Who Values Human Capitalists' Human Capital? Healthcare Spending and Physician Earnings

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Abstract

Is government guiding the invisible hand at the top of the labor market? We study this question among physicians, the most common occupation among the top one percent of income earners, and whose billings comprise one-fifth of healthcare spending. We use a novel linkage of population-wide tax records with the administrative registry of all physicians in the U.S. to study the characteristics of these high earnings, and the influence of government payments in particular. We find a major role for government on the margin, with half of direct changes to government reimbursement rates flowing directly into physicians' incomes. These policies move physicians' relative and absolute incomes more than any reasonable changes to marginal tax rates. At the same time, the overall level of physician earnings can largely be explained by labor market fundamentals of long work and training hours. Competing occupations also pay well and provide a natural lower bound for physician earnings. We conclude that government plays a major role in determining the value of physicians' human capital, but it is unrealistic to use this power to reduce healthcare spending substantially.

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The [healthcare] industry is not very good at promoting health, but it excels at promoting wealth among healthcare providers, including some successful private physicians who operate extremely profitable practices.

(Case and Deaton, 2020)

My hand surgeon should have been paid $4.5 billion for fixing my broken wrist, not $1,000.

(Crawford, 2019)

1 Introduction

Growth in income inequality, concentrated among skilled workers at the top of the income distribution, has led to widespread interest in tax and transfer programs that could affect this distribution (e.g., Zidar, 2019). The focus on taxes has taken the spotlight away from the fact that most government spending is in-kind—primarily on healthcare—and not cash transfers (CBO, 2020). While an expansive literature in public finance studies the value of this spending to the taxpayer (summarized by Hendren and Sprung-Keyser, 2019) and the distributional impact on those who receive its services (e.g. Meyer and Mittag, 2019), in-kind transactions have a third participant: the service providers whom the government pays. Due to the difficulty of associating income data with information on who provides government services, the impact of government purchases on the sellers' incomes, and their places in the income distribution, has been difficult to study.[1]

We study physicians, skilled workers at the top of the largest public procurement enterprise: healthcare. Physicians' direct services consume one-fifth of healthcare spending. Physicians are the quintessential "human capitalists" (Smith et al., 2019a), with long periods of training, frequent business ownership, and are the single most common occupation in the top percentile of income earners (Gottlieb et al., 2018). Although the U.S. government does not directly control physician wages as many other governments do (NHS, 2020; Blum et al., 2011), federal and state governments directly spend $1.7 trillion on healthcare, or 47 percent of healthcare spending (CMS, 2018), and indirectly drive prices in other parts of the market (Clemens and Gottlieb, 2017). So governments' decisions about how to pay for this care, whom to pay, and how much, could have a significant effect on both healthcare spending and the top of the income distribution.

[1] In contrast, the incidence of government payments on firms has been explored across a variety of procurement contracts, including in healthcare and health insurance, e.g. (Cabral et al., 2018; Duggan et al., 2016; Garthwaite et al., 2018; Decarolis et al., 2020), defense (Carril and Duggan, 2018), and infrastructure (Krasnokutskaya and Seim, 2011).

We use new administrative data linkages to describe the level and distribution of physicians' earnings. Existing evidence on physician earnings (e.g. Baker, 1996; Bhattacharya, 2005; Vaughn et al., 2010; Esteves-Sorenson and Snyder, 2012; Chen and Chevalier, 2012; Jagsi et al., 2012; Seabury et al., 2013; Altonji and Zhong, 2019; LoSasso et al., 2020) has relied on survey data and faced measurement challenges, such as top-coding and complicated income structures. Our data overcomes many (though not all) of these issues and allow us to determine basic facts about this occupation. How much of the United States' $3.3 trillion in medical spending ends up in physicians' own incomes? The tax data linkage allows us to answer this in the aggregate, across locations, by specialty, over time, and in response to government payments. Which physicians do well by doing good?

The evidence confirms many popular perceptions, but with some novel nuance. Physicians are top earners, with mean professional incomes of $343,600 in 2017. Over one quarter are in the top percentile of the overall income distribution, and half are in the top two percent, while the median is $255,200. There is substantial heterogeneity by specialty, with the mean primary care physician earning $243,400 and the mean surgeon earning more than half a million dollars. Some differences across specialties are associated with length of training and work hours. Income differences *not* predicted by these variables are associated with a specialty being more attractive to top medical school graduates.

Physicians' age-earnings profile is steep, with average incomes doubling from age 30 to age 40 and then flattening. This pattern is especially pronounced among top-earning specialties. The geographic pattern of earnings is striking, with the highest-earning physicians in the Great Plains and Deep South. The highest-income states, on the coasts, have low to average physician earnings. We have made data on physician mean incomes at the commuting zone level, and by physician specialty, publicly available for other researchers to use.[2]

Having established these facts, we ask how much government influences physician earnings at the margin. Of course, there are many margins and many relevant policies: government reimbursement rates, direct bonuses for practicing in "shortage areas" (Nicholson and Propper, 2011), entry restrictions, insurance subsidies, taxation, and others. We focus on direct government payments—reimbursement rates and insurance subsidies—as they seem likely to have the most direct relationship to physicians' earnings. Even so, it is not theoretically obvious what pass-through to expect, if any. On the one hand, labor economists tend to find limited sharing of firms' marginal rents with most workers (Card et al., 2018). Contemporary physicians are rarely the sole practitioners of yore, but now work in firms with multiple doctors and other employees. So

[2]Data are available here.

risk and reward could be absorbed by insurers, employers, changing cost structures, or distributed across the group. On the other hand, Kline et al. (2019) find more rent-sharing with high-income workers. And risk-sharing could be limited if physicians in a group are all exposed to the same risk.

We use quasi-experimental strategies to study changes in Medicaid reimbursement rates and in upstream subsidy payments to health insurance companies. Our identification relies on the fact that marginal changes in government payments typically only affect some specialties, in some geographic areas, for some time.

The government's influence is dramatic. On average, half of changes in reimbursement rates flow directly into physician earnings. We find that a single payment increase for primary care physicians (PCPs) implemented by the Affordable Care Act increased the share of PCPs in the top percentile of the national income distribution by 12 percent. At the margin, the government appears to play a major role in valuing physicians' human capital and shapes the top of the income distribution.

What contributes to this high pass-through? The physician setting features payments for specific professional services, often provided by small firms whose output is not very diversified. To test this theory, we examine which physicians' earnings are most responsive to government payment changes. Our effects are not driven by physicians with direct government employment, but come from those in private businesses. They are stronger among the self-employed, among those in smaller firms, and among those in firms with less diversification across specialties. On the flip side, the complementary groups—government employees, and physicians in larger or diversified practices—experience little-to-no pass-through. Many types of working physicians are insulated from marginal government payments.

To gauge how powerful payment changes are in shaping top incomes, we compute the magnitude of income tax changes that would be necessary to influence average incomes as much as the reimbursement changes do for physicians. We find that they would be historically large, indicating the power that healthcare payment policy commands over top earnings in the U.S.

Since we find that government can indeed influence earnings at the margin, one might consider using policy to reduce physicians' average earnings (Baker, 2017; Pollin et al., 2018; Case and Deaton, 2020). Physician offices produce $529 billion of output per year, and additional physicians are employed in hospitals and other industries. This might suggest a large scope for reimbursement cuts to address two public concerns simultaneously: high health spending and top income inequality.

In the final part of the paper we use our data to evaluate this idea. We entertain three thought experiments to quantify how national healthcare costs could be reduced by cutting physicians' incomes. We compare doctors with lawyers, consider cutting those specialty earnings that don't look like a return to labor or training, and consider an international comparison. Our findings are again nuanced. First, we simulate total career incomes for doctors and for lawyers. Lawyers have a reasonably comparable labor market structure but less restrictive entry, so are a plausible outside option for physicians. Accounting for the fact that doctors work 19 percent more hours than lawyers, the former earn an average of 25 percent more over their working lives. Eliminating this differential by uniformly reducing physicians' average earnings to the lawyer average would, all else equal, lower national health expenditures by 1.8 percent.

We next consider income differences across specialties. Overall, specialties' earnings are closely linked to work hours and training length, but there are some exceptions. For example, radiologists earn twice as much as neurologists despite working fewer hours. Similarly, both ophthalmologists and hematologist-oncologists earn around $450,000 on average. But ophthalmologists work an average of 7 fewer hours per week and have slightly shorter training. Such income deviations from the prediction (based on hours and training length) do not appear to be a compensating differential for some unmeasured aspect of the specialty. If that were the case, we would expect to see no relationship between these deviations and applicants' desire to enter the specialty. But we do see a strong positive relationship: for example, 89 percent of ophthalmologists trained domestically, while only 59 percent of hematologist-oncologists did. Given the general preference for domestic applicants in medical training, this suggests that domestic applicants prefer ophthalmology. In other words, the labor supply of U.S.-trained applicants responds positively to income net of disamenities.

So could the government cut healthcare costs by reducing incomes of specialties above those explained by labor market fundamentals? It could to some extent, but this power is constrained by the positive labor supply response (Chown et al., 2019). A targeted payment reduction could focus on specialties earning more than would be predicted by their training length and hours worked. But these high-earning specialties are relatively small. So, even though payment reforms could likely dent their earnings, the total potential savings from reasonable adjustments amount to about half of one percent of total health spending.

Finally, we consider a comparison between incomes of physicians in the U.S. and abroad. While this sort of comparison is commonplace (Pozen and Cutler, 2010; Chown et al., 2019) our data enable improved income measurements and allow us to consider physicians' relative position in the national income distribution. Moving average incomes of U.S. physicians to the levels in, for example, Sweden could save $200 billion or 5% of U.S. healthcare spending. But this comparison is misleading, since—even in Sweden—physicians are concentrated at the top of the income distribution. If we redistributed U.S. physicians to national income percentiles in a way that is more similar to Sweden, savings would be substantially less dramatic, as the distribution would then resemble the experience of primary care physicians in the U.S. In fact, moving the U.S. average to the PCPs' experience would be equivalent to cutting physician incomes to the level of lawyers, since an average PCP earns about the same as an average attorney over the course of their careers. These results emphasizes the limitations of using policy to reduce spending by cutting physicians' pay. While government reimbursements are powerful tools, their potential for reducing spending is constrained by the other attractive opportunities open to skilled workers in the 21st century.

We conclude that government payment rules do play a key role in determining the value of one of society's most expensive assets: the human capital of highly trained physicians. At the same time, physicians work long hours and have long training periods. So, even if government payments drive high earnings at the margin, this does not imply that economic rents are widespread. When it comes to physician labor markets, the invisible force of government is guiding the invisible hand.

2 Institutional Background and Data

This section presents basic institutional features and introduces our data. Institutionally, the key fact is that physicians can be paid through both wages and business income (section 2.1). By linking tax data with physician records (section 2.2), we are able to measure physician income appropriately (section 2.3).

2.1 How are Physicians Paid in the United States?

We begin with a simplified overview of a variety of income models that characterize physician compensation in the U.S. While a very large literature has studied how physicians are paid from the payer perspective (fee for service, bundled payments, capitation), physicians' personal earnings have been hard to observe so their institutional features haven't entered academic discourse.

The structure of physicians' earnings for their professional services can be classified into three broad models. On the one extreme are physicians whose income comes fully from W-2 wages. This is common in larger organizations such as academic medical centers. The second model is the exact opposite—only sole proprietorship income that physicians would file on Schedule C ("Profit or Loss from Business, Sole Proprietorship") of IRS Form 1040. While the easiest form of business to set up, as it does not require incorporating a legal entity, this form of income has been losing its appeal among physicians, as it offers no limited liability and is tax disadvantaged relative to other legal structures.

The third model is a popular hybrid option that involves a pass-through entity, usually an S-corporation or a partnership. A medical practice organized as an S-corporation (which can include one or more physicians) would pay physicians a market wage, which is reported on form W-2, and a share of profits that remain after all practice expenses, which is reported on Schedule K-1 ("Partner's Share of Income, Deductions, Credits, etc.") and then on Schedule E ("Supplemental Income and Loss") of Form 1040. The S-corporation structure may be more complex for larger group practices. For example, a large practice might have a joint S-corporation to hire practice staff and report income as a group and then individual S-corporations for each physician in the practice. The exact legal structure affects the tax liability and the profit-sharing incentives within the practice.

The upshot is that it is crucial to include non-wage earnings in physicians' incomes. Section 2.3 presents our measure of non-wage income.

2.2 Data Sources and Sample Definition

We use data from the universe of individual federal income tax returns spanning years 1998 to 2017 merged with an administrative registry of all healthcare providers in the U.S.

Income data We start by assembling income information from individual federal income tax returns. The IRS data extract available to us includes the universe of tax returns for tax years 1998 through 2017, plus some scattered earlier years, but only a limited number of variables. From Form 1040, we observe the tax unit's filing status, adjusted gross income (AGI), wage income, taxable dividend and interest amounts, and social security income.[3]

We enrich Form 1040 data by adding in third-party informational returns, notably Form W-2. W-2s report wage earnings for each filer in the tax unit. We aggregate W-2s across multiple employers if applicable. Observing W-2s at the individual-employer (employer defined using Employer Identification Number—EIN) level implies that we can observe wage income separately for the index physician and the spouse in married filing jointly tax units. Our W-2 data are only available for years 2005 to 2017, so most of our analysis focuses on this time frame.

Demographic data We merge in information about individuals' age and gender from the Social Security Administration's Numerical Identification System (Numident) database. The Numident file has been described elsewhere (*e.g.* Bailey et al., 2020). The variables of interest to us are the date of birth, date of death, and gender. We further add in geographic information about state and county of residence from

[3] We follow Chetty et al. (2014) approach for harmonizing raw Form 1040 data.

address reporting on Form 1040. If no address is available on Form 1040, informational returns or a compilation of other administrative sources are used. We drop income observations in the year in which an index individual dies, as well as in all subsequent years.

Physician sample Using Protected Identification Key (PIK)-based data linkage infrastructure of the U.S. Census Bureau, we merge federal income tax returns with the April 2018 version of the (cumulative) National Plan and Provider Enumeration System (NPPES) file.[4]

NPPES is a registry of National Provider Identifiers (NPI) maintained by the Centers for Medicare and Medicaid Services (CMS). Individuals and organizations that provide healthcare services in the U.S. must use their unique 10-digit NPI to identify themselves throughout the healthcare system. NPPES provides several pieces of information essential to our analysis. First, it allows us to identify tax returns of healthcare providers. Second, it reports providers' medical specialty. NPPES uses detailed Health Care Provider Taxonomy Code ASC X12 as its specialty taxonomy.[5] We use two crosswalks to aggregate provider specialties into larger categories. The first crosswalk, obtained from CMS, maps NPPES provider taxonomy into 60 Medicare Specialty Codes.[6] The second crosswalk, which we constructed ourselves, maps sixty Medicare specialties into nine specialty categories, allowing us to simplify the exposition of specialty-level information. We aggregate to anesthesiology, hospital-based providers, medicine subspecialties, neurology, OB/Gyn, primary care, procedural specialties, radiology, and surgery.[7]

Our sample of physicians is defined as all individuals in NPPES with a primary specialty taxonomy code that starts with "20" (physicians) for whom we observe at least one tax return. For each individual in that sample, we retrieve the history of tax returns for tax years 1998 through 2017. Two caveats about our sample are in order. First, NPPES is a cumulative list of all providers with an NPI who are either active on April 2018 or have been delisted since 2005. Using these data alone, we can only identify individuals as physicians if they had an active NPI in 2018 or had an NPI at some point between 2005 and 2018. We do not observe individuals whose NPIs were discontinued prior to 2005 (for example, because they retired or died). To address the age censoring concern, we non-parametrically adjust or control for age in our analyses.[8] Second, we note that by using NPPES to identify doctors, we are zooming in on practicing physicians and surgeons.

[4] Wagner and Layne (2014) describe the detail of the data linkage infrastructure.

[5] The full taxonomy system is maintained by the Washington Publishing Company and incorporates information about the type of provider and provider's area of specialization. Provider Taxonomy codes and their description can be found on the Washington Publishing Company web page.

[6] The crosswalk is available from CMS.

[7] Appendix Table A.1 presents this categorization.

[8] Adjusted values are calculated by regressing log income on 1-year age fixed effects as well as fixed effects for sample year, gender, state, and medicare specialty. Fitted values are exponentiated and then rescaled to match overall mean income in 2017.

We do not capture individuals who may have completed a medical degree, but never practiced and never filed for a National Provider Identifier. Our findings are thus representative of the financial experience of being a doctor rather than having a medical school degree.

American Community Survey We merge tax records and NPPES data with the American Community Survey (ACS) for years 2001-2017. Since 2005, each year's ACS samples a cross-section of approximately one percent of the U.S. population.[9] We pool all respondents from 2001 to 2017 and have roughly 15% of the U.S. population observed at least once across 17 ACS years. For anyone who ever appears in this sample, and whose responses are successfully linked to a PIK, we can track the full panel of tax returns.

This merge allows us to define several additional objects of interest. First, we use the occupational record in ACS to construct an alternative sample of physicians, allowing us to compare the measurement of income for physicians between survey and administrative data. One additional advantage of this exercise is that, since the ACS definition of physicians does not rely on the NPPES merge, the ACS sample avoids the age censoring concern (although it may introduce measurement error in who is identified as a physician). Benchmarking the time series of income between ACS and NPPES-based samples of physicians allows us to assess the extent of the age-censoring problem.

Next, we use ACS reporting of being self-employed or working for the government for the analyses of which physicians are most affected by changes in government payments. Third, ACS responses of working hours captures physicians' labor supply. Fourth, we use ACS records to compute geographic variation in the share of Medicare and Medicaid patients, which we use to understand the geographic distribution of physicians' incomes. Finally, we use ACS to benchmark physician salaries against another high-skilled occupation—lawyers. We use the occupation variable in ACS to identify lawyers.[10]

Other data sources We augment our analysis with a few additional data sources. We obtain additional details about specialties' training from the Association of American Medical Colleges. They provide administrative estimates of how many physicians in each specialty attended medical school in the United States.[11]

Second, we calculate the average tuition cost for a medical education from a variety of sources. These include undergraduate tuition from the National Center for Education Statistics and medical school tuition

[9] From 2001 through 2004, the ACS sampled 0.4 percent of the population annually.

[10] This variable includes individuals who reporting being lawyers, judges, magistrates, judicial law clerks, and other judicial workers.

[11] https://www.aamc.org/data-reports/workforce/interactive-data/active-physicians-us-doctor-medicine-us-md-degree-specialty-2017

from an American Association of Medical Colleges survey. Details are in Appendix A.1.

Finally, we use the tax data to construct our own estimates of average training length by specialty. Details are in Appendix A.2

2.3 Income Measure

Physician incomes come through a diverse and changing array of mechanisms. This mishmash of sources makes it particularly challenging to study physician income and highlights the advantage of using tax rather than survey data for measuring total earnings.

We are primarily interested in capturing income from contemporaneous professional labor of the physician, and excluding "passive" financial income. To arrive at total professional income, we separately compute wage income and business income, which we then add up. This sum is our preferred measure of professional earnings, which we refer to simply as "income" throughout for ease of exposition.

Individual wage income is directly observed from W-2 reporting. Measuring business income is more challenging. First, our data do not directly record the amount of business or self-employment income on Schedules E and C. Second, non-wage income on tax forms is reported at the tax unit rather than individual level. Hence, we pursue an imputation strategy to arrive at a measure of business income. We start with Adjusted Gross Income (AGI) for all households that have at least one index individual—a physician observed in NPPES. We then subtract wages of all members of the tax unit. This leaves us with a combination of business and financial income at the tax unit level. We define financial income as the taxable portion of social security payments, taxable dividends, and taxable interest. We subtract this financial income and define the remaining residual to be business income. For those physicians who file joint returns with a spouse, this object technically captures business income of both spouses. It may also include capital gains and other forms of income that are not necessarily professional income. That said, it is not clear capital gains should be excluded—a physician's income from selling her practice is clearly part of her return to practicing medicine. We use various approaches to approximate the income attributable to the index individual of interest. The results are not qualitatively sensitive to the approach we use, so to simplify exposition we focus on the measure that attributes all of imputed business income to the index physician. These series of steps brings us from the 2017 average AGI among physician tax units of $422,600 to average physician earnings of $343,600, and median of $255,200.[12] Following the literature on income inequality, we use AGI of the whole tax unit when measuring the location of physician households in the national income distribution.

