# Physician Competition[1]

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## I. Introduction

Barriers to entry impede competition. When a market is highly regulated, incumbents have an easier time restricting the competitive fringe and maintaining a collusive market structure (Schmalensee, 1989; Ellickson, 2015). To analyze concentration in the market for physician services, one must consider entry barriers and the resulting market structure together.

For at least 80 years, the regulation of health professions has been believed to create barriers to entering medicine, giving physicians market power (Friedman and Kuznets, 1945). In recent years, these barriers have been eroded by new occupations and perhaps new technologies that can substitute for high-priced physician labor. This article offers key facts and frameworks for thinking about competition among physicians and other medical professionals in this context.

Physician competition works in two stages: First, potential physicians compete to enter the profession, and to work in desirable specialties.[2] Second, fully trained physicians compete with each other and with other occupations in the market for patients. To understand how physicians compete, we must therefore go beyond measuring concentration in the output market.

Friedman and Kuznets's (1945) observations from 80 years ago remain central to understanding physician competition, but with important changes. There remain persistent barriers to entering medical school and becoming a physician, but the barriers to entering higher-paid specialties are far more substantial. These barriers create *ex post* rents, and play an important role in talent allocation. At the broader level of physician entry, market forces and regulatory changes have created new forms of competition for physicians. These effects are likely to continue.

Physician markets feature a two-tier competitive landscape: looking within physicians, tight regulatory caps on medical-school seats and residency slots—especially for high-paying specialties—continue to ration entry, create large *ex post* rents, and steer the most academically accomplished trainees toward lucrative fields. Yet at the broader margin where we account for substitutes, barriers have eroded: nurse practitioners, physician assistants, certified registered

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[2] It is much easier to obtain training in the other occupations we study, so we do not consider competition to enter, for example, nursing school.

nurse anesthetists, osteopaths, foreign-trained doctors, telemedicine, and emerging AI tools rapidly expand capacity and mitigate the oft-predicted physician shortage. These additional margins mean that standard concentration metrics such as the Herfindahl-Hirschman Index (HHI) overstate market power in primary care while missing the key factors that maintain rents in some specialties. Effective policy must therefore evaluate both the upstream gatekeeping institutions—accreditation bodies, residency review committees, state licensure boards—that ration physicians and the downstream scope-of-practice and technology rules that determine how easily other professionals can substitute for—or complement—physicians in treating patients.

## II. Preliminary Facts

From 1980 to 2025, the US population grew by 50%. The population above age 64, who use a disproportionate share of healthcare and might thus be a better proxy for demand, grew by 140%. Over the same 1980–2025 period, the number of first-year positions in traditional U.S. medical schools, which award the Doctor of Medicine (M.D.) degree, increased by only 34%. This smaller increase is unlikely to reflect students' disinterest in becoming doctors; in 2025, there were 2.3 times as many applicants to U.S. M.D. programs as available positions. This ratio has exceeded 2.0 every year since 2003.

The relatively small flow of entering physicians shows up in the stock: the U.S. has fewer practicing physicians per capita than most other rich countries. The U.S. has 2.7 practicing physicians per 1,000 population versus an average of 3.8 for OECD countries. The average annual growth rate of physicians per capita in the U.S. between 2000 and 2022 (0.8%) is about one-half of the average OECD growth rate (1.5%).

Many organizations and reports reach similar conclusions; for example, the American Association of Medical Colleges (2021) predicts a shortage of up to 124,000 physicians in 2034. In 15 large cities, it now takes an average of 31 days to schedule a physician appointment, an increase from 26 days in 2022 and 21 days in 2004 (AMN Healthcare, 2025). In Boston, the average is 65 days across six medical specialties, with average waits of over 200 days for a dermatology or obstetrics/gynecology appointment.

Over the past 30 years, U.S. physicians who train and practice in non-primary care specialties—which usually require four or more years of post-medical school training—have earned substantially more than primary care physicians (family medicine, pediatrics, and general internal medicine), which generally require three years of training. This persistent difference, along with barriers to entering non-primary care specialties, directs talent to the high-income specialties. In 2024, the average earnings in non-primary care specialties ranged from $342,000 in psychiatry to $680,000 in orthopedic surgery, compared with $265,000 to $326,000 in the three primary care specialties (Doximity, 2025).

There is also a large earning difference between physicians and so-called "mid-level practitioners"—nurses with advanced training who can increasingly substitute for physicians. This creates incentives for firms to treat patients using these lower-cost workers. Anesthesiologists earned $523,000 on average in 2024 versus $232,000 for certified registered

nurse anesthetists; nurse practitioners and physicians assistants earned $129,000 and $133,000 on average, respectively, less than one-half of what primary care physicians (PCPs) earn (Doximity, 2025; Bureau of Labor Statistics, 2024).

Physicians in the United States earn substantially more than those in other rich countries. This is likely one reason so many international physicians aim to enter the U.S. residency match—although, as discussed below, they cannot practice in the U.S. if they are unable to secure a position in the National Resident Matching Program (the Match). Gottlieb et al. (2026) show that physicians in multiple developed countries—Canada, Netherlands, Sweden, and the U.S.—are generally in the top few percentiles of their countries' respective earnings distributions. This pattern could reflect absolute talent requirements to become a physician—causing salaries to be set high enough to induce talented people to choose this career—or inequality spillovers (Gottlieb et al., 2023a), or both. Even so, U.S. physicians are more likely to be in the top percentile and in the top decile than physicians elsewhere. Combined with the higher relative top incomes in the U.S., this makes it even more attractive to be a physician in the U.S.

Economists often focus on competition within particular geographic markets and among specific workers or services. The HHI of physician practices within the average geographic market, one measure of such local competition, has increased over the past 25 years (Fulton 2017; Gaynor 2018; Gaynor et al., 2015), and this is associated with increased private health insurance prices (Sun and Baker, 2015; Dunn and Shapiro, 2014; Baker et al., 2014; Koch and Ulrick, 2017; Gaynor, 2018; Clemens and Gottlieb, 2017; Hausman and Lavetti, 2021). In 1983, forty-one percent of physicians were in solo practice. Now, only twelve percent of physicians are in solo practice, fifty-five percent are employed by a health system, and four percent are employed by private health insurers such as UnitedHealthcare/Optum (American Medical Association, 2025; Physicians Advocacy Institute, 2024; Adler et al., 2025).

## III. Conceptual Framework

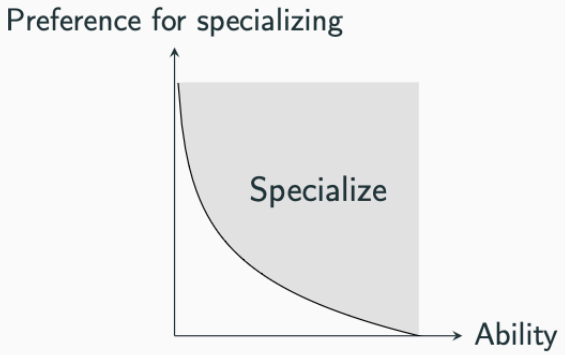
A simple conceptual framework from Gottlieb et al. (2023b) helps make sense of physicians' specialty choices. Newly-trained physicians differ in their skill level, which we interpret in a particular way: we assume training to become a specialist is challenging—but is less arduous for more-skilled physicians. If a specialty is well-compensated, skilled physicians will be more willing to cope with the long and challenging training period. As specialist pay increases, we thus expect to see an increase in the number of highly skilled physicians choosing that specialty.

So far, this model could apply to many industries. The distinguishing feature of the physician market is the cap on entry in a particular specialty. When a fixed number of physicians are allowed to enter training, the slots are rationed via the application and matching process, discussed further below. The model interprets this process as imposing a lower bar on the skill level of physicians who can match to a specialty. As a specialty's earnings increase, and more skilled physicians become interested in that specialty, the specialty becomes more selective. It can do this in two ways: increasing the minimum skill level required to match, or making training harder. Both mechanisms would deter less-skilled physicians from entering the more-desirable specialty.

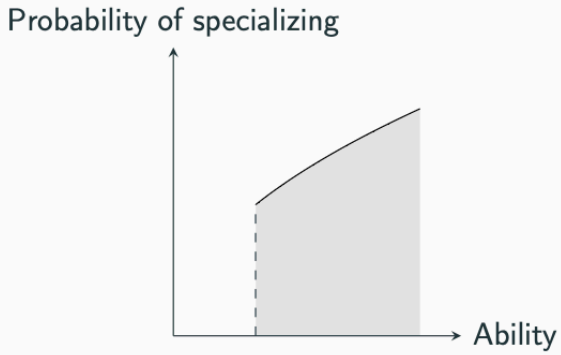
More generally, the model features an equilibrium that balances the specialty's earnings, number of trainees permitted, difficulty of training, and minimum skill level. Figure 1 illustrates this. As more-skilled physicians enter the higher-paid specialty, they displace the least-skilled physicians who would otherwise choose this specialty. With a fixed population of graduates choosing specialties, and fixed capacity constraints, Gottlieb et al. (2025b) find a positive supply response of the higher-scoring graduates—but a negative entry response for the lower-score graduates who are displaced.

