, Glymour, and Berkman, 2011; Kane, 2015; O'Brien and Robertson, 2018).

4. This paper focuses on market power and competition in the healthcare sector, taking a three-pronged approach:

- *Estimating market power*. We explain how we measure market power in the form of markups (the ability to charge prices above marginal costs) and provide estimates for the overall healthcare sector (including providers, pharmaceuticals, and healthcare equipment). We also use micro-data on U.S. hospitals and calculate markups across states. Hospitals are of particular interest since about one-third of healthcare spending is associated with hospitals.[4] In addition, we explore whether healthcare practitioners enjoy wage premia over employees in other sectors with similar profiles and qualifications and shed some light on marginal loss ratios (the ratio of claims over premia, the inverse markup) of insurers. We also assess whether higher hospital markups are associated with lower wage premia and markups of insurers.

- *The impact of market power on healthcare spending*. We analyze the connection between market power and other determinants of healthcare spending, notably income and Baumol's cost disease and their impact on costs. We do so in a cross-country setting and also exploit the variation in costs across U.S. states.

- *Event study on the impact of the Affordable Care Act (ACA) on healthcare sector wages*. We study if the ACA contributed to the faster pace of healthcare wage increases in recent years by using an event study that exploits the heterogeneity in states' choices and timing in expanding Medicaid.

5. We find evidence that market power in the U.S. healthcare sector has increased significantly since the 1980s and has contributed to rising healthcare costs. Markups for publicly listed firms in the U.S. healthcare sector have almost doubled since the early 1980s. Hospital markups have also increased significantly (by more than 6 percent on average) since the late 1990s across U.S. states. Incorporating markups into OECD cross-country regressions shows that, on average, they have contributed to up to a quarter of annual per capita U.S. healthcare cost growth. Similarly, results from U.S. state level regressions show that hospital markups are a significant driver of healthcare spending, explaining about 15 percent of variation across states. Rising hospital markups are not, however, associated with lower labor costs or insurance markups (suggesting that providers use their market power to raise prices to consumers rather than taking advantage of their monopsony power to lower costs of providers further down the supply chain). In fact, physicians' salaries have increasingly risen above the salaries of non-physicians with similar years of education and experience.

6. Following the ACA, wages for healthcare practitioners have increased by more in Medicaid expansion states, compared with non-expansion states. The Affordable Care Act and Medicaid expansion were successful in raising coverage and expanding care, including for low-income individuals. But they may have had the undesirable side-effect of

---

[4]Also, publicly traded companies represent only a minority of inpatient and physician care in the U.S., and hence it is important to go more granular, with quality data available for a large number of hospitals.

leading to labor cost increases. Hourly wages for healthcare practitioners and technical occupations are estimated to have increased by 2 to 3 percent more in expansion states over a five-year period. We test the results using both state-level wages for healthcare practitioners and technical occupations from the Occupational Employment and Wage Statistics and the metropolitan-level wage index used by Medicare to adjust for labor costs for hospital in different areas. The result is confirmed by an analysis using individual-level data from the Current Population Survey (CPS). We find no significant evidence that wages for other professions increased more in expansion than non-expansion states.

7. **The contribution of this paper is thus threefold.** First, it presents evidence on the evolution of market power for the healthcare sector overall (and vis-à-vis other OECD countries) and on a more granular basis for the U.S., including by looking at microdata for hospitals. Second, it investigates how this evolution relates to healthcare costs in advanced countries and across U.S. states. Third, it sheds light on a related but less discussed issue, namely that the supply of medical services may be relatively inelastic, even over a longer period, to the boost to demand created by the Medicaid expansion. This could be due to barriers to entry (and even barriers to mobility of existing providers across states), a preference by oligopolistic providers to respond to higher demand with higher prices (and less with an increase in supply) and/or a feature of medical services in general given the high set up costs and time it takes to build capacity.

8. **The remainder of the paper is structured as follows**. Section II describes some key institutional features of the U.S. healthcare system. Section III benchmarks U.S. healthcare costs and compares prices and outcomes to other countries. Section IV analyzes the evolution of market power in the U.S. healthcare sector, by computing markups for the overall sector, and then goes more granular by looking into hospitals, insurers and medical providers. Section V examines the connection between market power and other determinants of healthcare costs including Baumol's cost disease and quantifies their effect. Section VI studies the impact of the ACA on healthcare sector wages. Section VII concludes.

II. Key Institutional Arrangements of the U.S. Healthcare System

9. **The provision of healthcare in the U.S. is considerably more complex than in other advanced economies.** In the U.S., healthcare services are provided by government owned, non-profit institutions and for-profit institutions, with for-profit hospitals accounting for about one fifth of the total number of hospitals.[5] Most advanced economies other than the U.S. have universal public healthcare coverage, which covers (at least) primary healthcare services.[6]

[5] Source: https://www.aha.org/statistics/fast-facts-us-hospitals

[6] Source: https://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/oecd-health-data-social-protection_data-00544-en

10. Payment in the U.S. is mostly indirect and a mixture of public and private programs, with private insurance mostly purchased by employers.[7] More than half of the population is covered by private insurance, and another 40 percent by the two main public insurance programs, Medicare and Medicaid that date back to 1965 and were enacted through the Social Security Act (Box 1). Medicare ensures access to healthcare for persons age 65 and older. All beneficiaries are entitled to traditional Medicare, a fee-for-service program that provides hospital insurance (Part A) and medical insurance (Part B). Since 1973, beneficiaries have had the option of receiving their coverage through either traditional Medicare or Medicare Advantage (Part C), under which people enroll in a private health maintenance organization (HMO) or managed care organization. In 2003, Part D, a voluntary outpatient prescription drug coverage option provided through private carriers, was added to Medicare coverage. The Medicaid program provides health coverage to eligible low-income adults, children, pregnant women, elderly and people with disabilities. As it is a state-administered, means-tested program, eligibility criteria vary by state.[8]

11. The 2010 Affordable Care Act (ACA), popularly known as Obamacare, represented a major overhaul of the system. The act largely retained the existing structure of Medicare, Medicaid and the employer-sponsored market. Effective in 2014, it prohibited most insurance plans from excluding people for preexisting conditions, discriminating based on health status, and imposing annual monetary caps on coverage; and included reforms to require guaranteed issue and renewal of policies, premium rating rules, nondiscrimination in benefits, and mental health and substance abuse parity. The ACA also contained two major components that increased healthcare coverage. The Act expanded the eligibility for the Medicaid program, starting in 2014 with the help of federal subsidies. In states that chose this option, the eligibility threshold for Medicaid increased from 100 percent of the federal poverty line to 138 percent. The ACA also introduced the individual mandate and penalty for not having insurance coverage (although legislation enacted in December 2017 effectively repealed that requirement, starting in 2019) and created the Marketplace, effective in 2014, that offers insurance plans to individuals, families, and small businesses at a subsidized premium. As a result, the share of uninsured approximately halved, from 16 percent before the passage of the Act to about 9 ½ percent in 2019.[9]

---

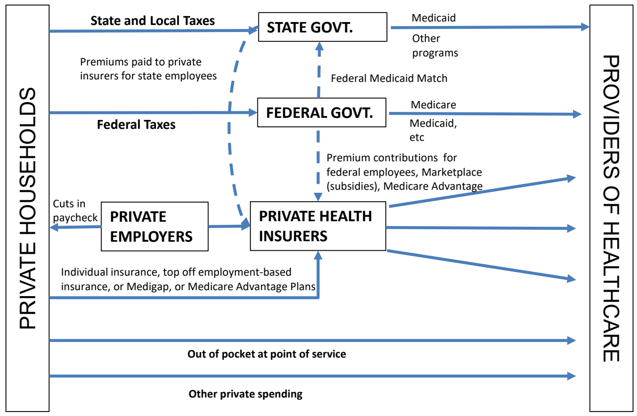
[7] The origin of this arrangement goes back to WWII when employers started offering health insurance to compete for scarce workers.

[8] Source: https://www.commonwealthfund.org/international-health-policy-center/countries/united-states

[9] Source: Center for Medicare and Medicaid Services (CMS), National Health Expenditure Accounts.

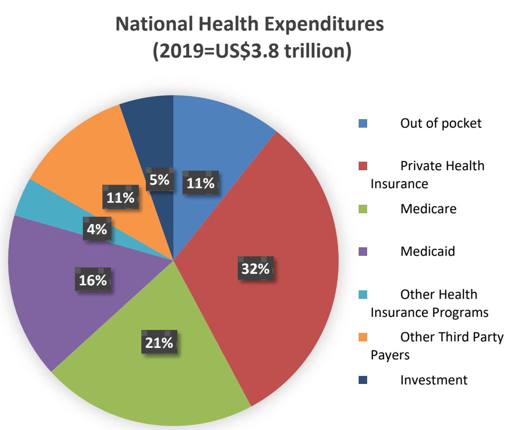
Box 1. The Flow of Funds in U.S. Healthcare

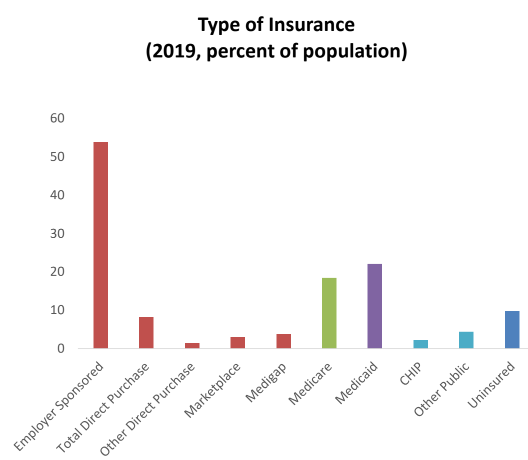
Most of healthcare financing deals with the flow of funds from U.S. households into health insurance funds (both governmental and private), which in turn disburse those funds to various providers.



Sources: Reinhardt, 2011 and IMF staff.

About 40 percent of funds come from public sources (Medicare/Medicaid), while another third come from private health insurance. Out of pocket expenses account for about 10 percent of total expenditures. More than half of the population is covered by employer-sponsored health insurance, about forty percent by Medicare and Medicaid. A relatively small proportion (3 percent) is part of the Marketplace. About 10 percent remains uninsured.





Sources: CMS.

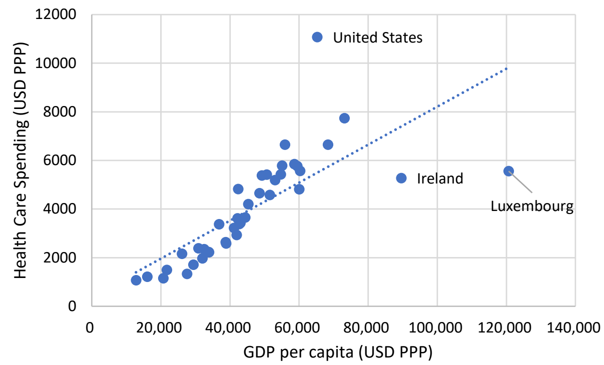
Notes: Right chart does not add up to 100 percent, as various insurance types can overlap. Other Third Party Payers include worksite health care, other private revenues, Indian Health Service, workers' compensation, general assistance, maternal and child health, vocational rehabilitation, other federal programs, Substance Abuse and Mental Health Services Administration, other state and local programs, and school health.

III. A Few Observations on U.S. Healthcare and Comparison To Other Countries

Income and healthcare spending are correlated but the U.S. is a total outlier.

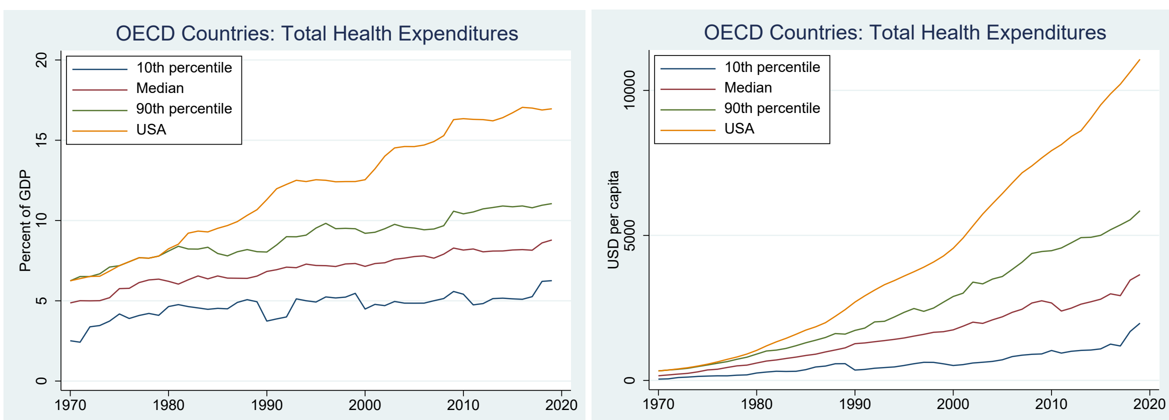
12. The share of healthcare in GDP grew in all OECD countries, but the growth in the U.S. was much faster. While in 1970 the share of healthcare expenditures in the U.S. was high at around the 90th percentile of OECD countries, its fast growth pushed the U.S. above all other OECD countries by 2019 (Figure 2).[10] The same is true in per capita terms, with U.S. per capita health expenditures (based on purchasing power parity) rising to about four times the median of the OECD by 2019. Taking into account that the per capita income in the U.S. is higher than in most OECD countries fails to explain the phenomenon (Figure 1).

Figure 1. Health Care Spending Per Capita, 2019



Sources: OECD, IMF Staff Calculations.

Figure 2. Healthcare Spending in OECD Countries



Sources: OECD and IMF staff calculations. Per capita health care spending is measured as USD PPP.

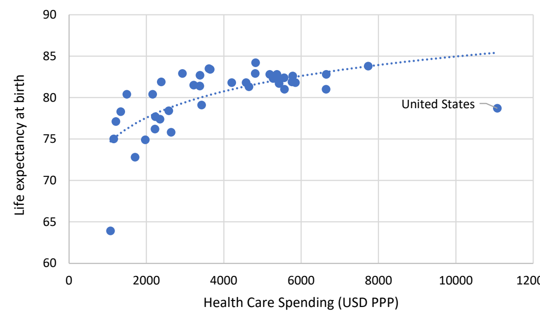
Key health-related indicators do not reflect the high expense.

13. The high healthcare expenditures in the U.S. do not lead to better outcomes. Life expectancy, arguably the most important indicator of health, is significantly lower in the U.S. than in comparator countries and has declined after 2012. Several potential explanations are

[10] The aging of baby boomers likely has contributed to increasing spending, e.g., Alemayehu and Warner (2004) estimated that per capita health care costs from 2000 to 2030 would increase 20 percent due to aging, or 0.6 percent/year.

on hand for this phenomenon, including inefficient utilization of healthcare resources and a high prevalence of chronic diseases and obesity of the U.S. population (both are about twice as high as in other advanced countries). The opioid crisis and gun violence may also play a role. However, for some determinants of health such as smoking, the U.S. ranks among the lowest in advanced countries (Papanicolas and others, 2018).