[12] Note that many tax units include only the index physician, which is why the physician's own earnings dominate the tax unit AGI. Appendix A.3 describes these calculations in more detail.

2.4 Present Discounted Value of Earnings

We use the panel structure of our data to estimate the present discounted value (PDV) of income earned over a physician's career. The data allow us to incorporate variability across individuals and over time, accounting for actual income dynamics over the career. We start by grouping observations with physicians of the same age. To minimize noise, we pool data from all years 2005 to 2017 and adjust income observed in different calendar years for inflation. For each age cohort, we divide individuals into thirteen income bins: top 1% of income within each age cohort, next 4%, next 5%, each of the bottom nine deciles, and zero income. We estimate empirical transition probabilities between income bins from age a to age $a + 1$. In practice, to improve precision, we use individuals within a five-year age window centered on each age; that is, to calculate transition probabilities between ages 50 and 51, we actually use people who had age a between 48 and 52 in any year t between 2005 and 2016. We link these respondents to their incomes at age $a + 1$ in year $t + 1$, and use the transition probabilities from a to $a + 1$ to estimate the transition probabilities between 50 and 51.

We estimate one-year transition probabilities across income bins for each year of age beginning at age 20 and ending at age 70. We use the empirical distribution of income levels at the starting age and age-specific transition probabilities to simulate 50,000 careers for physicians and lawyers, which gives us the distribution of income paths in each occupation. We calculate the discounted value of these incomes back to age 20 using three different discount factors β: 0.95, 0.97, and 0.99.

3 How Much Do Physicians Earn?

Basic Facts

Table 1 summarizes our data. In 2017, which is the most recent year of our data, we observe 863,000 physicians. Physicians are on average 50 years old and earn \$344,000 per year.[13] Over one quarter of physician households are in the top percentile of the national income distribution and 53% are in the top two percentiles. There is substantial variation in income across specialty categories. The lowest earning specialty category is also the most common one—primary care physicians (PCP) earn on average \$243,000 and account for 44% of physicians in our sample. The highest earners are procedural specialists and surgeons, earning more than twice as much as PCPs—\$535,000 and \$522,000, respectively—and together accounting for 15% of doctors. These income differences across specialty categories are reflected in where physicians in

[13] All numbers in the manuscript are rounded according to U.S. Census Bureau disclosure protocols.

these categories find themselves in the national income distribution. While half of surgeons and procedural specialists are in the top 1%, only 14% of PCPs are in this very top income bracket.

Our data suggest that in total physicians' personal income accounts for $297 billion, or 9% of U.S. total healthcare spending (in 2017). Put differently, out of $10,739 that an average American spent on healthcare in 2017, $910 was paid to physicians. While one-fifth of national health expenditure goes to physician and clinical services, less than half of this amount is physicians' actual take-home pay. A third of the total bill goes to PCPs. The two highest-paid specialty categories together ultimately account for 23% of the physician bill, or 1.6% of national healthcare spending.

Age Profile of Earnings

Figure 1A plots the average annual income of physicians by five year age groups in 2017. The solid line plots raw means, while the dashed line plots regression-adjusted means that account for differences in the composition of gender, specialties, and geographic locations across cohorts. The regression-adjusted and raw means are broadly similar, though the regression-adjustment tends to increase earnings at younger ages and reduce them at older ages, reflecting differential gender and specialty compensation in older cohorts. The earnings profile is very steep. Physicians earn $50,000 to $60,000 on average in their twenties, while they are still in training. This escalates rapidly to an average of nearly $200,000 in their early thirties, and they reach their peak earnings of circa $400,000 at age 50. They start scaling back their work hours at age 60, but still continue earning close to $200,000 into their mid 70s. Given how our income measure is defined, this can include retirement income—not ideal when measuring contemporary earnings, but appropriate for considering physicians' cumulative economic returns.

Figure 1B shows the importance of administrative data for capturing this pattern, as the gap between administrative and survey data is especially large at the career peak. We discuss this difference further below.

Role of Business Income

Figure 1C illustrates the importance of business income for thinking about physician earnings. At the age-50 earnings peak, over one-quarter of average earnings come from business income. Business income plays a much more significant role from age 40 and onward, presumably after physicians have completed training and established or joined practices. Business earnings are less prevalent for younger physicians, many of whom may still be in training. This pattern is consistent with survey evidence from the American Medical

Association (AMA) that practice ownership rates of physicians aged 55 and older were nearly twice as high as among those under 40 (54.9% vs. 27.9% in 2016).[14] Finally, business income is responsible for driving the growth in income during the most productive years—age 40 to 60. The wage profile is nearly flat at around $280,000 throughout these earning years, while business income exhibits steady growth.

Top Earners among Physicians

The top echelons of physician earners present a particularly interesting case study for understanding the far right tail of the income distribution. Table 2 documents how the approximately 9,000 and 43,000 physicians in the top 1% and top 5% of the physicians' income distribution, respectively, differ from an average doctor. This table uses the cross-section of earnings in 2017 data. We note several key patterns. First, as with the income inequality in the general population, the income gradient is extremely steep at the top. The average earnings of the top one percent of physicians is $3.9 million *annually*, which is 12 times the average annual earnings in the sample and more than twice the average earnings in the top 5%.

Second, business income is crucial for the very top earners. 91% of physicians in the top 1% of earners report meaningful business income,[15] compared to 45% for an above-median doctor and 32% overall. The share of income coming from business income is also substantially higher among top earners. 78% of income is attributable to non-wage sources for physicians in the top 1%, while the share of business income is 36% for above-median, and 32% for average, doctors.

Even though they are on average almost four years older, physicians in the top 1% work four hours more per week than an average physician, although their work hours are similar or lower than among those in the next nine percentiles of the income distribution. Top earners are much more likely to be in high-paying specialties, such as neurosurgery (4% versus 1%), and much less likely to be in the lowest paying specialty—primary care—than an average physician (18% versus 44%). This is quite different from physicians' *average* income patterns, discussed next.

Overall, the evidence on the top earners among physicians is consistent with the evidence on the nature of top income in the general population documented by Smith et al. (2019a). The very top incomes are observed among highly trained physicians, who likely create a multiplier effect on their skill through earnings from skill-intensive firms during the prime of their careers.

[14] AMAs Physician Practice Benchmark Surveys, 2016.
[15] Here we say that individuals report business income if business income is at least $25,000.

Differences Between Administrative and Survey Data

We next estimate how incomes have changed over time, an exercise that also highlights the importance of our rich data. Figure 2A shows the time series of physicians' mean incomes reported in each year's ACS data. Since the ACS is an independent random sample each year, the ACS lines show a random cross section of workers who self-report as physicians in each year (subject to survey non-response). The black line on the graph shows our tax-based measure for these same respondents. The difference between these lines provides striking evidence of income underreporting in the ACS.

Panel B reports the time series for a different sample: physicians identified from the administrative NPPES data. Since this is a constant sample, each year's raw mean (the green line) comes from a distribution of physicians at different points in their careers. The black line uses a flexible regression to adjust for changes in age, gender, state, and specialty over time. So it can be interpreted as the mean income for a comparable physician over time. It grew from around $280,000 in 2005 to nearly $360,000 in 2017. This is notably different from the black line in Panel A—showing a random cross-section of physicians at each point—which is much flatter over this period. This is because physician characteristics changed over this period, with the ACS reporting more physicians on the declining part of the earnings curve.[16] Appendix A.4 explores these differences in detail.

Geography

Geographic variation in physician incomes appears unique relative to many other high human capital workers. The map in Figure 3 displays average earnings, adjusted for differences in physicians' ages, gender, and specialties across states. The map reveals that the highest average physician earnings are not in the states with the highest incomes for other workers, or highest costs of living or productivity.[17] Instead, average physician earnings are significantly higher in rural states, with notably higher earnings in the Great Plains and Texas. In 2017, an average physician earned in the high $300,000s per year in these areas. Physician earnings are average or even below the national average in many high-productivity, higher cost-of-living places, such as New York, Massachusetts, Maryland, and California.[18]

[16] Appendix Figure A.4 shows age kernel densities for 2005 and 2017. 2017 has more mass at ages 60 and above, and less mass during prime earning years from 40 to 60.

[17] The geographic variation in the earnings of lawyers found in Appendix Figure A.5 provides a useful benchmark. The pattern for lawyers follows general regional income differences: average lawyer earnings are highest on the coasts, plus Illinois and Texas. In contrast, nine of the ten states with physician earnings in the highest quintile have lawyer earnings in the bottom three quintiles. In other words, with the exception of Texas, the geographic variation in earnings of physicians is largely flipped relative to lawyers. Appendix Table A.2 reports both the raw means by state and occupation and the regression-adjusted values shown on the maps.

[18] We note that the averages here mask some important heterogeneity across the income distribution. As Table 2 shows, the very top earners among physicians are nearly twice as likely to be practicing in New York and Florida relative to an average

These facts could be explained by amenities or market power. Physicians could value the amenities value of coastal and other productive regions more than other workers do, leading them to accept lower wages in those places. An alternative story is that rural areas can't support as many physicians, leading to market power and higher incomes (Bresnahan and Reiss, 1991). While we do not aim to determine the causal influences of local characteristics on incomes, Figure 4 considers descriptive relationships.

Figure 4A examines the descriptive relationship between earnings and market concentration. We relate the (demographically-adjusted) geographic variation in physician earnings to a measure of local physician concentration. Our measure of concentration is the state-level Herfindahl-Hirschman Index (HHI) of physician Medicare revenues, taken from Clemens and Gottlieb (2017). We consider areas to be more concentrated if Medicare payment volume in an area only go to relatively few providers. We observe a pronounced positive relationship between this measure of market concentration and physician income. A one standard deviation higher HHI (8.7 percentage points) is associated with $10,000 higher earnings (0.3 standard deviations).

More concentrated areas in the middle of the country also tend to have smaller Medicaid patient populations. Medicaid is notorious for offering low physician payment rates per patient, so a higher share of Medicaid patients could reduce local physicians' potential revenue. That said, it is not obvious how Medicaid share impacts physician compensation in equilibrium. Physicians have no obligation to treat Medicaid patients. They can respond to low Medicaid rates by reducing the number of Medicaid patients they treat, and by changing the location, quantity, or nature of care they provide. In the extreme, local physician entry could also respond to Medicaid policy, leading to subtle interactions with market power.

These caveats aside, Figure 4B shows the relationship between the Medicaid population share and physician earnings. We find that a one standard deviation higher share of Medicaid (5 percentage points) is associated with $10,500 lower annual physician income. This descriptive relationship points to a potentially major role for government policy to shift physician earnings. The next section considers this in detail.

4 How Much Does the Government Influence Physician Earnings?

We have documented physicians' earnings and places in the income distribution. We now ask how much government spending on healthcare—one-fifth of which is purportedly for physician and clinical services (NHE)—affects physician incomes on the margin. Given the government's enormous role in the healthcare system, many administrative and statutory policies aim to influence where government resources end up.

doctor.

Efforts to direct resources to particular areas, or particular types of care, are often motivated—at least rhetorically—as rewarding the affected physicians or creating incentives to encourage the desired medical care. The economics and medical literatures study many consequences of these policies, but have generally had to do so without evidence on their initial target: physicians' earnings.

The impact of policy on earnings is unclear, as the complex legal and employment structures in healthcare could absorb many of these payments. Indeed, the rent-sharing elasticity in other labor economics contexts tends to be quite low (Card et al., 2018). Physician practices have other costs, such as the much-maligned costs of billing and administration (Dunn et al., 2020). If the supply of care responds to payment rates (Clemens and Gottlieb, 2014), and marginal costs are increasing, then the associated variable costs could absorb much of the marginal revenue.

Our data enable us to estimate the effects of these many policies on physician incomes, a major part of the top of the income distribution—and a foundational fact for many other research questions. Even for policies specifically targeting physician payments, the direct effects are not obvious. Insurance reimbursements generally go to physicians' employers, not to the doctors' own bank accounts. Different employment contracts and labor market structures could mediate the incidence of these payments. For even more indirect policies, such as changes in public payments to insurers, it is even less clear whether physicians are likely to benefit. While there are many such policies we could examine, we focus on two with plausible direct and indirect impacts on physicians. We specifically consider one change in reimbursement rates and one in upstream insurance payments.

4.1 Price Changes

We first examine a policy that directly changed payments for physician services by adjusting public insurance program reimbursements. We take advantage of a federally mandated increase in Medicaid fees for primary care services that was implemented as part of the Affordable Care Act (ACA). States were required to increase their Medicaid reimbursement rates for some types of primary care services to achieve parity with Medicare rates. Alexander and Schnell (2019) and Polsky et al. (2015) examined the effect of this policy change on the propensity of providers to see new Medicaid patients, finding that increased Medicaid payments decreased the reports of being turned away by providers and improved self-reported health.

We examine how much the increase in Medicaid payments to primary care physicians (PCP) increased their incomes relative to physicians in our "Medicine Subspecialty" category. These are specialist physicians who completed an internal medicine residency plus a fellowship (e.g. cardiologists, endocrinologists, gastroenterologists, etc.). Like PCPs, they do not typically perform procedures, but primarily see their patients in their offices. Specialist physicians were generally not affected by this reimbursement change, though there are some limited exceptions.[19] To measure how much PCPs' incomes changed in response to the fee bump, we estimate the following event study specification:

$$\ln(y_{ist}) = \left[\sum_{t \neq 2012} \beta_t \times \mathbb{1}_t \times PCP_i \right] + \gamma PCP_i + \delta_t + \lambda_s + \theta^{PCP}_{a(i,t)} + \theta^{-PCP}_{a(i,t)} + \epsilon_{ist} \tag{1}$$

where y_{ist} is the income of physician i in year t and state s, while δ_t, λ_s, are year, and state fixed effects, respectively.[20] We include separate age fixed effects for PCPs and non-PCPs, denoted $\theta^{PCP}_{a(i,t)}$ and $\theta^{-PCP}_{a(i,t)}$, respectively. The coefficients of interest β_t interact the year indicators $\mathbb{1}_t$ with an indicator for being a PCP (PCP_i). Standard errors are clustered at the state level. We include states that had a sharp change in reimbursement rates in 2013 and exclude nine states that either didn't change the reimbursement or had reimbursement changes prior to 2013.[21]

Figure 5 plots coefficients $\hat{\beta}_t$ on the interaction between the PCP indicator and year effects. These coefficients can be interpreted as the percentage differences between PCPs' and specialists' incomes in the same state and year, relative to the difference in 2012. We observe that incomes of PCPs and specialists were on a similar trend prior to the change in fees, lending credence to the identifying assumption that PCPs and specialists would have had parallel income trends in the absence of the fee reform. Under this identifying assumption, our estimates suggest that the increase in Medicaid reimbursement for PCP patient office visits generated a 4-5% increase in incomes of primary care physicians. The average primary care physician in the affected states earned \$259,000 in 2012, while federal expenditure in these states was \$24,170 per primary care physician in 2014, which corresponds to 9.3% of their overall pre-implementation earnings.[22] So a 4-5% increase in their earnings implies a pass-through rate of 43% to 54% from extra Medicaid fees to physicians' earnings.

Federal reimbursements can clearly shape physician incomes. We now explicitly consider their ability to influence who is at the top of the income distribution. Recall from Section 3 that 27 percent of physicians

[19] Minor exceptions include some specialists who primarily provide primary care services (Tollen, 2015).

[20] The income measure for this analysis incorporates an attempt to remove capital gains from the physician's professional earnings since, while capital gains may be part of the physician's long-run return to practicing medicine, they are unlikely to be realized in the same year that the relevant income is actually earned. Appendix A.3 describes the empirical approach.

[21] Excluded states are: Arkansas, Delaware, the District of Columbia, Minnesota, Mississippi, Montana, North Dakota, Oklahoma, and South Dakota. We obtain each state's time pattern of Medicaid reimbursements from Alexander and Schnell (2019, Figure A.2).

[22] Federal expenditure by state is obtained from the Medicaid Budget and Expenditure System expenditure reports for 2013 to 2017. https://www.medicaid.gov/medicaid/financial-management/state-expenditure-reporting-for-medicaid-chip/expenditure-reports-mbescbes/index.html

are in the top percentile of income earners, with the bulk of the remainder in the next 4 percentiles. Figure 8 shows the time series of the top percentile share for PCPs, along with their mean incomes over time.[23] Before 2020 around 10 percent of PCPs were in the top percentile, and this figure increased as high as 16 percent during the Great Recession. To estimate how much the change in Medicaid reimbursement improved PCPs' relative standing in the income distribution, we run a version of our event study regression (1), but replacing the dependent variable with an indicator for whether a physician-year observation is in the top 1 percent of tax units by AGI. The estimated coefficient on Post-Policy$_t \times PCP_i$ is 0.017 with a standard error of 0.0022. So primary care physicians are 1.7 percentage points more likely, or 12 percent of the baseline, to be in the top 1 percent of income earners after the increase in reimbursements.[24]

In summary, it is clear that physician reimbursement policies can have profound effects on doctors' earnings and the structure of top incomes.

4.2 Heterogeneity: Whose Earnings Does Government Influence?

Our finding differs from the modest level of firm rent sharing found in response to many other shocks reviewed by Card et al. (2018). But the institutional setting of physician care is quite different than that in the broader rent-sharing literature. Our setting features payments for specific professional services, often provided by small firms whose output is not very diversified. Physicians are also high earners, perhaps more similar to those who benefit from patent rents (Kline et al., 2019).

To unpack why we find such dramatic sharing, we examine which physicians' earnings are most responsive to government payment changes. In Figure 6, we use the same variation from the PCP fee bump to examine how organizational structure and market power mediate the income response.[25]

In Panel A we split our physician sample into two categories—those are are employed directly by the government (e.g. the VA system) and those working for private employers. As the tax data do not allow us to classify firms as government or non-government entities, we use our ACS sample of doctors and ACS records of being a government employee for this analysis. We observe that government policy is affecting income of physicians who are not directly working for the government (88% of our sample are not), but are practicing in private businesses. The government doesn't appear to adjust income of physicians working for the government—at least in the short run—even though income of their counterparts working privately

[23] This income series has been regression-adjusted for age, state, and sex, in order to show incomes for a comparable physician over time.

[24] This calculation is subject to even more caveats than the usual ones, as we are not taking into account how percentiles of the underlying national distribution may shift when incomes of one group change.

[25] Appendix Table A.3 shows how various physician employment characteristics relate to doctors' positions in the income distribution at baseline.

increases.

In Panel B we again use the ACS sample to classify individuals based on reports of self-employment status.[26] We see that the increase in earnings was largest among the self-employed primary care physicians, who presumably did not have to share the fee bump with as much organizational overhead or other physicians. Incomes of self-employed PCPs went up by nearly 10%, compared with 3% for all other PCPs. This result is particularly striking since self-employed physicians with an incorporated practice have the option of re-investing in their practices. The fact that we see their personal incomes responding more strongly than for employed physicians implies that the true economic pass-through dominates any reinvestment difference. If there is some reinvestment, we could be underestimating the true incidence. Ultimately, this result means that self-employed physicians bear much of the incidence of a marginal dollar of healthcare payments. But this incidence falls elsewhere under other organizational forms.

Panel C highlights the role of risk-sharing and overhead costs from a different perspective. Here, we divide physicians into four categories, depending on the size of the firm in which their work and the share of physicians of the same specialty category within that firm. The firm is defined as the EIN listed on a physician's W-2. We consider a firm to be small if it has fewer than 5 physicians. For each physician we then compute the proportion of physicians in his or her EIN that have the same specialty category. We consider physicians to be in a diversified firm if they are at above the median of the distribution of specialty shares within their specialty category-year. We observe that government dollars to PCPs have the highest impact on earnings of PCPs who are working in small and less diversified firms. While being in larger and more diversified firms means that less is passed-through to physicians' incomes when government procurement rates increase, it presumably also implies less pass-through when rates decrease. As more policy proposals suggest cuts in public reimbursement rates, one reason for the observed trend towards bigger and more diversified physician practices (Welch et al., 2013) could be the desire to reduce income risk from changes in government payments.