**Figure 1: Conceptual Framework**

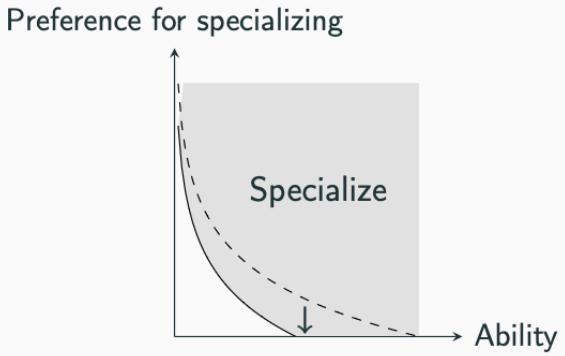
Panel A: Ability and preference heterogeneity



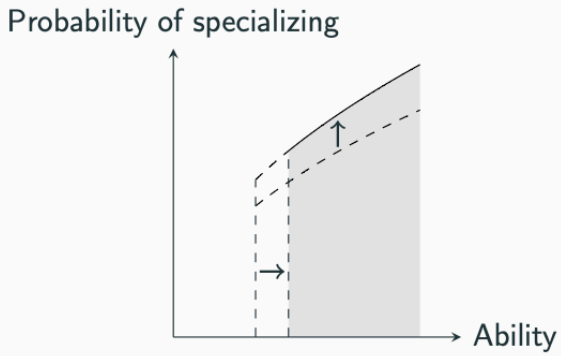

Panel B: Observed specialization with constraint




Panel C: Increase in earnings when specializing




Panel D: How earnings shift ability constraint




*Notes:* Panel A shows the physicians who would prefer to specialize: those with higher ability (who thus find the training and other entry barriers more manageable) and those with a higher idiosyncratic preference for specialization, illustrated in the shaded area. Panel B illustrates entry restrictions imposing an ability cutoff limiting specialization to those who are able to match for a residency position. The shaded area illustrates how many physicians end up specializing at each ability level. Panels C and D illustrate what happens as a specialty becomes more attractive. As specialization becomes more desirable (e.g., due to higher earnings), the shaded area in Panel C expands. In Panel D, this is illustrated by the probability increasing at any given ability level (the arrow pointing upwards). If there is a restriction on the number who can specialize, the ability threshold to match will increase. This is illustrated by the arrow showing the ability threshold shifting to the right.

Once specialties are chosen, physicians and non-physicians enter the market and compete for patients. While these two types of labor may be complementary within a firm, we abstract away from this and focus on the aggregate labor market, where physicians and non-physicians are likely substitutes in producing care. The stricter the entry barriers for any specialty or type of care, the higher the wages we would expect. These equilibrium wages then feed back into the initial specialty choice decision described above.

An important direction for future work is to consider multiple dimensions of skill. The simple version presented here has one skill dimension, which drives both individual training preferences and residency applications. This has advantages—Gottlieb et al. (2023b) obtain analytical solutions for ability distributions and application thresholds. But in practice, skills and admissions are likely multi-dimensional. Residency programs primarily select based on test scores, medical school performance, and personal statements; these may have little or no relationship to actual clinical performance or patients' preferences (Lipman et al., 2023). Skill may also be endogenous to competition in the output market (Currie, Li, and Schnell, 2025).

## IV. Regulation of Physicians and Their Substitutes

Both the education and training of physicians and their subsequent practice, the first and second stages of our framework, are heavily regulated. Regulation may restrict competition in the output market and create rents. The traditional justification for regulation is to address asymmetric information: consumers may not be able to determine the quality of services provided by the medical workforce (Arrow, 1963). The regulator can assure consumers that inputs into the health production function exceed a minimum acceptable quality level.[3]

Regulating the physician market can also hamper market functioning by placing constraints on the health production function and raising costs, reducing product variety, increasing wages due to restricted entry, and restricting access to physicians. Rents in turn create incentives for professionals to further organize to capture (and expand) these rents. Diminished product variety—specifically through the absence of lower-quality and lower-price medical services in the market—is likely to be most detrimental to low-income consumers.

To practice medicine in the United States, a prospective physician must graduate from an accredited medical school, complete at least one year of residency training at an accredited program, and obtain a state-specific medical license.[4] Halfway through medical school, students

[3] Nicholson and Propper (2012) discuss two other ways to address asymmetric information: providing consumers with information about provider-specific expected health outcomes, and making health professionals liable for poor quality.

[4] The Liaison Committee on Medical Education, which is formed by the Association of American Medical Colleges (AAMC) and the American Medical Association (AMA), accredits U.S. allopathic medical (MD-granting) schools; the Commission on Osteopathic College Accreditation (COCA), which is sponsored by American Osteopathic Association (AOA), accredits osteopathic (DO-granting) medical schools. Residency programs are accredited by the Accreditation Council for Graduate Medical Education (ACGME), a private organization that is sponsored by five health care provider organizations: the American Medical Association, the American Board of Medical Specialties (which includes specialty-specific organizations such as the American Board of Dermatology), the Association of American Medical Colleges, the American Hospital Association, and the Council of Medical

take the first of three standardized tests required for a medical license. The three U.S. Medical Licensing Examination exams are administered by the Federation of State Medical Boards (FSMB) and National Board of Medical Examiners (NBME). Further specialization requires at least three years of residency training (more in non-primary care specialties) and "board-certification" requires passing an additional exam (Singh et al., 2025), administered by the American Board of Medical Specialties. Although it is not required, over 90% of physicians choose to become board-certified in their specialty.[5] This certification has become more demanding over time, with certification boards requiring increasingly burdensome "maintenance of certification" exams and filings for physicians to remain certified (Sandhu et al., 2015).

Physicians in the U.S. strongly influence the regulation of their own profession, with implicit permission from the government (Starr, 1982; Johnson and Chaudhry, 2012). These organizations overseeing licensing and certification are all private non-governmental organizations run by health professionals. Johnson and Chaudhry (2012) argue that "As a largely self-regulating profession, physicians have had society's permission to set and maintain standards for entering the profession, for working in the profession, and the right to set rules for when and how members may be removed from the profession." Allensworth (2025) argues that self-regulation, in health and other professions, is failing to implement rational entry standards and police bad actors. This creates a structure that can be used to restrict entry to create and sustain rents.

Potential substitutes for physicians—nurse practitioners, physician assistants, certified registered nurse anesthetists, and certified nurse midwives—are also heavily regulated. To practice as a nurse practitioner (NP), an RN—who would have already graduated with an undergraduate nursing degree—must complete an accredited two-year NP masters (or doctoral) program, pass a national exam, and obtain a license from a state board of nursing. Twenty-seven states have passed liberal NP scope of practice laws since 1984, which allow NPs to independently diagnose and treat patients, including ordering and interpreting tests and writing prescriptions (American Association of Nurse Practitioners, 2025). In the other states, NPs can only perform tasks under the supervision of a physician or other health care provider.[6] The growth of NPs (and other mid-level practitioners), even in states with restrictive NP scope of practice laws, should increase competition among physicians because a physician practice can increase their physicians' income by using lower-cost inputs.

Starr (1982) argues that physicians controlled the professions that are potential substitutes: "In industry, despite the resistance of artisans, the dictates of the market broke up the work of skilled craftsmen into low-skill – and consequently cheaper – labor. In medicine, physicians maintained the integrity of their craft and control of the division of labor. While medicine itself became

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Specialty Societies (which includes specialty-specific organizations such as the American Academy of Dermatology) (Graduate Medical Education Directory, 1996).

[5] Some states require more than one year of residency training to obtain a license.

[6] Most health insurers reimburse an NP less (e.g., 85% of what they would pay a physician for the same service) when they practice independently than when an NP works with a physician on an episode of care (e.g., 100% of what they would pay a physician providing the service). Research shows that prices play their usual role in this context; raising physician reimbursements is another way to increase patients' access to primary care (Alexander and Schnell, 2024).

highly specialized, the division of labor among physicians was negotiated by doctors themselves instead of being hierarchically imposed upon them by owners, managers, or engineers."