Figure 3. Life Expectancy and Health Care



Sources: OECD, IMF Staff Calculations.

The largest percentage of spending goes to in-patient and outpatient care.

14. U.S. spending on inpatient and outpatient care per capita is about twice that of comparable countries[11] and accounts for about 60 percent of total spending. Inpatient care is provided in a hospital or other type of inpatient facility, where the patient spends at least one night. Outpatient care refers to almost any other kind of care (and can be provided by hospitals, walk-in clinics, outpatient surgery centers or doctors' offices). Out of the $3.8 trillion spent on healthcare in 2019, about $1.2 trillion was spent on hospitals and $1 trillion on professional services (physicians/dental).[12] Another category where the U.S. stands out is on administrative spending, which is more than four times higher per capita than in other comparable countries. Part of this difference is likely driven by the complexity of the U.S. healthcare system, as described in Section II. In most advanced economies, governments are heavily involved in healthcare and provide insurance to their citizens, which reduces the direct costs of insurance and other administrative costs. But administrative costs fail to account for the bulk of the cost differences between the U.S. and other advanced economies.

Table 1. Healthcare Spending Per Capita, by Category (2018)

	USA	**Comparable Countries**
Inpatient and outpatient	$6,624	$2,718
Prescription drugs and medical goods	$1,397	$884
Administrative	$937	$201
Long-term	$516	$1,111
Preventive	$309	$175
Other	$854	$439
Total	**$10,637**	**$5,528**

Source: https://www.healthsystemtracker.org/archive/?_sft_category=spending. Data consist of current expenditures on health expressed as per capita, current prices, current purchasing power parity (PPP), in U.S. dollars.

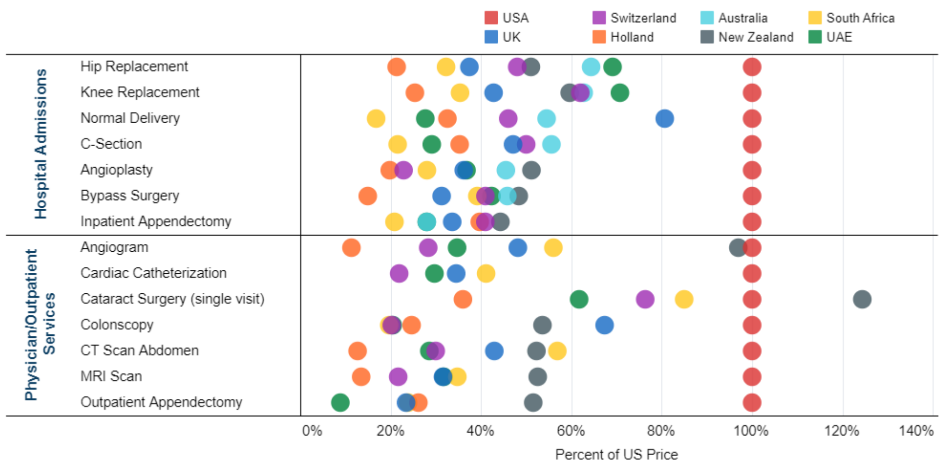
[11] Comparable countries include Austria, Belgium, Canada, France, Germany, Netherlands, Sweden, Switzerland, and the United Kingdom.

[12] Some have argued that doctors' liability (malpractice) insurance is one of the main causes of high healthcare cost. However, the data do not support this explanation. The average annual payouts from malpractice insurance are about $5 billion per year, which is a small fraction of total healthcare cost. Furthermore, data show that the utilization of healthcare resources in the U.S. is not higher than in comparable countries (which does not support the argument that fear of litigation creates strong incentives to undertake unnecessary procedures).

"It's the prices."

15. Price differences are broad based and not limited to a few procedures. Looking at the largest category of spending, Figure 4 shows that with a solitary exception, prices of both inpatient and outpatient procedures are significantly higher in the U.S. than in other countries. A comparison of prices of other categories of spending leads to similar conclusions.[13]

Figure 4. Prices of Hospital and Outpatient Procedures (2017)



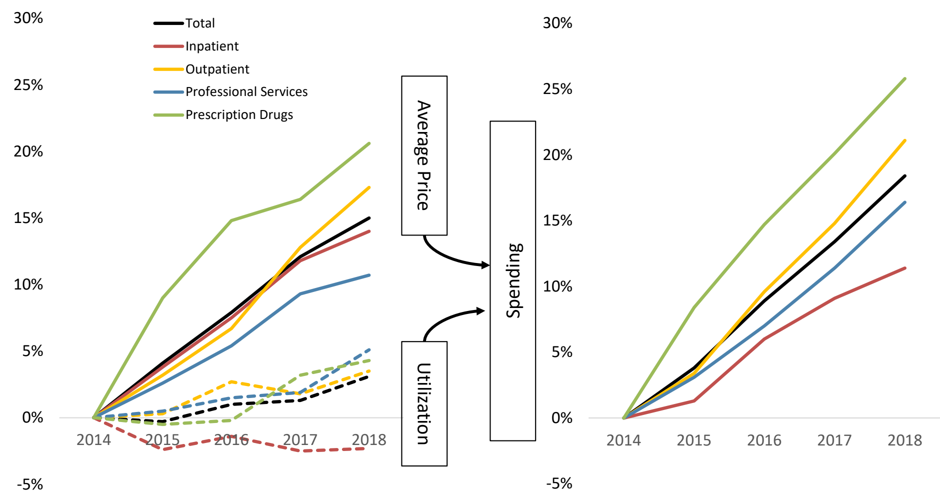
Source: Healthcare Cost Institute.
Notes: Figure shows median prices in USD paid by a sample of private health insurance companies for specific health care services in nine countries. Comparisons across different countries are complicated by differences in sectors, fee schedules, and prices may not be representative of prices paid by other plans in that market. The HCCI attempted to minimize these limitations by selecting services with very specific definitions and wording survey questions to match the procedures that are the basis of the US payment system.

16. Increased utilization contributes less to total costs than price growth. It is instructive to decompose changes in total U.S. healthcare expenditures into price growth and changes in quantities (i.e. utilization).[14] Figure 5 shows the decomposition for the period 2014–18. During this period, price growth contributed approximately three times as much as changes in utilization to the growth in total expenditures.

[13] See also https://www.brookings.edu/research/a-dozen-facts-about-the-economics-of-the-u-s-health-care-system/

[14] Metrics like average length of stay in hospital are below the OECD average, suggesting that the U.S. is not an outlier in utilization. https://data.oecd.org/healthcare/length-of-hospital-stay.htm

Figure 5. Cumulative Change in Spending per Person, Utilization, and Average Price by Service Category



Sources: Healthcare Cost Institute, Annual Report.
Notes: Utilization and average prices (adjusted for inflation) on left chart account for changes in the type or intensity of services used, except for prescription drugs. Prescription drug spending is the amount paid on the pharmacy claim, which reflects discounts from the wholesale price, but not manufacturers' rebates.

Density of healthcare providers is well below comparable countries.

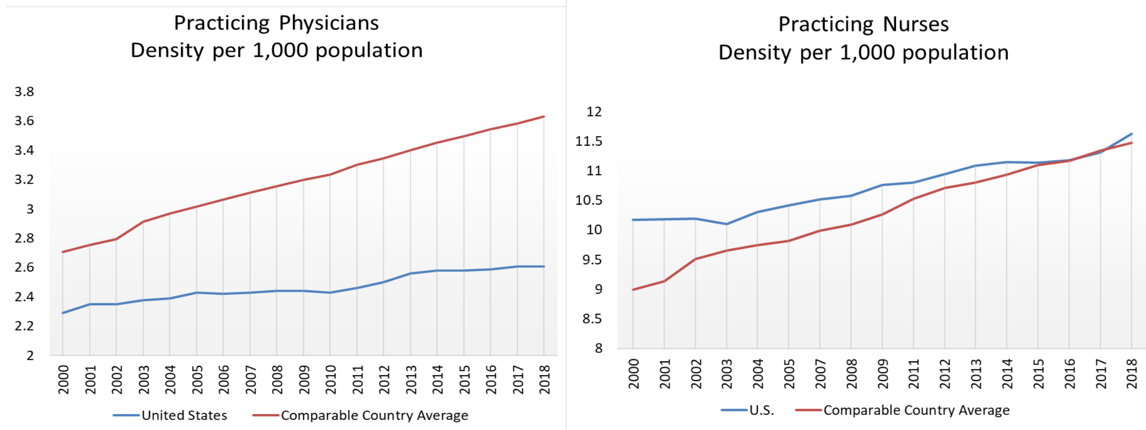
17. The density of physicians in the U.S. is below other advanced economies and this is not compensated by a larger number of nurses. In 2018, the U.S. had 2.5 physicians per 1000, well below other countries and the difference to other countries has been increasing over time.[15] While in the U.S. nurses perform some services that in other countries only physicians are allowed to perform, there is no evidence that the U.S. has a higher density of practicing nurses than other countries today. This was different some years ago, but growth in the U.S. has not kept pace with other countries.[16]

---

[15] Nunn and others (2020) find that the flat rate of per-capita medical residency positions since 1960—contrasted with rising expenditures and healthcare needs for an aging and richer population—suggests that limited supply of physicians has been a problem.

[16] Zhang and others (2020) predict a shortage of 139,160 physician jobs by 2030. Domestic barriers to entry include the limited numbers of residency positions, which are capped by Medicare. Efforts are underway to increase positions through the Resident Physician Shortage Reduction Act of 2021, which would gradually raise the number of Medicare supported graduate medical education positions by 2,000 per year for seven years, for a total of 14,000 new slots. Barriers to entry for immigrating healthcare sector professionals are also high, with strict licensing requirements. In addition to passing a medical exam, immigrating physicians are required to undertake a medical residency program, with some studies showing that the number of years of U.S. medical residencies required for foreign-trained doctors to get licensed in the United States—regardless of how many years of experience they have in other countries—is often higher than it is for a graduate from a U.S. medical school (Center for American Progress, 2020).

Figure 6. Density of Physicians and Nurses

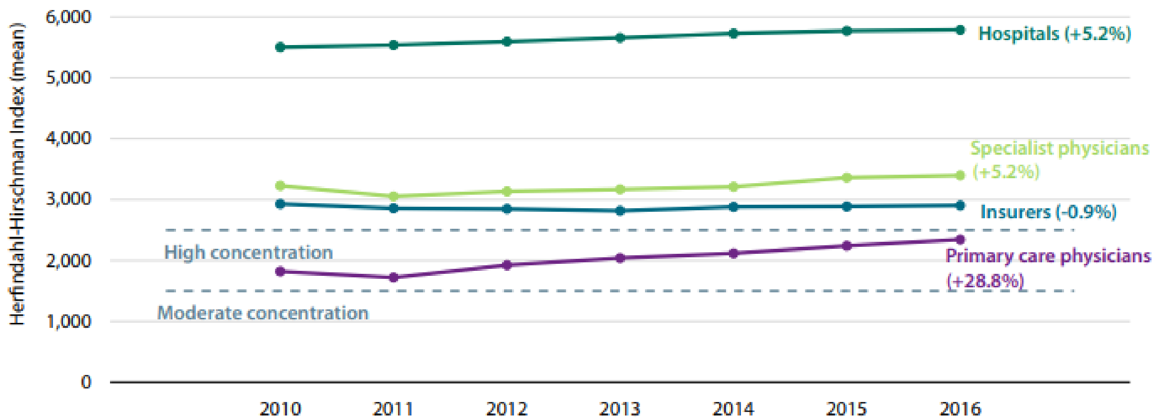


Sources: OECD and IMF staff calculations.
Notes: Practicing nurses refers to the total number of nurses certified/registered and actively practicing in public and private hospitals, clinics, and other health facilities, including self-employed. Nursing assistants and midwives should be included.

IV. Market Power

18. Market concentration in the U.S. healthcare sector is high. One indicator is the Herfindahl-Hirschman Index (HHI), shown in Figure 7, which takes the market shares of the respective market competitors (in percent), squares and adds them together, with specific cutoff values indicating levels of concentration. Under the Department of Justice/Federal Trade Commission Merger Guidelines, an HHI of 1,500 indicates a moderately concerning concentration level, and a HHI of 2,500 indicates high concentration. As shown in the figure, insurers, specialist physicians, and hospitals markets are all highly concentrated, with hospital market concentration especially high (with a HHI of 5,790 in 2016). Primary care physicians are between the moderate and high concentration levels, but they have experienced a rapid increase in the HHI. One explanation for this is that many private practices have been acquired by larger groups.

Figure 7. Market Concentration in U.S. Healthcare



Source: Fulton, 2017.
Notes: The geographic market for hospitals, specialist physician organizations, and insurers in this study was the Metropolitan Statistical Areas (MSAs). The figure shows the mean MSA Herfindahl-Hirschman Index (HHI) using data from the American Hospital Association (AHA) Annual Survey database; the SK&A Office Based Physicians Database provided by IMS Health (now Quintiles); and for insurers, the Managed Market Surveyor File from Health Leaders InterStudy (now Decision Resources Group).

19. Many studies have linked the high market concentration to prices and outcomes. Although higher concentration could result in greater economies of scale and produce efficiencies, the evidence does not point in that direction (Gaynor, 2020). Concentrated markets are associated with higher hospital prices, with price increases often exceeding 20 percent when mergers occur in such markets (e.g., Dafny and others 2019, Thompson 2011, Gowrisankaran and others, 2015). Cooper and others (2019) examine the 366 mergers and acquisitions that occurred between 2007 and 2011, and find that prices increased by over 6 percent when the merging hospitals were geographically close (e.g., 5 miles or less apart), but not when the hospitals were geographically distant (e.g., over 25 miles apart). These price increases did not appear to improve quality (Dafny and others, 2020). A relatively small number of studies has examined the impact of physician organization concentration. Overall, these studies found that higher concentration was associated with higher physician prices across a range of services (e.g., Baker and others, 2014).

20. This section will explore alternative measures of market power, with a focus on firm-level markups—the ratio of prices to (marginal) production costs. Thereby we provide a more granular measure of market power than concentration. We also compute measures of market power of healthcare practitioners (wage premia) and insurers (marginal loss ratios) to examine if increased market power by hospitals is associated with lower labor costs and insurers profits.