In Panel D, we divide physicians into three groups by the value of HHI based on Medicare revenue, computed at the specialty-county level. The results suggest no pronounced role for market power in this case. This contrasts with the importance of HHI in mediating Medicare's pass-though into private insurance prices (Clemens and Gottlieb, 2017). Medicare rates are often used as the benchmark for private insurance negotiations (Clemens et al., 2017), whereas the Medicaid rates adjusted here are not, which could explain

[26] While we observe which tax forms individuals file, the tax data do not report the legal or contractual structure of the practice. So we cannot determine administratively if someone bares the full financial risk from increase or decrease in government payments. Hence, we use ACS report of self-employment as a more accurate measure of the object we are trying to capture.

the difference.

In short, the pass-through effects are not driven by physicians with direct government employment, but are concentrated among those in private businesses. They are stronger among the self-employed, among those in smaller firms, and among those in firms with less diversification across specialties. This supports the idea that direct payments for individuals' professional services are shared differently than other sorts of rents. As a result, government payors who determine these payments have a fine-grained ability to affect the top of the income distribution.

4.3 Changes in Upstream Funding

We next consider whether physician incomes change in response to changes in public payments to insurers. We examine this question in the context of the 2000 Benefits Improvement and Protection Act (BIPA) policy change that increased payments to Medicare Advantage (MA) plans in some areas of the country. MA plans are a privately run insurance option for Medicare beneficiaries. Individuals that become eligible for Medicare when they turn 65 may choose to opt out of the traditional fee-for-service Medicare program and instead purchase a subsidized managed care plan, known as MA. The federal government makes annual risk-adjusted payments to MA plans for each Medicare beneficiary who chooses to purchase such plans. These payments vary across counties and are computed based on a formula that takes into account the level of spending in the fee-for-service version of Medicare in the county. In March 2001, BIPA imposed two payment floors (one which applied uniformly to urban counties and one which applied uniformly to rural counties) for payments from Medicare to MA insurers. Whether a county was below the payment floor prior to BIPA, and how far below, generates variation in whether MA plans in the county received any additional funds from Medicare. We use this variation in exposure across counties to examine whether paying MA plans more lead to increases in physician incomes.

We follow the empirical strategy of Cabral et al. (2018), who examined how much of the extra BIPA payments to MA plans were passed through to Medicare beneficiaries. Cabral et al. (2018) find that about 46% of the payments were not passed through to consumers. Conceptually, these payments could either accrue to insurers profits or be passed through by insurers downstream to medical providers. Using our data on physician incomes we test whether any such pass-through to medical providers took place.

The empirical strategy relies on the comparison of changes in physician incomes before and after BIPA's implementation in counties where the MA payment floor was binding to those where it was not binding.

Following Cabral et al. (2018), we estimate the following event study specification:

$$
\begin{aligned}
y_{jt} = \alpha_j + \alpha_t + \left[\sum_{t\neq 2000} \beta_t \times \mathbb{1}_t \times \Delta b_{jt}\right] + \left[\sum_{t=1999}^{2003} \gamma_t \times \mathbb{1}_t \times \Delta b_{jt}^{98}\right] + \left[\sum_{t=1998}^{2003} \mu_t \times \mathbb{1}_t \times \Delta p_{jt}\right] \\
+ \left[\sum_{q=1}^{3} \sum_{t=1998}^{2003} \eta_t \times \mathbb{1}_t \times I_j^q\right] + \theta_1 \Delta b_{jt} + \theta_2 b_{jt}^{98} + \theta_3 \Delta p_{jt} + \theta_4 I_j^q + \epsilon_{jt}
\end{aligned}
\tag{2}
$$

where y_{jt} is the county j by year t average physician income, α_j and α_t are county and year fixed effects, Δb_{jt} is the annualized distance of county j in year t from the relevant BIPA floor (from Cabral et al., 2018) multiplied by the average number of MA enrollees per physician in the county, Δb_{jt}^{98} is analogous to the first distance-to-floor variable, except it is the distance to the payment floor implemented in 1998 (following the Balanced Budget Act of 1997), Δp_{jt} is defined as the difference between the 2% minimum payment update and the actual update in 2000,[27] I_j^q is an indicator for if county j was in quartile q of the base payment in year 2000, which is interacted with year indicators I_t and ϵ_{jt} is the error term. The regression is weighted by the number of eligible Medicare beneficiaries in each county in year 2000. As in Cabral et al., the identifying assumption necessary for the causal interpretation of our results in that in the absence of BIPA, and conditional on a set of controls for other payment reforms that took place before BIPA, outcomes of counties that were deferentially affected by BIPA would have evolved in parallel over time.

Figure 7 reports the results of this event study analysis, plotting the estimated $\hat{\beta}_t$ coefficients. Our estimates are noisy, but perhaps somewhat informative. The point estimates suggest that a \$1 increase in annual BIPA payments for MA patients of an average physician, leads to about a 20 cent increase in that physician's income, although we cannot exclude a pass-through as low as zero or as high as 40%. Given that Cabral et al. estimate that 46 cents are on the table for insurers and physicians to split, our point estimates would imply that physicians may be able to capture about 40% of the money on the table.

Taking these two strategies together, it is clear that much of direct reimbursement changes passes through to physicians' personal earnings. The impact of upstream While the evidence on the pass-through of upstream payments is more suggestive than our findings on the change in direct procurement rates in the previous section, we can nevertheless conclude that changes in public payments to upstream insurers have the potential to alter physicians' earnings.

[27] This is to control for a payment increase that was implemented in some counties if, in 2000, the blended rate was higher than a 2% increase over the 1999 rate. Note that p_{jt} is interacted with year indicators for years 2000 onward.

4.4 Is Health Policy More Powerful than Tax Changes?

We have shown that government healthcare payments can shape physician earnings. Given physicians' prominence at the top of the income distribution, it follows that such changes in government procurement mechanisms could have a significant influence on the shape of this distribution. In this subsection, we compare the power of health care policy to affect top incomes with that of tax policy—the domain that commands most policy attention in discussions of income inequality.

While tax rate changes can affect the full income distribution (Scheuer and Slemrod, 2019) most estimates of the elasticity of taxable income rely on partial equilibrium approaches. This is appropriate in our setting, since our estimates also rely on partial equilibrium logic, comparing across specialties. Long-run and general equilibrium effects could surely yield different patterns for physician income changes. Using an income tax elasticity ϵ from the literature, we can find the tax rate τ_1 that would generate an increase of Δy in log physician earnings using the formula:[28]

$$\tau_1 = 1 - \exp\left(\frac{\Delta y}{\epsilon} + \ln(1 - \tau_0)\right). \tag{3}$$

Table 3 shows the tax changes that would be needed to generate effects comparable to that of the primary care fee bump. The changes needed would be dramatic: larger than those generated by the Tax Cut and Jobs Act of 2017, which lowered the top federal income tax rate from 39.6 to 37 percent; by the Affordable Care Act of 2009, which increased the Medicare payroll tax on high earners by 0.9 percentage points; and by the Economic Growth and Tax Relief Reconciliation Act of 2001, which lowered the top rate from 39.6 to 35 percent.

Compared with tax policy, health care payments are a powerful tool for shaping the top of the income distribution. Along some margins, changes in healthcare spending directly affect physician earnings. But this does not imply that widespread use of this power is costless. To evaluate the scope for government to reduce physician earnings, we next consider the return to practicing medicine, and to different specialties, relative to a plausible outside option.

[28] Equation (3) follows immediately from the definition of the elasticity of taxable income. To see this, simply solve equation (3) for Δy.

5 How Do Physician Earnings Compare to Outside Options?

We have documented physicians' prominence near the top of the income distribution, and the government's ability to influence their earnings. This might suggest that policymakers could reduce inequality and cut health spending by lowering physician pay. Any serious evaluation of such proposals would need to consider costs of such a policy alongside its potential benefits. These costs are potentially serious: lowering reimbursements can reduce physicians' investments and patients' access to care (Alexander and Schnell, 2019; Clemens et al., 2020). It can ultimately affect physicians' location and specialization decisions, and the quality of physicians (Nicholson and Souleles, 2001; Lockwood et al., 2017).

Given these many considerations, we do not attempt to conduct a welfare analysis nor to estimate optimal payment rates. Instead, we simply measure the distance between physicians' incomes and plausible outside options. Under the assumption that occupational choice exhibits a positive labor supply—a proposition for which we find suggestive evidence—this distance provides a loose upper bound of how much policy could realistically reduce incomes.

We first compute the distributions of physicians' and lawyers' earnings, providing a sense of how physicians overall earn relative to another high-skilled profession. An average physician earns a premium relative to the average lawyer that is around one-sixth of physician earnings. Among primary care physicians there is no premium relative to lawyers. So the premium must emerge from other specialties, which we investigate in section 5.2. We consider relative earnings and physicians' specialty choice. These analyses take seriously physicians' long training periods and work hours. We estimate specialties' average earnings conditional on these job characteristics (which we take as given). We then use these exercises to loosely quantify the potential savings from lowering some specialties' incomes.

But these averages are not magic numbers; there is no reason to think that payment reductions to exactly those that can be explained by average job characteristics would be innocuous, or larger ones devastating. Labor supply is likely to be reasonably continuous in practice.

5.1 Career Patterns for Physicians and Lawyers

Age Profile of Earnings and Work Hours

We first compare physicians writ large with lawyers. We choose this comparison because law is also a profession with high human capital investments, expensive specialized training, and licensure requirements. Law schools require accreditation of the professional society and graduates have to pass state exams to practice. At the same time, lawyers face lower barriers to entry into the occupation, so it seems plausible that most people who become a physician could have become a lawyer. In some states, such as California, individuals do not need to attend a law school to take the bar exam. Anecdotally, there is no shortage of law school spots. There is no analogue to limited residency slots. In contrast, limits to medical school accreditation and the restricted number of Medicare-funded residency slots are frequently cited as entry barriers that allow physicians to earn rents.[29] Since entry into law is less restricted—though by no means completely free—the comparison of incomes between physicians and lawyers can give us an initial sense of how much physicians' incomes exceed a plausible alternative.

As is intuitive given the longer training requirements, we observe, in Panel A of Figure 9, that physicians earn slightly less than lawyers while they are 25 to 30 years old. Physicians' income, however, increases much more rapidly than that of lawyers over the course of their 30s and 40s. At age 40, average physicians already earn more than $150,000 more than average lawyers. The gap in earnings persists into the beginning of retirement years. At the same time, physicians consistently work more hours throughout their careers, as we see in Panel B of Figure 9. The gap in hours is the largest during the ages when physicians are in residency—physicians work ten to twelve hours more than lawyers—and converges to about five more work hours per week throughout the rest of the career.

Present Discounted Value of Earnings

These dramatic lifecycle patterns mean that simple comparisons of mean earnings between working physicians and working lawyers omit key differences. The long training required to become a physician means that the subsequent high earnings are not realized for many years, implying a lower discounted value. The significant variation in physicians' incomes that we documented in section 3 also countenances caution when considering only the income distribution's first moment.

To paint a richer picture of the financial return to practicing medicine and law, we use the panel dimension of our data to estimate the distribution of total career earnings.[30] Panels C and D of Figure 9 report the simulated distributions of present discounted value (PDV) of income for 20-year-olds who will become physicians or lawyers. Panel C uses a 3% discount rate and Panel D a 5% rate. Four facts are apparent from these panels. First, for both discount factors, we estimate a significant amount of dispersion in earnings over the career. With 3% discounting, we estimate that the average present discounted value of earnings

[29]Empirical evidence on the role of these entry barriers is scant. Our investigation of Medicare-funded residency slots, for example, suggests that numerous hospitals offer many more residency slots than the number of residencies formally funded through Medicare's direct graduate medical education funds.

[30]Section 2.4 describes our methods.

for physicians is \$9.6 million. The analogous estimate for lawyers is \$6.7 million. Physicians' mean of \$9.6 million is equivalent to an annuity payment of \$360,000 for 51 years at a 3% interest rate.

Second, physicians have limited downside risk, with the 25th percentile at around \$6 million and 75th percentile at around \$12 million. The bottom 5% of simulated physicians still earn nearly \$4 million over their careers. Only about 6% of physicians in our data have expected income under \$4 million, while more than a third of physicians exceed \$10 million. Third, the distribution has a long right tail. The top 1-2% of physicians earn substantially more than the median physician—around \$24 million at the top versus \$8 million at the median.

Finally, the choice of the discount factor matters for both the levels and the distribution of earnings. At a higher discount rate of 5% (Panel D) the average present discounted value of earnings is \$5.9 million for physicians (and \$4.2 million for lawyers) and the right tail of the distribution is substantially compressed, since the high earnings at older ages are more heavily discounted.

Against these discounted earnings we must count the cost of training. We have assembled data on the cost of undergraduate and professional education for physicians and lawyers from the Association of American Medical Colleges and the American Bar Association, respectively. From these data we estimate that the average cost of undergraduate and graduate tuition is \$207,000 for physicians and \$165,000 for lawyers.[31] The difference between the occupations is primarily because law school is one year shorter than medical school. Once we account for this \$42,000 tuition difference, physicians earn 44% more over their lifetime than lawyers (Table 4).[32]

Table 4 presents a similar exercise for primary care physicians. We estimate that they earn \$6.1 million in present discounted value terms (at 3% discounting) over the course of their careers. So medical school tuition, and any associated debt, naturally presents a bigger burden for them. According for the same (rather extreme) potential debt we compute in footnote 32, the total cost is 3.3% of lifetime earnings. Thus, average PCPs earn slightly less than lawyers—about half a million dollars less over their careers—and pay about a percentage point more for their training. Nevertheless, even for PCPs average tuition accounts for a modest

[31] These numbers correspond to 2% of average lifetime earnings for physicians and 2.5% for lawyers. Even if we inflate them to account for borrowing costs (see footnote 32), it is clear that medical school tuition is not comparable in magnitude to the lifetime earnings that it enables.

[32] To make the calculation as conservative as possible, we can also consider borrowing costs. It is not obvious that these should matter—after all, future debt payments should be discounted. But, for argument's sake, suppose students have to pay a risk premium and their pure rate of time preference is zero. Medical students might borrow an extra \$100,000 relative to lawyers to cover the additional year of schooling (tuition of \$42,000 and approximately \$50,000 for living expenses) (Stanford, 2020). Suppose students borrow this at an average interest rate of 6.6% for 10 years (Bhole, 2017). This results in total (undiscounted) debt payment of \$136,920 over 10 years. Assuming a 40% marginal tax rate, but ignoring any beneficial tax treatment of student loans, physicians would need to earn \$228,200 in undiscounted income to repay this extra loan. Even under this extremely conservative calculation, the extra debt constitutes only 8% of the extra \$2.8 million in discounted income that an average physician earns relative to an average lawyer.

share of earnings. This casts doubt on the importance of efforts to reduce or eliminate tuition for medical education (Supiano, 2018) for an average physician.

We next consider differences in working hours. We include a premium for hours beyond a 40 hour work week,given that labor supply slopes up and the skilled labor market offers a premium for working long hours (Goldin, 2014). We estimate that if physicians and lawyers had the same base hourly income, physicians would earn 19% more based purely on the difference in hours. This leaves a 25% difference in earnings attributable to forces other than time in training and hours. In other words, our estimates suggest that with 3% discounting of later-career earnings, if physicians earn 144 cents for every 100 cents earned by lawyers, a maximum of 25 cents of these extra earnings are possibly attributable to economic rents.[33] For primary care physicians, we find lower income and longer work hours than average attorneys.

We use these estimates in section 5.3 to quantify plausible savings from hypothetical reductions in physician incomes.

5.2 Specialties

We delve further into earnings differences across medical specialties. Panel A of Figure 10 revisits the variation in annual earnings across nine specialty categories in 2017, but now we report peak annual earnings at age 45–50. Primary care is the most common specialty category, accounting for 44% of our sample. It includes physicians specializing in primary care, family medicine, pediatrics, and general internal medicine. Physicians in this category have the lowest peak annual income, earning an average of $283,700 at ages 45–50. Surgeons and procedure-based internists, who account for 15% of our sample, are the highest-earning categories, with peak annual incomes of about $660,000.

Panel B of Figure 10 illustrates the age profile of earnings for the highest and lowest earning specific specialties. Using more granular definition of specialties—Medicare specialty codes—we find that the lowest earning specialty is family practice, while the highest earning specialty—and one of the rarest—is neurosurgery. The difference between the age profiles for the two specialties is striking. After completing training, family practice physicians' incomes remain fairly stable at about $250,000–$260,000 throughout their careers. For neurosurgeons, the age profile is much steeper: Income grows rapidly from under $200,000 at ages 30–35 to nearly $1,000,000 in annual earnings at age 50, and then falls rapidly to about $500,000 at age 65. As Table 2 documents, neurosurgeons are four times more prevalent among the top 1% of physicians than

[33] A higher discount rate may better reflect the decision-making of undergraduates or recent college graduates choosing a career. With 5% discounting, we estimate that discounted earnings average $5.9 million for physicians' and $4.2 million for lawyers. This scenario suggests that physicians earn 141 cents for every 100 cents earned by lawyers, and a maximum of 23 cents of these extra earnings are not explained by simple labor market fundamentals.

among physicians overall. The reverse is true for family practice physicians, who comprise 3.7% of physicians in the top 1%, but 14% of physicians overall. Even at the end of their active careers, neurosurgeons sustain income that is nearly double that of family practice physicians during the latter's peak earning years. In proportional terms, the share of business income between neurosurgeons and family practice physicians is similar and accounts for about 25% of total earnings. In fact, while neurosurgeons are more commonly observed in the top echelon of earners, the share of their income from business sources is close to the average for the whole profession. Remarkably, a significant fraction of earnings at age 70 still comes from wage income (around $300,000 on average), strongly suggesting that they are still actively working and their income doesn't reflect only practice ownership. The example of neurosurgeons highlights that there are two types of physicians in the top earning echelons: those who command high wage income throughout their careers and those whose high earnings come from business ownership.

When we dig into specialties, the data quickly become too thin to conduct full lifecycle simulations. So we instead conduct reduced form comparisons of earnings against job characteristics. Figure 11 shows these exercises. In Panel A we observe a very strong relationship between specialty incomes and the average number of years in training each specialty requires. Although training is largely standardized within a specialty, some variation does exist across programs and across individuals. So to systematically determine each specialty's actual training length, we develop a method to estimate it empirically using the tax data.[34] We observe a very strong correlation between the duration of training and income. Each extra year of training between four and seven years corresponds to about $200,000 in extra annual income.

Panel B looks at the return to working time. This panel takes average self-reported hours worked from the ACS. We find a substantial return to working time: specialties in which physicians report a higher weekly hour load have higher incomes, with ten extra hours a week adding about $200,000 in income. Two notable outliers well above the regression line are procedural subspecialties of internal medicine, and radiology.

These plots help us gauge the plausibility that high incomes reflect returns to labor market fundamentals, as opposed to rents due to entry restrictions. To examine this, consider the variation in income that we observe across specialties along the regression lines in Figure 11. Cardiac surgeons, who have the longest training duration of more than seven years, train three years more than family practice physicians, earning an average of $332,000 more annually afterwards. Panel B allows a similar analysis with hours of work. Cardiac surgeons work an average of 13 hours per week more than anesthesiologists, and earn about $170,000 more

[34] To do this, we look at the sample of physicians who we see during the ages of residency and fellowship. We then examine their income patterns during that time to identify the years in which they start and finish residency and any fellowship. This allows us to determine each specialty's average length of training. See Appendix A.2 for more details.

in annual income. This amounts to $250 in hourly income for 676 extra annual hours of work—with those incremental hours coming on top of a 52-hour work week for the anesthesiologists. This premium hourly rate is twice that of the $130 per hour that anesthesiologists earn for their 52-hour work weeks and four times what family practice physicians earn per hour for their 48-hour weeks.