The physician profession before 1980 had all of the characteristics that Stigler (1971) argued are favorable for regulatory capture: a large occupation with high income absent licensing; stable occupational membership; operating in a local/state rather than a national market; and where all consumers are customers but they are not aggregated (e.g., into large health insurance plans that purchase physician services), so lack strong incentives to oppose entry barriers. As Stigler (1971, p. 14) says, "…a large occupation serving everyone will encounter no organized opposition."

Since the late 1980s conditions for regulatory capture have become less favorable and physicians now have less control over potential competitors' entry. We see this through the substantial growth of mid-level practitioners who compete with physicians (especially when policies give them greater independence), especially those in primary care, and growth of medical school and residency program positions since 2000, even if modest (see below). Health care consumers and their agents have stronger incentives to oppose restrictions to the supply of physician services now that medical spending constitutes 17.6% of GDP, and they have greater ability to do so because most consumers are enrolled with a private health insurer that negotiates physician prices on their behalf. The three largest private insurers now cover 123 million people, so the opposition is much more organized than it used to be, in Stigler's (1971) parlance. Furthermore, Medicaid is now the second largest state expenditure after K-12 education (National Association of State Budget Officers, 2021). Even though Medicaid physician prices are usually set rather than negotiated, states have incentives to make sure there will be enough physicians (and physician substitutes) who are willing to accept low prices to treat low-income patients.

## V. Competition to Enter the Profession and Desirable Specialties

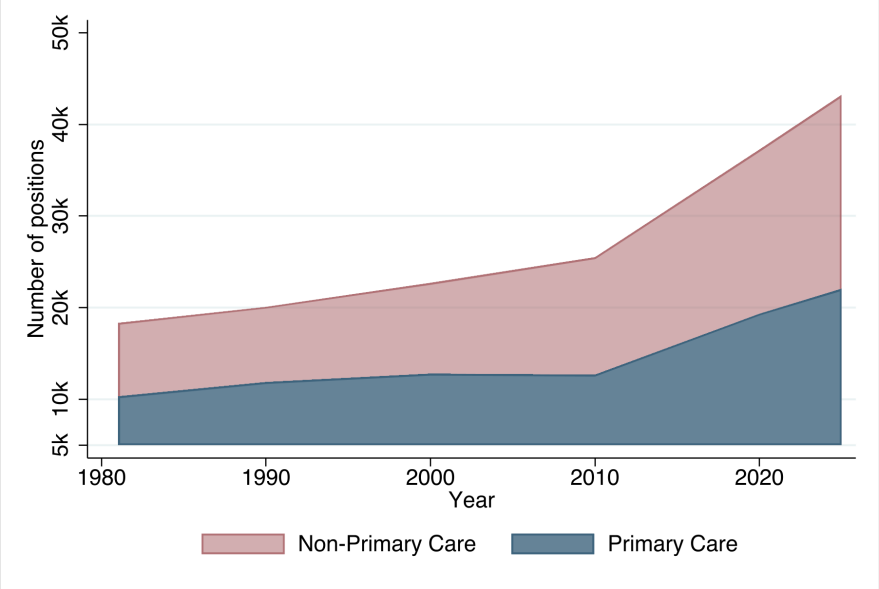
After graduating from medical school, newly minted physicians must receive residency training at an accredited residency program in the United States to practice medicine. Graduates from international medical schools ("international medical graduates" or IMGs) are required to complete a U.S.-based residency before they can be licensed, even if they have already completed a residency program or have practiced internationally, although some states have recently relaxed that rule. Therefore, the market for residents essentially determines the flow of new physicians in each specialty practicing in the United States.

Almost all first-year residency positions are allocated through the National Resident Matching Program, referred to as "the Match." After interviewing candidates in autumn, each residency program ranks applicants; each applicant ranks residency positions; and a computer algorithm makes binding assignments which theory shows to be stable and Pareto-optimal for applicants (Roth and Peranson, 1999). These results are revealed to much fanfare on Match Day in March. A residency program is a combination of a hospital and a specialty, such as pediatrics at Massachusetts General Hospital. Primary care residencies usually run for three years whereas non-primary care residencies are four or five years long, and some graduating residents

subsequently complete a fellowship to further specialize (for example, cardiology requires a three-year fellowship following completion of an internal medicine residency).

As depicted in Figure 2, a total of 18,300 first-year residency positions were offered in the Match in 1981 in 22 different specialties, of which 56% were in primary care specialties. Hospitals make substantial profits on eligible residents because they are subsidized by the federal government. Almost all residents from the mid-1980s through the 1990s were eligible for direct graduate medical education (DGME) and indirect medical education (IME) payments from Medicare, and about 74% of them today are eligible (Congressional Research Service, 2025; Accreditation Council for Graduate Medical Education, 2024). Since 1985, Medicare has paid hospitals DGME payments to cover its share of the direct costs (e.g., resident and faculty salaries) incurred to train an eligible resident, where share is defined as Medicare's proportion of a hospital's inpatient days. Since 1983, Medicare has also paid teaching hospitals an IME supplemental payment for every Medicare patient admitted to cover the estimated "indirect" costs of training eligible residents, such as their lower productivity relative to a nurse. A teaching hospital with 100 eligible residents and 400 beds, for example, currently receives an extra 13% for each Medicare patient it admits relative to a non-teaching hospital because the premium is based on a hospital's resident-to-bed ratio. In 2020, the average DGME and IME payments per eligible resident were $51,000 and $119,000, respectively.

**Figure 2: Residency Positions Offered**




*Source:* Authors' calculations using data from the National Resident Matching Program.

Residents acquire general rather than specific human capital; residency training increases a physician's lifetime earnings whether they decide to practice in the same area as the hospital where they train or elsewhere. As a result, residents should pay for training costs by accepting a salary below their marginal revenue product (Becker, 1964).[7] Several studies confirm that residents' salaries, which currently average $67,000 for a first-year resident, are indeed

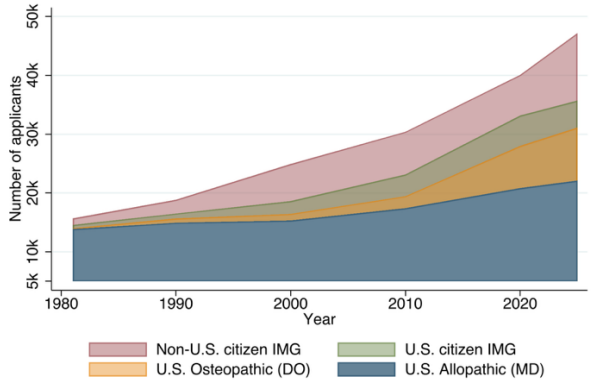
[7] See Nicholson (2002) for a more detailed explanation of the economic rationale for the Medicare Direct Medical Education (DME) and Indirect Medical Education (IME) programs.

considerably below the value they provide to a hospital (Todd et al., 2004; Green and Johnson, 1995; Thorpe, 1990), especially because residents often work close to the maximum allowed 80 hours per week. So if the Medicare supplemental payments fully cover a hospital's own cost of training a resident, hospitals can make money on residents eligible for Medicare DGME and IME payments. In 1998 Medicare capped the number of eligible residents at a hospital's 1996 level, so most residency positions added since 1998 do not generate incremental supplemental payments. Nevertheless, there is evidence that hospitals still earn profits on their residency programs when not receiving Medicare supplemental payments, at least in general surgery (Richards, Seward, and Whaley, 2025).

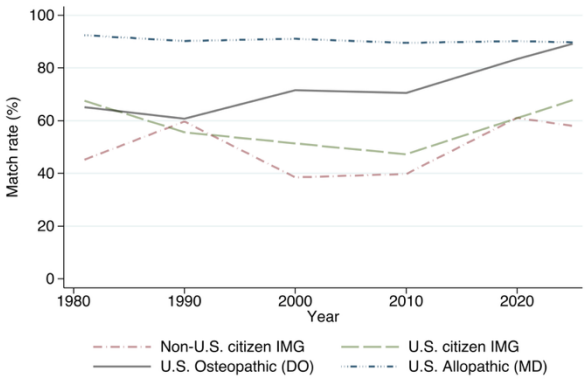
In Panel A of Figure 3 we depict the number of applicants to the National Resident Matching Program in 1981, 1990, 2000, 2010, 2020, and 2025 by type of applicant: US allopathic medical school graduates, DO graduates, United States citizens who graduated from an international medical school (US IMGs), and non-U.S. citizens who graduated from an international medical school (non-US IMGs). In 1981, graduates of MD-granting medical schools represented 86% of the applicants. Because there were 2,000 fewer applicants than available first-year residency positions, 93% of allopathic graduates successfully matched in that year (Panel B of Figure 3). Match rates for other applicant types were below 68% because allopathic graduates are generally perceived by residency programs to be the most qualified.[8]

**Figure 3: Applicants and Matches**

Panel A: Types of Applicants in the Match




Panel B: Match Rate by Applicant Type




*Source:* Authors' calculations using data from the National Resident Matching Program.