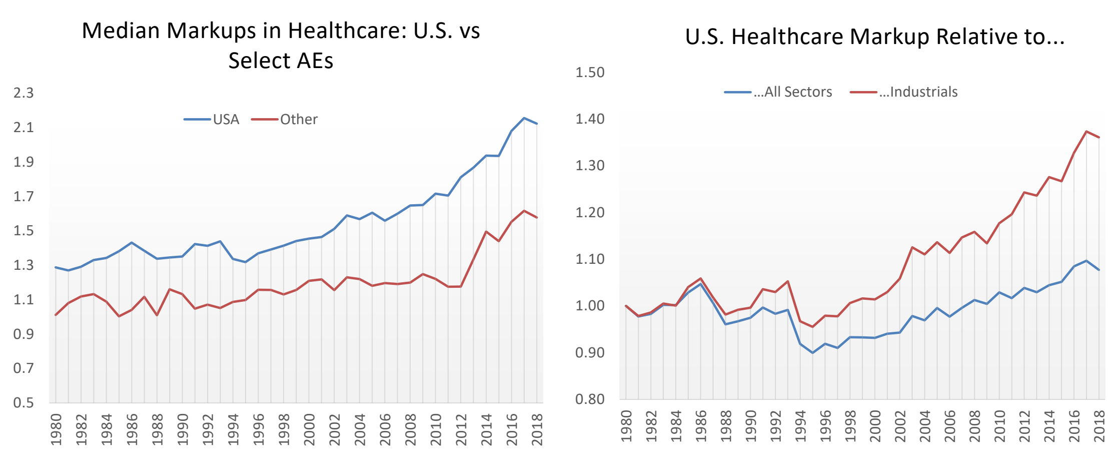
A. Overall Healthcare Sector Markups

21. Estimation of markups from income statements and balance sheets is based on the methodology of Diez and others (2018). Diez and others (2018) extend the U.S. based work of De Loecker and Eeckhout (2017) to a multi-country setup. The idea is to estimate a production function to recover the input elasticity, and combine it with data on input and output to obtain the markup estimates.[17] The approach uses the first order conditions of firm's profit maximization to derive an expression for the markup based on the elasticity of output to the capital stock and the ratio of sales to expenditures. Elasticities are then estimated using GMM.

22. The analysis uses Worldscope data, obtained through Datastream provided by Thomson Reuters. It contains information on financial fundamentals and ratios from over 81,000 publicly listed companies, accounting for over 99 percent of world market capitalization in 74 economies. Firms in the healthcare sector encompass healthcare equipment, healthcare providers and services, pharmaceuticals, and medical research. For advanced economies, the data date back to the 1980s. After selecting countries with enough observations and some data cleaning, markups were computed for 9 advanced countries (Australia, Canada, Germany, France, UK, Japan, Korea, Sweden, United States).

23. U.S. healthcare firms have been able to run persistently higher markups than firms in other countries. In line with rising market concentration, U.S. healthcare median markups have increased by more than 70 percent since 1980. In contrast, the median markup of other advanced economies has risen by about 40 percent (Figure 8). Zooming in on the U.S., healthcare sector markups have been increasing rapidly compared to industrials, with less of an increase compared to all other industries, meaning that rising market power is not unique to the healthcare sector.[18]

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



Sources: Thomson Reuters, OECD, IMF staff calculations.

[17] As explained in Diez and others (2018), we use a Cobb-Douglas production function and control function approach.

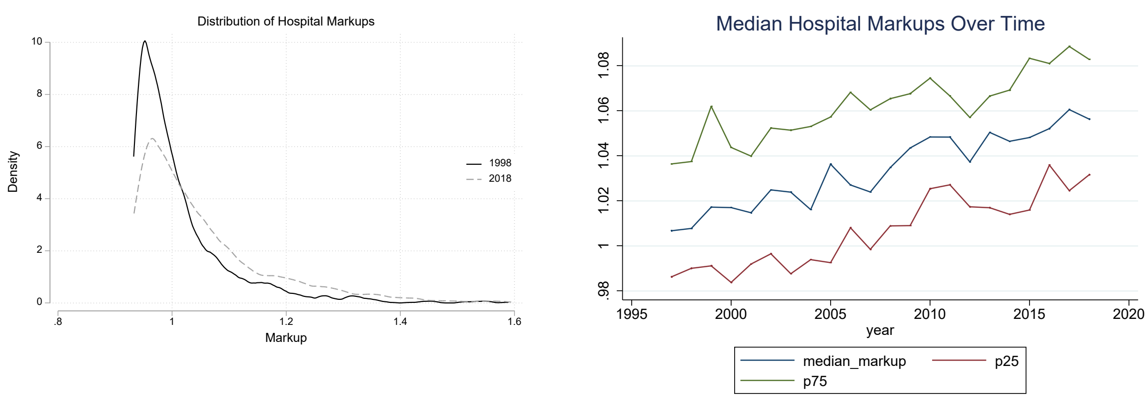
[18] As shown by Diez and others (2018) and Akcigit and others (2021), the technology sector also experienced rapid increases in markups.

B. Hospitals

24. Using data from the Centers for Medicare & Medicaid Services (CMS), we estimate markups for U.S. hospitals. Medicare-certified institutional providers are required to submit annual cost reports to a Medicare Administrative Contractor (MAC). CMS maintains the cost report data in the Healthcare Provider Cost Reporting Information System (HCRIS). To compute markups using the methodology of Diez and others (2018), we extract data from income and balance sheets on total operating expenses, total patient revenues and total fixed assets. After some data cleaning, we are left with more than 5000 hospitals between 1997 and 2018.

25. Markups for hospitals have been rising and there is significant variation across U.S. states. Figure 9 reports the distribution of markups in 1998 and 2018 for hospitals. The distribution of markups has broadened and become more skewed over time. Computing median markups over time across states, we find that hospitals' median markups have been increasing by about 6 percent since 1997. While the overall increase is moderate, the increase in dispersion is consistent with markup increases being driven by the largest hospital groups.

Figure 9. Markups in U.S. Hospitals

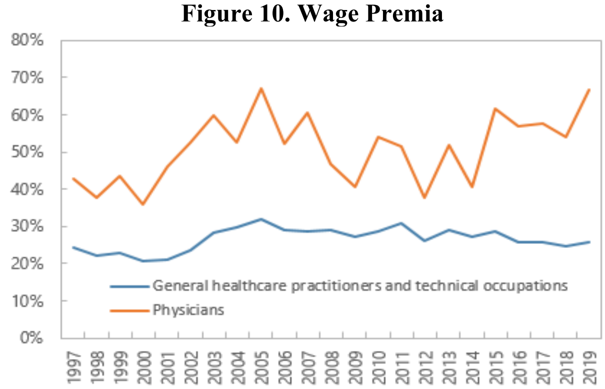


Sources: CMS, IMF Staff Calculations.

C. Healthcare Practitioners

26. Using data from the Current Population Survey, we estimate the wage premia of healthcare sector professionals. Following Glied and others (2015), we compare the wages of healthcare practitioners and technical occupations with wages of workers in other occupations that have the same years of education and work experience and the same individual characteristics (measured by race, sex, marital status, full-time work status and metropolitan

Figure 10. Wage Premia



Source: Current Population Survey and IMF staff calculations.

location).[19] For physicians, the time spent in residency is counted as work experience, not years of schooling. We run regressions of individual wages from all occupations on the above variables and an occupation dummy (equals one for individual in healthcare occupations and zero otherwise). We interpret the coefficient on the dummy variable as the wage premia for healthcare sector professionals. The data are from 1997 to 2019.

27. Wage premia of healthcare sector professionals are close to 30 percent on average.[20] Wage premia for physicians and surgeons are even higher and estimated at about 50 percent on average over our estimation horizon. Wage premia for both general healthcare sector and physicians have been largely stable in the past two decades, with the latter on a small upward trend in the last decade. Wage premia of physicians and surgeons appear to be more cyclical than wage premia for general healthcare professionals, even though the dependent variables are real wages (instead of nominal wages) and the regressions have incorporated the cyclical stance of the economy. This suggests that some healthcare services could resemble a "luxury good" more than a "necessity good", the latter would imply that wage premia should tend to be "counter-cyclical".

D. Insurers

28. We follow Cicala and others (2019) and define markups for the insurance sector as the inverse of the medical loss ratio (MLR). The MLR is the ratio of a firm's expenditures on medical claims to its premium revenues. An insurer with more market power will be able to achieve lower MLRs. As part of the ACA, the U.S. Federal Government instituted minimum requirements on insurers' MLRs. On a state-by-state and segment-by-segment basis, the regulation requires insurers to maintain an MLR of at least 80 percent in the individual and small group market segments and 80 percent in the large group market segment. If an insurer falls below the threshold, it has to send rebates to its policyholders.[21] CMS administers the rule and its Center for Consumer Information and Insurance Oversight (CCIIO) set new data reporting requirements for health insurers, collecting these in a new regulatory database since 2011, containing detailed financial information. We use the database to extract MLRs for 2486 insurance companies (following some data cleaning).

---

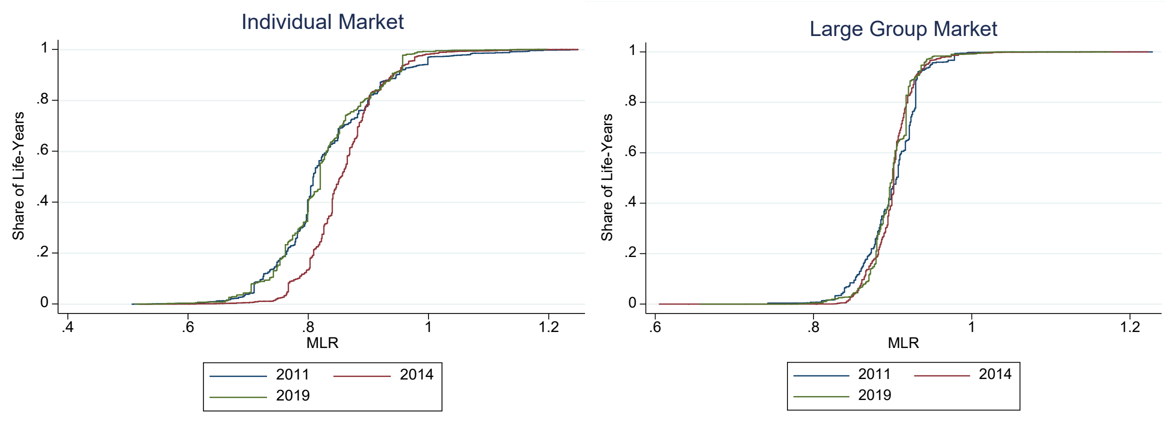
[19] Healthcare practitioners and technical occupations cover a wide range of occupations including general practitioners, nurses, specialists, therapists, and healthcare technicians. For a complete list of occupations under this category, see the definition of "29-0000 Healthcare Practitioners and Technical Occupations (Major Group)" in the Occupational Employment and Wage Statistics.

[20] The regression does not capture the quality of education. Therefore, the wage premia could be compensating for the quality of education, to the extent that medical education is of higher quality. In addition, the definition of "wages and salaries" in CPS explicitly includes cash bonuses, but not stock incentives. Therefore, the wage premia could also be compensating for the lack of stock incentives for physicians.

[21] These are calculated so that when the insurer has paid out the rebates and the rebates are counted as claims, the MLR is equal to the regulated threshold (Cicala and others, 2019). Due to this regulation, there is an incentive to cluster around thresholds, representing a potential caveat to our analysis. But, as our results will show, there is still significant variation among insurers though.

29. MLRs vary significantly among insurers in the individual market with much less variation for group insurance. Figure 11 shows the cumulative density functions (CDF) of MLRs in the individual and group markets for years 2011, 2014, and 2019.[22] After an initial increase in MLRs between 2011 and 2014, the distribution subsequently shifted to the left again, with more movement among firms close to the 0.80 federal threshold. There is very little variation in MLRs across groups insurers.

Figure 11. Distribution of MLRs

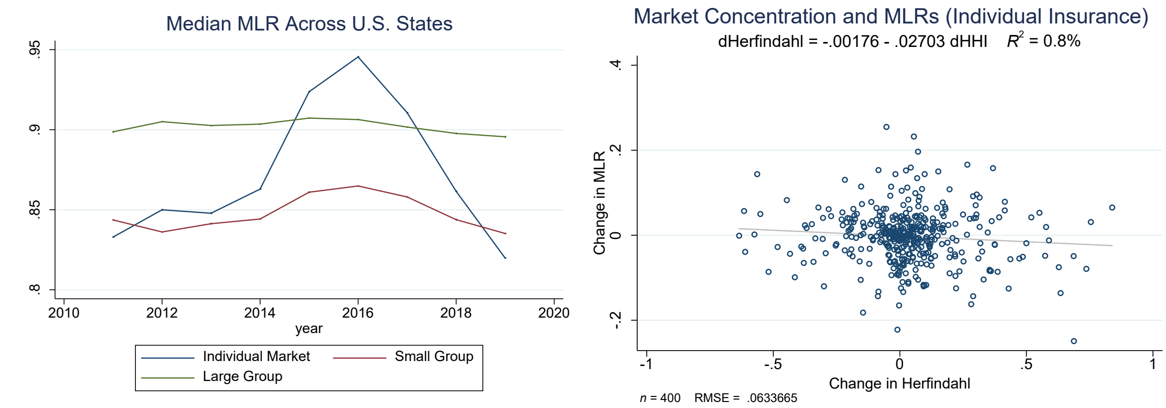


Sources: CMS, IMF Staff Calculations.

30. In line with the broadly flat Herfindahl indices shown in Figure 7, markups (inverse MLRs) have not increased significantly since 2011, but between state differences are correlated with market concentration. We calculate an average MLR for U.S. states using enrollment weighted averages of per-life year values between 2011-2019. The median MLR across states first increased substantially in 2014 among the individual market and subsequently decreased. There is less movement for the large group insurers. This could reflect ACA changes that took effect in 2014, which expanded access to health insurance, and which could have led to increased demand for healthcare with premia not catching up with claims initially. There is significant cross-state variation and MLRs are negatively correlated with market concentration as measured by the Herfindahl index. Regressing annual changes in MLRs across states on Herfindahl indices shows a clear negative relationship, which is significant for the individual market and small group but not for the large group market (Figure 12 and Table 2).

[22] Self-insured plans are not required to report the MLR and hence are not included in the analysis.

Figure 12. MLRs Over Time and Correlation with Market Concentration Indices



Sources: CMS, IMF Staff Calculations.

E. Correlations

31. Pairwise correlations of our estimated markups and wage premia indicate that states with higher hospital markups do not experience lower wage premia or insurance markups. The correlation between the hospital markups and wage premia is very small and positive, suggesting that more market power by hospitals is not associated with doctors and nurses earning a smaller wage premium. Similarly, the correlation with insurance MLRs is negative, so more market power by hospitals is not associated with lower markups by insurers.[23] This suggests that hospitals use their market power to raise prices to consumers rather than taking advantage of their monopsony power to lower costs of providers further down the supply chain. But there is a positive correlation between wage premia of practitioners and insurance MLRs, so in states in which insurance companies have more market power, physicians and nurses earn less (Table 3). The latter is in line with Roberts and others (2017) that find that higher health insurer concentration is being associated with lower physician prices.

V. Market Power and Healthcare Cost Determinants

32. Does market power increase healthcare costs and exacerbate Baumol's cost disease? Having estimated both overall markups for OECD countries and hospital markups for U.S. states, we can integrate these estimates in standard cross-country and state level regressions of per capita healthcare expenditures on various potential determinants. These regressions typically use OECD data and include per capita income and population aging (e.g., Baltagi and others, 2016, Newhouse, 1992, Smith and others, 2009 and Moscone and Tosetti, 2010 (U.S. states)). Some studies have also investigated the role of Baumol's costs disease for OECD countries (Hartwig, 2008, 2011 and Colombier, 2017) and U.S. states (Bates and Santerre, 2013). The existing literature has typically identified income as the most important factor explaining healthcare cost differences across countries, finding an income

---

[23] The annual correlation between hospital markups and Herfindahl indices for insurers is also positive.

elasticity of between 0.4 and 0.9 (suggesting health care is not a luxury good) and a significant but smaller effect of Baumol's cost disease. There is limited evidence that other variables (e.g., aging) are significant determinants (Baltagi and Moscone, 2010, Grossman, 1972). But none of these studies have so far included market power as an explanatory variable or its potential interactions with Baumol's cost disease.