If these are the equilibrium returns on investments and equilibrium prices of work hours under 40 and over 40 per week, then specialties that we observe to be far from the regression lines in Panel A and B are either paid compensating differentials (positive or negative) for particular characteristics of their job (such as differences in flexibility, time on call, liability potential, etc.) or are earning economic rents. For example, we observe that both dermatologists and neurosurgeons earn about $200,000 above the regression line with respect to length of training; it is conceivable that rents are more likely to be the explanation in dermatology, while compensating differentials as well as rents may be important in neurosurgery. In terms of hours of work, we observe a pattern consistent with a lot of popular reports on physician payments—primary care and OB/Gyn physicians are paid less per hour, while procedural specialties are paid significantly more for the same number of hours worked.

One way to gauge whether earnings above the regression line are likely to be compensating differentials is to examine labor supply given the bundle of earnings, training, and hours that each specialty offers. The centralized way that medicine allocates residency and fellowship slots generates a natural measure of this labor supply: the share of domestic medical students who match to each specialty. Residency and fellowship programs generally prefer domestic applicants to foreign graduates. So the share of domestic students in a given specialty is a metric of how attractive the specialty is to physicians.

Figure 12 show how this share relates to the part of specialty earnings not captured by fundamentals. We residualize both the share of U.S.-trained physicians and specialty mean (log) income with respect to training duration and work hours. We then plot the residualized U.S. share against residualized income. We observe a clear upward slope, with an elasticity of 0.3. This suggests that income above the regression lines in Figure 11 is indeed (at least to some extent) an attractive feature of a specialty, rather than a compensating differential.

Naturally, hours worked and years of training are by themselves equilibrium objects that may reflect differences in market power (and hence barriers to entry) across specialties. Alternatively, they may be important screening mechanisms for allocating individuals with different ability to different specialties, so that the variation in earnings reflects the variation in returns to ability rather than labor market fundamentals.

5.3 Quantifying Potential Savings

If physician labor supply is upward sloping, then exploiting the government's ability to reduce incomes may come at a cost. We now aim to quantify the health care cost savings that would arise from plausible changes in physician incomes. In doing this, we are cognizant that excessive cuts would in reality likely affect physician labor supply. For instance, Figure 12 clearly suggests that physician specialty choice may respond to earnings, conditional on job characteristics. A survey by Nicholson and Souleles (2001) found a similar result among medical students choosing their specialty. Further, on the extensive margin, young individuals may choose a different occupation instead of becoming physicians if being a doctor becomes less attractive.[35]

We consider several different versions of hypothetical physician income cuts, and compute the amount that could be saved with each approach. First, based on the aggregate difference with lawyers from section 5.1 we consider a cut in all physicians' incomes by 20 percent, so their lifetime earnings equal those of lawyers. This dramatic cut would save $59 billion, or under 2 percent of national health expenditures.

More targeted cuts of course yield smaller savings. Consider the regression of specialty-level earnings on average working hours and length of training. If we were to eliminate all positive residuals from this regression—i.e. move all physicians earning more than the regression predicts down to the regression line—incomes would fall by $23 billion, or 0.7 percent of national health expenditures. The four so-called "ROAD" specialties—radiology, ophthalmology, anesthesiology, and dermatology—are salient examples of those with high earnings relative to what the job amenities would predict. If these four specialties had incomes cut to primary care levels, aggregate physician earnings would fall by $19 billion, or 0.6 percent of national health expenditures.

We next compare U.S. physicians' earnings to those in Europe. We start with Sweden, where physicians are directly employed by the government. Reducing U.S. physicians' incomes to the *levels* of physicians' incomes in Sweden would require lowering the average to $95,000 (Chen et al., 2020).[36] All else equal, this would reduce earnings by $200 billion, or 5% of national healthcare expenditures. But this dramatic hypothetical is implausible in the U.S. While U.S. physicians clearly earn more than their counterparts in Sweden in absolute terms, their position in their respective national income distribution is not nearly as different. Using Swedish administrative earning records, Chen et al. (2020) found that 10% of physicians are

[35]Evidence from outside of the U.S. suggests that the extensive margin is important. For example, (Chen et al., 2020) find that in Sweden, among high school students who do not gain a randomized admission to a medical school on their first application attempt, 40% go on to pursue a different (usually similarly high-status) occupation instead of delaying their careers while attempting to apply to medical school again. Our evidence in Section 5.1 that shows the similar financial attractiveness of pursuing a career in law to primary care implicitly supports the idea that the extensive margin may be similarly elastic in the U.S.

[36]This is an AGI-like measure taken from individual-level tax data.

in the top two and 42% of physicians are in the top five percentiles of the Swedish income distribution. Thus Swedish physicians resemble U.S. primary care doctors (see Figure A.2, Panel A). Reducing all U.S. physicians to the PCP average would imply savings of $90 billion. This would yield similar incomes to Germany, where physician earnings average around $220,000 (Korzilius, 2017). Germany's healthcare market is somewhat more similar to the U.S.,[37] so may be a more plausible comparison of levels. While these two comparisons are certainly arbitrary, their implication is similar to those from the comparison with lawyers—primary care physicians in the U.S. appear to already be at the outside option. Therefore, any plausible cuts to physician incomes would have to come from higher paid specialists, whose earnings, as we discussed above, largely—though not fully—look like compensating differentials for labor market fundamentals.

We draw three conclusions from these quantification exercises. First, physicians earn more than lawyers, but the outside option is quite lucrative. Comparisons of physician earnings in the U.S. to other OECD countries miss the point that U.S. physicians could alternatively have been other high-skilled professionals, who also command high incomes. This limits the plausible savings from reducing incomes across the board. Second, across-the-board reductions neglect important differences across specialties. Primary care physicians' incomes are already similar to lawyers. Many other differences across specialties are explained by training and work hours. Once we focus on additional premiums not explained by fundamentals, the amount of money at stake is significantly lower. A more rigorous analysis of these hypothetical changes would require a credible estimate of physicians' aggregate labor supply, including the extensive margin, and incorporating quality differences (Lockwood et al., 2017) to determine an optimal target for physician labor of different types. The groundwork laid here, and data we make available, should facilitate future such analyses. The message of this section, however, is one of caution: While the government does have the ability to shape top earnings, plausible savings from using this power appear limited.

6 Conclusion

This paper uses a novel administrative data linkage to describe earnings among the universe of U.S. physicians, an occupation key to understanding health spending. The care physicians bill for commands at least one-fifth of healthcare resources, while their personal incomes comprise 8% of U.S. healthcare spending. Beyond their central role in healthcare decisions, physicians are the most common occupation in the top percentile of the U.S. income distribution. Indeed more than half of all physicians' households can be found

[37] German physicians regularly operate private practices and (collectively) negotiate reimbursement rates with insurers.

in the top two percentiles of the national income distribution.

We find that government decisions of how to value physicians' care plays a central role in defining incomes of these textbook human capitalists. We estimate that around half of marginal payments for physician care passes through to physicians' earnings.

But attractive outside options and elastic labor supply likely constrain governments' ability to cut physician earnings in practice. We find that physicians earn \$9.6 million on average over the course of their careers (about 2 percent of which is spent on tuition), which is equivalent to a \$360,000 annuity. This is \$2.9 million more than an average lawyer, but it varies dramatically by specialty. Physicians in the lowest paid, but most common, medical specialty—primary care—earn on par with lawyers, suggesting limited scope for reductions in earnings for nearly half of all physicians. Labor supply fundamentals can in turn explain much of the variation in earnings across specialties, although a generous estimate suggests that reductions of around \$20 billion, or around 0.5 percent of national healthcare expenditures, could be plausible.

Overall, we conclude that the government possesses a unique mechanism for altering the top of the income distribution that is more direct than taxes. But labor market mechanisms play an important role in mediating this influence.

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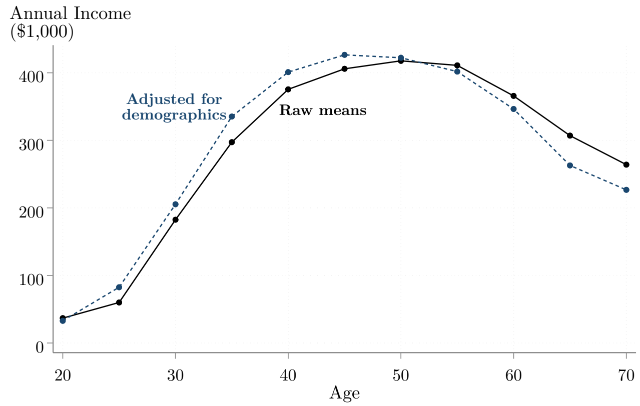
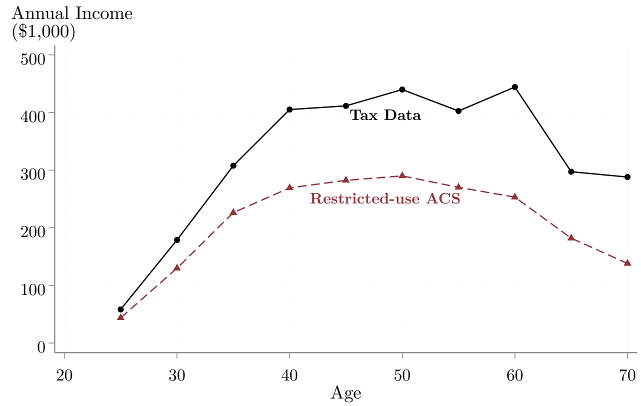
Figure 1: Physician Age Profiles

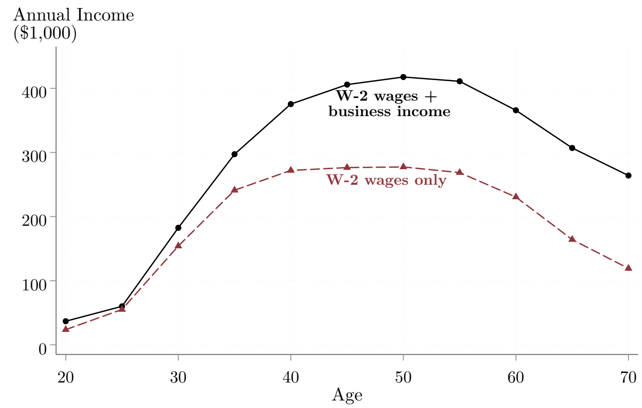
(A) Average Earnings by Age



(B) Measurement: Administrative vs. Survey Data



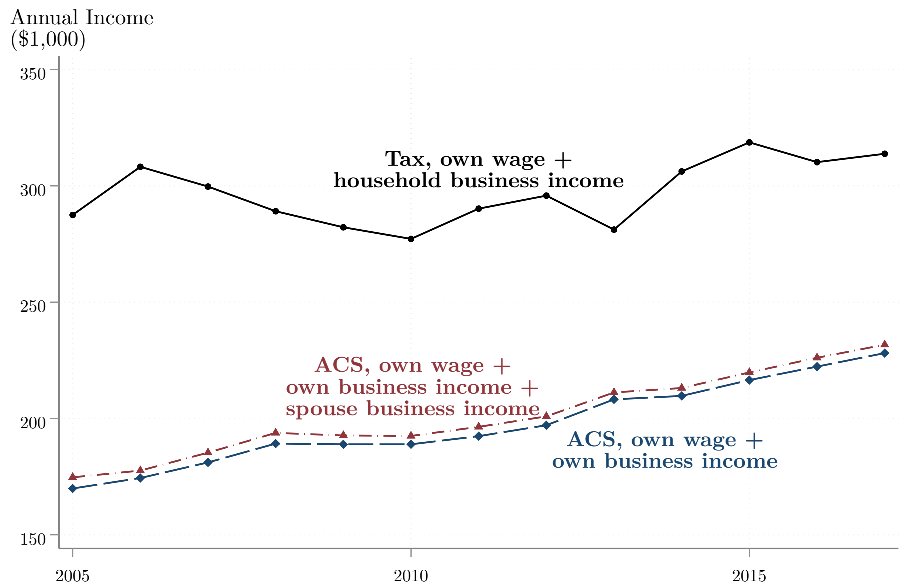
(C) Role of Business Income in Physician Earnings



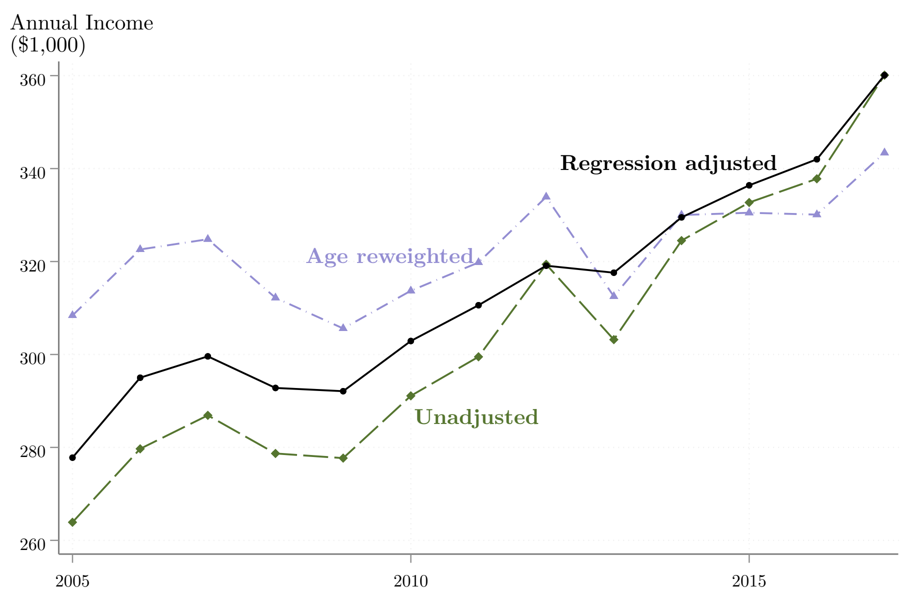
Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)
Notes: Total income in Panel A is defined as the sum of W-2 wages and imputed business earnings. Business earnings (in all panels) were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interests, and dividends. Income is measured in a cross-section: each data point is the sample mean of income in each 5-year age-(by gender) bin as observed in 2017 tax returns. The sample in Panels A and C consists of all 2017 tax filers who had a physician National Provider Identifier (NPI) in 2018 National Plan and Provider Enumeration System (NPPES). In Panel B, ACS income was defined analogously as the sum of wages, self-employment income of the index individual and self-employment income of the spouse. Both the tax and ACS samples in Panel B consist of individuals who filled out 2017 ACS survey and have an NPI in the 2018 NPPES data. The restricted-use ACS sample we use has several advantages over public-use data, including a higher threshold for top coding of income variables and approximately one-third more observations.

Figure 2: Physician Earnings Over Time

(A) ACS sample

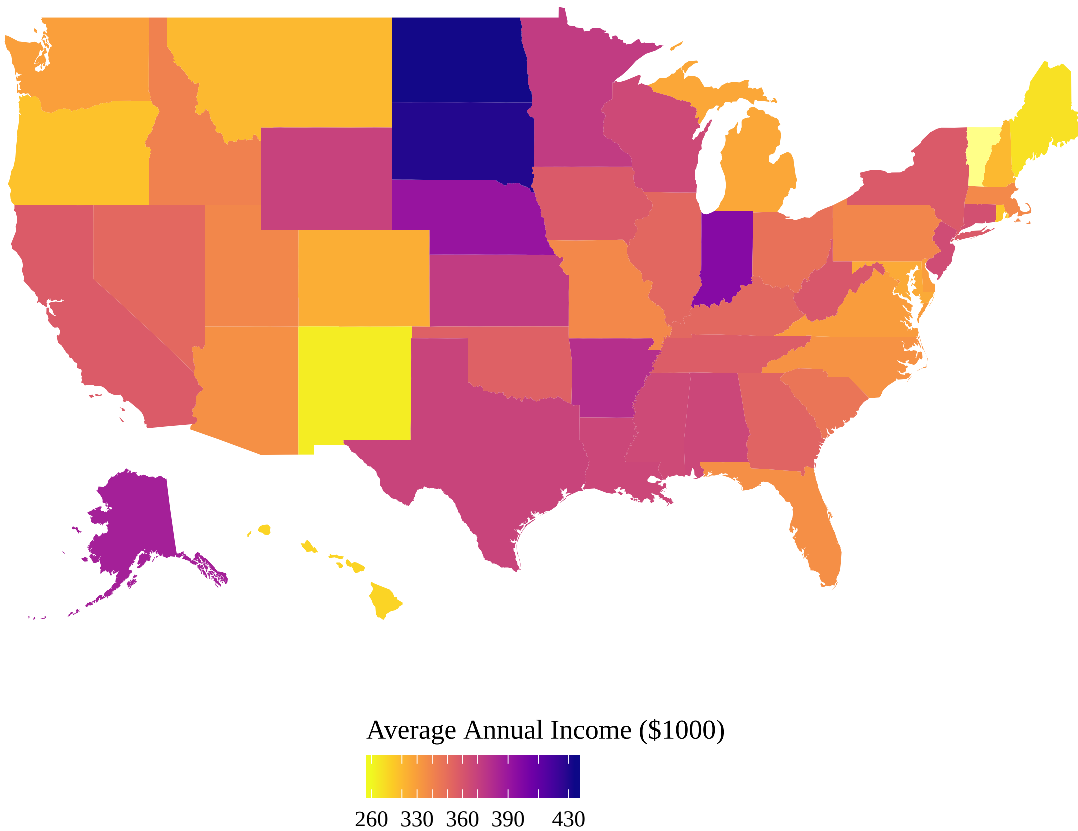


(B) NPPES sample



Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)
Notes: Both panels plot average annual income among physicians with positive income under the various measures. Panel A use only physician-years with positive income in which the physician was an ACS respondent and constructs average income using various income definitions. Panel B uses all physician-years with positive income and constructs average income using a single income definition, but makes various adjustments. The unadjusted series gives equal weight toe each observation. The age reweighted series weights observations to match the cross-sectional age distribution (in five-year bins) from the ACS in each year. The regression adjusted series plots the year fixed effects from a regression of log income on year, specialty, gender, age, and state fixed effects, with the year fixed effects exponentiated and adjusted so that the 2017 value matches the unadjusted series.

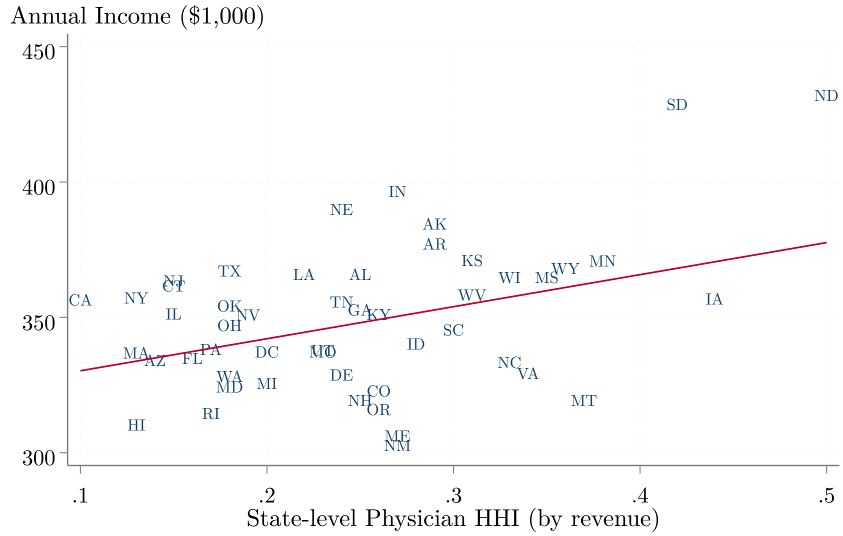
Figure 3: Physician Earnings by State



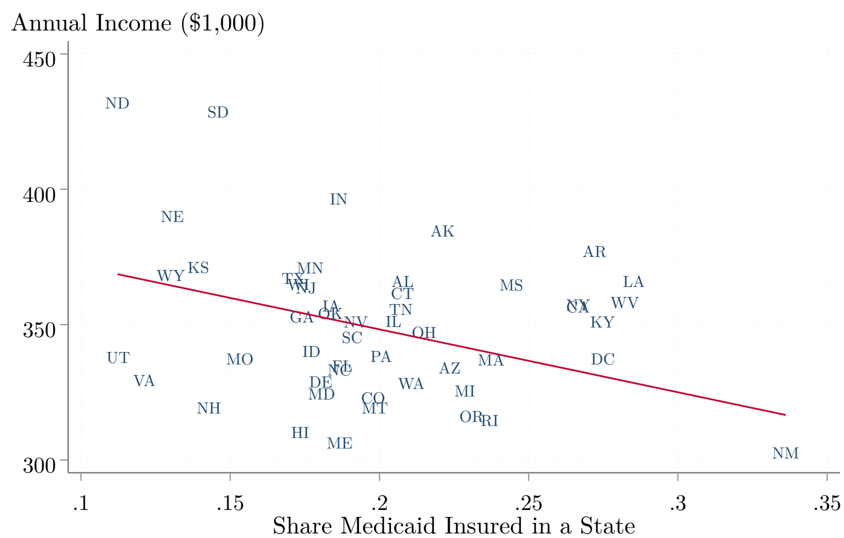
Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: The Figure plots 2017 average annual income among physicians by state. Income average is regression-adjusted for individual age, gender, and specialty. Income is defined as the sum of W-2 wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interest, and dividends. The sample consists of all 2017 tax filers who had a physician National Provider Identifierin 2018 NPPES.