Physicians must complete a residency in their preferred specialty, so not all matches are the same. The estimated returns to specializing relative to primary care were strikingly high between 1951 and 1998 and were increasing over time (Nicholson, 2008). Between 1987 and 1998, for example, the rate of return in radiology (relative to family practice) ranged from 47 percent to 105 percent. These returns come from a combination of Medicare payment policies, work hours, and training length (Chan and Dickstein, 2019; Gottlieb et al., 2025b).

[8] Unmatched applicants and unfilled positions can coexist because some applicants list a limited set of programs and some programs choose not to list all interested applicants. Some positions that are unfilled in the Match are subsequently filled in the post-Match "scramble."

How can we determine whether these differences in returns reflect entry barriers, selection, or compensating differentials? The persistence of these high rates of return, combined with a persistent excess of applicants relative to available positions in lucrative specialties, confirms that entry barriers are a key constraint on physicians' opportunity to specialize. Most visibly, there was much more competition among applicants to secure a non-primary care versus a primary care position in the 1980s, a phenomenon that has increased since then. The unmatched rates for allopathic graduates in the three primary care specialties in 1985, the earliest year for which data are available, ranged from 1.6% to 4.5%, versus 11.0% to 16.9% in four desirable, high income non-primary care specialties.[9] Even in 1985, pediatricians and family practitioners had mean incomes of about $78,000 versus $140,000 to $200,000 in anesthesiology, radiology, general surgery, and orthopedic surgery.[10]

One might expect medical students who want to enter the desirable non-primary care specialties with high rates of return to bid down the residents' salaries in those specialties, thereby encouraging teaching hospitals to add more positions, especially before 1998 when the federal resident subsidies were not capped. Over time, as more residents completed training in non-primary care specialties, their incomes would fall closer to those of PCPs. But this is not what happened. The number of non-primary care residency positions only grew by an average of 1.1% per year between 1981 and 2000 (Figure 2), and first-year residents were, and still are, almost always paid the same amount by a hospital, regardless of specialty.

Nicholson (2003) discusses two possible rigidities in the market for residents which maintain high non-primary-care incomes: cartel behavior by professional associations and wage rigidity. One possible explanation is that Residency Review Committees (RRCs), private organizations that consist primarily of physicians, restrict the flow of new physicians to non-primary care specialties to create rents. As mentioned above, the Accreditation Council for Graduate Medical Education (ACGME) is a private organization responsible for overseeing residency training. The ACGME sets overall policies and allows each of the 26 separate specialty-specific RRCs to review and accredit residency programs in its specialty.[11]

A teaching hospital that wants to open a new residency program or increase the number of residents in their existing program must receive permission from an RRC. In most states, medical students must attend a residency program that has been certified by the ACGME in order to be eligible to take the licensing exam, and thus to practice in that state. Attending an ACGME-certified program is also usually required when physicians seek employment and to obtain admitting privileges at a hospital. So an RRC essentially controls the flow of physicians into a specialty.

A second possible explanation is that teaching hospitals may not be willing or able to adjust residents' wages to allow the market to clear. The ACGME used to require teaching hospitals to

[9] The unmatched rates that we report are the percentage of applicants who rank programs in a single specialty in the Match, which is the most common strategy, and do not receive an assignment.
[10] Incomes reported in this paper are after all practice expenses, including malpractice insurance. The orthopedic surgery income above is from 1986 because it was not available for 1985.
[11] Each of the five sponsoring organizations appoints four representatives to each RRC and the government appoints a single non-voting representative.

pay all residents the same wage, regardless of specialty.[12] The Federal Trade Commission interpreted the ACGME's policy on residents' wages as a restraint of trade, so the ACGME softened the policy language.[13] Even so, the ACGME still requires that residents be paid an undefined amount—presumably positive—which might prevent the wage from adjusting to clear the excess supply of residents to certain non-primary care specialties.

Although residency positions grew by only 39% between 1981 and 2010 (Figure 2), applicants to the Match grew much more quickly (by 90%) during that period (Panel A of Figure 3). Two-thirds of this growth was from graduates of international medical schools (both US IMGs and non-US IMGs) and DO programs, and by 2010 allopathic graduates represented only 57% of the Match applicants. As the ratio of applicants-to-positions rose well above one, fewer than 50% of graduates of international medical schools were able to obtain a match (Panel B of Figure 3).

Medical schools, residency programs, and the organizations that regulate them appear to be responsive to forecasts regarding the adequacy of future physician supply. In 1976 Congress asked the Graduate Medical Education National Advisory Committee (GMENAC) to estimate the number and specialty mix of physicians required to meet the nation's health care needs (American Academy of Pediatrics, 1981). The 1981 GMENAC report predicted a surplus of 145,000 physicians by 2000, or 23 percent of the projected workforce, and recommended restricting enrollment in U.S. medical schools and the flow of immigrating international medical school graduates (Blumenthal, 2004). Congress responded by eliminating subsidies to allopathic medical schools and this had the intended effect; the number of students graduating from those schools essentially remained constant until the mid-2000s.

In 2005 the Council on Graduate Medical Education (COGME), the successor to the GMENAC responsible for providing guidance on graduate medical education to the Department of Health and Human Services and to Congress, updated their forecast model, predicted a *shortage* of 85,000 physicians by 2020, and recommended that U.S. medical schools expand enrollment. States and specialty societies concurred. Fourteen states issued reports in the 2000s concluding that there was, or soon would be, a shortage of physicians (Iglehart, 2008), and in 2006 the Association of American Medical Colleges (AAMC) recommended a 30 percent increase in allopathic medical school capacity.

Sure enough, the number of applicants to the Match almost doubled between 2000 and 2025 as 30 new allopathic schools opened (from 125 in 2002 to 155 schools today) and existing schools increased their class sizes. But the real growth, as depicted in Panel A of Figure 3, was in the other three applicant types. The number of DO programs has more than doubled since 2002 (from 19 to 43), and DO graduates now represent 19% of Match applicants.

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[12] "Financial support of residents is necessary to ensure that residents are able to fulfill the responsibilities of their educational programs. All residents at similar levels of experience and training in all of an institution's programs should receive a comparable level of financial support. Exceptions must be justified to the institution's Graduate Medical Education Committee" (Accreditation Council of Graduate Medical Education, 1996).

[13] "Adequate financial support of residents is necessary to ensure that residents are able to fulfill the responsibilities of their educational programs" (www.acgme.org).

We would expect non-US (citizen) IMG applicants to the Match to be particularly responsive to US market conditions and policies because they already have a medical degree and could practice in their home country. From 2011 to 2016, non-US IMG Match applicants grew by 2.3% per year, on average. Those applicant numbers then decreased by 1.9% per year between 2016 and 2020, and then increased by 10.7% per year between 2020 and 2025. This is consistent with different expectations regarding immigration policies during the Trump and Biden administrations (Lo Sasso, 2021), or regarding how the Affordable Care Act and other policies would affect physician earnings. Because non-US IMGs are more likely to practice in medically underserved areas (Hailat et al., 2025), they serve an important role in alleviating problems with access to medical care.

Around 2010, the number of residency positions available in the Match surged in both primary and non-primary care specialties (Figure 2). The number of students willing to attend DO programs and international medical schools and the number of available residency positions, especially in primary care specialties, influence one another. As the number of available residency slots rise, DO and international programs have stronger incentives to open and expand because prospective applicants will have higher expectations of obtaining a residency position after graduating, and thus have a greater interest in attending a non-allopathic medical school. Similarly, residency programs have stronger incentives to expand (when they are allowed to by an RRC) when they expect to be able to fill their slots from the expanded pool of Match applicants.