A. Data and Methodology

33. We first estimate regressions at the OECD level. The basic regression takes the following form:

$$\log\left(HCE_{i,t}\right) = \beta_0 + \beta_1 \frac{1}{L_{i.t}}\left[log\left(W_{i,t}\right) - log\left(Y_{i,t}\right)\right] + \beta_2 \cdot \log\left(MPR_{i,t}\right) + \beta_3 \cdot \log\left(MPR_{i,t}\right) \cdot \frac{1}{L_{i.t}}\left[log\left(W_{i,t}\right) - log\left(Y_{i,t}\right)\right] + \alpha log\left(ZE_{i,t}\right) + \mu_s + \tau_t + \varepsilon_{s,t} \qquad [1]$$

where HCE are per capita real current health-care expenditures for each country at time t and $L_{i,t} = \left(\frac{L_H}{L_T}\right)_{i,t}$ denotes the share of total labor employed in the services sector in each country at time t. The overall real wage per worker, W, is measured by dividing total real wages and salaries by the total number of persons employed. Economy-wide output per worker, Y, is calculated by dividing real GDP by the total number of persons employed. MPR denotes our estimates overall markups for the healthcare sector. Z denotes several controls, including the real GDP per capita and percentage of the population 65 years of age and older. The regression includes country and time fixed effects.

34. The first explanatory variable in the equation is the adjusted Baumol variable, derived from a two-sector theoretical model with a productive and non-productive sector. A detailed derivation can be found in Colombier (2017). The variable is based on Baumol's (1967) basic notion that nonprogressive industries, such as healthcare, are labor intensive in practice and relatively void of productivity-enhancing innovations. Consequently, labor productivity tends to be relatively stagnant. But wage rates in the nonprogressive industries tend to increase with higher wage rates in the progressive sectors as higher wages are necessary for nonprogressive industries to attract workers over time. Thus, unit costs are driven up in nonprogressive industries over time.

35. Theoretically it is not clear whether more market power exacerbates or reduces Baumol's cost disease. More market power could depress wages, especially if it is accompanied by a collapse of workers' market power. On the other hand, healthcare may be special in that workers such as physicians also enjoy market power since the supply is relatively limited and hence the two reinforce each other. The results from the previous section seem to suggest the latter for healthcare occupations.

36. As is well documented in the literature, the variables in equation 1 are integrated of order 1 and there is evidence of cointegration and cross-sectionally dependent error

terms[24]. The latter likely reflect several factors such as worldwide technological progress and exposures to common shocks that lead to cross-sectionally dependent errors. These factors are mostly unobserved and can affect both dependent and independent variables leading to biased estimates. Previous studies have used mixed approaches to account for these features. Most have proceeded with regressions in first differences, while only a few recognized that cross sectional dependence is an important characteristic of health data, and have tried to incorporate it in their models (e.g., Baltagi and Moscone, 2010, Carrion-i-Silvestre 2005; Chou, 2007).

37. **We specify a cross-sectionally distributed lag (CS-DL) regression**. As explained in Chudik and others (2017), this estimator is a direct approach of estimating long run relationships in the data and has generally been shown to have a better small sample performance for moderate values of T than autoregressive distributed lag models. It is also robust to residual serial correlation and possible breaks in error processes. These type of models are valid regardless of whether the regressors are exogenous, endogenous and irrespective of whether the underlying variables are I(0) or I(1). For comparison purposes, we also show Pedroni's (1996) fully modified OLS estimator, which is widely used in the literature to estimate cointegrated panel models.

38. **The CS-DL regression takes the following form**:

$$y_{it} = c_i + \boldsymbol{\theta}_i' x_{it} + \sum_{l=0}^{p-1} \boldsymbol{\delta}_{il}' \Delta \boldsymbol{x}_{i,t-l} + \omega_{iy} \bar{y}_t + \sum_{l=0}^{3} \boldsymbol{\omega}_{i,xl}' \bar{\boldsymbol{x}}_{t-l} + e_{it} \quad [2]$$

where the dependent variable continues to be the log of the real HCE per capita, **x** is a vector of all the independent variables in equation 1, including the logs of the markups, the Baumol variable and their interaction, and **θ** is a vector of long-run coefficients. The regression also includes the cross-sectional average of the dependent variable and up to three lags for the cross-sectional averages of the regressors.

39. **Data come mostly from the OECD**. Given data availability, the sample (excluding markups) consists of 20 OECD countries (1970 to 2019).[25] Healthcare and demographic data stem from the OECD Health Database, while macroeconomic variables, i.e., GDPs and wages, come from the OECD Annual National Accounts and employment data are based on the OECD STAN Database for Structural Analysis. As explained in the previous section, our coverage of overall markups is more limited. Hence, once we introduce them into the regressions, we are left with 9 countries between 1980 to 2018.[26]

[24] We performed both the Im-Pesaran-Shin and Fisher-type unit root tests on all variables. For the markups, the null hypothesis of a panel unit root cannot be rejected at the 5 percent level for the IPS and Fisher (Dicker Fuller) specification.

[25] These are Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA.

[26] Australia, Canada, Germany, France, Japan, Korea, Sweden, UK, USA.

40. We are also interested in exploring the variation of healthcare costs across U.S. states and estimate the following regression:

$$\Delta \log(HCE_{s,t}) = \beta_0 + \beta_1 \frac{1}{L_{s,t}} [\Delta log(W_{s,t}) - \Delta log(Y_{s,t})] + \alpha \Delta log(ZE_{s,t}) + \mu_s + \tau_t + \varepsilon_{s,t} \quad [3]$$

where $L_{s,t} = \left(\frac{L_H}{L_T}\right)_{s,t}$ denotes the share of total labor employed in the healthcare sector for each state at time t and HCE are real healthcare costs per capita from the Bureau of Economic Analysis (BEA). The overall real wage per worker, W, is measured by dividing total real wages and salaries by the total number of persons employed, including the self-employed, for each state-year observation. Economy-wide output per worker, Y, is calculated by dividing real gross state product (GSP) by the total number of persons employed, including the self-employed. Data for the real wage per worker and real GSP in each state are obtained from the Bureau of Economic Analysis. Z denotes a number of controls. Following Bates and Santerre (2013), we include the real gross state product (GSP) per capita, the percentage of the population 65 years of age and older, and the poverty, union coverage, and unemployment rates (from the Bureau of Labor Statistics, Bureau of the Census and Unionstats.com). The data span all 50 U.S. states between 1980-2019. In contrast to Bates and Santerre (2013), we include the inverse of the labor share on the right side (in line with Colombier, 2017) rather than interacting it with the dependent variable.

41. We pursue a different estimation strategy compared to the OECD regressions. Our estimated state-level hospital markups span a relatively short period starting only in 1997, which is too short for a cross-sectionally distributed lag model. Moreover, the variation in hospital markups is mostly across states and not year-on-year. We therefore estimate the above equation in first differences with time and state fixed effects. We then extract the country fixed effects from equation 3 and regress them on the average estimated hospital markups across states.

B. Results

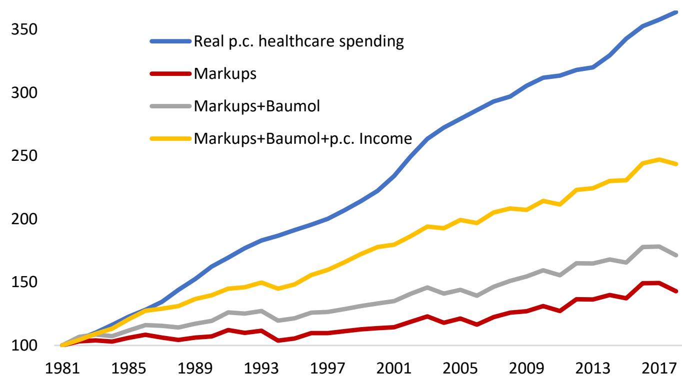
OECD Regressions

42. Results from simple fixed effect regressions in levels and first differences are generally in line with the previous literature. Income and Baumol's cost disease are significant drivers of healthcare costs across countries. The estimated coefficients on the markup and interaction with the Baumol variable are also positive and significant. The coefficients on the other explanatory variables are generally not significant. Table 4 shows evidence of the presence of cointegration, while the CD statistic shows that the null hypothesis of no cross-sectional dependence across error terms can be rejected at the 5 percent level for all regressions in levels (Table 5).

43. The CS-DL results provide evidence of long-run positive effects of our estimated markups and interaction with the Baumol variable on healthcare costs per capita (Table 6). Given the relatively small sample, we include those variables that have been identified as the main determinants of spending in the previous literature and also in the above simple fixed effects regressions, namely the Baumol variable, per capita income, the overall healthcare sector markups and their interaction with Baumol.[27] We check the robustness of results using different numbers of lags. All coefficients have the expected sign and the magnitude is broadly in line with the fixed effects regressions. The main difference to the fixed effects regressions is that real per capita income is no longer significant. Roughly one-third of the variation in healthcare costs can be explained by the right-hand side variables.

44. Based on the CS-DL regressions, markups account for about a quarter of annual increases in U.S. real health spending per capita on average since the early 1980s. This number is based on the CS-DL regressions coefficients (specification 3). U.S. markups and interactions with the Baumol variable (and their lags) account for about 1 percent of the 4 percent average annual increases of total per capita U.S. healthcare costs since 1980. If U.S. markups had instead risen in line with the average of other OECD countries in the sample, healthcare costs would have risen by 0.6 percent less per year in the U.S. and real per capita spending today could be about 10 percent lower today. The Baumol variable accounts for about 0.006 (or 0.6 percent) of annual healthcare cost growth on average. An alternative to computing average increases is to construct an annual index of healthcare costs and contributions (1981=100). The latter suggests that markups accounted for about 43 out of a total increase of 264 in the index since 1981, or about 16 percent.

Figure 13. Healthcare Cost Growth and its Contributions
(1981=100)



Source: IMF Staff calculations.
Note: Uses regression (2) in table 6 and includes real GDP per capita, since it is jointly significant with other variables.

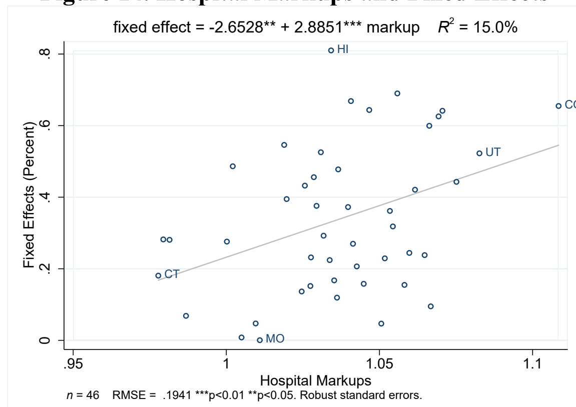
U.S. States Regressions

45. Baumol's cost disease and real per capita income are significant determinants of the growth of healthcare costs across U.S. states. The coefficient on the Baumol variable is around 0.05 while that on per capita income is 0.5 (in line with estimates from the previous literature) (Table 7). In addition, according to the results in Table 7, healthcare costs grow more rapidly when the elderly take on an increasing share of the population and when the unemployment rate grows faster. The latter may reflect increased spending on Medicare during recessions (McInerney and Mellor, 2012). However, the growth of healthcare costs is unrelated to both the growth of the union and poverty rates. Altogether, roughly two-thirds of the variation in the growth of healthcare costs can be explained by the right-hand side

[27] We tested for the significance of a measure of inequality (pre-tax Gini coefficients) but found them not to be significant.

variables in regression equation, when we look at first differences (a robustness check with a CS-DL specification results in a smaller R^2, but similar coefficients).[28]

Figure 14. Hospital Markups and Fixed Effects



46. **In general, higher hospital markups are associated with larger fixed effects obtained from the state-level regressions**. Cross-state regression results show a significant relationship between the extracted fixed effects and hospital markups, with about 15 percent of the variation of the dependent variable explained by the regression. The coefficient on the average hospital markup implies that a 0.1 increase in its level raises the fixed effect by 0.29 percent (in turn raising healthcare cost growth). In contrast, we find no significant relationship between the fixed effects and our measures of wage premia for healthcare professionals and insurance markups.[29] This could reflect some of the measurement issues related to insurance sector markups and wage premia, and that hospital-based care is the largest component of healthcare spending in the U.S. (Sisko and others, 2019).

47. **One caveat to the state-level analysis is that geographic markets for medical care are quite difficult to define, and hospital markets can span across states.** As an additional robustness check, we also ran regressions of per capita spending at the U.S. metropolitan (MSA) level, using the HCCI Healthy Marketplace index on hospital concentration as an explanatory variable. We find this variable to be significant over time in driving healthcare costs. Moreover, we confirm a positive and significant correlation with the Baumol variable, similarly to our OECD regressions (Table 8).

VI. THE IMPACT OF THE PATIENT PROTECTION AND AFFORDABLE CARE ACT ON HEALTHCARE SECTOR WAGES

48. **In this section, we rely on the heterogeneity of the decision and timing of the Medicaid expansion across states to study the impact of the ACA on labor costs** and to derive some information about the elasticity of supply (drawing on the exogenous nature of the demand shift).[30] Our hypothesis is that states that expanded Medicaid would over time see wages for healthcare practitioners growing faster than non-expansion states, due to the

[28] We found hospital markups to be significant in the level regressions (see table 7), but not in the regressions in first differences (given that the variation is mostly between states and not over time). However, because of the short time period (with data for markups only starting in 1997), we were unable to run a CS-DL model on this specification to correct for cointegration, which is why we proceeded with the fixed effects extraction.

[29] Results available upon request.

[30] Such heterogeneity is plausibly exogenous.

additional demand for healthcare services following the expansion of healthcare coverage, which may not be matched by a corresponding supply response. To the best of our knowledge, our paper would be the first attempt to analyze the ACA's impact on healthcare labor costs, which make up about one-half of total healthcare spending (Glied and others, 2015).

49. There are indications that the supply of medical services has not caught up with the increase in demand accompanying the broadened insurance coverage. Studies found that the ACA has increased emergency response times (Courtemanche and others, 2019) and wait times for Medicaid appointments (Miller and Wherry, 2017). In addition, there is no statistically significant evidence that the local medical education market has responded to the increase in demand after the ACA was introduced (Dillender and others, 2019).

50. There has also been a stream of studies examining the effects the ACA's Medicaid expansion on hospital financial outcomes. Rhodes and others (2020) find that the Medicaid expansion led to a decrease in uncompensated care expenditures and an increase in average operating margins. However, Moghtaderi and others (2020) find that hospitals in expansion states showed no significant relative gains in either total patient revenues or operating margins, as hospitals in non-expansion states see relative gains in commercial insurance revenues (likely related to the lower threshold in those states for accessing the subsidized ACA Marketplace insurance)[31].