Figure 4: Correlates of Geographic Variation in Earnings

(A) Geographic variation and concentration

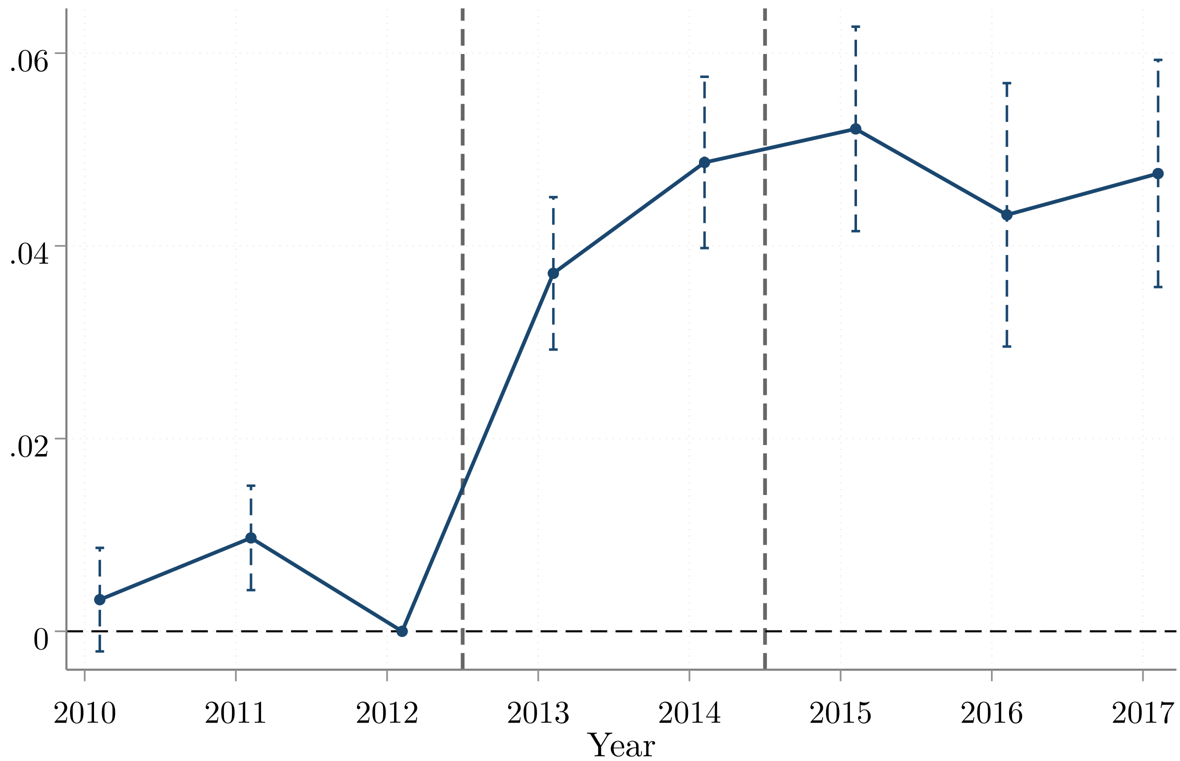


(B) Geographic variation and share population with Medicaid



Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: The y axis in both panels reports 2017 average annual total income among physicians, by state. Income average is regression-adjusted for individual age, gender, and specialty. Total income is defined as the sum of W-2 wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interest, and dividends. The sample consists of all 2017 tax filers who had a physician National Provider Identifier in 2018 NPPES. The x axis in Panel A records state-level (revenue-based) HHI measure of physician concentration from Clemens and Gottlieb (2017). The x axis in Panel B records the share of individuals in the state who had Medicaid insurance in 2017.

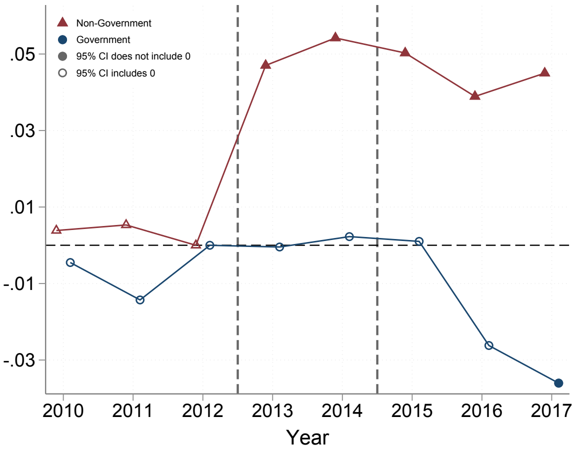
Figure 5: Event Study: Introduction of Primary Care Medicaid Fee Bump



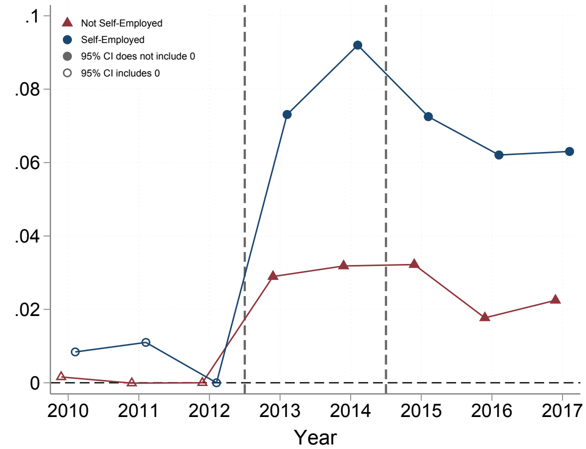
Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: This figure shows an event study of Primary Care physician incomes in response to the increase in Medicaid fees for primary care to Medicare levels instituted by the Affordable Care Act. The y axis reports the coefficient on time dummies, namely the $\hat{\beta}_t$ coefficients estimated in equation (1). It measures the percent change in total income of primary care physicians relative to physicians in our "Medicine Subspecialty" category. Total income is defined as the sum of wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interest, and dividends. The sample consists of all tax filers in relevant years who had a physician National Provider Identifier in 2018 National Plan and Provider Enumeration System and were classified as either primary care or being in a Medicine Subspecialty.

Figure 6: Heterogeneity in Impact of Primary Care Medicaid Fee Bump

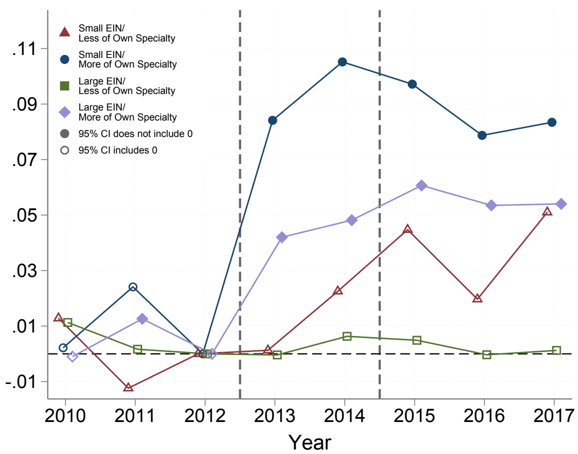
(A) By Government Employment



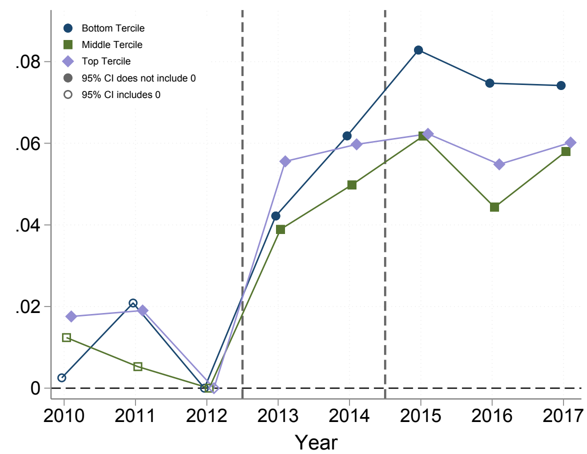
(B) By Self Employment



(C) By Firm Size and Specialty Concentration

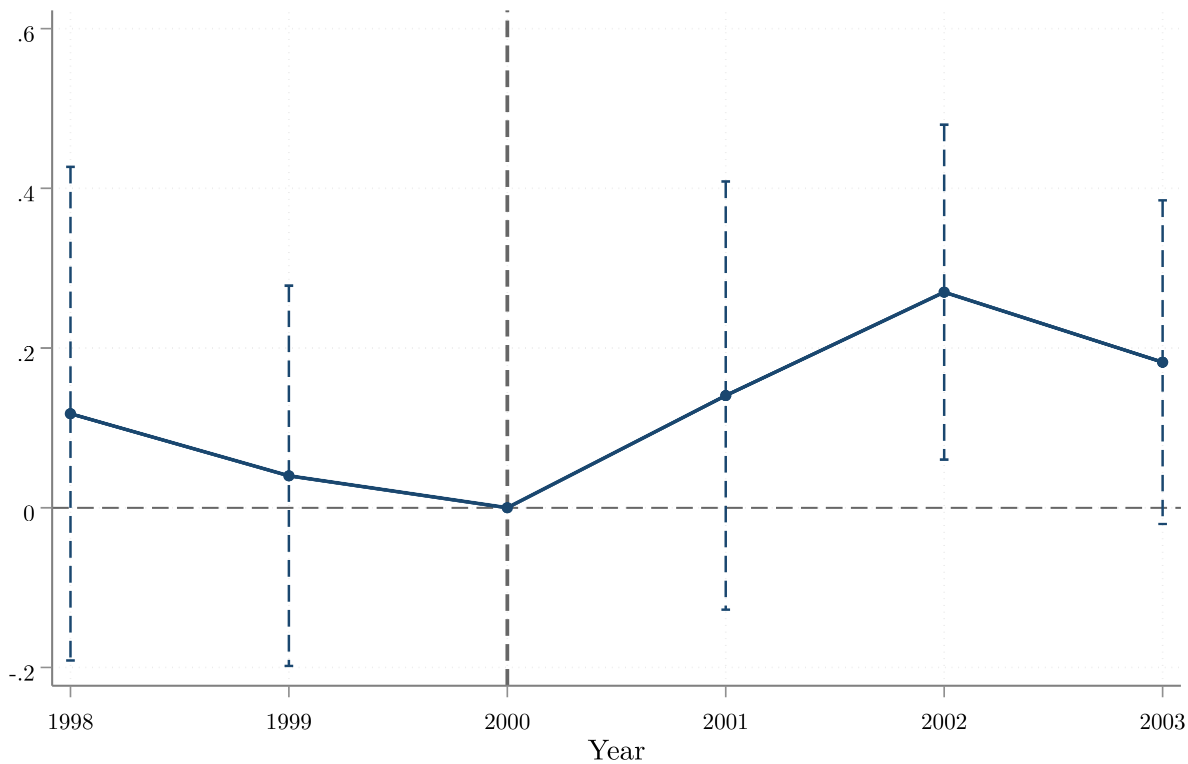


(D) By Physician Market Power



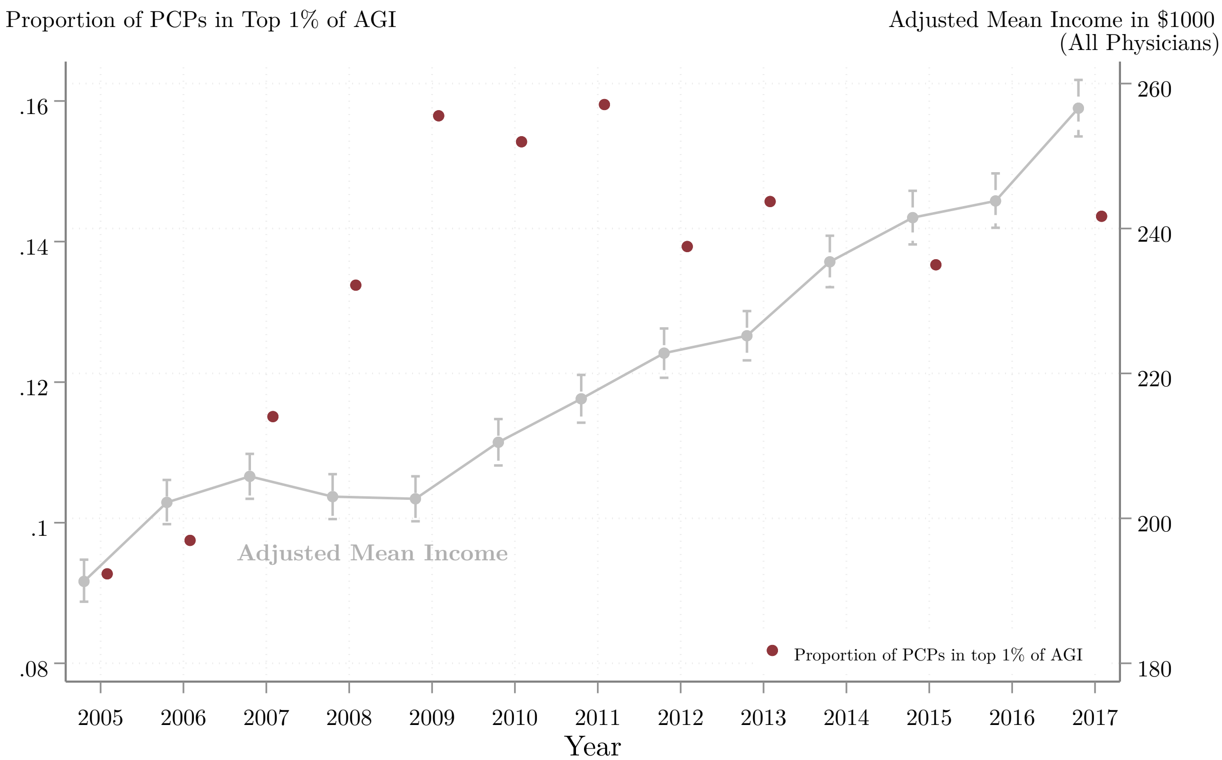
Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: This figure shows an event study of Primary Care physician incomes in response to the increase in Medicaid fees for primary care to Medicare levels instituted by the Affordable Care Act. The y axis reports the coefficient on time dummies, namely the $\hat{\beta}_t$ coefficients estimated in equation (1). It measures the percent change in total income of primary care physicians relative to physicians in our "Medicine Subspecialty" category. Total income is defined as the sum of wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interest, and dividends. The sample consists of all tax filers in relevant years who had a physician National Provider Identifier in 2018 National Plan and Provider Enumeration System and were classified as either primary care or being in a Medicine Subspecialty. In Panels A and B, the sample is also restricted to those who responded to the American Community Survey between 2001–17. Panel A splits the sample based on whether the physician is a government employee, and Panel B by whether the respondent is self-employed. Panel C splits the sample into four groups based on the number of physicians working for the same employer and how many of them are in the same specialty as the respondent. Panel D splits the sample into terciles according to a Herfindahl-Hirschman Index (HHI) of physician groups, from Clemens and Gottlieb (2017).

Figure 7: Event Study: Increase in Medicare Advantage Payments



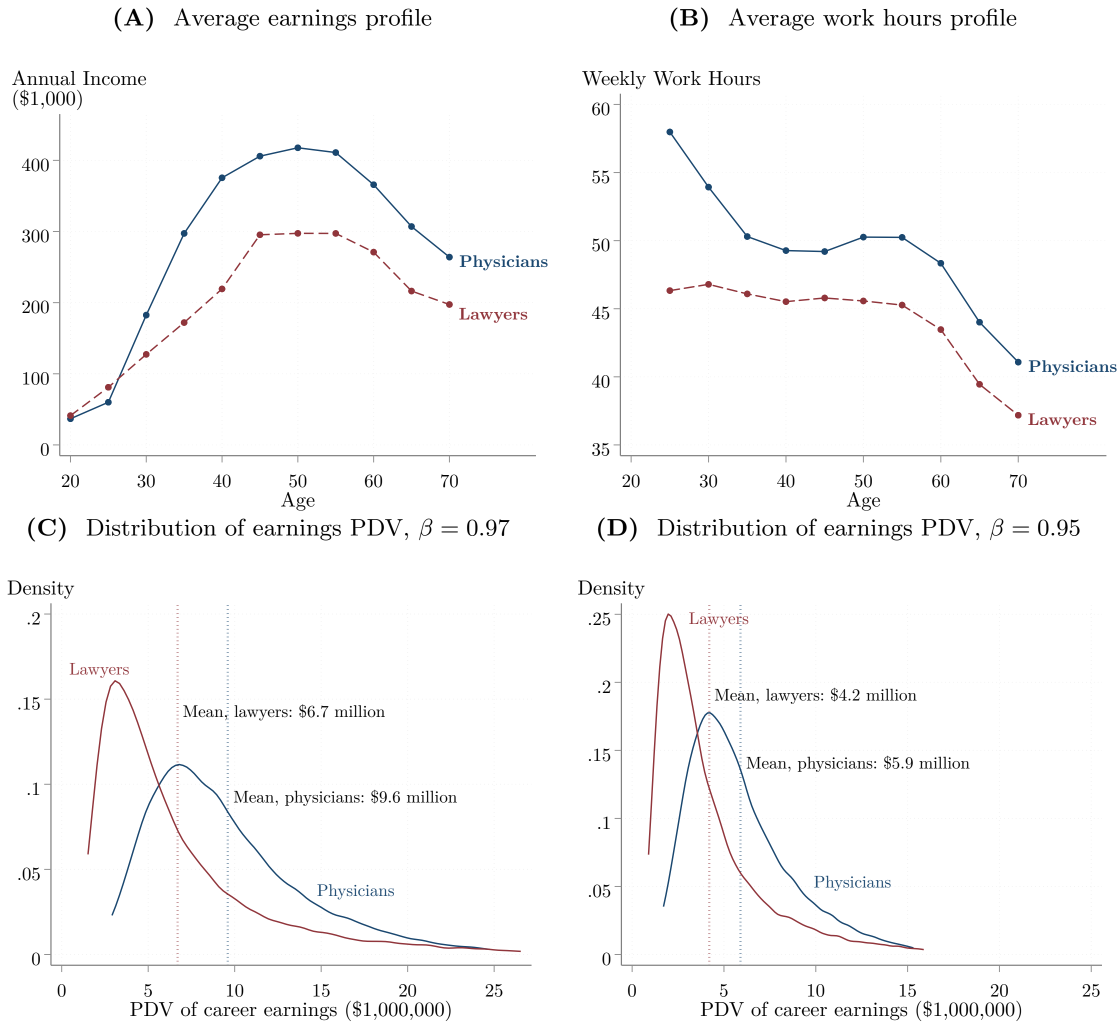
Source: NPPES (2018), Form 1040 (1998–2003), Census Numident (2018)
Notes: Event study of physician (defined as tax files with a physician NPI) incomes in response to an increase in Medicare Advantage Payments. The y axis reports the coefficient on distance-to-floor $\times$ year dummies, where the dependent variable of the differences-in-differences regression is total earnings, which are defined as the sum of W-2 wages and imputed business earnings. The sample is a panel of 650 unique counties from 1998-2003.