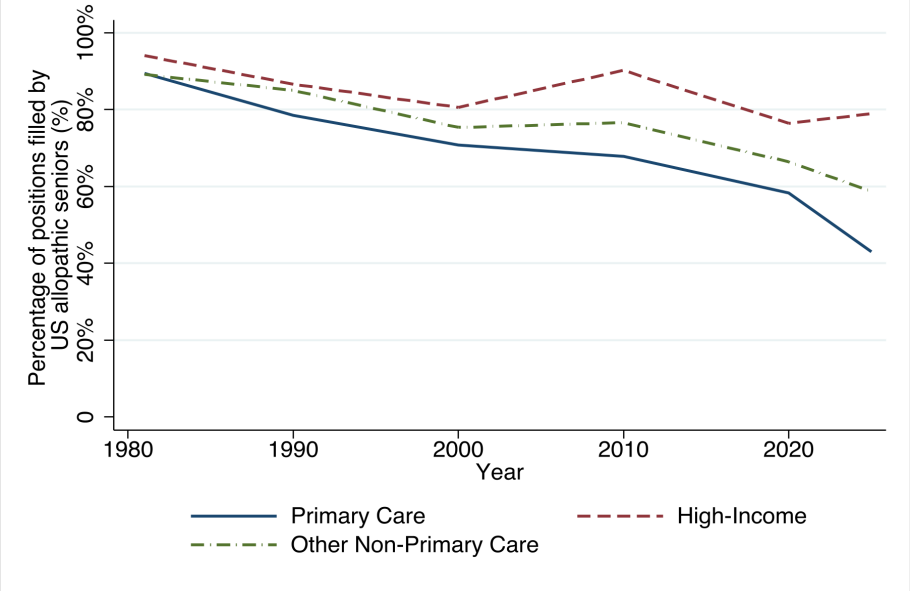
Indeed, the match rates for all three non-US-allopathic groups rose sharply between 2010 and 2025 to the point where DO graduates are now just as likely to match as allopathic graduates (Figure 3 Panel B). This rise reflects an increasingly segmented market: the three non-US allopathic graduate types are focusing on less desirable specialties where a residency match is easier. In Figure 4 we divide specialties into three groups: primary care, non-primary care specialties with relatively low income, and high-income non-primary care specialties. We define a high-income specialty as one with a mean income greater than $150,000 in 1988 (in nominal dollars) and greater than $475,000 in 2023.[14]

Figure 4 depicts the percentage of residency positions filled by US allopathic graduates in the three specialty groups. In 1981, when there were relatively few non-allopathic graduates in the Match, there was little difference in the residents' medical school type across the three specialty groups. As residency positions expanded, the market has stratified. Non-US-allopathic applicants are less likely to apply for or be accepted by the high-income specialty residency programs. This is also true, though to a lesser extent, with the lower-earning non-primary care specialties. Among DO graduates in 2025, for example, 14.5% ranked one of the six high-income specialties as their first choice in the Match, versus 25.6% for allopathic graduates. Conditional on ranking one of those specialties as their first choice, 66% of DO graduates and 81% of allopathic graduates successfully matched. In 2025, 79% of the high-income residency positions were filled by US allopathic graduates, although they constituted only 47% of the total

[14] High-income non-primary care specialties are orthopedic surgery, dermatology, plastic surgery, otolaryngology (ENT), anesthesiology, and radiology. The other non-primary care specialties are obstetrics/gynecology, general surgery, psychiatry, emergency medicine, and pathology.

Match applicants. Conversely, a minority of first-year primary care residents are now US allopathic graduates, down from 89% in 1981.

**Figure 4: US Share of Matches by Specialty Income**




*Source:* Authors' calculations using data from the National Resident Matching Program.

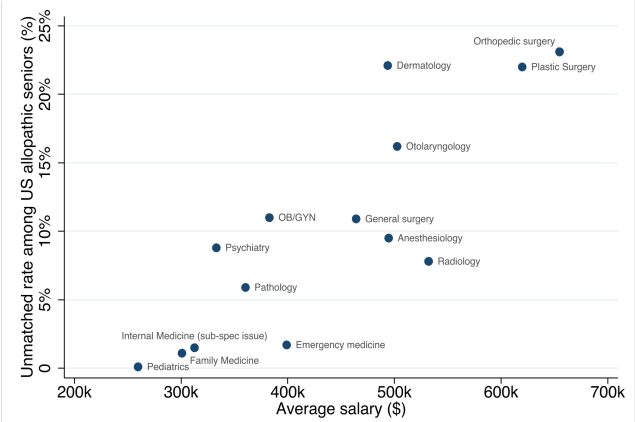
Because the likelihood of matching, and matching in a desirable specialty, depends on the type of medical school one attends, prospective physicians compete to enter a type of medical school that affords the best opportunity to enter the profession, and to enter a desirable specialty if that is of interest. There have always been at least twice as many applicants as available positions in allopathic medical schools, and likewise for osteopathic schools since the data were first available in 2010. The medical school market also stratifies by ability and educational effort. The mean Medical College Admission Test (MCAT) score among allopathic medical school matriculants in 2024 was 512 (the 83$^{rd}$ percentile among those who took the MCAT exam in 2024), substantially higher than for matriculants to DO programs (503 in 2024, or the 56$^{th}$ percentile among test takers). DO and international medical schools also compete for talent. DO programs appear to have the advantage because they have attracted US citizens who formerly attended international programs (i.e., DO graduates have grown faster than US IMG graduates in Panel A of Figure 3). This appears to be rational decision making because DO graduates have much higher match rates than US IMGs (Figure 3, Panel B).

There is additional stratification of students within a type of medical school. Once in medical school, students compete to develop credentials and skills that will provide them with a broad specialty choice set. In Figure 5 we use data from US allopathic graduates to depict how positions in the most desirable specialties are allocated via a tournament. US allopathic graduates are willing to incur risk to try to enter desirable, high-income specialties. Panel A shows that the unmatched rate in a specialty in 2024 was highly correlated with the mean income of physicians practicing in that specialty in 2023. Over 20% of US allopathic graduates in 2024 who ranked dermatology, orthopedic surgery, or plastic surgery residency programs as their only choices in the Match did not obtain a match and had to scramble for a position (likely in a

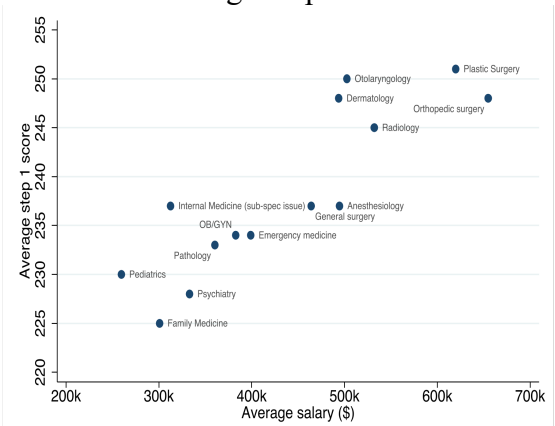
different specialty) following the Match, or take a year off and enter the Match the following year—a very costly outcome in a high-income profession. The students who successfully enter desirable, high-income specialties are those who decide to compete in the tournament, so these unmatched rates certainly understate the probability that the average US-allopathic applicant would be able to successfully enter these specialties.

**Figure 5: Specialty Earnings and Match Characteristics**

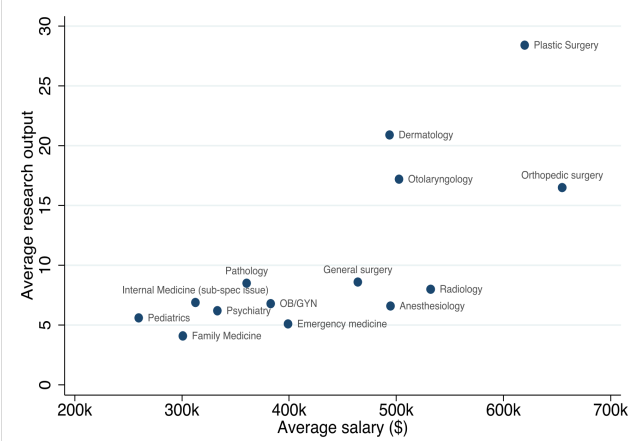
Panel A: Share Not Matched



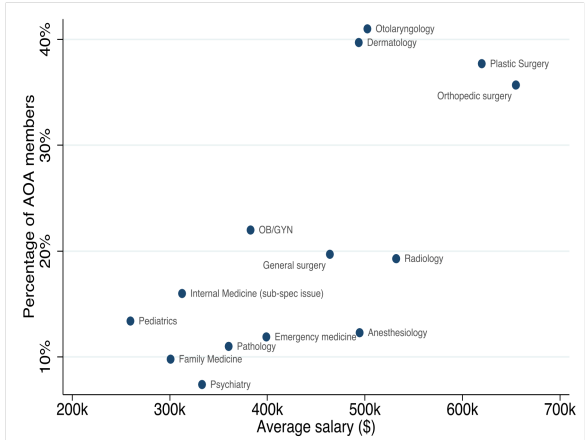

Panel B: Average Step 1 Score




Panel C: Average Research Output




Panel D: Share in Alpha Omega Alpha




*Notes:* Panel A shows the unmatched rate among US allopathic seniors who rank a single specialty in the Match (2024), plotted against the specialty's mean income in 2023 (from Doximity, 2025). Panel B shows the Mean Step 1 score in 2022 among US allopathic students who successfully matched by specialty, plotted against the specialty's mean income in 2022 (from Doximity, 2025). Panel C shows the mean number of presentations, abstracts, and publications among US allopathic students who successfully matched in each specialty in 2024. Panel D shows the share of students in AOA honor society among US allopathic students who matched in each specialty in 2024. Source: authors' calculations using data from the National Resident Matching Program.