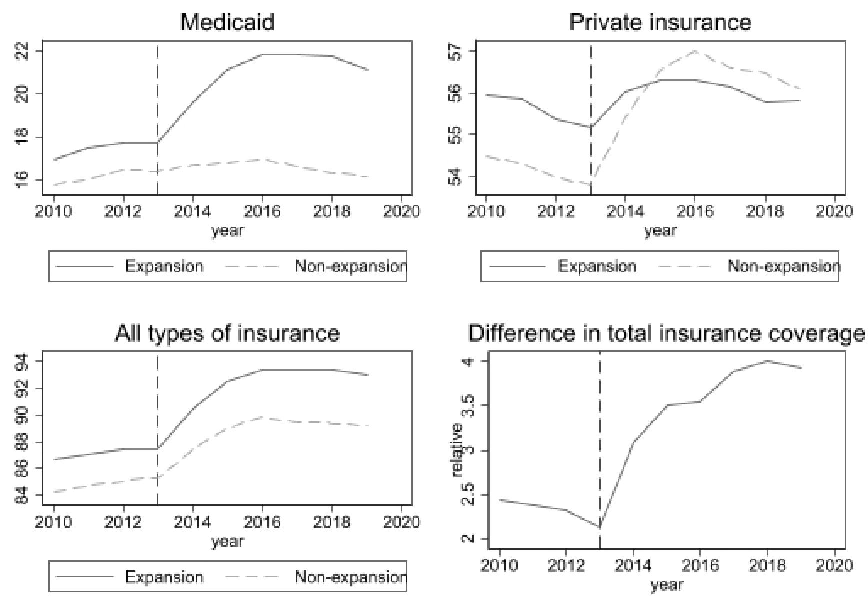
51. The literature shows that the ACA expanded both insurance enrollments and utilization of care considerably. For instance, Garrett and Gangopadhyaya (2016) reported that the 2014 provisions of the ACA insured about 20 million low-to-middle income non-elderly adults. Dillender (2021) documents that the healthcare sector did increase the demand for healthcare labor as measured by additional job postings. Using data from Kaiser Family Foundation and American Community Survey, Moghtaderi and others (2020) show that although there were some increases in healthcare coverage in those states that did not expand Medicaid (captured by the chart on "private insurance" in Figure 15), health insurance coverage has increased by more (about 4 percent) in Medicaid expansion states than in non-expansion states.

52. From a broader perspective, Gruber and Sommers (2019) review the literature on the impact of the ACA on patients, providers and the economy. They find strong evidence that the ACA's provisions have increased insurance coverage. There is also a positive effect on access to and consumption of healthcare, with suggestive but more limited evidence on improved health outcomes. There is no evidence of significant reductions in provider access, changes in labor supply or increases in budgetary pressures on state governments, and the law's total federal cost through 2018 has been less than predicted. Mazurenko and others (2018), also provide a systematic review of the effects of the Medicaid expansion under the ACA. They find that the expansion was associated with increases in coverage, service use, quality of care and Medicaid spending. Contrary to Miller and Wherry

[31] Another possible explanation is that hospitals in expansion states receive payments from Medicaid on previously uncompensated care, which do not change total patient revenue as they are recorded on an accrual basis.

(2017), they find no convincing evidence that the Medicaid expansion was associated with negative consequences, such as increased wait times for appointments.

Figure 15 Insurance Coverage Across the Two Groups of States (Percent)

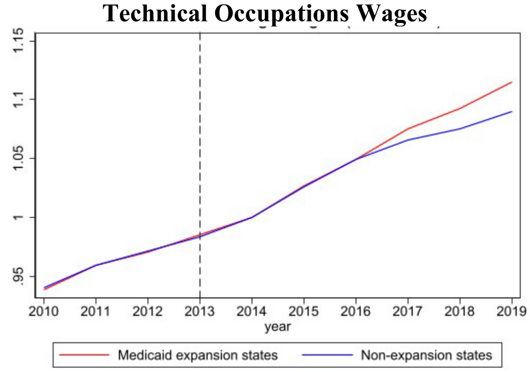


Source: Kaiser Family Foundation and American Community Survey.
Note: This graph replicates Figure 1 in Moghtaderi and others (2020). The numbers are different because they show insurance coverage as percent of non-elderly population.

A. Empirical Strategy

53. Between 2016 and 2019, average wages in Medicaid expansion states grew by about ¾ percent per year faster than in non-expansion states. Considering that seven states expanded Medicaid between January 2014 and the end of 2016, Figure 16 suggests that it takes about three years (or less) for wage differentials to emerge across the two group of states, as the official implementation of the Medicaid expansion started in 2014 (while the ACA was initiated in 2010).

Figure 16. Healthcare Practitioners and Technical Occupations Wages



Source: IMF staff calculations.

54. To formally test this result, we run cross section regressions on wage growth for healthcare providers for the two groups of states and estimate the following equation.

$$Y_i = \alpha + \beta \, expand_i + \boldsymbol{\theta} \, \boldsymbol{X_i} + \varepsilon_i \qquad [4]$$

where Y_i is the wage growth over the five-year period of 2014 to 2019 for each state i. The use of a five-year period is motivated by the observation that the difference in wage developments between the two groups of states become visible at the earliest two years after the official launch of Medicaid expansion and more pronounced over time. The delayed response is likely because wages respond gradually to the change in demand given wage stickiness. It could also reflect the offsetting effects from relative employment gains in Medicaid expansion states, which we will discuss later.

55. We include a dummy variable $expand_i$ for states' Medicaid expansion status, which equals one for states that expanded Medicaid and zero otherwise. This is the variable of interest and we would expect to see that the coefficient on the dummy is statistically and economically significant. We also included control variables $\boldsymbol{X_i}$ such as the five-year average state-specific unemployment and inflation rates, reflecting regular economic relationships between wages, economic activity and inflation. To capture other potential demand and supply factors that could explain wage variations across states, we also include the five-year population growth, the five-year average ratio of employment in the healthcare sector to population and the five-year average ratio of employment in the healthcare sector to total employment as explanatory variables.

56. We extend the cross-section regressions with difference-in-difference analyses. As suggested in Figure 16, before the Medicaid expansion, average wages for healthcare practitioners across the two groups of states were almost on the same line, while the two lines started to depart in the years following the Medicaid expansion. Following Moghtaderi and others, (2020), we run three exercises. First, we estimate a simple difference-in-difference model that assumes a one-time shift in the outcome at the time the Medicaid expansion shock is being studied:

$$Y_{i,t} = \alpha_i + \gamma_t + \beta\ expand_{it} + \boldsymbol{\theta}\, \boldsymbol{X_{i,t}} + \varepsilon_{i,t} \quad [5]$$

where $Y_{i,t}$ is the log hourly wage level for state i at year t, α_i and γ_t are state and time fixed effects, $expand_{it}$ is a dummy variable that equals one for expansion states in expansion years and zero otherwise. $\boldsymbol{X_{i,t}}$ is a vector of control variables including the inflation rate, unemployment rate, unemployment gap, population growth, share of medical employment in total employment, and share of medical employment to total population.

57. We also use a leads-and-lags specification to allow the effect of the Medicaid expansion to emerge over time. We estimate, in event time relative to each state's expansion year, the following specification:

$$Y_{i,t} = \alpha_i + \gamma_t + \sum_{j=-a}^{a} \beta_j \left(D_{it}^{j}\right) + \boldsymbol{\theta}\, \boldsymbol{X_{i,t}} + \varepsilon_{i,t} \quad [6]$$

where j indexes the year relative to the expansion; D_{it}^{j} equals one for expansion state i in the j^{th} year relative to the Medicaid expansion, zero for other years and zero for non-expansion states. In contrast to $expand_{it}$ in equation (5), which equals one for expansion states in the year of the Medicaid expansion and then remains one, the $D_{i,t}^{j}$ turns one for expansion state for a specific year, and then zero again. Therefore, β_0 provides the estimated treatment effect for the first expansion year, β_1 provides the effect for the second expansion year, and so on. We try up to five lags, as Figure 16 suggests that the wage differentiation will develop over time.

58. We also estimate a distributed lag model, again in event time, which allows the treatment effect to accumulate over time, relative to the pre-expansion average.

$$Y_{i,t} = \alpha_i + \gamma_t + \sum_{k=-a}^{a} \beta_j \left(expand_{it}^{k}\right) + \boldsymbol{\theta}\, \boldsymbol{X_{i,t}} + \varepsilon_{i,t} \quad [7]$$

where $expand_{it}^{k}$ equals one for expansion states k-year relative to the expansion year and all later years, zero for other years and zero for non-expansion states; $expand_{it}^{k}$ covers up to five years relative to the event. One can sum the incremental effects to obtain the overall treatment effect. This is different from the leads and lags model where a specific lag only measures the impact for that year (as the dummy only equals one in that year for expansion states and then turns zero).

59. We estimate the above three specifications (i.e. equations 5-7) with log hourly wages as the dependent variable. We use the hourly wage for "Healthcare Practitioners and Technical Occupations" using state-level Occupational Employment and Wage Statistics. To expand the sample, we also run the regressions using wages based on metropolitan and micropolitan statistical areas. Medicare provided such a wage adjustment index to reflect the different labor costs of hospitals in different areas.

60. We further examine the results using micro data from the Current Population Survey (CPS). We estimate an augmented Mincer human capital framework that has been used extensively to study wage developments in other contexts:

$$Y_{i,t} = \alpha\, year_t + \beta\, expand_i + \gamma\, year_t expand_i + \boldsymbol{\theta}\, \boldsymbol{X_{i,t}} + \varepsilon_{i,t} \quad [8]$$

The human capital model assumes that the log of hourly earnings, $Y_{i,t}$, for individual i varies linearly with education and quadratically with the job experience. We also included control variables such as individual characteristics (including race, sex, full-time work status and marital status) and macro variables (including the unemployment gap and log price levels) in $\boldsymbol{X}$. The macro variables are state specific. The CPS data are in the form of repeated cross sections[32] without tracking an individual over time. Following Woodridge (2012), we separate the individuals into a treatment group and a controlled group, with $expand_i$ equaling one for individuals in the Medicaid expansion group and zero otherwise. This captures possible differences between the treatment and control groups prior to the policy change. The dummy variable $year_t$ equals zero before the Medicaid expansion year 2014 and one in expansion years. It captures aggregate factors that would cause changes in y over time even in the absence of a policy change. We are interested in the coefficient γ on the interaction term of the year dummy and Medicaid expansion dummy. We also added state and year fixed effects in some of the regressions.

[32] Individuals in the Current Population Survey were interviewed for four months, then not interviewed for eight months, and then interviewed again for another four months before dropping out of the sample.

B. Data

61. **The CPS data are downloaded from the IMPUS CPS database.** The Occupation Employment and Wage Statistics (OEWS) provide data on wages on an annual frequency by occupation and by state, dating back to 1997 with 2019 being the latest year. The data include wages, total employment, number of employees in a certain occupation per 1000 employment for detailed occupational categories. The Medicare wage adjustment indexes for hospitals at the metropolitan and micropolitan statistical areas are provided by the Centers for Medicare & Medicaid surveys (CMS). We use the final hourly wages in our regressions. The inflation data are based on the SAIRPD Implicit Regional Price Deflators by state from the Bureau of Economic Analysis. These data are available for each state starting in 2008. The unemployment rate is from the Bureau of Labor Statistics local area unemployment statistics. The population data are from Annual Estimates of the Resident Population for the United States provided by the Census Bureau.

62. **The Kaiser Family Foundation documents the status and timing of the Medicaid expansion across states (Table 9).** There are 39 states that have adopted or are expected to expand Medicaid as allowed by the ACA. Among these states, as discussed in Rhodes and others (2020), some states have started the Medicaid expansion prior to the official implementation year of 2014, some states expanded Medicaid right on time (in January 2014), while others (13 states) expanded Medicaid at a later stage. Throughout the paper, we cross check the results by varying the grouping of states based on the timing of their Medicaid expansion status.

C. Results

63. **The results suggest that the Medicaid expansion accelerated wage growth for healthcare practitioners in a statistically significant way.** As shown in Table 10, between 2014 to 2019, the wage growth for healthcare practitioners in states that expanded Medicaid (accounting for about 60 percent of total healthcare practitioners in the U.S.) is about 0.5 to 0.6 percent higher per year than in states that did not expand Medicaid. The estimates on the control variables are mostly as expected, even though they are mostly statistically insignificant[33].

64. **The results for the basic difference in difference regressions confirm that wages for healthcare professionals grew faster in states that expanded Medicaid than in non-expansion states.** As shown in Table 11, relative to non-expansion states, hourly wages in expansion states grew about 0.7 percent faster on average in each of the expansion years. The result also suggests that a higher healthcare sector employment to population ratio could help

---

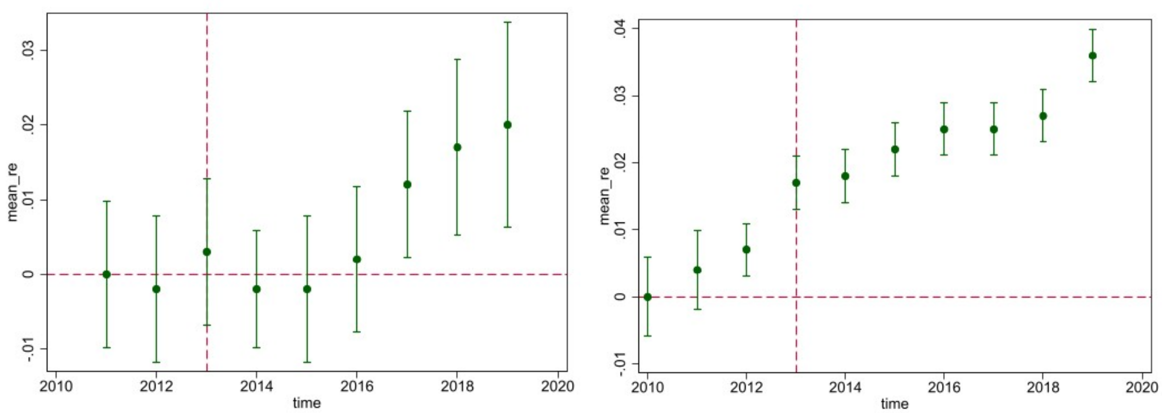
[33] A higher inflation or population growth at the state level is associated with lower wage growth, while a smaller unemployment rate or healthcare sector employment or healthcare job density is corresponding to higher wage growth for healthcare professionals. However, the coefficients on the unemployment gap was positive (even though statistically insignificant). In subsequent regressions, there is no conclusive finding on the coefficient of the unemployment rate or unemployment gap. A priori, it is not clear whether wages of healthcare professionals would be procyclical or countercyclical. Demand for healthcare could be higher in economic expansions (reflecting the “luxury good” assumption), driving up wages in the sector. However, demand for healthcare could also be higher in economic downturns, as people could become less healthy and seek additional medical services.

reduce the wage growth of healthcare professionals, suggesting that increasing the supply of healthcare sector labor inputs could help cost control.