Figure 8: Time Series of PCP Income and Top 1% Share



Source: NPPES (2018), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: This figure shows the evolution of Primary Care physicians' incomes, and the share of primary care physicians in the top one percent of the the income distribution. The circles show the share in the top one percent of that year's AGI distribution, read off of the left axis. The solid line shows regression-adjusted mean income, read off of the right axis. Regression-adjusted income consists of the year fixed effects from a regression of log income on year, gender, age, and state fixed effects, exponentiated and adjusted to match the raw 2017 mean for primary care physicians. The sample consists of all tax filers in relevant years who had a physician National Provider Identifier in 2018 National Plan and Provider Enumeration System and were classified as being in a primary care specialty.

Figure 9: Incomes of Physicians and Lawyers

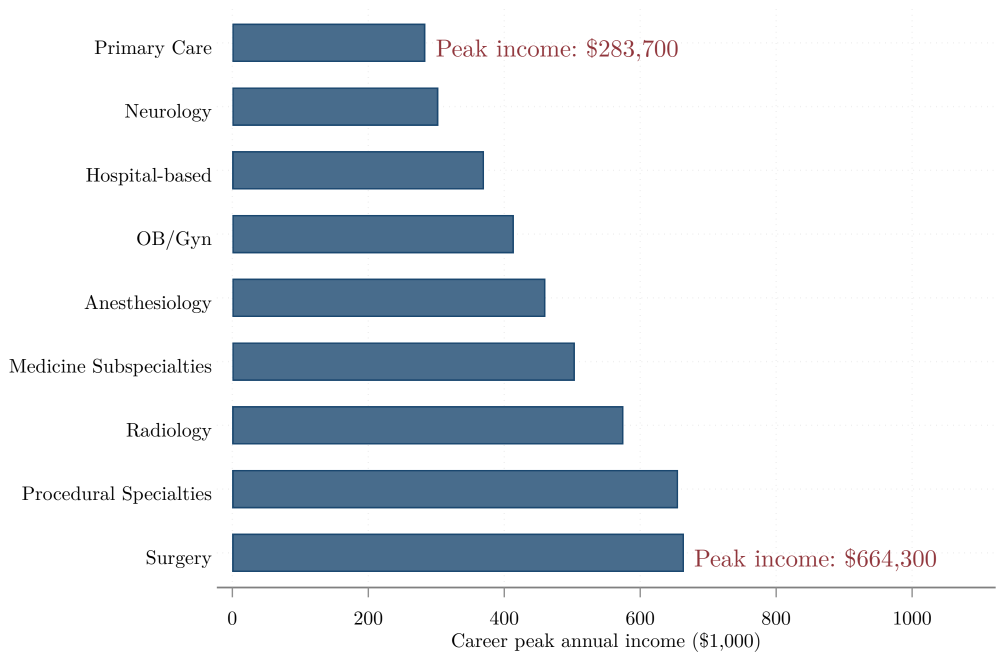


Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)

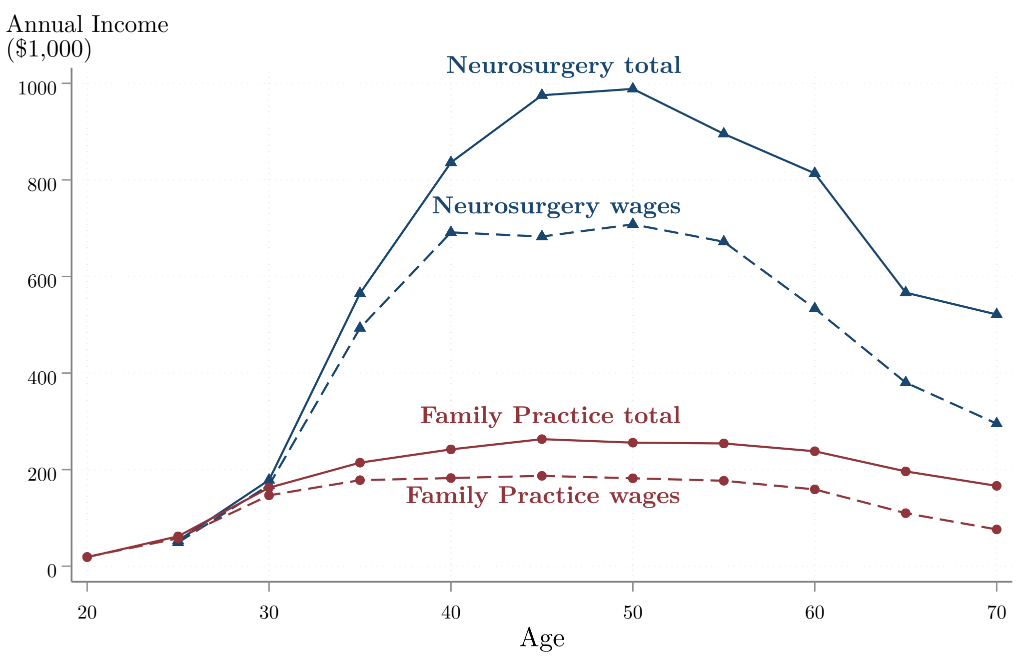
Notes: Panel A displays average 2017 earnings in 5-year age intervals for physicians (defined as tax filers with a physician NPI) and lawyers (defined using occupation records in ACS). Total earnings are a sum of W-2 wages and imputed business earnings. Panel B records the average number of hours worked per week reported by individuals with occupational codes for physicians and lawyers in 2017 ACS. Panel C displays the PDV of earnings from age 20 to 70 for physicians and lawyers, computed using the estimation methodology described in Section 2.4 at 3% discounting rate. Panel D displays the PDV of earnings from age 20 to 70 for physicians and lawyers, computed using the estimation methodology described in Section 2.4 at 5% discounting rate.

Figure 10: Variation in Earnings by Specialty

(A) Peak annual earnings in 2017



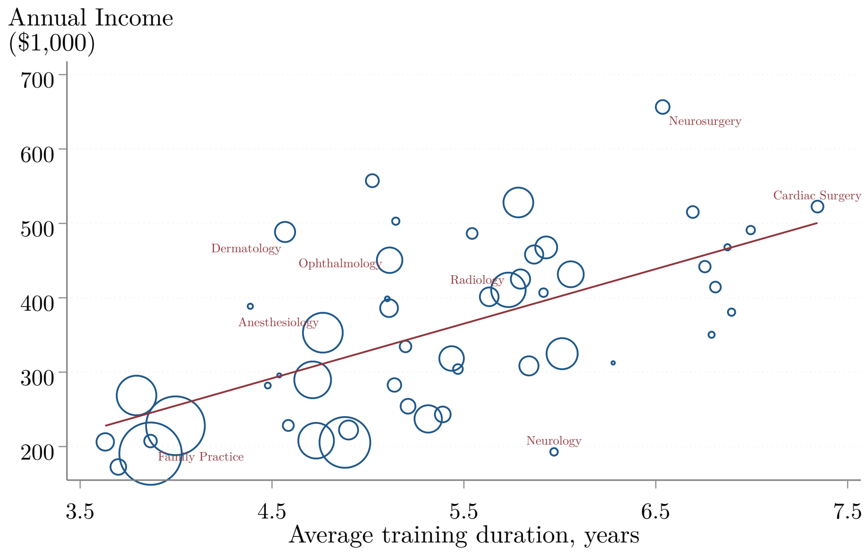
(B) Age profile for top and bottom earning specialties



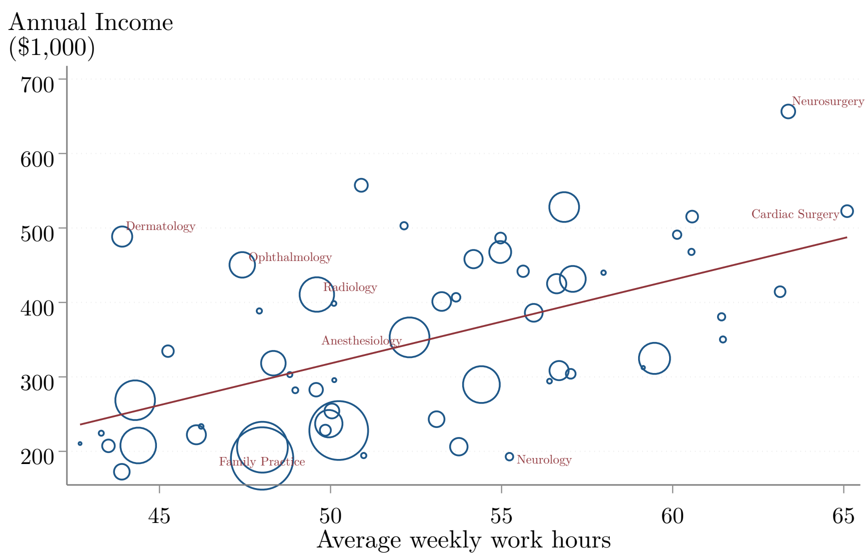
Source: NPPES (2018), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)
Notes: Panel A reports 2017 average total income at age 45-50 by nine aggregate specialty categories. Specialty categories were aggregated from more granular NPPES specialty taxonomy by the authors. Total income is defined as the sum of W-2 wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interests, and dividends. The sample consists of all 2017 tax filers who had a physician National Provider Identifier in 2018 NPPES. Panel B reports the same quantities as Figure 1C for two NPPES specialties: neurosurgery (Medicare specialty code "14") and family practice (Medicare specialty code "08").

Figure 11: Correlates of Specialty Earnings

(A) Earnings vs. length of training

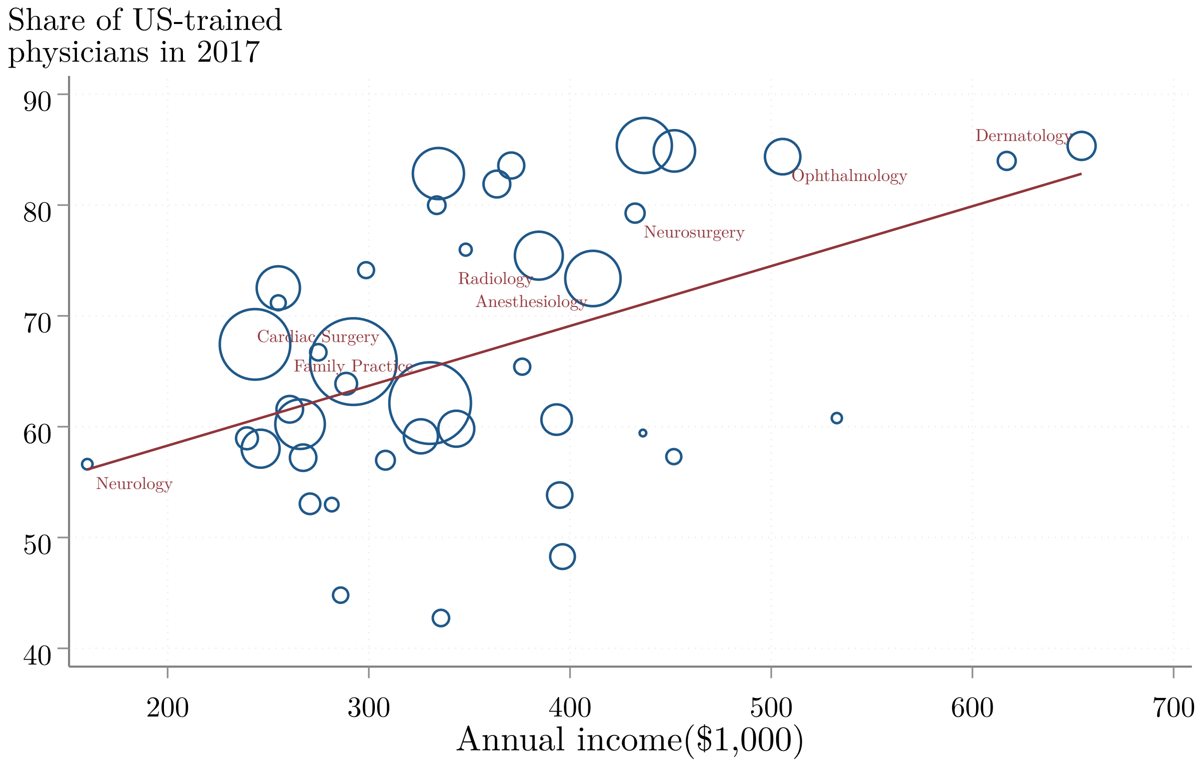


(B) Earnings vs. hours of work



Source: NPPES (2018), American Community Survey (2001–2017), Form 1040 (2001–2017), Form W-2 (2001–2017), Census Numident (2018)
Notes: The y axes in Panels A and B reports average total income by medicare specialty. Total income is defined as the sum of W-2 wages and imputed business earnings. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interests, and dividends. The sample consists of all tax filers who had a physician National Provider Identifier in the 2018 NPPES and answered the ACS between 2001 and 2017. The x axis in Panel A reports estimated average duration of training for each NPPES specialty. The estimate is constructed by identifying a large discontinuous increase in income that we hypothesize marks the end of residency training. The x axis in Panel B reports average weekly hours of work by aggregate specialty categories. Hours of work are self-reported in ACS. Panel C shows the relationship between specialty income levels and the share of physicians with US rather than foreign training credentials in each specialty. Income and share of US-trained physicians are residualized with respect to the length of training and hours worked by specialty; the axes plot the residuals plus the sample means.

Figure 12: Residualized share of U.S.-trained physicians vs. income



Source: NPPES (2018), American Community Survey (2001–2017), Form 1040 (2001–2017), Form W-2 (2001–2017), Census Numident (2018)
Notes: This graph shows the relationship between specialty income levels and the share of physicians with US rather than foreign training credentials in each specialty. Income and share of US-trained physicians are residualized with respect to the length of training and hours worked by specialty; the axes plot the residuals plus the sample means. Total income is defined as the sum of W-2 wages and imputed business earnings for individuals in an NPPES specialty. Business earnings were imputed from Form 1040 as a residual of AGI net of household wages, social security income, interests, and dividends. The sample consists of all tax filers who had a physician National Provider Identifier in the 2018 NPPES and answered the ACS between 2001 and 2017.

Table 1: Sample Sizes and Summary Statistics (2017)

Specialty	N	Mean Age	Mean Income	Share in Top 1%	Hours per Week	Residency Duration	%US-Trained
Physicians	863,000	49.8	343,600	28%	50.6	4.8	68.4%
Anesthesiology	50,900	50.4	398,800	36%	52.3	4.8	71%
Hospital-Based	93,200	47.8	308,500	21%	46.4	4	79.5%
Medicine Subspecialty	102,800	51.5	445,000	44%	54.9	5.8	62.1%
Neurology	25,400	50.4	282,400	20%	50.1	5.4	62.5%
Ob/Gyn	42,800	50.2	350,100	29%	54.6	4.8	78.3%
Primary Care	376,700	49.5	243,400	14%	48.1	4.2	59%
Procedural Specialties	50,750	50.3	534,700	49%	49.7	5.2	88.1%
Radiology	42,550	50.4	478,300	50%	49.9	5.7	83.8%
Surgery	77,730	49.7	521,600	49%	59	6.1	80%

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)
Notes: Sample of physicians includes individuals who filed Form 1040 tax return in the United States in 2017 and had a physician National Provider Identifier in National Plan and Provider Enumeration System. Specialty definitions are based on the author's aggregation of detailed NPPES specialty taxonomy. Mean incomes (in 2017 dollars) have been rounded to four significant digits. Share in top 1% reflects the proportion of physician tax units with AGI in the top 1% of tax units in 2017.

Table 2: Makeup of Top Earning Physicians (2017)

	Physician Income Group (top X%)					
	1%	5%	10%	25%	50%	All
Mean Age	53.0	52.4	52.1	51.3	50.4	49.3
Mean Weekly Hours Worked	54.8	56.2	56.2	55.4	53.8	50.8
Mean Income ($1000s)	3897	1702	1222	793	559	344
Share Reporting Business Income	0.91	0.78	0.70	0.56	0.45	0.32
Share of Income from Business	0.78	0.61	0.52	0.42	0.36	0.32
Share of Income from Labor	0.22	0.39	0.48	0.58	0.64	0.68
Share in Selected Specialties:						
Cardiology	0.030	0.046	0.052	0.047	0.034	0.023
Neurosurgery	0.042	0.042	0.033	0.018	0.010	0.007
General Surgery	0.026	0.034	0.042	0.049	0.042	0.035
Family Practice	0.037	0.03	0.034	0.047	0.085	0.14
Primary Care	0.18	0.14	0.15	0.18	0.29	0.44
Share in Selected States:						
New York	0.12	0.088	0.077	0.068	0.067	0.066
California	0.11	0.098	0.099	0.11	0.12	0.11
Maryland	0.022	0.020	0.018	0.019	0.021	0.024
Illinois	0.033	0.039	0.042	0.041	0.039	0.041
Florida	0.11	0.086	0.077	0.069	0.064	0.064
Arizona	0.031	0.023	0.022	0.020	0.020	0.020
Minnesota	0.010	0.015	0.019	0.021	0.021	0.019
Rural States	0.041	0.048	0.049	0.048	0.045	0.043
Urban/Rural:						
Share in MSA	0.98	0.97	0.96	0.95	0.95	0.94
Share in MicroSA	0.021	0.032	0.037	0.045	0.047	0.046
Share in Rural	0.005	0.006	0.007	0.011	0.015	0.026
N (000s)	8.63	43.2	86.3	216	432	863

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: Sample of physicians includes individuals who filed Form 1040 tax return in the United States in 2017 and had a physician National Provider Identifier in National Plan and Provider Enumeration System. Hours worked are self-reported and only available for the subsample of physicians who were observed at least once in the 2011 to 2017 data from the American Community Survey. Business income reporting is defined as having filed business income schedules with Form 1040. The level of business earnings was imputed from Form 1040 as a residual of AGI net of household wages, social security income, interests, and dividends. 100% of imputed business earnings were attributed to the physician spouse in married filing jointly households. Specialty is defined at the Medicare Specialty Code level (Cardiology - Medicare Specialty Code 06; Neurosurgery - 14; General Surgery - 02; Primary Care - 08 (Family Medicine)).

Table 3: Predicted Effect of Tax Changes on Income

Elasticity	Income growth	Original tax rate	New tax rate
ϵ	Δy	τ_0	τ_1
0.19	0.05	37%	18%
0.19	-0.05	37%	51.6%
0.19	0.05	39.6%	21.4%
0.19	-0.05	39.6%	53.6%
0.57	0.05	37%	31.2%
0.57	-0.05	37%	42.3%

Notes: The table uses equation (3) to estimate the top income tax rates needed to move top earnings by the same amount as the primary care fee bump did for physician earnings. The estimated income change comes from Figure 5. The elasticities of taxable income come from Kopczuk (2005) and Gruber and Saez (2002).

Table 4: Income versus Hours Worked for Physicians and Lawyers

	Physicians	PCPs	Lawyers
Mean PDV lifetime income ($\beta = 0.97$, at age 20, all business income)	\$9,600,000	\$6,100,000	\$6,700,000
Undergrad & grad tuition	\$207,000	\$207,000	\$165,000
Net disc. lifetime inc. in dollars	\$9,393,000	\$5,893,000	\$6,535,000
Net disc. lifetime inc. relative to lawyers	144%	90%	100%
Mean lifetime hrs. worked	113,400	108,100	104,300
Mean lifetime hrs. relative to lawyers	109%	104%	100%
Mean lifetime hrs. w/premium for >40/wk.	119%	111%	100%

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)
Notes: For the computation of the premium for hours worked for greater than 40 hours worked per week, we used the coefficients estimated in Table 3 of Goldin (2014), specifically row 2, column 5.

A Appendix

A.1 Tuition

To estimate the costs of medical and legal education as accurately as possible, we combine data from the best available sources for undergraduate and graduate school tuition. These datasets report both public and private school tuition, as well as the proportion of students in each category. We aggregate them up, taking appropriately weighted averages, to compute average tuition when training for law or medicine. The underlying sources are:

- American Association of Medical Colleges, Medical School Graduation Questionnaire (https://www.aamc.org/data/gq/)
- American Association of Medical Colleges, Tuition and Student Fees Report (https://www.aamc.org/data/tuitionandstudentfees/)
- National Center for Education Statistics, 2017 Digest of Education Statistics, Table 330.10 (https://nces.ed.gov/programs/digest/d17/tables/dt17_330.10.asp). This reports average undergraduate tuition and fees and room and board rates charged for full-time students in degree-granting postsecondary institutions, by level and control of institution.