How does a US allopathic graduate increase her chances of entering an attractive specialty? Looking at Panels B, C, and D, the answer appears to be that while in medical school, she should study very hard in courses and for standardized tests and invest substantial time conducting and presenting research. The Step 1 exam, which all students take after the second year of medical school, was scored through 2021, and now it is pass/fail. When it was scored, applicants with

higher scores were much more likely to obtain a match in competitive specialties. In dermatology, for example, a US-allopathic medical student graduating in 2022 with the median Step 1 score (232.2) had about a 72% chance to match in that specialty, versus about 85% for a student with a score of 260. In Panel B, as expected, there is a strong positive correlation between the average Step 1 score of applicants who successfully matched in a specialty and that specialty's income. Likewise, there is a strong positive correlation between the research credentials (Panel C) and overall academic credentials (Panel D) of students who successfully match in a specialty and that specialty's income. Each medical school may elect up to 20% of its graduating class to be members of Alpha Omega Alpha based on "high quality patient care, leadership, service, and scholarship." One consequence of this tournament is that students with the greatest resources are most likely to be able to take a year off from medical school to conduct research, thereby increasing their appeal to residency programs in selective specialties.

## VI. Competition in the Output Market

Once physicians are trained, the main output they produce is patient care. In the time of Friedman and Kuznets (1945), physicians had a monopoly on this market.[15] But as demand for their product has increased, physician training failed to keep up.

When semaglutide demand exceeded Novo Nordisk's manufacturing capability, compound pharmacies arose to fill the gap (Mattingly and Conti, 2025).[16] When baby formula was in short supply in 2022, some parents turned to imports while others shared breast milk (Pearson, 2022). So it may not be surprising that the same has happened in the market for physicians.

A key restriction on this growth is state restrictions on the practice of medicine. For new types of workers to compete, they must be able to practice. Regulatory changes have enabled this, often driven by state-level policy initiatives. Twenty-seven states have passed laws to expand Nurse Practitioners' scope of practice, increasing their substitutability with physicians and the attractiveness of the profession. Twelve states have recently relaxed licensing laws to allow foreign-trained physicians to practice without completing a U.S.-based residency.

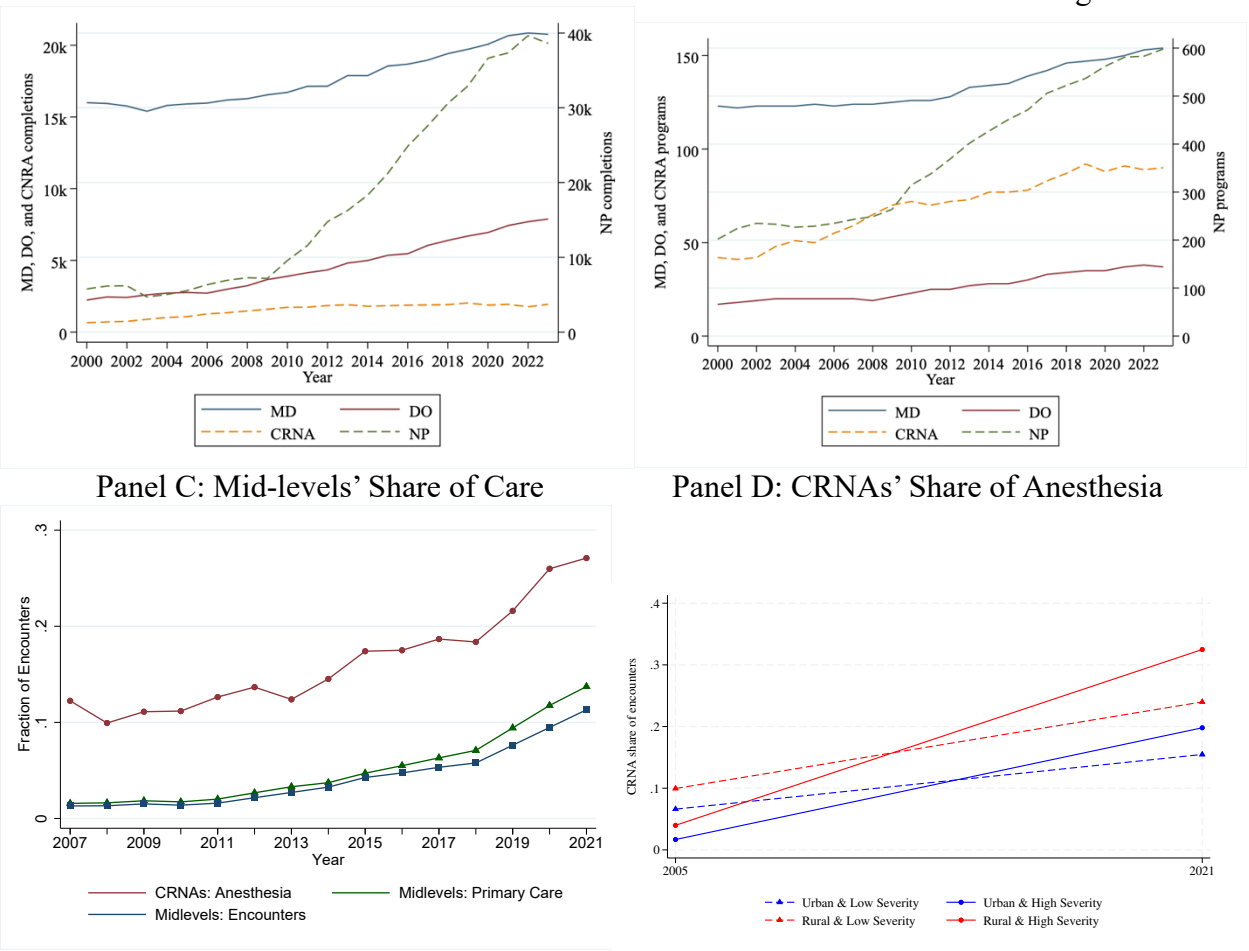
Panel A of Figure 6 shows the training of new MDs, DOs, Nurse Practitioners (NPs), and Certified Registered Nurse Anesthetists (CRNAs). Panel B depicts the number of training programs for each of these professions over time. We see substantial increases in DO, NP and CRNA training programs and total training volumes. MD training, in contrast, grew much more slowly.

As non-MD providers have expanded much more rapidly than physicians, the latter's share of the output market has fallen. Gottlieb et al. (2025a) show the rapid growth of mid-level practitioners' employment and nurses' wages from 1980 to 2022, and that this lines up with their share of the output market. Panel C of Figure 6 shows this pattern for three types of care, as

[15] "The organization of medical education in the United States permits close control over the admissions practices and standards of the individual medical schools" (Friedman and Kuznets, 1945, p. 13).
[16] Just as with the need to change healthcare licensing, discussed below, the Food and Drug Administration (FDA) had to formally designate a shortage for compound pharmacies to be allowed to offer this substitute.

observed in private insurance claims data (MarketScan). Panel C shows rapid growth in CRNAs' share of anesthesia procedures and NPs' share of both primary care and overall professional services. Patel et al. (2022, 2023) show similar patterns in Medicare data. Panel D investigates the types of care and locations in which CRNAs have become particularly important. The data are split into more vs. less severe patients, measured based on the severity reported in the claims, and rural vs. urban locations. The graph reports CRNAs' share of each group's care in 2005 and 2021. We see that rural areas consistently rely on CRNAs more than urban areas within each type of care. In 2005, CRNAs were focused on low-severity patients. By 2021, this was no longer true.

**Figure 6: Training Rates of Physicians and their Substitutes**




*Notes:* Panels A and B report authors' calculations of data from the Department of Education's Integrated Postsecondary Education Data System (IPEDS). Panel A reports the number of students completing programs in each category listed (MD = Medical Doctor; DO = Doctor of Osteopathic Medicine; NP = Nurse Practitioner; CRNA = Certified Registered Nurse Anesthetist). Panel B reports the number of programs operating in each year. The values of the NP lines are read off the right-side axis, while all others are on the left-side axis. Panels C and D are reproduced from Gottlieb et al.'s (2025a, Figure C.8) calculations based on MarketScan private insurance claims data. Panel C shows CRNAs' share of anesthesia claims, NPs' share of office visits, and NPs' share of broader professional claims. Panel D decomposes CRNAs' shares into urban and rural regions, and based on the severity of the patient. Severity is measured using American Society of Anesthesiologists (ASA) Physical Status Classification System as recorded in claims modifiers. Levels 1-2 are considered "low severity" and levels 3-5 "high severity."