65. To study the dynamic impact of the Medicaid expansion on healthcare sector wages, we run the lead and lag analysis. Instead of separating the period into pre-2014 and post-2014, the lead and lag analysis (and the distributed lag analysis below) incorporate the different timing of the Medicaid expansion across states. Figure 17 plots the cumulative impact and suggests that the differential impact on wages across states start to turn significant in the fourth year following the Medicaid expansion. If, however, we plot the coefficient relative to the coefficient on β_{-3} as in Moghtaderi (2020), the differential wage impact starts to show up in the third year. Over the course of five years, the cumulative wage difference is about 2 percent. Figure 18 plots the cumulative coefficients from the distributed lag model. It confirms that the wage impact starts to show up in the third year following the Medicaid expansion.

Figure 17. Lead and Lag Analysis

State-level data | Metropolitan-area-level data

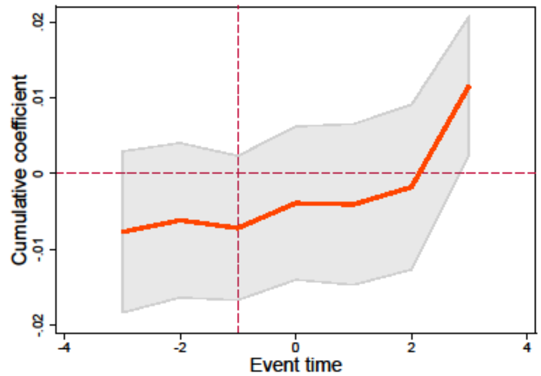


Source: IMF staff calculations

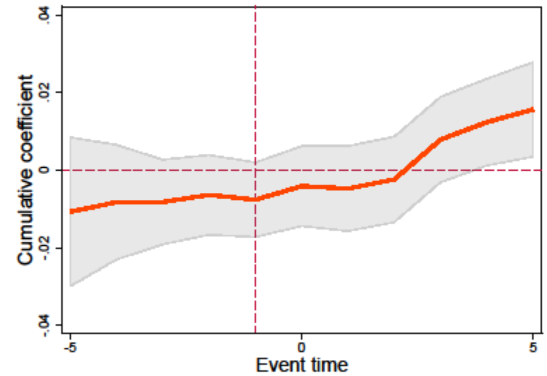
Figure 18. Cumulative Coefficients in the Distributed Lag Regressions

Using state-level data

Three leads and lags

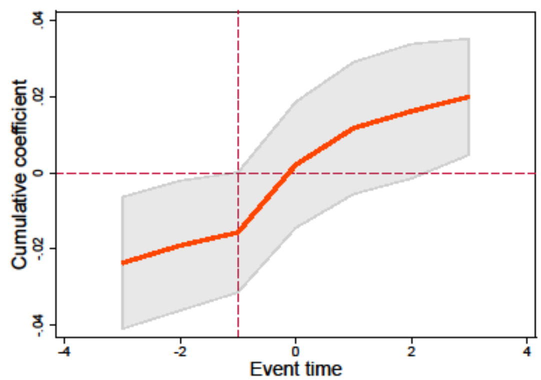


Five leads and lags

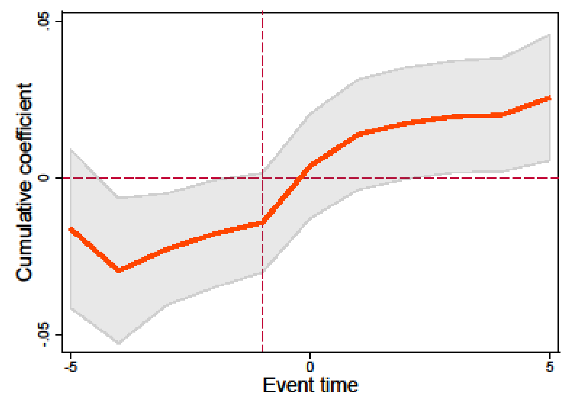


Using metropolitan-area-level data

Three leads and lags



Five leads and lags



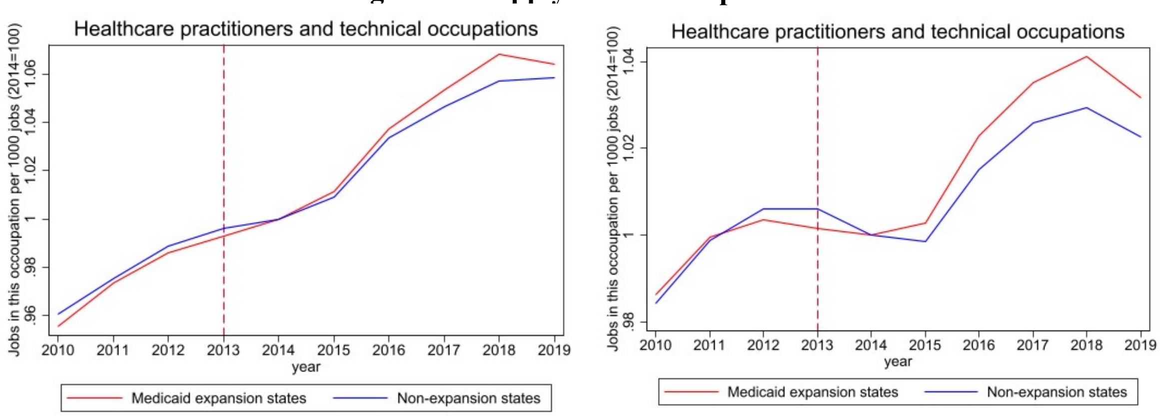
Source: IMF staff calculations.

66. The results using Medicare wage adjustment indexes at the metropolitan and micropolitan statistical area levels are consistent with the above findings (Table 12). In these regressions, besides introducing state-level control variables, we also included the number of providers at the metropolitan areas as these data are provided together with the wage index. The difference in wages across the two groups of states turned statistically significant starting in 2012, likely because a small number of states expanded Medicaid before 2014. However, it is likely that the coverage gains in these states before 2014 were limited (Rhodes and others (2020)).

67. The individual-level regressions also confirm that wages in expansion states in expansion years are on average higher than in non-expansion states or in non-expansion years, and of a higher magnitude (about 4 to 6 percent higher, Table 13). This could still potentially underestimate the impact of the Medicaid expansion on wage differentials, as the CPS data do not capture well higher wages. Healthcare sector practitioners and technical staff tend to receive higher wages and have their wages top-coded in the CPS. Therefore, the corresponding top-coded wages in CPS may not reflect the full extent of the impact of the Medicaid expansion on wages.

68. The result is unlikely to be related to declines in employment of healthcare professionals in Medicaid expansion states (e.g. due to retirement of doctors). Figure 19 compares the employment to population across the two groups of states and suggests that employment of healthcare practitioners has increased in states that expanded Medicaid relative to states that did not, though not sufficiently to compensate for demand increases and alleviate wage pressures. Moreover, regardless of the relative change in employment, our result is based on regressions that control for the employment to population ratio and therefore address related considerations.[34]

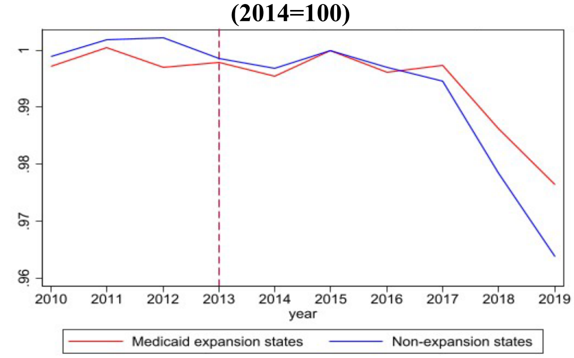
Figure 19. Supply Side Developments



Source: IMF staff calculations.

69. To cross check the results, we show that the ratio of healthcare to non- healthcare wages also increased in Medicaid expansion states compared to non-expansion states. We use OEWS data to construct wages for other occupations.[35] The ratio of healthcare wages to non-healthcare wages was broadly the same before the Medicaid expansion in the two group of states, but was relatively higher in

Figure 20. Ratio of Healthcare to Non-healthcare Wages (2014=100)



Source: IMF staff calculations.

[34] The pace of hospital markup growth is also higher in expansion than in non-expansion states (results available from the authors upon request). This suggests that the higher wages of physicians are passed through to consumer prices with an elasticity of greater than 1.

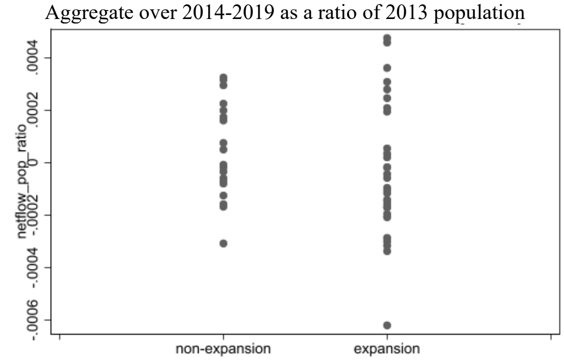
[35] Average wages for other occupations = (average wages for all occupations*total employment for all occupations – average wages for "Healthcare Practitioners and Technical Occupations" *total employment for "Healthcare Practitioners and Technical Occupations")/(total employment for all occupations – total employment for "Healthcare Practitioners and Technical Occupations").

Medicaid expansion states following the expansion. To formally test this, we run panel regressions with the wage ratio as the dependent variable and confirm that the coefficient on the Medicaid expansion dummy is positive and statistically significant (Table 14). We control for the ratio of healthcare employment to non-healthcare employment, the unemployment gap, unemployment rate and population growth. A higher ratio of employment is corresponding with a lower ratio of healthcare to non-healthcare wages, as expected. Coefficients on the other control variables are largely statistically insignificant. It is not clear how the wage ratio would relate to the cyclical stance of the economy and the size of the population.

70. In theory our results would not hold if there was perfect labor mobility across states, but we do not find evidence that Medicaid expansion states have received more inflows of healthcare professionals. Using the Census Job-to-Job flow data, we calculate the number of net inflows of "healthcare and social service workers" into each state as a ratio of state population. Medicaid expansion states do not necessarily have a higher inflow ratio than non-expansion states. In Table 15, we run a regression of the new inflow ratio on a Medicaid expansion dummy and the unemployment rate. The regression results are in line with the findings from Figure 21. This is not surprising for two reasons. First, many studies have documented a general decline in labor mobility across U.S. states (e.g., Azzopardi and others, 2020). Second, the U.S. has a state based medical licensing system in place, which requires that physicians and other healthcare professionals with out-of-state licenses be licensed in the state in which they are providing services. The literature has long identified this as a deterrent to mobility and shown that it provides market power for in-state physicians, many of which sit on medical boards (Mullangi and others, 2021). House price differentials can also be an important barrier to entry into Medicaid expansion states.

Figure 21. Net Inflows of Healthcare and Social Assistance by State

Aggregate over 2014-2019 as a ratio of 2013 population



Source: IMF staff calculations.

VII. CONCLUSION

71. This paper finds that market power in the U.S. healthcare sector has increased significantly since the 1980s and has contributed to rising healthcare costs. Markups for publicly listed firms in the U.S. healthcare sector have almost doubled since the early 1980s. Hospital markups have also increased significantly (by more than 6 percent on average) since the late 1990s and vary significantly across U.S. states. Incorporating markups into OECD regressions shows that, on average, they account for up to a quarter of annual increases in per capita U.S. healthcare costs. Similarly, results from U.S. state level regressions show that hospital markups are a significant driver of healthcare spending, explaining about 15 percent of variation across states.

72. Following the ACA, wages for healthcare practitioners have increased by more in Medicaid expansion than non-expansion states, a side-effect of policies that have been

successful in raising coverage and expanding care. The ratio of wages for healthcare practitioners to wages for other occupations also became relatively higher in Medicaid expansion states after Medicaid expansion. It is not likely that the wage gain is a result of having Medicaid pay for the previously "incurred but uncompensated care". Hospitals typically accept patients regardless of whether payments can be made. If more patients have insurance, then potentially this would boost profits for providers or even result in lower prices since there are smaller cross subsidies, rather than leading to increases in hourly wages. Studies show that even though hospitals in Medicaid expansion states enjoyed more Medicaid revenues, they do not show gains on overall revenues due to the relative loss in commercial insurance revenues (Moghtaderi and others, 2020).

73. Even before the ACA, healthcare practitioners enjoyed a sizable wage premium over individuals with similar education, experience and characteristics. Our findings suggest that policies which increase insurance coverage and boost demand for healthcare—and do not go hand-in-hand with supply-side measures that lessen barriers to entry and make supply more elastic—could make resources scarcer, potentially increasing the market power of providers. This means that in addition to the direct costs of increasing coverage, resulting increases in demand may also lead to some price increases. Going forward, this suggests that there are benefits to making supply more elastic, also in light of recent steps by the Biden administration to further widen the coverage of healthcare insurance.[36]

74. The significant contribution of market power to healthcare costs suggests the need for carefully considered policy responses. In cases where barriers to entry are driving the increase in market power, the first best is to dilute those barriers and to encourage entry by new health providers and insurers. In this context, licensing requirements or limits on the flow of new medical professionals intended to underpin the quality of services may have become an increasingly binding constraint to entry and may need to be recalibrated. A more assertive approach to antitrust policies (at both the federal and state level) with regards to ongoing mergers and acquisitions could play an important role to identify and counter any restraints of trade that unreasonably restrict competition. Many local geographic markets are already highly concentrated, and cases are time and resource intensive, which means that antitrust policy should also consider actions to constrain the exercise of pricing power by providers and insurers (National Academy of Social Insurance, 2015).[37] Some consideration could be given to creating an agency responsible for monitoring and oversight of healthcare markets (Gaynor, 2020). Moreover, greater transparency that provides consumers with accurate and timely information about price, quality, costs, and provider networks can help them make better choices and make markets more competitive.

---

[36] The Executive Order on "Strengthening Medicaid and the Affordable Care Act" (January 28, 2021) provides a special enrollment window to the Marketplace for uninsured/under-insured Americans. The 2021 American Rescue Plan (ARP) fully paid for coverage for the lowest income workers, increased premium subsidies for those earning up to 400 percent of the federal poverty level, and capped the costs for a benchmark plan for two years while also providing incentives to encourage Medicaid expansions by states that have not done so. The proposed American Families Plan contains provisions to make the premium reductions of the ARP permanent.

[37] One such practice by hospitals is to bundle services where they have greater market power with services where they have relatively less market power ("tying"). Through such arrangements, monopolist providers can extend their market power and limit entry by competitors. This can be challenged under the Sherman Act and Clayton Act (National Academy of Social Insurance, 2015).