A.2 Estimating Training Duration Using Income Data

There is relatively little variation in physicians' earnings during residency. While earnings may increase somewhat as resident progress into fellowships, earnings reliably increase dramatically when physicians start their first real jobs. These two facts about physicians' early-career income levels and changes allow us to use panel income data to estimate the average duration of training by specialty.

For this exercise, we use all physicians in our data who were between 20 and 28 years old (inclusive) in 2005 and have income information available every year from 2005 through 2017. Given that residencies begin halfway through the year, we can identify new residents as those who earn about half the typical resident's income in year t (assuming they do not have meaningful income while in their last semester of medical school) and then see their income increase to a typical resident's income in year $t + 1$.

We identify a person as starting their residency when we observe year t income between \$15,000 and \$35,000 (roughly half the income range in which we observe a large share of the mass in the distribution of physicians at typical residency ages) followed by an increase in income of at least 30 percent (constructed as the change in income between the first and second year divided by the average income over the two years). We use a percent change requirement rather than specifying the level of income for the second year to allow for some variation in salaries across programs, as well as the possibility that residents might have income from other sources. We identify a person as completing their training in the first year that they experience another 30 percent increase in their income from the prior year, and that year's income is at least $80,000. Variations on these parameters produce similar results.

We use the 85,000 people for whom we identify both starting and ending years of training to estimate the duration of that training. We perform these calculations by both Medicare specialty and broad specialty group. This approach also allows us to identify the ages at which physicians typically begin and complete their training. Table A.5 reports the mean training duration estimated by Medicare specialty.

A.3 Income Measure and Components

This section describes the tax variables we use to construct physicians' professional earnings. Table A.6 shows the means and medians of these variables and how they aggregate. The first seven rows come directly from the tax data described in section 2.2, while the final two reflect our calculations described below. The first row shows the mean and median adjusted gross income (AGI) for all tax units with a physician aged 20–70, identified from the NPPES, who filed Form 1040 for tax year 2017. We see a mean of $436,000 and median of $330,700. The right-hand side of the table limits the sample to those who report positive professional earnings, as defined below. This is intended to remove those out of the labor force, to the extent possible. This reduces the sample size from 824,000 to 808,000, and increases mean AGI slightly to $445,200 and the median to $335,600.

All subsequent rows in the table account for non-filers. To do this, we include anyone who received a Form W-2 or filed Form 1040. For those with a W-2, but no 1040, the only income available is that which is reported on W-2. This expanded sample, used on the second row and below, has 863,000 physicians rather than 824,000. This sample does not condition on having positive professional earnings. Mean AGI falls to $422,600 from $436,000.

The subsequent rows show the components of this broader income measure. Wage and salary (W-2) income from the tax unit overall accounts for 70 percent of the total, or $293,800 on average. Of this amount, 80 percent or $234,300 is the physician's own wage and salary. The remainder comes from the spouse, but note that we are not conditioning on the presence of a spouse, let alone a working spouse. So the difference between these numbers is not informative about spousal earnings among married physicians.

As described in section 2.3, our concept of professional earnings includes wage, salary, and business income. The latter is not provided directly in our data, so we back it out from AGI and the other components we do observe. These are reported on the table's subsequent rows. Taxable dividends average $12,990, taxable interest averages $3,515, and we estimate taxable social security earnings of $2,863.[38] Our estimate of the physician's professional earnings is AGI minus spousal W-2 earnings, taxable dividends, interest, and social security. This variable averages $343,600, with a median of $255,200.[39] The conditioning on the right-hand side of the table is specifically requiring our computed professional earnings to be positive. For this sample, mean earnings are $359,900 and the median is $264,100. This professional earnings measure includes everything in AGI that we have not removed—that is, the physician's wage and salary, business earnings, and potentially some other types of capital income.[40] If we further subtract the physician's own wage and salary income (mean of $243,000) we are left with estimated business earnings of $109,300.

A.4 Time Series, Age Composition, and Data Sources

Here we discuss in more detail the value-added of administrative data in establishing the facts about physician incomes so far. While multiple studies have reported descriptive statistics about physician incomes in the U.S., they have been based on survey evidence, raising the possibility of income underreporting. In Figure 1B we measure the magnitude of the underreporting concern by comparing age profiles of earnings between tax data and ACS data.[41] We use the restricted-use internal ACS data, which include a larger sample size and less top-coding than in publicly available ACS data.

This comparison provides striking evidence of income underreporting. During physicians' most productive years in between age 40 and 55, ACS underestimates annual income by about $130,000, to $150,000, or about a third of physicians' $418,000 average annual earnings over those ages. Differences are smaller

[38]The tax data provide the full amount of social security received. Only a portion of this is taxable, and the non-taxable portion does not show up in AGI. We estimate taxable social security following the worksheet in IRS Publication 915 as closely as possible, given the income measures available in our data. The rules governing taxability of social security benefits do not change during the period we consider.

[39]The components reported in the table do not exactly add up to this total due to rounding.

[40]For instance, we do not separately observe capital gains, private retirement income, or property rental income, so have no way to precisely eliminate them from professional earnings. Note that some capital gains could indeed be professional earnings, such as if the physician or spouse sells shares of a practice they own. Capital gains that reflect purely financial income presumably do not reflect professional earnings from the current year, though they could plausibly be considered part of the long-term return to a career of practicing medicine, if they are a return on principal that the physician earned from practicing medicine.

We have conducted an empirical exercise that attempts to back out likely capital gains income based on each year's national trends. In this exercise, we estimate a tax unit's capital gains income by multiplying its dividend income by the ratio of aggregate capital gains to dividend income that year, using estimates from (Smith et al., 2019b) through 2014 and IRS Statistics of Income from 2015 on. Results based on this capital gains-adjusted income measure are qualitatively similar to those reported in this paper.

[41]To make our estimates between tax data and ACS comparable, we define total income in ACS as being the sum of wages, self-employment income and spousal self-employment income.

earlier in physicians' careers, but even so average $50,000 by age 35. ACS incomes are also less steep relative to tax earnings during the years of highest income growth. Together with evidence in Figure 1C, this pattern suggests that business income especially, which accounts for a large share of physicians' total earnings, is likely to be significantly mismeasured in survey instruments. This underscores the importance of using administrative data sources for understanding the nature of incomes among physicians, but also more generally at the top of the income distribution, where the patchwork of income sources tends to be more complex, rates of non-response to income questions are higher (Bollinger et al., 2019), and business income is crucial (Smith et al., 2019a).

Tax- and survey-based measures also tell different stories about how physicians' earnings have changed over time. Cross-sectional self-reported measures from the ACS show much lower levels of income but faster growth than a tax-based measure for the same sample, as shown in Panel A of Figure 2.[42] The tax measure is more than $110,000 greater than the conceptually aligned survey measure in 2005, with that gap shrinking to just over $80,000 in 2017.

To understand why, we construct measures in Panel B using income from tax forms and physicians identified via NPPES in 2018. The unadjusted tax-based measure starts at a lower level than the tax-based measure in Panel A but grows much more quickly. This is because following this fixed sample back in time produces a 2005 cross-section that is younger on average than the average 2005 physician in the ACS. Some of the increase in this series represents progression into the higher-earning portion of the age-profile. Reweighting to match the age distribution of physicians in the ACS each year increases earnings early in the series and reduces earnings later in the series, but both earnings levels and earnings growth are higher than the tax-based measure for the ACS sample in Panel A shows.

The difference between these two tax-based income series must be due to sample composition, which highlights an additional advantage of identifying physicians using administrative data. Identifying physicians using survey-based occupation information is subject to some classification error in both directions: a physician assistant might inadvertently be coded as a physician and included, while a physician who runs a hospital might report an administrative or managerial occupation (or have one reported for them by someone else in their household) and be excluded, even though their position (and higher income) stem from being a physician. Survey non-response may also contribute to both the lower level and slower growth of income in the tax-based constructed from the ACS sample. Unit non-response in the ACS has been increasing over

[42]This figure also indicates that inclusion of spousal self-employment earnings makes little difference in the the level or trend in physician earnings, at least within the ACS.

time, and evidence from other surveys indicates that it is higher among top earners.[43] Combining these facts with physicians' position at the top of the income distribution, the highest earning physicians may be decreasingly likely to appear in measures constructed from survey-based samples, leading measures to understate both levels of and growth in physician income.

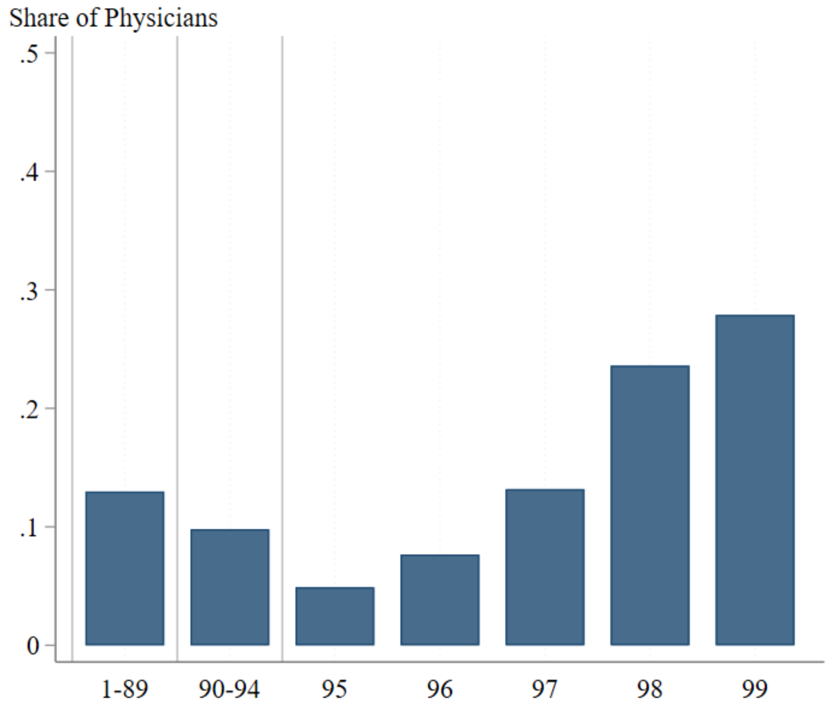
One might also wonder how physician earnings have changed over time, holding physician characteristics constant. The series discussed above conflates changes in income conditional on physician characteristics with changes in the composition of physicians. The regression-adjusted series in Panel B, which controls for age, gender, state, and specialty, shows that physician income grows faster when holding these characteristics fixed. Changes in physician characteristics have put downward pressure on earnings since 2005. Notably, mass in the physician age distribution has shifted right since 2005, with a larger share of physicians working at older ages in the downward sloping region of the age profile.[44]

[43] Unit non-response increased from 2.7 percent in 2005 to 8.0 percent in 2018. See https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/response-rates/. Brummet et al. (2018) find substantially lower response rates to the Consumer Expenditure Survey among top earners (see Figure 7 therein). Unit and item non-response among top earners has been a long-standing concern (Baird and Fine, 1939).

[44] Appendix Figure A.4 shows age kernel densities for 2005 and 2017. 2017 has more mass at ages 60 and above, and less mass during prime earning years from 40 to 60.

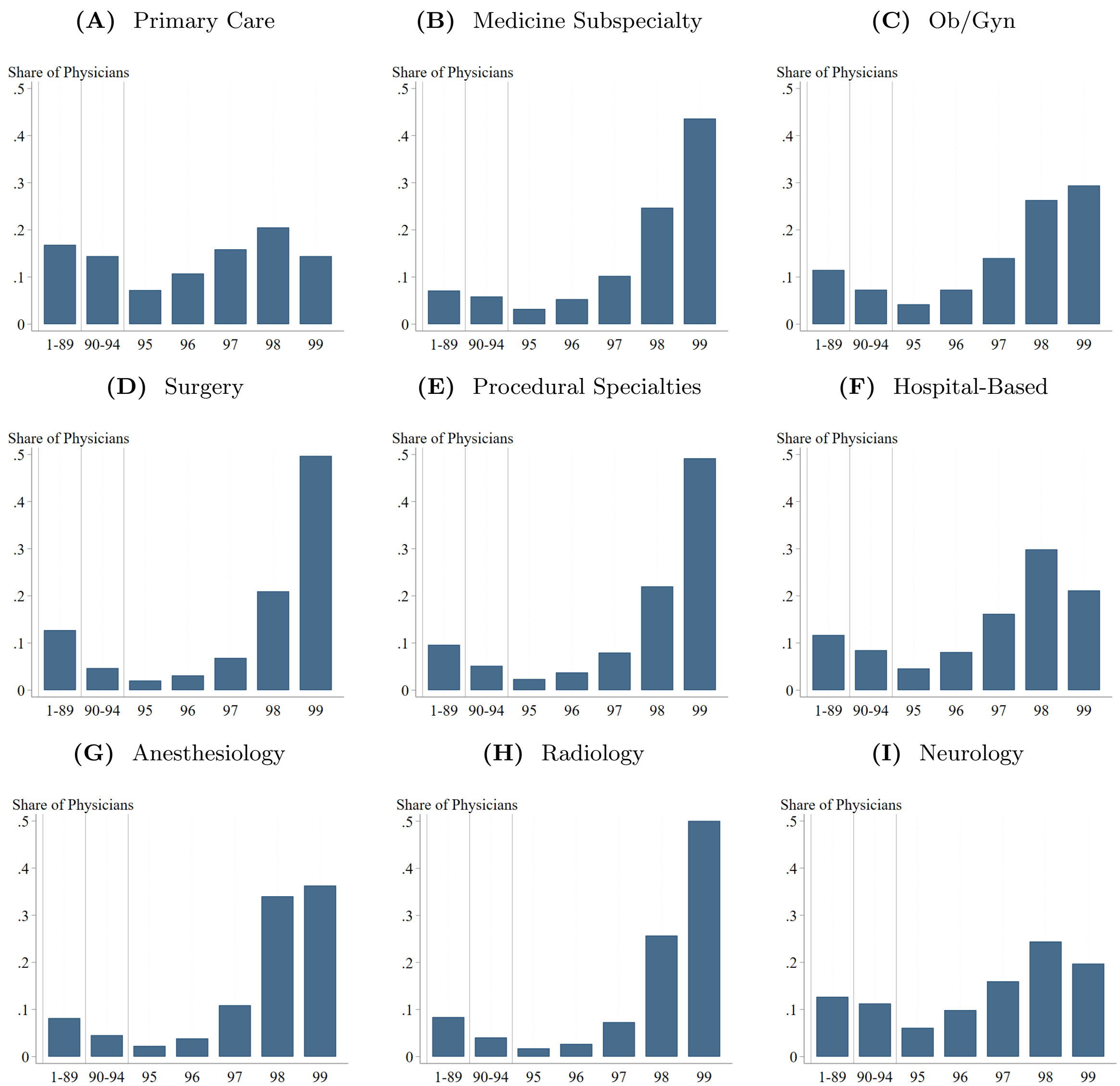
Appendix Figures and Tables

Figure A.1: Where in the National Income Distribution are Physicians Located?



Source: NPPES (2018), Form 1040 (2005–2017), Census Numident (2018)
Notes: This figure shows the distribution of physician income, measured based on household adjusted gross income (AGI) relative to the national AGI distribution. We use AGI cutoffs of the national income distribution in 2017 and AGI of physician households to assign physicians to national income percentiles. Each bar measures the share of physicians in our sample whose AGI would put them into the income percentile(s) specified on the x axis. Panel A shows the distribution for all physicians, panel B for primary care physicians, and panel C for procedural specialties.

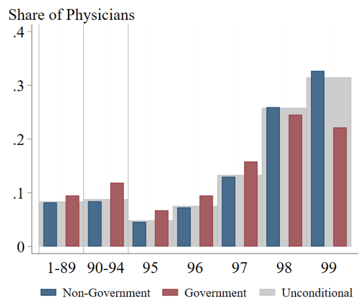
Figure A.2: Physician Income Shares by Broad Specialty



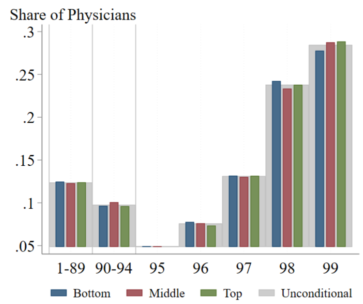
Source: NPPES (2018), Form 1040 (2005–2017), Census Numident (2018)
Notes: This figure shows the distribution of physician income, for each of nine broadh specialty categories, measured based on household adjusted gross income (AGI) relative to the national AGI distribution. We use AGI cutoffs of the national income distribution in 2017 and AGI of physician households to assign physicians to national income percentiles. Each bar measures the share of physicians in our sample whose AGI would put them into the income percentile(s) specified on the x axis.

Figure A.3: Heterogeneity in Physician Income Shares

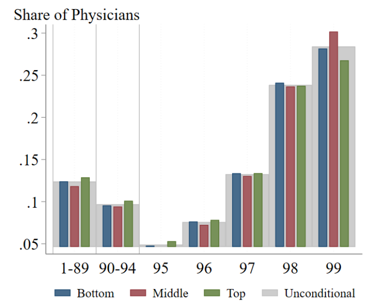
(A) Government vs. Private Sector



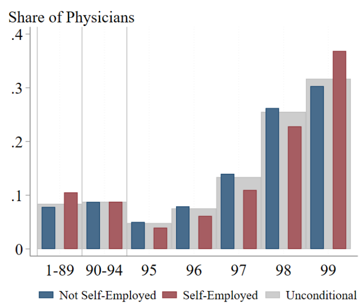
(B) Terciles of CBSA Medicaid Share



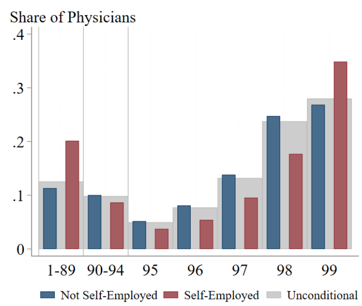
(C) Terciles of CBSA Medicare Share



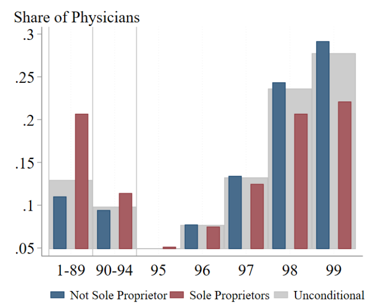
(D) Self-Employment (ACS)



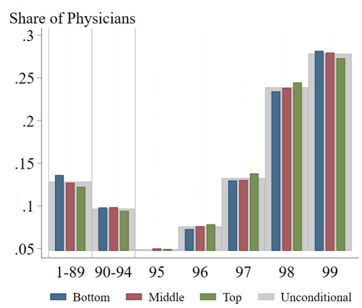
(E) Self-Employment (Tax)