If healthcare demand has increased, and this broader set of occupations are substituting for hard-to-find physicians, we would expect their compensation to reflect this high demand. This is exactly what we see. Figure 7 shows updated versions of Figures 2(a), 2(b), and C.1 from Gottlieb et al. (2025a). The first two panels show growth in employment and earnings by occupation from 1980 to 2023. As Gottlieb et al. (2025a) emphasize, both employment and earnings have grown faster in all healthcare occupations than outside of healthcare. Among clinical occupations, mid-levels have the fastest employment growth, averaging nearly three times physicians'.[17] Earnings growth in healthcare is markedly faster than outside of healthcare, with nurses' earnings growing at twice the average rate. Moving beyond averages, Panels C and D show the earnings distribution for four categories of occupations in 1980 and in 2022. In 2022, physicians' earnings are more spread out than in 1980, with much of the distribution in the range of 8-10 times the modal RN earnings, compared with 4-6 times RN earnings in 1980.

Mid-level practitioners appear to fill the gap. Their earnings slot neatly between the distribution of RNs and that of physicians, earning much more than RNs but much less than physicians. If equilibrium earnings reflect productivity, this suggests that mid-levels' productivity is between that of physicians and nurses. This makes sense if mid-levels can undertake many of the simpler tasks physicians formerly performed, but not all of them—especially not those requiring physicians' full talent and training. Nevertheless, the ability to substitute for some physician tasks would explain why mid-levels' earnings are so much higher than nurses and why they are particularly prevalent in areas where physicians are not.

Figure 8 offers further evidence for this substitution. If physicians specifically like to live in high-amenity areas (Lee, 2010), the presence of such amenities is a shock to the relative supply of physicians. Figure 8 (reproduced from Gottlieb et al., 2025a, Figure C.7) treats the area's share of college graduates as a measure of these amenities. Panel A shows that the physician per capita ratio increases much faster in areas that are becoming more educated overall. Panel B depicts the growth in NPs per capita relative to the value in 2008. We see that NPs per capita grow faster in areas with a lower share of college graduates.

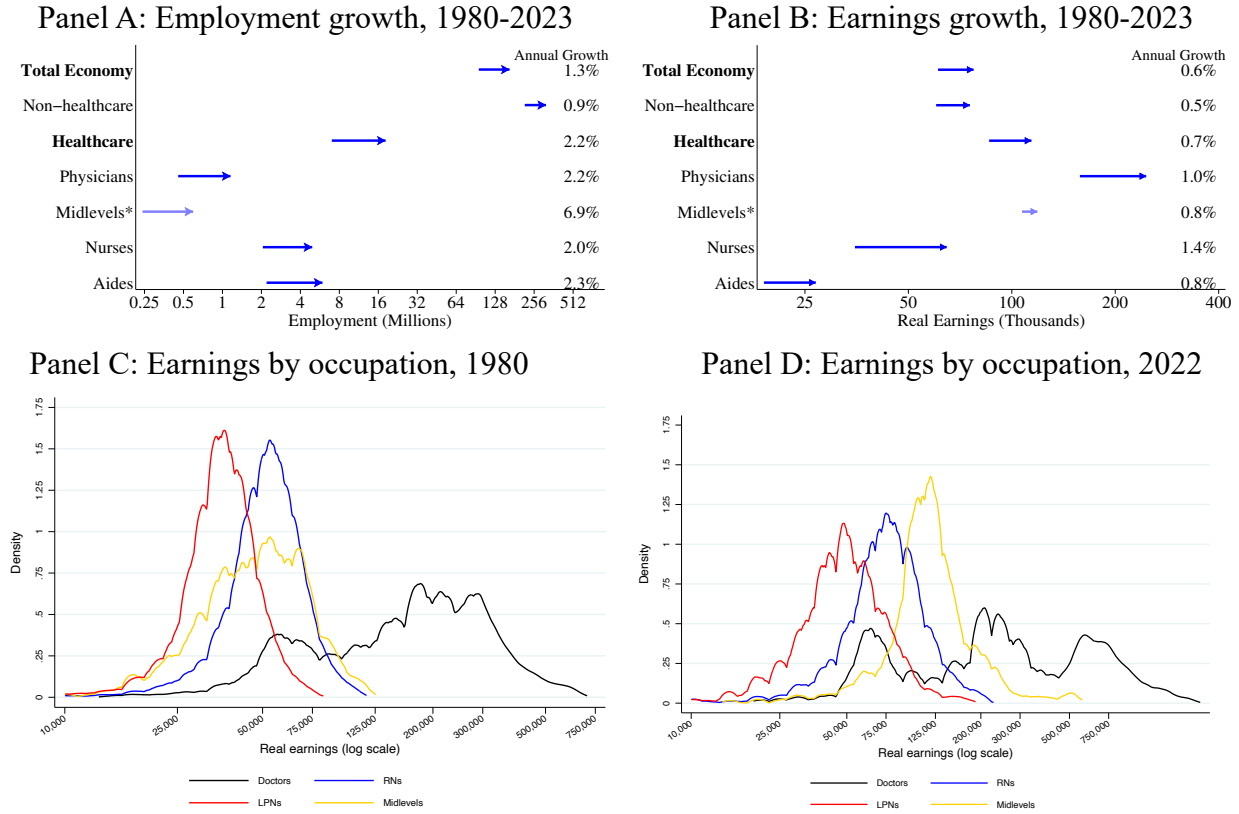
Panel C shows, in the cross-section, that areas with more college graduates have fewer NPs per physician. Panel D demonstrates that these same areas have higher relative NP wages, compared to physician wages. Putting Panels C and D together enables an inference about the elasticity of substitution between NPs and physicians in healthcare labor demand. Suppose the local college graduate share shifts relative NP/physician supply, and not technology or relative NP/physician demand. Under this assumption, we can compare the slopes of these two panels to compute the elasticity of substitution between NP and physician labor. Since the same change in college graduate share associated with relative NP log wages increasing by 1.1 is associated with relative NP log quantity declining by 2.25, this would imply an elasticity of substitution around 2.

This would also explain why the dire predictions of physician shortages are not apparent in waiting times. The AAMC has been predicting a physician shortage since at least 2006. Yet the average time to schedule an appointment with a family physician was 20 days in 2009 and 19.5

[17] Data for midlevels are shown for a shorter period, since key midlevel occupations are only observed in the ACS starting in 2010.

days in 2017 (Gudbranson et al., 2017). Waiting times do appear to have increased recently, reaching 31 days in a 2025 survey, though this is driven by specialists; the same survey reports 23.5 days for family medicine (AMN Healthcare, 2025). This difference is consistent with mid-level practitioners effectively substituting for physicians in the specialties where they can do so best—and with entry barriers remaining high for specialists.