Table 2. MLRs and HHIs

VARIABLES	(1) Δ MLR (Individual)	(2) Δ MLR (Small Group)	(3) Δ MLR (Large Group)
ΔHHI (Ind.)	-0.0315*		
	(0.0167)		
Δ HHI (small)		-0.0220***	
		(0.00773)	
Δ HHI (large)			-0.00431
			(0.00749)
Constant	-0.00162	-8.45e-05	-0.000128
	(0.00339)	(0.00109)	(0.000601)
Observations	400	400	400
R-squared	0.010	0.023	0.001
Number of cid	50	50	50

Standard errors in parentheses. FE regressions.
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Pairwise Correlations between Hospital Markups, Insurers MLR's and Wage Premia of Healthcare Practitioners

	Hospital markup	Wage premium	Insurer MLR (individual)	Insurer MLR (small group)	Insurer MLR (large group)
Hospital markup	1				
Wage premium	0.0045	1			
Insurer MLR (individual)	-0.0723	0.0952*	1		
Insurer MLR (small group)	-0.2053*	0.1531*	0.5074*	1	
Insurer MLR (large group)	-0.0021	0.1770*	0.3165*	0.5096*	1

*p<0.05

Table 4. Cointegration Tests. OECD Data

Variables: Health expenditure p.c, Baumol variable, population over 65, real GDP p.c., markups and their interaction with Baumol variable (all in logs)

Type	Details	Statistic	p-value
Westerlund	Panel means	-2.1149	0.0172
Pedroni - Phillips-Perron	Panel means	-2.1783	0.0147
Kao- Augmented Dickey-Fuller	Panel means	-1.9924	0.0232

\

Table 5. Basic OECD Regressions

a. All variables in first differences

Dependent variable: Δlog of p.c. real health costs

VARIABLES	(1) Baseline	(2) Aging	(3) Aging Life Expectancy	(4) Union Death rate	(5) All	(6) Baseline_small sample
baumol	0.440***	0.443***	0.449***	0.522***	0.559***	0.501***
	(0.0670)	(0.0722)	(0.0765)	(0.0940)	(0.0953)	(0.110)
dlrgdp_pc	0.460***	0.462***	0.472***	0.580***	0.763***	0.280**
	(0.0852)	(0.0828)	(0.0865)	(0.122)	(0.122)	(0.0964)
dlpop65		0.400	0.425*	0.231	0.220	
		(0.239)	(0.231)	(0.188)	(0.210)	
dlinfant					-0.0613***	
					(0.0159)	
dllifeexpect			0.229		-1.178	
			(0.485)		(1.293)	
dlphysicians				0.0324	0.0358	
				(0.0884)	(0.102)	
dlunion				0.102**	-0.00736	
				(0.0460)	(0.0657)	
dldeaths				-0.253***	-0.264**	
				(0.0727)	(0.107)	
Constant	0.0395*	0.0332	0.0148	-0.0293	-0.0303	0.0368***
	(0.0210)	(0.0242)	(0.0226)	(0.0324)	(0.0303)	(0.00975)
Observations	866	866	836	370	341	333
R-squared	0.331	0.339	0.344	0.403	0.420	0.268
Number of cid	20	20	20	16	16	9

Robust standard errors in parentheses. Time and country fixed effects.
*** p<0.01, ** p<0.05, * p<0.1

Notes: all data are from the OECD. dl stands for the first difference in logs. Baumol=(wage-rate growth – labor-productivity growth) × 1/(share of Baumol sector in total employment). Rrgdp=real GDP per capita. Pop65 denotes share of population that is over 64 years old. Infant= infant mortality (Deaths/1 000 live births), lifeexpect=life expectancy at birth (years), physicians=density of physicians per 1k population, union=trade union density (ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners, deaths= number of deaths registered in a country in a year divided by the population.

b. All variables in log-levels

Dependent variable: log of p.c. real health costs

VARIABLES	(1) Baseline	(2) Baseline_small sample	(3) Markup	(4) Markup Interaction
baumol_level	0.0420**	0.0335	0.0240	0.0127
	(0.0161)	(0.0274)	(0.0304)	(0.0299)
lrgdp_pc	0.971***	0.994***	1.011***	1.075***
	(0.0939)	(0.0945)	(0.0984)	(0.117)
lmarkup			-0.00763	1.136*
			(0.116)	(0.494)
int_level				0.110**
				(0.0412)
Constant	-2.103*	-2.277	-2.625	-3.508*
	(1.215)	(1.462)	(1.565)	(1.770)
CD-statistic	-3.339***	-3.797***	-3.467***	-3.631***
Observations	885	337	319	319
R-squared	0.971	0.970	0.971	0.974
Number of cid	20	9	9	9

Robust standard errors in parentheses. Time and Country fixed effects.
*** p<0.01, ** p<0.05, * p<0.1

Notes: "l" denotes natural log. baumol_level=(l(avg. wage)–l(labor productivity)) × 1/(share of Baumol sector in total employment). Markup is our estimated markup based on Worldscope. Int_level=interaction of Baumol variable and markups.

Table 6. CS-DL Regressions

Dependent variable: log of p.c. real health costs

	(1)	(2)	(3)	(4)
VARIABLES	CS-DL 3-Lags	CS-DL 2-Lags	CS-DL 1-Lag	FMOLS
lmarkup	4.106*	5.603**	5.603**	3.505***
	(2.373)	(2.691)	(2.691)	(0.780)
lrgdp_pc	0.191	0.869	0.869	0.921***
	(0.866)	(0.544)	(0.544)	(0.0542)
baumol_level	0.0675	0.170*	0.170*	0.378***
	(0.0891)	(0.0949)	(0.0949)	(0.0334)
int_level	0.355*	0.508**	0.508**	0.380***
	(0.201)	(0.246)	(0.246)	(0.0874)
Constant				2.458***
				(0.861)
Observations	301	306	306	306
R-squared	0.391	0.352	0.352	0.996
Number of groups	9	9	9	9

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: "l" denotes natural log. baumol_level=(l(avg. wage)–l(labor productivity)) × 1/(share of Baumol sector in total employment). Markup is our estimated markup based on Worldscope. Int_level=interaction of Baumol variable and markups.

Table 7. State-Level Regressions

Dependent variable: per capita real healthcare expenditure (1st differences, except for (5, 6)).

	(1)	(2)	(3)	(5)	(6)
VARIABLES	Baseline	All variables	IV regression	CS-DL Level regression	Markups
dbaumol	0.0441***	0.0491***	0.0772**		
	(0.00304)	(0.00280)	(0.0362)		
dlog_GSP_pc	0.400***	0.524***	0.765**		
	(0.0594)	(0.0704)	(0.318)		
dold		0.448***	0.716*		
		(0.109)	(0.376)		
dunemp		0.0533***	0.0659***		
		(0.00752)	(0.0199)		
dunion		-0.00246	0.000555		
		(0.00470)	(0.00561)		
dpov		-0.000573	-0.000659		
		(0.00292)	(0.00333)		
baumol_level				0.0559***	0.0671***
				(0.00639)	(0.00964)
log_GSP_pc				0.524***	0.749***
				(0.0763)	(0.156)
lold				0.245	0.175
				(0.160)	(0.134)
lunemp				0.0228**	0.112***
				(0.00996)	(0.0239)
lunion				-0.00440	0.0359
				(0.00933)	(0.0255)
lpov				-0.00129	-0.00603
				(0.00549)	(0.0142)
D.baumol_level				-0.00574*	
				(0.00295)	
lmark_hospital					0.471*
					(0.250)
lmark_hospital*baumol					0.0528*
					(0.0308)
Constant	0.0534***	0.0448***	-0.0230		-0.395
	(0.00365)	(0.00399)	(0.0297)		(1.614)
Observations	1,950	1,950	1,900	1,950	934
R-squared	0.624	0.648	0.615	0.325	0.946
Number of cid	50	50	50	50	50

Robust standard errors in parentheses

IV regression uses state housing price indices as instrumental variable (see Bates and Santere, 2013).

Specification (2) is used to extract fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Notes: d stands for first difference, "l"=natural log. dbaumol=(wage growth-labor productivity growth)*1/(share of Baumol sector in total employment). GSP_pc=gross state product per capita, old=% of population 65 years or older, unemp, union, pov: unemployment, poverty and union coverage rates (from BLS, unionstats.com). baumol_level = (l(avg wage)-l(labor productivity))*1/(share of Baumol sector in total employment). Mark_hospital=our hospital markups by state.

Table 8. MSA Regressions

VARIABLES	(1) FE	(2) lagged	(3) CS-DL
lconcen	0.0900***	0.0427**	
	(0.0213)	(0.0184)	
lRGDP_pc	0.351***	0.122***	0.448***
	(0.0540)	(0.0416)	(0.0479)
baumol	0.0530***	0.0216**	0.0719***
	(0.0133)	(0.00843)	(0.00541)
int (baumol*lconcen)	0.0102***	0.00483**	
	(0.00291)	(0.00195)	
L.lpc_rhexp		0.747***	
		(0.0321)	
D.baumol			-0.00447
			(0.00324)
D.lRGDP_pc			0.0189
			(0.0253)
Constant	4.741***	0.952***	
	(0.535)	(0.330)	
Observations	831	761	3,930
R-squared	0.865	0.944	0.226
Number of cid	114	106	231

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variable: per capita real healthcare expenditure.

Notes: includes time effects (i.year), concen is Healthy Marketplace Index for hospital markets from HCCI, based on Herfindahl indices, which is available from 2008-2017 (other variables: 2001-2019, all from BEA). All variables are in log-levels. baumol= (l(avg real wage)-l(labor productivity))*1/(share of Baumol sector in total employment). Rgdp=real GDP per county/metropolitan area. L. lpc_rhexp=log of per capita real healthcare spending.

Table 9: List of States with Medicaid Expansion

State	Timing (implemented/expected)	State	Timing (implemented/expected)
Arizona	1/1/2014	Oregon	1/1/2014
Arkansas	1/1/2014	Rhode Island	1/1/2014
California	1/1/2014	Vermont	1/1/2014
Colorado	1/1/2014	Washington	1/1/2014
Connecticut	1/1/2014	West Virginia	1/1/2014
Delaware	1/1/2014	Michigan	4/1/2014
District of Columbia	1/1/2014	New Hampshire	8/15/2014
Hawaii	1/1/2014	Pennsylvania	1/1/2015
Illinois	1/1/2014	Indiana	2/1/2015
Iowa	1/1/2014	Alaska	9/1/2015
Kentucky	1/1/2014	Montana	1/1/2016
Maryland	1/1/2014	Louisiana	7/1/2016
Massachusetts	1/1/2014	Virginia	1/1/2019
Minnesota	1/1/2014	Maine	1/10/2019
Nevada	1/1/2014	Idaho	1/1/2020
New Jersey	1/1/2014	Utah	1/1/2020
New Mexico	1/1/2014	Nebraska	10/1/2020
New York	1/1/2014	Missouri	7/1/2021
North Dakota	1/1/2014	Oklahoma	7/1/2021
Ohio	1/1/2014		

Source: Kaiser Family Foundation (2020), "Status of State Medicaid Expansion Decisions: Interactive Map".

Table 10. Cross-Section Regressions on Wage Growth Based on State-Level Wages in the Occupational Employment and Wage Statistics

Dependent variable: hourly wage growth over a five-year period (2014-2019)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	h_mean_g	h_mean_g	h_mean_g	h_mean_g	h_mean_g
exp_dum	2.776***	2.308**	2.797***	2.653***	2.721***
	(0.959)	(0.971)	(1.003)	(0.952)	(0.953)
une_rate_avg	-0.866*		-0.863*	-0.683	-0.864*
	(0.486)		(0.492)	(0.497)	(0.482)
inflation	0.087	0.145	0.079	0.208	0.050
	(0.236)	(0.251)	(0.258)	(0.248)	(0.236)
une_gap_avg		0.400			
		(0.769)			
pop_g			0.013		
			(0.158)		
tot_emp_avg				-0.000	
				(0.000)	
jobs_1000_avg					-0.079
					(0.061)
Constant	12.328***	8.286***	12.314***	11.530***	17.331***
	(2.707)	(1.606)	(2.741)	(2.733)	(4.732)
Observations	51	51	51	51	51
R-squared	0.176	0.125	0.176	0.211	0.204

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: hourly wage growth is the change of wages for healthcare practitioner over the period of 2014 to 2019. Medicaid expansion dummy (exp_dum) equals to 1 for states that expanded Medicaid by 2016 and equals to zero otherwise. Unemployment rate (une_rate_avg) is the state-specific average unemployment of 2015 to 2019. Unemployment gap (une_gap_vag) is the difference between unemployment rate and NAIRU, which is proxied by the average unemployment rate over 2000 to 2006. Inflation rate (inflation) is the state-specific average inflation rate of 2015 to 2019. Population growth (pop_g) is the state-specific population growth over the period of 2014 to 2019. Total healthcare sector employment to population ratio (tot_emp) is the state-specific average ratio over the period of 2014 to 2019. The number of healthcare sector jobs per one thousand employment (jobs_1000_avg) is the average number of the period of 2014 to 2019.

Table 11. Basic Difference-in-Difference Regression Using State-Level Wages in the Occupational Employment and Wage Statistics

Dependent variable: log hour wages

VARIABLES	(1) l_h_mean	(2) l_h_mean	(3) l_h_mean	(4) l_h_mean	(5) l_h_mean
exp_dum	0.007**	0.007**	0.007**	0.008**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
l_price	0.461***	0.461***	0.463***	0.429***	0.418***
	(0.091)	(0.091)	(0.093)	(0.094)	(0.097)
une_rate	0.005***				
	(0.001)				
une_gap		0.005***			
		(0.001)			
l_tot_emp			-0.086***	-0.139***	
			(0.032)	(0.039)	
l_pop				0.154**	0.019
				(0.066)	(0.055)
l_job					-0.016
					(0.037)
Constant	1.375***	1.400***	2.394***	0.822	1.394
	(0.415)	(0.415)	(0.527)	(0.850)	(0.901)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	510	510	510	510	510
R-squared	0.898	0.898	0.895	0.896	0.893
Number of states	51	51	51	51	51

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Medicaid expansion dummy (exp_dum) equals 1 for expansion states in expansion years, zero for non-expansion year, and zero for non-expansion states. Unemployment rate (une_rate) and unemployment gap (une_gap_vag) are state-specific, with NAIRU proxied by the average unemployment rate over 2000 to 2006. Log price level (l_price), log population (l_pop), log total employment (l_tot_emp) and log number of jobs per 1000 jobs (l_job) are all state-specific variables.

Table 12. Basic Difference-in-Difference Regressions Using Metropolitan and Micropolitan Statistical Area Medicare Wage Adjustment Index

Dependent variable: log hourly wages

	(1)	(2)	(3)
VARIABLES	l_wage	l_wage	l_wage
l_price	0.461***	0.449***	0.396***
	(0.067)	(0.067)	(0.069)
une_gap	0.001	0.001	0.002**
	(0.001)	(0.001)	(0.001)
l_no_prov	-0.002	-0.002	-0.003
	(0.005)	(0.005)	(0.005)
tot_emp_ratio		-3.083**	
		(1.256)	
med_exp_dum	0.026***	0.027***	0.027***
	(0.002)	(0.002)	(0.002)
jobs_1000			-0.002***
			(0.000)
Constant	1.360***	1.490***	1.766***
	(0.303)	(0.308)	(0.320)
Statistical area fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	3,561	3,561	3,561
R-squared	0.823	0.824	0.824
Number of areas	376	376	376

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Medicaid expansion dummy (med_exp_dum) equals 1 for expansion states in expansion years, zero for non-expansion year, and zero for non-expansion states. Unemployment gap (une_gap_vag) is state-specific, with NAIRU proxied by the average unemployment rate over 2000 to 2006. Log number of providers (i.e. hospitals) is statistical area specific. Log price level (l_price), employment to population ratio (tot_emp_ratio) and log number of jobs per 1000 jobs (l_job) are all state-specific variables.