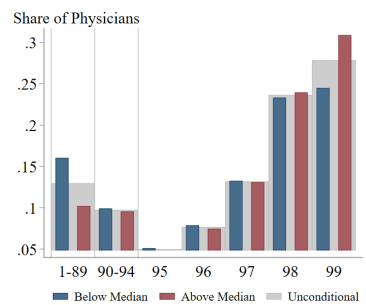
(F) Sole Proprietorship



(G) Terciles of Specialty HHI



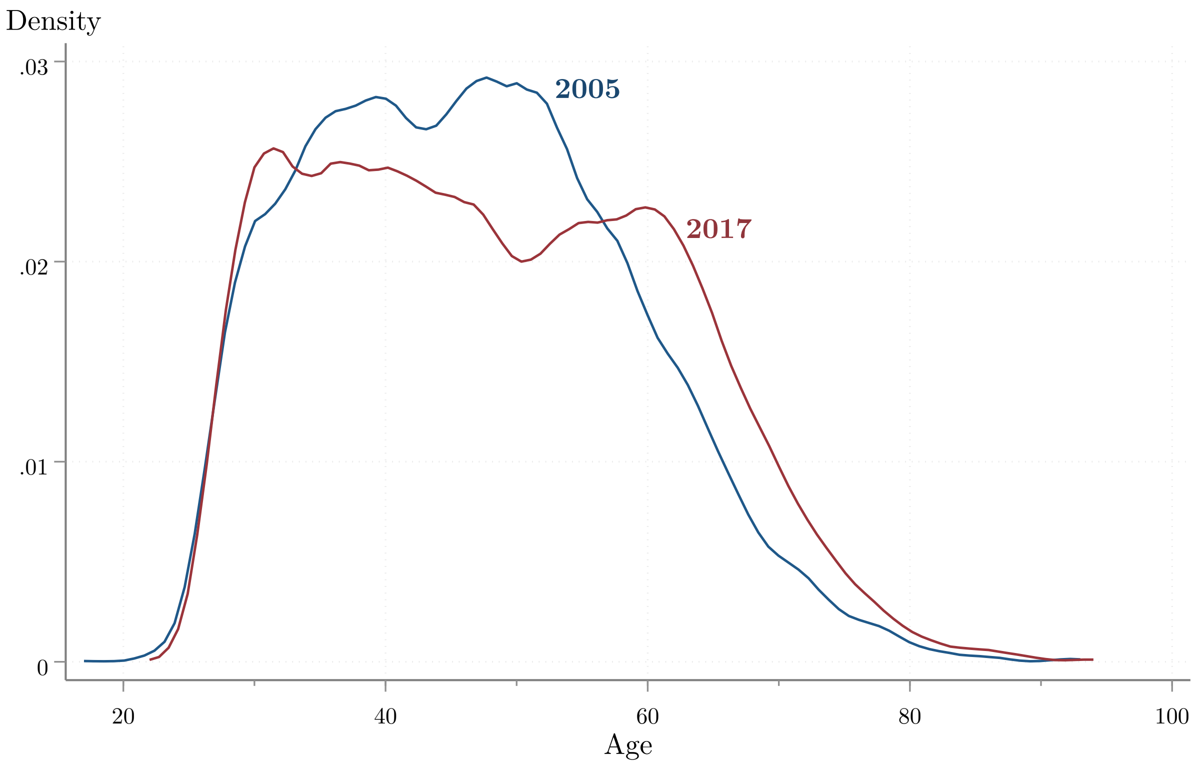
(H) Proportion of Own Specialty within Employer



Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)

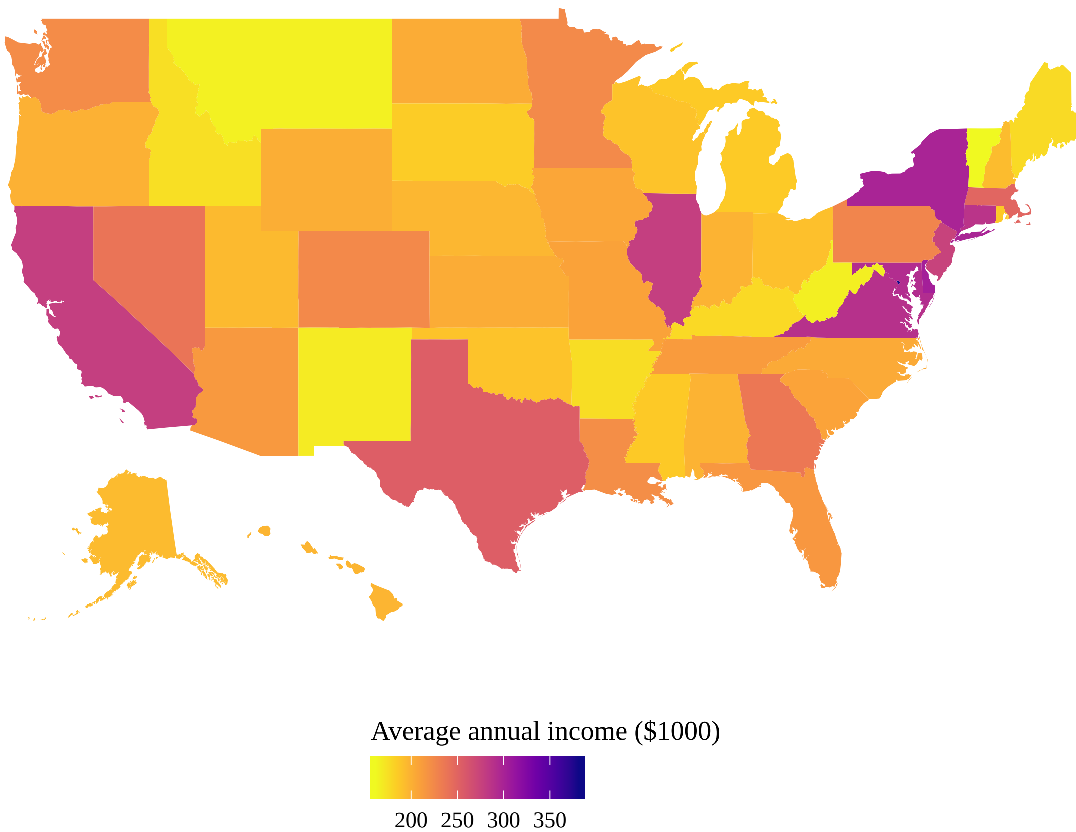
Notes: This figure shows the shares of physician households within percentiles of the national AGI distribution, across several dimensions of heterogeneity. Distributions by type are overlain on the unconditional distributions, which include all observations for which data on a given heterogeneity measure are available (e.g. Panels A and D include only physicians observed in the ACS sample).

Figure A.4: Physician Age Distribution



Source: Public Use American Community Survey (2005 and 2017)
Notes: The figure plots the age distribution of employed physicians in ACS.

Figure A.5: Lawyers' Earnings by State



Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: The figure plots 2017 average annual total income among lawyers by state. Income average is regression-adjusted for individual age, gender, and specialty. The sample consists of all 2017 tax filers who were present in at least one ACS sample from 2001–2017 and reported their occupation in ACS as lawyer.

Table A.1: Specialty Categorization

Specialty category	Medicare code	Medicare description
1	**Primary Care**	
	1	General Practice
	8	Family Practice
	11	Internal Medicine
	17	Hospice and Palliative Care
	23	Sports Medicine
	26	Psychiatry
	37	Pediatric Medicine
	38	Geriatric Medicine
	72	Pain Management
	79	Addiction Medicine
	84	Preventive Medicine
	C0	Sleep Medicine
2	**Medicine Subspecialty**	
	3	Allergy/Immunology
	6	Cardiovascular Disease (Cardiology)
	10	Gastroenterology
	21	Clinical Cardiac Electrophysiology
	29	Pulmonary Disease
	39	Nephrology
	44	Infectious Disease
	46	Endocrinology
	66	Rheumatology
	81	Critical Care (Intensivists)
	82	Hematology
	83	Hematology-Oncology
	90	Medical Oncology
	91	Surgical Oncology
	C3	Interventional Cardiology
	C7	Advanced Heart Failure and Transplant Cardiology
	U1	Genetics
	U3	Hypertension Specialist
	U4	Phlebology
3	**Obstetrics & Gynecology**	
	16	Obstetrics & Gynecology
	98	Gynecological Oncology
4	**Surgery**	
	2	General Surgery
	14	Neurosurgery
	20	Orthopedic Surgery
	24	Plastic and Reconstructive Surgery
	28	Colorectal Surgery (Proctology)
	40	Hand Surgery
	76	Peripheral Vascular Disease
	78	Cardiac Surgery
	85	Maxillofacial Surgery
...	...	Continued on next page...

Specialty category	Medicare code	Medicare description
...	...	...continued from previous page
5	**Procedural Specialties**	
	4	Otolaryngology
	7	Dermatology
	18	Ophthalmology
	34	Urology
6	**Hospital-Based**	
	22	Pathology
	25	Physical Medicine and Rehabilitation
	93	Emergency Medicine
	C6	Hospitalist
7	**Anesthesiology**	
	5	Anesthesiology
	9	Interventional Pain Management
8	**Radiology**	
	30	Diagnostic Radiology
	36	Nuclear Medicine
	92	Radiation Oncology
	94	Interventional Radiology
9	**Neurology**	
	12	Osteopathic Manipulative Medicine
	13	Neurology
	86	Neuropsychiatry
	U5	Electrodiagnostic Medicine

Source: Authors

Table A.2: Physician and Lawyer Incomes by State

	Physicians		Lawyers			Physicians		Lawyers	
State	Mean	Adjusted	Mean	Adjusted	State	Mean	Adjusted	Mean	Adjusted
AL	313.5	367.2	153.6	199.3	MT	281.6	320.6	123.6	166.1
AK	369	385.9	135.1	194.8	NE	301.4	391.2	139.6	196.9
AZ	296.6	335.3	167.5	214.5	NV	346.5	352.2	242.6	239.1
AR	296	378.3	128.4	176.2	NH	266.3	320.6	146.1	194.0
CA	289.2	357.8	236.5	278.3	NJ	317.7	364.8	234.8	275.3
CO	282.1	324.2	183.2	225.0	NM	238.7	303.9	131.1	169.4
CT	304.3	362.9	272.1	286.9	NY	285.5	358.5	302	299.3
DE	273.7	330.0	261.9	303.1	NC	280.9	334.6	167.3	204.4
DC	210.6	338.6	274.2	381.8	ND	321.1	433.2	141.4	203.4
FL	326.8	336.1	197.5	215.6	OH	268.4	348.3	154.8	191.9
GA	300	354.1	206	236.6	OK	300	355.5	156	189.7
HI	242.5	311.5	133.9	198.3	OR	263.1	317.4	141.2	200.2
ID	326.8	341.4	157.2	175.4	PA	260.4	339.5	198.5	227.8
IL	269.5	352.6	251.8	278.3	RI	237.3	315.8	170.7	186.7
IN	331.1	397.7	161	199.0	SC	282.5	346.6	181.7	208.0
IA	275.5	358.1	134.6	206.3	SD	374.2	429.9	128.2	185.2
KS	292.2	372.4	177.4	203.4	TN	312.1	357.0	166	212.7
KY	284.6	352.3	136.8	178.8	TX	316.8	368.4	232.4	254.7
LA	295	367.2	168.5	221.8	UT	281.3	339.2	147.4	194.9
ME	240.6	307.6	132	178.1	VT	213.7	190.7	113.9	162.1
MD	248.5	325.6	257.7	293.0	VA	257.5	330.6	248.5	289.5
MA	270.9	338.2	213.6	249.3	WA	265.8	329.5	172.1	222.7
MI	247.3	326.9	152	186.2	WV	262.6	359.6	149.7	167.1
MN	289.1	372.2	183.2	224.6	WI	314.3	366.1	157.5	189.8
MS	314	366.0	160.4	186.3	WY	365.1	369.4	155.8	201.9
MO	268.4	338.6	173.8	208.5					

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018)
Notes: Table presents mean incomes by state, both unadjusted, and adjusted for age gender and specialty composition (for physicians) in thousands of 2017 dollars.

Table A.3: Physicians in the Income Distribution

	% in Category	% within National AGI Percentile						
		< 90	90-94	95	96	97	98	> 99
All Physicians	100	13	9.8	4.9	7.7	13	24	28
Specialty:								
Primary Care	43	17	14	7.2	11	16	21	14
Medicine Subspecialty	12	7.1	5.9	3.2	5.3	10	25	44
Ob/Gyn	4.9	12	7.3	4.2	7.3	14	26	29
Surgery	8.9	13	4.7	2	3.1	6.8	21	50
Procedural Specialties	5.9	9.6	5.2	2.3	3.7	8	22	49
Hospital-Based	11	12	8.5	4.6	8.1	16	30	21
Anesthesiology	6.1	8.2	4.5	2.3	3.9	11	34	36
Radiology	5.1	8.4	4.1	1.8	2.7	7.3	26	50
Neurology	2.9	13	11	6.1	9.9	16	24	20
Public vs. Private:								
Non-Government	88	8.2	8.4	4.6	7.3	13	26	33
Government	12	9.5	12	6.7	9.5	16	25	22
CBSA Medicaid Enrollment:								
Bottom Tercile	35	13	9.6	4.9	7.8	13	24	28
Middle Tercile	33	12	10	4.9	7.6	13	23	29
Top Tercile	32	12	9.6	4.9	7.3	13	24	29
CBSA Medicare Enrollment:								
Bottom Tercile	34	12	9.5	4.8	7.6	13	24	28
Middle Tercile	34	12	9.4	4.6	7.2	13	24	30
Top Tercile	32	13	10	5.3	7.8	13	24	27
Share of Own Specialty in EIN:								
Below Median for Specialty	47	16	9.9	5.1	7.9	13	23	25
Above Median for Specialty	53	10	9.6	4.8	7.5	13	24	31
Self-Employment:								
Not Self-Employed (ACS)	79	7.8	8.7	5	7.9	14	26	30
Self-Employed (ACS)	21	11	8.8	3.9	6.1	11	23	37
Not Self-Employed (Tax)	86	11	10	5.2	8.1	14	25	27
Self-Employed (Tax)	14	20	8.6	3.7	5.4	9.5	18	35
Sole Proprietorship:								
Not Sole Proprietor	80	11	9.4	4.9	7.7	13	24	29
Sole Proprietor	20	21	11	5.1	7.5	13	21	22
Physician HHI:								
Bottom Tercile	33	14	9.8	4.7	7.3	13	23	28
Middle Tercile	33	13	9.8	5	7.6	13	24	28
Top Tercile	34	12	9.4	5	7.8	14	25	27

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018), Clemens and Gottlieb (2017)

Table A.4: Mean Values of Continuous Heterogeneity Variables by Category

	Physician HHI Tercile			Own Specialty Share in EIN	
	Bottom	Middle	Top	Below Median	Above Median
Primary Care	.023	.074	.27	.58	.82
Medicine Subspecialty	.054	.15	.47	.32	.67
Ob/Gyn	.037	.1	.33	.36	.66
Surgery	.039	.11	.34	.44	.6
Procedural Specialties	.043	.11	.32	.45	.8
Hospital-Based	.083	.22	.56	.34	.68
Anesthesiology	.072	.2	.51	.35	.89
Radiology	.075	.19	.52	.29	.87
Neurology	.054	.13	.38	.33	.44

Source: NPPES (2018), Form 1040 (2005–2017), Form W-2 (2005–2017), Form 1099 (2005–2017), Census Numident (2018), Clemens and Gottlieb (2017)

Table A.5: Characteristics of Physician Specialties

Specialty	N	Mean Age	Mean Income	Hours per Week	Residency Duration	%US-Trained
General Practice	11,050	50.7	134.2	43.9	3.7	59.4
General Surgery	30,150	48.6	363.4	59.5	6	75
Allergy/ Immunology	3,490	52.3	352.5	45.3	5.2	72.8
Otolaryngology	10,200	49.9	481.1	53.3	5.6	88
Anesthesiology	48,900	50.4	391.5	52.3	4.8	71.1
Cardiovascular Disease (Cardiolo	19,500	53.3	491	57.1	6.1	64.7
Dermatology	12,050	49	586.4	43.9	4.6	88.4
Family Practice	119,720	50.1	226.7	48	3.9	59.4
Interventional Pain Management	1,760	50.4	616	52.2	5.1	61.9
Gastroenterology	13,880	52.1	543.2	55	5.9	66.2
Internal Medicine	118,530	48.1	261.3	50.2	4	54.9
Osteopathic Manipulative Medicin	860	54.6	245	43.3	.	.
Neurology	1,730	48.5	270.3	55.2	6	.
Neurosurgery	5,990	49.1	740.5	63.4	6.5	83
Obstetrics/Gynecology	41,550	50.2	346.2	54.4	4.7	78.3
Hospice and Palliative Care	1,010	47.5	237.4	49	4.5	.
Ophthalmology	18,500	51.1	534.6	47.4	5.1	89.2
Orthopedic Surgery	26,570	49.9	645.1	56.8	5.8	87.6
Cardiac Electrophysiology	2,340	49.3	585.8	60.1	7	.
Pathology	16,700	51.8	328.7	48.3	5.4	66
Sports Medicine	570	53.6	305.8	46.2	.	.
Plastic and Reconstructive Surge	4,160	51.4	505	55.6	6.8	86.3
Physical Medicine and Rehabilita	12,330	47.8	261.2	46.1	4.9	61.3
Psychiatry	36,900	52.2	252.7	44.4	4.7	64.3
Colorectal Surgery (Proctology)	1,420	50.3	419.8	61.4	6.9	.
Pulmonary Disease	10,770	51.8	384	56.7	5.8	64.9
Diagnostic Radiology	34,800	50.5	464.5	49.6	5.7	83.8
Urology	9,850	50.7	523.4	56.6	5.8	84.9

Continued on next page...

Specialty	N	Mean Age	Mean Income	Hours per Week	Residency Duration	%US-Trained
... continued from previous page						
Nuclear Medicine	770	55.6	449.5	48.8	.	.
Pediatric Medicine	79,920	48.6	249	48	4.9	69.7
Geriatric Medicine	3,620	53.4	270.9	49.8	4.6	43
Nephrology	9,420	50.2	425.2	55.9	5.1	45.9
Hand Surgery	540	51	554.8	58	.	.
Infectious Disease	7,450	50.7	291.5	53.1	5.4	61.4
Endocrinology	6,570	50	276.5	50	5.2	56.5
Rheumatology	5,250	51.8	335.1	49.6	5.1	60.2
Pain Management	760	52.2	461.1	50.1	5.1	61.9
Peripheral Vascular Disease	3,360	51.1	514.6	63.1	6.8	77.5
Cardiac Surgery	4,270	53.6	618.6	65.1	7.3	76
Addiction Medicine	250	59.1	230.5	42.7	.	64.3
Critical Care (Intensivists)	3,030	48.7	381.6	57	5.5	52.8
Hematology	690	52.2	381.8	56.4	.	59.5
Hematology-Oncology	10,070	50.7	526.2	54.2	5.9	59.5
Preventive Medicine	4,540	56.2	229.3	43.5	3.9	77.3
Maxillofacial Surgery	830	48.1	475.9	47.9	4.4	.
Neuropsychiatry	22,800	50.4	285.2	50	5.3	62.5
Medical Oncology	3,270	52.2	515.2	55	5.5	59.5
Surgical Oncology	1,140	48.9	425	61.5	6.8	.
Radiation Oncology	4,750	50.1	563.2	50.9	5	85.1
Emergency Medicine	51,820	47.8	319.9	44.3	3.8	81.4
Interventional Radiology	2,470	48.4	506.8	53.7	5.9	82.5
Gynecological Oncology	1,140	50.5	501.5	60.5	6.9	.
Sleep Medicine	560	51.6	343.7	50.1	4.5	.
Interventional Cardiology	4,250	51.1	628.8	60.6	6.7	50.2
Hospitalist	12,370	42.5	283.4	53.8	3.6	.
Advanced Heart Failure and Trans	340	44.7	434	59.1	6.3	.
Genetics	740	52.8	243.7	51	.	.
Back Office	110	63	187.7	.	.	.

Source: NPPES (2018), American Community Survey (2005–2017), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)

Table A.6: 2017 Physician Income Measures from Tax Data

	All Earnings		Positive Earnings	
Income Measure	Mean	Median	Mean	Median
AGI (1040 filing sample)	436,000	330,700	445,200	335,600
AGI (expanded sample including W-2 only taxpayers)	422,600	321,100	439,600	331,100
Wage and Salary: Physician and Spouse (if present)	293,800	247,700	303,000	255,900
Wage and Salary: Physician	234,300	198,200	243,000	205,400
Taxable Dividends	12,990	175	13,050	231
Taxable Interest	3,515	97	3,314	108
Taxable Social Security	2,863	0	2,923	0
Professional Earnings	343,600	255,200	359,900	264,100
Business Income	109,300	10,220	116,900	12,590
N (1040 Filing Sample)	824,000		808,000	
N (Expanded Sample)	863,000		831,000	

Source: NPPES (2018), Form 1040 (2005–2017), Form W-2 (2005–2017), Census Numident (2018)