**Figure 7: Earnings and employment from 1980 to 2023 by occupation**



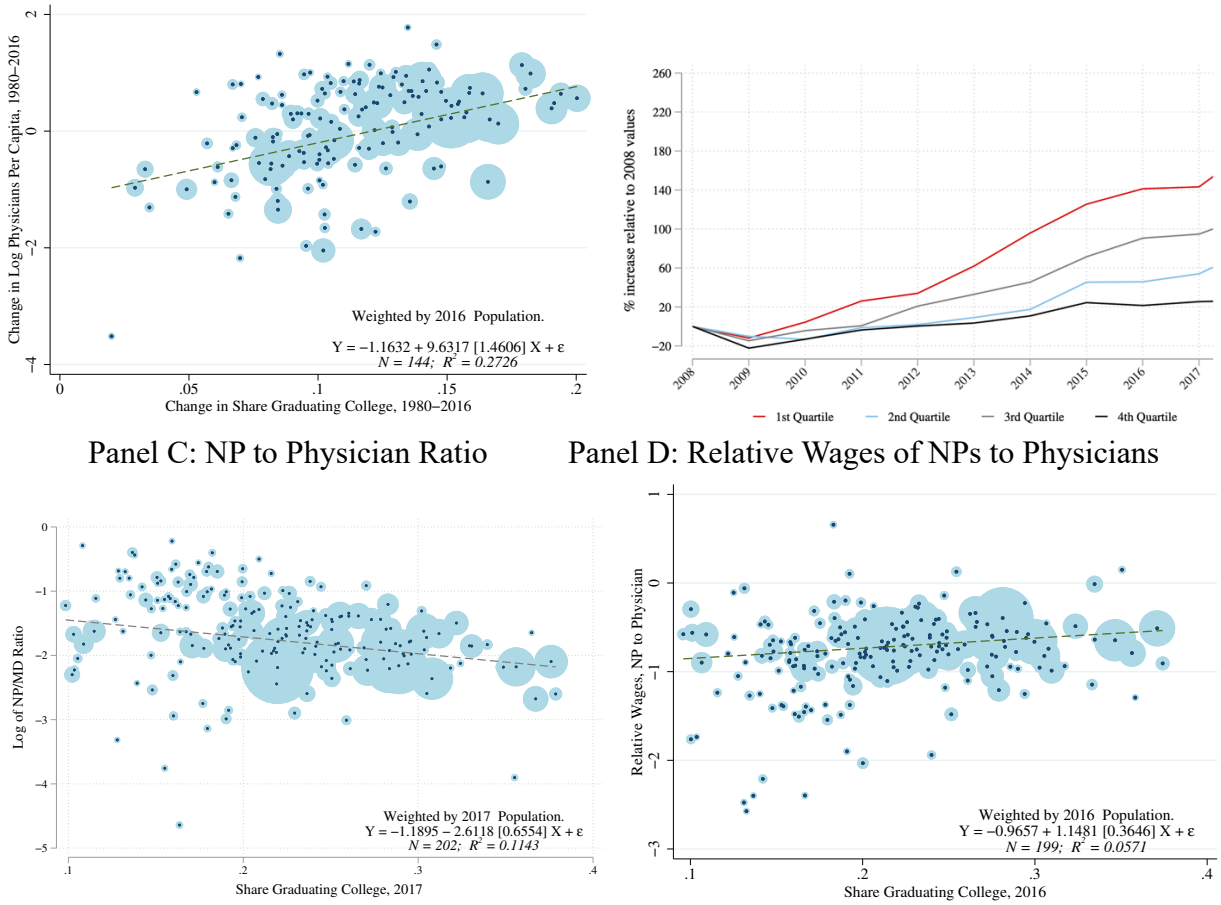

*Source:* Gottlieb et al. (2025a), Figure 2 and Appendix Figure C.1, updated using IPUMS (Ruggles et al., 2025). Panels A and B show average annual employment growth and earnings growth, respectively. Nurse practitioners, CRNAs, and nurse midwives were not classified until the 2010 ACS. For that reason, the mid-level line in Panels A and B is for 2010–2023. Panel C shows the earnings distribution by healthcare occupation in 1980 and 2022. Data come from IPUMS files for 1980 Decennial Census and the 2022 American Community Survey. Wages are inflation-adjusted to 2022 dollars using the CPI-U. Panel C impute physicians' incomes above the public-use censoring threshold using a Pareto distribution. We take the (inverse) shape parameters from Gottlieb et al. (2023a), applying their 1980 parameter to our data in 1980 and their 2012 parameter to our data in 2022. We use the censoring threshold for each year and state from IPUMS as the scale parameter. We assign censored incomes by randomly drawing from a Pareto distribution with these two parameters.

The rapid growth in physician substitutes, whose training is closest to that of primary care physicians, limits PCPs' ability to earn economic rents. Gottlieb et al. (2025b) compare lifetime earnings of PCPs, all physicians, and lawyers. Since law and medicine are both common occupations for hard-working university graduates, with both requiring a graduate degree but not substantial quantitative coursework, becoming an attorney may be a realistic alternative for many

prospective physicians. Comparing their earnings can thus offer a sense of how physician earnings compare to these workers' outside options.

**Figure 8: Healthcare Employment Characteristics vs. Area's Educational Attainment**

Panel A: Number of Physicians Per Capita  Panel B: Growth in NPs by Area Education




Panel C: NP to Physician Ratio  Panel D: Relative Wages of NPs to Physicians




*Source:* Gottlieb et al. (2025a), Figure C.7. In Panels A, C, and D, each observation is a Commuting Zone, and the graphs are limited to those Commuting Zones with sufficient data to be disclosed from Census Bureau internal data. In Panel B, quartiles refer to the area's quartile of educational attainment.

Gottlieb et al. (2025b, App. D) find that, accounting for length of training and work hours, primary care physicians earn slightly less than lawyers. Other physicians earn substantially more. This suggests that primary care physicians may not earn economic rents, at least relative to law—though law has its own barriers to entry. So, PCPs may be earning close to their outside option, but total rents may be under-stated to the extent lawyers also earn rents. These results feed back to the first stage of our model from section III, as they imply a substantial premium that motivates high-achieving trainees to specialize.

Taking a longer historical perspective, Nicholson (2008) summarizes eight studies that estimate the rate of return to a medical school education in the United States between 1929 and 1990. Averaged across all specialties, the general conclusion is similar: there were financial returns from entering medicine through 1966 relative to alternative professions like dentistry,

presumably due to barriers to entering the profession. Between 1966 and 1990, however, the estimated overall rates of return for physicians have been modest.

Besides competing directly with PCPs, mid-levels may buttress the value of specialization in a second way. Mid-level practitioners may be complements to specialists, for example by handling the low-fee patient office visits and freeing the specialist up to perform more high-fee procedures. If they enable surgeons and medical specialists to increase productivity, the existence of mid-levels may contribute to the specialization premium.

Another factor pushing physicians to specialize may be the ability to compete for top-paying patients. Gottlieb et al. (2023a) emphasize the value of providing a premium service in an environment with growing income inequality. They show that rich patients make some doctors rich. As income inequality increases, occupations providing services to these unequal consumers can themselves become more unequal, as the highest-income consumers compete for quality and are less concerned with price. A physician's ability to effectively treat some high-income patients—and charge them a premium for it—can make that physician a high earner in turn. Thus, regardless of any potential changes in entry barriers, competition policy, or AI, some top-earning physicians might retain their high earnings and elite status in the future.

While we highlight the role of mid-levels, physician competition is also changing in other ways. While the most traditional form of competition is across firms within a geographic location, competition across regions is growing in two ways. First, patients increasingly travel to their preferred source of care. Second, telemedicine and other forms of outsourcing enable physicians to treat patients far away. Other ways of outsourcing care are remote reading of radiology images, centralized pathology centers, and even remote monitoring of intensive care unit (ICU) patients. All of these mechanisms of matching patients and care across long distances hamper measurements of competition within a particular geographic location.

These mechanisms may also improve quality: Dingel et al. (2024) show that patients travel to physicians with more experience, more appropriate expertise, and rare specializations and capital equipment. Dahlstrand (2025) shows how online healthcare can enable better matches of physicians and their patients. Yet traditional measures of competition within a region, such as physician or hospital HHI, may not capture the true range of care to which patients have access.

Another major change to competition is through new technology. AI that can read radiology images (Agarwal et al., 2024) and perhaps even chat with patients instead of a physician, also change the appropriate market definition and make competition measurement even more challenging than it already is. It is not clear if AI necessarily reduces demand for physicians; just like mid-levels can complement specialists, AI may complement rather than substitute for physician services – for example, radiology staffing has grown over time at the Mayo Clinic (Lohr, 2025). Critically, an appropriate measure of competition must account for these various substitution options.

## VII. Conclusion

Despite high health spending, the U.S. does not always appear to have an abundance of providers available when needed. We argue that analyses of patients' choices of physician, provider group, and health insurer need to consider the fundamental questions about entry barriers: who becomes a physician, and which types of workers are allowed to compete with physicians to provide care?

We do not address competition between physician practices once those practices are assembled with the available labor inputs, nor do we consider bargaining between the resulting practices and private health insurers.[18] This paper also does not examine the monopsony power that Medicare and other insurers may have with respect to physicians and related professions. These questions are all downstream of our focus—but the upstream competition to enter these professions, and downstream competition in care provision, are connected.

In one direction, changes in the physician services output market affect prospective physicians' occupational and specialty choices. In the other direction, changes in entry barriers affect downstream competition, the availability of medical care, and prices. Restrictions on physician entry could limit downstream competition through multiple mechanisms: if physician supply is limited, their practices must either be smaller or less numerous. If the former, they may lack scale economies and thus face higher costs and charge higher prices. If instead there are fewer practices, these firms may have more market power and thus less need to compete aggressively. Either way, competition within the physician profession—and between physicians and related professions—affects the labor that is available in the output market for medical care, and which can in turn be assembled to form physician and other professional services practices.

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[18] Clemens and Gottlieb (2017), Gaynor and Town (2012); Gaynor, Ho, and Town (2015), and Handel and Ho (2021) discuss competition between physician practices in the physician services output market.

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