Table 13. Individual Wages Regressions Using CPS Data

Dependent variables: log hourly wages

VARIABLES	(1) lhrw	(2) lhrw	(3) lhrw
lcpi	0.943***	1.196***	2.016***
	(0.071)	(0.217)	(0.647)
ugap	-0.002	-0.002	-0.005
	(0.003)	(0.004)	(0.008)
hs	-0.395***	-0.386***	-0.386***
	(0.022)	(0.022)	(0.022)
ypexp	0.025***	0.025***	0.025***
	(0.002)	(0.002)	(0.002)
ypexp2	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
male	0.057***	0.054***	0.054***
	(0.016)	(0.016)	(0.016)
white	0.090***	0.080***	0.081***
	(0.016)	(0.017)	(0.017)
married	0.077***	0.074***	0.074***
	(0.013)	(0.013)	(0.013)
ftime	0.007	0.014	0.014
	(0.013)	(0.013)	(0.013)
med_year_dum	0.059**	0.049*	0.047*
	(0.025)	(0.025)	(0.025)
med_dum	-0.004	0.165**	0.154**
	(0.018)	(0.068)	(0.069)
year_dum	-0.071***	-0.081***	-0.176*
	(0.023)	(0.028)	(0.100)
Constant	-1.537***	-2.770***	-6.385**
	(0.326)	(0.966)	(2.848)
State fixed effect		Yes	Yes
Time fixed effect		No	Yes
Observations	5,945	5,945	5,945
R-squared	0.146	0.165	0.166

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Medicaid expansion treatment dummy (med_dum) equals 1 for states that expanded Medicaid by 2016 and equals 0 otherwise. Medicaid expansion year dummy (year_dum) equals 1 for years starting 2014 and 0 otherwise. The interaction term (med_year_dum) equals 1 for expansion states in expansion years, zero for non-expansion year, and zero for non-expansion states. Unemployment gap (une_gap) is state-specific, with NAIRU proxied by the average unemployment rate over 2000 to 2006. Log price level (l_price) is state-specific.

Table 14. Regressions on Between-occupational Wage Ratios

Dependent variables: ratio of healthcare wages to non-healthcare wages

VARIABLES	h_mean	h_mean	h_mean	h_mean
Medicaid expansion	0.007**	0.007**	0.007**	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)
relative employment ratio	-2.670**	-2.642*	-2.642*	-3.017**
	(1.354)	(1.356)	(1.356)	(1.366)
unemployment rate		-0.001		
		(0.001)		
unemployment gap			-0.001	
			(0.001)	
log popuation				-0.089*
				(0.051)
Constant	0.601***	0.607***	0.603***	1.957**
	(0.034)	(0.035)	(0.034)	(0.776)
Year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Observations	510	510	510	510
R-squared	0.216	0.217	0.217	0.222
Number of state_new	51	51	51	51

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Medicaid expansion dummy (exp_dum) equals 1 for expansion states in expansion years, zero for non-expansion year, and zero for non-expansion states. Relative employment ratio is the ratio of employment in "Healthcare Practitioners and Technical Occupations" to employment in all occupations. Unemployment rate (une_rate) and unemployment gap (une_gap_vag) are state-specific, with NAIRU proxied by the average unemployment rate over 2000 to 2006. Log price level (l_price), log population (l_pop), log total employment (l_tot_emp) and log number of jobs per 1000 jobs (l_job) are all state-specific variables.

Table 15. Regressions on Job Mobility

Dependent variables: net inflow ratio of "healthcare and social assistance" jobs

VARIABLES	(1) netflow_pop_ratio	(2) netflow_pop_ratio	(3) netflow_emp_ratio	(4) netflow_emp_ratio
exp_dum	-0.001	-0.001*	-0.015	-0.020
	(0.000)	(0.000)	(0.014)	(0.013)
une_rate		-0.001***		-0.041***
		(0.000)		(0.005)
Constant	-0.000	0.009***	-0.002	0.357***
	(0.000)	(0.001)	(0.011)	(0.042)
Year fixed effect	Yes	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes	Yes
Observations	501	501	501	501
R-squared	0.014	0.135	0.008	0.159
Number of states	51	51	51	51

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: the dependent variables "netflow_pop_ratio" is the net inflow of jobs in the "healthcare and social assistance" to population ratio of the previous year and "newflow_emp_ratio" is the net job inflow to employment ratio of the previous year. Medicaid expansion treatment dummy (med_dum) equals 1 for states that expanded Medicaid by 2016 and equals 0 otherwise. Unemployment gap (une_rate) is state-specific.

References

Akcigit, U., W. Chen., F. J. Diez., R. A. Duval., P. Engler., J. Fan., C. Maggi., M. Mendes Tavares., D. A. Schwarz., I. Shibata., C. Villegas-Sánchez., 2021. "Rising Corporate Market Power: Emerging Policy Issues," IMF SDN 21/01 (Washington: International Monetary Fund).

Alemayehu B., Warner K.E., 2004. "The Lifetime Distribution of Health Care Costs". *Health Services Research*, 39 (3):627–42.

Azzopardi, Damien, Fozan Fareed, Mikkel Hermansen, Patrick Lenain and Douglas Sutherland, 2020. "The decline in labor mobility in the United States: Insights from new administrative data," OECD Economics Department Working Papers No. 16/2020.

Baker, L.C , Bundorf M.K. , Royalty A.B. , Levin Z., 2014. "Physician practice competition and prices paid by private insurers for office visits". JAMA 2014; 312 (16): 1653- 62.

Baltagi, B. H., Feng, Q. and Kao, C., 2016. "Estimation of heterogeneous panels with structural breaks," *Journal of Econometrics*, vol. 191(1), pages 176-195.

Baltagi, B. H., and F. Moscone, 2010. "Healthcare Expenditure and Income in the OECD Reconsidered: Evidence from Panel Data" IZA DP No. 4851.

Bates, L.J., Santerre, R.E., 2013. "Does the U.S. healthcare sector suffer from Baumol's cost disease? Evidence from the 50 states." *Journal of Health Economics*, Volume 32, Issue 2, March 2013, Pages 386-391.

Baumol, W.J., 1967. "Macroeconomics of unbalanced growth: the anatomy of urban crisis." *American Economic Review*, 57 (3) (1967), pp. 415-426.

Carrion-i-Silvestre, J. L., 2005. "Healthcare expenditure and GDP: Are they broken stationary?" *Journal of Health Economics* 24, 839-854.

Case, A., and A. Deaton, 2020. "Deaths of Despair and the Future of Capitalism," Princeton University Press.

Cicala, S., E.M.J. Lieber, and V. Marone, 2019. "Regulating Markups in U.S. Health Insurance," *American Economic Journal: Applied Economics*, 11(4):71-104.

Chou, W. L., 2007. "Explaining China's regional health expenditures using Im-type unit root tests," *Journal of Health Economics* 26, 682-698.

Chudik A., Mohaddes K., Pesaran, M.H., and M. Raissi, 2017. "Is There a Debt-Threshold Effect on Output Growth?" *The Review of Economics and Statistics*, vol. 99(1), pages 135-150, March.

Colombier, C., 2017. "Drivers of Health-Care Expenditure: What Role Does Baumol's Cost Disease Play?" *Social Science Quarterly,* Volume 98, Number 5, November 2017.

Cooper, Z., S.V. Craig, M. Gaynor, J.Van Reenen, 2019. "The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured," *The Quarterly Journal of Economics*, Volume 134, Issue 1, February 2019, Pages 51–107.

Coutemanche, C., Friedson, A., Koller, A. & Rees, D., 2019. "The affordable care act and ambulance response times," *Journal of Health Economics*, 67: 102213

Dafny, Leemore, Kate Ho, Robin Lee. 2019. "The price effects of cross-market mergers: theory and evidence from the hospital industry." *The RAND Journal of Economics*, 50 (2): 289–325.

Dafny, Leemore, Nancy Beaulieu, Bruce Landon, Jesse Dalton, Ifedayo Kuye, and J. Michael McWilliams. 2020. "Changes in Quality of Care after Hospital Mergers and Acquisitions." *New England Journal of Medicine* 384, 51–59.

De Loecker, J., and J. Eeckhout, 2017. "The Rise of Market Power and the Macroeconomic Implications," NBER Working Paper No. 23687.

Diez, F.J., Leigh, D., and Tambunlertchai, S., 2018. "Global Market Power and its Macroeconomic Implications," IMF Working Paper WP/18/137 (Washington: International Monetary Fund).

Dillender, M. 2021. "How did the ACA's Medicaid expansion affect the demand for healthcare workers? Evidence from Vacancy Postings", *Journal of Human Resources,* Forthcoming.

Dillender, M., Friedson, A., Gian C. & Simon K., 2019. "Does the healthcare educational market respond to short-run local demand?" *Economics and Education Review*, 73.

Fulton, B.D., 2017. "Healthcare Market Concentration Trends In The United States: Evidence And Policy Responses" *Health Affairs*, vol. 36, No. 9.

Garrett, B., & Gangopadhyaya, A., 2016. "Who gained health insurance coverage under the ACA, and where do they live." The Urban Institute.

Gaynor, Martin. 2020. "What to Do about Health-Care Markets? Policies to Make Health-Care Markets Work." Brookings Institution. https://www.brookings.edu/wp-content/uploads/2020/03/Gaynor_PP_FINAL.pdf.

Glied, S., Ma, S. and Pearlstein I., 2015. "Understanding pay differentials among health professionals, nonprofessionals, and their counterparts in other sectors," *Health Affairs* 34, No. 6 (2015) 925-935.

Gowrisankaran, G., A. Nevo, and R. Town. 2015. "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry." *American Economic Review* 105 (1): 172–203.

Grossman, M., 1972. “On the concept of health capital and the demand for Health,” *Journal of Political Economy* 80, 223-255.

Gruber, J., & Sommers, B., 2019. “The affordable care act's effects on patients, providers and the economy: What we've learned so far,” NBER.

Haas, S. A, Glymour M.M., and L.F. Berkman, 2011. “Childhood Health and Labor Market Inequality over the Life Course,” *Journal of Health and Social Behavior*, 52(3):298–313.

Hartwig, J., 2011. “Can Baumol's model of unbalanced growth contribute to explaining the secular rise in healthcare expenditure? An alternative test,” *Applied Economics*, 43 (2) (2011), pp. 173-184.

Hartwig, J., 2008. “What drives healthcare expenditure? Baumol's model of unbalanced growth revisited,” *Journal of Health Economics*, 27 (2008), pp. 603-623.

Kane, J. B., 2015. “An Integrative Model of Inter-and Intragenerational Preconception Processes Influencing Birthweight in the United States.” *Journal of Health and Social Behavior.* 56(2):246–61.

Mazurenko, O., Balio, C. P., Agarwal, R., Carroll, A. E., & Menachemi, N., 2018. “The effects of Medicaid expansion under the ACA: A systematic review,” *Health Affairs*, 37(6), 944 ‐ 950.

McInerney, M.P., Mellor, J.M., 2012. “State Unemployment In Recessions During 1991–2009 Was Linked to Faster Growth In Medicare Spending.” *Health Affairs* 11, 2464–2473.

Miller, S., & Wherry, L. R., 2017. “Health and access to care during the first 2 years of the ACA Medicaid Expansions,” *New England Journal of Medicine*, 376(10), 947–956.

Moghtaderi, A., Pines, J., Zocchi, M. and Black, B., 2020. “The effect of ACA Medicaid expansion on hospital revenue,” *Health Economics*, Volume29, Issue12, December 2020, Pages 1682-1704.

Moscone, F., and E. Tosetti, 2010. “Health expenditure and income in the United States,” *Health Economics*, Volume 19, Issue 12, December 2010, Pages 1385-1403.

Mullangi, S., M. Agrawal, and K. Schulman, 2021. “The COVID-19 Pandemic—An Opportune Time to Update Medical Licensing,” Jama Network, https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2775345.

National Academy of Social Insurance, 2015. “Addressing Pricing Power in Health Care Markets: Principles and Policy Options to Strengthen and Shape Markets.” Final Report of the Academy’s Panel on Pricing Power in Health Care Markets, April 2015.

Newhouse, J., 1992. Medical care costs: How much welfare loss. *Journal of Economic Perspectives* 6, 3-21.

Nunn, R., J. Parsons and J. Shambaugh, 2020. "A dozen facts about the economics of the U.S. health-care system", https://www.brookings.edu/research/a-dozen-facts-about-the-economics-of-the-u-s-health-care-system/.

O'Brien, R.L., and C.L. Robertson, 2018. "Early-life Medicaid Coverage and Intergenerational Economic Mobility," *Journal of Health and Social Behavior*. 59(2): 300–315.

Papanicolas, I., Woskie, L.R., and Jha, A.K., 2018. "Health Care Spending in the United States and Other High-Income Countries", *JAMA*, 319 (10), pp. 1024-1039.

Pedroni, P., 1996. "Fully Modified OLS for Heterogeneous Cointegrated Panels and the Case of Purchasing Power Parity." Working paper No. 96–020, Department of Economics, Indiana University.

Pesaran, M. H., 2006. "Estimation and inference in large heterogenous panels with multifactor error structure". *Econometrica* 74, 967-1012.

Pesaran, M. H., 2007. "A simple panel unit root test in the presence of cross section dependence." *Journal of Applied Econometrics* 22, 265-312.

Rhodes, J., Buchmueller, T.C., Levy, H.G. & Nikpay, S.S., 2020. "The heterogenous effects of the ACA Medicaid expansion on hospital financial outcomes." *Contemporary Economic Policy*, Volume 38, Issue 1.

Roberts E.T., Chernew M.E., and McWilliams J.M., 2017. "Market share matters: evidence of insurer and provider bargaining over prices." *Health Affairs* (Millwood); 36(1):141.

Sisko, A. M., S. P. Keehan, J. A. Poisal, G. A. Cuckler, S. D. Smith, A. J. Madison, K. E. Rennie, and J. C. Hardesty, 2019, "National Health Expenditure Projections, 2018–27: Economic and Demographic Trends Drive Spending and Enrollment Growth," *Health Affairs* 38 (3).

Smith, S. D., J. P. Newhouse, and M. S. Freeland, 2009. "Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?" *Health Affairs* 28(5):1276–84.

Thompson, A., 2011. "The Effect of Hospital Mergers on Inpatient Prices: A Case Study of the New Hanover–Cape Fear Transaction." *International Journal of the Economics of Business*, 18 (1): 91–101.

Woodridge J. (2012) Difference-in-Differences Estimation.

Zhang, X., D. Lin, H. Pforsich, and Vernon W., 2020. "Physician workforce in the United States of America: forecasting nationwide shortages", *Human Resources Health*. 2020; 18: 8.